Vermont Electric Energy Efficiency Potential Study

Final Report

January 2007

Prepared for the Vermont Department of Public Service

Prepared and Submitted by:

GDS Associates, Inc.
Engineers and Consultants

GDS Associates, Inc. • 1850 Parkway Place • Suite 800 • Marietta, GA 30067 • www.gdsassociates.com
Marietta, GA • Austin, TX • Auburn, AL • Manchester, NH • Madison, WI

Table of Contents

List of Appendices

Appendix A – Residential Sector Data

- Measure costs, measure savings, measure useful lives, levelized cost per kWh saved by measure, remaining factors, technical potential by measure, maximum achievable potential by measure
- List of data sources for measure costs, savings and useful lives
- Residential program budgets for the base case for 2006 to 2015
- Residential program participants for the base case 2006 to 2015
- Residential measure descriptions
- Discussion of emerging energy efficiency measures

Appendix B – Commercial Sector Data

- Measure costs, measure savings (kWh, kW, and MMBtu), measure useful lives, persistence factors, levelized cost per kWh saved by measure, benefit cost ratio by measure
- Incremental costs per prototypical building type
- List of sources used to develop all commercial savings and cost estimates
- Base Case Factors by building type
- Savings Factors by building type
- Remaining Factors by building type
- Convertible Factors by building type

Appendix C – Industrial Sector Data

- Vermont industrial sector kWh sales by end use for the year 2015
- Technical potential, maximum achievable potential and maximum achievable cost effective potential for industrial sector electricity savings
- Breakdown of maximum achievable cost effective potential for industrial sector electricity savings by type of energy efficiency measure
- Measure costs, measure savings, measure useful lives, levelized cost per kWh saved by measure
- Detailed tables showing maximum achievable potential electricity savings by industry by end use by type of measure

Appendix D – Cumulative Annual mWh and MW Impacts of Potential Savings for the Maximum Achievable Cost Effective Potential Base Case Scenario based upon Societal Test screening

Appendix E – Assumptions for Discount Rate, Inflation Rate, Line Loss Factors, Reserve Margin, Emissions Factors for Electric Generation Plants

Appendix F – Avoided Costs for Electricity and Natural Gas; Retail Rate Projections for Fuel Oil, Natural Gas, Propane, Kerosene, Water

Appendix G – Results of the Special Early Retirement Scenario

ACKNOWLEDGEMENTS

This technical report was prepared for the Vermont Department of Public Service (VDPS) by GDS Associates, Inc and the American Council for an Energy Efficient Economy. GDS would like to acknowledge the many helpful data sources and the technical support provided by the VDPS staff and staff of Efficiency Vermont. GDS would like to give special recognition to Riley Allen, David O'Brien, Carole Welch, Dave Lamont and Doug Thomas of the VDPS, all of whom were instrumental in reviewing detailed data developed by GDS relating to electric load forecasts, electric energy efficiency measure costs, energy savings and useful lives. Neal Elliott of the American Council for an Energy Efficient Economy was also helpful in contributing data sources and analytical support for the industrial sector potential analysis. GDS also appreciates the detailed review of draft versions of this report provided to the Vermont Department of Public Service by staff of Efficiency Vermont, the Vermont Public Interest Research Group, the Conservation Law Foundation, the Burlington Electric Department, the Associated Industries of Vermont, and other interested stakeholders.

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.
January 2007

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.

.

1.1 Study Scope

The objective of the study was to estimate the achievable cost effective potential for energy efficiency resources over the ten-year period from 2006 through 2015 in Vermont. The definitions used in this study for energy efficiency potential estimates are the following:

- **Technical potential** is defined in this study as the complete and immediate penetration of all measures analyzed in applications where they were deemed technically feasible from an engineering perspective.

- **Achievable potential** is defined as the achievable penetration of an efficient measure that would be adopted given aggressive funding, and by determining the achievable market penetration that can be achieved with a concerted, sustained campaign involving highly aggressive programs and market interventions. The State of Vermont would need to undertake an extraordinary effort to achieve this level of savings. The term "achievable" refers to efficiency measure penetration, and means that the GDS Team has based our estimates of efficiency potential on the realistic penetration level that can be achieved by 2015.

- **Achievable cost effective potential** is defined as the potential for the realistic penetration over time of energy efficient measures that are cost effective according to the Vermont Societal Test, and would be adopted given aggressive funding levels, and by determining the level of market penetration that can be achieved with a concerted, sustained campaign involving highly aggressive programs and market interventions. As demonstrated later in this report, the State of Vermont would need to continue to undertake an aggressive effort to achieve this level of savings.

The main outputs of this study are summary data tables and graphs reporting the total cumulative achievable cost effective potential for electric energy efficiency over the ten-year period, and the annual incremental achievable potential and cumulative potential, by year, for 2006 through 2015.

This study makes use of over 200 existing studies conducted in Vermont and throughout the US on the potential energy savings, costs and penetration of energy efficiency measures. These other existing studies provided an extensive foundation for estimates of electric energy savings potential in existing residential, commercial and industrial facilities.

1.2 Implementation Costs

Realizing the achievable cost effective energy efficiency savings by 2015 would require programmatic support. Programmatic support includes financial

incentives to customers, marketing, administration, planning, and program evaluation activities provided to ensure the delivery of energy efficiency products and services to consumers. As noted above, the base case projection for the achievable cost effective potential electricity savings in Vermont assumes that Efficiency Vermont pays financial incentives equivalent to fifty percent of measure incremental costs.[12] This incentive level assumption is based upon a review of numerous energy efficiency potential studies recently conducted in the US and a review by GDS of the December 2004 National Energy Efficiency Best Practices Study. Examples of the energy savings potential studies from Vermont and other states reviewed by GDS are listed in Table 1-7.

GDS developed cost estimates for program planning, administration, marketing, reporting and evaluation ("other program costs") based upon historical experience at Efficiency Vermont for the period 2002 to 2005, as well as financial incentives to electric consumers in order to realize the achievable cost effective potential savings. It is clear that to realize all of the achievable cost effective savings, Efficiency Vermont would have to undertake steps to add staffing (either in-house staff or contractors), and Efficiency Vermont would have to spend approximately $348 million in today's dollars (this figure includes financial incentives, but excludes the Fiscal Agent, the Contract Administrator and the VDPS Monitoring and Evaluation functions) over the next decade to achieve such results (or $34.8 million a year in 2006 dollars, assuming the EVT pays 50% of measure incremental costs).[13]

If Efficiency Vermont had to pay 100% of measure incremental or full costs to obtain achievable cost effective potential savings levels, then this $34.8 million annual Efficiency Vermont budget for the base case scenario would increase by at least $16.5 million a year.

A significant portion of this average annual budget of $34.8 million over the next decade is for conversion of residential electric space heating and water heating systems and electric dryers to alternative fuels. Table 1-3 below shows that approximately 22 percent of the total annual budget (the total budget for residential, commercial and industrial programs) would be for fuel conversion programs, where electric end uses are converted to fossil fuels.

[12] The January 2003 Optimal Energy potential study for Vermont assumed that Efficiency Vermont paid 100 percent of incremental measure costs.
[13] This cost estimate is based on the key assumption that Efficiency Vermont pays at least 50% of the incremental costs of energy efficiency measures.

Table 1-3: Annual Energy Efficiency Utility Budget for the Base Case Scenario And Other Budgets (Includes Burlington Electric Department)					
	Column 1	Column 2	Column 3	Column 4	Column 5
Year	Annual Program Budget for Conversion of Electric End Uses to Fossil Fuels	Percent of Total Vermont Program Budget	Total Annual Energy Efficiency Utility Budget for Vermont (Including Burlington Electric Department)	Annual Budget for Fiscal Agent, Contract Agent, and VDPS Monitoring and Evaluation	Total Energy Efficiency Utility Budget Including Fiscal Agent, Contract Agent and M&E
2006	$7,282,076	23%	$31,537,767	$897,000	$32,434,767
2007	$7,333,022	23%	$32,174,445	$917,183	$33,091,627
2008	$7,385,115	22%	$32,864,503	$937,819	$33,802,322
2009	$7,438,380	22%	$33,638,628	$958,920	$34,597,548
2010	$7,492,843	22%	$34,436,453	$980,496	$35,416,949
2011	$7,548,532	22%	$34,946,938	$1,002,557	$35,949,495
2012	$7,605,474	21%	$35,787,372	$1,025,114	$36,812,486
2013	$7,663,696	21%	$36,653,612	$1,048,179	$37,701,791
2014	$7,723,229	21%	$37,546,453	$1,071,764	$38,618,216
2015	$7,784,102	20%	$38,466,711	$1,095,878	$39,562,590
Sum	$75,256,468	22%	$348,052,882	$9,934,910	$357,987,792
Average annual budget	$7,525,647	22%	$34,805,288	$993,491	$35,798,779
NPV of annual budgets	$54,333,622	22%	$249,005,011	$7,106,024	$256,111,035

1.3 Present Value of Savings and Costs (in $2006)

The results of this study demonstrate that energy-efficiency resources could play an expanded role in the Vermont resource mix over the next decade. Table 1-4 below shows the present value[14] of benefits and costs associated with implementing the achievable potential energy savings in Vermont. Benefit/cost screening results for the base case are shown for the Vermont Societal test, the Total Resource Cost Test, the Utility Test, and the Participant Test. The Vermont Societal Test net present savings to the State of Vermont for long-term implementation of energy efficiency programs throughout the State are **$964 million.** The overall Vermont Societal Test benefit/cost ratio for the achievable cost effective potential scenario is 3.45, higher than the Vermont Societal Test ratio from the 2003 energy efficiency potential study.[15] The net present value savings to Vermonters for the Total Resource Cost (TRC) Test are significantly lower, $776 million. The net present value savings of the Vermont Societal Test are 24% higher than the net present value savings of the TRC Test.

[14] The term "present value" refers to a mathematical technique used to convert a future stream of dollars into their equivalent value in today's dollars.

[15] The Societal Test benefit/cost ratio in the 2003 Optimal Energy Study was 2.31. This benefit/cost ratio is listed in Table 5 of the 2003 study.

Table 1-4: VERMONT SOCIETAL TEST - ACHIEVABLE COST EFFECTIVE ELECTRICITY SAVINGS POTENTIAL SCENARIO FOR VERMONT (July 21, 2006)						
Column #	1	2	3	4	5	6
	Present Value of Total Resource Benefits ($2006)	Present Value of Total Measure Incremental Costs ($2006)	Present Value of Vermont Implementation Costs (Staffing, Marketing, Data Tracking & Reporting, etc., $2006)	Present Value Of Total Costs (Col 2 + Col 3)	Net Present Value savings ($2006)	Vermont Societal Test Benefit/Cost Ratio
Residential Sector	$659,181,397	$149,440,570	$51,914,527	$201,355,097	$457,826,300	3.27
Commercial Sector	$409,669,646	$135,407,577	$26,488,747	$161,896,324	$247,773,322	2.53
Industrial Sector	$289,612,700	$15,021,343	$15,721,632	$30,742,975	$258,869,725	9.42
Total	$1,358,463,742	$299,869,489	$94,124,907	$393,994,396	$964,469,346	3.45

TOTAL RESOURCE COST TEST - ACHIEVABLE COST EFFECTIVE ELECTRICITY SAVINGS POTENTIAL SCENARIO FOR VERMONT						
Column #	1	2	3	4	5	6
	Present Value of Total Resource Benefits ($2006)	Present Value of Total Measure Incremental Costs ($2006)	Present Value of Vermont Implementation Costs (Staffing, Marketing, Data Tracking & Reporting, etc., $2006)	Present Value Of Total Costs (Col 2 + Col 3)	Net Present Value savings ($2006)	TRC Test Benefit/Cost Ratio
Residential Sector	$543,049,183	$139,894,604	$49,550,574	$189,445,178	$353,604,005	2.87
Commercial Sector	$354,807,342	$141,923,347	$26,488,747	$168,412,094	$186,395,248	2.11
Industrial Sector	$268,618,432	$16,690,381	$15,721,632	$32,412,013	$236,206,419	8.29
Total	$1,166,474,957	$298,508,331	$91,760,953	$390,269,285	$776,205,672	2.99

UTILITY COST TEST - ACHIEVABLE COST EFFECTIVE ELECTRICITY SAVINGS POTENTIAL SCENARIO FOR VERMONT						
Column #	1	2	3	4	5	6
	Present Value of Total Resource Benefits ($2006)	Present Value of Total Measure Incremental Costs ($2006)	Present Value of Vermont Implementation Costs (Staffing, Marketing, Data Tracking & Reporting, etc., $2006)	Present Value Of Total Costs (Col 2 + Col 3)	Net Present Value savings ($2006)	Utility Cost Test Benefit/Cost Ratio
Residential Sector	$606,347,177	$89,623,458	$53,603,353	$143,226,811	$463,120,366	4.23
Commercial Sector	$354,806,685	$70,961,673	$26,488,747	$97,450,420	$257,356,264	3.64
Industrial Sector	$268,618,432	$7,461,331	$15,721,632	$23,182,963	$245,435,469	11.59
Total	$1,229,772,293	$168,046,462	$95,813,733	$263,860,195	$965,912,099	4.66

PARTICIPANT TEST - ACHIEVABLE COST EFFECTIVE ELECTRICITY SAVINGS POTENTIAL SCENARIO FOR VERMONT						
Column #	1	2	3	4	5	6
	Present Value of Total Resource Benefits ($2006)	Present Value of Total Measure Incremental Costs ($2006)	Present Value of Vermont Implementation Costs (Staffing, Marketing, Data Tracking & Reporting, etc., $2006)	Present Value Of Total Costs (Col 2 + Col 3)	Net Present Value savings ($2006)	Participant Test Benefit/Cost Ratio
Residential Sector	$489,389,745	$96,531,256	$0	$96,531,256	$392,858,489	5.07
Commercial Sector	$332,378,629	$70,961,673	$0	$70,961,673	$261,416,956	4.68
Industrial Sector	$181,200,949	$8,345,190	$0	$8,345,190	$172,855,759	21.71
Total	$1,002,969,323	$175,838,120	$0	$175,838,120	$827,131,203	5.70

Table 1-4 also provides the benefit/cost ratios for each major market sector (residential, commercial and industrial sectors). One factor causing the Societal Test benefit/cost ratio calculation to differ among sectors is differences in the incremental costs of energy efficient equipment by sector. It is common for benefit/cost ratios to differ by sector. The Societal Test is a standard benefit-cost test used by public utilities commissions and energy efficiency organizations in the US and other energy efficiency organizations to compare the value of the avoided energy production and power plant construction to the costs of energy-efficiency measures and program activities necessary to deliver them. The value of both energy savings and peak demand reductions are incorporated into the Societal Test (a full description of this and other cost effectiveness tests is provided in Section 1.4 below). The sector with the highest Societal Test benefit/cost ratio is the industrial sector.

The Vermont Department of Public Service developed an Excel spreadsheet model to determine the rate impacts of various budget scenarios for energy efficiency spending in Vermont. Over the period 2006 to 2009, the average annual rate impact (levelized) of the base case scenario for energy efficiency spending is over 2.0%. Over the period 2006 to 2009, the average annual rate impact (levelized) of the early retirement scenario for energy efficiency spending is over 7.2%.

1.4 Definitions of Benefit Cost Tests

A standard methodology for energy efficiency program cost effectiveness analysis was published in California in 1983 by the California Public Utilities Commission and updated in December 1987 and October 2001.[16] It was based on experience with evaluating conservation and load management programs in the late 1970's and early 1980's. This methodology examines five perspectives:

- the Total Resource Cost Test
- the Participant Test
- the Utility Cost Test (or Program Administrator Test)
- the Rate Impact Measure (RIM) Test
- the Societal Cost Test

Table 1-5 below summarizes the major components of these five benefit/cost tests. Examining this table is useful when trying to understand the differences among the five benefit/cost tests.

[16]California Public Utilities Commission and California Energy Commission, Standard Practice Manual, Economic Analysis of Demand-Side Programs and Projects, 1987 and 2001.

Table 1-5
Components of Energy Efficiency Benefit/Cost Tests

	PARTICIPANT TEST	RATE IMPACT MEASURE TEST	TOTAL RESOURCE COST TEST	UTILITY COST TEST	SOCIETAL TEST
BENEFITS:					
Reduction in Customer's Utility Bill	X				
Incentive Paid By Utility	X				
Any Tax Credit Received	X		X		
Avoided Supply Costs		X	X	X	X
Avoided Participant Costs	X		X		X
Participant Payment to Utility (if any)		X		X	
External Benefits					X
COSTS:					
Utility Costs		X	X	X	X
Participant Costs	X		X		X
External Costs					X
Lost Revenues		X			

The five cost-benefit tests are defined by the California Standard Practice Manual as follows:

1.4.1 The Total Resource Cost Test

The Total Resource Cost (TRC) test measures the net costs of a demand-side management or energy efficiency program as a resource option based on the total costs of the program, including both the participants' and the utility's costs.[17]

Benefits and Costs: The TRC test represents the combination of the effects of a program on both the customers participating and those not participating in a program. In a sense, it is the summation of the benefit and cost terms in the

[17]California Public Utilities Commission, California Standard Practice Manual, Economic Analysis of Demand-Side Management Programs and Projects, October 2001, page 18.

Participant and the Ratepayer Impact Measure tests, where the revenue (bill) change and the incentive terms intuitively cancel (except for the differences in net and gross savings).

The benefits calculated in the Total Resource Cost Test include the avoided electric supply costs for the periods when there is an electric load reduction, as well as savings of other resources such as fossil fuels and water. The avoided supply costs are calculated using net program savings, which are the savings net of changes in energy use that would have happened in the absence of the program.

The costs in this test are the program costs paid by the utility and the participants plus any increase in supply costs for periods in which load is increased. Thus all equipment costs, installation, operation and maintenance, cost of removal (less salvage value), and administration costs, no matter who pays for them, are included in this test. Any tax credits are considered a reduction to costs in this test.

1.4.2 The Participant Test

The Participant Test is the measure of the quantifiable benefits and costs to program participants due to participation in a program. Since many customers do not base their decision to participate in a program entirely on quantifiable variables, this test cannot be a complete measure of the benefits and costs of a program to a customer.[18] This test is designed to give an indication as to whether the program or measure is economically attractive to the customer. Benefits include the participant's retail bill savings over time, and costs include only the participant's costs.

1.4.3 The Rate Impact Measure Test

The Ratepayer Impact Measure (RIM) Test measures what happens to customer bills or rates due to changes in utility revenues and operating costs caused by a program. Rates will go down if the change in revenues from the program is greater than the change in utility costs. Conversely, rates or bills will go up if revenues collected after program implementation are less than the total costs incurred by the utility in implementing the program. This test indicates the direction and magnitude of the expected change in customer rate levels.[19] Thus, this test evaluates an energy efficiency program from the point of view of rate levels. The RIM test is a test of fairness or equity; it is not a measure of economic efficiency.

As noted above, the Vermont Department of Public Service developed an Excel spreadsheet model to determine the rate impacts of various budget scenarios for

[18] Ibid., page 9.
[19] Ibid., page 17.

energy efficiency spending in Vermont. VDPS staff used this model to calculate the year-by-year rate impacts of the base case and other scenarios examined for this study.

1.4.4 The Utility Cost Test

The Utility Cost Test measures the net costs of a demand-side management program as a resource option based on the costs incurred by the utility (including incentive costs) and excluding any net costs incurred by the participant. The benefits are similar to the Total Resource Cost Test benefits. Costs are defined more narrowly, and only include the utility's costs.[20] This test compares the utility's costs for an energy efficiency program to the utility's avoided costs for electricity and/or gas. It is important to remember that the Utility Cost Test ignores participant costs. This means that a measure could pass the Utility Cost Test but not be cost effective from a more comprehensive perspective.

1.4.5 The Societal Test

The Societal Cost Test is structurally similar to the Total Resource Cost Test. It goes beyond the TRC test in that it attempts to quantify the change in total resource costs to society as a whole rather than to only the service territory (the utility and its ratepayers). In taking society's perspective, the Societal Cost Test utilizes essentially the same input variables as the TRC test, but they are defined with a broader societal point of view.[21] An example of societal benefits is reduced emissions of carbon, nitrous and sulfur dioxide and particulates from electric utility power plants.[22] When calculating the Societal Cost Test benefit/cost ratio, future streams of benefits and costs are discounted to the present using a discount rate. The avoided costs of electricity, natural gas, propane, #2 fuel oil, kerosene and water used in this study are provided in Appendix F of this report.

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 costs to account for the risk diversification benefits of energy efficiency measures and programs. The Board subsequently adopted an environmental adder of $.0070 per kWh saved (in $2000). This adder replaces the original 5% adder for environmental externalities. 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. GDS has also applied the 10% reduction to energy efficiency measure costs for all

[20] Ibid., page 33.
[21] Ibid., page 27.
[22] The Vermont Public Service Board Order in Docket No. 5270 cites the following as such societal benefits: reductions in acidic precipitation, carbon dioxide and other greenhouse gases, reduction in habitat destruction, and reduction in nuclear waste disposal risks).

calculations of the Vermont Societal Test. Finally, the VDPS provided GDS with environmental adders relating to fossil fuel savings, and GDS has reflected these adders in the calculation of benefit/cost ratios for the Societal Test.

1.5 Definition of Electric Avoided Costs

The **avoided electric supply costs** for this Vermont energy efficiency potential study consist of the electric supply costs avoided due to the implementation of electric energy efficiency programs. The costs that are avoided depend on the amount electricity that is saved, and when it is saved (in peak heating season periods, seasonal or annual, etc.).

Second, it is very important to note that the electricity avoided costs used in the Total Resource Cost (TRC) Test do not represent the retail rate for each customer class. While the actual retail rate is used in the calculation of the benefits for the Participant Test, the actual retail rate is not the avoided electric cost used in the calculation of the benefits for the Societal Test or the Total Resource Cost Test.

1.6 Spending Per Customer on Energy Efficiency Programs

The Vermont Department of Public Service asked GDS to identify data sources for data on annual spending per customer on energy efficiency programs by various energy efficiency organizations. GDS examined data from US electric utilities available on the Energy Information Administration web site (www.eia.doe.gov) relating to kWh and kW savings from electric utility energy efficiency programs, and data on utility spending on energy efficiency programs. Listed below in Table 1-6 is data on utility spending per customer on energy efficiency by the top 20 DSM utilities in the US and for Efficiency Vermont. The top 20 are defined as those US electric utilities that have saved the largest percentage of annual kWh sales by 2004 with energy efficiency programs. The average spending per customer by the top 20 DSM utilities on energy efficiency programs ranges from $1.01 to $47.16 per customer. These twenty utilities had the highest kWh savings based on energy efficiency savings as a percent of annual kWh sales in 2004.

Table 1-6: 2004 US Electric Utility Annual Spending Per Customer on Energy Efficiency Programs			
Name of Electric Utility or Energy Efficiency Organization	**2004 Dollars spent on Energy Efficiency**	**Number of Customers In Service Area**	**2004 Spending per Customer**
Vermont	$16,200,000	342,142	$47.35
Seattle City of	$17,474,000	370,499	$47.16
Western Mass. Elec Company	$9,043,000	203,223	$44.50
Burlington City of	$846,000	19,696	$42.95
Eugene City of	$3,397,000	83,118	$40.87
United Illuminating Co	$12,968,000	320,800	$40.42
Connecticut Light & Power Co	$45,130,000	1,165,140	$38.73
Massachusetts Electric Co	$46,295,000	1,198,696	$38.62
Avista Corp	$3,846,000	110,293	$34.87
Boulder City City of	$246,000	7,580	$32.45
City of Redding	$1,216,000	42,080	$28.90
Granite State Electric Co	$1,090,000	39,785	$27.40
Wisconsin Power & Light Co	$11,401,000	431,669	$26.41
Northern States Power Co	$31,944,000	1,352,175	$23.62
Minnesota Power Inc	$3,105,000	135,649	$22.89
Puget Sound Energy Inc	$20,869,000	990,020	$21.08
Sacramento Municipal Util Dist	$11,238,000	560,991	$20.03
Southern California Edison Co	$68,922,000	4,597,577	$14.99
City of Tallahassee	$799,000	95,604	$8.36
Northern States Power Co	$1,285,000	238,065	$5.40
City of Springfield	$70,000	69,082	$1.01

According to the Vermont Public Service Board Order in Docket, the total energy efficiency program budget in Vermont in 2004 was $16.2 million.[23] This $16.2 million budget included energy efficiency spending for Efficiency Vermont and the Burlington Electric Department. There were 342,142 electric utility customers in Vermont in 2004.[24] Thus the average annual budget per utility customer in Vermont in calendar year 2004 was $47.35, higher than the top twenty energy efficiency utilities in the US. In 2005 and 2006, the annual budget has been increased to $17.5 million per year.[25]

GDS has also examined data for these top 20 energy efficiency utilities on their actual cost per kWh saved versus the percent of annual kWh sales saved through energy efficiency programs. Figure 1-1 shows a graph of this data for these twenty utilities. There does not appear to be a distinctly clear relationship or clear correlation for these 20 utilities for the cost per kWh saved and the yield

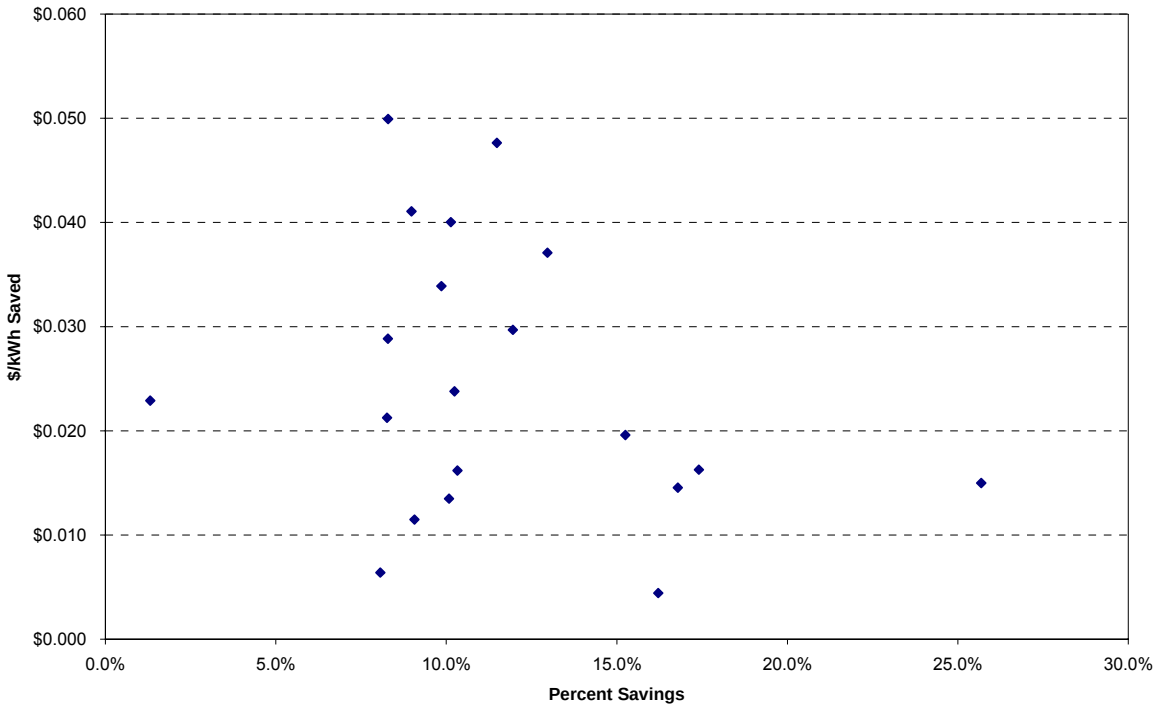
[23] See the Board's Order in Docket 6874 at http://www.state.vt.us/psb/orders/2003/files/6874ord2004rates.pdf

[24] GDS obtained the number of electric utility customers in Vermont for 2004 from the Vermont Department of Public Service web site at http://publicservice.vermont.gov/electric/electric-utilities.html.

[25] To see the text in Docket 6987 relating to the $17.5 million budget, see www.state.vt.us/psb/orders/2004/files/6987finalrates.pdf

of their programs (yield in terms of the percent of annual kWh sales saved with energy efficiency programs).

Figure 1-1: Cumulative Cost Per kWh Saved Versus Percent of Annual kWh Sa;es saved



In fact, it appears that the four utilities that have saved the largest percent of their annual kWh sales (these are the four utilities that have saved more than 15% of annual kWh sales) rank relatively low on the cost per kWh saved for their energy efficiency programs. Thus it is apparent that higher savings levels are not simply a product of higher budgets.

1.7 Comparison of Results to Other Energy Efficiency Potential Studies

Table 1-7 presents a comparison of the results of this study to other recent electric energy efficiency potential studies. As shown in this table, the achievable cost effective potential for electricity savings ranges from 6 percent by 2023 in the service area of Puget Sound Energy to 24 percent in Massachusetts by 2007. Five of the thirteen studies listed in Table 1-7 report achievable cost effective potential in the range of 9 to 13 percent of annual electricity sales. It is very interesting to note that the incentive level assumptions for these thirteen studies range from a low of 15% to a high of 100% of measure costs.

Table 1-7: Comparison of Potential Electrcity Savings from Recent Studies in Other States												
Percent of Total Electricity (GWh) Sales												
Sector	Conn. 2012[1]	California 2011[2,3]	Vermont 2012[4,5]	Mass. 2007[4,5]	Southwest 2020[6]	Big Rivers (KY) 2015[7]	Georgia 2015[8]	New York 2012[9]	Oregon 2013[10]	Puget Sound (WA) 2023[11]	NJ/NH/ PA 2011[12]	Wisconsin 2015
Technical Potential												
Residential	21%	21%			26%	26%	33%	37%	28%			
Commercial	25%	17%			37%		33%	41%	32%			
Industrial	20%	13%			33%	11%	17%	22%	35%			
Total	***24%***	***19%***			***33%***		***29%***	***37%***	***31%***			
Maximum Achievable Potential												
Residential	17%	15%	30%			18%	21%	26%		17%	35%	
Commercial	17%	13%	32%				22%	38%		7%	35%	
Industrial	17%	12%	32%			9%	15%	16%		0%	41%	
Total	***17%***	***14%***	***31%***				***20%***	***30%***		***12%***		
Maximum Achievable Cost Effective Potential												
Residential	13%	10%		31%		16%	9%			7%		4.9%
Commercial	14%	10%		21%		10%	10%			6%		4.8%*
Industrial	13%	11%		21%		9%	7%			0%		
Total	***13%***	***10%***		***24%***		***12%***	***9%***			***6%***		**9.2%**
Incentive Level as a Percent of Incremental Cost												
Percentage	51%-70%	25%, 40%, 55%, 100%	N/A	N/A	15%-25%	50%	25%, 50%, 100%	20% - 50%	N/A			

1.8 Impacts of Early Replacement Programmatic Approach

Energy efficiency potential in the existing stock of buildings can be captured over time through two principal processes:

1. as equipment replacements are made normally in the market when a piece of equipment is at the end of its useful life (we refer to this as the "market-driven" or "replace-on-burnout" case); and,
2. at any time in the life of the equipment or building (which we refer to as the "retrofit" case).

Market-driven measures are generally characterized by *incremental* measure costs and savings (e.g., the incremental costs and savings of a high-efficiency versus a standard efficiency air conditioner); whereas retrofit measures are generally characterized by full costs and savings (e.g., the full costs and savings associated with retrofitting ceiling insulation into an existing attic). A specialized retrofit case is often referred to as "early replacement" or "early retirement". This refers to a piece of equipment whose replacement is accelerated by several years, as compared to the market-driven assumption, for the purpose of capturing energy savings earlier than they would otherwise occur.

For this study, GDS did examine the electric rate impacts of an "early replacement" scenario. In this early replacement scenario, GDS assumed that all energy efficiency potential would be captured over a four-year period, instead of using a "replace-on-burnout" programmatic approach. For this scenario, GDS assumed that the Program Administrator would pay an incentive equivalent to 50% of the full cost of energy efficiency measures. Table 1-8 provides a comparison of the impacts of the replace-on-burnout scenario to the "early replacement" scenario.

Table 1-8: Comparison of Impacts of "Replace-On-Burnout" and "Early Replacement" Programmatic Strategies

	Replace-On-Burnout	Early Replacement
Cumulative Annual MWh Savings by 2015	1,286,824	1,166,144
Cumulative Annual Winter MW Savings by 2015	400	389
Cumulative Annual Summer MW Savings by 2015	243	244
VT Societal Test Ratio	3.45	3.18
NPV of Incentives Paid to Participants	$154,879,104	$290,457,037
Percent Rate Impact Over first four years of program	2.00%	7.20%
Societal Test NPV Savings	$964,469,346	$1,148,841,435

The impacts of the 'early replacement" scenario are interesting. Using an early replacement programmatic approach results in an incentive budget that is higher by $136 million. By the year 2015, cumulative annual kWh and summer peak kW savings are lower than in the "replace-on-burnout" approach. The VT Societal Test benefit/cost ratio is lower for the early replacement scenario. On the other hand, the net present value savings for the early replacement approach is $184.3 million higher than in the replace-on-burnout base case. Overall, the early replacement programmatic approach results in lower kWh and summer peak kW savings by 2015, and this approach has a lower Societal Test benefit/cost ratio.

2.0 INTRODUCTION

The main objective of this energy efficiency potential assessment is to update the assessment of the potential for achievable and cost-effective electric energy efficiency measures for residential, commercial and industrial electric customers in Vermont. The main outputs of this study include the following deliverables:

- A concise, fully documented report on the work performed and the results of the analysis of opportunities for achievable, cost effective electric energy efficiency in Vermont.
- An overview of the impacts that energy efficiency measures and programs can have on electric use in Vermont.
- A summary of the economic costs and benefits of potential energy efficiency measures and programs for the achievable cost effective potential scenario.
- An assessment of the environmental and other non-energy benefits of the achievable cost effective electric energy efficiency options examined in this study.
- An assessment of the long-term rate impacts of the achievable cost effective potential scenario.

2.1 Summary of Approach

A comprehensive discussion of the study methodology is presented in Section 4. GDS first developed estimates of the technical potential and the achievable potential for electric energy efficiency opportunities for the residential, commercial and industrial sectors in Vermont. The GDS analysis utilized the following models and information:

(1) an existing GDS electric and natural gas energy efficiency potential spreadsheet model[26];

(2) detailed information relating to the current and potential saturation of electric energy efficiency measures in Vermont; and

(3) available data on electric energy efficiency measure costs, saturations, energy savings, and useful lives.

The technical potential for electric energy efficiency was based upon calculations that assume one hundred percent penetration of all energy efficiency measures analyzed in applications where they were deemed to be technically feasible from an engineering perspective.

[26] GDS has developed an Excel spreadsheet model and used it to estimate the energy efficiency potential for electric energy efficiency measures in Vermont. It operates on a PC platform using the Microsoft Windows operating system, is documented, and can be followed by a technician with expertise. GDS has provided this model to the Vermont Department of Public Service as a deliverable of this project.

The achievable potential for electric energy efficiency was estimated by determining the highest realistic level of penetration of an efficient measure that would be adopted given aggressive funding, and by determining the highest realistic level of market penetration that can be achieved with a concerted, sustained campaign involving highly aggressive programs and market intervention.

The third level of energy efficiency examined is the achievable cost effective potential. The calculation of the cost effective achievable potential is based, as the term implies, on the assumption that energy efficiency measures/bundles will only be included in Vermont electric efficiency programs when it is cost effective to do so.

All cost effectiveness calculations for electric energy efficiency measures and programs were done using a GDS spreadsheet model that operates in Excel and that has been approved by regulators in several states.

2.2 Report Organization

The remainder of this report is organized as follows:

- Section 3 – Electric Usage – Overview of Vermont Electric Sales and Peak Load Forecast
- Section 4 – Methodology for Determining Energy Savings Potential
- Section 5 – Electric Energy Efficiency Potential – Residential Sector
- Section 6 – Electric Energy Efficiency Potential – Commercial Sector
- Section 7 – Electric Energy Efficiency Potential – Industrial Sector
- Section 8 – Environmental and Other Non-Energy Benefits of Electric Energy Efficiency Programs
- Section 9 – Summary of Findings

3.0 CHARACTERIZATION OF CUSTOMER BASE, ELECTRIC USAGE, AND LOAD FORECAST FOR THE STATE OF VERMONT

This section of the report provides a description of the latest available electric load forecast for the State of Vermont from ISO-New England, and the latest available load growth forecast assumption provided by the Vermont Department of Public Service. This section also provides information on economic, demographic, geographic and appliance saturation characteristics of the State. In order to develop estimates of electricity savings potential, it is important to understand how electricity is used by households and businesses in Vermont. Vermont is a rural state with a population of approximately 625,371 persons in 2005, and 303,000 housing units.[27]

3.1 Vermont Geographic Characteristics

Vermont is the second largest state (in terms of surface area) in New England after Maine. Dominating the state's geography are the Green Mountains, one of the oldest mountain ranges in the world. The nation's sixth largest lake, Lake Champlain, runs along the state's western border.

In comparison with the other forty-nine states, Vermont is small in total area (9,609 square miles). Delivering energy efficiency services in a small state like Vermont presents different challenges than in larger states like Alaska, California and Texas[28]. The State is bordered by Canada, New York, Massachusetts, and New Hampshire. It is 157.4 miles in length, 90.3 miles wide at the Canadian border, and 41.6 miles along the Massachusetts border. The Connecticut River forms the eastern boundary, while the western boundary runs down the middle of Lake Champlain for more than half of its length. Burlington is the largest of Vermont's 255 communities, and it had an estimated population of 38,531[29] in 2005 according the US Census Bureau.

[27] Data obtained by GDS from the Scan USA forecast for the State of Vermont published in the summer of 2005.
[28] Vermont's population density of 65.8 persons per square mile is higher than the population density in Maine (41.3), but it is much lower than the other four New England states. For more detailed information, see http://www.answers.com/topic/list-of-u-s-states-by-population-density.
[29] US Census Bureau, 2005 population estimate for Burlington, Vermont.

3.2 Vermont Map

3.3 Economic/Demographic Forecast Vermont

The Vermont Department of Public Service prepares an annual Electric Plan for the state. The Department's January 2005 Plan noted that the rate of growth in the Vermont economy is slowing. Vermont and the nation experienced recessions in 1990 - 1991 and in 2001 - 2002 that severely impacted personal income, although the National Bureau of Economic Research declared the 2001 –2002 recession over. The Plan also noted that the current economic climate (as of January 2005) in Vermont is significantly improved and Vermont currently enjoys the lowest unemployment rate in the nation. The January 2005 VDPS forecast accounts for the effects of the recessions of 1990 – 1991 and 2001 – 2002. The latest VDPS economic forecast for the State does not project any further recession in the near term, although there is the probability of occurrence given the nature of economic cycles. The VDPS, however, does anticipate that the rate of economic growth in Vermont will decline in the future. This declining growth rate in the Vermont economy in the January 2005 VDPS forecast mirrors that of the U.S. economy and is based mostly on demographic and other long-term changes.

3.3 Historical kWh Sales and Electric Customers in Vermont

Table 3-1 and 3-2 show historical Vermont data for annual kWh sales and electric customers by class of service.[30] Total annual kWh sales in Vermont grew at an annual rate of 1.3% from 1992 to 2004. As one can see from the kWh sales data, the commercial/industrial sector kWh sales grew the fastest from 1994 to 2004 (at 1.7% per year on average),[31] while the residential sector annual kWh sales only grew at 0.6% per year.

Table 3-1: Vermont Sales to Ultimate Customers by Customer Class (kWh)

	Residential	Commercial	Industrial	Other	Total
1992	2,052,047,563	1,528,585,391	1,440,803,001	42,187,090	5,063,623,045
1993	2,010,568,418	1,566,230,573	1,431,005,318	40,023,999	5,047,828,308
1994	2,016,298,354	1,585,438,898	1,425,881,728	40,094,343	5,067,713,323
1995	1,978,870,333	1,600,952,885	1,476,087,147	39,415,838	5,095,326,203
1996	2,005,686,276	1,643,056,833	1,531,469,272	38,357,533	5,218,569,914
1997	1,986,463,698	1,672,972,257	1,608,999,823	38,194,860	5,306,630,638
1998	1,951,303,712	1,853,216,919	1,514,355,515	38,929,921	5,357,806,067
1999	1,993,990,616	1,897,409,767	1,593,169,050	38,650,293	5,523,219,726
2000	2,034,714,985	1,900,823,062	1,652,162,500	40,504,752	5,628,205,299
2001	2,009,278,870	1,920,846,814	1,611,750,379	41,181,682	5,583,057,745
2002	2,046,101,168	1,943,752,256	1,592,436,197	41,575,991	5,623,865,612
2003	2,128,701,848	1,911,511,710	1,561,371,381	41,504,526	5,643,089,465
2004	2,141,488,094	1,926,615,690	1,638,953,742	41,366,336	5,748,423,862
Annual Rate of Growth-1998 to 2004	1.6%	0.6%	1.3%	1.0%	1.2%
Annual Rate of Growth-1994 to 2004	0.6%	2.0%	1.4%	0.3%	1.3%

Table 3-2: Number of Customers by Customer Class - Vermont

	Residential	Commercial	Industrial	Other	Total
1992	264,762	36,371	1,019	NA	302,152
1993	267,284	36,727	1,147	NA	305,158
1994	269,549	37,043	1,167	NA	307,759
1995	272,519	37,474	1,160	NA	311,153
1996	274,779	37,905	1,139	NA	313,823

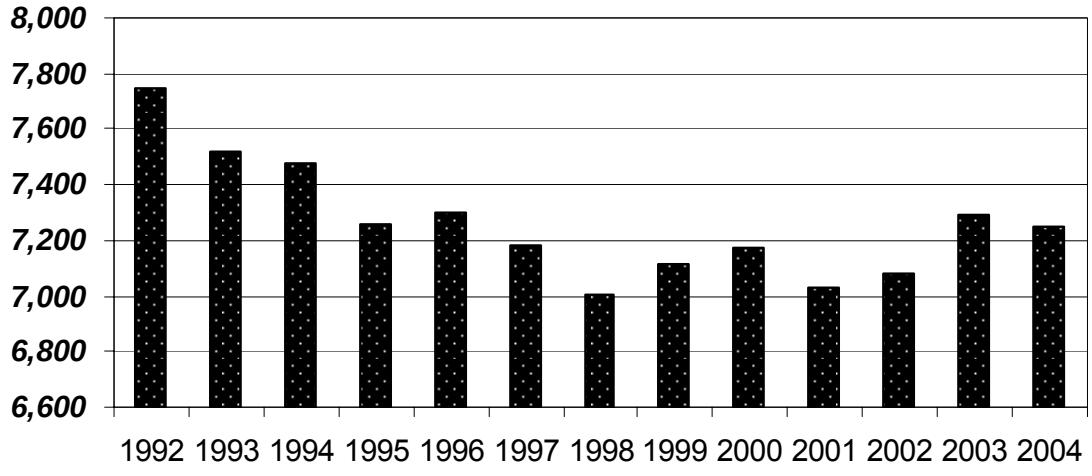
[30] This historical kWh sales data for Vermont was provided to GDS via email on February 17, 2006 by Riley Allen of the Vermont Department of Public Service.

[31] Reclassification of industrial customers to the commercial class in 1998 requires that the two classes be combined for purposes of the growth measurement.

1997	276,447	38,487	1,134	NA	316,068
1998	278,511	39,593	436	NA	318,540
1999	280,312	40,148	441	NA	320,901
2000	283,494	41,125	388	NA	325,007
2001	285,905	42,435	412	NA	328,752
2002	288,966	43,066	455	NA	332,487
2003	292,031	43,783	468	NA	337,826
2004	295,505	44,743	554	NA	342,142

Figure 3-1 shows historical data for average annual kWh use per residential customer for the period 1992 to 2004. There has been a gradual downward trend in electric use per residential customer since 1992. Average annual use per customer in 2004 was 6.5 percent lower than in 1992. Average annual kWh use per residential customer in Vermont is below the New England average and below the US average. Vermont has operated energy efficiency programs throughout this historical period from 1992 to 2004.

FIgure 3-1: Residential Sector Average Annual kWh Use Per Customer



3.4 Latest ISO New England Forecast of kWh Sales and Peak Demand for the State of Vermont

The latest ISO New England (ISO-NE) load forecast for Vermont (forecast after DSM impacts) was completed in January 2006 and is available on the public ISO-NE web site. The ISO-New England load forecast for Vermont is shown below in Tables 3-3 and 3-4. ISO New England does not develop or publish a load forecast by sector, and only develops a forecast of total kWh sales. The ISO-New England load forecast by sector shown in this report in Tables 3-3 and 3-4 was developed by GDS with the assistance of VDPS staff. VDPS staff

provided GDS with a preliminary load forecast by class of service for the State of Vermont.[32] GDS then developed allocation factors (for sector kWh sales as a percent of total annual kWh sales) based on the preliminary load forecast provided by VDPS staff, and then GDS applied these allocation factors to the ISO-NE load forecasts for Vermont to obtain forecasts of kWh sales by sector (e.g., residential, commercial, industrial).

The new ISO-NE load forecast for Vermont[33] (after inclusion of DSM impacts provided by Efficiency Vermont) projects that total kWh sales in the State will grow slowly over the next decade, at a compound average annual growth rate of 1.0% a year. The residential sector is projected to grow at 1.6% a year, the commercial sector at .48% per year, and the industrial sector at 1.54% per year. It is important to note that the commercial and the industrial market shares are expected to decline over time, while the residential market share is expected to increase.

Table 3-3: ISO-New England Load Forecast for Vermont After DSM Impacts (Energy KWH)

Year	Residential	Commercial	Industrial	Other	Total
2006	2,383,766,273	2,097,005,947	1,793,244,945	45,982,835	6,320,000,000
2007	2,425,052,895	2,109,528,944	1,808,671,172	46,746,988	6,390,000,000
2008	2,470,515,892	2,125,104,084	1,826,789,509	47,590,516	6,470,000,000
2009	2,512,542,190	2,137,146,032	1,841,945,077	48,366,701	6,540,000,000
2010	2,551,061,959	2,145,705,545	1,854,158,157	49,074,338	6,600,000,000
2011	2,584,060,685	2,149,216,207	1,862,048,266	49,674,842	6,645,000,000
2012	2,627,081,654	2,160,624,275	1,876,827,047	50,467,024	6,715,000,000
2013	2,672,429,906	2,173,403,110	1,892,864,217	51,302,767	6,790,000,000
2014	2,712,222,173	2,181,159,899	1,904,587,179	52,030,749	6,850,000,000
2015	2,752,326,884	2,188,721,661	1,916,187,765	52,763,691	6,910,000,000
Compound Average Annual Growth Rate	1.61%	0.48%	0.74%	1.54%	1.00%

Table 3-4: ISO-New England Load Forecast for Vermont After DSM Impacts (Energy KWH): Percent of Total Sales by Sector

Year	Residential	Commercial	Industrial	Other	Total
2006	37.7%	33.2%	28.4%	0.7%	100.0%
2007	38.0%	33.0%	28.3%	0.7%	100.0%
2008	38.2%	32.8%	28.2%	0.7%	100.0%
2009	38.4%	32.7%	28.2%	0.7%	100.0%
2010	38.7%	32.5%	28.1%	0.7%	100.0%
2011	38.9%	32.3%	28.0%	0.7%	100.0%
2012	39.1%	32.2%	27.9%	0.8%	100.0%
2013	39.4%	32.0%	27.9%	0.8%	100.0%
2014	39.6%	31.8%	27.8%	0.8%	100.0%
2015	39.8%	31.7%	27.7%	0.8%	100.0%

[32] This preliminary electric load forecast for the State of Vermont for the years 2006 to 2015 was provided by email to Richard Spellman of GDS in February 2006 by Riley Allen of the VDPS.
[33] See ISO-NE Table titled "2006 CELT & RSP Forecast Detail: ISO-NE Control Area, New England States and RSP Sub Areas". This load forecast is at the VELCO level of delivery.

3.4 Latest VDPS Assumption for Future Growth of Vermont kWh Sales and Peak Demand

VDPS staff developed assumptions for use by GDS for growth in kWh sales and peak load for the period 2006 to 2015 before and after DSM impacts are reflected in the numbers. This "before" DSM load growth planning assumption of 1.5% growth per year in kWh sales is listed below in Table 3-5, and the "after" DSM load growth planning assumption is listed above in Table 3-3. It is necessary to use a load forecast before DSM (as shown in Table 3-5) as the starting point for this study for two reasons: (1) in order to be able to determine the achievable electricity savings that could be captured over the next decade and (2) to avoid double-counting of electric energy efficiency savings potential. The GDS energy efficiency potential estimates for Vermont are based on the "before" DSM load growth assumption shown below in Table 3-5.

Table 3-5: VDPS Load Forecast for Vermont Before DSM Impacts (Energy KWH)

Year	Residential	Commercial	Industrial	Other	Total
2006	2,202,847,417	1,937,851,117	1,657,144,427	42,492,912	5,840,335,872
2007	2,249,698,007	1,956,989,504	1,677,886,672	43,366,726	5,927,940,910
2008	2,297,488,146	1,976,267,977	1,698,846,486	44,257,414	6,016,860,024
2009	2,346,235,303	1,995,686,873	1,720,025,472	45,165,276	6,107,112,924
2010	2,395,957,245	2,015,246,524	1,741,425,234	46,090,615	6,198,719,618
2011	2,446,672,036	2,034,947,253	1,763,047,381	47,033,743	6,291,700,412
2012	2,498,398,047	2,054,789,375	1,784,893,523	47,994,974	6,386,075,918
2013	2,551,153,957	2,074,773,199	1,806,965,274	48,974,627	6,481,867,057
2014	2,604,958,761	2,094,899,025	1,829,264,249	49,973,028	6,579,095,063
2015	2,659,831,768	2,115,167,148	1,851,792,067	50,990,506	6,677,781,489
Compound Average Annual Growth Rate	2.12%	0.98%	1.24%	2.05%	1.50%

VDPS Load Forecast for Vermont Before DSM Impacts (Energy KWH) - Percent of Total Annual kWh Sales by Sector

Year	Residential	Commercial	Industrial	Other	Total
2006	37.7%	33.2%	28.4%	0.7%	100.0%
2007	38.0%	33.0%	28.3%	0.7%	100.0%
2008	38.2%	32.8%	28.2%	0.7%	100.0%
2009	38.4%	32.7%	28.2%	0.7%	100.0%
2010	38.7%	32.5%	28.1%	0.7%	100.0%
2011	38.9%	32.3%	28.0%	0.7%	100.0%
2012	39.1%	32.2%	27.9%	0.8%	100.0%
2013	39.4%	32.0%	27.9%	0.8%	100.0%
2014	39.6%	31.8%	27.8%	0.8%	100.0%
2015	39.8%	31.7%	27.7%	0.8%	100.0%

The VDPS January 2005 Electric plan states that the demand for electricity in Vermont will increase modestly in the future. Electric demand in Vermont increased from 4,961 GWh in 1990 to 5,628 GWh in 2000, a compound annual growth rate of 1.3 percent between 1990 and 2000. Between 2000 and 2003, the growth rate further dampened to a rate of only 0.3% growth per year (partially due to an economic recession in the state during that time period). The VDPS plan projected that the compound annual growth rate in electric demand would be about 1% from 2005 to 2020.[34]

The VDPS plan noted that, within Vermont, the growth in the demand for electricity will vary by region where some regions may see much higher growth rates. On a statewide basis, however, areas showing faster growth are offset by slower growth areas of the state to produce an overall projected growth rate of only 1% throughout the forecast period. A persistent trend of higher growth in the Northwest section of the state is an ongoing challenge for utility managers and regulators. As discussed in the VDPS 2005 Plan, growth in electric demand is occurring fastest in and around Chittenden County and some of the winter recreational communities in central and southern Vermont. A comparison of population density growth correlates closely with areas that are experiencing the transmission and distribution constraints for which Distributed Utility Planning (DUP) is targeting Area Specific Collaboratives (ASC).

3.5 Appliance Saturation Data for Vermont

During 2005 the VDPS completed a Residential Appliance Saturation Survey (RASS). This survey collected information on appliance holdings, fuel shares, and other energy related characteristics from a sample of residential customers in Vermont. The survey data were used to develop penetration and saturation rates for heating and cooling equipment, appliances, and other plug loads. Listed below is a summary of the appliance saturation data that was collected. Most of this data has been used by GDS in developing up-to-date estimates for the remaining potential for electricity savings in Vermont. While this survey information provides a timely and useful snapshot of the State, there are notable differences between statewide data and the City of Burlington.[35] Table 3-7 provides a summary of key residential appliance saturation data for Vermont.

[34] The VDPS load forecast in the January 2005 plan includes the impacts of DSM.

[35] In comments to the Public Service Board presented in a May 3, 2006 memo, BED notes, for example, that electric hot water penetration is 37% statewide, but only 15 to 20% in Burlington. Only about 10% of their hot water tanks could be cost effectively fuel switched. The housing ownership characteristics of Burlington are also different than the state as a whole. Statewide, approximately 70% of residences are owner-occupied. In Burlington, approximately 60% are rental units. Memo from Chris Burns, BED, to the Public Service Board dated May 3, 2006.

Table 3-7
2005 Appliance Penetration and Saturation Data for Vermont

Equipment Type	Penetration (N = 600)	Saturation (N = 600)
Electric Space Heat	2%	2%
Electric Water Heat	37%	37%
Electric Central Air Conditioning	4%	4%
Electric Clothes Washers	92%	92%
Electric Clothes Dryers	74%	74%
Dishwashers	57%	57%
Refrigerators	100%	113%
Freezers	42%	44%
Prog. Thermostats (Elec. Space Heat)	4.2%	4.2
Fans		
Kitchen Range Vent Fan	71%	72%
Bathroom Fan	63%	93%
Ceiling Fan	58%	114%
Portable Fan	56%	119%
Attic or Whole-House Fan	11%	15%
Radon mitigation fans or pumps	1%	2%
Pumps		
Electric pump for well water	44%	45%
Swimming pool pump	11%	*
Aquarium with a pump	7%	7%
Whirlpool bathtub	7%	*
Heaters, Hot Tubs, and Saunas		
Hot tub or spa	6%	*
Heat pump water heater	4%	4%
Heated waterbed	3%	3%
Swimming pool heater	2%	2%
Instant hot water dispenser	2%	2%
Sauna	1%	*
Other Plug Loads		
Cordless telephones	86%	134%
Portable appliances or tools	63%	136%
Dehumidifier	29%	30%
Humidifier	25%	28%
Backup portable generator	14%	15%
Electronic household air cleaner	13%	15%

4.0 OVERALL APPROACH TO ASSESS ACHIEVABLE POTENTIAL FOR ENERGY EFFICIENCY MEASURES IN VERMONT

This section of the report presents an overview of the approach and methodology that was used to determine the achievable cost-effective potential for electric energy efficiency measures in the State of Vermont. The three key calculations that have been undertaken to complete this assessment are described below. Following the descriptions, the three stages of potential energy savings are shown graphically in a Venn diagram[36] in Figure 4-1.

The first step was to estimate the technical potential for electric energy efficiency savings in Vermont. **Technical potential** is defined as the complete penetration of all measures analyzed in applications where they are deemed to be technically feasible from an engineering perspective. The total technical potential for electric energy efficiency for each sector was developed from estimates of the technical potential of individual energy efficiency measures applicable to each sector (energy efficient space heating, energy efficient water heating, etc.). For each energy efficiency measure, GDS calculated the electricity savings that could be captured if 100 percent of inefficient electric appliances and equipment were replaced instantaneously (where they are deemed to be technically feasible).

- The second step was to estimate the achievable energy efficiency potential. **Achievable potential** is defined as the achievable penetration of an efficient measure that would be adopted given aggressive funding, and by determining the achievable market penetration that can be achieved with a concerted, sustained campaign involving highly aggressive programs and market interventions. The State of Vermont would need to undertake an extraordinary effort to achieve this level of savings. The term "achievable" refers to efficiency measure penetration, and means that the GDS Team has based our estimates of efficiency potential on the realistic penetration level that can be achieved by 2015.

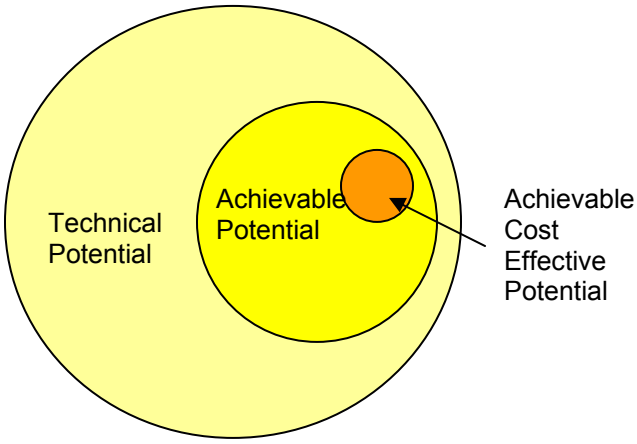
- **Achievable cost effective potential** is defined as the potential for the realistic penetration of energy efficient measures that are cost effective according to the Vermont Societal Test, and would be adopted given aggressive funding levels, and by determining the highest level of realistic market penetration that can be achieved with a concerted, sustained campaign involving highly aggressive programs and market interventions. As demonstrated later in this report, the State of Vermont would need to continue to undertake an aggressive effort to achieve this level of savings.

To develop the cost effective achievable potential, the GDS Team only retained those electric energy efficiency measures in the analysis that were found to be cost effective (according to the Vermont Societal Test) based on the individual

[36] A Venn diagram is a graph that employs circles to represent logical relations between sets and subsets.

measure cost effective analyses conducted in this Study. Energy efficiency measures that are not cost effective were excluded from the estimate of cost effective achievable electric energy efficiency potential. Figure 4-1 below shows these three stages of the electric energy savings potential (this Venn diagram figure is for illustrative purposes only and does not reflect actual data for Vermont).

Figure 4-1 – Venn Diagram of the Stages of Energy Savings Potential



4.1 Overview of Methodology

Our analytical approach began with a careful assessment of the existing level of electric energy efficiency that has already been accomplished in Vermont. For each electric energy efficiency measure, this analysis assessed how much energy efficiency has already been accomplished as well as the remaining potential for energy efficiency savings for a particular electric end use. For example, if 100 percent of the homes in Vermont had electric lighting, and 30 percent of light bulbs were already high efficiency compact fluorescent bulbs (CFLs), then the remaining potential for energy efficiency savings is the 70 percent of light bulbs in the residential sector that are not already high efficiency fluorescent bulbs.

The general methodology used for estimating the potential for electric energy efficiency in the residential, commercial and industrial sectors of Vermont included the following steps:

1. Identification of data sources for electric energy efficiency measures.
2. Identification of electric energy efficiency measures to be included in the assessment.
3. Determination of the characteristics of each energy efficiency measure including its incremental cost, electric energy savings, operations and maintenance savings, current saturation, the percent of installations that are already energy efficient, and the useful life of the measure.

4. Calculation of initial cost-effectiveness screening metrics (e.g., the Societal Test benefit cost ratio) and sorting of measures from least-cost to highest cost per kWh saved.
5. Collection and analysis (where data was available) of the baseline and forecasted characteristics of the electric end use markets, including electric equipment saturation levels and consumption, by market segment and end use over the forecast period.
6. Integration of measure characteristics and baseline data to produce estimates of cumulative costs and savings across all measures (supply curves).
7. Determination of the cumulative technical and achievable potentials using supply curves.
8. Determination of the annual achievable cost effective potential for electricity savings over the forecast period.

A key element in this approach is the use of energy efficiency supply curves. The advantage of using an energy efficiency supply curve is that it provides a clear, easy-to-understand framework for summarizing a variety of complex information about energy efficiency technologies, their costs, and the potential for energy savings. Properly constructed, an energy-efficiency supply curve avoids the double counting of energy savings across measures by accounting for interactions between measures. The supply curve also provides a simplified framework to compare the costs of electric energy efficiency measures with the costs of electric energy supply resources.

The supply curve is typically built up across individual measures that are applied to specific base-case practices or technologies by market segment. Measures are sorted on a least-cost basis and total savings are calculated incrementally with respect to measures that precede them. Supply curves typically, but not always, end up reflecting diminishing returns, i.e., costs increase rapidly and savings decrease significantly at the end of the curve. There are a number of other advantages and limitations of energy-efficiency supply curves (see, for example, Rufo 2003).[37]

4.2 General Methodological Approach

This section describes the calculations used to estimate the electric energy efficiency potential in the residential, commercial, and industrial sectors. There is a core equation, shown in Tables 4-1 and 4-2, used to estimate the technical potential for each individual electric efficiency measure and it is essentially the same for each sector. However, for the residential sector, the equation is applied

[37] Rufo, Michael, 2003. *Attachment V – Developing Greenhouse Mitigation Supply Curves for In-State Sources*, *Climate Change Research Development and Demonstration Plan,* prepared for the California Energy Commission, Public Interest Energy Research Program, P500-03-025FAV, April. http://www.energy.ca.gov/pier/reports/500-03-025fs.html

to a "bottom-up" approach where the equation inputs are displayed in terms of the number of homes or the number of high efficiency units (e.g., compact fluorescent light bulbs, high efficiency air conditioning systems, programmable thermostats, etc.). For the commercial and industrial (C&I) sectors, a "top-down" approach was used for developing the technical potential estimates. In this case, the data is displayed in terms of energy rather than number of units or square feet of floor area.[38] For the commercial and industrial sectors, GDS used Vermont specific equipment saturation and electric end use data wherever such data was available. The core equations used by GDS are very similar to the equations used in the prior Vermont energy efficiency potential study completed in January 2003.

4.2.1 Core Equation for Estimating Technical Potential

The core equation used to calculate the electric energy efficiency technical potential for each individual efficiency measure for the residential sector is shown below in Table 4-1.

Table 4-1 – Core Equation for Residential Sector

Technical Potential of Efficient Measure	=	Total Number of Residential Households	X	Base Case Equipment End Use Intensity (annual kWh use per home)	X	Base Case Factor	X	Remaining Factor	X	Convertible Factor	X	Savings Factor

where:

- **Number of Households** is the number of residential electric customers in the market segment.

- **Base-case equipment end use intensity** is the electricity used per customer per year by each base-case technology in each market segment. This is the consumption of the electric energy using equipment that the efficient technology replaces or affects. For example purposes only, if the efficient measure were a high efficiency light bulb (CFL), the base end use intensity would be the annual kWh use per bulb per household associated with an incandescent light bulb that provides equivalent lumens to the CFL.

- **Base Case factor** is the fraction of the end use electric energy that is applicable for the efficient technology in a given market segment. For

[38] It is important to note that square-foot based saturation assumptions cannot be applied to energy use values without taking into account differences in energy intensity (e.g., an area covered by a unit heater may represent two percent of floor space but a larger percent of space heating energy in the building because it is likely to be less efficient than the main heating plant).

example, for residential lighting, this would be the fraction of all residential electric customers that have electric lighting in their household.

- **Remaining factor** is the fraction of applicable dwelling units that have not yet been converted to the electric energy efficiency measure; that is, one minus the fraction of households that already have the energy-efficiency measure installed.

- **Convertible factor** is the fraction of the applicable dwelling units that is technically feasible for conversion to the efficient technology from an *engineering* perspective (e.g., it may not be possible to install CFLs in all light sockets in a home because the CFLs may not fit in every socket in a home).

- **Savings factor** is the percentage reduction in electricity consumption resulting from application of the efficient technology.

The core equation used to calculate the electric energy efficiency technical potential for each individual efficiency measure for the commercial and industrial sectors is shown below in Table 4-2.

Table 4-2 – Core Equation for C&I Sectors

Technical Potential of Efficient Measure	=	Total End Use kWh Sales by Industry Type	X	Base Case Factor	X	Remaining Factor	X	Convertible Factor	X	Savings Factor

where:

- **Total end use kWh sales (by segment)** is the forecasted level of electric sales for a given end-use (e.g., space heating) in a commercial or industrial market segment (e.g., office buildings).

- **Base Case factor** is the fraction of the end use electric energy that is applicable for the efficient technology in a given market segment. For example, for fluorescent lighting, this would be the fraction of all lighting kWh in a given market segment that is associated with fluorescent fixtures.

- **Remaining factor** is the fraction of applicable kWh sales that are associated with equipment that has not yet been converted to the electric energy efficiency measure; that is, one minus the fraction of the market segment that already have the energy-efficiency measure installed.

- **Convertible factor** is the fraction of the equipment or practice that is technically feasible for conversion to the efficient technology from an *engineering* perspective (e.g., it may not be possible to install VFDs on all motors in a given market segment).

- **Savings factor** is the percentage reduction in electricity consumption resulting from application of the efficient technology.

Technical electric energy efficiency savings potential was calculated in two steps. In the first step, all measures are treated *independently*; that is, the savings of each measure are not reduced or otherwise adjusted for overlap between competing or synergistic measures. By treating measures independently, their relative economics are analyzed without making assumptions about the order or combinations in which they might be implemented in customer buildings. However, the total technical potential across measures cannot be estimated by summing the individual measure potentials directly because some savings would be double-counted. For example, the savings from a weatherization measure, such as low-e ENERGY STAR® windows, are partially dependent on other measures that affect the efficiency of the system being used to cool or heat the building, such as high-efficiency space heating equipment or high efficiency air conditioning systems; the more efficient the space heating equipment or electric air conditioner, the less energy saved from the installation of low-e ENERGY STAR windows.

For the residential and commercial sectors, the GDS Team addressed the new construction market as a separate market segment, with a program targeted specifically at the new construction market. In the residential new construction market segment, for example, detailed energy savings estimates for the ENERGY STAR Homes program were used as a basis for determining electricity savings for this market segment in Vermont.

4.2.2 Rates of Implementation for Energy Efficiency Measures

For new construction, energy efficiency measures can be implemented when each new home or building is constructed, thus the rate of availability is a direct function of the rate of new construction. For existing buildings, determining the annual rate of availability of savings is more complex. Energy efficiency potential in the existing stock of buildings can be captured over time through two principal processes:

1. as equipment replacements are made normally in the market when a piece of equipment is at the end of its useful life (we refer to this as the “market-driven” or “replace-on-burnout” case); and,
2. at any time in the life of the equipment or building (which we refer to as the “retrofit” case).

Market-driven measures are generally characterized by *incremental* measure costs and savings (e.g., the incremental costs and savings of a high-efficiency versus a standard efficiency air conditioner); whereas retrofit measures are generally characterized by full costs and savings (e.g., the full costs and savings associated with retrofitting ceiling insulation into an existing attic). A specialized retrofit case is often referred to as "early replacement" or "early retirement". This refers to a piece of equipment whose replacement is accelerated by several years, as compared to the market-driven assumption, for the purpose of capturing energy savings earlier than they would otherwise occur.

For the market driven measures, we assumed that existing equipment will be replaced with high efficiency equipment at the time a consumer is shopping for a new appliance or other energy using equipment, or if the consumer is in the process of building or remodeling. Using this assumption, equipment that needs to be replaced (replaced on burnout) in a given year is eligible to be upgraded to high efficiency equipment. For the retrofit measures, savings can theoretically be captured at any time; however, in practice it takes many years to retrofit an entire stock of buildings, even with the most aggressive of efficiency programs.

As noted above, a special retrofit case is "**early retirement**" of electrical equipment that is still functioning well, and replacing such equipment with high efficiency equipment. For early retirement energy efficiency measures, GDS assumed that the measure would be replaced early, at least five years prior to reaching the end of its expected lifetime. Therefore, for the first five years, the energy savings associated with the efficiency measure reflect the large savings that result from replacing an old, relatively inefficient measure with a new energy-efficient model (the energy savings are calculated as the difference between the old unit that is replaced and the new high efficiency unit that is installed). For the remaining life of the measure beyond year five, the energy savings associated with the measure reflects the incremental savings associated with installing an energy-efficient model rather than a new standard-efficiency model. While there are more substantial energy savings available in the first five years, continued savings at a lower level are captured for the remainder of the measure lifetime. Over the long-term (longer than five years), the energy savings from an early retirement scenario in most cases are very similar to the market driven (replace on burnout) scenario. On the other hand, the implementation costs for an early retirement scenario are much higher in the near term, because total resource costs are based on the full cost of purchasing a new appliance or piece of energy efficient equipment, not the incremental cost. GDS notes that in modeling early retirement scenarios, it is also appropriate to reflect a deferred cost credit for the energy efficient equipment to reflect the purchase cost avoided at the time the participant would have purchased new equipment in the absence of the early retirement program. It is also necessary, however, to reflect reduced energy savings, beginning at the same time that the deferred cost credit is recognized.

GDS has developed a special "early retirement" scenario for this report where all residential appliances are replaced during the four-year period from 2006 to 2009, and similar early replacements are made in the commercial sector. The results of this scenario are presented in Appendix G, and show that the financial incentive budget for Efficiency Vermont increases dramatically, by several hundred million dollars as compared to a replace on burnout programmatic strategy. The cumulative annual mWh and mW savings are similar to the replace on burnout approach, but the budget impact of the early retirement approach is dramatic.

Example for Early Retirement of a Refrigerator

To understand the impacts of an early retirement strategy, GDS prepared a case study for a single refrigerator. The findings of this case are very interesting. Both the early retirement replacement strategy and the replace-on burnout replacement strategy pass the Vermont Societal Test. While both strategies result in identical cumulative annual kWh and kW savings by 2015, the early retirement strategy costs the State of Vermont $535 more per refrigerator because it is necessary to pay an incentive equal to 50% of the full cost of the refrigerator, or $550 per participant, instead of a $15 incentive for the replace-on-burn-out strategy (the total incremental cost of an Energy Star refrigerator is only $30). With the replace on burnout strategy, you get the same kWh and kW savings by 2015, but the State of Vermont only has to pay an incentive of $15 per home. There are 228,000 inefficient refrigerators that can be replaced. If the early retirement strategy is used, and if the incentive necessary to get participation for the early retirement strategy is 50% of the full cost of a refrigerator, then the State of Vermont would have to pay $125.4 million in incentives instead of $3.4 million.[39]

There is one more cost that needs to be considered for the early replacement programmatic approach. Using the case study example for one refrigerator noted above, it is necessary to capture the additional costs to program participants of roughly five years of additional capital costs of equipment due to advancing the refrigerator replacement cycle by five years. Because the early replacement programmatic approach permanently advances the cycle of when the refrigerator will be replaced in the future, it is necessary to add this cost impact to the economic analysis.[40] The point is that by advancing a capital expense five years, you advance an entire stream of capital expenses over many years, and this has to be accounted for in the cost effectiveness screening analysis.

[39] The societal costs increase significantly as well; early retirement means that the stream of capital plant replacement expenditures that would otherwise occur over time is substantially advanced. For purposes of the analysis, it would be advanced by 5 years adding significantly to the capital costs of the energy efficiency on any of the relevant economic tests.

[40] This cost is discussed on page 2 of a paper titled "Retrofit Economics 201: Correcting Common Errors in Demand-Side Management Cost-Benefit Analysis", by Rachel Brailove, John Plunkett, and Jonathan Wallach, Resource Insight, Inc. William Steinhurst of the Vermont Department of Public Service assisted in the derivation of this deferred replacement concept.

In the case of a refrigerator with a useful life of 13 years that is replaced five years early, this additional cost is equal to 5/13th of the full cost of the new high efficiency refrigerator, or $423. GDS includes this additional cost when considering the cost effectiveness of the early retirement programmatic approach.

4.2.3 Development of Achievable Cost Effective Potential Estimates for Energy Efficiency

To develop the **achievable cost effective potential** for electric energy efficiency, energy efficiency measures that were found to be cost effective (according to the Societal Test) were retained in the energy efficiency supply curves. Electric energy efficiency measures that were not cost effective (such as the "turn in" program for room air conditioners in single-family homes) were excluded from the estimate of achievable cost effective energy efficiency potential.

4.2.4 Free-Ridership and Free-Driver Issues

Free-riders are defined as participants in an energy efficiency program who would have undertaken the energy-efficiency measure or improvement in the absence of a program or in the absence of a monetary incentive. Free-drivers are those who adopt an energy efficient product or service because of the intervention, but are difficult to identify either because they do not collect an incentive or they do not remember or are not aware of exposure to the intervention.[41]

The issue of free-riders and free-drivers is important. For the commercial and industrial sectors, where a top-down approach is used to estimate electric savings potential, free-riders are accounted for through the electric energy and peak demand forecast provided by ISO-New England. This electric kWh sales forecast already includes the impacts of naturally occurring energy efficiency (including impacts from vintaging of electric appliances, electric price impacts, and electric appliance efficiency standards). Because naturally occurring energy savings are already reflected in the electricity sales forecast used in this study, these electric savings will not be available to be saved again through the GDS energy efficiency supply curve analysis. GDS used this process to ensure that there is no "double-counting" of energy efficiency savings. This technical methodology for accounting for free-riders for the commercial and industrial sectors is consistent with the standard practice used in other recent technical potential studies, such as those conducted in California, Connecticut, Florida, Georgia, Idaho, Kentucky, New Mexico and Utah.

[41] Pacific Gas and Electric Company, "A Framework for Planning and Assessing Publicly Funded Energy Efficiency Programs", Study ID PG&E-SW040, March 1, 2001.

Adjustments to Savings for the Residential Sector

As noted above, GDS used a "bottom-up" approach to estimate potential kWh savings remaining in the residential sector in Vermont. Because a detailed residential end use forecast for electricity sales in Vermont was not available to GDS for this study, GDS and VDPS staff examined whether it would be necessary to adjust projected electricity savings for free-ridership, spillover and other market effects. GDS collected data on energy efficiency program realization rates from programs at NYSERDA, National Grid and Wisconsin Focus on Energy. As a result of this review, and using NYSERDA's most recent data, GDS has used an adjustment factor of 1.0 at this time for the residential sector to capture the impacts reflected in realization rates and net to gross ratios for this sector. The definitions of these terms are provided below.

net to gross ratio: this is an adjustment factor that accounts for the amount of energy savings, determined after adjusting for free ridership and spillover (market effects), attributable to the program.

realization rate: this factor is calculated as the energy or demand savings measured and verified divided by the energy or demand savings claimed by NYSERDA. A rate of 1.0 means that the savings measured and verified aligned exactly with the savings claimed. A rate greater than 1.0 means that the savings were under-reported, while a rate less than 1.0 means the savings were over-estimated.

4.3 Basis for Long Term Achievable Market Penetration Rate for High Efficiency Equipment and Building Practices

This section explains the basis used in this study for the achievable penetration rate that cost effective electric energy efficiency programs can attain over the long-term (ten years) with well-designed programs and aggressive funding. GDS is using an achievable penetration rate of **80 percent** by 2015 for the residential, commercial and industrial sectors in Vermont.

The achievable electric energy efficiency potential for the residential, commercial and industrial sectors is a subset of the technical potential estimates. The GDS Team has based the estimates of efficiency potential on the highest realistic penetration that can be achieved by 2015 (ten years from now) based on aggressive funding and an incentive level equal to 50% of measure costs.

The achievable potential estimate for energy efficiency defines the upper limit of savings from market interventions. For each sector, the GDS Team developed the initial year (2006) and terminal year (2015) penetration rate that is likely to be achieved over the long term for groups of measures (space heating equipment, water heating equipment, etc.) by end use for the "naturally occurring scenario" and the "aggressive programs and unlimited funding" scenario. GDS reviewed

penetration rate forecasts from other recent energy efficiency technical potential studies, actual penetration experience for electric and natural gas energy efficiency programs operated by energy efficiency organizations (Efficiency Vermont, Efficiency Maine, Pacific Gas and Electric, KeySpan Energy Delivery, NEEP, NYSERDA, Northwest Energy Efficiency Alliance, BPA, Wisconsin, Focus on Energy, other electric and gas utilities, etc.), and penetration data from other sources (program evaluation reports, market progress reports, etc.) to estimate terminal penetration rates in 2015 for the achievable scenario. In addition, the GDS Team conducted a survey of nationally recognized energy efficiency experts requesting their estimate of the achievable penetration rate over the long-term for a state or region, assuming implementation of aggressive programs and assuming aggressive funding. The terminal year (2015) penetration estimates used by GDS in this study are based on the information gathered through this process. Based on a thorough review of all of this information, GDS used an achievable penetration rate of **80 percent** by 2015 for Vermont's residential, commercial and industrial sectors.

4.3.1 Examples of US Efficiency Programs with High Market Penetration

GDS collected information on electric and gas energy efficiency programs conducted during the past three decades where high penetration has been achieved. Examples of such programs are listed below:

1. The Residential Multifamily/Low-Income Program in Vermont achieved a market share of over 90 percent for new construction and nearly 30 percent for existing housing.[42]
2. The residential water heater bundle-up program conducted by Central Maine Power Company has achieved a market penetration of over 80 percent of residential electric water heaters in the Company's service area. This program has been operated by CMP since the 1980's.
3. The Northwest Energy Efficiency Alliance reported that the market share of ENERGY STAR windows in the Northwest reached 75 percent by mid-2002 and is continuing to increase.[43]
4. Vermont Gas Systems' reported that 68 percent of new homes in their service territory were ENERGY STAR Homes in 2002.[44]
5. Gaz Metro in Quebec reported that the national market share of high efficiency furnaces in Canada has reached 40 percent due to years of energy efficiency programs.[45]

[42] York, Dan; Kushler, Martin; America's Best: Profiles of America's Leading Energy Efficiency Programs," published by the American Council for an Energy Efficient Economy, March 2003. Report Number U032.
[43] Id.
[44] American Council for an Energy Efficient Economy, "America's Best Gas Energy Efficiency Programs", 2003.

6. Residential weatherization and insulation programs implemented by electric and gas utilities in New England have achieved high participation rates.
7. In the State of Wisconsin, a natural gas energy efficiency program to promote high efficiency gas furnaces attained a penetration rate of over 90 percent.[46]
8. KeySpan Energy Delivery's high efficiency residential furnace program has achieved a market share of approximately 70 percent over eight years (1997-2005).[47]

GDS finds that the actual market penetration experience from electric and gas energy efficiency programs in Vermont and in other States is useful and pertinent information that should be used as a basis for developing long-term market penetration estimates for electric energy efficiency programs in Vermont. In addition, recent technical potential studies in such states as California, Connecticut, Florida, Georgia, Kentucky, New Mexico, and Utah also have used a maximum achievable penetration rate of 80 percent.

4.3.2 Lessons Learned from America's Leading Efficiency Programs

GDS also reviewed program participation and penetration data included in ACEEE's March 2003 report on America's leading energy efficiency programs.[48] The information presented in this ACEEE report clearly demonstrates the wide range of high-quality energy efficiency programs that are being offered in various areas of the United States today. A common characteristic of the programs profiled in this ACEEE report is their success in reaching customers with their messages and changing behavior, whether regarding purchasing of new appliances, designing new office buildings, or operating existing buildings. GDS considered this information in the development of assumptions for maximum penetration rates achievable over the long term with aggressive programs.

4.4 Bundling of Efficiency Measures Into Programs

In addition to performing cost effectiveness screening at the measure level, GDS completed cost effectiveness screening of programs. For the program level

---

[45] Id.
[46] Hewitt, David. C., "The Elements of Sustainability", paper presented at the 2000 ACEEE Summer Study on Energy Efficiency in Buildings. Washington: American Council for an Energy Efficient Economy. Pages 6.179-6.190. The Wisconsin furnaces case study data can be found in the 2000 ACEEE Summer Study Proceedings on pages 6.185-6.186.
[47] American Council for an Energy Efficient Economy, "America's Best Gas Energy Efficiency Programs", 2003.
[48] York, Dan; Kushler, Martin; "America's Best: Profiles of America's Leading Energy Efficiency Programs," published by the American Council for an Energy Efficient Economy, March 2003, Report Number U032.

screening, GDS bundled measures targeting specific end uses into a program portfolio. Table 4-3 below shows how measures were bundled for residential programs for purposes of this study. Then GDS performed cost effectiveness screening at the program level for all programs. It is important to note that this final version of this report does include an assessment of electric savings potential from electric space heat, electric water heater, and electric dryer fuel switching in the residential sector.

Table 4-3: Bundling of Measures Into Programs – Residential Sector

Number	Program	Measures Included
1	Residential Lighting (Bulbs and Fixtures)	Compact fluorescent lightbulbs, fixtures, torchieres, Energy Star ceiling fans
2	Weatherization and Insulation	Attic insulation, wall insulation, floor insulation, caulking, weather-stripping for homes with electric space heat
3	Programmable Thermostats	Programmable Thermostats
4	Residential Energy Star Appliances	Energy Star Refrigerators, Freezers, Dishwashers, Clothes Washers
5	Low Income Weatherization Program	Attic insulation, wall insulation, floor insulation, caulking, weather-stripping
6	Energy Star Windows (retrofit measure)	High efficiency windows for existing homes with electric space heat
7	Appliance pick-up program	Old refrigerators, room air conditioners, freezers
8	Energy Star Homes Program	Efficient building practices and Energy Star Appliances for New Homes
9	Electric Water Heater Efficiency Measures	Water heater insulation jacket, faucet aerators, low flow showerheads, pie wrap for hot water pipes
10	Electric Water Heater Fuel Conversion	Conversion of electric water heaters to non-electric fuels (natural gas, #2 fuel oil, kerosene, propane, wood, etc.)
11	Solar Water Heating	Conversion of existing electric water heaters to solar water heating
12	Electric space heat fuel conversion	Conversion of electric space heating systems to alternate fueled systems
13	Electric dryer fuel conversion	Conversion of electric dryers to alternate fueled dryers
14	High efficiency swimming pool pumps	Efficient swimming pool pumps
15	High efficiency furnace fans	High efficiency electric fans for forced hot air heating systems

4.5 Development of Program Budgets

GDS obtained the latest available accounting data from Efficiency Vermont for actual costs related to administration, marketing, staffing, and evaluation for each existing Efficiency Vermont program. These costs, excluding incentives paid to participants or market actors, will be referred to as "overhead administrative costs" throughout the remainder of this report. Then GDS calculated two ratios for each program as follows:

Ratio 1 = Overhead administrative costs/first year kWh savings for a program

Ratio 2 = Overhead administrative costs/number of program participants for that year

These ratios for Efficiency Vermont's residential programs are listed below in Table 4-4. GDS selected one of these ratios for each program as the basis for developing overhead administrative costs.

BASIS FOR PROGRAM ADMINISTRATIVE, MARKETING, IMPLEMENTATION AND EVALUATION COSTS

Number	Program Name	Basis for Non-Incentive Budget	Data Source	Pg.	Implementation $ per kWh
1-2	Appliance Buy-Back Program (Refrigerators & Freezers)	Per participant data	United Illuminating		$92.53/part
3	Appliance Buy-Back Program (Room ACs w/ Replacement)	Per participant data	United Illuminating		$117.53/part
4	Appliance Buy-Back Program (Room ACs w/o Replacement)	Per participant data	United Illuminating		$107.53/part
5-14	Energy Star Appliances	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	42	$0.033903/kWh
15	Standby Power	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	42	$0.033903/kWh
16	Pool Pump & Motor	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	42	$0.033903/kWh
17	Programmable Thermostat	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	42	$0.033903/kWh
18	Central Air Conditioning	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	42	$0.033903/kWh
19-20	Residential Lighting	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	42	$0.033903/kWh
21-26	Residential Water Heating (Non-Fuel Switch Measures and Equipment)	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	42	$0.033903/kWh
27-29	Efficiency Furnace Fan	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	42	$0.033903/kWh
30	Energy Star Windows	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	47	$0.342396/kWh
31	Weatherization - Low Income	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	47	$0.342396/kWh
32	Energy Star Homes	Per participant data	EVT 2005 Data from the EVT Q1 2006 Performance Report	37	$2319.62/part
33	Weatherization - Non Low Income	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	47	$0.342396/kWh
34-55	All Water Heater Fuel Switching	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	42	$0.033903/kWh
56	Space Heating Fuel Switching	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	47	$0.342396/kWh
57	Clothes Dryer Fuel Switching	$ per kWh saved	EVT 2005 Data from the EVT Q1 2006 Performance Report	42	$0.033903/kWh

Then GDS used these ratios to develop program budgets for the next ten years (2006 to 2015) for "overhead administrative costs" for each program. Using this methodology to develop program budgets ensures that the budgets are tied directly to actual cost experience at Efficiency Vermont.[49]

[49] GDS was not able to obtain historical data on actual expenditures and kWh savings separately for the residential lighting component of Efficiency Vermont's residential lighting program. While GDS was able to obtain actual cost and savings data for residential programs that included several measures, GDS was not able to obtain this data just for the Efficiency Vermont Residential Lighting Program. GDS was able, however, to obtain historical residential lighting program cost and savings data from the Efficiency Maine residential lighting program.

5.0 RESIDENTIAL SECTOR ELECTRIC EFFICIENCY POTENTIAL IN VERMONT

This section of the report presents the estimates of electric technical, achievable and achievable cost effective energy efficiency potential for the existing and new construction market segments of the residential sector in Vermont. According to this analysis, there is still a large remaining potential for electric energy efficiency savings in this sector. Table 5-1 below summarizes the technical, achievable and maximum achievable cost effective savings potential by the year 2015.

Table 5-1: Summary of Residential Electric Energy Efficiency Savings Potential in Vermont

	Estimated Cumulative Annual Savings by 2015 (kWh)	Savings in 2015 as a Percent of Total 2015 Residential Sector Electricity Sales
Technical Potential	**1,057,749,267**	**39.8%**
Maximum Achievable Potential	**677,893,631**	**25.5%**
Achievable Cost Effective Potential	**567,511,161**	**21.3%**

The achievable cost effective potential in the residential sector is 567,511 mWh, or 21.3 percent of the Vermont residential sector kWh sales forecast in 2015.

5.1 Residential Sector Electric Energy Efficiency Programs

Fifty-seven residential electric energy efficiency programs or measures were included in the analysis for the residential sector. In order to develop the list of energy efficiency measures to be examined, GDS reviewed the January 2003 Vermont Energy Efficiency Potential Study as well as other electric energy efficiency technical potential studies that have been conducted in the US. The set of electric energy efficiency programs or measures considered was pre-screened to only include those measures that are currently commercially available. Thus, emerging technologies were not included in the analysis (residential sector emerging technologies are discussed in Appendix A). Tables 5-2, 5-3, and 5-4 below list the residential sector electric energy efficiency programs or measures included in the technical, achievable, and achievable cost effective potential analyses. The portfolio of measures includes retrofit, early retirement and replace on burnout programmatic approaches to achieve energy efficiency savings. To obtain up-to-date appliance saturation data, GDS made extensive use of the recent residential market assessment study for Vermont that was completed in December 2005 by KEMA.

Characteristics of Energy Efficiency Measures

GDS collected data on the energy savings, incremental costs, useful lives and other key "per unit" characteristics of each of the residential electric energy efficiency measures. Estimates of the size of the eligible market were also developed for each efficiency measure. For example, electric water heater efficiency measures are only applicable to those homes in Vermont that have electric water heaters.

For the residential new construction market segment, GDS obtained a forecast of the number of new homes estimated to be built each year from a national forecasting firm (Scan US).[50] The sizes of various end-use market segments were based on saturation estimates provided in the December 2005 KEMA residential market assessment report for Vermont.

As discussed in Section 1 of this report, achievable market penetrations were estimated assuming that consumers would receive a financial incentive equal to 50% of the incremental cost of the measure in most programs.

In the residential new construction market, market penetration in the near term was based on actual penetration data for the ENERGY STAR Homes Program in Vermont (20%). It was assumed that the penetration rate for this program would reach 80% by 2015 (a decade from now).

In this report we also present the technical achievable potential results in the form of electric supply curves. The supply curve for residential electric energy efficiency savings is shown in Figure 5-1, found after Tables 5-1 through 5-4. This analysis is based on the most recent residential electric sales forecast for Vermont the years 2006 to 2015.[51] Energy-efficiency measures were analyzed for the most important electric consuming end uses in the residential sector:

- space heating
- water heating
- refrigeration
- dish washing
- clothes washing
- clothes drying
- air conditioning
- lighting

[50] The source of this economic/demographic forecast for Vermont is Scan US. GDS Associates purchases the Scan US forecast. The forecast for Vermont was released during the summer of 2005. Scan US updates their economic/demographic forecast for Vermont once a year.

[51] This residential sector load forecast was provided to GDS in February 2006 by staff of the Vermont Department of Public Service.

Table 5-2: Total Cumulative Annual Technical Potential kWh Savings for Electric Energy Efficiency In Vermont By Residential Sector - Market Driven and Retrofit Savings				
1	2	3	4	5
Measure #	Measure Description	Single-Family	Multi-Family	Total
1	Refrigerator Turn-in	10,037,178	1,841,139	11,878,317
2	Freezer Turn-in	1,544,232	283,262	1,827,494
3	Room AC Turn-in without Replacement	0	0	0
4	Room AC Turn-in with ES Replacement	0	0	0
5	Energy Star Single Room Air Conditioner	2,758,414	505,981	3,264,395
6	Energy Star Compliant Top Freezer Refrigerator	12,005,083	2,202,116	14,207,199
7	Energy Star Compliant Bottom Mount Freezer Refrigerator	1,627,975	298,623	1,926,598
8	Energy Star Compliant Side-by-Side Refrigerator	5,618,836	1,030,674	6,649,510
9	Energy Star Compliant Upright Freezer (Manual Defrost)	2,776,443	509,288	3,285,731
10	Energy Star Compliant Chest Freezer	2,332,032	427,769	2,759,801
11	Energy Star Built-In Dishwasher (Electric)	8,302,900	1,523,017	9,825,917
12	Energy Star Clothes Washers with Electric Water Heater	7,611,453	1,396,184	9,007,637
13	Energy Star Clothes Washers with Non-Electric Water Heater	3,915,185	718,170	4,633,355
14	Energy Star Dehumidifier (40 pt)	12,310,932	2,258,218	14,569,150
15	Standby-Power	57,684,636	10,581,205	68,265,841
16	Pool Pump & Motor	18,739,468	1,299,367	20,038,835
17	Energy Star Compliant Programmable Thermostat	2,813,281	516,046	3,329,327
18	High Efficiency Central AC	2,528,151	463,744	2,991,895
19	CFL's: Homes with partial CFL installation	93,800,965	17,206,094	111,007,059
20	CFL's: Homes without CFL installation	103,865,433	19,052,239	122,917,672
21	Water Heater Blanket	0	0	0
22	Low Flow Shower Head	0	0	0
23	Pipe Wrap	0	0	0
24	Low Flow Faucet Aerator	0	0	0
25	Solar Water Heating	0	0	0
26	Efficient Water Heating	0	0	0
27	Efficient Furnace Fan Motor (Fuel Oil)	18,900,714	2,170,046	21,070,760
28	Efficient Furnace Fan Motor (Natural Gas)	3,993,109	1,953,237	5,946,346
29	Efficient Furnace Fan Motor (Propane)	5,462,572	867,237	6,329,809
30	Energy Star Windows - Electric Heat and no AC	0	0	0
31	Insulation and Weatherization - Electric Heat and no AC	0	0	0
32	Residential New Construction	49,261,080	0	49,261,080
33	Low Income Insulation & Weatherization - Elec. Heat & No AC	0	0	0
34	Water Heater-Elec. To Natural Gas (1 Bedroom)	407,097	533,021	940,118
35	Water Heater-Elec. To Natural Gas (2 Bedroom)	2,823,594	1,165,764	3,989,358
36	Water Heater-Elec. To Natural Gas (3 Bedroom)	8,132,292	1,039,426	9,171,718
37	Water Heater-Elec. To Natural Gas (4 Bedroom)	4,701,030	299,868	5,000,898
38	Water Heater-Elec. To Natural Gas (5+ Bedroom)	1,676,297	60,150	1,736,447
39	Water Heater-Elec. To Fuel Oil (1 Bedroom)	4,152,385	5,436,815	9,589,200
40	Water Heater-Elec. To Fuel Oil (2 Bedroom)	28,800,663	11,890,790	40,691,453
41	Water Heater-Elec. To Fuel Oil (3 Bedroom)	82,949,380	10,602,147	93,551,527
42	Water Heater-Elec. To Fuel Oil (4 Bedroom)	47,950,502	3,058,657	51,009,159
43	Water Heater-Elec. To Fuel Oil (5+ Bedroom)	17,098,225	613,525	17,711,750
44	Water Heater-Elec. To Propane (1 Bedroom)	1,139,870	1,492,459	2,632,329
45	Water Heater-Elec. To Propane (2 Bedroom)	7,906,064	3,264,138	11,170,202
46	Water Heater-Elec. To Propane (3 Bedroom)	22,770,418	2,910,393	25,680,811
47	Water Heater-Elec. To Propane (4 Bedroom)	13,162,883	839,631	14,002,514
48	Water Heater-Elec. To Propane (5+ Bedroom)	4,693,630	168,419	4,862,049
49	Water Heater-Elec. To Kerosene (1 Bedroom)	1,302,709	1,705,667	3,008,376
50	Water Heater-Elec. To Kerosene (2 Bedroom)	9,035,502	3,730,444	12,765,946
51	Water Heater-Elec. To Kerosene (3 Bedroom)	26,023,335	3,326,164	29,349,499
52	Water Heater-Elec. To Kerosene (4 Bedroom)	15,043,295	959,579	16,002,874
53	Water Heater-Elec. To Kerosene (5+ Bedroom)	5,364,149	192,479	5,556,628
54	WH Fuel Switching (Electric to Kerosene- Stand Alone)	0	0	0
55	WH Fuel Switching (Electric to Wood)	40,592,005	6,905,878	47,497,883
56	Space Heating (Fuel Switching)	102,436,646	9,395,077	111,831,723
57	Clothes Dryer (Fuel Switching)	36,644,098	8,358,979	45,003,077
	Total kilowatt hours (kWh)	912,696,141	145,053,126	1,057,749,267
	Forecast 2015 Vermont Residential kWh Sales			2,659,831,768
	As a percent of forecasted residential sales 2015			39.8%

Note: Technical potential kWh savings were obtained from Appendix A column 29

The forecast of annual Vermont residential kWh sales was obtained by applying a percentage breakdown of sales by sector (received from VDPS) to the overall forecasts for Vermont published by ISO-New England for the 2006 CELT Report.

Table 5-3: Total Cumulative Annual Achievable Potential kWh Savings for Electric Energy Efficiency In Vermont By 2015

Residential Sector - Market Driven and Retrofit Savings

1	2	3	4	5
Measure #	Measure Description	Single-Family	Multi-Family	Total
1	Refrigerator Turn-in	7,287,266	1,336,717	8,623,983
2	Freezer Turn-in	1,083,268	198,706	1,281,974
3	Room AC Turn-in without Replacement	0	0	0
4	Room AC Turn-in with ES Replacement	0	0	0
5	Energy Star Single Room Air Conditioner	1,622,596	297,636	1,920,232
6	Energy Star Compliant Top Freezer Refrigerator	7,159,471	1,313,276	8,472,747
7	Energy Star Compliant Bottom Mount Freezer Refrigerator	970,875	178,090	1,148,965
8	Energy Star Compliant Side-by-Side Refrigerator	3,350,905	614,663	3,965,568
9	Energy Star Compliant Upright Freezer (Manual Defrost)	1,950,394	357,765	2,308,159
10	Energy Star Compliant Chest Freezer	1,638,204	300,499	1,938,703
11	Energy Star Built-In Dishwasher (Electric)	6,200,900	1,137,443	7,338,343
12	Energy Star Clothes Washers with Electric Water Heater	5,310,316	974,082	6,284,398
13	Energy Star Clothes Washers with Non-Electric Water Heater	2,731,524	501,049	3,232,573
14	Energy Star Dehumidifier (40 pt)	8,154,677	1,495,828	9,650,505
15	Standby-Power	30,878,246	5,664,057	36,542,303
16	Pool Pump & Motor	9,969,145	691,246	10,660,391
17	Energy Star Compliant Programmable Thermostat	2,181,083	400,080	2,581,163
18	High Efficiency Central AC	1,034,916	189,837	1,224,753
19	CFL's: Homes with partial CFL installation	58,396,197	10,711,728	69,107,925
20	CFL's: Homes without CFL installation	76,427,839	14,019,308	90,447,147
21	Water Heater Blanket	0	0	0
22	Low Flow Shower Head	0	0	0
23	Pipe Wrap	0	0	0
24	Low Flow Faucet Aerator	0	0	0
25	Solar Water Heating	0	0	0
26	Efficient Water Heating	0	0	0
27	Efficient Furnace Fan Motor (Fuel Oil)	8,166,975	937,674	9,104,649
28	Efficient Furnace Fan Motor (Natural Gas)	1,725,417	843,991	2,569,408
29	Efficient Furnace Fan Motor (Propane)	2,360,371	374,732	2,735,103
30	Energy Star Windows - Electric Heat and no AC	0	0	0
31	Insulation and Weatherization - Electric Heat and no AC	0	0	0
32	Residential New Construction	26,108,372	0	26,108,372
33	Low Income Insulation & Weatherization - Elec. Heat & No AC	0	0	0
34	Water Heater-Elec. To Natural Gas (1 Bedroom)	250,521	328,013	578,534
35	Water Heater-Elec. To Natural Gas (2 Bedroom)	1,737,597	717,393	2,454,990
36	Water Heater-Elec. To Natural Gas (3 Bedroom)	5,004,487	639,647	5,644,134
37	Water Heater-Elec. To Natural Gas (4 Bedroom)	2,892,941	184,534	3,077,475
38	Water Heater-Elec. To Natural Gas (5+ Bedroom)	1,031,567	37,015	1,068,582
39	Water Heater-Elec. To Fuel Oil (1 Bedroom)	3,321,908	4,349,452	7,671,360
40	Water Heater-Elec. To Fuel Oil (2 Bedroom)	23,040,531	9,512,632	32,553,163
41	Water Heater-Elec. To Fuel Oil (3 Bedroom)	66,359,504	8,481,718	74,841,222
42	Water Heater-Elec. To Fuel Oil (4 Bedroom)	38,360,402	2,446,925	40,807,327
43	Water Heater-Elec. To Fuel Oil (5+ Bedroom)	13,678,580	490,820	14,169,400
44	Water Heater-Elec. To Propane (1 Bedroom)	701,459	918,436	1,619,895
45	Water Heater-Elec. To Propane (2 Bedroom)	4,865,270	2,008,701	6,873,971
46	Water Heater-Elec. To Propane (3 Bedroom)	14,012,565	1,791,011	15,803,576
47	Water Heater-Elec. To Propane (4 Bedroom)	8,100,236	516,696	8,616,932
48	Water Heater-Elec. To Propane (5+ Bedroom)	2,888,388	103,642	2,992,030
49	Water Heater-Elec. To Kerosene (1 Bedroom)	0	0	0
50	Water Heater-Elec. To Kerosene (2 Bedroom)	0	0	0
51	Water Heater-Elec. To Kerosene (3 Bedroom)	0	0	0
52	Water Heater-Elec. To Kerosene (4 Bedroom)	0	0	0
53	Water Heater-Elec. To Kerosene (5+ Bedroom)	0	0	0
54	WH Fuel Switching (Electric to Kerosene- Stand Alone)	37,112,690	6,313,946	43,426,636
55	WH Fuel Switching (Electric to Wood)	32,473,604	5,524,703	37,998,307
56	Space Heating (Fuel Switching)	40,974,658	3,758,031	44,732,689
57	Clothes Dryer (Fuel Switching)	20,939,485	4,776,559	25,716,044

Achievable kWh Savings by 2015	582,455,350	95,438,281	677,893,631
Forecast 2015 Vermont Residential kWh Sales			2,659,831,768
As a percent of forecasted residential sales 2015			25.5%

Note: Technical potential kWh savings were obtained from Appendix A of this report, column 32

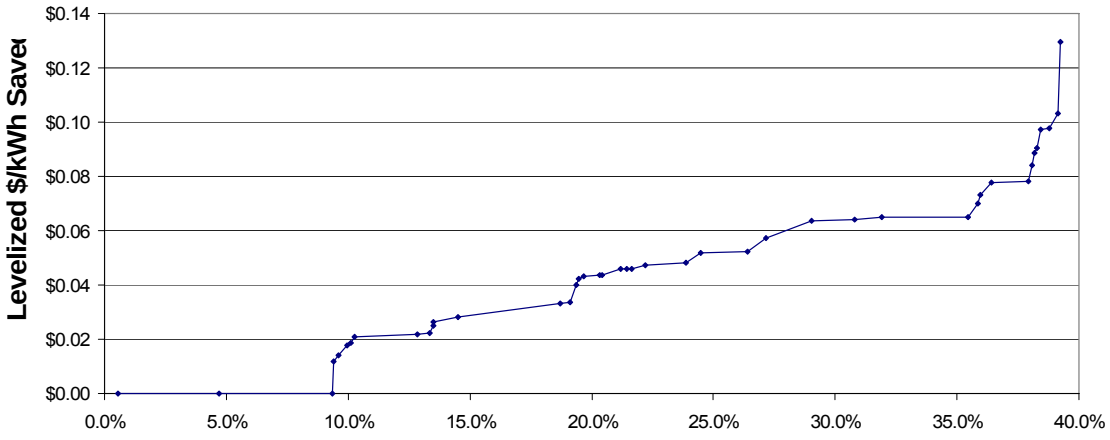
Table 5-4: Total Annual Achievable Cost-Effective Potential kWh Savings for Electric Energy Residential Sector - Market Driven and Retrofit Savings				
1	2	5	6	7
Measure #	Measure Description	Measure Level Societal Test Ratio SF	Measure Level Societal Test Ratio MF	Total Cumulative Annual kWh Savings by 2015
1	Refrigerator Turn-in	3.22	3.22	8,623,983
2	Freezer Turn-in	3.04	3.04	1,281,974
3	Room AC Turn-in without Replacement	0.79	0.79	0
4	Room AC Turn-in with ES Replacement	0.30	0.30	0
5	Energy Star Single Room Air Conditioner	5.95	5.95	1,920,232
6	Energy Star Compliant Top Freezer Refrigerator	3.33	3.33	8,472,747
7	Energy Star Compliant Bottom Mount Freezer Refrigerator	3.62	3.62	1,148,965
8	Energy Star Compliant Side-by-Side Refrigerator	3.96	3.96	3,965,568
9	Energy Star Compliant Upright Freezer (Manual Defrost)	1.84	1.84	2,308,159
10	Energy Star Compliant Chest Freezer	1.74	1.74	1,938,703
11	Energy Star Built-In Dishwasher (Electric)	3.01	3.01	7,338,343
12	Energy Star Clothes Washers with Electric Water Heater	3.08	3.08	6,284,398
13	Energy Star Clothes Washers with Non-Electric Water Heater	3.27	3.27	3,232,573
14	Energy Star Dehumidifier (40 pt)	>1	>1	9,650,505
15	Standby-Power	5.13	5.13	36,542,303
16	Pool Pump & Motor	2.14	2.14	10,660,391
17	Energy Star Compliant Programmable Thermostat	20.94	20.94	2,581,163
18	High Efficiency Central AC	4.39	4.39	1,224,753
19	CFL's: Homes with partial CFL installation	5.12	5.12	69,107,925
20	CFL's: Homes without CFL installation	5.64	5.64	90,447,147
21	Water Heater Blanket	17.33	17.33	0
22	Low Flow Shower Head			0
23	Pipe Wrap			0
24	Low Flow Faucet Aerator			0
25	Solar Water Heating	0.67	0.67	0
26	Efficient Water Heating	4.92	4.92	0
27	Efficient Furnace Fan Motor (Fuel Oil)	3.38	3.38	9,104,649
28	Efficient Furnace Fan Motor (Natural Gas)	3.38	3.38	2,569,408
29	Efficient Furnace Fan Motor (Propane)	3.38	3.38	2,735,103
30	Energy Star Windows - Electric Heat and no AC	>1	>1	0
31	Insulation and Weatherization - Electric Heat and no AC	13.04	6.52	0
32	Residential New Construction	12.05	N/A	26,108,372
33	Low Income Insulation & Weatherization - Elec. Heat & No AC	13.04	6.52	0
34	Water Heater-Elec. To Natural Gas (1 Bedroom)	3.63	3.63	578,534
35	Water Heater-Elec. To Natural Gas (2 Bedroom)	4.54	4.54	2,454,990
36	Water Heater-Elec. To Natural Gas (3 Bedroom)	5.45	5.45	5,644,134
37	Water Heater-Elec. To Natural Gas (4 Bedroom)	6.81	6.81	3,077,475
38	Water Heater-Elec. To Natural Gas (5+ Bedroom)	8.17	8.17	1,068,582
39	Water Heater-Elec. To Fuel Oil (1 Bedroom)	0.75	0.75	0
40	Water Heater-Elec. To Fuel Oil (2 Bedroom)	0.94	0.94	0
41	Water Heater-Elec. To Fuel Oil (3 Bedroom)	1.12	1.12	74,841,222
42	Water Heater-Elec. To Fuel Oil (4 Bedroom)	1.40	1.40	40,807,327
43	Water Heater-Elec. To Fuel Oil (5+ Bedroom)	1.69	1.69	14,169,400
44	Water Heater-Elec. To Propane (1 Bedroom)	0.57	0.57	0
45	Water Heater-Elec. To Propane (2 Bedroom)	0.71	0.71	0
46	Water Heater-Elec. To Propane (3 Bedroom)	0.85	0.85	0
47	Water Heater-Elec. To Propane (4 Bedroom)	1.07	1.07	8,616,932
48	Water Heater-Elec. To Propane (5+ Bedroom)	1.28	1.28	2,992,030
49	Water Heater-Elec. To Kerosene (1 Bedroom)	1.09	1.09	1,604,467
50	Water Heater-Elec. To Kerosene (2 Bedroom)	1.37	1.37	6,808,505
51	Water Heater-Elec. To Kerosene (3 Bedroom)	1.64	1.64	15,653,066
52	Water Heater-Elec. To Kerosene (4 Bedroom)	2.05	2.05	8,534,866
53	Water Heater-Elec. To Kerosene (5+ Bedroom)	2.46	2.46	2,963,534
54	WH Fuel Switching (Electric to Kerosene- Stand Alone)	0.43	0.60	0
55	WH Fuel Switching (Electric to Wood)	0.17	0.48	0
56	Space Heating (Fuel Switching)	2.72	1.36	44,732,689
57	Clothes Dryer (Fuel Switching)	1.97	1.97	25,716,044

Achievable Cost Effective kWh Savings		567,511,161
Forecast 2015 Vermont Residential kWh Sales		2,659,831,768
Savings as a percent of forecasted residential sales in 2015		21.3%

The Societal Test Benefit/Cost ratios show above in Table 5-4 were obtained from the GDS Benefit/Cost Screening Model, from the Program Cost Effectiveness Results Worksheet. The kWh savings shown above in Table 5-4 were obtained from Table 5-3, and kWh savings in the last column in Table 5-4 are greater than zero only for those measures that have a Societal Test benefit/cost ratio greater than or equal to 1.0.

Figures 5-2 to 5-8 provide information on the potential electric savings in the residential sector. About thirty-eight percent of the technical potential savings by 2015 is for fuel switching of electric water heating load to alternative fuels, twenty-two percent is for high efficiency lighting, and eleven percent is for fuel switching of space heating load to alternative fuels. Figure 5-9 and 5-10 presents the cost of conserved energy (CCE) for residential electric energy efficiency measures included in this study. Note that the CCE figures shown in Figures 5-10 and 5-11 only include electric savings, and do not include savings of other fuels (gas, oil, wood, etc.) or water. Note that Figures 5-10 and 5-11 are not supply curves; rather, these figures simply provide a picture of the relative cost of conserved energy for the electric energy efficiency and fuel shifting measures examined in this study. Note that there are **ten** residential energy efficiency measures having a cost of conserved energy less than $.02 per kWh saved.

Figure 5-1 Residential Electric Energy Efficiency Supply Curve for Vermont



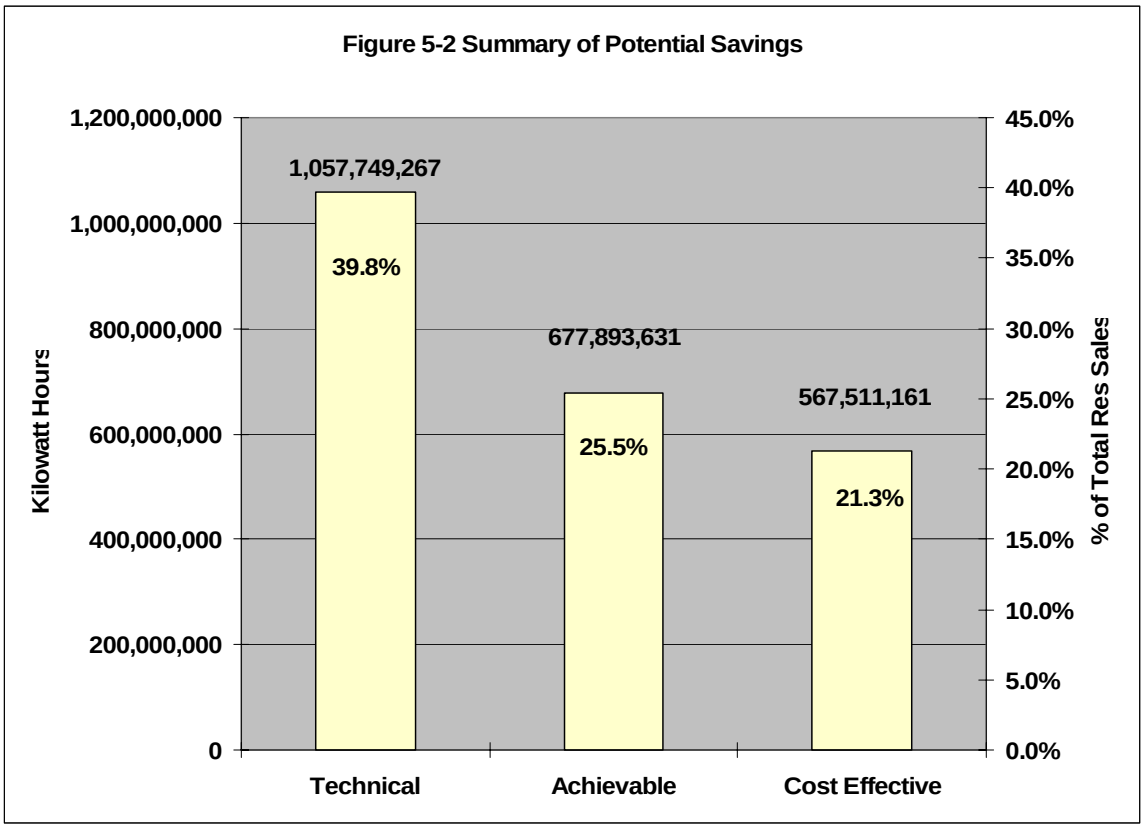


Figure 5-2 Summary of Potential Savings
1,200,000,000
1,000,000,000
800,000,000
600,000,000
400,000,000
200,000,000
0
Kilowatt Hours
45.0%
40.0%
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
% of Total Res Sales
1,057,749,267
39.8%
677,893,631
25.5%
567,511,161
21.3%
Technical
Achievable
Cost Effective

Figure 5-3 Residential Sector Technical Potential Savings By Measure Type - Kilowatt Hours

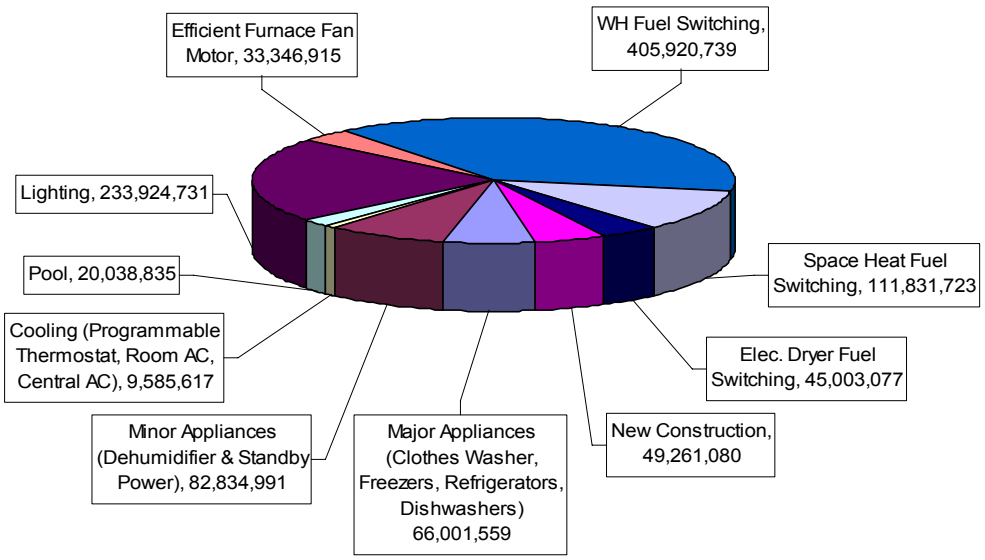


Figure 5-4 Residential Sector Technical Potential Savings By Measure Type - Percent of Total Savings

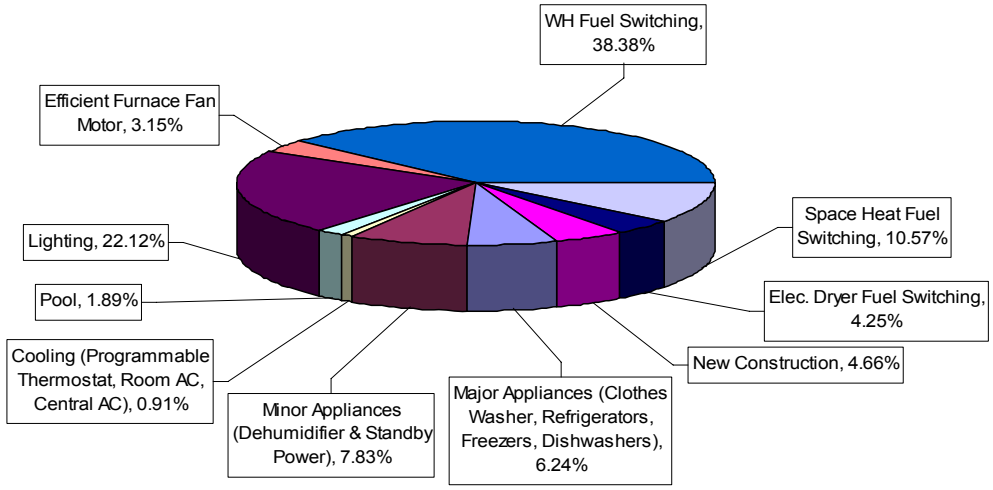


Figure 5-5 Residential Sector Achievable Savings By Measure Type - Kilowatt Hours

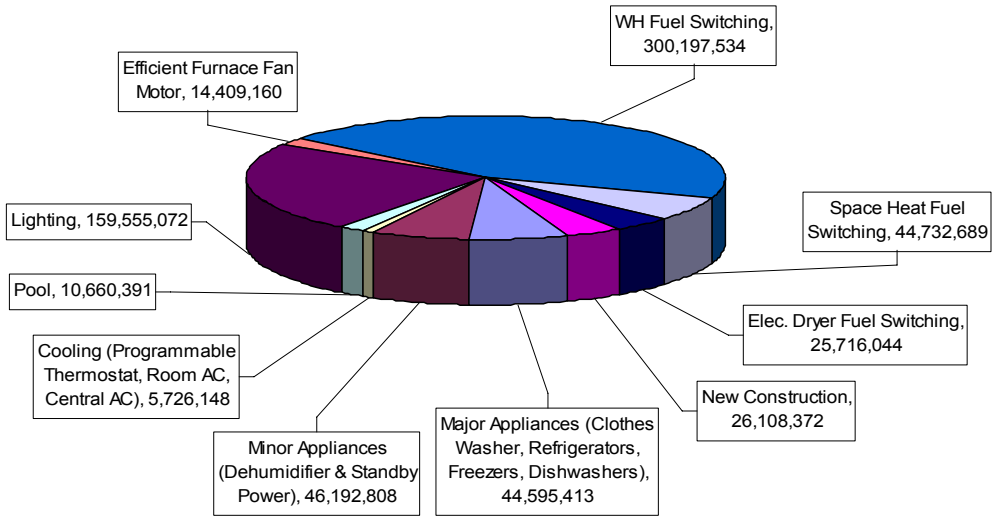


Figure 5-6 Residential Sector Achievable Savings by Measure Type - Percent of Total Savings

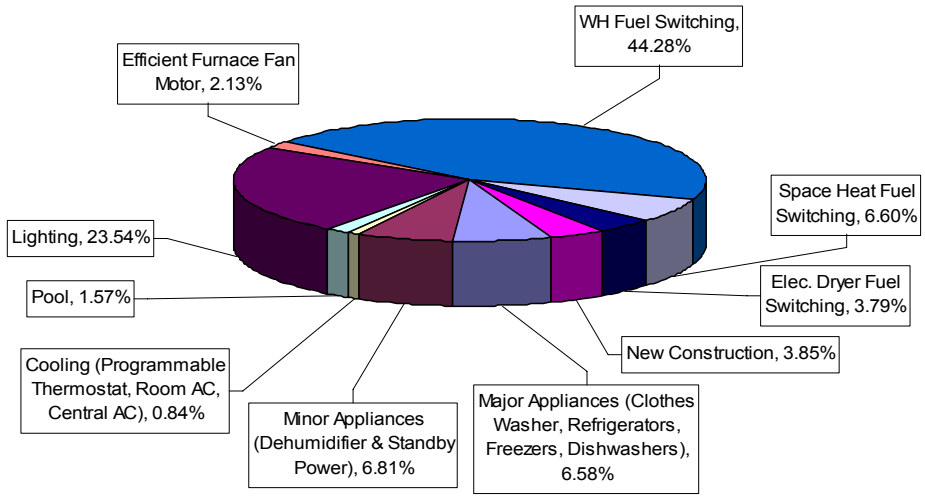


FIgure 5-7 Residential Sector Achievable Cost Effective Savings by Measure Type - Kilowatt Hours

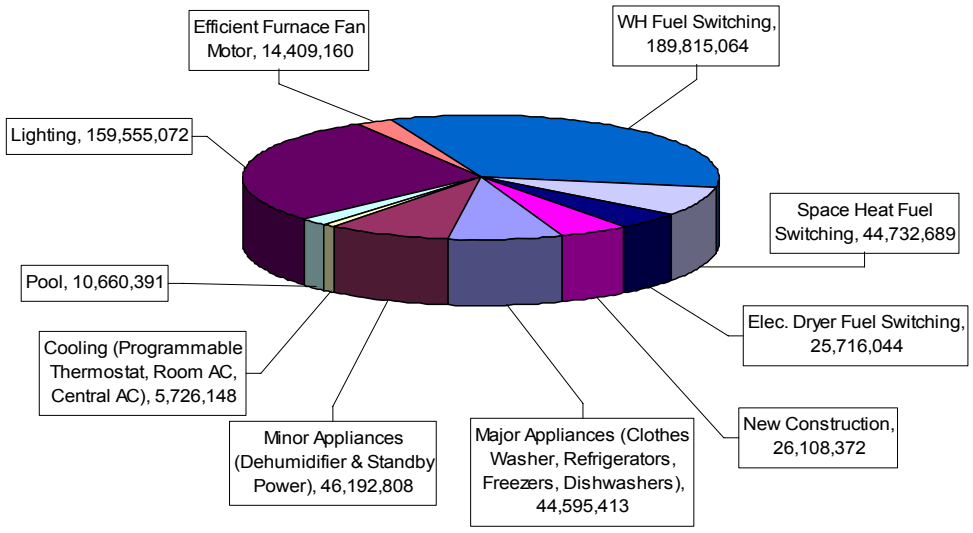


Figure 5-8 Residential Sector Achievable Cost Effective Savings by Measure Type - Percent of Total Savings

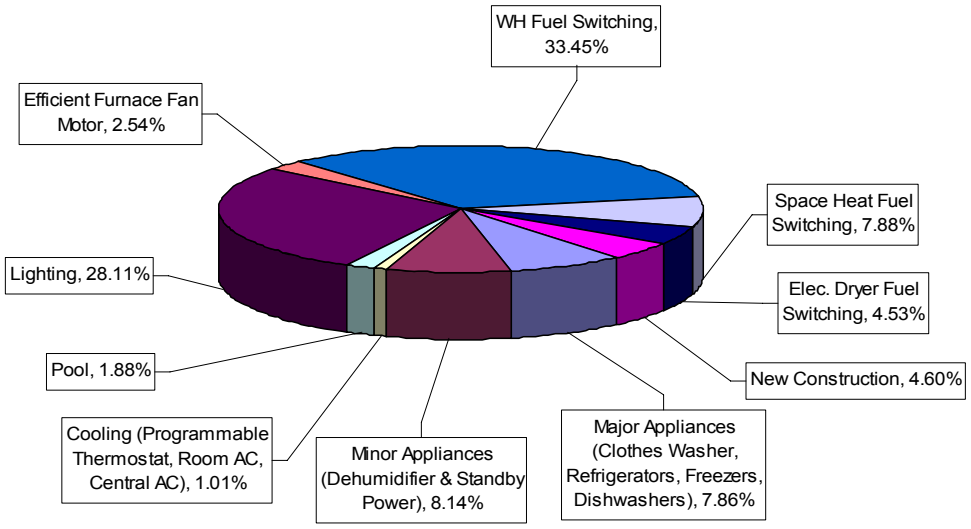


Figure 5-9
Cost of Conserved Energy - Residential Electric Energy Efficiency Measures (Measures under $.05 Per kWh Saved)

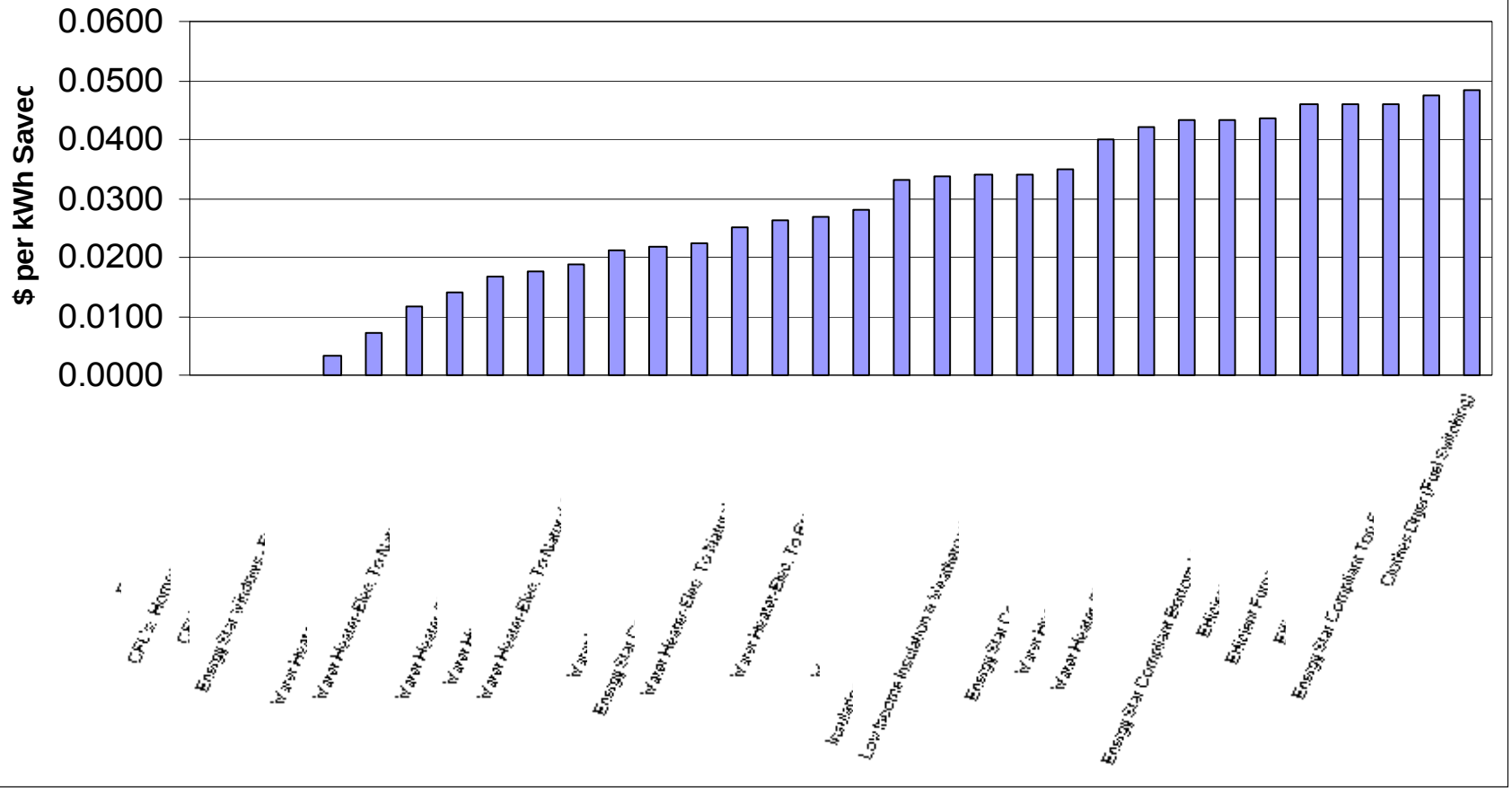
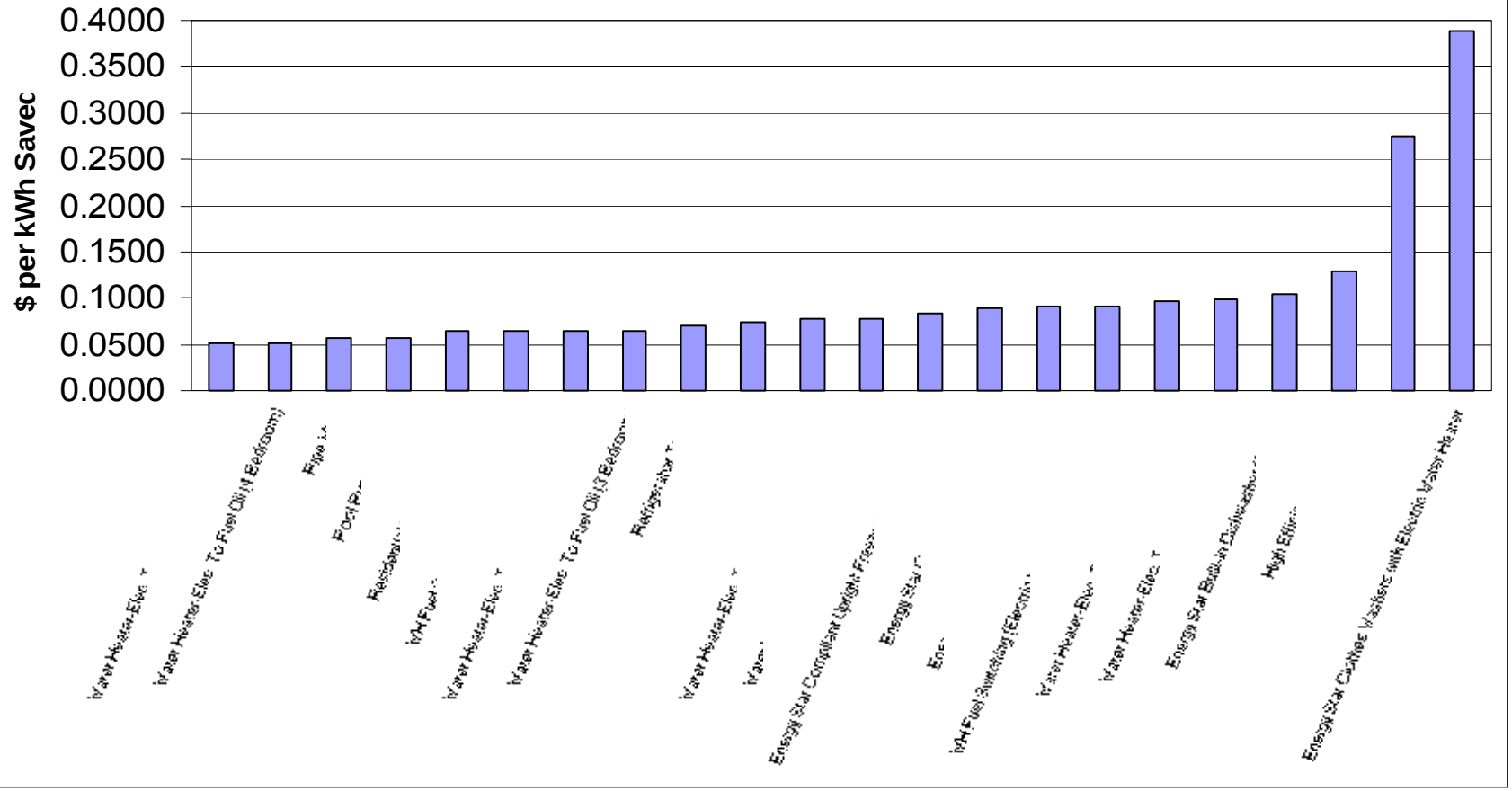


Figure 5-10
Cost of Conserved Energy - Residential Electric Energy Efficiency Measures (Measures over $.05 & under $.40 Per kWh Saved)

Note: 3 measures over $0.40 were left off this figure.



As shown in Table 5-5 below, the achievable electricity savings of 25.5% determined in this study is very close to the 30% determined in the January 2003 Vermont energy efficiency potential study.

Table 5-5: Comparison to 2006 Potential Savings Estimates to 2002 Estimates
Residential Sector

	Optimal Energy - 2002	GDS Associates- 2006
Technical Potential	NA	39.8%
Achievable Potential	30%	25.5%
Achievable Cost Effective Potential	NA	21.3%

6.0 COMMERCIAL SECTOR ENERGY EFFICIENCY POTENTIAL

6.1 Introduction

For the commercial sector in Vermont, the electric lighting end use still represents the largest savings potential in absolute terms for both energy and peak demand, despite the significant adoption of high-efficiency lighting throughout the 1990's. Refrigeration represents the second largest end-use category for kWh savings and space cooling makes up the second largest category for kW demand savings. The distribution of commercial sector savings by end use is shown in Figure 6-5 later in this section. It is important to note that GDS has used definitions for the commercial and industrial sectors provided by VDPS staff.[52]

This section of the report provides the estimates of technical, achievable and achievable cost effective energy efficiency potential for electric energy efficiency measures for the commercial sector in Vermont. The commercial sector as defined in this analysis is based on the kWh sales data provided by Central Vermont Public Service (CVPS) and is reported to be based on level of kWh sales and kW demand rather than building type. CVPS provided GDS with a summary of all industrial kWh sales by SIC code and this data was subtracted from the total commercial and industrial data to result in a commercial-only kWh sales estimate. Therefore, the commercial sector does include the smaller end of the manufacturing sector.

Technical electricity savings potential is estimated to be approximately 854,144,426 kWh by the year 2015. Achievable potential is estimated to be approximately 516,303,285 kWh and achievable cost effective potential is estimated to be 450,383,577 kWh by 2015. Table 6-1 shows the potential savings in cumulative annual kWh and in percentage terms for the existing buildings and new construction sector.

[52] Staff of the Vermont Department of Public Service provided historical Vermont data on commercial and industrial sector kWh sales and customers for the period 1992 to 2004. See Tables 3-1 and 3-2 in Section 3 of this report to see this historical kWh sales and customer data for the commercial and industrial sectors in Vermont. In the year 2004, there were 44,743 commercial sector electric customers, according to the historical data provided by Riley Allen of the VDPS.

Table 6-1: Summary of Commercial Sector Electric Savings Potential in Vermont		
	Estimated Cumulative Annual kWh Savings by 2015	**% Savings of 2015 Commercial Sector kWh Sales**
Technical Potential	**854,144,426**	**40.4%**
Existing Buildings	*844,261,646*	*40.5%*
New Construction	*9,882,780*	*31.4%*
Achievable Potential	**516,303,285**	**24.4%**
Existing Buildings	*509,105,415*	*24.4%*
New Construction	*7,197,870*	*22.9%*
Achievable Cost Effective Potential	**450,383,577**	**21.3%**
Existing Buildings	*444,282,285*	*21.3%*
New Construction	*6,101,292*	*19.4%*

The methodology used to develop these estimates of electricity savings is described in Section 4 of this report.

6.2 Efficiency Measures Examined

In order to develop a list of commercial technologies to be included in this analysis, GDS reviewed several sources including the Efficiency Vermont Technical Resource Manual (TRM), the previous Vermont and New York potential savings analyses conducted by Optimal Energy, Inc., and the Connecticut potential savings study conducted by GDS. A preliminary list of measures was provided to the Vermont DPS for review and comment.

A total of 73 commercial electric measures were used in the analyses (7 cooling, 3 space heating, 6 whole building/controls, 5 water heating, 25 lighting, 14 refrigeration, 2 ventilation, and 11 miscellaneous). The total number of commercial technologies considered for inclusion was 93, however this was comprised of similar measures of varying sizes (i.e., 3, 7.5, and 15 ton packaged AC units). When running the savings potential analysis on the commercial sector using the top-down approach, which is based on kWh sales rather number of units, it is useful to select a prototypical unit size rather than including all sizes. This number of commercial technologies compares well with the 90 technologies that were analyzed in the 2003[53] Vermont statewide savings analysis conducted by Optimal Energy, Inc.

[53] This report is titled "Vermont Department of Public Service, Electric and Economic Impacts of Maximum Achievable Statewide Efficiency Savings, 2003 to 2012, Results and Analysis Summary", and this report is dated January 31, 2003. This report was prepared for the Department by Optimal Energy.

Table 6-2 lists the commercial electric energy efficiency measures included in the technical potential analysis as well as the savings estimates used for the major commercial building types. Measures were analyzed as either market driven replacements or retrofits. Replacement measures include incremental cost and savings assumptions whereas retrofit measures include full installed cost and total savings to go from the existing inefficient unit to the energy efficient model. Further discussion of market driven versus retrofit measures is included in Section 6.5.

Table 6-2 Commercial Sector Energy Efficiency Measures

Measure Name	Energy Savings Range[1]
Space Heating	
High Efficiency Heat Pump	8%
Hydronic Heating Pump	34%
Ground Source Heat Pump - Heating	29%
Integrated Building Design	40%
Double Pane Low Emissivity Windows	15%
Retrocommissioning	10%
Programmable Thermostats	3% - 10%
EMS install	10%
EMS Optimization	1% - 8%
Dual Enthalpy Economizer - from Fixed Damper	22%
Dual Enthalpy Economizer - from Dry Bulb	22%
Water Heating	
Heat Pump Water Heater	43%
Booster Water Heater	13%
Point of Use Water Heater	7%
Solar Water Heating System	60%
Solar Pool Heating	40%
Space Cooling	
Centrifugal Chiller, 0.51 kW/ton, 300 tons	15%
Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 tons	33%
Chiller Tune Up/Diagnostics - 300 ton	8%
Packaged AC - 7.5 tons, Tier 2	14%
Ground Source Heat Pump - Cooling	36%
DX Tune Up/ Advanced Diagnostics	10%
Comprehensive Track Proper HVAC Sizing	5%
Ventilation	
Fan Motor, 5hp, 1800rpm, 89.5%	3%
Variable Speed Drive Control, 15 HP	30%
Motors	
Efficient Motors	1%
Variable Frequency Drives (VFD)	41%
Lighting	
Super T8 Fixture - from 34W T12 – *Early Replacement*	43%
Super T8 Fixture - from standard T8	20%
T5 Troffer/Wrap	27%
T5 Industrial Strip	27%
T5 Indirect	27%
Dairy Farm Vapor Proof T8 Fixture with Electronic Ballast	29%
Lighting Controls	30%
Bi-Level Switching	10%
Occupancy Sensors	30%
Daylight Dimming	35%
5% & 10% More Efficient Design	5% & 10%
15% & 30% More Efficient Design - New Construction	15% & 30%
T5 Fluorescent High-Bay Fixtures	49%

Measure Name	Energy Savings Range[1]
Electronic HID Fixture Upgrade	25%
CFL Fixture	71%
Halogen Infra-Red Bulb	20%
Integrated Ballast MH 25W	72%
Induction Fluorescent 23W	74%
CFL Screw-in	71%
Dairy Farm Hard-Wired Vapor-Proof CFL Fixture with Electronic Ballast	71%
Metal Halide Track	60%
Exterior HID	55%
LED Exit Sign	82%
LED Traffic / Pedestrian Signals	85%
Refrigeration	
Vending Miser for Soft Drink Vending Machines	46%
Refrigerated Case Covers	6%
Refrigeration Economizer	30%
Commercial Reach-In Refrigerators	26%
Evaporator Fan Motor Controls	30%
Permanent Split Capacitor Motor	4%
Zero-Energy Doors	20%
Door Heater Controls	55%
Discus and Scroll Compressors	7%
Floating Head Pressure Control	7%
Anti-sweat (humidistat) controls (refrigerator & freezer)	5%
Commercial Reach-In Freezer	9%
High Efficiency Ice Maker	6%
Commercial Ice-makers	6%
Miscellaneous	
EZ Save Monitor Power Management Software	15%
Compressed Air – Non-Controls	20%
Compressed Air – Controls	15%
Efficient Snow Making	80%
Water/Wastewater Treatment Improved equipment and controls	35%
Energy Star Transformers	44%
Dairy Farms	
VFDs for Milk Transfer & Vacuum Pumps	30%

[1] Range of energy savings indicates variability across building types and climate zones.

Estimated annual savings, and consequently the benefit/cost ratios, vary for some of the measures based on the type of building. Also, for certain niche technologies such as efficient snowmaking equipment and VFD's for dairy pumps, these savings values only apply to the specific market for which they are intended. Emerging technologies that are not yet commercially available were not included in this analysis.

The measure analysis was segmented into ten commercial building types for the Vermont service territory. The technical, achievable and achievable cost effective potential results are presented in aggregate in the form of electricity supply curves. We provide estimates of savings in both absolute kWh and percentage terms.

We based this technical, achievable and achievable cost effective potential energy savings analysis on Vermont's commercial sector electricity sales forecast for the period 2006 to 2015, as presented in Section 3. Electrical energy efficiency measures were analyzed for the most common and energy-intensive end uses.

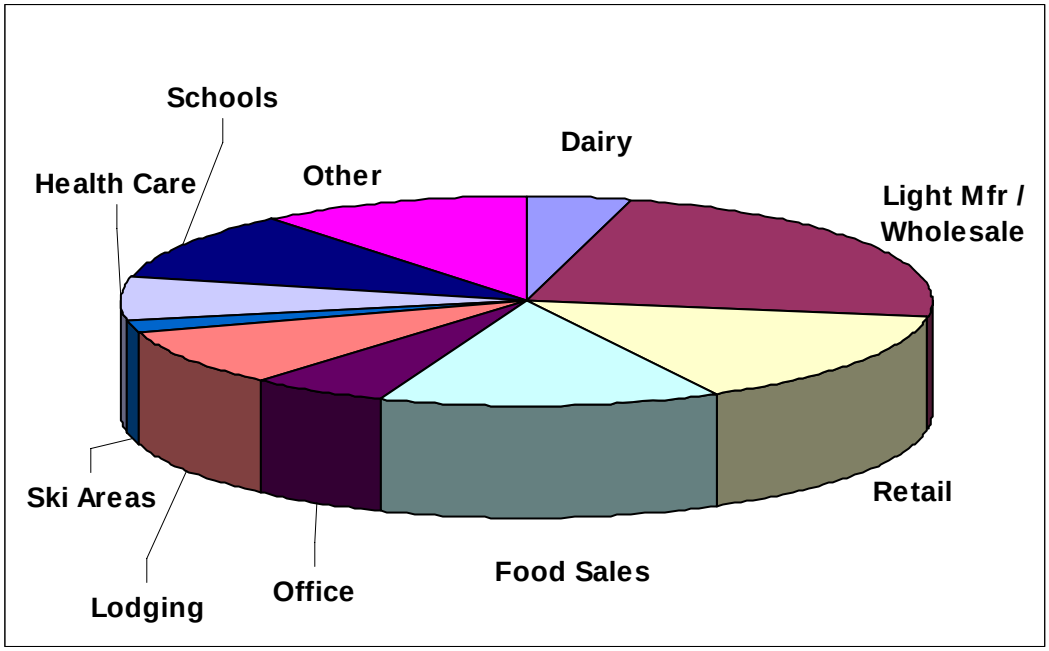
6.3 Commercial Sector Segmentation

Table 6-3 and Figure 6-1 illustrate the commercial sector electricity sales based segmentation. This segmentation is based on 2004 commercial sales data by SIC code as provided by Central Vermont Public Service (CVPS). The CVPS data is used as a proxy for the entire State of Vermont as state-wide sales data by SIC code was not available.

Table 6.3 Commercial Sector Segmentation

	Industry Type	Percent of kWh Sales	SIC Categories
1	Dairy	4%	024
2	Light Mfr / Wholesale	23%	20-39, 42, 50-51
3	Retail	15%	52-53, 55-57, 59, 72, 75-79
4	Food Sales	14%	54, 58
5	Office	6%	60-64, 66-67, 73, 81, 87-97
6	Lodging	9%	65, 70
7	Ski Areas	2%	799
8	Health Care	7%	80, 83
9	Schools	10%	82
10	Other	11%	01-09, 11-17, 40, 41, 44-49, 84-86, 99
	Total	100%	

Figure 6-1 Commercial Sector Segmentation



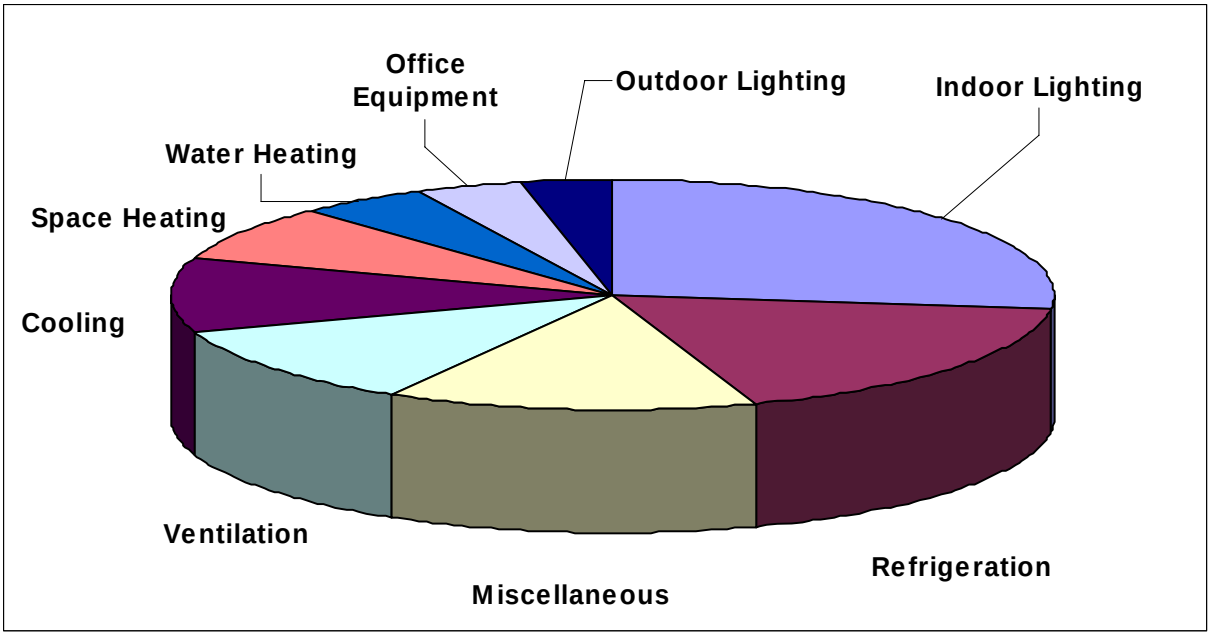
6.4 Commercial End Use Breakdown

A breakdown of commercial electricity use by end-use and industry type was developed based on data included in the 2003 New York Technical Potential Study. This study divided New York into regions and the Albany region (Region F) was used as a reasonable representation of the commercial sector in Vermont. Table 6.4 and Figure 6.2 show the resulting end use allocation used in this analysis.

Table 6.4 Commercial End Use Breakdown

End Use	Percent of Total
Indoor Lighting	27%
Refrigeration	18%
Miscellaneous	14%
Cooling	12%
Ventilation	10%
Space Heating	8%
Water Heating	5%
Office Equipment	4%
Outdoor Lighting	3%

Figure 6-2 Commercial End Use Breakdown



In order to estimate the level of commercial kWh sales that are associated with commercial new construction in Vermont, we used data provided by the VT DPS from the previous Vermont Technical Potential Study conducted by Optimal Energy. Given the very low load growth for the commercial sector in the current statewide load forecast, the percent of electric sales associated with commercial new construction was decreased from the forecast used in the 2002 study. The level of kWh associated with commercial new construction in 2015 is estimated to be 31,468 MWh.

6.5 Technical, Achievable, and Achievable Cost Effective Potential

This section presents technical, achievable, and the achievable cost effective savings potential estimates for the commercial sector for the year 2015. Following the presentation of the commercial sector results in terms of kWh and percent of commercial market, energy efficiency supply curves are presented for the each of the savings potential estimates.

Technical savings potential is estimated to be 854,144,426 kWh by 2015, achievable potential is estimated to be 516,303,285 kWh and achievable cost effective potential is estimated to be 450,383,577 kWh (or between 21 and 40 percent of expected commercial electricity consumption in the year 2015). Figure 6-3 illustrates the three values along with the associated percent of Vermont's commercial electricity sales in 2015.

Figure 6-3 Estimated Technical, Achievable, and Cost Effective Potential for Electric Energy Efficiency in Vermont in 2015 - Commercial Sector

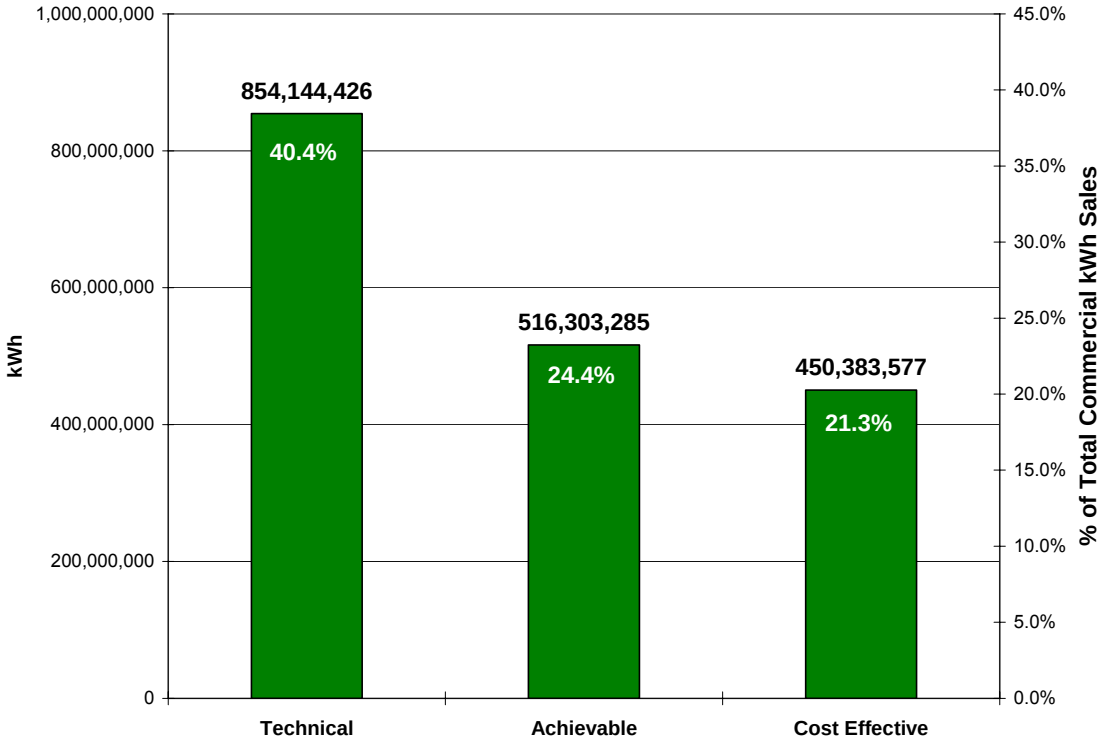


Table 6-5 and Figure 6-4 show the total achievable cost effective potential kWh savings for existing commercial buildings within each of the commercial end uses. Lighting accounts for the largest percentage of savings potential at 41 percent, with refrigeration being the second largest at 36 percent. Space cooling and related HVAC controls are third largest at 13 percent and water heating, space heating, motors, and miscellaneous loads represent the remaining 10 percent.

Table 6-5 Achievable Cost Effective kWh Savings by End Use for Existing Commercial Buildings

End Use Category	Total kWh Saved	% Savings
Lighting	182,922,974	41.17%
Refrigeration	159,062,625	35.80%
HVAC, Cooling	58,629,630	13.20%
Water Heating	16,922,824	3.81%
Motors, Pumping	13,127,712	2.95%
Space Heating	12,676,725	2.85%
Transformers	939,796	0.21%
Total Savings	**444,282,286**	**100%**

Figure 6-4 Achievable Cost Effective kWh Savings by End Use for Existing Commercial Buildings

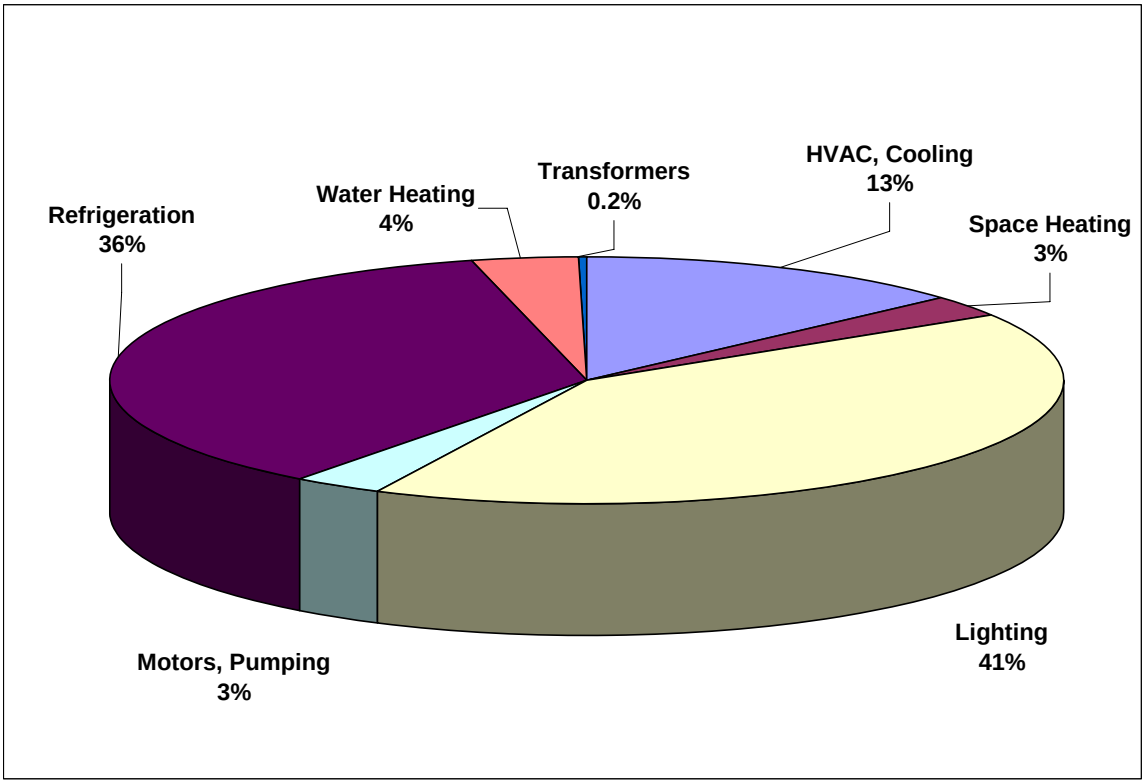


Table 6-6 and Figure 6-5 show the total achievable cost effective potential kWh savings associated with commercial new construction within each of the commercial end uses. For new construction, refrigeration measures account for the largest percentage of savings potential at 44 percent, with space cooling being a distant second at 17 percent. Lighting is next highest at 13 percent and space heating, motors, and water heating are lower at between 5 and 11 percent each.

Table 6-6 Achievable Cost Effective kWh Savings by End Use for Commercial New Construction

End Use Category	Total kWh Saved	% Savings
Refrigeration	2,673,414	43.82%
HVAC, Cooling	1,052,946	17.26%
Lighting	774,258	12.69%
Space Heating	665,546	10.91%
Motors, Pumping	569,592	9.34%
Water Heating	278,997	4.57%
Transformers, Misc.	86,540	1.42%
Total Savings	**6,101,292**	**100%**

Figure 6-5 Achievable Cost Effective kWh Savings by End Use for Commercial New Construction

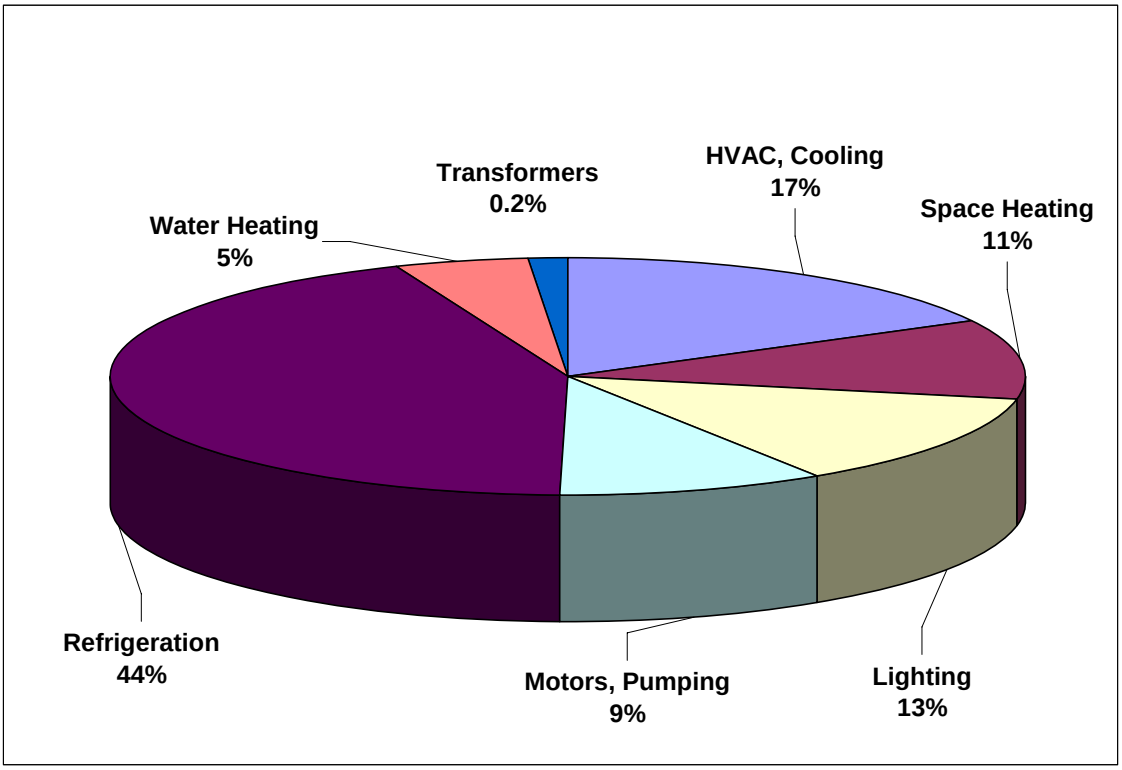


Table 6-7 and Figure 6-6 show the electric demand (kW) savings that is associated with the achievable cost effective potential savings level for existing buildings. Lighting technologies account for a large percentage of the kW savings potential at 40 percent. Refrigeration and space cooling measures make up the next two largest demand savings categories at 20 percent and 18 percent, respectively. Space heating represents 9 percent of the total demand savings and water heating, miscellaneous loads, and motors make up the remaining 14 percent

Table 6-7 Achievable Cost Effective kW Savings by End Use Existing Commercial Buildings

End Use Category	Total kW Saved	% Savings
Lighting	50,951.2	39.8%
Refrigeration	25,665.2	20.0%
HVAC, Cooling	22,789.2	17.8%
Space Heating	11,638.0	9.1%
Water Heating	7,262.5	5.7%
Miscellaneous	5,305.9	4.1%
Motors	4,433.4	3.5%
Total kW Savings	128,045.4	100.0%

Figure 6-6 Achievable Cost Effective kW Savings by End Use for Existing Commercial Buildings

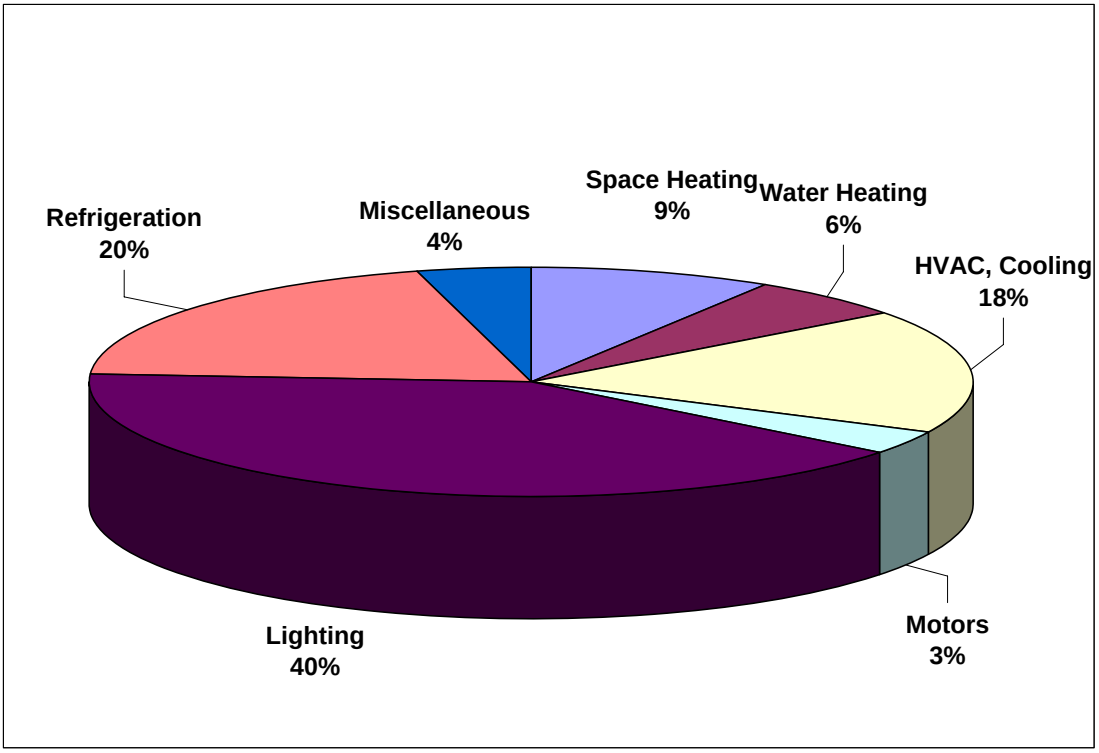
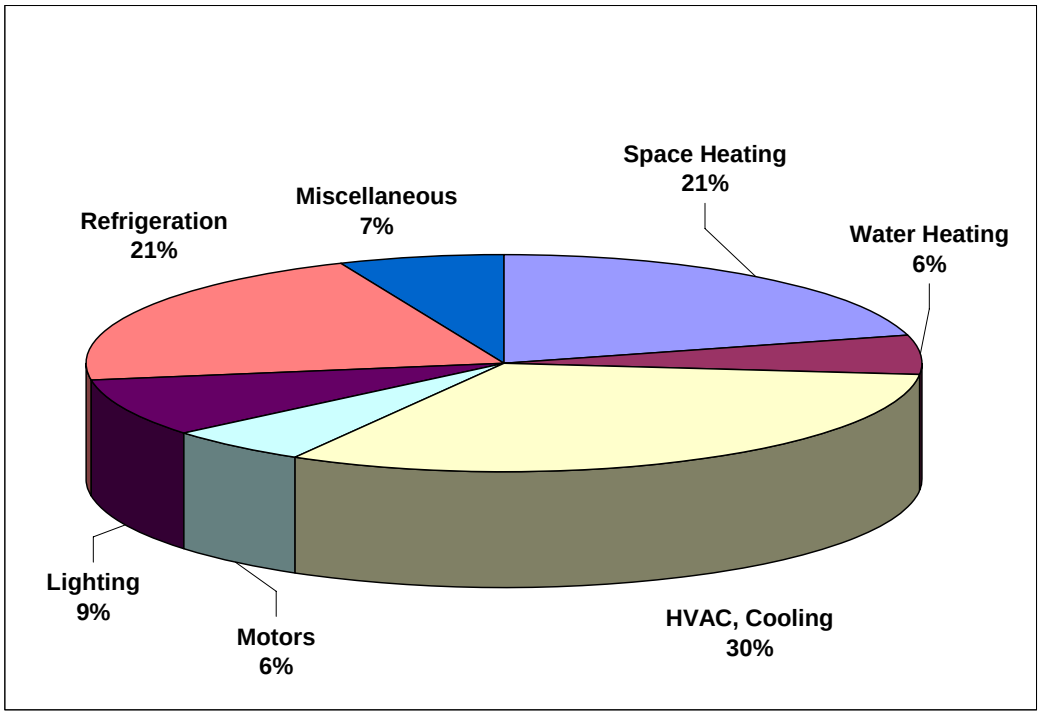


Table 6-8 and Figure 6-7 show the electric demand (kW) savings that is associated with the achievable cost effective potential savings level for commercial new construction. Space cooling technologies account for the largest percentage of the kW savings potential at 31 percent. Space heating and refrigeration make up the next largest demand savings categories at 21 percent each. Lighting, miscellaneous, water heating and motors make up remaining 27 percent, at between 6 and 9 percent each.

Table 6-8 Achievable Cost Effective kW Savings by End Use Commercial New Construction

End Use Category	Total kW Saved	% Savings
HVAC, Cooling	635.1	31.4%
Space Heating	421.6	20.9%
Refrigeration	421.6	20.9%
Lighting	176.4	8.7%
Miscellaneous	131.7	6.5%
Water Heating	119.8	5.9%
Motors	115.3	5.7%
Total kW Savings	2,021.4	100.0%

Figure 6-7 Achievable Cost Effective kW Savings by End Use for Commercial New Construction



Retrofit, Market Driven, and Early Replacement Measures

For the commercial sector, retrofit, market driven (also referred to as replace-on-burnout), and early replacement (a specialized case of retrofit which is addressed in Appendix G) measures were considered. The primary difference between the types of measures is the timing of interaction with the program participant and the ramp-in rate of the measures over the ten year study period. Listed below is a description of the three types of equipment replacement approaches examined in this report.

- Retrofit and early replacement measures are assumed to be installed in an aggressive manner for the first five years of the period and then less so for the remaining five years. These measures are replaced before the end of the useful life of equipment.
- With a market driven approach, measures are replaced at the end of their useful lives or when they burn out. In this study, measures that are replaced at they time they burn out are ramped in on a linear basis at a rate that is dictated by the estimated life of the measure, in years. For example, for efficient motors with a measure life of 20 years, the motors are ramped-in at a linear ten percent per year but only half of the total potential savings can be captured in the ten year study period because only half of the motors would “burn out” in ten years.
- Early replacement refers to a piece of equipment whose replacement is accelerated by several years for the purposes of capturing energy and

peak demand savings earlier than would otherwise occur under a market driven scenario

For retrofit measures (including both early retirement and other retrofits), the ramp-in rate is independent of the estimated life of the measure so all potential savings can be captured in the ten year study period regardless of the measure life. For this study, retrofit measures were categorized as those that would not typically "burn out". For example, programmable thermostats are typically installed for their added features rather than because a standard thermostat "burned out". However, it is understood that in some cases, a programmable thermostat may be installed during a renovation or remodeling project. Similarly, control and system optimization measures such as retrocomissioning and the optimization of Energy Management Systems (EMS) were also considered on a retrofit basis.

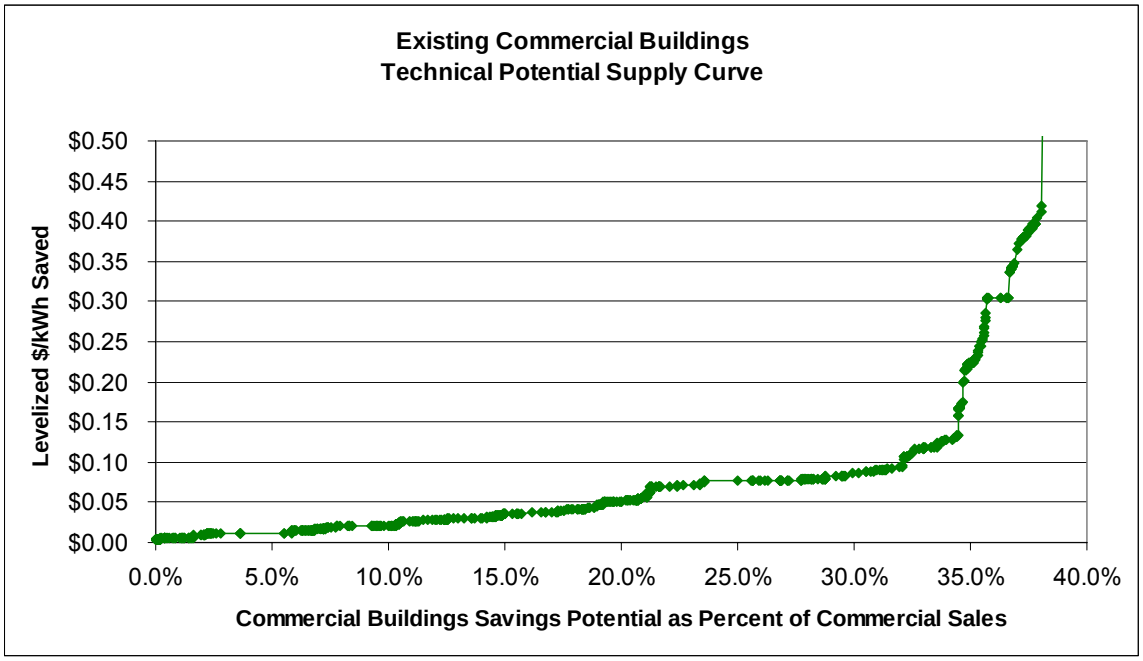
Early replacement measures are a specialized retrofit case. Early replacement refers to a piece of equipment whose replacement is accelerated by several years for the purposes of capturing energy and peak demand savings earlier than would otherwise occur under a market driven scenario. The modeling for early replacement measures differs from retrofit measures in that all of the measures are assumed to be installed in the initial four years of the study.

The achievable cost effective savings potential for existing buildings is made up of approximately 59 percent from market driven measures and 41 percent from retrofit measures. New construction measures are not bound by measure life because they are all measures being installed in a given year. For purposes of modeling, they are essentially viewed as retrofit, where the entire potential for each measure is available without regard to the measure life.

Energy Efficiency Supply Curves

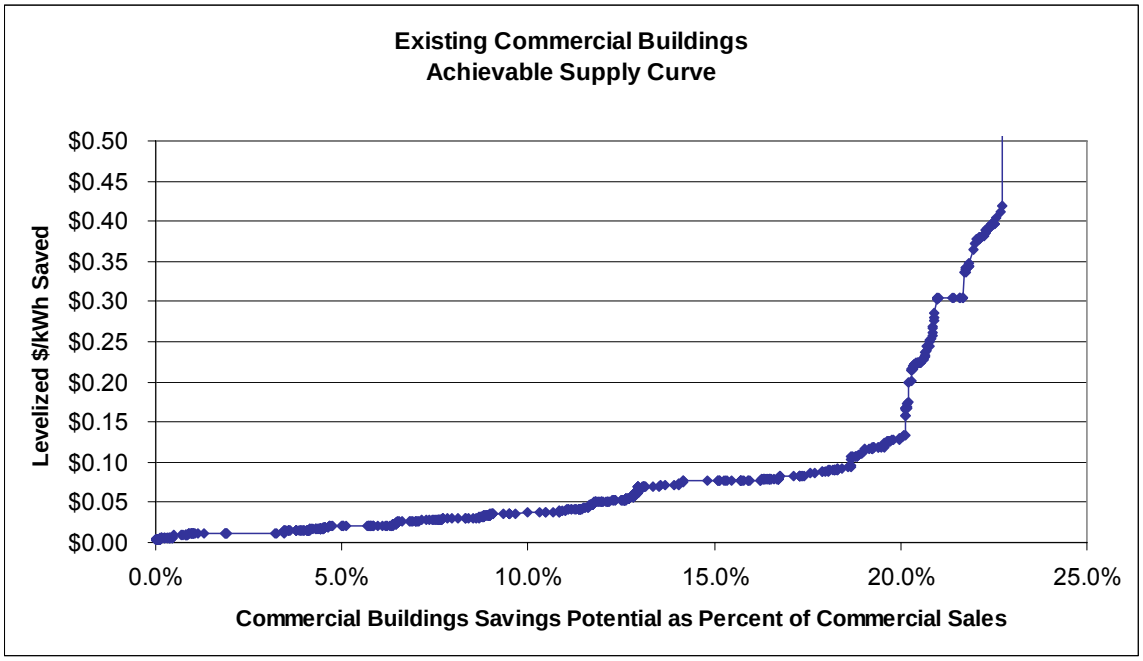
Figures 6-8 through 6-13 on the following pages illustrate the technical, achievable and achievable cost effective supply curves for the existing building and new construction components of the commercial sector. As can be seen in each of the supply curve graphs, much of the savings (nearly all in the case of the achievable cost effective scenario) can be achieved at less than $0.10 per kWh saved. It should be noted that due to the inclusion of non-electric benefits, which are not reflected in the supply curves, some measures with relatively high levelized cost per kWh values are included in the cost effective results.

Figure 6-8 Technical Potential Supply Curve for Existing Commercial Buildings



Note: Non-electric benefits are not reflected in the supply curve.

Figure 6-9 Achievable Potential Supply Curve for Existing Commercial Buildings



Note: Non-electric benefits are not reflected in the supply curve.

Figure 6-10 Achievable Cost Effective Potential Supply Curve for Existing Commercial Buildings

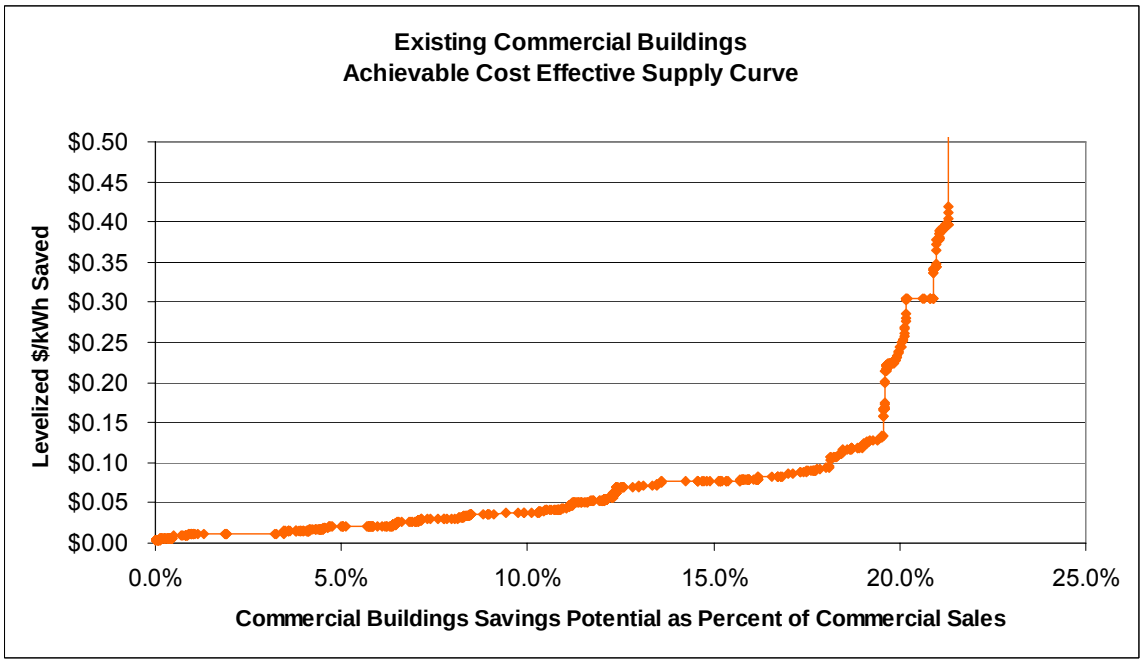
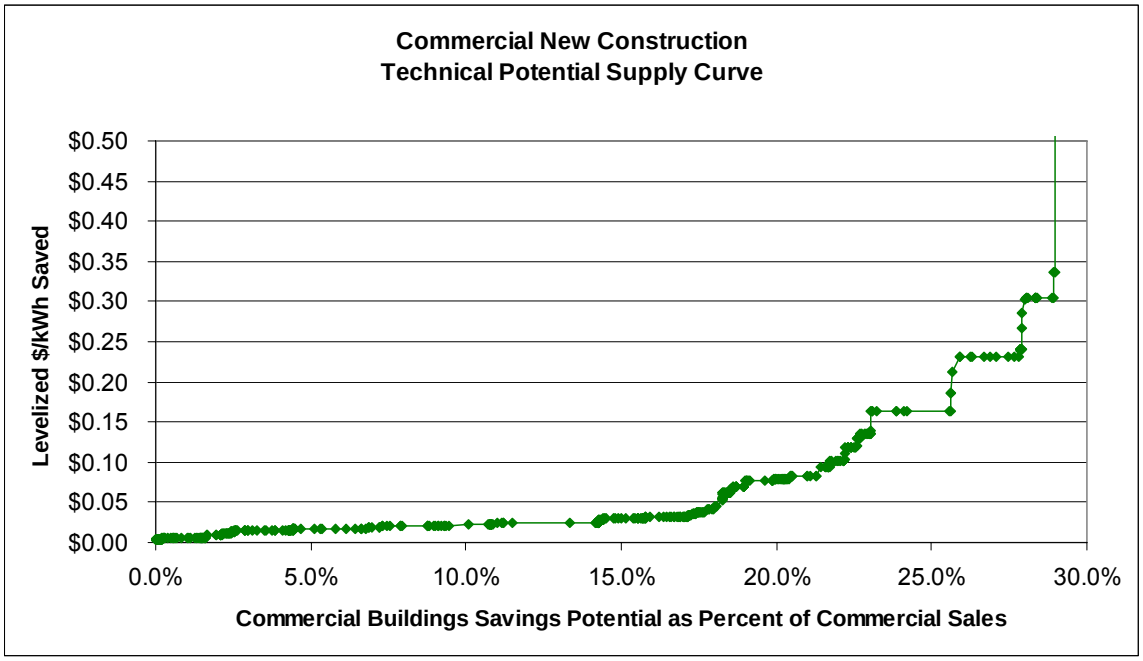
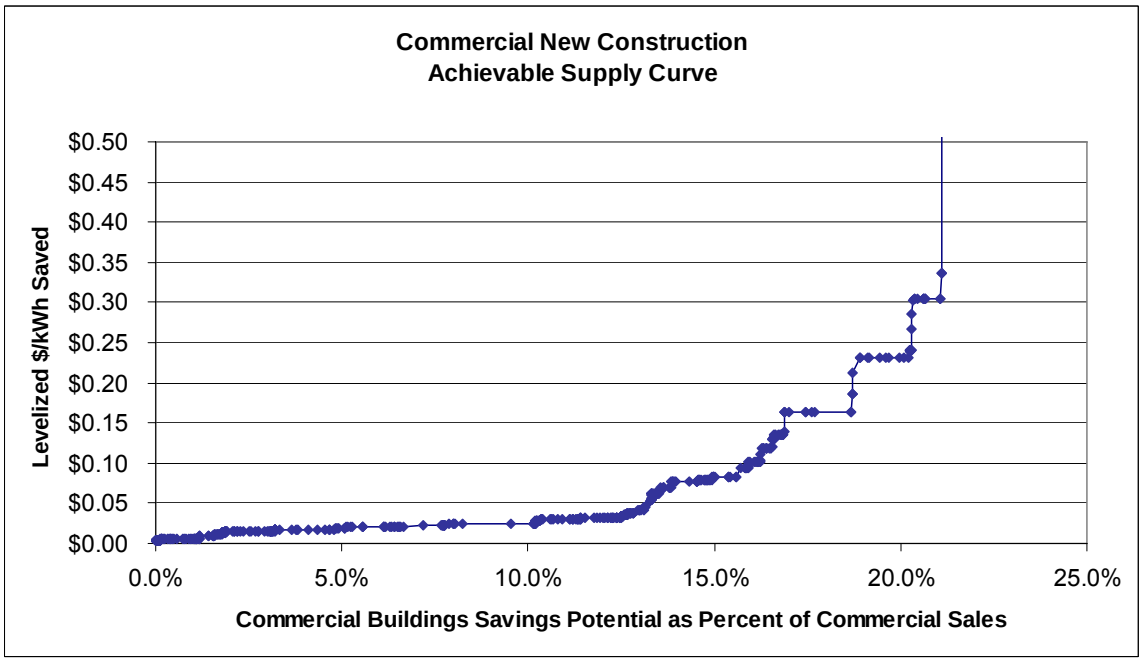


Figure 6-11 Technical Potential Supply Curve for Commercial New Construction



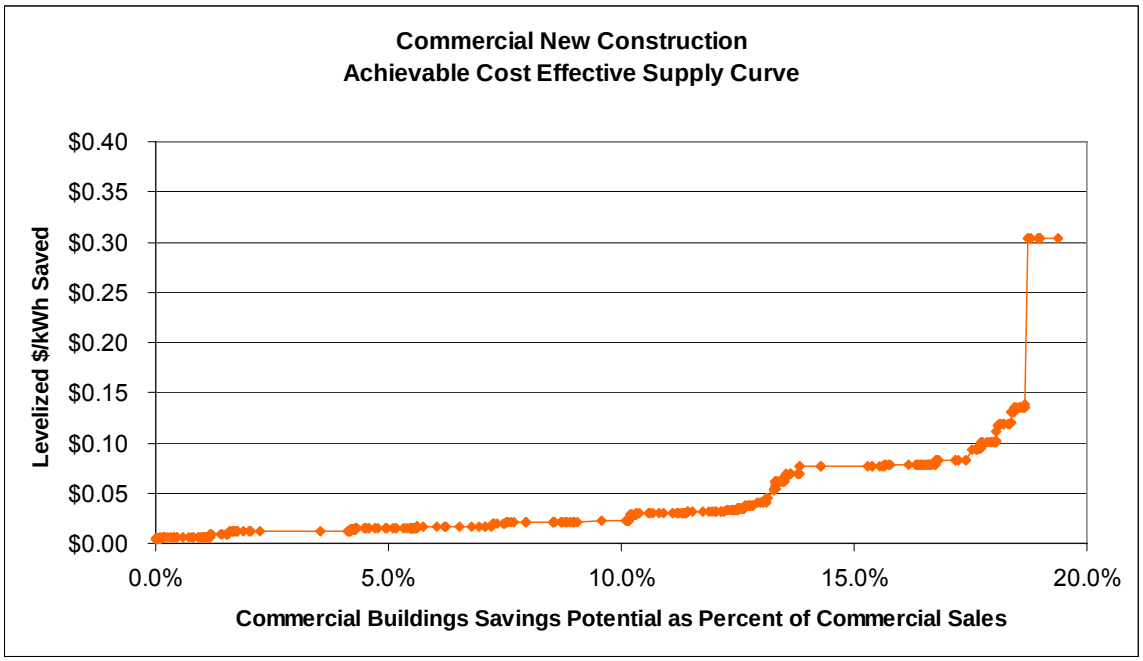
Note: Non-electric benefits are not reflected in the supply curve.

Figure 6-12 Achievable Potential Supply Curve for Commercial New Construction



Note: Non-electric benefits are not reflected in the supply curve.

Figure 6-13 Achievable Cost Effective Potential Supply Curve for Commercial New Construction



Note: Non-electric benefits are not reflected in the supply curve.

Table 6-9 illustrates how the current energy efficiency potential study compares to the study completed in 2002. The achievable savings of 24.4% by 2015 determined in this study is below the 31.5% determined in the January 2003 Vermont energy efficiency potential study.

Table 6-9: Comparison to 2006 Potential Savings Estimates to 2002 Estimates
Commercial Sector

	Optimal Energy - 2002	GDS Associates- 2006
Technical Potential	NA	40.4%
Achievable Potential	31.5%	24.4%
Achievable Cost Effective Potential	NA	21.3%

7.0 LARGE INDUSTRIAL SECTOR ENERGY EFFICIENCY POTENTIAL IN VERMONT

As noted in Section 3 of this report, the industrial classification in Vermont represented 28% of total annual kWh sales in the State in 2004.[54] This sector includes large industrial customers in such industries as electrical and electronic equipment, pulp and paper and food manufacturing. There are approximately 500 electric customers in the industrial sector in Vermont. The number of consumers for the class is expected to remain level through 2015. As discussed in Section 3 of this report, annual kWh sales are projected to increase at an average annual compound rate of growth of 0.74% per year through 2015.

7.1 Introduction

This section of the report provides the estimates of technical, achievable, and achievable cost effective energy-efficiency potential for electric energy efficiency measures for the industrial sector in Vermont.

There are still significant electric savings opportunities in this sector. Technical electric energy savings potential is estimated to be approximately 382,700 MWH by 2015, or 21 percent of projected annual kWh sales in 2015. Achievable potential is estimated to be approximately 306,160 MWH and achievable cost effective potential is estimated to be 268,929 MWH by 2015. Thus the range of expected electricity savings is between 15% and 21% of projected industrial electric consumption (before DSM programs) in the year 2015. The electric energy efficiency potential estimates are based on a detailed analysis of the electric usage and potential savings for industrial customers.

Table 7-1 below summarizes the three types of electric energy efficiency savings potential for the industrial sector in Vermont by 2015. It is important to note that all of the energy efficiency measures examined for the industrial sector proved to be cost effective according to the Societal Test.

Table 7-1: Summary of Industrial Sector Energy Efficiency Potential in Vermont

	Estimated Cumulative Annual Savings by 2015 (mwWh)	Savings in 2015 as a Percent of Total 2015 Industrial Sector mWh Sales
Technical Potential	382,700	20.7%
Maximum Achievable Potential	268,929	14.5%
Maximum Achievable Cost Effective Potential	268,929	14.5%

[54] Staff of the Vermont Department of Public Service provided historical Vermont data on industrial sector kWh sales and customers for the period 1992 to 2004. See tables 3-1 and 3-2 in Section 3 of this report to see this historical data for the industrial sector in Vermont. In the year 2004, there were 554 industrial customers, according to the historical data provided by Riley Allen of the VDPS.

Overall Approach for the Industrial Sector

A literature review of several recent industrial electric potential studies indicates that due to the unique nature of industrial customers, the approach to develop savings potential generally is done on industrial sub-sectors (e.g. Food Processing, Paper, Computers, Agriculture, etc.) basis. The specific data sources used by GDS and the American Council for an Energy Efficient Economy (ACEEE) for the development of the industrial sector electric savings potential estimates are listed below. The detailed appendices of this report also provide detailed information on the costs, savings and useful lives of industrial sector electric energy efficiency technologies.

Steps to Develop Electric Energy Efficiency Potential for the Industrial Sector

ACEEE provided input to the GDS analysis of the electric energy efficiency potential in the industrial sector in Vermont. ACEEE provided the following data for the industrial sector to GDS:

1. ACEEE developed estimates of the disaggregated industrial sector electricity consumption at the three-digit North American Industrial Classification System (NAICS) code level based on state value of shipments data (Census 2005), national energy intensity data from EIA's *Manufacturing Energy Consumption Survey* (EIA 2005a). This estimate was then apportioned to the 2004 state industrial sector energy consumption reported by EIA (2005b).

2. ACEEE provided a break down of end-use electric energy-use at the three-digit NAICS code level based on a proprietary data analysis by ACEEE.

3. ACEEE provided data on Industrial energy efficiency measures, including measure life, technical savings potential and measure cost. ACEEE also developed up-to-date information on the end-uses that are applicable to each industry segment, and the fraction of applicable use energy that is eligible for each measure.

Using the data provided by ACEEE, GDS then completed the following steps to arrive at final estimates of potential electricity savings by industry sector by end use:

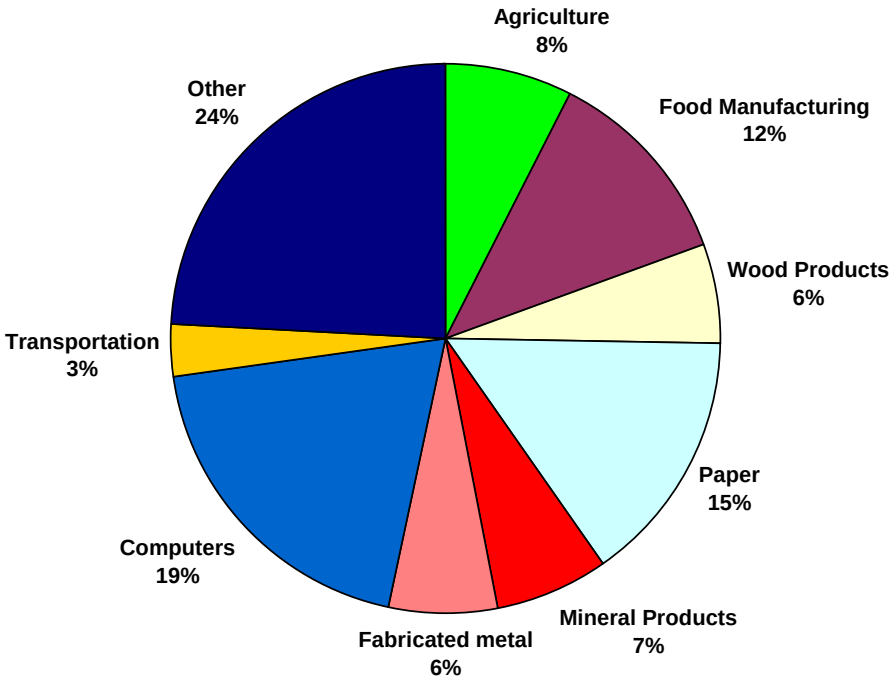
1. GDS then applied energy efficiency measures to applicable end-use electricity kWh sales for each industry group using eligibility factors to determine technical potential.
2. GDS then applied economic screening criteria to the estimates of the technical potential for electricity savings.

It is important to note that the estimates of the remaining potential for electricity savings for the Vermont industrial sector are based upon a "frozen" technology set as of 2006, though it does include some "emerging" technologies. While this assumption is probably not significant for a 10 year horizon, ACEEE has concerns about the value of projecting beyond 10 years because ACEEE does not capture emerging technologies that cannot be envisioned based on current market knowledge. See Nadel, Shipley and Elliott, 2004 for a further discussion of this issue.

Industrial Sector Characterization

Electricity use in Vermont is fairly balanced between the three primary sectors with residential using 37%, commercial at 35% and industrial at 28% of the state's total 2004 kWh sales. Almost half of industrial electricity use can be accounted for in four industry groups (see Figure 7-1 below).

Figure 7-1 Estimates of the Distribution of 2004 Industrial Sector Electricity Consumption in Vermont



Within significant industry groups, there is limited diversity. Within food agriculture, dairy accounts for the overwhelming share of the electricity use. In food manufacturing, dairy products also accounts for the majority as would be expected. Within paper, four large paper mills account for most of the electricity use. Within computers, computer components dominate. In other significant sectors, sawmills appear to dominate the wood products, while cut stone appears to dominate mineral products.

Energy Efficiency Measures

ACEEE drew upon its past work to assemble a grouping of measures that ACEEE felt were relevant to the industrial sector in Vermont. ACEEE focused only on measures that would likely offer significant aggregate savings.

In agriculture ACEEE focused exclusively on dairy because of its dominance in the sector in the state. ACEEE identified five primary measures based on past research (Brown and Elliott 2005):

- Pumps
- Fans
- Compressed air/vacuum pumps
- Refrigeration
- Lighting

Because of the extensive work on energy efficiency with the dairy industry in the state by Efficiency Vermont and the investor-owned utilities, ACEEE feels that much of the efficiency opportunity in this market segment is already identified, and the existing programs are already realizing much of the potential.

We do not propose specific measures for mining or construction. Information on efficiency opportunities in hard rock mining is limited, though it is thought that motors are the dominant electrical load. ACEEE has not found viable measures for the construction industry because of the transient nature of industry, and energy's small fraction of operating costs.

For the manufacturing sector, we have focused on several crosscutting measures that we feel represent the majority of the savings potential:

- Sensor and Controls
- Advanced lubricants
- Electric supply system improvements
- Pump system efficiency improvements
- Advanced Air compressor Controls
- Industrial motor management
- Air compressor system management
- Fan system improvements
- Advanced motor designs
- Motor system optimization (including ASD)
- Transformers (NEMA Tier II)
- Efficient industrial lighting

Since this list is not comprehensive, due to budget and time constraints, the resulting savings should be viewed as a bounded technical potential. Industry

and site specific opportunities clearly exist, but represent a small fraction of the total potential. Thus we focus on cross cutting measures.

The specific data sources used by GDS for industrial energy efficiency measures are listed below:

Brown, E. and R.N. Elliott. 2005. *Potential Energy Efficiency Savings in the Agriculture Sector*, http://aceee.org/pubs/ie053full.pdf. Washington, D.C.: American Council for an Energy-Efficient Economy.

[Census] Bureau of the Census. 2005. *2002 Economic Census Manufacturing Geographic Area Series: Vermont,* EC02-31A-VT (RV). Washington, D.C.: U.S. Department of Commerce.

2002 Economic Census Mining Geographic Area Series: Vermont, EC02-21A-VT. Washington, D.C.: U.S. Department of Commerce.

Elliott, R.N. 1994. Electricity Consumption and the Potential for Electric Energy Savings in the Manufacturing Sector, ACEEE Report #IE942. Washington, D.C.: American Council for an Energy-Efficient Economy.

[EIA] Energy Information Administration. 2005a. *Manufacturing Energy Consumption Survey,* http://www.eia.doe.gov/emeu/mecs/contents.html. Washington, D.C.: U.S. Department of Energy.

Electric Sales, Revenue, and Average Price 2004, http://www.eia.doe.gov/cneaf/electricity/esr/esr_sum.html. Washington, D.C.: U.S. Department of Energy.

Martin, N., et al. 2000. *Emerging Energy-Efficient Industrial Technologies*, ACEEE Report #IE003. Washington, D.C.: American Council for an Energy-Efficient Economy.

Nadel, S., A. Shipley and Elliott, R.N. 2004. "The Technical, Economic and Achievable Potential for Energy-Efficiency in the U.S. - A Meta-Analysis of Recent Studies," in the *Proceedings of the 2004 ACEEE Summer Study on Energy Efficiency in Buildings*, http://aceee.org/conf/04ss/rnemeta.pdf. Washington, D.C.: American Council for an Energy-Efficient Economy.

7.2 Technical and Maximum Achievable Economic Potential

This section presents estimates of the technical, achievable and achievable cost effective potential electricity savings for the industrial and agriculture sector for the year 2015.

Technical savings potential is estimated to be approximately 382,700 MWH by 2015, or 21% of projected annual kWh sales in the year 2015. Achievable potential is estimated to be approximately 268,929 MWH and achievable cost effective potential is estimated to be 268,929 MWH. Thus the achievable cost effective electricity savings potential in the industrial sector is 14.5% of projected industrial electric consumption in the year 2015. The savings level for the achievable and the achievable cost effective scenarios are identical for the industrial sector because all energy efficiency measures considered in the industrial sector analysis were cost effective (according to the Societal Test).

Figure 7-3 shows the percentage of total technical potential savings within each of the industrial end uses. Efficient lighting measures account for the largest percentage of technical potential at 34 percent, with motor systems improvements being second at 19 percent. Electric supply system improvements and pump system improvements provide 12 percent and 8 percent respectively of the technical potential electricity savings. These percentages are identical for the maximum achievable cost effective potential savings estimates.

Table 7-2 provides estimates of the technical savings potential by type of industrial energy efficiency measure in terms of potential kWh savings in the year 2015. The lighting and motors end uses have the largest technical savings potential in the industrial sector.

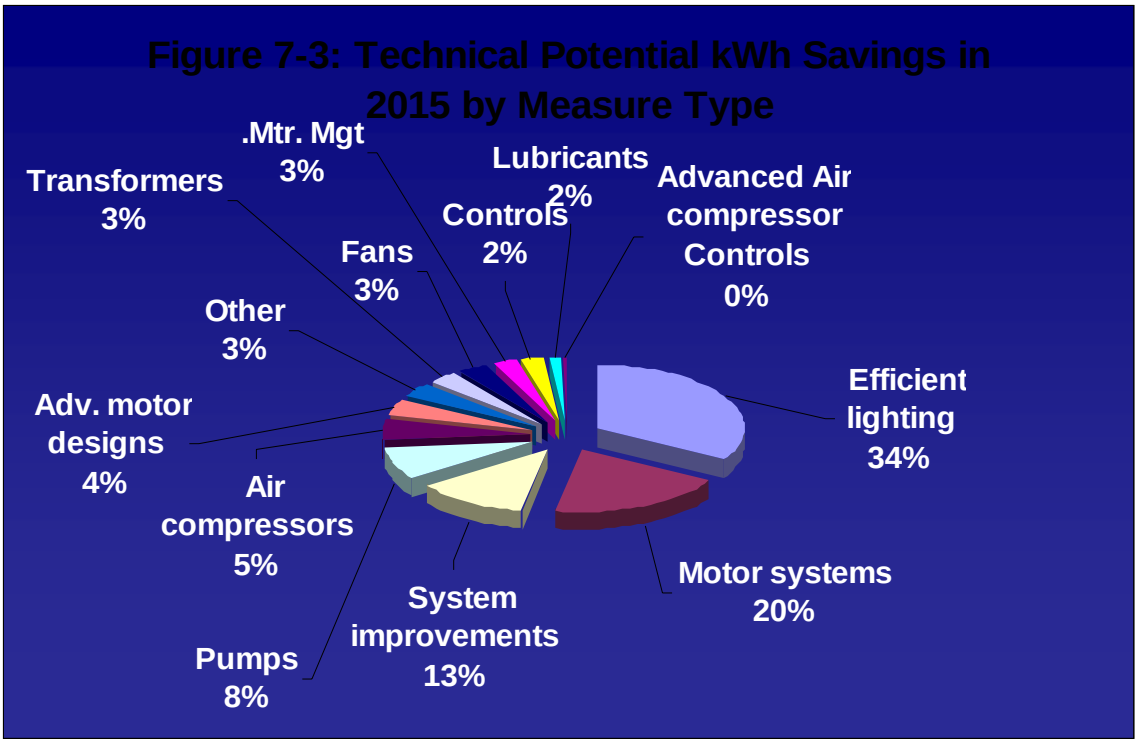


Table 7-2: Industrial Sector Technical Savings Potential (kWh) by Type of Energy Efficiency Measure By 2015			
Measure #	Industrial Energy Efficiency Measure	Technical Potential Savings by 2015 (annual kWh)	Percent of Total
1	Efficient industrial lamps and fixtures	127,754,709	33.4%
2	Motor system optimization (including ASD)	74,404,424	19.4%
3	Electric supply system improvements	47,830,845	12.5%
4	Pump system efficiency improvements	31,115,972	8.1%
5	Air compressor system management	20,484,776	5.4%
6	Advanced motor designs	16,704,811	4.4%
7	Other industrial energy efficiency measures	13,356,056	3.5%
8	Transformers (NEMA Tier II)	12,754,892	3.3%
9	Fan system improvements	12,731,080	3.3%
10	Industrial motor management	9,683,948	2.5%
11	Sensor and Controls	9,378,023	2.5%
12	Advanced lubricants	5,791,001	1.5%
13	Advanced Air compressor Controls	709,686	0.2%
	Total Industrial Sector Savings Potential	382,700,223	100.0%

In Table 7-3, we present estimates of achievable cost effective savings potential by type of energy efficiency measure in terms of potential kWh savings in the year 2015. These numbers are before adjustments are made to factor in the useful life of the measures. The lighting and motors end uses have the largest technical potential savings. When the useful life of industrial sector energy efficiency measures is factored in, the achievable cost effective potential declines

to 268,929 mWh (due to the decay of savings over time). This is due to the fact that some of the industrial sector measures have useful lives of five years.

Table 7-3: Industrial Sector Maximum Achievable Cost Effective Savings Potential (kWh) by Type of Energy Efficiency Measure by 2015

Measure #	Industrial Energy Efficiency Measure	Technical Potential Savings by 2015 (annual kWh)	Percent of Total
1	Efficient industrial lamps and fixtures	102,203,767	33.4%
2	Motor system optimization (including ASD)	59,523,539	19.4%
3	Electric supply system improvements	38,264,676	12.5%
4	Pump system efficiency improvements	24,892,777	8.1%
5	Air compressor system management	16,387,821	5.4%
6	Advanced motor designs	13,363,848	4.4%
7	Other industrial energy efficiency measures	10,684,845	3.5%
8	Transformers (NEMA Tier II)	10,203,914	3.3%
9	Fan system improvements	10,184,864	3.3%
10	Industrial motor management	7,747,159	2.5%
11	Sensor and Controls	7,502,419	2.5%
12	Advanced lubricants	4,632,801	1.5%
13	Advanced Air compressor Controls	567,749	0.2%
	Total Industrial Sector Savings Potential	306,160,178	100.0%

Key Data Limitations Associated with Estimates of Industrial Electric Potential

- **End-use costs:** Estimates of aggregate measure costs for each end-use category were developed using several sources. While the sources used offer reasonable values for the end-use costs, GDS was unable (within the budget and schedule for this project) to gather end-use cost data specific to Vermont for every energy efficiency measure for the industrial sector.

- **End-use savings**. Estimates of aggregate measure savings for each end-use category were developed using several sources. While the sources used offer reasonable values for the end-use savings, GDS was unable (within the budget and schedule for this project) to gather energy savings data specific to Vermont for every industrial energy efficiency measure.

8.0 NON-ENERGY IMPACTS AND FAIRNESS ISSUE RELATED TO ELECTRIC ENERGY EFFICIENCY PROGRAMS

In addition to saving energy, electric energy efficiency programs can provide a variety of non-energy impacts.[55] Continuing to implement energy efficiency programs in Vermont will save electricity and will provide several other benefits to the State's economy.

Listed below are examples of non-energy impacts that will result from implementation of the electric energy efficiency measures included in this study:

- Electric energy efficiency programs can help reduce emissions of air pollutants[56] and greenhouse gases. Every mWh saved through an energy efficiency program in Vermont reduces power plant emissions by the following amounts of pounds[57]:
  - :SOX – 2.03 lbs per mWh saved
  - NOX – 0.54 lbs per mWh saved
  - C02 – 1102 lbs per mWh saved
- Electric energy efficiency programs can be more reliable than increasing the infrastructure of the electric generation supply system because electric energy efficiency measures are "distributed resources" and require no on-going fuel supply. As such, they are not subject to potential supply interruptions and/or fuel price increases.
- Electric energy efficiency can make homes and businesses more comfortable - less drafty, etc.
- Electric energy efficiency programs can help homes and businesses reduce operating costs and can make businesses in Vermont more competitive with businesses in other states and other countries.

[55] The New Mother Lode: The Potential for More Efficient Electricity Use in the Southwest, Southwest Energy Efficiency Project (SWEEP), November 2002.

[56] GDS uses the following definitions of these emissions: CO2 is the major green house gas; NOx contributes to ground level ozone, particulate matter, acid rain, visibility impairment and nitrogen deposition; and SO2 contributes visibility impairment, acid rain, and particulate matter.

[57] These marginal emissions rates for 2004 were provided by email to GDS by Dave Lamont of the VDPS staff on April 18, 2006. The original source of these emissions rates is the ISO New England web site, and these rates were listed in a presentation to the Power Planning Committee. It is, however, important to note that for SO2, and NOx are already capped under the Clear Air Act. The reductions here do not change the cap, but, more likely, can be expected to reduce the market clearing prices for SO2 and NOx under the cap and trade system. The same logic applies to reductions of CO2 beginning in 2009. For purposes of the analysis, a value of 0.7 cents per kWh (2000 dollars) was used to account for the externality benefits. These externality benefits are always the subject of controversy. The 0.7 cents per kWh value (2000 dollars) used here is the product of a settlement in a Vermont Public Service Board investigation in Docket 5980. For purposes of the analysis, the 0.7 cents per kWh is broad and encompasses the benefits for all externality values, especially those associated with categories of pollutants that remain uncapped..

8.1 Residential Sector Non Energy Benefits

Electric energy efficiency measures installed in homes or businesses can be more reliable than investments in electric supply-side resources. Unlike transmission and distribution lines, for example, the location of electric energy efficiency projects may not be as vulnerable to severe storms (ice storms, snow storms, hurricanes, wind storms, or hail storms) or spikes in the price of electricity. Contractors or homeowners, depending on the complexity of the measure, can easily install the electric energy efficiency measures. Energy efficiency measures are designed not only to save energy but also to improve the comfort of the occupant. Caulking, weather-stripping, insulation, ENERGY STAR windows, infiltration measures, CFLs and high efficiency air conditioners will reduce household and business operating costs and will decrease infiltration and heat loss.

The following impacts and benefits of energy efficiency programs have been noted in a recent evaluation report from the Wisconsin Focus on Energy Program[58]:

- Increased safety resulting from a reduction of gases emitted into the atmosphere, such as carbon monoxide.
- Fewer illnesses resulting from elimination of mold problems due to proper sealing, insulating and ventilation of a home
- Reduced repair and maintenance expense due to having newer, higher quality equipment
- Increased property values resulting from installation of new equipment

Non-energy impacts can play a key role for residential builders who promote energy efficiency in new home construction as seen in Wisconsin's Energy Star Home Program (WESH). Given that WESH homes are reported as selling at a higher price for 79 percent of homebuilders and the fact that 86 percent of homebuilders are more inclined to promote themselves as energy efficient builders, WESH homebuilders can view and market themselves as high-end homebuilders. WESH program implementers market the program by telling prospective homebuilders that they will be able to expand their business as a result of the WESH program. Also, given the frequency that comfort and safety improvements are cited as non-energy benefits associated with both WESH and Home Performance with Energy Star Program (HPWES), emphasizing these two non-energy benefits in program marketing efforts may help to increase program participation. In addition, increased durability and longevity of household

[58] State of Wisconsin Department of Administration Division of Energy, Focus on Energy Public Benefits Statewide Evaluation, Quarterly Summary Report: Contract Year 2, Second Quarter, March 31, 2003, Evaluation Contractor: PA Government Services Inc. Prepared by: Focus Evaluation Team.

equipment can be a selling point for the Wisconsin HPWES program, where 84 percent of contractors cite this as a non-energy benefit.[59]

8.2 Commercial Sector Non Energy Benefits

By utilizing electric energy efficiency programs, businesses in Vermont can become more efficient and lower their monthly utility bills. The energy and monetary savings from electric energy efficiency programs can provide businesses with additional capital to invest in business infrastructure. Electric energy efficiency programs can help businesses in Vermont become more competitive with other businesses in the United States and in other countries. Implementing electric energy efficiency measures may also increase productivity and afford the business with the opportunity to add new jobs, further bolstering the economy in Vermont.

Examples of Non Energy Benefits from The Wisconsin Focus on Energy Business Programs:[60]

- Increased productivity
- Improvement in morale
- Reduced repair and maintenance costs
- Reduced waste
- Reduced defect or error rates

8.3 Environmental and Price Impacts of Energy Efficiency Programs

Increased energy efficiency is in the public interest for environmental, economic and national security reasons. The production and use of energy causes a large portion of the nation's air pollution. Fossil fuel combustion and the resulting emissions can be harmful to public health in a variety of ways:

- by harming to ecological systems, especially by increasing the acidity of rainfall and water bodies, and
- by being a major source of greenhouse gases causing climate change.

A reduction in energy consumption through greater efficiency of energy use is a means to reduce all emissions from burning fossil fuels, including NO_x, SO_2, and CO_2.[61]

[59] State of Wisconsin Department of Administration, Division of Energy, Focus on Energy Statewide Evaluation, Non-Energy Benefits Cross-Cutting Report, Year 1 Efforts, *Evaluation Contractor: PA Government Services Inc., Prepared by: Nick Hall, TecMarket Works, Oregon, Wisconsin Under Contract To PA Consulting,* January 20, 2003
[60] Ibid.
[61] Energy Efficiency and Renewables Sources: A Primer, Prepared by the National Association of State Energy Officials Updated by Global Environment & Technology Foundation, October 2001.

Cost-effective energy efficiency actions are beneficial (1) to individual users of electricity by reducing consumer costs and (2) to the economy by increasing discretionary income. The implementation of energy efficiency measures can help consumers save money.[62]

A recent American Council for An Energy Efficient Economy (ACEEE) analysis found that modestly reducing both natural gas and electricity consumption and increasing the installation of renewable energy generation could dramatically affect natural gas price and availability. According to the ACEEE report, in just 12 months, nationwide efforts to expand energy efficiency and renewable energy could reduce wholesale natural gas prices by 20 percent and save consumers $15 billion/year in retail gas and electric power costs.[63] [64]

8.5 Non Energy Impacts of Low Income Weatherization and Insulation Programs

GDS also conducted a literature search on the non-energy benefits of energy efficiency programs targeted at low-income households. Such programs can help reduce low income customer account arrearages, and can help make the monthly electric bill affordable for low income households. One of the most comprehensive studies of low-income program non-energy benefits was recently completed for five investor-owned utilities in California.[65,66] This study identified over twenty non-energy benefits of energy efficiency programs targeted at low income households.

8.6 Other Impacts, Uncertainty and Equity

There are also other impacts, risks and equity issues associated with energy efficiency programs delivered through an efficiency utility type structure. Included among these impacts are the following:

---

[62] Ibid.

[63] The ACEEE study notes how natural gas energy efficiency programs can help reduce prices of natural gas.

[64] R. Neal Elliot, PH.D., P.E., et al., Natural Gas Price Effects of Energy Efficiency and Renewable Energy Practices and Policies, ACEEE, December 2003.

[65] TecMRKT Works, Skumatz Economic Research Associates, and Megdal & Associates, Low-income Public Purpose Test, (The LIPPT), Final Report, Up-Dated for LIPPT Version 2.0, A Report Prepared for the RRM Working Group's Cost Effectiveness Committee, April 2001. This report provides a description of each non-energy benefit included in the KeySpan analysis of non-energy benefits, and provides the methodology for calculating the value of each category of non-energy benefits.

[66] TecMRKT Works, Skumatz Economic Research Associates, and Megdal & Associates, User's Guide for California Utility's Low-Income Program Cost Effectiveness Model, The Low-Income Public Purpose Test, Version 2.0, A Microsoft Excel Based Model, Prepared for The RRM Cost Effectiveness Subcommittee, May 25, 2001.

- Higher electric rates and bills to non-participants – Despite the considerable savings identified in this analysis through these programs, there will always be consumers that have not participated and do not benefit from the programs of an efficiency utility, even where there are programs available to them. For such customers, rate impacts will translate into higher bills.
- Uncertainty over savings and costs – Despite the considerable experience with programs, savings estimates always require some degree of understanding of what would have happened but for the existence of the program. This is not simply a question of engineering calculations or metering, but of judgment for which reasonable persons may differ and certainty is never assured.
- New technologies bring with them new dimensions of service and quality that may require time for consumers and the markets to adjust. Early version of compact fluorescent bulbs, for example, provided different coloration that varied by installation and bulb, and those coloration issues were an annoyance to some consumers. Also, certain technologies, including CFLs, suffer from considerable variability in product quality by manufacturer, especially in the early stages of product development.
- Fuel switching programs that expose consumers to fossil fuel alternatives, also expose these retail consumers to the costs and price uncertainty of those alternatives.
- Utility concerns that energy efficiency erodes their financial incentives to perform efficiency programs and aggressive programs could undermine their financial health.

That said, there are analogous concerns with supply-side resources. Major supply resources and contracts present their own risks to utilities. Electricity prices in Vermont may also expose consumers to greater marketplace volatility as existing contracts and resources in Vermont expire and expose consumers to the new marketplace realities of electricity.

9.0 SUMMARY OF FINDINGS

In summary, the achievable cost effective potential for electric energy efficiency in Vermont by 2015 is significant. GDS estimates that the achievable cost effective potential electricity savings would amount to almost 1.3 billion kWh a year (a 19.4 percent reduction in projected 2015 kWh sales forecast in Vermont). Table 9-1 below summarizes the electricity savings potential in Vermont by 2015.

Table 9-1: Maximum Achievable Cost Effective Electric Energy Efficiency Potential By 2015 in Vermont

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	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%

The results of this study demonstrate that cost effective electric energy-efficiency resources can play a significantly expanded role in Vermont's energy resource mix over the next decade. Table 1-3 in the Executive Summary shows the present value of benefits and costs associated with implementing the achievable cost effective potential energy savings in Vermont as well as the overall Societal Test benefit/cost ratio of 3.45 The potential net present savings to ratepayers in Vermont for implementation of cost effective electric energy efficiency programs over the next decade are approximately **$964 million** in 2006 dollars.

It is clear that electric energy efficiency programs could save Vermonters a significant amount of electricity by 2015. The electric energy efficiency potential estimates and the Societal Test savings provided in this report are based upon a planning load forecast for Vermont of 1.5% growth per year in annual kWh sales and peak load, appliance saturation data, economic forecasts, data on energy efficiency measure costs and savings, and energy efficiency measure lives available to GDS at the time of this study. All input assumptions and data have been reviewed by GDS and VDPS staff. GDS has conducted extra market research with energy services providers in Vermont to ensure that data for residential energy efficiency weatherization and insulation measure costs and savings are applicable and up to date.

There are also significant environmental benefits with the achievable cost effective scenario.

APPENDIX A

Residential Sector

APPENDIX A-1

Single-Family Assumptions

Table A-1
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Single-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
1	Single-Family	**Refrigerator Turn-in**	303,067	Buyback	Per refrigerator	Per refrigerator	$50.00	$92.53	$142.53	0	6.5	1383.00	413.00	0.00	$28.94	$0.0701	0	Refrigerator	1	13.0%
2	Single-Family	**Freezer Turn-in**	303,067	Buyback	Per freezer	Per freezer	$50.00	$92.53	$142.53	0	5.5	1181.00	450.00	0.00	$33.02	$0.0734	0	Freezer	1	2.0%
3	Single-Family	**Room AC Turn-in without Replacement**	303,067	Buyback	Per Room AC	Per Room AC	$25.00	$117.53	$142.53	0	6	191.00	40.00	0.00	$30.81	$0.7702	0	Room AC	1	36.0%
4	Single-Family	**Room AC Turn-in with ES Replacement**	303,067	Buyback	Per Room AC	Per Room AC	$35.00	$107.53	$142.53	0	6	53.00	14.00	0.00	$30.81	$2.2006	0	Room AC	1	36.0%
5	Single-Family	**Energy Star Single Room Air Conditioner**	303,067	Market Driven	Per air conditioner	Per air conditioner	$30.00	$0.00	$30.00	0	12	469.00	44	0.00	$3.98	$0.0904	0	Room AC	2	36.0%
6	Single-Family	**Energy Star Compliant Top Freezer Refrigerator**	303,067	Market Driven	Per refrigerator	Per refrigerator	$30.00	$0.00	$30.00	0	13	532.00	80	0.00	$3.79	$0.0474	0	Refrigerator	2	65.8%
7	Single-Family	**Energy Star Compliant Bottom Mount Freezer Refrigerator**	303,067	Market Driven	Per refrigerator	Per refrigerator	$30.00	$0.00	$30.00	0	13	579.00	87	0.00	$3.79	$0.0436	0	Refrigerator	2	8.2%

Table A-1
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Single-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
1	Single-Family	**Refrigerator Turn-in**	27.00%	73.0%	100%	84.5%	All homes in Vermont with second refrigerators	33,292	24,303	10,037,178	1,764	1,764	7,287,266	29.86%	0	0	$0.00
2	Single-Family	**Freezer Turn-in**	33.00%	67.0%	100%	84.5%	All homes in Vermont with second freezers	5,122	3,432	1,544,232	241	241	1,083,268	38.10%	0	0	$0.00
3	Single-Family	**Room AC Turn-in without Replacement**	60.20%	39.8%	100%	84.5%	All homes in Vermont with old room air conditioners.	92,193	36,693	1,467,712	1,825	1,825	730,168	20.94%	0	0	$0.00
4	Single-Family	**Room AC Turn-in with ES Replacement**	60.20%	39.8%	100%	84.5%	All homes in Vermont with old room air conditioners.	92,193	36,693	513,699	1,825	1,825	255,559	26.42%	0	0	$0.00
5	Single-Family	**Energy Star Single Room Air Conditioner**	32.00%	68%	100%	84.5%	Homes in service area with one or more window A/C units	92,193	62,691	2,758,414	3,688	3,688	1,622,596	9.38%	0	0	$0.00
6	Single-Family	**Energy Star Compliant Top Freezer Refrigerator**	11.00%	89%	100%	84.5%	Homes in service area	168,611	150,064	12,005,083	8,949	8,949	7,159,471	15.04%	0	0	$0.00
7	Single-Family	**Energy Star Compliant Bottom Mount Freezer Refrigerator**	11.00%	89%	100%	84.5%	Homes in service area	21,025	18,712	1,627,975	1,116	1,116	970,875	15.03%	0	0	$0.00

Table A-1
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Single-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
8	Single-Family	**Energy Star Compliant Side-by-Side Refrigerator**	303,067	Market Driven	Per refrigerator	Per refrigerator	$30.00	$0.00	$30.00	0	13	639.00	95	0.00	$3.79	$0.0399	0	Refrigerator	2	26.0%
9	Single-Family	**Energy Star Compliant Upright Freezer (Manual Defrost)**	303,067	Market Driven	Per freezer	Per freezer	$33.00	$0.00	$33.00	0	11	546.00	55	0.00	$4.62	$0.0839	0	Freezer	2	22.4%
10	Single-Family	**Energy Star Compliant Chest Freezer**	303,067	Market Driven	Per freezer	Per freezer	$33.00	$0.00	$33.00	0	11	520.00	52	0.00	$4.62	$0.0888	0	Freezer	2	19.9%
11	Single-Family	**Energy Star Built-In Dishwasher (Electric)**	303,067	Market Driven	Per dishwasher	Per dishwasher	$50.00	$0.00	$50.00	0	10	413.00	72	0.00	$7.44	$0.1034	860	Dishwasher	2	57.0%
12	Single-Family	**Energy Star Clothes Washers with Electric Water Heater**	303,067	Market Driven	Per clothes washer	Per clothes washer	$300.00	$0.00	$300.00	0	11	529.00	108	0.00	$41.97	$0.3886	7056	Clothes Washer	2	32.0%
13	Single-Family	**Energy Star Clothes Washers with Non-Electric Water Heater**	303,067	Market Driven	Per clothes washer	Per clothes washer	$300.00	$0.00	$300.00	0	11	529.00	29	1.20	$41.97	$1.4473	7056	Clothes Washer	2	61.3%
14	Single-Family	**Energy Star Dehumidifier (40pt)**	303,067	Market Driven	Per Home	Per Home	$0.00	$0.00	$0.00	0	12	1902.00	173	0.00	$0.00	$0.0000	0	Dehumidifier	2	28.5%
15	Single-Family	**Standby-Power**	303,067	Market Driven	Per home	Per home	$30.00	$0.00	$30.00	0	7	440.00	265	0.00	$5.76	$0.0217	0	Appliances	2	100.0%

Table A-1
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Single-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
8	Single-Family	**Energy Star Compliant Side-by-Side Refrigerator**	11.00%	89%	100%	84.5%	Homes in service area	66,456	59,146	5,618,836	3,527	3,527	3,350,905	14.87%	0	0	$0.00
9	Single-Family	**Energy Star Compliant Upright Freezer (Manual Defrost)**	12.00%	88%	100%	84.5%	Homes in service area which contain a freezer	57,365	50,481	2,776,443	3,546	3,546	1,950,394	10.07%	0	0	$0.00
10	Single-Family	**Energy Star Compliant Chest Freezer**	12.00%	88%	100%	84.5%	Homes in service area which contain a freezer	50,962	44,847	2,332,032	3,150	3,150	1,638,204	10.00%	0	0	$0.00
11	Single-Family	**Energy Star Built-In Dishwasher (Electric)**	21.00%	79%	100%	84.5%	Homes in Vermont with a dishwasher	145,972	115,318	8,302,900	8,612	8,612	6,200,900	17.43%	7,406,630	0	$0.00
12	Single-Family	**Energy Star Clothes Washers with Electric Water Heater**	14.00%	86%	100%	84.5%	Homes in service area with an electric water heater and an electric clothes dryer	81,949	70,476	7,611,453	4,917	4,917	5,310,316	20.42%	34,694,063	0	$0.00
13	Single-Family	**Energy Star Clothes Washers with Non-Electric Water Heater**	14.00%	86%	100%	84.5%	Homes in service area with a non-electric water heater and an electric clothes dryer	156,984	135,006	3,915,185	9,419	9,419	2,731,524	5.48%	66,460,814	113,029	$0.00
14	Single-Family	**Energy Star Dehumidifier (40pt)**	2.50%	98%	100%	84.5%	Homes in service area with a dehumidifier	72,986	71,161	12,310,932	4,714	4,714	8,154,677	9.10%	0	0	$0.00
15	Single-Family	**Standby-Power**	15.00%	85%	100%	84.5%	Homes in service area with small appliances	256,092	217,678	57,684,636	16,646	16,646	30,878,246	60.23%	0	0	$0.00

Table A-1
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Single-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
16	Single-Family	**Pool Pump & Motor**	303,067	Market Driven	Per Home	Per Home	$313.00	$0.00	$313.00	0	15	1588.00	635	0.00	$36.51	$0.0575	0	Pool	2	11.6%
17	Single-Family	**Energy Star Compliant Programmable Thermostat**	303,067	Retrofit	Per home	Per home	$50.00	$0.00	$50.00	0	10	778.00	296	0.00	$7.44	$0.0251	0	Central AC	1	4.2%
18	Single-Family	**High Efficiency Central AC**	303,067	Market Driven	Per home	Per home	$379.00	$0.00	$379.00	0	18	-	311.5	0.00	$40.37	$0.1296	0	Central AC	2	4.2%
19	Single-Family	**CFL's: Homes with partial CFL installation**	5,299,323	Market Driven	Per fixture	Per fixture	$5.00	$0.00	$5.00	0	12.08	72.57	25.97	0.00	$0.00	$0.0000	0	Lighting	2	100.0%
20	Single-Family	**CFL's: Homes without CFL installation**	3,944,220	Market Driven	Per fixture	Per fixture	$5.00	$0.00	$5.00	0	10.872	72.57	31.164	0.00	$0.00	$0.0000	0	Lighting	2	100.0%
21	Single-Family	**Water Heater Blanket**	303,067	Retrofit	Per water heater	Per water heater	$35.00	$0.00	$35.00	1	7	-	250	0.00	$6.72	$0.0269	0	Water Heating	1	36.9%
22	Single-Family	**Low Flow Shower Head**	303,067	Retrofit	Per shower head	Per shower head	$15.00	$0.00	$15.00	1	9	-	340	0.00	$2.40	$0.0071	3440.8	Water Heating	1	36.9%

Table A-1
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Single-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
16	Single-Family	**Pool Pump & Motor**	1.00%	99%	100%	84.5%	Homes in service territory with a pool	29,809	29,511	18,739,468	1,570	1,570	9,969,145	39.99%	0	0	$0.00
17	Single-Family	**Energy Star Compliant Programmable Thermostat**	11.00%	89%	100%	84.5%	Homes in service area with central air conditioning and or electric space heat	10,679	9,504	2,813,281	737	737	2,181,083	38.05%	0	0	$0.00
18	Single-Family	**High Efficiency Central AC**	24.00%	76%	100%	84.5%	Homes in service area with central air conditioning and or electric space heat	10,679	8,116	2,528,151	332	332	1,034,916	#VALUE!	0	0	$0.00
19	Single-Family	**CFL's: Homes with partial CFL installation**	19.34%	81%	100%	84.5%	Homes with partial CFL installation (57.3% of homes)	4,477,928	3,611,897	93,800,965	224,860	224,860	58,396,197	35.79%	0	0	$5.00
20	Single-Family	**CFL's: Homes without CFL installation**	0.00%	100%	100%	84.5%	Homes without CFL installation (42.7% of homes)	3,332,866	3,332,866	103,865,433	245,244	245,244	76,427,839	42.94%	0	0	$5.00
21	Single-Family	**Water Heater Blanket**	61.60%	38%	100%	84.5%	Homes in service territory with an electric water heater	94,447	36,267	9,066,872	1,738	1,738	4,344,543	#VALUE!	0	0	$0.00
22	Single-Family	**Low Flow Shower Head**	58.60%	41%	100%	84.5%	Homes in service territory with an electric water heater	94,447	39,101	13,294,302	2,021	2,021	6,871,934	#VALUE!	6,954,397	0	$0.00

Table A-1
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Single-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
23	Single-Family	**Pipe Wrap**	303,067	Retrofit	Per home	Per home	$15.00	$0.00	$15.00	1	13	-	33	0.00	$1.90	$0.0574	0	Water Heating	1	36.9%
24	Single-Family	**Low Flow Faucet Aerator**	303,067	Retrofit	Per Faucet Aerator	Per Faucet Aerator	$6.00	$0.00	$6.00	1	9	-	57.00	0.00	$0.96	$0.02	1496	Water Heating	1	36.9%
25	Single-Family	**Solar Water Heating**	303,067	Retrofit	Per Home	Per Home	$4,500.00	$0.00	$4,500.00	1	20	-	1665.00	0.00	$457.48	$0.27	0	Water Heating	1	36.9%
26	Single-Family	**Efficient Water Heater**	303,067	Market Driven	Per Home	Per home	$90.00	$0.00	$90.00	0	13	-	326.00	0.00	$11.37	$0.03	0	Water Heating	2	36.9%
27	Single-Family	**Efficient Furnace Fan Motor (Fuel Oil)**	303,067	Market Driven	Per Home	Per Home	$200.00	$0.00	$200.00	0	18	-	462	0.00	$21.30	$0.0461	0	Space Heating	2	17.8%
28	Single-Family	**Efficient Furnace Fan Motor (Natural Gas)**	303,067	Market Driven	Per Home	Per Home	$200.00	$0.00	$200.00	0	18	-	462	0.00	$21.30	$0.0461	0	Space Heating	2	3.8%

Table A-1
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Single-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
23	Single-Family	**Pipe Wrap**	60.00%	40%	100%	84.5%	Homes in service territory with an electric water heater	94,447	37,779	1,246,695	1,889	1,889	623,347	#VALUE!	0	0	$0.00
24	Single-Family	**Low Flow Faucet Aerator**	58.60%	41%	100%	84.5%	Homes in service territory with an electric water heater	94,447	39,101	2,228,751	2,021	2,021	1,152,059	#VALUE!	3,023,651	0	$0.00
25	Single-Family	**Solar Water Heating**	0.00%	100%	100%	84.5%	Homes in service territory with an electric water heater	94,447	94,447	157,253,568	944	944	15,725,357	#VALUE!	0	0	$0.00
26	Single-Family	**Efficient Water Heater**	6.00%	94%	100%	84.5%	Homes in service territory with an electric water heater	94,498	88,828	28,957,908	5,379	5,379	17,535,885	#VALUE!	0	0	$0.00
27	Single-Family	**Efficient Furnace Fan Motor (Fuel Oil)**	10.00%	90%	100%	84.5%	Homes in service territory with a fuel-oil space heater using a central forced air furnace	45,456	40,911	18,900,714	1,768	1,768	8,166,975	#VALUE!	0	0	$0.00
28	Single-Family	**Efficient Furnace Fan Motor (Natural Gas)**	10.00%	90%	100%	84.5%	Homes in service territory with a natural gas space heater using a central forced air furnace	9,603	8,643	3,993,109	373	373	1,725,417	#VALUE!	0	0	$0.00

Table A-1
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Single-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
29	Single-Family	**Efficient Furnace Fan Motor (Propane)**	303,067	Market Driven	Per Home	Per Home	$200.00	$0.00	$200.00	0	18	-	462	0.00	$21.30	$0.0461	0	Space Heating	2	5.1%
30	Single-Family	**Energy Star Windows - Electric Heat and no AC**	303,067	Retrofit	Per Home	Per Home	$200.00	$0.00	$200.00	1	35	20000	5000.00	0.00	$17.12	$0.00	0	Space Heating	1	2.00%
31	Single-Family	**Insulation and Weatherization - Electric Heat and no AC**	216,996	Retrofit	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	1	20	20000	6000.00	0.00	$203.33	$0.03	0	Space Heating	1	2.00%
32	New Construction	**Residential New Construction**	2,948	Market Driven	Per Home	Per Home	$997.51	$0.00	$997.51	1	18		1671.00	31.70	$106.25	$0.06	1331.44	Total Home Electric Use	1	100.0%
33	Single-Family **(Low Income)**	**Insulation and Weatherization - Electric Heat and no AC**	86,071	Retrofit	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	1	20	20000	6000.00	0.00	$203.33	$0.03	0	Space Heating	1	2.00%

Table A-1
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Single-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
29	Single-Family	**Efficient Furnace Fan Motor (Propane)**	10.00%	90%	100%	84.5%	Homes in service territory with a propane space heater using a central forced air furnace	13,137	11,824	5,462,572	511	511	2,360,371	#VALUE!	0	0	$0.00
30	Single-Family	**Energy Star Windows - Electric Heat and no AC**	60.00%	40%	100%	84.5%	Homes in service territory with windows with electric heat but no AC	5,122	2,049	10,243,665	102	102	5,121,832	25.00%	0	0	$0.00
31	Single-Family	**Insulation and Weatherization - Electric Heat and no AC**	75.00%	25%	100%	84.5%	Homes in service territory with windows with electric heat but no AC	3,667	917	5,500,849	18	18	1,100,170	30.00%	0	0	$0.00
32	New Construction	**Residential New Construction**	20.00%	80%	100%	100.0%	New Homes	2,948	2,948	49,261,080	n/a	n/a	26,108,372	#DIV/0!	20,802,951	495,293	$0.00
33	Single-Family **(Low Income)**	**Insulation and Weatherization - Electric Heat and no AC**	39.03%	61%	100%	50.0%	Low Income Homes in service territory with windows with electric heat but no AC	861	525	3,148,649	35	35	2,115,797	30.00%	0	0	$0.00

Table A-2
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Single-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
34	Single-Family	**Water Heating - Electric to Natural Gas (1 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$500.00	$0.00	$500.00	0	13	2400	2400	-12.22	$63.17	$0.03	0	Water Heating	2	0.1%
35	Single-Family	**Water Heating - Electric to Natural Gas (2 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$500.00	$0.00	$500.00	0	13	3000	3000	-15.27	$63.17	$0.02	0	Water Heating	2	0.4%
36	Single-Family	**Water Heating - Electric to Natural Gas (3 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$500.00	$0.00	$500.00	0	13	3600	3600	-18.33	$63.17	$0.02	0	Water Heating	2	0.9%
37	Single-Family	**Water Heating - Electric to Natural Gas (4 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$500.00	$0.00	$500.00	0	13	4500	4500	-22.91	$63.17	$0.01	0	Water Heating	2	0.4%
38	Single-Family	**Water Heating - Electric to Natural Gas (5 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$500.00	$0.00	$500.00	0	13	5400	5400	-27.49	$63.17	$0.01	0	Water Heating	2	0.1%
39	Single-Family	**Water Heating - Electric to Fuel Oil (1 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$1,575.00	$0.00	$1,575.00	0	10	2400	2400	-11.26	$234.46	$0.10	0	Water Heating	2	0.7%
40	Single-Family	**Water Heating - Electric to Fuel Oil (2 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$1,575.00	$0.00	$1,575.00	0	10	3000	3000	-14.08	$234.46	$0.08	0	Water Heating	2	3.7%
41	Single-Family	**Water Heating - Electric to Fuel Oil (3 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$1,575.00	$0.00	$1,575.00	0	10	3600	3600	-16.89	$234.46	$0.07	0	Water Heating	2	9.0%

Table A-2
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Single-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
34	Single-Family	**Water Heating - Electric to Natural Gas (1 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	170	170	407,097	10	10	250,521	100.00%	0	-1,276	$0.00
35	Single-Family	**Water Heating - Electric to Natural Gas (2 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	941	941	2,823,594	58	58	1,737,597	100.00%	0	-8,844	$0.00
36	Single-Family	**Water Heating - Electric to Natural Gas (3 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	2,259	2,259	8,132,292	139	139	5,004,487	100.00%	0	-25,481	$0.00
37	Single-Family	**Water Heating - Electric to Natural Gas (4 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	1,045	1,045	4,701,030	64	64	2,892,941	100.00%	0	-14,728	$0.00
38	Single-Family	**Water Heating - Electric to Natural Gas (5 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	310	310	1,676,297	19	19	1,031,567	100.00%	0	-5,251	$0.00
39	Single-Family	**Water Heating - Electric to Fuel Oil (1 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	1,730	1,730	4,152,385	138	138	3,321,908	100.00%	0	-15,585	$0.00
40	Single-Family	**Water Heating - Electric to Fuel Oil (2 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	9,600	9,600	28,800,663	768	768	23,040,531	100.00%	0	-108,137	$0.00
41	Single-Family	**Water Heating - Electric to Fuel Oil (3 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	23,041	23,041	82,949,380	1,843	1,843	66,359,504	100.00%	0	-311,337	$0.00

Table A-2
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Single-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
42	Single-Family	**Water Heating - Electric to Fuel Oil (4 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$1,575.00	$0.00	$1,575.00	0	10	4500	4500	-21.12	$234.46	$0.05	0	Water Heating	2	4.2%
43	Single-Family	**Water Heating - Electric to Fuel Oil (5 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$1,575.00	$0.00	$1,575.00	0	10	5400	5400	-25.34	$234.46	$0.04	0	Water Heating	2	1.2%
44	Single-Family	**Water Heating - Electric to Propane (1 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$800.00	$0.00	$800.00	0	13	2400	2400	-11.82	$101.08	$0.04	0	Water Heating	2	0.2%
45	Single-Family	**Water Heating - Electric to Propane (2 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$800.00	$0.00	$800.00	0	13	3000	3000	-14.77	$101.08	$0.03	0	Water Heating	2	1.0%
46	Single-Family	**Water Heating - Electric to Propane (3 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$800.00	$0.00	$800.00	0	13	3600	3600	-17.73	$101.08	$0.03	0	Water Heating	2	2.5%
47	Single-Family	**Water Heating - Electric to Propane (4 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$800.00	$0.00	$800.00	0	13	4500	4500	-22.16	$101.08	$0.02	0	Water Heating	2	1.1%
48	Single-Family	**Water Heating - Electric to Propane (5 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$800.00	$0.00	$800.00	0	13	5400	5400	-26.59	$101.08	$0.02	0	Water Heating	2	0.3%
49	Single-Family	**Water Heating - Electric to Kerosene (1 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	0	15	2400	2400	-8.19	$233.30	$0.10	0	Water Heating	2	0.2%

Table A-2
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Single-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
42	Single-Family	**Water Heating - Electric to Fuel Oil (4 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	10,656	10,656	47,950,502	852	852	38,360,402	100.00%	0	-180,038	$0.00
43	Single-Family	**Water Heating - Electric to Fuel Oil (5 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	3,166	3,166	17,098,225	253	253	13,678,580	100.00%	0	-64,188	$0.00
44	Single-Family	**Water Heating - Electric to Propane (1 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	475	475	1,139,870	29	29	701,459	100.00%	0	-3,455	$0.00
45	Single-Family	**Water Heating - Electric to Propane (2 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	2,635	2,635	7,906,064	162	162	4,865,270	100.00%	0	-23,953	$0.00
46	Single-Family	**Water Heating - Electric to Propane (3 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	6,325	6,325	22,770,418	389	389	14,012,565	100.00%	0	-69,012	$0.00
47	Single-Family	**Water Heating - Electric to Propane (4 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	2,925	2,925	13,162,883	180	180	8,100,236	100.00%	0	-39,889	$0.00
48	Single-Family	**Water Heating - Electric to Propane (5 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	869	869	4,693,630	53	53	2,888,388	100.00%	0	-14,223	$0.00
49	Single-Family	**Water Heating - Electric to Kerosene (1 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	543	543	1,302,709	29	29	694,778	100.00%	0	-2,371	$0.00

Table A-2
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Single-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
50	Single-Family	**Water Heating - Electric to Kerosene (2 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	0	15	3000	3000	-10.24	$233.30	$0.08	0	Water Heating	2	1.2%
51	Single-Family	**Water Heating - Electric to Kerosene (3 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	0	15	3600	3600	-12.29	$233.30	$0.06	0	Water Heating	2	2.8%
52	Single-Family	**Water Heating - Electric to Kerosene (4 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	0	15	4500	4500	-15.36	$233.30	$0.05	0	Water Heating	2	1.3%
53	Single-Family	**Water Heating - Electric to Kerosene (5 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	0	15	5400	5400	-18.43	$233.30	$0.04	0	Water Heating	2	0.4%
54	Single-Family	**Water Heater - Electric to Kerosene (Stand Alone)**	303,067	Market Driven	Per Home	Per Home	$1,880.00	$0.00	$1,880.00	0	10	3068.25	3068.25	-15.26	$279.86	$0.09	0	Water Heating	2	5.9%
55	Single-Family	**Water Heater - Electric to Wood**	303,067	Market Driven	Per Home	Per Home	$1,320.00	$0.00	$1,320.00	0	10	3068.25	3068.25	-20.75	$196.50	$0.06	0	Water Heating	2	5.2%
56	Single-Family	**Space Heating (Fuel Switching)**	303,067	Retrofit	Per Home	Per Home	$6,500.00	$0.00	$6,500.00	1	20	20000.00	20000	-85.33	$660.81	$0.0330	0	Space Heating	2	2.0%

Table A-2
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Single-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
50	Single-Family	**Water Heating - Electric to Kerosene (2 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	3,012	3,012	9,035,502	161	161	4,818,935	100.00%	0	-16,449	$0.00
51	Single-Family	**Water Heating - Electric to Kerosene (3 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	7,229	7,229	26,023,335	386	386	13,879,112	100.00%	0	-47,382	$0.00
52	Single-Family	**Water Heating - Electric to Kerosene (4 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	3,343	3,343	15,043,295	178	178	8,023,091	100.00%	0	-27,385	$0.00
53	Single-Family	**Water Heating - Electric to Kerosene (5 Bedroom)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	993	993	5,364,149	53	53	2,860,879	100.00%	0	-9,764	$0.00
54	Single-Family	**Water Heater - Electric to Kerosene (Stand Alone)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	15,120	15,120	46,390,863	1,210	1,210	37,112,690	100.00%	0	-184,581	$0.00
55	Single-Family	**Water Heater - Electric to Wood**	0.00%	100%	100%	84.50%	Homes in service territory with an electric water heater	13,230	13,230	40,592,005	1,058	1,058	32,473,604	100.00%	0	-219,613	$0.00
56	Single-Family	**Space Heating (Fuel Switching)**	0.00%	100%	100%	84.50%	Homes in service territory with an electric space heater	5,122	5,122	102,436,646	205	205	40,974,658	100.00%	0	-174,808	$100.00

Table A-2
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Single-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
57	Single-Family	**Dryer (Fuel Switching)**	303,067	Retrofit	Per Home	Per Home	$375.00	$0.00	$375.00	1	14	942.00	942	-3.38	$45.42	$0.0482	0	Space Heating	2	15.2%

Table A-2
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Single-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
57	Single-Family	**Dryer (Fuel Switching)**	0.00%	100%	100%	84.50%	Homes in service territory with natural gas or propane space heating and an electric dryer	38,900	38,900	36,644,098	2,223	2,223	20,939,485	100.00%	0	-75,133	$0.00

APPENDIX A-2

Multi-Family Assumptions

Table A-3
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Multi-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
1	Multi-Family	**Refrigerator Turn-in**	303,067	Buyback	Per refrigerator	Per refrigerator	$50.00	$92.53	$142.53	0	6.5	1383.00	413.00	0.00	$28.94	$0.0701	0	Refrigerator	1	13.0%
2	Multi-Family	**Freezer Turn-in**	303,067	Buyback	Per freezer	Per freezer	$50.00	$92.53	$142.53	0	5.5	1181.00	450.00	0.00	$33.02	$0.0734	0	Freezer	1	2.0%
3	Multi-Family	**Room AC Turn-in without Replacement**	303,067	Buyback	Per Room AC	Per Room AC	$25.00	$117.53	$142.53	0	6	191.00	40.00	0.00	$30.81	$0.7702	0	Room AC	1	36.0%
4	Multi-Family	**Room AC Turn-in with ES Replacement**	303,067	Buyback	Per Room AC	Per Room AC	$35.00	$107.53	$142.53	0	6	53.00	14.00	0.00	$30.81	$2.2006	0	Room AC	1	36.0%
5	Multi-Family	**Energy Star Single Room Air Conditioner**	303,067	Market Driven	Per air conditioner	Per air conditioner	$30.00	$0.00	$30.00	0	12	469.00	44	0.00	$3.98	$0.0904	0	Room AC	2	36.0%
6	Multi-Family	**Energy Star Compliant Top Freezer Refrigerator**	303,067	Market Driven	Per refrigerator	Per refrigerator	$30.00	$0.00	$30.00	0	13	532.00	80	0.00	$3.79	$0.0474	0	Refrigerator	2	65.8%
7	Multi-Family	**Energy Star Compliant Bottom Mount Freezer Refrigerator**	303,067	Market Driven	Per refrigerator	Per refrigerator	$30.00	$0.00	$30.00	0	13	579.00	87	0.00	$3.79	$0.0436	0	Refrigerator	2	8.2%

Table A-3
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Multi-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed)**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
1	Multi-Family	**Refrigerator Turn-in**	27.00%	73.0%	100%	15.5%	All homes in Vermont with second refrigerators	6,107	4,458	1,841,139	324	324	1,336,717	29.86%	0	0	$0.00
2	Multi-Family	**Freezer Turn-in**	33.00%	67.0%	100%	15.5%	All homes in Vermont with second freezers	940	629	283,262	44	44	198,706	38.10%	0	0	$0.00
3	Multi-Family	**Room AC Turn-in without Replacement**	60.20%	39.8%	100%	15.5%	All homes in Vermont with old room air conditioners.	16,911	6,731	269,225	335	335	133,936	20.94%	0	0	$0.00
4	Multi-Family	**Room AC Turn-in with ES Replacement**	60.20%	39.8%	100%	15.5%	All homes in Vermont with room old air conditioners	16,911	6,731	94,229	335	335	46,878	26.42%	0	0	$0.00
5	Multi-Family	**Energy Star Single Room Air Conditioner**	32.00%	68%	100%	15.5%	Homes in service area with one or more window A/C units	16,911	11,500	505,981	676	676	297,636	9.38%	0	0	$0.00
6	Multi-Family	**Energy Star Compliant Top Freezer Refrigerator**	11.00%	89%	100%	15.5%	Homes in service area	30,929	27,526	2,202,116	1,642	1,642	1,313,276	15.04%	0	0	$0.00
7	Multi-Family	**Energy Star Compliant Bottom Mount Freezer Refrigerator**	11.00%	89%	100%	15.5%	Homes in service area	3,857	3,432	298,623	205	205	178,090	15.03%	0	0	$0.00

Table A-3
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Multi-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
8	Multi-Family	**Energy Star Compliant Side-by-Side Refrigerator**	303,067	Market Driven	Per refrigerator	Per refrigerator	$30.00	$0.00	$30.00	0	13	636.00	95	0.00	$3.79	$0.0399	0	Refrigerator	2	26.0%
9	Multi-Family	**Energy Star Compliant Upright Freezer (Manual Defrost)**	303,067	Market Driven	Per freezer	Per freezer	$33.00	$0.00	$33.00	0	11	546.00	55	0.00	$4.62	$0.0839	0	Freezer	2	22.4%
10	Multi-Family	**Energy Star Compliant Chest Freezer**	303,067	Market Driven	Per freezer	Per freezer	$33.00	$0.00	$33.00	0	11	520.00	52	0.00	$4.62	$0.0888	0	Freezer	2	19.9%
11	Multi-Family	**Energy Star Built-In Dishwasher (Electric)**	303,067	Market Driven	Per dishwasher	Per dishwasher	$50.00	$0.00	$50.00	0	10	413.00	72	0.00	$7.44	$0.1034	860	Dishwasher	2	57.0%
12	Multi-Family	**Energy Star Clothes Washers with Electric Water Heater**	303,067	Market Driven	Per clothes washer	Per clothes washer	$300.00	$0.00	$300.00	0	11	529.00	108	0.00	$41.97	$0.3886	7056	Clothes Washer	2	32.0%
13	Multi-Family	**Energy Star Clothes Washers with Non-Electric Water Heater**	303,067	Market Driven	Per clothes washer	Per clothes washer	$300.00	$0.00	$300.00	0	11	529.00	29	1.20	$41.97	$1.4473	7056	Clothes Washer	2	61.3%
14	Multi-Family	**Energy Star Dehumidifier (40pt)**	303,067	Market Driven	Per Home	Per Home	$0.00	$0.00	$0.00	0	12	1902.00	173	0.00	$0.00	$0.0000	0	Dehumidifier	2	28.5%
15	Multi-Family	**Standby-Power**	303,067	Market Driven	Per home	Per home	$30.00	$0.00	$30.00	0	7	440.00	265	0.00	$5.76	$0.0217	0	Appliances	2	100.0%

Table A-3
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Multi-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed)**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
8	Multi-Family	**Energy Star Compliant Side-by-Side Refrigerator**	11.00%	89%	100%	15.5%	Homes in service area	12,190	10,849	1,030,674	647	647	614,663	14.94%	0	0	$0.00
9	Multi-Family	**Energy Star Compliant Upright Freezer (Manual Defrost)**	12.00%	88%	100%	15.5%	Homes in service area which contain a freezer	10,522	9,260	509,288	650	650	357,765	10.07%	0	0	$0.00
10	Multi-Family	**Energy Star Compliant Chest Freezer**	12.00%	88%	100%	15.5%	Homes in service area which contain a freezer	9,348	8,226	427,769	578	578	300,499	10.00%	0	0	$0.00
11	Multi-Family	**Energy Star Built-In Dishwasher (Electric)**	21.00%	79%	100%	15.5%	Homes in Vermont with a dishwasher	26,776	21,153	1,523,017	1,580	1,580	1,137,443	17.43%	1,358,613	0	$0.00
12	Multi-Family	**Energy Star Clothes Washers with Electric Water Heater**	14.00%	86%	100%	15.5%	Homes in service area with an electric water heater and an electric clothes dryer	15,032	12,928	1,396,184	902	902	974,082	20.42%	6,364,000	0	$0.00
13	Multi-Family	**Energy Star Clothes Washers with Non-Electric Water Heater**	14.00%	86%	100%	15.5%	Homes in service area with a non-electric water heater and an electric clothes dryer	28,796	24,764	718,170	1,728	1,728	501,049	5.48%	12,191,037	20,733	$0.00
14	Multi-Family	**Energy Star Dehumidifier (40pt)**	2.50%	98%	100%	15.5%	Homes in service area with a dehumidifier	13,388	13,053	2,258,218	865	865	1,495,828	9.10%	0	0	$0.00
15	Multi-Family	**Standby-Power**	15.00%	85%	100%	15.5%	Homes in service area with small appliances	46,975	39,929	10,581,205	3,053	3,053	5,664,057	60.23%	0	0	$0.00

Table A-3
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Multi-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
16	Multi-Family	**Pool Pump & Motor**	303,067	Market Driven	Per Home	Per Home	$313.00	$0.00	$313.00	0	15	1588.00	635	0.00	$36.51	$0.0575	0	Pool	2	4.4%
17	Multi-Family	**Energy Star Compliant Programmable Thermostat**	303,067	Retrofit	Per home	Per home	$50.00	$0.00	$50.00	0	10	778.00	296	0.00	$7.44	$0.0251	0	Central AC	1	4.2%
18	Multi-Family	**High Efficiency Central AC**	303,067	Market Driven	Per home	Per home	$379.00	$0.00	$379.00	0	18	-	311.5	0.00	$40.37	$0.1296	0	Central AC	2	4.2%
19	Multi-Family	**CFL's: Homes with partial CFL installation**	5,299,323	Market Driven	Per fixture	Per fixture	$5.00	$0.00	$5.00	0	12.08	72.57	25.97	0.00	$0.00	$0.0000	0	Lighting	2	100.0%
20	Multi-Family	**CFL's: Homes without CFL installation**	3,944,220	Market Driven	Per fixture	Per fixture	$5.00	$0.00	$5.00	0	10.872	72.57	31.164	0.00	$0.00	$0.0000	0	Lighting	2	100.0%
21	Multi-Family	**Water Heater Blanket**	303,067	Retrofit	Per water heater	Per water heater	$35.00	$0.00	$35.00	1	7	-	250	0.00	$6.72	$0.0269	0	Water Heating	1	41.6%
22	Multi-Family	**Low Flow Shower Head**	303,067	Retrofit	Per shower head	Per shower head	$15.00	$0.00	$15.00	1	9	-	340	0.00	$2.40	$0.0071	3440.8	Water Heating	1	41.6%

Table A-3
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Multi-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed)**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
16	Multi-Family	**Pool Pump & Motor**	1.00%	99%	100%	15.5%	Homes in service territory with a pool	2,067	2,046	1,299,367	109	109	691,246	39.99%	0	0	$0.00
17	Multi-Family	**Energy Star Compliant Programmable Thermostat**	11.00%	89%	100%	15.5%	Homes in service area with central air conditioning and or electric space heat	1,959	1,743	516,046	135	135	400,080	38.05%	0	0	$0.00
18	Multi-Family	**High Efficiency Central AC**	24.00%	76%	100%	15.5%	Homes in service area with central air conditioning and or electric space heat	1,959	1,489	463,744	61	61	189,837	#VALUE!	0	0	$0.00
19	Multi-Family	**CFL's: Homes with partial CFL installation**	19.34%	81%	100%	15.5%	Homes with partial CFL installation (57.3% of homes)	821,395	662,537	17,206,094	41,247	41,247	10,711,728	35.79%	0	0	$5.00
20	Multi-Family	**CFL's: Homes without CFL installation**	0.00%	100%	100%	15.5%	Homes without CFL installation (42.7% of homes)	611,354	611,354	19,052,239	44,986	44,986	14,019,308	42.94%	0	0	$5.00
21	Multi-Family	**Water Heater Blanket**	61.60%	38%	100%	15.5%	Homes in service territory with an electric water heater	19,542	7,504	1,876,009	360	360	898,921	#VALUE!	0	0	$0.00
22	Multi-Family	**Low Flow Shower Head**	58.60%	41%	100%	15.5%	Homes in service territory with an electric water heater	19,542	8,090	2,750,698	418	418	1,421,858	#VALUE!	1,438,921	0	$0.00

Table A-3
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Multi-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
23	Multi-Family	**Pipe Wrap**	303,067	Retrofit	Per home	Per home	$15.00	$0.00	$15.00	1	13	-	33	0.00	$1.90	$0.0574	0	Water Heating	1	41.6%
24	Multi-Family	**Low Flow Faucet Aerator**	303,067	Retrofit	Per Faucet Aerator	Per Faucet Aerator	$6.00	$0.00	$6.00	1	9	-	57.00	0.00	$0.96	$0.02	1496	Water Heating	1	41.6%
25	Multi-Family	**Solar Water Heating**	303,067	Retrofit	Per Home	Per Home	$4,500.00	$0.00	$4,500.00	1	20	-	1665.00	0.00	$457.48	$0.27	0	Water Heating	1	41.6%
26	Multi-Family	**Efficient Water Heater**	303,067	Market Driven	Per Home	Per home	$90.00	$0.00	$90.00	0	13	-	326.00	0.00	$11.37	$0.03	0	Water Heating	2	41.6%
27	Multi-Family	**Efficient Furnace Fan Motor (Fuel Oil)**	303,067	Market Driven	Per Home	Per Home	$200.00	$0.00	$200.00	0	18	-	462	0.00	$21.30	$0.0461	0	Space Heating	2	11.1%
28	Multi-Family	**Efficient Furnace Fan Motor (Natural Gas)**	303,067	Market Driven	Per Home	Per Home	$200.00	$0.00	$200.00	0	18	-	462	0.00	$21.30	$0.0461	0	Space Heating	2	10.0%
29	Multi-Family	**Efficient Furnace Fan Motor (Propane)**	303,067	Market Driven	Per Home	Per Home	$200.00	$0.00	$200.00	0	18	-	462	0.00	$21.30	$0.0461	0	Space Heating	2	4.4%

Table A-3
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Multi-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed)**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
23	Multi-Family	**Pipe Wrap**	60.00%	40%	100%	15.5%	Homes in service territory with an electric water heater	19,542	7,817	257,951	391	391	128,976	#VALUE!	0	0	$0.00
24	Multi-Family	**Low Flow Faucet Aerator**	58.60%	41%	100%	15.5%	Homes in service territory with an electric water heater	19,542	8,090	461,146	418	418	238,370	#VALUE!	625,618	0	$0.00
25	Multi-Family	**Solar Water Heating**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	19,542	19,542	32,537,031	195	195	3,253,703	#VALUE!	0	0	$0.00
26	Multi-Family	**Efficient Water Heater**	6.00%	94%	100%	15.5%	Homes in service territory with an electric water heater	19,542	18,369	5,988,377	1,112	1,112	3,626,349	#VALUE!	0	0	$0.00
27	Multi-Family	**Efficient Furnace Fan Motor (Fuel Oil)**	10.00%	90%	100%	15.5%	Homes in service territory with a fuel-oil space heater using a central forced air furnace	5,219	4,697	2,170,046	203	203	937,674	#VALUE!	0	0	$0.00
28	Multi-Family	**Efficient Furnace Fan Motor (Natural Gas)**	10.00%	90%	100%	15.5%	Homes in service territory with a natural gas space heater using a central forced air furnace	4,698	4,228	1,953,237	183	183	843,991	#VALUE!	0	0	$0.00
29	Multi-Family	**Efficient Furnace Fan Motor (Propane)**	10.00%	90%	100%	15.5%	Homes in service territory with a propane space heater using a central forced air furnace	2,086	1,877	867,237	81	81	374,732	#VALUE!	0	0	$0.00

Table A-3
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Multi-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
30	Multi-Family	**Energy Star Windows - Electric Heat and no AC**	303,067	Retrofit	Per Home	Per Home	$200.00	$0.00	$200.00	1	35	10000	2500.00	0.00	$17.12	$0.01	0	Space Heating	1	2.00%
31	Multi-Family	**Insulation and Weatherization - Electric Heat and no AC**	216,996	Retrofit	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	1	20	10000	3000.00	0.00	$203.33	$0.07	0	Space Heating	1	2.00%
33	Multi-Family **(Low Income)**	**Insulation and Weatherization - Electric Heat and no AC**	86,071	Retrofit	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	1	20	10000	3000.00	0.00	$203.33	$0.07		Space Heating	1	2.00%

Table A-3
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector (Multi-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed)**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
30	Multi-Family	**Energy Star Windows - Electric Heat and no AC**	60.00%	40%	100%	15.5%	Homes in service territory with windows with electric heat but no AC	940	376	939,508	19	19	469,754	25.00%	0	0	$0.00
31	Multi-Family	**Insulation and Weatherization - Electric Heat and no AC**	75.00%	25%	100%	15.5%	Homes in service territory with windows with electric heat but no AC	673	168	504,516	3	3	100,903	30.00%	0	0	$0.00
33	Multi-Family **(Low Income)**	**Insulation and Weatherization - Electric Heat and no AC**	39.03%	61%	100%	50.0%	Low Income homes in service territory with windows with electric heat but no AC	861	525	1,574,325	35	35	1,057,899	30.00%	0	0	$0.00

Table A-4
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Multi-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
34	Multi-Family	**Water Heating - Electric to Natural Gas (1 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$500.00	$0.00	$500.00	0	13	2400	2400	-12.22	$63.17	$0.03	0	Water Heating	2	0.5%
35	Multi-Family	**Water Heating - Electric to Natural Gas (2 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$500.00	$0.00	$500.00	0	13	3000	3000	-15.27	$63.17	$0.02	0	Water Heating	2	0.8%
36	Multi-Family	**Water Heating - Electric to Natural Gas (3 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$500.00	$0.00	$500.00	0	13	3600	3600	-18.33	$63.17	$0.02	0	Water Heating	2	0.6%
37	Multi-Family	**Water Heating - Electric to Natural Gas (4 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$500.00	$0.00	$500.00	0	13	4500	4500	-22.91	$63.17	$0.01	0	Water Heating	2	0.1%
38	Multi-Family	**Water Heating - Electric to Natural Gas (5 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$500.00	$0.00	$500.00	0	13	5400	5400	-27.49	$63.17	$0.01	0	Water Heating	2	0.0%
39	Multi-Family	**Water Heating - Electric to Fuel Oil (1 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$1,575.00	$0.00	$1,575.00	0	10	2400	2400	-11.26	$234.46	$0.10	0	Water Heating	2	4.8%
40	Multi-Family	**Water Heating - Electric to Fuel Oil (2 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$1,575.00	$0.00	$1,575.00	0	10	3000	3000	-14.08	$234.46	$0.08	0	Water Heating	2	8.4%
41	Multi-Family	**Water Heating - Electric to Fuel Oil (3 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$1,575.00	$0.00	$1,575.00	0	10	3600	3600	-16.89	$234.46	$0.07	0	Water Heating	2	6.3%

Table A-4
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Multi-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed)**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
34	Multi-Family	**Water Heating - Electric to Natural Gas (1 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	222	222	533,021	14	14	328,013	100.00%	0	-1,670	$0.00
35	Multi-Family	**Water Heating - Electric to Natural Gas (2 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	389	389	1,165,764	24	24	717,393	100.00%	0	-3,652	$0.00
36	Multi-Family	**Water Heating - Electric to Natural Gas (3 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	289	289	1,039,426	18	18	639,647	100.00%	0	-3,257	$0.00
37	Multi-Family	**Water Heating - Electric to Natural Gas (4 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	67	67	299,868	4	4	184,534	100.00%	0	-939	$0.00
38	Multi-Family	**Water Heating - Electric to Natural Gas (5 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	11	11	60,150	1	1	37,015	100.00%	0	-188	$0.00
39	Multi-Family	**Water Heating - Electric to Fuel Oil (1 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	2,265	2,265	5,436,815	181	181	4,349,452	100.00%	0	-20,406	$0.00
40	Multi-Family	**Water Heating - Electric to Fuel Oil (2 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	3,964	3,964	11,890,790	317	317	9,512,632	100.00%	0	-44,646	$0.00
41	Multi-Family	**Water Heating - Electric to Fuel Oil (3 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	2,945	2,945	10,602,147	236	236	8,481,718	100.00%	0	-39,793	$0.00

Table A-4
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Multi-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
42	Multi-Family	**Water Heating - Electric to Fuel Oil (4 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$1,575.00	$0.00	$1,575.00	0	10	4500	4500	-21.12	$234.46	$0.05	0	Water Heating	2	1.4%
43	Multi-Family	**Water Heating - Electric to Fuel Oil (5 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$1,575.00	$0.00	$1,575.00	0	10	5400	5400	-25.34	$234.46	$0.04	0	Water Heating	2	0.2%
44	Multi-Family	**Water Heating - Electric to Propane (1 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$800.00	$0.00	$800.00	0	13	2400	2400	-11.82	$101.08	$0.04	0	Water Heating	2	1.3%
45	Multi-Family	**Water Heating - Electric to Propane (2 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$800.00	$0.00	$800.00	0	13	3000	3000	-14.77	$101.08	$0.03	0	Water Heating	2	2.3%
46	Multi-Family	**Water Heating - Electric to Propane (3 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$800.00	$0.00	$800.00	0	13	3600	3600	-17.73	$101.08	$0.03	0	Water Heating	2	1.7%
47	Multi-Family	**Water Heating - Electric to Propane (4 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$800.00	$0.00	$800.00	0	13	4500	4500	-22.16	$101.08	$0.02	0	Water Heating	2	0.4%
48	Multi-Family	**Water Heating - Electric to Propane (5 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$800.00	$0.00	$800.00	0	13	5400	5400	-26.59	$101.08	$0.02	0	Water Heating	2	0.1%
49	Multi-Family	**Water Heating - Electric to Kerosene (1 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	0	15	2400	2400	-8.19	$233.30	$0.10	0	Water Heating	2	1.5%

Table A-4
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Multi-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed)**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
42	Multi-Family	**Water Heating - Electric to Fuel Oil (4 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	680	680	3,058,657	54	54	2,446,925	100.00%	0	-11,484	$0.00
43	Multi-Family	**Water Heating - Electric to Fuel Oil (5 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	114	114	613,525	9	9	490,820	100.00%	0	-2,303	$0.00
44	Multi-Family	**Water Heating - Electric to Propane (1 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	622	622	1,492,459	38	38	918,436	100.00%	0	-4,523	$0.00
45	Multi-Family	**Water Heating - Electric to Propane (2 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	1,088	1,088	3,264,138	67	67	2,008,701	100.00%	0	-9,890	$0.00
46	Multi-Family	**Water Heating - Electric to Propane (3 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	808	808	2,910,393	50	50	1,791,011	100.00%	0	-8,821	$0.00
47	Multi-Family	**Water Heating - Electric to Propane (4 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	187	187	839,631	11	11	516,696	100.00%	0	-2,544	$0.00
48	Multi-Family	**Water Heating - Electric to Propane (5 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	31	31	168,419	2	2	103,642	100.00%	0	-510	$0.00
49	Multi-Family	**Water Heating - Electric to Kerosene (1 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	711	711	1,705,667	38	38	909,689	100.00%	0	-3,104	$0.00

Table A-4
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Multi-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
50	Multi-Family	**Water Heating - Electric to Kerosene (2 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	0	15	3000	3000	-10.24	$233.30	$0.08	0	Water Heating	2	2.6%
51	Multi-Family	**Water Heating - Electric to Kerosene (3 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	0	15	3600	3600	-12.29	$233.30	$0.06	0	Water Heating	2	2.0%
52	Multi-Family	**Water Heating - Electric to Kerosene (4 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	0	15	4500	4500	-15.36	$233.30	$0.05	0	Water Heating	2	0.5%
53	Multi-Family	**Water Heating - Electric to Kerosene (5 Bedroom)**	303,067	Market Driven	Per Home	Per Home	$2,000.00	$0.00	$2,000.00	0	15	5400	5400	-18.43	$233.30	$0.04	0	Water Heating	2	0.1%
54	Multi-Family	**Water Heater-Electric to Kerosene (Stand Alone)**	303,067	Market Driven	Per Home	Per Home	$1,880.00	$0.00	$1,880.00	0	10	2524.22	2524.22	-12.87	$279.86	$0.11	0	Water Heating	2	6.7%
55	Multi-Family	**Water Heater - Electric to Wood**	303,067	Market Driven	Per Home	Per Home	$1,320.00	$0.00	$1,320.00	0	10	2524.22	2524.22	-17.48	$196.50	$0.08	0	Water Heating	2	5.8%
56	Multi-Family	**Space Heating (Fuel Switching)**	303,067	Retrofit	Per Home	Per Home	$6,500.00	$0.00	$6,500.00	1	20	10000.00	10000	-42.66	$660.81	$0.0661	0	Space Heating	2	2.0%

Table A-4
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Multi-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed)**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
50	Multi-Family	**Water Heating - Electric to Kerosene (2 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	1,243	1,243	3,730,444	66	66	1,989,570	100.00%	0	-6,791	$0.00
51	Multi-Family	**Water Heating - Electric to Kerosene (3 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	924	924	3,326,164	49	49	1,773,954	100.00%	0	-6,056	$0.00
52	Multi-Family	**Water Heating - Electric to Kerosene (4 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	213	213	959,579	11	11	511,775	100.00%	0	-1,747	$0.00
53	Multi-Family	**Water Heating - Electric to Kerosene (5 Bedroom)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	36	36	192,479	2	2	102,655	100.00%	0	-350	$0.00
54	Multi-Family	**Water Heater-Electric to Kerosene (Stand Alone)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	3,127	3,127	7,892,432	250	250	6,313,946	100.00%	0	-32,192	$0.00
55	Multi-Family	**Water Heater - Electric to Wood**	0.00%	100%	100%	15.5%	Homes in service territory with an electric water heater	2,736	2,736	6,905,878	219	219	5,524,703	100.00%	0	-38,258	$0.00
56	Multi-Family	**Space Heating (Fuel Switching)**	0.00%	100%	100%	15.5%	Homes in service territory with an electric space heater	940	940	9,395,077	38	38	3,758,031	100.00%	0	-16,033	$100.00

Table A-4
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Multi-Family)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.00	16	17	18	19	20	21
Measure #	**Single- or Multi-family**	**Measure Description**	**Total Number of Residential Households (SF and MF Homes)**	**Market Driven or Retrofit**	**Savings Units**	**Cost Units**	**Equipment Cost**	**Labor Cost**	**Total Installed Cost**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life (yrs)**	**Base Case Equipment End Use Intensity (Annual kWh per appliance)**	**Annual kWh Savings Per Unit Installed**	**Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per kWh Saved**	**Annual Gallons of water saved**	**Electric End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**End Use Saturation (Percentage of total homes that contain the electric end use or the measure)**
57	Multi-Family	**Dryer (Fuel Switching)**	303,067	Retrofit	Per Home	Per Home	$375.00	$0.00	$375.00	1	14	942.00	942	-3.38	$45.42	$0.0482	0	Space Heating	2	18.9%

Table A-4
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching (Multi-Family)

1	2	3	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Measure #	**Single- or Multi-family**	**Measure Description**	**Base Case Factor (Fraction of the end use energy that is already energy efficient)**	**Remaining Factor (In how many homes can this be installed)**	**Convertibility Factor**	**Single-/Multi-Family Fraction**	**Type of home where applicable**	**Number of applicable homes in 2005 (before applying remaining factor and convertibility factor)[1]**	**Total Homes Remaining without measure (after applying remaining factor and convertibility factor)**	**Technical Potential-Total annual kWh savings potential in 2005 if 100% penetration attained "overnight"**	**Maximum Achievable Program Participants per year (80% penetration limit, and before application of convertibility factor)[2]**	**Maximum Achievable Program Participants per year (80% penetration limit, and after application of convertibility factor)[2]**	**Maximum Achievable kWh Savings by 2015 (80% penetration limit, and after application of convertibility factor)[2]**	**Savings Factor (Percentage reduction in electric energy consumption)**	**Total annual gallons of water savings potential in 2005**	**Annual Maximum Achievable Therm Savings Potential in 2015**	**On-going annual O&M cost (+) or savings (-)**
57	Multi-Family	**Dryer (Fuel Switching)**	0.00%	100%	100%	15.5%	Homes in service territory with natural gas or propane space heating and an electric dryer	8,874	8,874	8,358,979	507	507	4,776,559	100.00%	0	-17,139	$0.00

APPENDIX A-3

Residential Data Sources

Table A-5
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector

1	2	3	4	5	6	7
	Source for Incremental Cost	Source for Useful Life	Source for Base Case Equipment End Use Intensity	Source for MMBTU, Therm, kWh and Water savings	Source for Saturation of End Use	Source for Saturation of Energy Efficient Measure
Refrigerator Turn-in	N/A	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov). Divided useful life in half to reflect that participants are turning in old appliances and not new ones.	Gross savings kWh per unit. Impact, Process, and Market Study of the Connecticut Appliance Retirement Program: Overall Report. December 23, 2005. Nexus Market Research, Inc. & RLW Analytics, Inc. Page 3, Table ES.4	Net Savings kWh per unit after applying realization rate. Impact, Process, and Market Study of the Connecticut Appliance Retirement Program: Overall Report. December 23, 2005. Nexus Market Research, Inc. & RLW Analytics, Inc. Page 3, Table ES.4	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs - KEMA, Inc. December 2005. Page 4-5	Sum of 19% and 8%, 2nd refrigerators that are 0-4 years old. Page 4-8 Table 4-3 in the Phase 2 Evaluation of the Efficiency VT Residential Programs.
Freezer Turn-in	N/A	Savings Calculator-Residential Freezers (.xls), found on the EnergyStar website (www.energystar.gov). Divided useful life in half to reflect that participants are turning in old appliances and not new ones.	Gross savings kWh per unit. Impact, Process, and Market Study of the Connecticut Appliance Retirement Program: Overall Report. December 23, 2005. Nexus Market Research, Inc. & RLW Analytics, Inc. Page 3, Table ES.4	Net Savings kWh per unit after applying realization rate. Impact, Process, and Market Study of the Connecticut Appliance Retirement Program: Overall Report. December 23, 2005. Nexus Market Research, Inc. & RLW Analytics, Inc. Page 3, Table ES.4	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs - KEMA, Inc. December 2005. Page 4-5	2nd freezers that are 0-4 years old. Page 4-8 Table 4-4 in the Phase 2 Evaluation of the Efficiency VT Residential Programs.
Room AC Turn-in without Replacement	N/A	Savings Calculator-Room Air Conditioners (.xls), found on the EnergyStar website (www.energystar.gov). Divided useful life in half to reflect that participants are turning in old appliances and not new ones.	Gross savings kWh per unit. Impact, Process, and Market Study of the Connecticut Appliance Retirement Program: Overall Report. December 23, 2005. Nexus Market Research, Inc. & RLW Analytics, Inc. Page 3, Table ES.4	Net Savings kWh per unit after applying realization rate. Impact, Process, and Market Study of the Connecticut Appliance Retirement Program: Overall Report. December 23, 2005. Nexus Market Research, Inc. & RLW Analytics, Inc. Page 3, Table ES.4	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs. KEMA, Inc. December 2005. Page 3-12	GDS Calculation based on Vermont Residential Appliance Saturation Study. Room Air Conditioners that are 0-4 years old.
Room AC Turn-in with ES Replacement	N/A	Savings Calculator-Room Air Conditioners (.xls), found on the EnergyStar website (www.energystar.gov). Divided useful life in half to reflect that participants are turning in old appliances and not new ones.	Gross savings kWh per unit. Impact, Process, and Market Study of the Connecticut Appliance Retirement Program: Overall Report. December 23, 2005. Nexus Market Research, Inc. & RLW Analytics, Inc. Page 3, Table ES.4	Net Savings kWh per unit after applying realization rate. Impact, Process, and Market Study of the Connecticut Appliance Retirement Program: Overall Report. December 23, 2005. Nexus Market Research, Inc. & RLW Analytics, Inc. Page 3, Table ES.4	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs. KEMA, Inc. December 2005. Page 3-12	GDS Calculation based on Vermont Residential Appliance Saturation Study. Room Air Conditioners that are 0-4 years old.
Energy Star Single Room Air Conditioner	Savings Calculator-Room Air Conditioners (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Room Air Conditioners (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Room Air Conditioners (.xls), found on the EnergyStar website (www.energystar.gov). Burlington, VT specific.	Savings Calculator-Room Air Conditioners (.xls), found on the EnergyStar website (www.energystar.gov). Burlington, VT specific.	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs. KEMA, Inc. December 2005. Page 3-12	Email from Bill NcNary of D&R Intl. Feb. 22, 2006
Energy Star Compliant Top Freezer Refrigerator	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)	GDS Calculation based on Vermont Residential Appliance Saturation Study.	Email from Bill NcNary of D&R Intl. Feb. 22, 2006
Energy Star Compliant Bottom Mount Freezer Refrigerator	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)	GDS Calculation based on Vermont Residential Appliance Saturation Study.	Email from Bill NcNary of D&R Intl. Feb. 22, 2006
Energy Star Compliant Side-by-Side Refrigerator	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)	GDS Calculation based on Vermont Residential Appliance Saturation Study.	Email from Bill NcNary of D&R Intl. Feb. 22, 2006
Energy Star Compliant Upright Freezer (Manual Defrost)	Savings Calculator-Residential Freezers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Freezers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Freezers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Freezers (.xls), found on the EnergyStar website (www.energystar.gov)	GDS Calculation based on Vermont Residential Appliance Saturation Study.	Assumes an average market 20% market share of Energy Star Freezers for the last 10 years. Based on shipping reports from AHAM for 2002 and NGRID Report June 28, 2000 Energy Star Market Update, page 5 - average 1999 Energy Star Shipments = 21%.
Energy Star Compliant Chest Freezer	Savings Calculator-Residential Freezers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Freezers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Freezers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Freezers (.xls), found on the EnergyStar website (www.energystar.gov)	GDS Calculation based on Vermont Residential Appliance Saturation Study.	Assumes an average market 20% market share of Energy Star Freezers for the last 10 years. Based on shipping reports from AHAM for 2002 and NGRID Report June 28, 2000 Energy Star Market Update, page 5 - average 1999 Energy Star Shipments = 21%.
Energy Star Built-In Dishwasher (Electric)	Savings Calculator-Residential Dishwashers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Dishwashers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Dishwashers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Residential Dishwashers (.xls), found on the EnergyStar website (www.energystar.gov)	Final Report: Phase 2 Evaluation of the Efficiency VT Residential Programs. KEMA, Inc. December 2005. Page 3-23	Email from Bill NcNary of D&R Intl. Feb. 22, 2006
Energy Star Clothes Washers with Electric Water Heater	Savings Calculator-Clothes Washers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Clothes Washers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Clothes Washers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Clothes Washers (.xls), found on the EnergyStar website (www.energystar.gov) & Efficiency Vermont Residential Master Technical Reference Manual. 2005-37. Page 92.	GDS Calculation based on Vermont Residential Appliance Saturation Study.	Email from Bill NcNary of D&R Intl. Feb. 22, 2006

Table A-5
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector

1	2	3	4	5	6	7
	Source for Incremental Cost	Source for Useful Life	Source for Base Case Equipment End Use Intensity	Source for MMBTU, Therm, kWh and Water savings	Source for Saturation of End Use	Source for Saturation of Energy Efficient Measure
Energy Star Clothes Washers with Non-Electric Water Heater	Savings Calculator-Clothes Washers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Clothes Washers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Clothes Washers (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Clothes Washers (.xls), found on the EnergyStar website (www.energystar.gov)	GDS Calculation based on Vermont Residential Appliance Saturation Study.	Email from Bill NcNary of D&R Intl. Feb. 22, 2006
Energy Star Dehumidifier (40pt)	Savings Calculator-Dehumidifier (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Dehumidifier (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Dehumidifier (.xls), found on the EnergyStar website (www.energystar.gov)	Savings Calculator-Dehumidifier (.xls), found on the EnergyStar website (www.energystar.gov)	GDS Calculation based on Vermont Residential Appliance Saturation Study.	Illinois Residential Market Analysis. MEEA. May 12, 2003. Pg 20
Standby-Power	Emerging Technologies & Practices: 2004, ACEEE. Page 41	Emerging Technologies & Practices: 2004, ACEEE. Page 41	Emerging Technologies & Practices: 2004, ACEEE. Page 41	Emerging Technologies & Practices: 2004, ACEEE. Page 41	All homes have small appliances	Email from Jennifer T. Amann (ACEEE). March 09, 2006.
Pool Pump and Motor	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	GDS Calculation based on Vermont Residential Appliance Saturation Study.	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
Energy Star Compliant Programmable Thermostat	Dick Spellman's in store visit to Home Depot. 2005	Dick Spellman's phone call with Honeywell. 2001	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	"2002 DSM Performance Measurement Report" National Grid for the MA Department of Telecommunications and Energy. July 2003	GDS Calculation based on Vermont Residential Appliance Saturation Study. Includes customers that have electric heat, central AC or both.	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
High Efficiency Central AC	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 492	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 492	-	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 491	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs. KEMA, Inc. December 2005. Page 3-11	GDS Calculation based on Vermont Residential Appliance Saturation Study.
CFL's (partial installation already present)	Jeffrey Huber's phone call with Home Depot - Williston, VT (#4501). Feb 15, 2006. Brought down calculated incremental cost of all bulbs by $.69 based on multipack impacts.	Useful life of 7500 hours were taken from manufacturer data on product package and used to calculate useful life in years. Hour use of 3.4 hours/day came from the Impact Evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs on Oct. 1, 2004.	GDS Calculation based on Maine Residential Lighting Program data. 2003-2005	GDS Calculation based on Maine Residential Lighting Program data. 2003-2005	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs. KEMA, Inc. December 2005. Page 121	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs. KEMA, Inc. December 2005. Page 121
CFL's	Jeffrey Huber's phone call with Home Depot - Williston, VT (#4501). Feb 15, 2006. Brought down calculated incremental cost of all bulbs by $.69 based on multipack impacts.	Useful life of 7500 hours were taken from manufacturer data on product package and used to calculate useful life in years. Hour use of 3.4 hours/day came from the Impact Evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs on Oct. 1, 2004.	GDS Calculation based on Maine Residential Lighting Program data. 2003-2005	GDS Calculation based on Maine Residential Lighting Program data. 2003-2005	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs. KEMA, Inc. December 2005. Page 121	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs. KEMA, Inc. December 2005. Page 121
Water Heater Blanket	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 368.	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 368.	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 367.	GDS Calculation based on Vermont Residential Appliance Saturation Study.	GDS Calculation based on Vermont Residential Appliance Saturation Study.
Low Flow Shower Head	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 380.	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 380.	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 379.	GDS Calculation based on Vermont Residential Appliance Saturation Study.	GDS Calculation based on Vermont Residential Appliance Saturation Study.
Pipe Wrap	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 372.	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 372.	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 371.	GDS Calculation based on Vermont Residential Appliance Saturation Study.	GDS Assumption based on saturation of similar measures.

Table A-5
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector

1	2	3	4	5	6	7
	Source for Incremental Cost	Source for Useful Life	Source for Base Case Equipment End Use Intensity	Source for MMBTU, Therm, kWh and Water savings	Source for Saturation of End Use	Source for Saturation of Energy Efficient Measure
Low Flow Faucet Aerator	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 383.	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 383.	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 382.	GDS Calculation based on Vermont Residential Appliance Saturation Study.	GDS Assumption extended from Low-Flow Showerhead Calculation based on Vermont Residential Appliance Saturation Study.
Solar Water Heating	Incremental Cost based on estimation given in "Supplemental Findings on GDS Draft Potential Study - Residential Sector" by Jim Plunkett.	Table 6-6 in "Consumer Guide to Home Energy Savings" 8th ed. ACEEE. 2003.	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
Efficient Water Heater	Table 6-6 in "Consumer Guide to Home Energy Savings" 8th ed. ACEEE. 2003.	Table 6-6 in "Consumer Guide to Home Energy Savings" 8th ed. ACEEE. 2003.	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Energy calculations based on DOE Energy Efficiency and Renewable Energy assumptions of electric water heater energy costs. Found on DOE website (www.eere.energy.gov) on Feb. 27, 2006.	GDS Calculation based on Vermont Residential Appliance Saturation Study.	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
Efficient Furnace Fan Motor (Fuel Oil)	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 552	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 552	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 550	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 552	GDS Calculation based on Vermont Residential Appliance Saturation Study. Based on # of homes with Fuel Oil space heating & central forced air furnace.	GDS Estimate
Efficient Furnace Fan Motor (Natural Gas)	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 552	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 552	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 550	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 552	GDS Calculation based on Vermont Residential Appliance Saturation Study. Based on # of homes with Nat. Gas space heating & central forced air furnace.	GDS Estimate
Efficient Furnace Fan Motor (Propane)	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 552	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 552	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 550	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 552	GDS Calculation based on Vermont Residential Appliance Saturation Study. Based on # of homes with propane space heating & central forced air furnace.	GDS Estimate
Energy Star Windows (SF & MF)	"Baseline Characterization of the Residential Market for Energy Star Windows in the Northeast." The study was prepared for NEEP by Quantec LLC and Nexus Market Research in October of 2002. Table V.10 on page V-11.	ACEEE report, "Selecting Targets for Market Transformation Programs, A National Analysis", August 1998, page 60. This data source was supplemented by phone interviews conducted of window manufacturers by GDS in February 2004.	GDS calculation based on figures derived from "Supplemental Findings on GDS Draft Potential Study-Residential Sector" comments by John Plunkett	GDS calculation based on figures derived from "Supplemental Findings on GDS Draft Potential Study-Residential Sector" comments by John Plunkett	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs. KEMA, Inc. December 2005. Page 3-33	GDS Calculation based on Vermont Residential Appliance Saturation Study.
Insulation and Weatherization (SF & MF)	GDS calculation based on program incentive figures from KeySpan Weatherization program completed in February 2006.	GDS calculation based on useful life of insulation/weatherization individual measures	GDS calculation based on figures derived from "Supplemental Findings on GDS Draft Potential Study-Residential Sector" comments by John Plunkett	GDS calculation based on figures derived from "Supplemental Findings on GDS Draft Potential Study-Residential Sector" comments by John Plunkett	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs. KEMA, Inc. December 2005. Page 3-33	GDS Assumption based on meeting with Efficiency Vermont and Vermont Department of Public Services
Residential New Construction	GDS calculation based off figures in the Efficiency Vermont 2004 Annual Report. November 2005. Page 49	Efficiency Vermont 2004 Annual Report. November 2005. Page 49	-	Electric: Efficiency Vermont 2004 Annual Report. November 2005. Page 49. Gas: Efficiency Vermont 2004 Annual Report. November 2005. Page 48 and Efficiency Vermont 2003 Annual Report. October 2004. Page 50.	The entire new home market is eligible for this program.	GDS Calculation based on Efficiency Vermont 2004 Annual Report Information. November 2005. Page 49. Took 2004 New Homes Construction Participants divided by the number of New Homes Constructed each year.
Low-Income Insulation and Weatherization (SF & MF)	GDS calculation based on program incentive figures from KeySpan Weatherization program completed in February 2006	GDS calculation based on useful life of insulation/weatherization individual measures	GDS calculation based on figures derived from "Supplemental Findings on GDS Draft Potential Study-Residential Sector" comments by John Plunkett	GDS calculation based on figures derived from "Supplemental Findings on GDS Draft Potential Study-Residential Sector" comments by John Plunkett	Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs. KEMA, Inc. December 2005. Page 3-33	GDS Calculation based on # of eligible homes for low income weatherization assistance (60% of state median income) and number of homes that have participated in program.

Table A-6
Vermont Electric Energy Efficiency Potential Study
Database of Energy Efficiency Measures - Residential Sector Fuel-Switching

1	2	3	4	5	6	7
	Source for Incremental Cost	Source for Useful Life	Source for Base Case Equipment End Use Intensity	Source for MMBTU, Therm, kWh and Water savings	Source for Saturation of End Use	Source for Saturation of Energy Efficient Measure
WH Fuel Switching (Electric to Natural Gas)	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 577	Efficiency Vermont Residentail Master Technical Reference User Manual No. 2005-37. Page 576	Efficiency Vermont Residential MasterTechnical Reference User Manual No. 2005-37. Page 574	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 577 & 579. (Stand Alone model)	GDS Calculation based on Vermont Residential Appliance Saturation Study. End use= % of homes with with electric water heaters * % of homes with # of bedroom * % of homes with specific fossil fuel source.	GDS Assumption that no homes in Vermont currently using electric water heating have already switched fuel sources.
WH Fuel Switching (Electric to Fuel Oil)	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 577	Efficiency Vermont Residentail Master Technical Reference User Manual No. 2005-37. Page 576	Efficiency Vermont Residential MasterTechnical Reference User Manual No. 2005-37. Page 574	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 577 & 579. (Stand Alone model)	GDS Calculation based on Vermont Residential Appliance Saturation Study. End use= % of homes with with electric water heaters * % of homes with # of bedroom * % of homes with specific fossil fuel source.	GDS Assumption that no homes in Vermont currently using electric water heating have already switched fuel sources.
WH Fuel Switching (Electric to Propane)	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 577	Efficiency Vermont Residentail Master Technical Reference User Manual No. 2005-37. Page 576	Efficiency Vermont Residential MasterTechnical Reference User Manual No. 2005-37. Page 574	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 577 & 579. (Stand Alone model)	GDS Calculation based on Vermont Residential Appliance Saturation Study. End use= % of homes with with electric water heaters * % of homes with # of bedroom * % of homes with specific fossil fuel source.	GDS Assumption that no homes in Vermont currently using electric water heating have already switched fuel sources.
WH Fuel Switching (Electric to Kerosene)	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 577	Efficiency Vermont Residentail Master Technical Reference User Manual No. 2005-37. Page 576	Efficiency Vermont Residential MasterTechnical Reference User Manual No. 2005-37. Page 574	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 577 & 579. (Stand Alone model)	GDS Calculation based on Vermont Residential Appliance Saturation Study. End use= % of homes with with electric water heaters * % of homes with # of bedroom * % of homes with specific fossil fuel source.	GDS Assumption that no homes in Vermont currently using electric water heating have already switched fuel sources.
WH Fuel Switching (Electric to Kerosene - Stand Alone)	GDS Calculation based on list price of kerosene water heater models made by John Wood and Bradford-White. April 81, 2006.	GDS Estimate based on similar model assumptions	The residential water heating annual energy usage estimates were calculated an engineering end use computer model developed by Scott Pigg at the Energy Enter of Wisconsin. Data on the number of persons per household and house size were obtained from the VDPS 2005 Residential Appliance Saturation Survey.	The residential water heating annual energy usage estimates were calculated an engineering end use computer model developed by Scott Pigg at the Energy Enter of Wisconsin. Data on the number of persons per household and house size were obtained from the VDPS 2005 Residential Appliance Saturation Survey. Savings based on an electric water heater with an efficiency rating of .95 being switched to a kerosene water heater with an efficiency rating of .68	GDS Calculation based on Vermont Residential Appliance Saturation Study. End use= % of homes with with electric water heaters * % of homes with specific fossil fuel source.	GDS Assumption that no homes in Vermont currently using electric water heating have already switched fuel sources.
WH Fuel Switching (Electric to Wood)	GDS phone call with Black Stove Shop (ME) on March 28, 2006.	GDS Estimate based on similar model assumptions	The residential water heating annual energy usage estimates were calculated an engineering end use computer model developed by Scott Pigg at the Energy Enter of Wisconsin. Data on the number of persons per household and house size were obtained from the VDPS 2005 Residential Appliance Saturation Survey.	The residential water heating annual energy usage estimates were calculated an engineering end use computer model developed by Scott Pigg at the Energy Enter of Wisconsin. Data on the number of persons per household and house size were obtained from the VDPS 2005 Residential Appliance Saturation Survey. Savings based on an electric water heater with an efficiency rating of .95 being switched to a wood consuming water heater with an efficiency rating of .50	GDS Calculation based on Vermont Residential Appliance Saturation Study. End use= % of homes with with electric water heaters * % of homes with specific fossil fuel source.	GDS Assumption that no homes in Vermont currently using electric water heating have already switched fuel sources.
Space Heating Fuel Switching	2003 Optimal Energy Model Inputs.	GDS estimate based on known Space Heating measures.	Annual Consumption based on figures derived from "Supplemental Findings on GDS Draft Potential Study-Residential Sector" comments by John Plunkett	GDS calculation based on figures derived from "Supplemental Findings on GDS Draft Potential Study-Residential Sector" comments by John Plunkett	GDS Calculation based on Vermont Residential Appliance Saturation Study.	GDS Assumption that no homes in Vermont currently using electric space heating have already switched fuel sources.
Dryer Fuel Switching	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 36	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 37	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 36	Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 36	GDS Calculation based on Vermont Residential Appliance Saturation Study. SF & MF homes with electric clothes dryers and natural gas or propane space heating.	GDS Assumption that no homes in Vermont currently using electric dryers in natural gas space heated homes have already switched dryer fuel sources.

APPENDIX A-4

Residential Energy Star Appliance Savings and Cost Comparison

Table A-7
Vermont Electric Energy Efficiency Potential Study
Comparison of Energy Star Appliance Savings (kWh) and Costs

Comparison of Energy Star Appliance Savings (kWh) and Costs				
Measure	Savings (kWh)		Cost ($)	
	Energy Star Savings Calculator	Efficiency Vermont Tech. Resource Manual[1]	Energy Star Savings Calculator	Efficiency Vermont Tech. Resource Manual[1]
Energy Star Refrigerator				
Top Freezer Refrigerator	80	85.5	$30	$30
Bottom Mount Freezer Refrigerator	87		$30	
Side-by-Side Refrigerator	95		$30	
Energy Star Freezer				
Upright Freezer	55	56.7	$33	$30
Chest Freezer	52		$33	
Energy Star Dishwasher				
Built-In Dishwasher	72	68.6	$50	$27
Energy Star Clothes Washer				
Clothes Washer (Electric WH)	286*	108	$300	$270
Clothes Washer (Non-Electric WH)	29	23	$300	$270
Energy Star Room A/C				
Single Room Air Conditioner	44	39.6	$30	$40
Energy Star Dehumidifier				
Dehumidifier (40 pint)	173	n/a	$0	n/a

* Includes electric dryer savings.

1. Efficiency Vermont Residential Master Technical Reference Manual. 2005-37.

APPENDIX A-5

Residential Single Family and Multi-Family Vermont Household Data (by Square Footage)

Table A-8
Vermont Electric Energy Efficiency Potential Study
Single Family and Multi Family Vermont Household Data

Single Family & Multi Family Vermont Household Data (by Square Footage)			
Home Sq. Footage	# of homes (according to 2005 RASS data)	% of Homes in Vermont (Sq. Ft.)	Avg. # of persons per HH (Sq. Ft.)
Single:			
<800	13	3.92%	1.77
800-1199	35	10.54%	2.23
1200-1599	76	22.89%	2.44
1600-1999	53	15.96%	2.96
2000-2499	82	24.70%	2.98
2500-2999	38	11.45%	2.77
>3000	35	10.54%	2.94
Multi:			
<800	7	14.00%	1.29
800-1199	20	40.00%	2.05
1200-1599	8	16.00%	2.00
1600-1999	6	12.00%	3.33
2000-2499	6	12.00%	2.17
2500-2999	2	4.00%	3.00
>3000	1	2.00%	4.00

Single Family & Multi Family Vermont Household Data (by # of bedrooms)		
No. of Bedrooms	# of homes (according to 2005 RASS data)	% of homes in Vermont
Single Family		
1 Bedroom	18	3.59%
2 Bedroom	100	19.92%
3 Bedroom	240	47.81%
4 Bedroom	111	22.11%
5+ Bedroom	33	6.57%
Multi Family		
1 Bedroom	20	22.73%
2 Bedroom	35	39.77%
3 Bedroom	26	29.55%
4 Bedroom	6	6.82%
5+ Bedroom	1	1.14%

APPENDIX A-6

Residential Program Budgets

Table A-9: Single Family Program Budgets (without incentives) by Year
Maximum Achievable Measures Only

	Single Family	$ per kWh Saved or Per Participant	Amount	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Refrigerator Turn-in	Per participant	$92.53	$163,222.92	$166,895.44	$170,650.58	$174,490.22	$178,416.25	$182,430.62	$186,535.31	$190,732.35	$195,023.83	$199,411.86
2	Freezer Turn-in	Per participant	$92.53	$22,299.73	$22,801.47	$23,314.51	$23,839.08	$24,375.46	$24,923.91	$25,484.70	$26,058.10	$26,644.41	$27,243.91
3	Room AC Turn-in without Replacement	Per participant	$117.53	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4	Room AC Turn-in with ES Replacement	Per participant	$107.53	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$185,522.65	**$189,696.91**	**$193,965.09**	**$198,329.30**	**$202,791.71**	**$207,354.53**	**$212,020.00**	**$216,790.45**	**$221,668.24**	**$226,655.78**
5	Energy Star Single Room Air Conditioner	Per kWh	$0.0339	$5,501.51	$5,625.29	$5,751.86	$5,881.28	$6,013.61	$6,148.91	$6,287.26	$6,428.73	$6,573.37	$6,721.27
6	Energy Star Compliant Top Freezer Refrigerator	Per kWh	$0.0339	$24,271.84	$24,817.95	$25,376.36	$25,947.32	$26,531.14	$27,128.09	$27,738.47	$28,362.59	$29,000.75	$29,653.26
7	Energy Star Compliant Bottom Mount Freezer Refrigerator	Per kWh	$0.0339	$3,291.71	$3,365.77	$3,441.50	$3,518.94	$3,598.11	$3,679.07	$3,761.85	$3,846.49	$3,933.04	$4,021.53
8	Energy Star Compliant Side-by-Side Refrigerator	Per kWh	$0.0339	$11,359.71	$11,615.30	$11,876.65	$12,143.87	$12,417.11	$12,696.49	$12,982.16	$13,274.26	$13,572.93	$13,878.32
9	Energy Star Compliant Upright Freezer (Manual Defrost)	Per kWh	$0.0339	$6,612.10	$6,760.87	$6,912.99	$7,068.54	$7,227.58	$7,390.20	$7,556.48	$7,726.50	$7,900.35	$8,078.10
10	Energy Star Compliant Chest Freezer	Per kWh	$0.0339	$5,553.31	$5,678.26	$5,806.02	$5,936.66	$6,070.23	$6,206.81	$6,346.47	$6,489.26	$6,635.27	$6,784.56
11	Energy Star Built-In Dishwasher (Electric)	Per kWh	$0.0339	$21,022.03	$21,495.03	$21,978.66	$22,473.18	$22,978.83	$23,495.85	$24,024.51	$24,565.06	$25,117.78	$25,682.93
12	Energy Star Clothes Washers with Electric Water Heater	Per kWh	$0.0339	$18,003.71	$18,408.80	$18,822.99	$19,246.51	$19,679.56	$20,122.35	$20,575.10	$21,038.04	$21,511.40	$21,995.40
13	Energy Star Clothes Washers with Non-Electric Water Heater	Per kWh	$0.0339	$9,260.64	$9,469.00	$9,682.06	$9,899.90	$10,122.65	$10,350.41	$10,583.29	$10,821.42	$11,064.90	$11,313.86
14	Energy Star Dehumidifier (40 pt)	Per kWh	$0.0339	$27,648.64	$28,270.74	$28,906.83	$29,557.23	$30,222.27	$30,902.27	$31,597.57	$32,308.52	$33,035.46	$33,778.76
				$132,525.20	**$135,507.02**	**$138,555.92**	**$141,673.43**	**$144,861.09**	**$148,120.46**	**$151,453.17**	**$154,860.87**	**$158,345.24**	**$161,908.00**
15	Standby-Power	Per kWh	$0.0339	$149,552.57	$152,917.51	$156,358.15	$159,876.21	$163,473.42	$167,151.58	$170,912.49	$174,758.02	$178,690.07	$182,710.60
				$149,552.57	**$152,917.51**	**$156,358.15**	**$159,876.21**	**$163,473.42**	**$167,151.58**	**$170,912.49**	**$174,758.02**	**$178,690.07**	**$182,710.60**
16	Pool Pump & Motor	Per kWh	$0.0339	$33,799.60	$34,560.09	$35,337.69	$36,132.79	$36,945.77	$37,777.05	$38,627.04	$39,496.15	$40,384.81	$41,293.47
				$33,799.60	**$34,560.09**	**$35,337.69**	**$36,132.79**	**$36,945.77**	**$37,777.05**	**$38,627.04**	**$39,496.15**	**$40,384.81**	**$41,293.47**
17	Energy Star Compliant Programmable Thermostat	Per kWh	$0.0339	$7,396.01	$7,562.42	$7,732.57	$7,906.55	$8,084.45	$8,266.35	$8,452.35	$8,642.52	$8,836.98	$9,035.81
				$7,396.01	**$7,562.42**	**$7,732.57**	**$7,906.55**	**$8,084.45**	**$8,266.35**	**$8,452.35**	**$8,642.52**	**$8,836.98**	**$9,035.81**
18	High Efficiency Central AC	Per kWh	$0.0339	$3,506.18	$3,585.07	$3,665.73	$3,748.21	$3,832.55	$3,918.78	$4,006.95	$4,097.11	$4,189.29	$4,283.55
				$3,506.18	**$3,585.07**	**$3,665.73**	**$3,748.21**	**$3,832.55**	**$3,918.78**	**$4,006.95**	**$4,097.11**	**$4,189.29**	**$4,283.55**
19	CFL's: Homes with partial CFL installation	Per Participant	$0.0339	$197,980.44	$202,435.00	$206,989.79	$211,647.06	$216,409.12	$221,278.32	$226,257.08	$231,347.87	$236,553.20	$241,875.64
20	CFL's: Homes without CFL installation	Per participant	$0.0339	$259,113.31	$264,943.36	$270,904.58	$276,999.93	$283,232.43	$289,605.16	$296,121.28	$302,784.01	$309,596.65	$316,562.57
				$457,093.75	**$467,378.36**	**$477,894.37**	**$488,646.99**	**$499,641.55**	**$510,883.48**	**$522,378.36**	**$534,131.88**	**$546,149.84**	**$558,438.21**
21	Water Heater Blanket	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
22	Low Flow Shower Head	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
23	Pipe Wrap	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
24	Low Flow Faucet Aerator	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
25	Solar Water Heating	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
26	Efficient Water Heating	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
27	Efficient Furnace Fan Motor (Fuel Oil)	Per kWh	$0.0339	$27,692.51	$28,315.59	$28,952.70	$29,604.13	$30,270.22	$30,951.30	$31,647.71	$32,359.78	$33,087.88	$33,832.35
28	Efficient Furnace Fan Motor (Natural Gas)	Per kWh	$0.0339	$5,842.37	$5,973.82	$6,108.23	$6,245.67	$6,386.20	$6,529.88	$6,676.81	$6,827.04	$6,980.64	$7,137.71
29	Efficient Furnace Fan Motor (Propane)	Per kWh	$0.0339	$8,003.89	$8,183.98	$8,368.11	$8,556.40	$8,748.92	$8,945.77	$9,147.05	$9,352.86	$9,563.29	$9,778.47
				$41,538.77	**$42,473.39**	**$43,429.04**	**$44,406.20**	**$45,405.34**	**$46,426.96**	**$47,471.56**	**$48,539.67**	**$49,631.82**	**$50,748.53**
30	Energy Star Windows - Electric Heat and no AC	Per kWh	$0.3424	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
31	Insulation and Weatherization - Electric Heat and no AC	Per kWh	$0.3424	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
32	Residential New Construction	Per Participant	$2,087.66	$1,600,147.45	$2,013,724.02	$2,445,101.46	$2,894,871.44	$3,363,643.23	$3,852,044.23	$4,360,720.43	$4,890,336.96	$5,441,578.62	$6,015,150.42
				$1,600,147.45	**$2,013,724.02**	**$2,445,101.46**	**$2,894,871.44**	**$3,363,643.23**	**$3,852,044.23**	**$4,360,720.43**	**$4,890,336.96**	**$5,441,578.62**	**$6,015,150.42**

	Single Family / Low Income			2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
33	Insulation and Weatherization - Electric Heat and no AC	Per kWh	$0.3424	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
	Total for All Programs:			**$2,611,082.17**	**$3,047,404.77**	**$3,502,040.03**	**$3,975,591.13**	**$4,468,679.12**	**$4,981,943.42**	**$5,516,042.35**	**$6,071,653.62**	**$6,649,474.91**	**$7,250,224.38**

Table A-10: Single Family Program Budgets (without incentives) by Year
Fuel-Switching Programs
Maximum Achievable Measures Only

	Single Family	$ per kWh Saved or Per Participant	Amount	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
34	**Water Heater-Elec. To Natural Gas (1 Bedroom)**	Per kWh	$0.0339	$813.67	$831.98	$850.70	$869.84	$889.41	$909.42	$929.89	$950.81	$972.20	$994.08
35	**Water Heater-Elec. To Natural Gas (2 Bedroom)**	Per kWh	$0.0339	$5,899.12	$6,031.85	$6,167.57	$6,306.34	$6,448.23	$6,593.32	$6,741.67	$6,893.35	$7,048.45	$7,207.04
36	**Water Heater-Elec. To Natural Gas (3 Bedroom)**	Per kWh	$0.0339	$16,965.06	$17,346.78	$17,737.08	$18,136.16	$18,544.23	$18,961.47	$19,388.10	$19,824.34	$20,270.38	$20,726.47
37	**Water Heater-Elec. To Natural Gas (4 Bedroom)**	Per kWh	$0.0339	$9,764.06	$9,983.76	$10,208.39	$10,438.08	$10,672.94	$10,913.08	$11,158.62	$11,409.69	$11,666.41	$11,928.90
38	**Water Heater-Elec. To Natural Gas (5+ Bedroom)**	Per kWh	$0.0339	$3,478.45	$3,556.71	$3,636.74	$3,718.57	$3,802.23	$3,887.78	$3,975.26	$4,064.70	$4,156.16	$4,249.67
				$36,920.37	**$37,751.08**	**$38,600.47**	**$39,468.99**	**$40,357.04**	**$41,265.07**	**$42,193.53**	**$43,142.89**	**$44,113.60**	**$45,106.16**
39	**Water Heater-Elec. To Fuel Oil (1 Bedroom)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
40	**Water Heater-Elec. To Fuel Oil (2 Bedroom)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
41	**Water Heater-Elec. To Fuel Oil (3 Bedroom)**	Per kWh	$0.0339	$224,939.62	$230,000.77	$235,175.78	$240,467.24	$245,877.75	$251,410.00	$257,066.73	$262,850.73	$268,764.87	$274,812.08
42	**Water Heater-Elec. To Fuel Oil (4 Bedroom)**	Per kWh	$0.0339	$129,984.10	$132,908.74	$135,899.19	$138,956.92	$142,083.45	$145,280.33	$148,549.14	$151,891.49	$155,309.05	$158,803.51
43	**Water Heater-Elec. To Fuel Oil (5+ Bedroom)**	Per kWh	$0.0339	$46,318.28	$47,360.44	$48,426.05	$49,515.64	$50,629.74	$51,768.91	$52,933.71	$54,124.72	$55,342.52	$56,587.73
				$401,242.01	**$410,269.95**	**$419,501.02**	**$428,939.80**	**$438,590.94**	**$448,459.24**	**$458,549.57**	**$468,866.94**	**$479,416.44**	**$490,203.31**
44	**Water Heater-Elec. To Propane (1 Bedroom)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
45	**Water Heater-Elec. To Propane (2 Bedroom)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
46	**Water Heater-Elec. To Propane (3 Bedroom)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
47	**Water Heater-Elec. To Propane (4 Bedroom)**	Per kWh	$0.0339	$27,461.43	$28,079.31	$28,711.10	$29,357.10	$30,017.63	$30,693.03	$31,383.62	$32,089.75	$32,811.77	$33,550.04
48	**Water Heater-Elec. To Propane (5+ Bedroom)**	Per kWh	$0.0339	$9,703.04	$9,921.36	$10,144.59	$10,372.84	$10,606.23	$10,844.87	$11,088.88	$11,338.38	$11,593.49	$11,854.35
				$37,164.47	**$38,000.67**	**$38,855.68**	**$39,729.94**	**$40,623.86**	**$41,537.90**	**$42,472.50**	**$43,428.13**	**$44,405.26**	**$45,404.38**
49	**Water Heater-Elec. To Kerosene (1 Bedroom)**	Per kWh	$0.0339	$2,359.65	$2,412.74	$2,467.03	$2,522.54	$2,579.29	$2,637.33	$2,696.67	$2,757.34	$2,819.38	$2,882.82
50	**Water Heater-Elec. To Kerosene (2 Bedroom)**	Per kWh	$0.0339	$16,375.15	$16,743.59	$17,120.32	$17,505.53	$17,899.40	$18,302.14	$18,713.94	$19,135.00	$19,565.54	$20,005.76
51	**Water Heater-Elec. To Kerosene (3 Bedroom)**	Per kWh	$0.0339	$47,111.61	$48,171.62	$49,255.48	$50,363.73	$51,496.91	$52,655.59	$53,840.35	$55,051.75	$56,290.42	$57,556.95
52	**Water Heater-Elec. To Kerosene (4 Bedroom)**	Per kWh	$0.0339	$27,156.30	$27,767.32	$28,392.08	$29,030.91	$29,684.10	$30,351.99	$31,034.91	$31,733.20	$32,447.20	$33,177.26
53	**Water Heater-Elec. To Kerosene (5+ Bedroom)**	Per kWh	$0.0339	$9,703.04	$9,921.36	$10,144.59	$10,372.84	$10,606.23	$10,844.87	$11,088.88	$11,338.38	$11,593.49	$11,854.35
				$102,705.75	**$105,016.63**	**$107,379.50**	**$109,795.54**	**$112,265.94**	**$114,791.92**	**$117,374.74**	**$120,015.67**	**$122,716.03**	**$125,477.14**
54	**WH Fuel Switching (Electric to Kerosene- Stand Alone)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
55	**WH Fuel Switching (Electric to Wood)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
56	**Space Heating (Fuel Switching)**	Per kWh	$0.3424	$1,403,823.60	$1,435,409.63	$1,467,706.35	$1,500,729.74	$1,534,496.16	$1,569,022.32	$1,604,325.33	$1,640,422.65	$1,677,332.15	$1,715,072.13
				$1,403,823.60	**$1,435,409.63**	**$1,467,706.35**	**$1,500,729.74**	**$1,534,496.16**	**$1,569,022.32**	**$1,604,325.33**	**$1,640,422.65**	**$1,677,332.15**	**$1,715,072.13**
57	**Clothes Dryer (Fuel Switching)**	Per kWh	$0.0339	$70,995.12	$72,592.51	$74,225.84	$75,895.92	$77,603.58	$79,349.66	$81,135.03	$82,960.57	$84,827.18	$86,735.79
				$70,995.12	**$72,592.51**	**$74,225.84**	**$75,895.92**	**$77,603.58**	**$79,349.66**	**$81,135.03**	**$82,960.57**	**$84,827.18**	**$86,735.79**
			Total for All Programs:	**$2,052,851.31**	**$2,099,040.46**	**$2,146,268.87**	**$2,194,559.92**	**$2,243,937.52**	**$2,294,426.12**	**$2,346,050.70**	**$2,398,836.84**	**$2,452,810.67**	**$2,507,998.91**

Table A-11: Single Family Incentive Budgets by Year
Maximum Achievable Measures Only

	Single Family	Incremental $	Incentive $	$2,006	$2,007	$2,008	$2,009	$2,010	$2,011	$2,012	$2,013	$2,014	$2,015
1	Refrigerator Turn-in	$50.00	$50.00	$88,200.00	$88,200.00	$88,200.00	$88,200.00	$88,200.00	$88,200.00	$88,200.00	$88,200.00	$88,200.00	$88,200.00
2	Freezer Turn-in	$50.00	$50.00	$12,050.00	$12,050.00	$12,050.00	$12,050.00	$12,050.00	$12,050.00	$12,050.00	$12,050.00	$12,050.00	$12,050.00
3	Room AC Turn-in without Replacement	$25.00	$25.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4	Room AC Turn-in with ES Replacement	$35.00	$35.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$100,250.00	**$100,250.00**	**$100,250.00**	**$100,250.00**	**$100,250.00**	**$100,250.00**	**$100,250.00**	**$100,250.00**	**$100,250.00**	**$100,250.00**
5	Energy Star Single Room Air Conditioner	$30.00	$15.00	$55,320.00	$55,320.00	$55,320.00	$55,320.00	$55,320.00	$55,320.00	$55,320.00	$55,320.00	$55,320.00	$55,320.00
6	Energy Star Compliant Top Freezer Refrigerator	$30.00	$15.00	$134,235.00	$134,235.00	$134,235.00	$134,235.00	$134,235.00	$134,235.00	$134,235.00	$134,235.00	$134,235.00	$134,235.00
7	Energy Star Compliant Bottom Mount Freezer Refrigerator	$30.00	$15.00	$16,740.00	$16,740.00	$16,740.00	$16,740.00	$16,740.00	$16,740.00	$16,740.00	$16,740.00	$16,740.00	$16,740.00
8	Energy Star Compliant Side-by-Side Refrigerator	$30.00	$15.00	$52,905.00	$52,905.00	$52,905.00	$52,905.00	$52,905.00	$52,905.00	$52,905.00	$52,905.00	$52,905.00	$52,905.00
9	Energy Star Compliant Upright Freezer (Manual Defrost)	$33.00	$16.50	$58,509.00	$58,509.00	$58,509.00	$58,509.00	$58,509.00	$58,509.00	$58,509.00	$58,509.00	$58,509.00	$58,509.00
10	Energy Star Compliant Chest Freezer	$33.00	$16.50	$51,975.00	$51,975.00	$51,975.00	$51,975.00	$51,975.00	$51,975.00	$51,975.00	$51,975.00	$51,975.00	$51,975.00
11	Energy Star Built-In Dishwasher (Electric)	$50.00	$25.00	$215,300.00	$215,300.00	$215,300.00	$215,300.00	$215,300.00	$215,300.00	$215,300.00	$215,300.00	$215,300.00	$215,300.00
12	Energy Star Clothes Washers with Electric Water Heater	$300.00	$150.00	$737,550.00	$737,550.00	$737,550.00	$737,550.00	$737,550.00	$737,550.00	$737,550.00	$737,550.00	$737,550.00	$737,550.00
13	Energy Star Clothes Washers with Non-Electric Water Heater	$300.00	$150.00	$1,412,850.00	$1,412,850.00	$1,412,850.00	$1,412,850.00	$1,412,850.00	$1,412,850.00	$1,412,850.00	$1,412,850.00	$1,412,850.00	$1,412,850.00
14	Energy Star Dehumidifier (40 pt)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$2,735,384.00	**$2,735,384.00**	**$2,735,384.00**	**$2,735,384.00**	**$2,735,384.00**	**$2,735,384.00**	**$2,735,384.00**	**$2,735,384.00**	**$2,735,384.00**	**$2,735,384.00**
15	Standby-Power	$30.00	$15.00	$249,690.00	$249,690.00	$249,690.00	$249,690.00	$249,690.00	$249,690.00	$249,690.00	$249,690.00	$249,690.00	$249,690.00
				$249,690.00	**$249,690.00**	**$249,690.00**	**$249,690.00**	**$249,690.00**	**$249,690.00**	**$249,690.00**	**$249,690.00**	**$249,690.00**	**$249,690.00**
16	Pool Pump & Motor	$313.00	$156.50	$245,705.00	$245,705.00	$245,705.00	$245,705.00	$245,705.00	$245,705.00	$245,705.00	$245,705.00	$245,705.00	$245,705.00
				$245,705.00	**$245,705.00**	**$245,705.00**	**$245,705.00**	**$245,705.00**	**$245,705.00**	**$245,705.00**	**$245,705.00**	**$245,705.00**	**$245,705.00**
17	Energy Star Compliant Programmable Thermostat	$50.00	$25.00	$18,425.00	$18,425.00	$18,425.00	$18,425.00	$18,425.00	$18,425.00	$18,425.00	$18,425.00	$18,425.00	$18,425.00
				$18,425.00	**$18,425.00**	**$18,425.00**	**$18,425.00**	**$18,425.00**	**$18,425.00**	**$18,425.00**	**$18,425.00**	**$18,425.00**	**$18,425.00**
18	High Efficiency Central AC	$379.00	$189.50	$62,914.00	$62,914.00	$62,914.00	$62,914.00	$62,914.00	$62,914.00	$62,914.00	$62,914.00	$62,914.00	$62,914.00
				$62,914.00	**$62,914.00**	**$62,914.00**	**$62,914.00**	**$62,914.00**	**$62,914.00**	**$62,914.00**	**$62,914.00**	**$62,914.00**	**$62,914.00**
19	CFL's: Homes with partial CFL installation	$5.00	$1.25	$281,075.00	$281,075.00	$281,075.00	$281,075.00	$281,075.00	$281,075.00	$281,075.00	$281,075.00	$281,075.00	$281,075.00
20	CFL's: Homes without CFL installation	$5.00	$1.25	$306,555.00	$306,555.00	$306,555.00	$306,555.00	$306,555.00	$306,555.00	$306,555.00	$306,555.00	$306,555.00	$306,555.00
				$587,630.00	**$587,630.00**	**$587,630.00**	**$587,630.00**	**$587,630.00**	**$587,630.00**	**$587,630.00**	**$587,630.00**	**$587,630.00**	**$587,630.00**
21	Water Heater Blanket	$35.00	$17.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
22	Low Flow Shower Head	$15.00	$7.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
23	Pipe Wrap	$15.00	$7.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
24	Low Flow Faucet Aerator	$6.00	$3.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
25	Solar Water Heating	$4,500.00	$900.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
26	Efficient Water Heating	$90.00	$45.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
27	Efficient Furnace Fan Motor (Fuel Oil)	$200.00	$100.00	$176,800.00	$176,800.00	$176,800.00	$176,800.00	$176,800.00	$176,800.00	$176,800.00	$176,800.00	$176,800.00	$176,800.00
28	Efficient Furnace Fan Motor (Natural Gas)	$200.00	$100.00	$37,300.00	$37,300.00	$37,300.00	$37,300.00	$37,300.00	$37,300.00	$37,300.00	$37,300.00	$37,300.00	$37,300.00
29	Efficient Furnace Fan Motor (Propane)	$200.00	$100.00	$51,100.00	$51,100.00	$51,100.00	$51,100.00	$51,100.00	$51,100.00	$51,100.00	$51,100.00	$51,100.00	$51,100.00
				$265,200.00	**$265,200.00**	**$265,200.00**	**$265,200.00**	**$265,200.00**	**$265,200.00**	**$265,200.00**	**$265,200.00**	**$265,200.00**	**$265,200.00**
30	Energy Star Windows - Electric Heat and no AC	$200.00	$100.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
31	Insulation and Weatherization - Electric Heat and no AC	$2,000.00	$1,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
32	Residential New Construction	$997.51	$652.92	$500,450.12	$615,938.61	$731,427.10	$846,915.59	$962,404.08	$1,077,892.57	$1,193,381.06	$1,308,869.55	$1,424,358.04	$1,539,846.53
				$500,450.12	**$615,938.61**	**$731,427.10**	**$846,915.59**	**$962,404.08**	**$1,077,892.57**	**$1,193,381.06**	**$1,308,869.55**	**$1,424,358.04**	**$1,539,846.53**
	Single Family / Low Income			2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
33	Insulation and Weatherization - Electric Heat and no AC	$2,000.00	$2,000.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
	Total for All Programs:			**$4,765,648.12**	**$4,881,136.61**	**$4,996,625.10**	**$5,112,113.59**	**$5,227,602.08**	**$5,343,090.57**	**$5,458,579.06**	**$5,574,067.55**	**$5,689,556.04**	**$5,805,044.53**

Table A-12: Single Family Incentive Budgets by Year
Fuel-Switching Programs
Maximum Achievable Measures Only

	Single Family	Incremental $	Incentive $	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
34	**Water Heater-Elec. To Natural Gas (1 Bedroom)**	$500.00	$250.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00
35	**Water Heater-Elec. To Natural Gas (2 Bedroom)**	$500.00	$250.00	$14,500.00	$14,500.00	$14,500.00	$14,500.00	$14,500.00	$14,500.00	$14,500.00	$14,500.00	$14,500.00	$14,500.00
36	**Water Heater-Elec. To Natural Gas (3 Bedroom)**	$500.00	$250.00	$34,750.00	$34,750.00	$34,750.00	$34,750.00	$34,750.00	$34,750.00	$34,750.00	$34,750.00	$34,750.00	$34,750.00
37	**Water Heater-Elec. To Natural Gas (4 Bedroom)**	$500.00	$250.00	$16,000.00	$16,000.00	$16,000.00	$16,000.00	$16,000.00	$16,000.00	$16,000.00	$16,000.00	$16,000.00	$16,000.00
38	**Water Heater-Elec. To Natural Gas (5+ Bedroom)**	$500.00	$250.00	$4,750.00	$4,750.00	$4,750.00	$4,750.00	$4,750.00	$4,750.00	$4,750.00	$4,750.00	$4,750.00	$4,750.00
				$72,500.00	**$72,500.00**	**$72,500.00**	**$72,500.00**	**$72,500.00**	**$72,500.00**	**$72,500.00**	**$72,500.00**	**$72,500.00**	**$72,500.00**
39	**Water Heater-Elec. To Fuel Oil (1 Bedroom)**	$1,575.00	$787.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
40	**Water Heater-Elec. To Fuel Oil (2 Bedroom)**	$1,575.00	$787.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
41	**Water Heater-Elec. To Fuel Oil (3 Bedroom)**	$1,575.00	$787.50	$1,451,362.50	$1,451,362.50	$1,451,362.50	$1,451,362.50	$1,451,362.50	$1,451,362.50	$1,451,362.50	$1,451,362.50	$1,451,362.50	$1,451,362.50
42	**Water Heater-Elec. To Fuel Oil (4 Bedroom)**	$1,575.00	$787.50	$670,950.00	$670,950.00	$670,950.00	$670,950.00	$670,950.00	$670,950.00	$670,950.00	$670,950.00	$670,950.00	$670,950.00
43	**Water Heater-Elec. To Fuel Oil (5+ Bedroom)**	$1,575.00	$787.50	$199,237.50	$199,237.50	$199,237.50	$199,237.50	$199,237.50	$199,237.50	$199,237.50	$199,237.50	$199,237.50	$199,237.50
				$2,321,550.00	**$2,321,550.00**	**$2,321,550.00**	**$2,321,550.00**	**$2,321,550.00**	**$2,321,550.00**	**$2,321,550.00**	**$2,321,550.00**	**$2,321,550.00**	**$2,321,550.00**
44	**Water Heater-Elec. To Propane (1 Bedroom)**	$800.00	$400.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
45	**Water Heater-Elec. To Propane (2 Bedroom)**	$800.00	$400.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
46	**Water Heater-Elec. To Propane (3 Bedroom)**	$800.00	$400.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
47	**Water Heater-Elec. To Propane (4 Bedroom)**	$800.00	$400.00	$72,000.00	$72,000.00	$72,000.00	$72,000.00	$72,000.00	$72,000.00	$72,000.00	$72,000.00	$72,000.00	$72,000.00
48	**Water Heater-Elec. To Propane (5+ Bedroom)**	$800.00	$400.00	$21,200.00	$21,200.00	$21,200.00	$21,200.00	$21,200.00	$21,200.00	$21,200.00	$21,200.00	$21,200.00	$21,200.00
				$93,200.00	**$93,200.00**	**$93,200.00**	**$93,200.00**	**$93,200.00**	**$93,200.00**	**$93,200.00**	**$93,200.00**	**$93,200.00**	**$93,200.00**
49	**Water Heater-Elec. To Kerosene (1 Bedroom)**	$2,000.00	$1,000.00	$29,000.00	$29,000.00	$29,000.00	$29,000.00	$29,000.00	$29,000.00	$29,000.00	$29,000.00	$29,000.00	$29,000.00
50	**Water Heater-Elec. To Kerosene (2 Bedroom)**	$2,000.00	$1,000.00	$161,000.00	$161,000.00	$161,000.00	$161,000.00	$161,000.00	$161,000.00	$161,000.00	$161,000.00	$161,000.00	$161,000.00
51	**Water Heater-Elec. To Kerosene (3 Bedroom)**	$2,000.00	$1,000.00	$386,000.00	$386,000.00	$386,000.00	$386,000.00	$386,000.00	$386,000.00	$386,000.00	$386,000.00	$386,000.00	$386,000.00
52	**Water Heater-Elec. To Kerosene (4 Bedroom)**	$2,000.00	$1,000.00	$178,000.00	$178,000.00	$178,000.00	$178,000.00	$178,000.00	$178,000.00	$178,000.00	$178,000.00	$178,000.00	$178,000.00
53	**Water Heater-Elec. To Kerosene (5+ Bedroom)**	$2,000.00	$1,000.00	$53,000.00	$53,000.00	$53,000.00	$53,000.00	$53,000.00	$53,000.00	$53,000.00	$53,000.00	$53,000.00	$53,000.00
				$807,000.00	**$807,000.00**	**$807,000.00**	**$807,000.00**	**$807,000.00**	**$807,000.00**	**$807,000.00**	**$807,000.00**	**$807,000.00**	**$807,000.00**
54	**WH Fuel Switching (Electric to Kerosene- Stand Alone)**	$1,880.00	$940.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
55	**WH Fuel Switching (Electric to Wood)**	$1,320.00	$660.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
56	**Space Heating (Fuel Switching)**	$6,500.00	$3,250.00	$666,250.00	$666,250.00	$666,250.00	$666,250.00	$666,250.00	$666,250.00	$666,250.00	$666,250.00	$666,250.00	$666,250.00
				$666,250.00	**$666,250.00**	**$666,250.00**	**$666,250.00**	**$666,250.00**	**$666,250.00**	**$666,250.00**	**$666,250.00**	**$666,250.00**	**$666,250.00**
57	**Clothes Dryer (Fuel Switching)**	$375.00	$187.50	$416,812.50	$416,812.50	$416,812.50	$416,812.50	$416,812.50	$416,812.50	$416,812.50	$416,812.50	$416,812.50	$416,812.50
				$416,812.50	**$416,812.50**	**$416,812.50**	**$416,812.50**	**$416,812.50**	**$416,812.50**	**$416,812.50**	**$416,812.50**	**$416,812.50**	**$416,812.50**
	Total for All Programs:			**$4,377,312.50**	**$4,377,312.50**	**$4,377,312.50**	**$4,377,312.50**	**$4,377,312.50**	**$4,377,312.50**	**$4,377,312.50**	**$4,377,312.50**	**$4,377,312.50**	**$4,377,312.50**

Table A-13: Single Family Total Budgets by Year
Maximum Achievable Measures Only

	Single Family	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Refrigerator Turn-in	$251,422.92	$255,095.44	$258,850.58	$262,690.22	$266,616.25	$270,630.62	$274,735.31	$278,932.35	$283,223.83	$287,611.86
2	Freezer Turn-in	$34,349.73	$34,851.47	$35,364.51	$35,889.08	$36,425.46	$36,973.91	$37,534.70	$38,108.10	$38,694.41	$39,293.91
3	Room AC Turn-in without Replacement	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4	Room AC Turn-in with ES Replacement	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$285,772.65	**$289,946.91**	**$294,215.09**	**$298,579.30**	**$303,041.71**	**$307,604.53**	**$312,270.00**	**$317,040.45**	**$321,918.24**	**$326,905.78**
5	Energy Star Single Room Air Conditioner	$60,821.51	$60,945.29	$61,071.86	$61,201.28	$61,333.61	$61,468.91	$61,607.26	$61,748.73	$61,893.37	$62,041.27
6	Energy Star Compliant Top Freezer Refrigerator	$158,506.84	$159,052.95	$159,611.36	$160,182.32	$160,766.14	$161,363.09	$161,973.47	$162,597.59	$163,235.75	$163,888.26
7	Energy Star Compliant Bottom Mount Freezer Refrigerator	$20,031.71	$20,105.77	$20,181.50	$20,258.94	$20,338.11	$20,419.07	$20,501.85	$20,586.49	$20,673.04	$20,761.53
8	Energy Star Compliant Side-by-Side Refrigerator	$64,264.71	$64,520.30	$64,781.65	$65,048.87	$65,322.11	$65,601.49	$65,887.16	$66,179.26	$66,477.93	$66,783.32
9	Energy Star Compliant Upright Freezer (Manual Defrost)	$65,121.10	$65,269.87	$65,421.99	$65,577.54	$65,736.58	$65,899.20	$66,065.48	$66,235.50	$66,409.35	$66,587.10
10	Energy Star Compliant Chest Freezer	$57,528.31	$57,653.26	$57,781.02	$57,911.66	$58,045.23	$58,181.81	$58,321.47	$58,464.26	$58,610.27	$58,759.56
11	Energy Star Built-In Dishwasher (Electric)	$236,322.03	$236,795.03	$237,278.66	$237,773.18	$238,278.83	$238,795.85	$239,324.51	$239,865.06	$240,417.78	$240,982.93
12	Energy Star Clothes Washers with Electric Water Heater	$755,553.71	$755,958.80	$756,372.99	$756,796.51	$757,229.56	$757,672.35	$758,125.10	$758,588.04	$759,061.40	$759,545.40
13	Energy Star Clothes Washers with Non-Electric Water Heater	$1,422,110.64	$1,422,319.00	$1,422,532.06	$1,422,749.90	$1,422,972.65	$1,423,200.41	$1,423,433.29	$1,423,671.42	$1,423,914.90	$1,424,163.86
14	Energy Star Dehumidifier (40 pt)	$27,648.64	$28,270.74	$28,906.83	$29,557.23	$30,222.27	$30,902.27	$31,597.57	$32,308.52	$33,035.46	$33,778.76
		$2,867,909.20	**$2,870,891.02**	**$2,873,939.92**	**$2,877,057.43**	**$2,880,245.09**	**$2,883,504.46**	**$2,886,837.17**	**$2,890,244.87**	**$2,893,729.24**	**$2,897,292.00**
15	Standby-Power	$399,242.57	$402,607.51	$406,048.15	$409,566.21	$413,163.42	$416,841.58	$420,602.49	$424,448.02	$428,380.07	$432,400.60
		$399,242.57	**$402,607.51**	**$406,048.15**	**$409,566.21**	**$413,163.42**	**$416,841.58**	**$420,602.49**	**$424,448.02**	**$428,380.07**	**$432,400.60**
16	Pool Pump & Motor	$279,504.60	$280,265.09	$281,042.69	$281,837.79	$282,650.77	$283,482.05	$284,332.04	$285,201.15	$286,089.81	$286,998.47
		$279,504.60	**$280,265.09**	**$281,042.69**	**$281,837.79**	**$282,650.77**	**$283,482.05**	**$284,332.04**	**$285,201.15**	**$286,089.81**	**$286,998.47**
17	Energy Star Compliant Programmable Thermostat	$25,821.01	$25,987.42	$26,157.57	$26,331.55	$26,509.45	$26,691.35	$26,877.35	$27,067.52	$27,261.98	$27,460.81
		$25,821.01	**$25,987.42**	**$26,157.57**	**$26,331.55**	**$26,509.45**	**$26,691.35**	**$26,877.35**	**$27,067.52**	**$27,261.98**	**$27,460.81**
18	High Efficiency Central AC	$66,420.18	$66,499.07	$66,579.73	$66,662.21	$66,746.55	$66,832.78	$66,920.95	$67,011.11	$67,103.29	$67,197.55
		$66,420.18	**$66,499.07**	**$66,579.73**	**$66,662.21**	**$66,746.55**	**$66,832.78**	**$66,920.95**	**$67,011.11**	**$67,103.29**	**$67,197.55**
19	CFL's: Homes with partial CFL installation	$479,055.44	$483,510.00	$488,064.79	$492,722.06	$497,484.12	$502,353.32	$507,332.08	$512,422.87	$517,628.20	$522,950.64
20	CFL's: Homes without CFL installation	$565,668.31	$571,498.36	$577,459.58	$583,554.93	$589,787.43	$596,160.16	$602,676.28	$609,339.01	$616,151.65	$623,117.57
		$1,044,723.75	**$1,055,008.36**	**$1,065,524.37**	**$1,076,276.99**	**$1,087,271.55**	**$1,098,513.48**	**$1,110,008.36**	**$1,121,761.88**	**$1,133,779.84**	**$1,146,068.21**
21	Water Heater Blanket	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
22	Low Flow Shower Head	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
23	Pipe Wrap	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
24	Low Flow Faucet Aerator	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
25	Solar Water Heating	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
26	Efficient Water Heating	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
27	Efficient Furnace Fan Motor (Fuel Oil)	$204,492.51	$205,115.59	$205,752.70	$206,404.13	$207,070.22	$207,751.30	$208,447.71	$209,159.78	$209,887.88	$210,632.35
28	Efficient Furnace Fan Motor (Natural Gas)	$43,142.37	$43,273.82	$43,408.23	$43,545.67	$43,686.20	$43,829.88	$43,976.81	$44,127.04	$44,280.64	$44,437.71
29	Efficient Furnace Fan Motor (Propane)	$59,103.89	$59,283.98	$59,468.11	$59,656.40	$59,848.92	$60,045.77	$60,247.05	$60,452.86	$60,663.29	$60,878.47
		$306,738.77	**$307,673.39**	**$308,629.04**	**$309,606.20**	**$310,605.34**	**$311,626.96**	**$312,671.56**	**$313,739.67**	**$314,831.82**	**$315,948.53**
30	Energy Star Windows - Electric Heat and no AC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
31	Insulation and Weatherization - Electric Heat and no AC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
32	Residential New Construction	$2,100,597.57	$2,629,662.63	$3,176,528.56	$3,741,787.03	$4,326,047.31	$4,929,936.80	$5,554,101.49	$6,199,206.51	$6,865,936.66	$7,554,996.95
		$2,100,597.57	**$2,629,662.63**	**$3,176,528.56**	**$3,741,787.03**	**$4,326,047.31**	**$4,929,936.80**	**$5,554,101.49**	**$6,199,206.51**	**$6,865,936.66**	**$7,554,996.95**
	Single Family / Low Income	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
33	Insulation and Weatherization - Electric Heat and no AC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
	Total for All Programs:	**$7,376,730.29**	**$7,928,541.38**	**$8,498,665.13**	**$9,087,704.72**	**$9,696,281.20**	**$10,325,033.99**	**$10,974,621.41**	**$11,645,721.17**	**$12,339,030.95**	**$13,055,268.90**

Table A-14: Single Family Total Budgets by Year
Fuel-Switching Programs
Maximum Achievable Measures Only

	Single Family	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
34	**Water Heater-Elec. To Natural Gas (1 Bedroom)**	$3,313.67	$3,331.98	$3,350.70	$3,369.84	$3,389.41	$3,409.42	$3,429.89	$3,450.81	$3,472.20	$3,494.08
35	**Water Heater-Elec. To Natural Gas (2 Bedroom)**	$20,399.12	$20,531.85	$20,667.57	$20,806.34	$20,948.23	$21,093.32	$21,241.67	$21,393.35	$21,548.45	$21,707.04
36	**Water Heater-Elec. To Natural Gas (3 Bedroom)**	$51,715.06	$52,096.78	$52,487.08	$52,886.16	$53,294.23	$53,711.47	$54,138.10	$54,574.34	$55,020.38	$55,476.47
37	**Water Heater-Elec. To Natural Gas (4 Bedroom)**	$25,764.06	$25,983.76	$26,208.39	$26,438.08	$26,672.94	$26,913.08	$27,158.62	$27,409.69	$27,666.41	$27,928.90
38	**Water Heater-Elec. To Natural Gas (5+ Bedroom)**	$8,228.45	$8,306.71	$8,386.74	$8,468.57	$8,552.23	$8,637.78	$8,725.26	$8,814.70	$8,906.16	$8,999.67
		$109,420.37	**$110,251.08**	**$111,100.47**	**$111,968.99**	**$112,857.04**	**$113,765.07**	**$114,693.53**	**$115,642.89**	**$116,613.60**	**$117,606.16**
39	**Water Heater-Elec. To Fuel Oil (1 Bedroom)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
40	**Water Heater-Elec. To Fuel Oil (2 Bedroom)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
41	**Water Heater-Elec. To Fuel Oil (3 Bedroom)**	$1,676,302.12	$1,681,363.27	$1,686,538.28	$1,691,829.74	$1,697,240.25	$1,702,772.50	$1,708,429.23	$1,714,213.23	$1,720,127.37	$1,726,174.58
42	**Water Heater-Elec. To Fuel Oil (4 Bedroom)**	$800,934.10	$803,858.74	$806,849.19	$809,906.92	$813,033.45	$816,230.33	$819,499.14	$822,841.49	$826,259.05	$829,753.51
43	**Water Heater-Elec. To Fuel Oil (5+ Bedroom)**	$245,555.78	$246,597.94	$247,663.55	$248,753.14	$249,867.24	$251,006.41	$252,171.21	$253,362.22	$254,580.02	$255,825.23
		$2,722,792.01	**$2,731,819.95**	**$2,741,051.02**	**$2,750,489.80**	**$2,760,140.94**	**$2,770,009.24**	**$2,780,099.57**	**$2,790,416.94**	**$2,800,966.44**	**$2,811,753.31**
44	**Water Heater-Elec. To Propane (1 Bedroom)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
45	**Water Heater-Elec. To Propane (2 Bedroom)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
46	**Water Heater-Elec. To Propane (3 Bedroom)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
47	**Water Heater-Elec. To Propane (4 Bedroom)**	$99,461.43	$100,079.31	$100,711.10	$101,357.10	$102,017.63	$102,693.03	$103,383.62	$104,089.75	$104,811.77	$105,550.04
48	**Water Heater-Elec. To Propane (5+ Bedroom)**	$30,903.04	$31,121.36	$31,344.59	$31,572.84	$31,806.23	$32,044.87	$32,288.88	$32,538.38	$32,793.49	$33,054.35
		$130,364.47	**$131,200.67**	**$132,055.68**	**$132,929.94**	**$133,823.86**	**$134,737.90**	**$135,672.50**	**$136,628.13**	**$137,605.26**	**$138,604.38**
49	**Water Heater-Elec. To Kerosene (1 Bedroom)**	$31,359.65	$31,412.74	$31,467.03	$31,522.54	$31,579.29	$31,637.33	$31,696.67	$31,757.34	$31,819.38	$31,882.82
50	**Water Heater-Elec. To Kerosene (2 Bedroom)**	$177,375.15	$177,743.59	$178,120.32	$178,505.53	$178,899.40	$179,302.14	$179,713.94	$180,135.00	$180,565.54	$181,005.76
51	**Water Heater-Elec. To Kerosene (3 Bedroom)**	$433,111.61	$434,171.62	$435,255.48	$436,363.73	$437,496.91	$438,655.59	$439,840.35	$441,051.75	$442,290.42	$443,556.95
52	**Water Heater-Elec. To Kerosene (4 Bedroom)**	$205,156.30	$205,767.32	$206,392.08	$207,030.91	$207,684.10	$208,351.99	$209,034.91	$209,733.20	$210,447.20	$211,177.26
53	**Water Heater-Elec. To Kerosene (5+ Bedroom)**	$62,703.04	$62,921.36	$63,144.59	$63,372.84	$63,606.23	$63,844.87	$64,088.88	$64,338.38	$64,593.49	$64,854.35
		$909,705.75	**$912,016.63**	**$914,379.50**	**$916,795.54**	**$919,265.94**	**$921,791.92**	**$924,374.74**	**$927,015.67**	**$929,716.03**	**$932,477.14**
54	**WH Fuel Switching (Electric to Kerosene- Stand Alone)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
55	**WH Fuel Switching (Electric to Wood)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
56	**Space Heating (Fuel Switching)**	$2,070,073.60	$2,101,659.63	$2,133,956.35	$2,166,979.74	$2,200,746.16	$2,235,272.32	$2,270,575.33	$2,306,672.65	$2,343,582.15	$2,381,322.13
		$2,070,073.60	**$2,101,659.63**	**$2,133,956.35**	**$2,166,979.74**	**$2,200,746.16**	**$2,235,272.32**	**$2,270,575.33**	**$2,306,672.65**	**$2,343,582.15**	**$2,381,322.13**
57	**Clothes Dryer (Fuel Switching)**	$487,807.62	$489,405.01	$491,038.34	$492,708.42	$494,416.08	$496,162.16	$497,947.53	$499,773.07	$501,639.68	$503,548.29
		$487,807.62	**$489,405.01**	**$491,038.34**	**$492,708.42**	**$494,416.08**	**$496,162.16**	**$497,947.53**	**$499,773.07**	**$501,639.68**	**$503,548.29**
	Total for All Programs:	**$6,430,163.81**	**$6,476,352.96**	**$6,523,581.37**	**$6,571,872.42**	**$6,621,250.02**	**$6,671,738.62**	**$6,723,363.20**	**$6,776,149.34**	**$6,830,123.17**	**$6,885,311.41**

Table A-15: Multi Family Program Budgets (without incentives) by Year
Maximum Achievable Measures Only

	Multi Family	$ per kWh Saved or Per Participant	Amount	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	**Refrigerator Turn-in**	Per participant	$92.53	$29,979.72	$30,654.26	$31,343.98	$32,049.22	$32,770.33	$33,507.66	$34,261.59	$35,032.47	$35,820.70	$36,626.67
2	**Freezer Turn-in**	Per participant	$92.53	$4,071.32	$4,162.92	$4,256.59	$4,352.36	$4,450.29	$4,550.42	$4,652.81	$4,757.50	$4,864.54	$4,973.99
3	**Room AC Turn-in without Replacement**	Per participant	$117.53	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4	**Room AC Turn-in with ES Replacement**	Per participant	$107.53	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$34,051.04	**$34,817.19**	**$35,600.58**	**$36,401.59**	**$37,220.62**	**$38,058.09**	**$38,914.39**	**$39,789.97**	**$40,685.24**	**$41,600.66**
5	**Energy Star Single Room Air Conditioner**	Per kWh	$0.0339	$1,008.41	$1,031.10	$1,054.30	$1,078.02	$1,102.28	$1,127.08	$1,152.44	$1,178.37	$1,204.88	$1,231.99
6	**Energy Star Compliant Top Freezer Refrigerator**	Per kWh	$0.0339	$4,453.50	$4,553.70	$4,656.16	$4,760.92	$4,868.04	$4,977.58	$5,089.57	$5,204.09	$5,321.18	$5,440.90
7	**Energy Star Compliant Bottom Mount Freezer Refrigerator**	Per kWh	$0.0339	$604.66	$618.26	$632.18	$646.40	$660.94	$675.81	$691.02	$706.57	$722.47	$738.72
8	**Energy Star Compliant Side-by-Side Refrigerator**	Per kWh	$0.0339	$2,083.85	$2,130.73	$2,178.68	$2,227.70	$2,277.82	$2,329.07	$2,381.47	$2,435.06	$2,489.85	$2,545.87
9	**Energy Star Compliant Upright Freezer (Manual Defrost)**	Per kWh	$0.0339	$1,212.03	$1,239.30	$1,267.19	$1,295.70	$1,324.85	$1,354.66	$1,385.14	$1,416.31	$1,448.17	$1,480.76
10	**Energy Star Compliant Chest Freezer**	Per kWh	$0.0339	$1,018.99	$1,041.92	$1,065.36	$1,089.33	$1,113.84	$1,138.90	$1,164.53	$1,190.73	$1,217.52	$1,244.91
11	**Energy Star Built-In Dishwasher (Electric)**	Per kWh	$0.0339	$3,856.81	$3,943.58	$4,032.31	$4,123.04	$4,215.81	$4,310.67	$4,407.66	$4,506.83	$4,608.23	$4,711.92
12	**Energy Star Clothes Washers with Electric Water Heater**	Per kWh	$0.0339	$3,302.69	$3,377.01	$3,452.99	$3,530.68	$3,610.12	$3,691.35	$3,774.40	$3,859.33	$3,946.16	$4,034.95
13	**Energy Star Clothes Washers with Non-Electric Water Heater**	Per kWh	$0.0339	$1,698.95	$1,737.17	$1,776.26	$1,816.23	$1,857.09	$1,898.88	$1,941.60	$1,985.29	$2,029.95	$2,075.63
14	**Energy Star Dehumidifier (40 pt)**	Per kWh	$0.0339	$5,073.41	$5,187.57	$5,304.29	$5,423.63	$5,545.66	$5,670.44	$5,798.03	$5,928.48	$6,061.87	$6,198.27
				$24,313.30	**$24,860.35**	**$25,419.71**	**$25,991.65**	**$26,576.46**	**$27,174.43**	**$27,785.86**	**$28,411.04**	**$29,050.29**	**$29,703.92**
15	**Standby-Power**	Per kWh	$0.0339	$27,429.05	$28,046.21	$28,677.25	$29,322.48	$29,982.24	$30,656.84	$31,346.62	$32,051.92	$32,773.09	$33,510.48
				$27,429.05	**$28,046.21**	**$28,677.25**	**$29,322.48**	**$29,982.24**	**$30,656.84**	**$31,346.62**	**$32,051.92**	**$32,773.09**	**$33,510.48**
16	**Pool Pump & Motor**	Per kWh	$0.0339	$2,346.60	$2,399.39	$2,453.38	$2,508.58	$2,565.03	$2,622.74	$2,681.75	$2,742.09	$2,803.79	$2,866.87
				$2,346.60	**$2,399.39**	**$2,453.38**	**$2,508.58**	**$2,565.03**	**$2,622.74**	**$2,681.75**	**$2,742.09**	**$2,803.79**	**$2,866.87**
17	**Energy Star Compliant Programmable Thermostat**	Per kWh	$0.0339	$1,354.76	$1,385.25	$1,416.41	$1,448.28	$1,480.87	$1,514.19	$1,548.26	$1,583.09	$1,618.71	$1,655.14
				$1,354.76	**$1,385.25**	**$1,416.41**	**$1,448.28**	**$1,480.87**	**$1,514.19**	**$1,548.26**	**$1,583.09**	**$1,618.71**	**$1,655.14**
18	**High Efficiency Central AC**	Per kWh	$0.0339	$644.21	$658.70	$673.52	$688.68	$704.17	$720.02	$736.22	$752.78	$769.72	$787.04
				$644.21	**$658.70**	**$673.52**	**$688.68**	**$704.17**	**$720.02**	**$736.22**	**$752.78**	**$769.72**	**$787.04**
19	**CFL's: Homes with partial CFL installation**	Per Participant	$0.0339	$36,316.37	$37,133.49	$37,968.99	$38,823.30	$39,696.82	$40,590.00	$41,503.27	$42,437.10	$43,391.93	$44,368.25
20	**CFL's: Homes without CFL installation**	Per participant	$0.0339	$47,530.10	$48,599.52	$49,693.01	$50,811.11	$51,954.36	$53,123.33	$54,318.60	$55,540.77	$56,790.44	$58,068.23
				$83,846.47	**$85,733.01**	**$87,662.01**	**$89,634.40**	**$91,651.18**	**$93,713.33**	**$95,821.88**	**$97,977.87**	**$100,182.37**	**$102,436.48**
21	**Water Heater Blanket**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
22	**Low Flow Shower Head**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
23	**Pipe Wrap**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
24	**Low Flow Faucet Aerator**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
25	**Solar Water Heating**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
26	**Efficient Water Heating**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
27	**Efficient Furnace Fan Motor (Fuel Oil)**	Per kWh	$0.0339	$3,179.63	$3,251.17	$3,324.32	$3,399.12	$3,475.60	$3,553.80	$3,633.76	$3,715.52	$3,799.12	$3,884.60
28	**Efficient Furnace Fan Motor (Natural Gas)**	Per kWh	$0.0339	$2,866.36	$2,930.86	$2,996.80	$3,064.23	$3,133.17	$3,203.67	$3,275.75	$3,349.46	$3,424.82	$3,501.88
29	**Efficient Furnace Fan Motor (Propane)**	Per kWh	$0.0339	$1,268.72	$1,297.26	$1,326.45	$1,356.30	$1,386.81	$1,418.02	$1,449.92	$1,482.55	$1,515.90	$1,550.01
				$7,314.71	**$7,479.29**	**$7,647.57**	**$7,819.64**	**$7,995.59**	**$8,175.49**	**$8,359.43**	**$8,547.52**	**$8,739.84**	**$8,936.49**
30	**Energy Star Windows - Electric Heat and no AC**	Per kWh	$0.3424	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
31	**Insulation and Weatherization - Electric Heat and no AC**	Per kWh	$0.3424	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

	Multi Family / Low Income			2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
33	**Insulation and Weatherization - Electric Heat and no AC**	Per kWh	$0.3424	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
	Total for All Programs:			**$181,300.14**	**$185,379.39**	**$189,550.43**	**$193,815.31**	**$198,176.15**	**$202,635.12**	**$207,194.41**	**$211,856.28**	**$216,623.05**	**$221,497.07**

Table A-16: Multi Family Program Budgets (without incentives) by Year
Fuel-Switching Programs
Maximum Achievable Measures Only

	Multi Family	$ per kWh Saved or Per Participant	Amount	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
34	**Water Heater-Elec. To Natural Gas (1 Bedroom)**	Per kWh	$0.0339	$1,139.14	$1,164.77	$1,190.98	$1,217.78	$1,245.18	$1,273.19	$1,301.84	$1,331.13	$1,361.08	$1,391.71
35	**Water Heater-Elec. To Natural Gas (2 Bedroom)**	Per kWh	$0.0339	$2,441.02	$2,495.94	$2,552.10	$2,609.52	$2,668.23	$2,728.27	$2,789.66	$2,852.42	$2,916.60	$2,982.23
36	**Water Heater-Elec. To Natural Gas (3 Bedroom)**	Per kWh	$0.0339	$2,196.91	$2,246.34	$2,296.89	$2,348.57	$2,401.41	$2,455.44	$2,510.69	$2,567.18	$2,624.94	$2,684.00
37	**Water Heater-Elec. To Natural Gas (4 Bedroom)**	Per kWh	$0.0339	$610.25	$623.98	$638.02	$652.38	$667.06	$682.07	$697.41	$713.11	$729.15	$745.56
38	**Water Heater-Elec. To Natural Gas (5+ Bedroom)**	Per kWh	$0.0339	$183.08	$187.20	$191.41	$195.71	$200.12	$204.62	$209.22	$213.93	$218.75	$223.67
				$6,570.40	**$6,718.24**	**$6,869.40**	**$7,023.96**	**$7,182.00**	**$7,343.59**	**$7,508.82**	**$7,677.77**	**$7,850.52**	**$8,027.16**
39	**Water Heater-Elec. To Fuel Oil (1 Bedroom)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
40	**Water Heater-Elec. To Fuel Oil (2 Bedroom)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
41	**Water Heater-Elec. To Fuel Oil (3 Bedroom)**	Per kWh	$0.0339	$28,803.99	$29,452.08	$30,114.75	$30,792.33	$31,485.16	$32,193.58	$32,917.93	$33,658.58	$34,415.90	$35,190.26
42	**Water Heater-Elec. To Fuel Oil (4 Bedroom)**	Per kWh	$0.0339	$8,238.43	$8,423.79	$8,613.33	$8,807.13	$9,005.29	$9,207.91	$9,415.09	$9,626.93	$9,843.53	$10,065.01
43	**Water Heater-Elec. To Fuel Oil (5+ Bedroom)**	Per kWh	$0.0339	$1,647.69	$1,684.76	$1,722.67	$1,761.43	$1,801.06	$1,841.58	$1,883.02	$1,925.39	$1,968.71	$2,013.00
				$38,690.10	**$39,560.63**	**$40,450.75**	**$41,360.89**	**$42,291.51**	**$43,243.07**	**$44,216.03**	**$45,210.90**	**$46,228.14**	**$47,268.27**
44	**Water Heater-Elec. To Propane (1 Bedroom)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
45	**Water Heater-Elec. To Propane (2 Bedroom)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
46	**Water Heater-Elec. To Propane (3 Bedroom)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
47	**Water Heater-Elec. To Propane (4 Bedroom)**	Per kWh	$0.0339	$1,678.20	$1,715.96	$1,754.57	$1,794.04	$1,834.41	$1,875.69	$1,917.89	$1,961.04	$2,005.16	$2,050.28
48	**Water Heater-Elec. To Propane (5+ Bedroom)**	Per kWh	$0.0339	$366.15	$374.39	$382.81	$391.43	$400.24	$409.24	$418.45	$427.86	$437.49	$447.33
				$2,044.35	**$2,090.35**	**$2,137.38**	**$2,185.47**	**$2,234.65**	**$2,284.93**	**$2,336.34**	**$2,388.90**	**$2,442.65**	**$2,497.61**
49	**Water Heater-Elec. To Kerosene (1 Bedroom)**	Per kWh	$0.0339	$3,091.95	$3,161.52	$3,232.66	$3,305.39	$3,379.76	$3,455.81	$3,533.56	$3,613.07	$3,694.36	$3,777.49
50	**Water Heater-Elec. To Kerosene (2 Bedroom)**	Per kWh	$0.0339	$6,712.79	$6,863.83	$7,018.27	$7,176.18	$7,337.64	$7,502.74	$7,671.55	$7,844.16	$8,020.66	$8,201.12
51	**Water Heater-Elec. To Kerosene (3 Bedroom)**	Per kWh	$0.0339	$5,980.49	$6,115.05	$6,252.64	$6,393.32	$6,537.17	$6,684.26	$6,834.66	$6,988.43	$7,145.67	$7,306.45
52	**Water Heater-Elec. To Kerosene (4 Bedroom)**	Per kWh	$0.0339	$1,678.20	$1,715.96	$1,754.57	$1,794.04	$1,834.41	$1,875.69	$1,917.89	$1,961.04	$2,005.16	$2,050.28
53	**Water Heater-Elec. To Kerosene (5+ Bedroom)**	Per kWh	$0.0339	$366.15	$374.39	$382.81	$391.43	$400.24	$409.24	$418.45	$427.86	$437.49	$447.33
				$17,829.59	**$18,230.75**	**$18,640.95**	**$19,060.37**	**$19,489.22**	**$19,927.73**	**$20,376.11**	**$20,834.57**	**$21,303.35**	**$21,782.67**
54	**WH Fuel Switching (Electric to Kerosene- Stand Alone)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
55	**WH Fuel Switching (Electric to Wood)**	Per kWh	$0.0339	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
56	**Space Heating (Fuel Switching)**	Per kWh	$0.3424	$130,110.48	$133,037.97	$136,031.32	$139,092.02	$142,221.60	$145,421.58	$148,693.57	$152,039.17	$155,460.05	$158,957.90
				$130,110.48	**$133,037.97**	**$136,031.32**	**$139,092.02**	**$142,221.60**	**$145,421.58**	**$148,693.57**	**$152,039.17**	**$155,460.05**	**$158,957.90**
57	**Clothes Dryer (Fuel Switching)**	Per kWh	$0.0339	$16,191.87	$16,556.19	$16,928.70	$17,309.60	$17,699.06	$18,097.29	$18,504.48	$18,920.83	$19,346.55	$19,781.85
				$16,191.87	**$16,556.19**	**$16,928.70**	**$17,309.60**	**$17,699.06**	**$18,097.29**	**$18,504.48**	**$18,920.83**	**$19,346.55**	**$19,781.85**
			Total for All Programs:	**$211,436.79**	**$216,194.12**	**$221,058.49**	**$226,032.30**	**$231,118.03**	**$236,318.19**	**$241,635.35**	**$247,072.14**	**$252,631.26**	**$258,315.47**

Table A-17: Multi Family Incentive Budgets by Year
Maximum Achievable Measures Only

	Multi Family	Incremental $	Incentive $	$2,006	$2,007	$2,008	$2,009	$2,010	$2,011	$2,012	$2,013	$2,014	$2,015
1	Refrigerator Turn-in	$50.00	$50.00	$16,200.00	$16,200.00	$16,200.00	$16,200.00	$16,200.00	$16,200.00	$16,200.00	$16,200.00	$16,200.00	$16,200.00
2	Freezer Turn-in	$50.00	$50.00	$2,200.00	$2,200.00	$2,200.00	$2,200.00	$2,200.00	$2,200.00	$2,200.00	$2,200.00	$2,200.00	$2,200.00
3	Room AC Turn-in without Replacement	$25.00	$25.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4	Room AC Turn-in with ES Replacement	$35.00	$35.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$18,400.00	**$18,400.00**	**$18,400.00**	**$18,400.00**	**$18,400.00**	**$18,400.00**	**$18,400.00**	**$18,400.00**	**$18,400.00**	**$18,400.00**
5	Energy Star Single Room Air Conditioner	$30.00	$15.00	$10,140.00	$10,140.00	$10,140.00	$10,140.00	$10,140.00	$10,140.00	$10,140.00	$10,140.00	$10,140.00	$10,140.00
6	Energy Star Compliant Top Freezer Refrigerator	$30.00	$15.00	$24,630.00	$24,630.00	$24,630.00	$24,630.00	$24,630.00	$24,630.00	$24,630.00	$24,630.00	$24,630.00	$24,630.00
7	Energy Star Compliant Bottom Mount Freezer Refrigerator	$30.00	$15.00	$3,075.00	$3,075.00	$3,075.00	$3,075.00	$3,075.00	$3,075.00	$3,075.00	$3,075.00	$3,075.00	$3,075.00
8	Energy Star Compliant Side-by-Side Refrigerator	$30.00	$15.00	$9,705.00	$9,705.00	$9,705.00	$9,705.00	$9,705.00	$9,705.00	$9,705.00	$9,705.00	$9,705.00	$9,705.00
9	Energy Star Compliant Upright Freezer (Manual Defrost)	$33.00	$16.50	$10,725.00	$10,725.00	$10,725.00	$10,725.00	$10,725.00	$10,725.00	$10,725.00	$10,725.00	$10,725.00	$10,725.00
10	Energy Star Compliant Chest Freezer	$33.00	$16.50	$9,537.00	$9,537.00	$9,537.00	$9,537.00	$9,537.00	$9,537.00	$9,537.00	$9,537.00	$9,537.00	$9,537.00
11	Energy Star Built-In Dishwasher (Electric)	$50.00	$25.00	$39,500.00	$39,500.00	$39,500.00	$39,500.00	$39,500.00	$39,500.00	$39,500.00	$39,500.00	$39,500.00	$39,500.00
12	Energy Star Clothes Washers with Electric Water Heater	$300.00	$150.00	$135,300.00	$135,300.00	$135,300.00	$135,300.00	$135,300.00	$135,300.00	$135,300.00	$135,300.00	$135,300.00	$135,300.00
13	Energy Star Clothes Washers with Non-Electric Water Heater	$300.00	$150.00	$259,200.00	$259,200.00	$259,200.00	$259,200.00	$259,200.00	$259,200.00	$259,200.00	$259,200.00	$259,200.00	$259,200.00
14	Energy Star Dehumidifier (40 pt)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$501,812.00	**$501,812.00**	**$501,812.00**	**$501,812.00**	**$501,812.00**	**$501,812.00**	**$501,812.00**	**$501,812.00**	**$501,812.00**	**$501,812.00**
15	Standby-Power	$30.00	$15.00	$45,795.00	$45,795.00	$45,795.00	$45,795.00	$45,795.00	$45,795.00	$45,795.00	$45,795.00	$45,795.00	$45,795.00
				$45,795.00	**$45,795.00**	**$45,795.00**	**$45,795.00**	**$45,795.00**	**$45,795.00**	**$45,795.00**	**$45,795.00**	**$45,795.00**	**$45,795.00**
16	Pool Pump & Motor	$313.00	$156.50	$17,058.50	$17,058.50	$17,058.50	$17,058.50	$17,058.50	$17,058.50	$17,058.50	$17,058.50	$17,058.50	$17,058.50
				$17,058.50	**$17,058.50**	**$17,058.50**	**$17,058.50**	**$17,058.50**	**$17,058.50**	**$17,058.50**	**$17,058.50**	**$17,058.50**	**$17,058.50**
17	Energy Star Compliant Programmable Thermostat	$50.00	$25.00	$3,375.00	$3,375.00	$3,375.00	$3,375.00	$3,375.00	$3,375.00	$3,375.00	$3,375.00	$3,375.00	$3,375.00
				$3,375.00	**$3,375.00**	**$3,375.00**	**$3,375.00**	**$3,375.00**	**$3,375.00**	**$3,375.00**	**$3,375.00**	**$3,375.00**	**$3,375.00**
18	High Efficiency Central AC	$379.00	$189.50	$11,559.50	$11,559.50	$11,559.50	$11,559.50	$11,559.50	$11,559.50	$11,559.50	$11,559.50	$11,559.50	$11,559.50
				$11,559.50	**$11,559.50**	**$11,559.50**	**$11,559.50**	**$11,559.50**	**$11,559.50**	**$11,559.50**	**$11,559.50**	**$11,559.50**	**$11,559.50**
19	CFL's: Homes with partial CFL installation	$5.00	$1.25	$51,558.75	$51,558.75	$51,558.75	$51,558.75	$51,558.75	$51,558.75	$51,558.75	$51,558.75	$51,558.75	$51,558.75
20	CFL's: Homes without CFL installation	$5.00	$1.25	$56,232.50	$56,232.50	$56,232.50	$56,232.50	$56,232.50	$56,232.50	$56,232.50	$56,232.50	$56,232.50	$56,232.50
				$107,791.25	**$107,791.25**	**$107,791.25**	**$107,791.25**	**$107,791.25**	**$107,791.25**	**$107,791.25**	**$107,791.25**	**$107,791.25**	**$107,791.25**
21	Water Heater Blanket	$35.00	$17.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
22	Low Flow Shower Head	$15.00	$7.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
23	Pipe Wrap	$15.00	$7.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
24	Low Flow Faucet Aerator	$6.00	$3.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
25	Solar Water Heating	$4,500.00	$900.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
26	Efficient Water Heating	$90.00	$45.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
27	Efficient Furnace Fan Motor (Fuel Oil)	$200.00	$100.00	$20,300.00	$20,300.00	$20,300.00	$20,300.00	$20,300.00	$20,300.00	$20,300.00	$20,300.00	$20,300.00	$20,300.00
28	Efficient Furnace Fan Motor (Natural Gas)	$200.00	$100.00	$18,300.00	$18,300.00	$18,300.00	$18,300.00	$18,300.00	$18,300.00	$18,300.00	$18,300.00	$18,300.00	$18,300.00
29	Efficient Furnace Fan Motor (Propane)	$200.00	$100.00	$8,100.00	$8,100.00	$8,100.00	$8,100.00	$8,100.00	$8,100.00	$8,100.00	$8,100.00	$8,100.00	$8,100.00
				$46,700.00	**$46,700.00**	**$46,700.00**	**$46,700.00**	**$46,700.00**	**$46,700.00**	**$46,700.00**	**$46,700.00**	**$46,700.00**	**$46,700.00**
30	Energy Star Windows - Electric Heat and no AC	$200.00	$100.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
31	Insulation and Weatherization - Electric Heat and no AC	$2,000.00	$1,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
	Multi Family / Low Income			2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
33	Insulation and Weatherization - Electric Heat and no AC	$2,000.00	$2,000.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
			Total for All Programs:	**$752,491.25**	**$752,491.25**	**$752,491.25**	**$752,491.25**	**$752,491.25**	**$752,491.25**	**$752,491.25**	**$752,491.25**	**$752,491.25**	**$752,491.25**

Table A-18: Multi Family Incentive Budgets by Year
Fuel-Switching Programs
Maximum Achievable Measures Only

	Multi Family	Incremental $	Incentive $	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
34	**Water Heater-Elec. To Natural Gas (1 Bedroom)**	$500.00	$250.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00
35	**Water Heater-Elec. To Natural Gas (2 Bedroom)**	$500.00	$250.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00
36	**Water Heater-Elec. To Natural Gas (3 Bedroom)**	$500.00	$250.00	$4,500.00	$4,500.00	$4,500.00	$4,500.00	$4,500.00	$4,500.00	$4,500.00	$4,500.00	$4,500.00	$4,500.00
37	**Water Heater-Elec. To Natural Gas (4 Bedroom)**	$500.00	$250.00	$1,000.00	$1,000.00	$1,000.00	$1,000.00	$1,000.00	$1,000.00	$1,000.00	$1,000.00	$1,000.00	$1,000.00
38	**Water Heater-Elec. To Natural Gas (5+ Bedroom)**	$500.00	$250.00	$250.00	$250.00	$250.00	$250.00	$250.00	$250.00	$250.00	$250.00	$250.00	$250.00
				$15,250.00	**$15,250.00**	**$15,250.00**	**$15,250.00**	**$15,250.00**	**$15,250.00**	**$15,250.00**	**$15,250.00**	**$15,250.00**	**$15,250.00**
39	**Water Heater-Elec. To Fuel Oil (1 Bedroom)**	$1,575.00	$787.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
40	**Water Heater-Elec. To Fuel Oil (2 Bedroom)**	$1,575.00	$787.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
41	**Water Heater-Elec. To Fuel Oil (3 Bedroom)**	$1,575.00	$787.50	$185,850.00	$185,850.00	$185,850.00	$185,850.00	$185,850.00	$185,850.00	$185,850.00	$185,850.00	$185,850.00	$185,850.00
42	**Water Heater-Elec. To Fuel Oil (4 Bedroom)**	$1,575.00	$787.50	$42,525.00	$42,525.00	$42,525.00	$42,525.00	$42,525.00	$42,525.00	$42,525.00	$42,525.00	$42,525.00	$42,525.00
43	**Water Heater-Elec. To Fuel Oil (5+ Bedroom)**	$1,575.00	$787.50	$7,087.50	$7,087.50	$7,087.50	$7,087.50	$7,087.50	$7,087.50	$7,087.50	$7,087.50	$7,087.50	$7,087.50
				$235,462.50	**$235,462.50**	**$235,462.50**	**$235,462.50**	**$235,462.50**	**$235,462.50**	**$235,462.50**	**$235,462.50**	**$235,462.50**	**$235,462.50**
44	**Water Heater-Elec. To Propane (1 Bedroom)**	$800.00	$400.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
45	**Water Heater-Elec. To Propane (2 Bedroom)**	$800.00	$400.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
46	**Water Heater-Elec. To Propane (3 Bedroom)**	$800.00	$400.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
47	**Water Heater-Elec. To Propane (4 Bedroom)**	$800.00	$400.00	$4,400.00	$4,400.00	$4,400.00	$4,400.00	$4,400.00	$4,400.00	$4,400.00	$4,400.00	$4,400.00	$4,400.00
48	**Water Heater-Elec. To Propane (5+ Bedroom)**	$800.00	$400.00	$800.00	$800.00	$800.00	$800.00	$800.00	$800.00	$800.00	$800.00	$800.00	$800.00
				$5,200.00	**$5,200.00**	**$5,200.00**	**$5,200.00**	**$5,200.00**	**$5,200.00**	**$5,200.00**	**$5,200.00**	**$5,200.00**	**$5,200.00**
49	**Water Heater-Elec. To Kerosene (1 Bedroom)**	$2,000.00	$1,000.00	$38,000.00	$38,000.00	$38,000.00	$38,000.00	$38,000.00	$38,000.00	$38,000.00	$38,000.00	$38,000.00	$38,000.00
50	**Water Heater-Elec. To Kerosene (2 Bedroom)**	$2,000.00	$1,000.00	$66,000.00	$66,000.00	$66,000.00	$66,000.00	$66,000.00	$66,000.00	$66,000.00	$66,000.00	$66,000.00	$66,000.00
51	**Water Heater-Elec. To Kerosene (3 Bedroom)**	$2,000.00	$1,000.00	$49,000.00	$49,000.00	$49,000.00	$49,000.00	$49,000.00	$49,000.00	$49,000.00	$49,000.00	$49,000.00	$49,000.00
52	**Water Heater-Elec. To Kerosene (4 Bedroom)**	$2,000.00	$1,000.00	$11,000.00	$11,000.00	$11,000.00	$11,000.00	$11,000.00	$11,000.00	$11,000.00	$11,000.00	$11,000.00	$11,000.00
53	**Water Heater-Elec. To Kerosene (5+ Bedroom)**	$2,000.00	$1,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00
				$166,000.00	**$166,000.00**	**$166,000.00**	**$166,000.00**	**$166,000.00**	**$166,000.00**	**$166,000.00**	**$166,000.00**	**$166,000.00**	**$166,000.00**
54	**WH Fuel Switching (Electric to Kerosene- Stand Alone)**	$1,880.00	$940.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
55	**WH Fuel Switching (Electric to Wood)**	$1,320.00	$660.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
				$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
56	**Space Heating (Fuel Switching)**	$6,500.00	$3,250.00	$123,500.00	$123,500.00	$123,500.00	$123,500.00	$123,500.00	$123,500.00	$123,500.00	$123,500.00	$123,500.00	$123,500.00
				$123,500.00	**$123,500.00**	**$123,500.00**	**$123,500.00**	**$123,500.00**	**$123,500.00**	**$123,500.00**	**$123,500.00**	**$123,500.00**	**$123,500.00**
57	**Clothes Dryer (Fuel Switching)**	$375.00	$187.50	$95,062.50	$95,062.50	$95,062.50	$95,062.50	$95,062.50	$95,062.50	$95,062.50	$95,062.50	$95,062.50	$95,062.50
				$95,062.50	**$95,062.50**	**$95,062.50**	**$95,062.50**	**$95,062.50**	**$95,062.50**	**$95,062.50**	**$95,062.50**	**$95,062.50**	**$95,062.50**
	Total for All Programs:			**$640,475.00**	**$640,475.00**	**$640,475.00**	**$640,475.00**	**$640,475.00**	**$640,475.00**	**$640,475.00**	**$640,475.00**	**$640,475.00**	**$640,475.00**

Table A-19: Multi Family Total Budgets by Year
Maximum Achievable Measures Only

	Multi Family	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Refrigerator Turn-in	$46,179.72	$46,854.26	$47,543.98	$48,249.22	$48,970.33	$49,707.66	$50,461.59	$51,232.47	$52,020.70	$52,826.67
2	Freezer Turn-in	$6,271.32	$6,362.92	$6,456.59	$6,552.36	$6,650.29	$6,750.42	$6,852.81	$6,957.50	$7,064.54	$7,173.99
3	Room AC Turn-in without Replacement	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4	Room AC Turn-in with ES Replacement	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$52,451.04	**$53,217.19**	**$54,000.58**	**$54,801.59**	**$55,620.62**	**$56,458.09**	**$57,314.39**	**$58,189.97**	**$59,085.24**	**$60,000.66**
5	Energy Star Single Room Air Conditioner	$11,148.41	$11,171.10	$11,194.30	$11,218.02	$11,242.28	$11,267.08	$11,292.44	$11,318.37	$11,344.88	$11,371.99
6	Energy Star Compliant Top Freezer Refrigerator	$29,083.50	$29,183.70	$29,286.16	$29,390.92	$29,498.04	$29,607.58	$29,719.57	$29,834.09	$29,951.18	$30,070.90
7	Energy Star Compliant Bottom Mount Freezer Refrigerator	$3,679.66	$3,693.26	$3,707.18	$3,721.40	$3,735.94	$3,750.81	$3,766.02	$3,781.57	$3,797.47	$3,813.72
8	Energy Star Compliant Side-by-Side Refrigerator	$11,788.85	$11,835.73	$11,883.68	$11,932.70	$11,982.82	$12,034.07	$12,086.47	$12,140.06	$12,194.85	$12,250.87
9	Energy Star Compliant Upright Freezer (Manual Defrost)	$11,937.03	$11,964.30	$11,992.19	$12,020.70	$12,049.85	$12,079.66	$12,110.14	$12,141.31	$12,173.17	$12,205.76
10	Energy Star Compliant Chest Freezer	$10,555.99	$10,578.92	$10,602.36	$10,626.33	$10,650.84	$10,675.90	$10,701.53	$10,727.73	$10,754.52	$10,781.91
11	Energy Star Built-In Dishwasher (Electric)	$43,356.81	$43,443.58	$43,532.31	$43,623.04	$43,715.81	$43,810.67	$43,907.66	$44,006.83	$44,108.23	$44,211.92
12	Energy Star Clothes Washers with Electric Water Heater	$138,602.69	$138,677.01	$138,752.99	$138,830.68	$138,910.12	$138,991.35	$139,074.40	$139,159.33	$139,246.16	$139,334.95
13	Energy Star Clothes Washers with Non-Electric Water Heater	$260,898.95	$260,937.17	$260,976.26	$261,016.23	$261,057.09	$261,098.88	$261,141.60	$261,185.29	$261,229.95	$261,275.63
14	Energy Star Dehumidifier (40 pt)	$5,073.41	$5,187.57	$5,304.29	$5,423.63	$5,545.66	$5,670.44	$5,798.03	$5,928.48	$6,061.87	$6,198.27
		$526,125.30	**$526,672.35**	**$527,231.71**	**$527,803.65**	**$528,388.46**	**$528,986.43**	**$529,597.86**	**$530,223.04**	**$530,862.29**	**$531,515.92**
15	Standby-Power	$73,224.05	$73,841.21	$74,472.25	$75,117.48	$75,777.24	$76,451.84	$77,141.62	$77,846.92	$78,568.09	$79,305.48
		$73,224.05	**$73,841.21**	**$74,472.25**	**$75,117.48**	**$75,777.24**	**$76,451.84**	**$77,141.62**	**$77,846.92**	**$78,568.09**	**$79,305.48**
16	Pool Pump & Motor	$19,405.10	$19,457.89	$19,511.88	$19,567.08	$19,623.53	$19,681.24	$19,740.25	$19,800.59	$19,862.29	$19,925.37
		$19,405.10	**$19,457.89**	**$19,511.88**	**$19,567.08**	**$19,623.53**	**$19,681.24**	**$19,740.25**	**$19,800.59**	**$19,862.29**	**$19,925.37**
17	Energy Star Compliant Programmable Thermostat	$4,729.76	$4,760.25	$4,791.41	$4,823.28	$4,855.87	$4,889.19	$4,923.26	$4,958.09	$4,993.71	$5,030.14
		$4,729.76	**$4,760.25**	**$4,791.41**	**$4,823.28**	**$4,855.87**	**$4,889.19**	**$4,923.26**	**$4,958.09**	**$4,993.71**	**$5,030.14**
18	High Efficiency Central AC	$12,203.71	$12,218.20	$12,233.02	$12,248.18	$12,263.67	$12,279.52	$12,295.72	$12,312.28	$12,329.22	$12,346.54
		$12,203.71	**$12,218.20**	**$12,233.02**	**$12,248.18**	**$12,263.67**	**$12,279.52**	**$12,295.72**	**$12,312.28**	**$12,329.22**	**$12,346.54**
19	CFL's: Homes with partial CFL installation	$87,875.12	$88,692.24	$89,527.74	$90,382.05	$91,255.57	$92,148.75	$93,062.02	$93,995.85	$94,950.68	$95,927.00
20	CFL's: Homes without CFL installation	$103,762.60	$104,832.02	$105,925.51	$107,043.61	$108,186.86	$109,355.83	$110,551.10	$111,773.27	$113,022.94	$114,300.73
		$191,637.72	**$193,524.26**	**$195,453.26**	**$197,425.65**	**$199,442.43**	**$201,504.58**	**$203,613.13**	**$205,769.12**	**$207,973.62**	**$210,227.73**
21	Water Heater Blanket	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
22	Low Flow Shower Head	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
23	Pipe Wrap	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
24	Low Flow Faucet Aerator	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
25	Solar Water Heating	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
26	Efficient Water Heating	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
27	Efficient Furnace Fan Motor (Fuel Oil)	$23,479.63	$23,551.17	$23,624.32	$23,699.12	$23,775.60	$23,853.80	$23,933.76	$24,015.52	$24,099.12	$24,184.60
28	Efficient Furnace Fan Motor (Natural Gas)	$21,166.36	$21,230.86	$21,296.80	$21,364.23	$21,433.17	$21,503.67	$21,575.75	$21,649.46	$21,724.82	$21,801.88
29	Efficient Furnace Fan Motor (Propane)	$9,368.72	$9,397.26	$9,426.45	$9,456.30	$9,486.81	$9,518.02	$9,549.92	$9,582.55	$9,615.90	$9,650.01
		$54,014.71	**$54,179.29**	**$54,347.57**	**$54,519.64**	**$54,695.59**	**$54,875.49**	**$55,059.43**	**$55,247.52**	**$55,439.84**	**$55,636.49**
30	Energy Star Windows - Electric Heat and no AC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
31	Insulation and Weatherization - Electric Heat and no AC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
	Multi Family / Low Income	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
33	Insulation and Weatherization - Electric Heat and no AC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
	Total for All Programs:	**$933,791.39**	**$937,870.64**	**$942,041.68**	**$946,306.56**	**$950,667.40**	**$955,126.37**	**$959,685.66**	**$964,347.53**	**$969,114.30**	**$973,988.32**

Table A-20: Multi Family Total Budgets by Year
Fuel-Switching Programs
Maximum Achievable Measures Only

	Multi Family	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
34	**Water Heater-Elec. To Natural Gas (1 Bedroom)**	$4,639.14	$4,664.77	$4,690.98	$4,717.78	$4,745.18	$4,773.19	$4,801.84	$4,831.13	$4,861.08	$4,891.71
35	**Water Heater-Elec. To Natural Gas (2 Bedroom)**	$8,441.02	$8,495.94	$8,552.10	$8,609.52	$8,668.23	$8,728.27	$8,789.66	$8,852.42	$8,916.60	$8,982.23
36	**Water Heater-Elec. To Natural Gas (3 Bedroom)**	$6,696.91	$6,746.34	$6,796.89	$6,848.57	$6,901.41	$6,955.44	$7,010.69	$7,067.18	$7,124.94	$7,184.00
37	**Water Heater-Elec. To Natural Gas (4 Bedroom)**	$1,610.25	$1,623.98	$1,638.02	$1,652.38	$1,667.06	$1,682.07	$1,697.41	$1,713.11	$1,729.15	$1,745.56
38	**Water Heater-Elec. To Natural Gas (5+ Bedroom)**	$433.08	$437.20	$441.41	$445.71	$450.12	$454.62	$459.22	$463.93	$468.75	$473.67
		$21,820.40	**$21,968.24**	**$22,119.40**	**$22,273.96**	**$22,432.00**	**$22,593.59**	**$22,758.82**	**$22,927.77**	**$23,100.52**	**$23,277.16**
39	**Water Heater-Elec. To Fuel Oil (1 Bedroom)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
40	**Water Heater-Elec. To Fuel Oil (2 Bedroom)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
41	**Water Heater-Elec. To Fuel Oil (3 Bedroom)**	$214,653.99	$215,302.08	$215,964.75	$216,642.33	$217,335.16	$218,043.58	$218,767.93	$219,508.58	$220,265.90	$221,040.26
42	**Water Heater-Elec. To Fuel Oil (4 Bedroom)**	$50,763.43	$50,948.79	$51,138.33	$51,332.13	$51,530.29	$51,732.91	$51,940.09	$52,151.93	$52,368.53	$52,590.01
43	**Water Heater-Elec. To Fuel Oil (5+ Bedroom)**	$8,735.19	$8,772.26	$8,810.17	$8,848.93	$8,888.56	$8,929.08	$8,970.52	$9,012.89	$9,056.21	$9,100.50
		$274,152.60	**$275,023.13**	**$275,913.25**	**$276,823.39**	**$277,754.01**	**$278,705.57**	**$279,678.53**	**$280,673.40**	**$281,690.64**	**$282,730.77**
44	**Water Heater-Elec. To Propane (1 Bedroom)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
45	**Water Heater-Elec. To Propane (2 Bedroom)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
46	**Water Heater-Elec. To Propane (3 Bedroom)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
47	**Water Heater-Elec. To Propane (4 Bedroom)**	$6,078.20	$6,115.96	$6,154.57	$6,194.04	$6,234.41	$6,275.69	$6,317.89	$6,361.04	$6,405.16	$6,450.28
48	**Water Heater-Elec. To Propane (5+ Bedroom)**	$1,166.15	$1,174.39	$1,182.81	$1,191.43	$1,200.24	$1,209.24	$1,218.45	$1,227.86	$1,237.49	$1,247.33
		$7,244.35	**$7,290.35**	**$7,337.38**	**$7,385.47**	**$7,434.65**	**$7,484.93**	**$7,536.34**	**$7,588.90**	**$7,642.65**	**$7,697.61**
49	**Water Heater-Elec. To Kerosene (1 Bedroom)**	$41,091.95	$41,161.52	$41,232.66	$41,305.39	$41,379.76	$41,455.81	$41,533.56	$41,613.07	$41,694.36	$41,777.49
50	**Water Heater-Elec. To Kerosene (2 Bedroom)**	$72,712.79	$72,863.83	$73,018.27	$73,176.18	$73,337.64	$73,502.74	$73,671.55	$73,844.16	$74,020.66	$74,201.12
51	**Water Heater-Elec. To Kerosene (3 Bedroom)**	$54,980.49	$55,115.05	$55,252.64	$55,393.32	$55,537.17	$55,684.26	$55,834.66	$55,988.43	$56,145.67	$56,306.45
52	**Water Heater-Elec. To Kerosene (4 Bedroom)**	$12,678.20	$12,715.96	$12,754.57	$12,794.04	$12,834.41	$12,875.69	$12,917.89	$12,961.04	$13,005.16	$13,050.28
53	**Water Heater-Elec. To Kerosene (5+ Bedroom)**	$2,366.15	$2,374.39	$2,382.81	$2,391.43	$2,400.24	$2,409.24	$2,418.45	$2,427.86	$2,437.49	$2,447.33
		$183,829.59	**$184,230.75**	**$184,640.95**	**$185,060.37**	**$185,489.22**	**$185,927.73**	**$186,376.11**	**$186,834.57**	**$187,303.35**	**$187,782.67**
54	**WH Fuel Switching (Electric to Kerosene- Stand Alone)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
55	**WH Fuel Switching (Electric to Wood)**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
56	**Space Heating (Fuel Switching)**	$253,610.48	$256,537.97	$259,531.32	$262,592.02	$265,721.60	$268,921.58	$272,193.57	$275,539.17	$278,960.05	$282,457.90
		$253,610.48	**$256,537.97**	**$259,531.32**	**$262,592.02**	**$265,721.60**	**$268,921.58**	**$272,193.57**	**$275,539.17**	**$278,960.05**	**$282,457.90**
57	**Clothes Dryer (Fuel Switching)**	$111,254.37	$111,618.69	$111,991.20	$112,372.10	$112,761.56	$113,159.79	$113,566.98	$113,983.33	$114,409.05	$114,844.35
		$111,254.37	**$111,618.69**	**$111,991.20**	**$112,372.10**	**$112,761.56**	**$113,159.79**	**$113,566.98**	**$113,983.33**	**$114,409.05**	**$114,844.35**
	Total for All Programs:	**$851,911.79**	**$856,669.12**	**$861,533.49**	**$866,507.30**	**$871,593.03**	**$876,793.19**	**$882,110.35**	**$887,547.14**	**$893,106.26**	**$898,790.47**

APPENDIX A-7

Residential Program Participants

Table A-21: Single Family Program Participants by Year
Maximum Achievable Measures Only

	Single Family	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Refrigerator Turn-in	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764
2	Freezer Turn-in	241	241	241	241	241	241	241	241	241	241
3	Room AC Turn-in without Replacement	0	0	0	0	0	0	0	0	0	0
4	Room AC Turn-in with ES Replacement	0	0	0	0	0	0	0	0	0	0
5	Energy Star Single Room Air Conditioner	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688
6	Energy Star Compliant Top Freezer Refrigerator	8,949	8,949	8,949	8,949	8,949	8,949	8,949	8,949	8,949	8,949
7	Energy Star Compliant Bottom Mount Freezer Refrigerator	1,116	1,116	1,116	1,116	1,116	1,116	1,116	1,116	1,116	1,116
8	Energy Star Compliant Side-by-Side Refrigerator	3,527	3,527	3,527	3,527	3,527	3,527	3,527	3,527	3,527	3,527
9	Energy Star Compliant Upright Freezer (Manual Defrost)	3,546	3,546	3,546	3,546	3,546	3,546	3,546	3,546	3,546	3,546
10	Energy Star Compliant Chest Freezer	3,150	3,150	3,150	3,150	3,150	3,150	3,150	3,150	3,150	3,150
11	Energy Star Built-In Dishwasher (Electric)	8,612	8,612	8,612	8,612	8,612	8,612	8,612	8,612	8,612	8,612
12	Energy Star Clothes Washers with Electric Water Heater	4,917	4,917	4,917	4,917	4,917	4,917	4,917	4,917	4,917	4,917
13	Energy Star Clothes Washers with Non-Electric Water Heater	9,419	9,419	9,419	9,419	9,419	9,419	9,419	9,419	9,419	9,419
14	Energy Star Dehumidifier (40 pt)	4,714	4,714	4,714	4,714	4,714	4,714	4,714	4,714	4,714	4,714
15	Standby-Power	16,646	16,646	16,646	16,646	16,646	16,646	16,646	16,646	16,646	16,646
16	Pool Pump & Motor	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570
17	Energy Star Compliant Programmable Thermostat	737	737	737	737	737	737	737	737	737	737
18	High Efficiency Central AC	332	332	332	332	332	332	332	332	332	332
19	CFL's: Homes with partial CFL installation	224,860	224,860	224,860	224,860	224,860	224,860	224,860	224,860	224,860	224,860
20	CFL's: Homes without CFL installation	245,244	245,244	245,244	245,244	245,244	245,244	245,244	245,244	245,244	245,244
21	Water Heater Blanket	0	0	0	0	0	0	0	0	0	0
22	Low Flow Shower Head	0	0	0	0	0	0	0	0	0	0
23	Pipe Wrap	0	0	0	0	0	0	0	0	0	0
24	Low Flow Faucet Aerator	0	0	0	0	0	0	0	0	0	0
25	Solar Water Heating	0	0	0	0	0	0	0	0	0	0
26	Efficient Water Heating	0	0	0	0	0	0	0	0	0	0
27	Efficient Furnace Fan Motor (Fuel Oil)	1,768	1,768	1,768	1,768	1,768	1,768	1,768	1,768	1,768	1,768
28	Efficient Furnace Fan Motor (Natural Gas)	373	373	373	373	373	373	373	373	373	373
29	Efficient Furnace Fan Motor (Propane)	511	511	511	511	511	511	511	511	511	511
30	Energy Star Windows - Electric Heat and no AC	0	0	0	0	0	0	0	0	0	0
31	Insulation and Weatherization - Electric Heat and no AC	0	0	0	0	0	0	0	0	0	0
32	Residential New Construction	766	943	1120	1297	1474	1651	1828	2005	2182	2358

	Single Family / Low Income	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
33	Insulation and Weatherization - Electric Heat and no AC	0	0	0	0	0	0	0	0	0	0

Table A-22: Single Family Program Participants by Year
Fuel Switching Programs
Maximum Achievable Measures Only

	Single Family	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
34	**Water Heater-Elec. To Natural Gas (1 Bedroom)**	10	10	10	10	10	10	10	10	10	10
35	**Water Heater-Elec. To Natural Gas (2 Bedroom)**	58	58	58	58	58	58	58	58	58	58
36	**Water Heater-Elec. To Natural Gas (3 Bedroom)**	139	139	139	139	139	139	139	139	139	139
37	**Water Heater-Elec. To Natural Gas (4 Bedroom)**	64	64	64	64	64	64	64	64	64	64
38	**Water Heater-Elec. To Natural Gas (5+ Bedroom)**	19	19	19	19	19	19	19	19	19	19
39	**Water Heater-Elec. To Fuel Oil (1 Bedroom)**	0	0	0	0	0	0	0	0	0	0
40	**Water Heater-Elec. To Fuel Oil (2 Bedroom)**	0	0	0	0	0	0	0	0	0	0
41	**Water Heater-Elec. To Fuel Oil (3 Bedroom)**	1,843	1,843	1,843	1,843	1,843	1,843	1,843	1,843	1,843	1,843
42	**Water Heater-Elec. To Fuel Oil (4 Bedroom)**	852	852	852	852	852	852	852	852	852	852
43	**Water Heater-Elec. To Fuel Oil (5+ Bedroom)**	253	253	253	253	253	253	253	253	253	253
44	**Water Heater-Elec. To Propane (1 Bedroom)**	0	0	0	0	0	0	0	0	0	0
45	**Water Heater-Elec. To Propane (2 Bedroom)**	0	0	0	0	0	0	0	0	0	0
46	**Water Heater-Elec. To Propane (3 Bedroom)**	0	0	0	0	0	0	0	0	0	0
47	**Water Heater-Elec. To Propane (4 Bedroom)**	180	180	180	180	180	180	180	180	180	180
48	**Water Heater-Elec. To Propane (5+ Bedroom)**	53	53	53	53	53	53	53	53	53	53
49	**Water Heater-Elec. To Kerosene (1 Bedroom)**	29	29	29	29	29	29	29	29	29	29
50	**Water Heater-Elec. To Kerosene (2 Bedroom)**	161	161	161	161	161	161	161	161	161	161
51	**Water Heater-Elec. To Kerosene (3 Bedroom)**	386	386	386	386	386	386	386	386	386	386
52	**Water Heater-Elec. To Kerosene (4 Bedroom)**	178	178	178	178	178	178	178	178	178	178
53	**Water Heater-Elec. To Kerosene (5+ Bedroom)**	53	53	53	53	53	53	53	53	53	53
54	**WH Fuel Switching (Electric to Kerosene- Stand Alone)**	0	0	0	0	0	0	0	0	0	0
55	**WH Fuel Switching (Electric to Wood)**	0	0	0	0	0	0	0	0	0	0
56	**Space Heating (Fuel Switching)**	205	205	205	205	205	205	205	205	205	205
57	**Clothes Dryer (Fuel Switching)**	2,223	2,223	2,223	2,223	2,223	2,223	2,223	2,223	2,223	2,223

Table A-23: Multi Family Program Participants by Year
Maximum Achievable Measures Only

	Multi Family	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Refrigerator Turn-in	324	324	324	324	324	324	324	324	324	324
2	Freezer Turn-in	44	44	44	44	44	44	44	44	44	44
3	Room AC Turn-in without Replacement	0	0	0	0	0	0	0	0	0	0
4	Room AC Turn-in with ES Replacement	0	0	0	0	0	0	0	0	0	0
5	Energy Star Single Room Air Conditioner	676	676	676	676	676	676	676	676	676	676
6	Energy Star Compliant Top Freezer Refrigerator	1,642	1,642	1,642	1,642	1,642	1,642	1,642	1,642	1,642	1,642
7	Energy Star Compliant Bottom Mount Freezer Refrigerator	205	205	205	205	205	205	205	205	205	205
8	Energy Star Compliant Side-by-Side Refrigerator	647	647	647	647	647	647	647	647	647	647
9	Energy Star Compliant Upright Freezer (Manual Defrost)	650	650	650	650	650	650	650	650	650	650
10	Energy Star Compliant Chest Freezer	578	578	578	578	578	578	578	578	578	578
11	Energy Star Built-In Dishwasher (Electric)	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580
12	Energy Star Clothes Washers with Electric Water Heater	902	902	902	902	902	902	902	902	902	902
13	Energy Star Clothes Washers with Non-Electric Water Heater	1,728	1,728	1,728	1,728	1,728	1,728	1,728	1,728	1,728	1,728
14	Energy Star Dehumidifier (40 pt)	865	865	865	865	865	865	865	865	865	865
15	Standby-Power	3,053	3,053	3,053	3,053	3,053	3,053	3,053	3,053	3,053	3,053
16	Pool Pump & Motor	109	109	109	109	109	109	109	109	109	109
17	Energy Star Compliant Programmable Thermostat	135	135	135	135	135	135	135	135	135	135
18	High Efficiency Central AC	61	61	61	61	61	61	61	61	61	61
19	CFL's: Homes with partial CFL installation	41,247	41,247	41,247	41,247	41,247	41,247	41,247	41,247	41,247	41,247
20	CFL's: Homes without CFL installation	44,986	44,986	44,986	44,986	44,986	44,986	44,986	44,986	44,986	44,986
21	Water Heater Blanket	0	0	0	0	0	0	0	0	0	0
22	Low Flow Shower Head	0	0	0	0	0	0	0	0	0	0
23	Pipe Wrap	0	0	0	0	0	0	0	0	0	0
24	Low Flow Faucet Aerator	0	0	0	0	0	0	0	0	0	0
25	Solar Water Heating	0	0	0	0	0	0	0	0	0	0
26	Efficient Water Heating	0	0	0	0	0	0	0	0	0	0
27	Efficient Furnace Fan Motor (Fuel Oil)	203	203	203	203	203	203	203	203	203	203
28	Efficient Furnace Fan Motor (Natural Gas)	183	183	183	183	183	183	183	183	183	183
29	Efficient Furnace Fan Motor (Propane)	81	81	81	81	81	81	81	81	81	81
30	Energy Star Windows - Electric Heat and no AC	0	0	0	0	0	0	0	0	0	0
31	Insulation and Weatherization - Electric Heat and no AC	0	0	0	0	0	0	0	0	0	0
	Multi Family / Low Income	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
33	Insulation and Weatherization - Electric Heat and no AC	0	0	0	0	0	0	0	0	0	0

Table A-24: Multi Family Program Participants by Year
Fuel-Switching Programs
Maximum Achievable Measures Only

	Multi Family	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
34	**Water Heater-Elec. To Natural Gas (1 Bedroom)**	14	14	14	14	14	14	14	14	14	14
35	**Water Heater-Elec. To Natural Gas (2 Bedroom)**	24	24	24	24	24	24	24	24	24	24
36	**Water Heater-Elec. To Natural Gas (3 Bedroom)**	18	18	18	18	18	18	18	18	18	18
37	**Water Heater-Elec. To Natural Gas (4 Bedroom)**	4	4	4	4	4	4	4	4	4	4
38	**Water Heater-Elec. To Natural Gas (5+ Bedroom)**	1	1	1	1	1	1	1	1	1	1
39	**Water Heater-Elec. To Fuel Oil (1 Bedroom)**	0	0	0	0	0	0	0	0	0	0
40	**Water Heater-Elec. To Fuel Oil (2 Bedroom)**	0	0	0	0	0	0	0	0	0	0
41	**Water Heater-Elec. To Fuel Oil (3 Bedroom)**	236	236	236	236	236	236	236	236	236	236
42	**Water Heater-Elec. To Fuel Oil (4 Bedroom)**	54	54	54	54	54	54	54	54	54	54
43	**Water Heater-Elec. To Fuel Oil (5+ Bedroom)**	9	9	9	9	9	9	9	9	9	9
44	**Water Heater-Elec. To Propane (1 Bedroom)**	0	0	0	0	0	0	0	0	0	0
45	**Water Heater-Elec. To Propane (2 Bedroom)**	0	0	0	0	0	0	0	0	0	0
46	**Water Heater-Elec. To Propane (3 Bedroom)**	0	0	0	0	0	0	0	0	0	0
47	**Water Heater-Elec. To Propane (4 Bedroom)**	11	11	11	11	11	11	11	11	11	11
48	**Water Heater-Elec. To Propane (5+ Bedroom)**	2	2	2	2	2	2	2	2	2	2
49	**Water Heater-Elec. To Kerosene (1 Bedroom)**	38	38	38	38	38	38	38	38	38	38
50	**Water Heater-Elec. To Kerosene (2 Bedroom)**	66	66	66	66	66	66	66	66	66	66
51	**Water Heater-Elec. To Kerosene (3 Bedroom)**	49	49	49	49	49	49	49	49	49	49
52	**Water Heater-Elec. To Kerosene (4 Bedroom)**	11	11	11	11	11	11	11	11	11	11
53	**Water Heater-Elec. To Kerosene (5+ Bedroom)**	2	2	2	2	2	2	2	2	2	2
54	**WH Fuel Switching (Electric to Kerosene- Stand Alone)**	0	0	0	0	0	0	0	0	0	0
55	**WH Fuel Switching (Electric to Wood)**	0	0	0	0	0	0	0	0	0	0
56	**Space Heating (Fuel Switching)**	38	38	38	38	38	38	38	38	38	38
57	**Clothes Dryer (Fuel Switching)**	507	507	507	507	507	507	507	507	507	507

APPENDIX A-8

Residential Measure Descriptions

Description of Residential Energy Efficiency Measures

This technical appendix describes a broad range of residential sector energy efficiency measures and programs included in the Vermont Electrical Energy Technical Potential Study.

1.1 Appliance Turn-In Program

1.1.1 Description of Measure – Appliance Turn in Program

The two primary goals of an appliance turn in program are:

1. To remove older, secondary freezers and/or refrigerators from customer homes so to prevent these appliances from entering the secondary market.
2. To encourage customers to replace older room air conditioners by providing incentives for new Energy Star qualified room air conditioners.

In other programs conducted in the US, typical incentive amounts for the appliances are $50 for the refrigerators/freezers, $25 for customers turning in a room AC and $35 for those customers turning in a room AC and buying an Energy Star qualified replacement. This type of program has been run in Connecticut, for example, with an overall annual savings of 4,504 MWh.[1] Table A-12 below lists the typical average annual kWh savings for each of these three appliances (room air conditioners, refrigerators, freezers).

Table A-25 – Typical Annual kWh Savings per Appliance from a Turn-In Program

Appliance	Typical Annual kWh Savings Per Appliance from a Turn-In Program[2]
Refrigerator (from turn-in of old unit)	413 kWh
Freezer (from turn-in of old unit)	450 kWh
Room Air Conditioner (without replacement)	40 kWh
Room Air Conditioner (with replacement)	14 kWh

1.2 High Efficiency Room Air Conditioners

1.2.1 Description of Measure – High Efficiency Room Air Conditioners

Room air conditioner units are typically mounted in a window so that part of the unit is outside and part is inside. An insulated divider to reduce heat transfer losses typically separates the two sides. The outdoor portion generally includes a

[1] Impact, Process, and Market Study of the Connecticut Appliance Retirement Program: Overall Report. December 23, 2005. Page 4.

[2] Impact, Process, and Market Study of the Connecticut Appliance Retirement Program: Overall Report. December 23, 2005. Nexus Market Research, Inc. & RLW Analytics, Inc. Page 3, Table ES.4

compressor, condenser, condenser fan, fan motor, and capillary tube. The indoor portion generally includes an evaporator and evaporator fan.[3] The key program currently promoting high efficiency room air conditioners is DOE's ENERGY STAR® program. Currently, units with Energy Efficiency Ratios (EERs) of 9.4 to 10.8 (depending on model type and capacity) are eligible for the ENERGY STAR® label. The federal standard for the most popular room air conditioner types and sizes have an EER of 9.7 and 9.8.[4] CEE's Super-Efficient Home Appliance (SEHA) program is defined as the upper end of the ENERGY STAR® spectrum, based on energy efficiency. SEHA promotes room air-conditioners that use 17-38 percent less electricity than the federal minimum.[5] Room air conditioners qualifying for this program have an EER of 10.5 or greater and represent the top 24 percent (in EER) of those models meeting the ENERGY STAR® requirements.

1.2.2 Market Barriers

Among the market barriers in this market are lack of consumer awareness of high efficiency equipment and lack of information about this equipment.

1.2.3 ENERGY STAR® Room Air Conditioners - Measure Data

Description – ENERGY STAR® labeled air conditioners feature high-efficiency compressors, fan motors, and heat transfer surfaces. In an air conditioner, air is cooled when it passes over refrigerant coils, which have fins similar to an automobile radiator. The compressor sends cooled refrigerant through the coils, which draws heat from the air as it is forced over the coils. By using advanced heat transfer technologies, more heat from the air is transferred into the coils than in conventional models, saving energy required to compress the refrigerant. ENERGY STAR labeled room air conditioners must exceed minimum federal standards for energy consumption by at least 10 percent.[6]

Measure savings – An Energy Star labeled Single Room A/C Unit saves an average of 44 kWh per year based on climate data specific to Vermont.[7]

Measure incremental cost – The comparison between a very high efficiency room air conditioner unit and a conventional unit yields about a $30 incremental cost.[8]

---

[3] Technology Summary. CEE website. www.cee1.org

[4] Products and Specifications, Room Air Conditioners. http://www.ceeformt.org/resid/seha/seha-spec.php3

[5] SEHA Specifications on Residential Appliances. http://www.cee1.org/resid/seha/rm-ac/rm-ac-main.php3

[6] Energy Star website http://www.energystar.gov/products/roomac/.

[7] Savings Calculator-Room Air Conditioners (.xls), found on the EnergyStar website (www.energystar.gov)

[8] ibid

Measure useful life – The useful life of a high efficiency room air conditioner is 12 years.[9]

Estimated baseline saturation in Vermont – Of homes with room air conditioners, the saturation of high efficiency units is estimated to be 32% in the Vermont area.[10]

Table A-26 - Summary of Data Sources for High Efficiency Room AC Technology

Cost of high efficiency room AC	Energy Star website
Cost of standard efficiency room AC	Energy Star website
Energy use of high efficiency room AC	Energy Star website
Energy use of standard efficiency room AC	Energy Star website
Useful life of room AC	Energy Star website
Baseline saturation of high efficiency residential room AC	D&R International
Market barrier information	ACEEE, CEE
National and regional programs	NEEP, MEEA, NEEA

1.3 High Efficiency Refrigerators

1.3.1 Description of Measure –High Efficiency Refrigerators

As of July 1, 2001, new federal minimum efficiency standards went into effect that reduced the average energy use of a new refrigerator to approximately 496 kWh per year. This corresponds to a typical 20 cubic foot unit with a top-mounted freezer and no ice-maker. Very high efficiency refrigerators use a number of technologies to achieve energy savings (more efficient compressors, insulation, door seals, etc.). Additional efficiency improvements, however, are possible beyond this new standard.

There are a few variations of high efficiency refrigerator models. There are top freezer models, side by side models, and bottom freezer models. Top freezer models account for 2/3 of refrigeration sales, the side-by-side models are second in sales volume across the U.S., and bottom freezers, although growing in popularity, are still low in sales volume.[11]

1.3.2 Market Barriers

Barriers to improved refrigerator efficiency are several fold, including the useful life of refrigerators of approximately 13 years, limited consumer interest in

[9] Savings Calculator-Room Air Conditioners (.xls), found on the EnergyStar website (www.energystar.gov)

[10] Email exchange with Bill McNary, D&R International. February 22, 2006.

[11] "Refrigerators: Buying Advice", (www.consumerreports.org)

improved efficiency (due in part to limited understanding of the benefits of high efficiency products), and the fact that many refrigerators are purchased by landlords and builders who care only about purchase price as someone else (home buyers and renters) pay the energy bills. Activities that can address these barriers include improved appliance efficiency labels, increased promotion of the ENERGY STAR® label, and further improvements in federal minimum efficiency standards.

1.3.3 ENERGY STAR® Residential Refrigerators - Measure Data

Description – The refrigerator is the single biggest power consumer in most households.[12] There are a few different models of refrigerators, the top freezer model accounts for almost 61% of refrigerator sales in the Vermont, with side-by-side models coming in second for sales, and bottom freezers being last.[13]

Measure savings – An annual kWh savings of 80 kWh for top freezer models, 95 kWh for side-by-side models, and 87 for bottom freezer models was determined for this analysis.[14]

Measure incremental cost – The average incremental costs for an ENERGY STAR® refrigerator over a standard model is $30.[15]

Measure useful life – The useful life of a refrigerator is 13 years.[16]

Estimated baseline saturation in Vermont – The saturation of energy efficient refrigerators in Vermont is 11%.[17]

Table A-27 - Summary of Data Sources for High Efficiency Refrigerator Technology

Cost of very high efficiency refrigerator	Energy Star website
Cost of standard refrigerator	Energy Star website
Energy use of high efficiency refrigerator	Energy Star website
Energy use of standard refrigerator	Energy Star website
Useful life of refrigerator	Energy Star website
Baseline saturation of refrigerators	D&R International
Market barrier information	ACEEE, CEE
National and regional programs	NEEP, MEEA, NEEA

[12] Energy Star website. http://www.energystar.gov/products/refrigerators/

[13] "Phase 2 Evaluation of the Efficiency Vermont Residential Programs." KEMA, Inc. Dec. 2005. pg 3-20.

[14] Savings Calculator-Residential Refrigerators (.xls), found on the EnergyStar website (www.energystar.gov)

[15] ibid

[16] ibid

[17] Email exchange with Bill McNary, D&R International. February 22, 2006.

1.4 High Efficiency Freezers

1.4.1 Description of Measure

As with refrigerators, new federal minimum efficiency standards for freezers went into effect in July 2001. The increase in the freezer energy efficiency standard was relatively modest, primarily because the new standards were negotiated between manufacturers and efficiency advocates, resulting in a compromise where high savings were agreed to for high volume products (e.g. top-mount and side-by-side refrigerators) in exchange for modest savings on lower volume products such as freezers. As a result, there is substantial room for improving freezer efficiency.

The energy savings gained in purchasing an energy efficient freezer come from replacing an older model with a newer, more up to date model. Today's freezers are all similar in energy usage; therefore savings between the different models is not an issue.

1.4.2 Market Barriers

Freezer sales in the U.S. are relatively modest and largely stagnant. Due to these factors, manufacturers claim that they cannot make the investments needed to improve freezer efficiency and still make a profit. To buttress their claims, they note that following the last increase in freezer efficiency standards, several manufacturers stopped making freezers, leaving only two major manufacturers to serve the North American market. Other barriers to improved freezer efficiency are similar to those discussed previously for refrigerators.

Given the small size of the freezer market and past improvements in freezer efficiency, national energy savings from additional freezer improvements will be modest. Still improvements to the FTC Energy Guide labels may have some impact, as could extension of the ENERGY STAR® program to freezers.

1.4.3 ENERGY STAR® Freezers - Measure Data

Description – Freezers account for 5% of residential electricity consumption in the U.S., with more than 33 million households having at least one freezer.[18] Unlike refrigerators that offer several styles to choose from, freezers come in only two styles; Chest and Upright. Chest style models have a door on top that opens upward while Upright models have the door on the front opening outward. The market is split fairly evenly between the two styles. Upright freezers offer the advantage of easier access; you don't have to bend over and reach down into the unit, but tend to be slightly less efficient than chest freezers. In a chest freezer, there is little exchange of hot and cold air, since hot air rises. An upright freezer uses about 25 percent more electricity than a chest model.

[18] Food Storage/Cooking: Freezers. www.energyguide.com/library

Measure savings – A savings of 55 kWh was determined for upright freezer models and a 52 kWh savings was determined for chest freezer models.[19]

Measure incremental cost – Incremental costs were found to be about $33 for all freezer models.[20]

Measure useful life – The useful life of a freezer is approximately 11 years.[21]

Estimated baseline saturation in Vermont – 12% of all homes with freezers in Vermont currently satisfy Energy Star efficiency requirements.[22]

Table A-28 - Summary of Data Sources for High Efficiency Freezer Technology

Cost of high efficiency freezer	Energy Star website
Cost of standard efficiency freezer	Energy Star website
Energy use of high efficiency freezer	Energy Star website
Energy use of standard efficiency freezer	Energy Star website
Useful life of freezer	Energy Star website
Baseline saturation of freezers	Connecticut Study (GDS)
Market barrier information	ACEEE, CEE
National and regional programs	NEEP, MEEA, NEEA

1.5 High Efficiency Dishwashers – Residential Sector

1.5.1 Description of Measure

DOE requires dishwasher manufacturers to meet a minimum energy efficiency standard of 2.17 kWh per cycle, equivalent to an energy factor (EF) of 0.46, for residential standard-capacity dishwashers.[23] About 80% of the total energy used by dishwashers goes towards heating the water. So, the best way to improve the efficiency of a dishwasher is to reduce the amount of water needed to clean the dishes. Some dishwashers take advantage of European technology, using a spray system that activates the upper and lower spray arms alternately instead of simultaneously, and thereby reducing water use. A "normal" load for this high efficiency equipment requires 6 gallons of water, instead of 8 to 10 gallons used in competitive models.

---

[19] Savings Calculator-Residential Freezers (.xls), found on the EnergyStar website (www.energystar.gov)

[20] ibid

[21] ibid

[22] "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region, Appendix B." June, 2004, by GDS Associates.

[23] Energy Star Program Requirements for Dishwashers, found on the EnergyStar website (www.energystar.gov)

To enable consumers to identify dishwashers that are more efficient, DOE has established voluntary energy efficiency targets for dishwashers (as well as other products) under its ENERGY STAR® program. The program promotes the purchase of highly efficient appliances through product labeling, advertising, sales staff training, and promotional activities. Utilities participating in the program share the costs of promoting ENERGY STAR® products in their service territories. Under the ENERGY STAR® program, however, the efficiency targets for dishwashers have been set at an EF of 0.58. Similar to clothes washers, ENERGY STAR® is raising their efficiency requirements on dishwashers effective January 2007 to an EF of .65. These revised standards will further increase the energy savings of efficient models.[24]

To drive the market toward higher-efficiency targets, CEE also developed the Super Efficient Home Appliance (SEHA) Initiative that will add on to the DOE ENERGY STAR® program. Through this initiative, CEE encourages its members to support both the ENERGY STAR® appliance levels as well as higher efficiency tiers established by CEE. Participants in the initiative will work with retailers, providing information, tools, and incentives to increase the sales of products that qualify for CEE's more aggressive tiers. To avoid sending mixed messages to consumers, the distinction between ENERGY STAR® product levels and CEE levels will be transparent to the consumer. DOE is planning to review the ENERGY STAR® qualifying levels for several products including dishwashers; at this time there is a good chance that the qualifying efficiencies will be raised.

Ultimately, however, customer demand for high efficiency products and ancillary benefits of these products (i.e., low noise, better cleaning, etc.) will drive the market. National and regional market transformation initiatives can play a significant role in spurring consumer demand by promoting consumer awareness and knowledge of efficient dishwashers and their benefits. These educational efforts could be incorporated into current energy education efforts.

Educating consumers about the availability of high efficiency dishwashers, and working with retailers to ensure that they are adequately prepared to market high efficiency dishwashers will be key to successful market transformation efforts. Furthermore, actions to increase the availability and market share of high efficiency dishwashers can influence the new standard.

1.5.2 Market Barriers

Among the market barriers in the dishwasher market are lack of consumer awareness of high efficiency equipment and lack of information about this equipment.

[24] Energy Star Program Requirements for Dishwashers, found on the EnergyStar website (www.energystar.gov)

1.5.3 ENERGY STAR® - Measure Data

Description –ENERGY STAR® labeled dishwashers save energy by using both improved technology for the primary wash cycle, and by using less hot water to clean. Construction includes more effective washing action, energy efficient motors and other advanced technology such as sensors that determine the length of the wash cycle and the temperature of the water necessary to clean the dishes.[25]

Measure savings – Annual savings of an electric heated ENERGY STAR® dishwasher are approximately 72 kWh. ENERGY STAR® dishwashers also save approximately 860 gallons of water annually. All estimates are based on an estimate of 215 cycles per year.[26]

Measure incremental cost – The average incremental cost of a high efficiency ENERGY STAR® dishwasher and a standard model is $50.[27]

Measure useful life – The useful life of an Energy Star dishwasher is 10 years.[28]

Estimated baseline saturation in Vermont – The saturation of energy efficient dishwashers in the Vermont service area is approximately 21%.[29]

Table A-29 - Summary of Data Sources for High Efficiency Dish Washer Technology

Cost of high efficiency DW	Energy Star website
Cost of standard DW	Energy Star website
Energy use of high efficiency DW	Energy Star website
Energy use of standard DW	Energy Star website
Useful life of DW	Energy Star website
Baseline saturation of DW	D&R International
Market barrier information	ACEEE, CEE
National and regional programs	NEEP, MEEA, NEEA

1.6 High Efficiency Clothes Washers

1.6.1 Description of Measure

About 84 percent of clothes washers in Vermont are top-loading units that spin on a vertical axis.[30] To wash clothes, the washtub must be filled so that all

[25] Energy Star® website. http://www.energystar.gov/products/dishwashers/#design
[26] Savings Calculator-Dishwasters (.xls), found on the EnergyStar website (www.energystar.gov)
[27] ibid
[28] ibid
[29] Email exchange with Bill McNary, D&R International. February 22, 2006.

clothes are covered. In Europe the dominant type of washer is the horizontal axis machine. Horizontal axis machines reduce water use by 50 percent because the washtub is only partially filled. With each rotation of the tub, clothes are dipped in the water at the bottom of the half filled tub. When replacing vertical axis machines that meet the 2006 U.S. energy efficiency standard with H-axis machines, energy use can be reduced by up to 50 percent.[31] Many horizontal axis units are front-loading machines, but some units sold in the US are top loading, consisting of a conventional top loading door with a second door in the rotating metal drum. Additional energy savings can be derived from faster spin speeds. The spin cycle in standard American clothes washers spins clothes at approximately 600 rpm, which reduces the moisture content of the load from 100 percent to approximately 50 to 75 percent (depending on fabric). Typically, this laundry is moved to a dryer, to reduce the moisture content to 2.5 to 5 percent.[32] However, a study by the National Institute of Standards and Technology (NIST) found that to reduce moisture content of a typical laundry load from 70 percent to 40 percent, a spin cycle is approximately 70 times more energy efficient (i.e., requires 1 /70th the energy) than a dryer thermal cycle. For 7 pound loads, increasing the spin speed to 900 rpm reduced dryer energy use by 28 to 47 percent depending on the fabric.[33] Many of the new high-efficiency washers that have recently entered the U.S. market have spin speeds significantly higher than conventional U.S. machines. To reduce wrinkling, these machines typically have complex cycles - slow spin, re-balancing, fast spin, and a final slow spin to ventilate the clothes. High spin speeds are also common in Europe, with many machines having spin speeds over 800 rpm, and some machines operating as high as 1500 rpm.

Studies of horizontal-axis clothes washer performance indicate that these products produce substantial energy savings in the field, not just in the laboratory. In 2000, the U.S. Department of Energy and Maytag Appliances conducted field studies in Reading, Massachusetts. This study was done to assess savings in an urban setting experiencing rapid growth in water and sewer rates. The results were 50 percent energy savings and 44 percent water savings.[34]

In addition to saving water and energy, horizontal-axis machines may offer several other advantages. First, customers who own horizontal-axis washers are highly satisfied with their purchases (e.g. 81 to 95 percent in a study of the

---

[30] "Phase 2 Evaluation of the Efficiency Vermont Residential Programs." KEMA, Inc. Dec.2005. pg 3-20.

[31] Partnership for Advancing Technology in Housing. March 10, 2006. (www.toolbase.org/techinv/)

[32] An Evaluation of Assigning Credit/Debit to the Energy Factor of Clothes Washers Based On Water Extraction Performance." NBSIR 81-2309. 1981.

[33] ibid

[34] E Source Technology Atlas Series, Residential Appliances, section 6.2, "Study Finds Conservation Benefits in Switching to High-Efficiency Appliances," Maytag press release (October 2000), www.newstream.com

Northwest WashWise program).[35] Second, by eliminating the agitator, these units may create less wear and tear on clothes (however, some manufacturers dispute these claims). Third, they may use less detergent than vertical axis machines. This issue is complex and controversial, and may come down to consumer choices about whether they want better cleaning performance than standard machines (in which case there are unlikely to be detergent savings) or whether current cleaning performance is acceptable (in which case there may be some detergent savings). Finally, they are not as prone to load imbalance problems as some vertical axis machines.[36]

The analysis that follows is based on a high-efficiency machine meeting current ENERGY STAR® qualifications. At these performance levels, washer energy use is reduced by greater than 50 percent relative to the average vertical-axis washer now being sold. In addition, substantial savings on water and sewer bills contribute to the economic benefits of high-efficiency washers. ENERGY STAR® is raising their current standards effective January 2007 from a Modified Energy Factor (MEF) of 1.42 to 1.72. These revised ratings will result in even greater energy savings compared to their standard counterparts.[37]

There are currently many on-going efforts to promote high-efficiency washers. The CEE's Residential Clothes Washer Initiative, launched in 1993, promotes the manufacture and sales of energy-efficient clothes washers. CEE has developed a set of specifications and a qualifying product list to define energy efficiency and works with Initiative participants (utilities and energy organizations) to promote qualifying washers through incentive, educational and promotional programs. There are currently more than 50 participating utilities and energy organizations, including Efficiency Vermont. Today, hundreds of different high efficiency models are available in leading retail outlets across the country. Every major domestic appliance manufacturer – including Maytag, Frigidaire, Whirlpool and General Electric – has introduced at least one high-efficiency clothes washer to the market. In addition, DOE is sponsoring an ENERGY STAR® marketing and promotion program that awards an ENERGY STAR® label to washers that meet the CEE efficiency thresholds.

1.6.2 Market Barriers

All new washing machines must display EnergyGuide labels to help consumers compare energy efficiency. The EnergyGuide label for clothes washers is based on estimated energy use for 392 loads of laundry per year. This value does not

---

[35] "Coming Clean About Resource Efficient Clothes Washers: An Initial WashWise Program and Market Progress Report." Pacific Energy Associates. January 1998.

[36] Lebot, B. et al. "Horizontal Access Domestic Clothes Washers: An Alternative Technology That Can Reduce Residential Energy and Water Use." Proceedings from the ACEEE's 1990 Summer Study on Energy Efficiency in Buildings. 1990. 1.148-1.155.

[37] Energy Star Program Requirements for Clothes Washers, found on the EnergyStar website (www.energystar.gov)

take into account the variations in tub size and other factors. Top loading machines with smaller tubs may have a better rating, but might mean you have to run the machine more often. While high-efficiency washers have many benefits, there may be some limitations. First, most of the current high-efficiency units are front-loading machines. Consumers are used to top-loading machines and it is unclear what proportion of consumers will be averse to front-loaders. Second, some high-efficiency machines have longer cycle times than conventional machines. Third, high-efficiency machines currently sell at a significant cost premium (approximately $300) relative to conventional machines.[38] While prices are likely to come down in the future, the cost increment is likely to be significant (e.g. several knowledgeable industry experts have suggested a long-term incremental cost in mass production of approximately $175).

1.6.3 ENERGY STAR® Clothes Washers - Measure Data

Description – Clothes washers come in two main designs, horizontal-axis (often front-loading) and the conventional vertical axis model. Some new top-loading, horizontal-axis designs use much less water to clean clothes and numerous studies show they clean clothes better than vertical-axis models.

Measure savings – Energy savings for an ENERGY STAR® clothes washer for residential applications are between 29-108 kWh per year, depending on whether the water heater is gas or electric powered. Given the many different models, offering different features, the number will vary with the options needed or chosen. In addition, both machines save approximately 7056 gallons of water per year, while the gas-powered clothes washer adds 1.2 mmbtus in natural gas savings. All estimates are based on either 379 or 392 loads per year.[39]

Measure incremental cost – The incremental cost of this equipment is about $300.00.[40]

Measure useful life – The useful life of a high efficiency clothes washer is 11 years.[41]

Estimated baseline saturation in Vermont - The current saturation of high efficiency clothes washers in Vermont is approximately 14% of all clothes washers.[42]

---

[38] Savings Calculator-Clothes Washers (.xls), found on the EnergyStar website (www.energystar.gov) & Efficiency Vermont Residential Master Technical Reference Manual. 2005-37. Page 92.
[39] ibid
[40] ibid
[41] ibid
[42] Email exchange with Bill McNary, D&R International. February 22, 2006.

Table A-30 - Market Penetration of High Efficiency Clothes Washers

New England	16%[43]
California	17.9%[44]
New York	21%[45]
Vermont	14%
National Penetration Rate	10.5%[46]

Table A-31 - Summary of Data Sources for High Efficiency Clothes Washer Technology

Cost of high efficiency CW	EnergyStar website
Cost of standard CW	EnergyStar website
Energy use of high efficiency CW	EnergyStar website
Energy use of standard CW	EnergyStar website
Useful life of CW	EnergyStar website
Baseline saturation of CW	D&R International
Market barrier information	ACEEE, CEE
National and regional programs	NEEP, MEEA, NEEA

1.7 Dehumidifiers

1.7.1 Description of Measure - Dehumidifiers

Often used in the damp areas of a home, such as basements, dehumidifiers remove moisture from the air to maintain comfort and to limit the growth of mold and mildew. A standard efficiency dehumidifier can use as much electricity as a conventional refrigerator, which consumes more energy than most other products in the home[47]. ENERGY STAR® qualified dehumidifiers provide the same features as conventional models— moisture removal, quiet operation, and durability— but they are more energy efficient. ENERGY STAR® qualified models have more efficient refrigeration coils, compressors, and fans than conventional models, which means they use less energy to remove moisture. ENERGY STAR® qualified dehumidifiers operate at least 10 percent more efficiently than conventional models. Depending on the size of the dehumidifier,

[43] "Clothes Washer Market Assessment. TumbleWash Program Evaluation" October 1999. RLW Analytics.
[44] "2005 California Statewide Residential Lighting and Appliance Efficiency Saturation Study" RLW Analytics. August 2005.
[45] "NYSERDA Electricity and Peak Demand Savings Review for Residential Appliances & Lighting Program. 2001. (Non-public workpaper.)"
[46] "The Residential Clothes Washer Initiative: A Case Study of the Contributions of a Collaborative Effort to Transform a Market" Shel Feldman Management Consulting, Research Into Action Inc., XENERGY, Inc. June 2001.
[47] Dehumidifiers. Northeast Energy Star Lighting and Appliance Initiative website. April 2006. (www.myenergystar.com/Dehumidifiers.aspx)

consumers can save up to $300 on their electricity bills over the 12-year lifetime of an ENERGY STAR® qualified unit[48].

1.7.2 Market Barriers

Among the market barriers in this market are a lack of consumer awareness of high efficiency equipment, a lack of information about this equipment, as well as product availability and model variety. Cost does not appear to be a market barrier for high efficiency dehumidifiers.

1.7.3 Dehumidifiers - Measure Data

Description – This analysis compared replacing a standard 40 pint dehumidifier with a 40 pint ENERGY STAR® dehumidifier that is used 6 months out of the year.

Measure savings – An ENERGY STAR® labeled dehumidifier saves an average of 173 kWh per year.[49]

Measure incremental cost – According to ENERGY STAR® there is no incremental between a standard and high efficiency dehumidifier.[50]

Measure useful life – According to ACEEE, the useful life of an ENERGY STAR® labeled dehumidifier is 12 years.[51]

Estimated baseline saturation in Vermont – The saturation of ENERGY STAR® labeled dehumidifies in homes that operate dehumidifiers is estimated to be 2.5%.[52]

Table A-32 - Summary of Data Sources for Dehumidifiers

Cost of high efficiency dehumidifier	Energy Star
Cost of standard dehumidifier	Energy Star
Energy use of high efficiency dehumidifier	Energy Star
Energy use of standard dehumidifier	Energy Star
Useful life of high efficiency dehumidifier	Energy Star
Baseline saturation of high efficiency dehumidifier	MEEA
Market barrier information	ACEEE, CEE
National and regional programs	NEEP, EPA

[48] Dehumidifiers. Northeast Energy Star Lighting and Appliance Initiative website. April 2006. (www.myenergystar.com/Dehumidifiers.aspx)

[49] Savings Calculator-Dehumidifiers (.xls), found on the EnergyStar website (www.energystar.gov).

[50] ibid.

[51] ibid.

[52] "Illinois Residential Market Analysis, Final Report." Midwest Energy Efficiency Alliance. May 12, 2003. Page. 20.

1.8 Standby Power

1.8.1 Description of Measure – Standby Power

In homes and offices, electrical equipment consumes some electricity when placed on standby mode or even when switched off. For example, telephone chargers left plugged into a wall socket will continue to draw electricity even after the equipment is fully charged and is not in use, and televisions also continue to draw power after the user switches them off with the remote control. Equipment responsible for standby power waste is present in all sectors: household, services and industry. However, in the household sector, equipment is more generic and easier to target.[53]

In 1999, the International Energy Agency (IEA) proposed that all countries enact energy policies to reduce standby power use to no more than one watt per device by 2010. To date, several countries (including Australia and Korea) have formally adopted the '1-Watt Plan' and other countries (notably Japan and China) have also undertaken strong measures to reduce standby power. In July 2001, President Bush issued an executive order requiring the federal government to purchase products with low standby, with the eventual goal of one-watt or less.[54]

1.8.2 Market Barriers

Standby Power appliances, are often replaced not upon burnout, but by changes in technology. Retrofitting solutions, then, are not cost effective compared to low standby power solutions directly incorporated into the design of newer products. As a result, the introduction of newer and more efficient products are dependent upon technological advances more than the useful lives of appliances.

1.8.3 Standby Power - Measure Data

Description – Standby power is the electricity consumed by end-use electrical equipment that is switched off or not performing its main function. A wide variety of consumer electronics, small household appliances, and office equipment use standby power. The most common sources of standby power consumption include products with remote controls, low-voltage power supplies, rechargeable devices, and continuous digital displays.[55] A typical North American home often contains fifteen to twenty devices constantly drawing standby power.[56]

---

[53] "The 1 Watt-Standby Power Initiative: an International Action to Reduce Standby Power Waste of Electrical Equipment" IEA, 2002. (www.iea.org)

[54] "Reducing Standby Power Waste to Less than 1 Watt: A Relevant Global Strategy That Delivers" IEA, 2002. (www.iea.org)

[55] Emerging Technologies & Practices. ACEEE 2004. Chapter 6: Measures, Page 40.

[56] "The 1 Watt-Standby Power Initiative: an International Action to Reduce Standby Power Waste of Electrical Equipment" IEA, 2002. (www.iea.org)

Measure savings – Although the amount of standby power consumed by an individual product is relatively small, typically ranging from 0.5 to 30 Watts, the cumulative total is significant given the large number of products involved: an estimated 50 to 70 Watts per household, or 5% of average residential electricity consumption (EIA 2003b; Meier 2002). [57] The savings that can be acquired by replacing 15 devices with models consuming 1-watt or less of standby power is 265 kWh/year.[58]

Measure incremental cost – The incremental cost to consumers of consumer electronics and other small home appliances with standby power use of 1W or less is about $30.[59]

Measure useful life – The useful life of consumer electronics using standby power is about 7 years.[60]

Estimated baseline saturation in Vermont – Approximately 15% of all homes in the US have at least one product with 1-watt standby.[61]

Table A-33 - Summary of Data Sources for Standby Power

Cost of Standby Power Devices	ACEEE
Energy use of 1-Watt Standby Device	ACEEE
Energy use of standard Device	ACEEE
Useful life of 1-Watt Standby Device	ACEEE
Baseline saturation of 1-Watt Standby Device	ACEEE
Market barrier information	IEA
National programs	IEA

1.9 Pool Pump & Motor

1.9.1 Description of Measure – Pool Pump & Motor

With regard to pool filtration, quicker is not necessarily better. While large, single speed pool pumps filter pools quickly, they use substantially more energy than multi-speed or small single speed pool pumps and motors. The energy used to operate the cleaning and filtering equipment for a typical pool for one swimming season can equal the energy used to power the average home for the same period of time.[62] Programs offer rebates for high efficiency pool filtration pump and motors as part of a new swimming pool installation or a replacement of the

[57] Emerging Technologies & Practices. ACEEE 2004. Chapter 6: Measures, Page 40.
[58] ibid
[59] ibid
[60] ibid
[61] Email from Jennifer Thorne Amann of ACEEE on March 9, 2006.
[62] Pool Pumps and Motors Factsheet. SMUD. April 2006. (www.smud.org)

standard single-speed filtration pump and motor in an existing swimming pool. Generally, the new pump and motor must be the primary filtration pump and motor assembly of a residential in-ground swimming pool. Above ground pool pumps, booster pumps or spa pumps, do not qualify.[63]

Energy efficient pool pump motors use copper and better magnetic materials to reduce electrical and mechanical losses. As a result, they are longer lasting and more efficient than standard pool pumps. Additionally, high efficiency pumps are much quieter at low speed than standard pumps. High efficiency pumps will also circulate water for a longer period of time, increasing the efficiency of most filter types, automatic chemical dispensers and chlorinators, as well as increasing filter efficiency by decreasing particle impact on most filter types.[64,65]

1.9.2 Market Barriers

High efficiency pool pump and motors may not be compatible with all pool equipment such as roof mounted solar heating systems and some pool sweeps. Efficient equipment may not provide adequate circulation if a system utilizes roof mounted solar water heating units, and pressure and suction side pool sweeps may not receive sufficient water flow. Another potential market barrier is the useful life of pool pump and motors in areas where pump and motor use is not year-round. Replacement opportunities are fewer in areas where residential pool use is seasonal compared to areas where pool pump and motor burnout is more frequent due to continued daily operation.

1.9.3 Pool Pump & Motor - Measure Data

Description – This analysis compared replacing a standard efficiency pool pump and motor utilized for pool filtration and circulation with a high efficiency pool pump and motor.

Measure savings – A high efficiency pool pump and motor saves an average of 635 kWh per year.[66]

Measure incremental cost – The incremental cost of an efficient pool pump and motor is estimated at $313.[67]

Measure useful life – The useful life of a high efficiency pool pump and motor is 15 years.[68]

---

[63] Pool Pumps and Motors Factsheet. SMUD. April 2006. (www.smud.org)
[64] Multi-Speed Pool Pump Factsheet. PG&E. April 2006 (www.pge.com)
[65] Pool Pumps and Motors Factsheet. SMUD. April 2006. (www.smud.org)
[66] "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region, Appendix B." June, 2004, by GDS Associates.
[67] ibid
[68] ibid

Estimated baseline saturation in Vermont – The saturation of homes in Vermont with residential outdoor swimming pools is 11.6%.[69] Of these, approximately 1% is estimated to be operating high efficiency pool pump and motors.[70]

Table A-34 - Summary of Data Sources for Pool Pump & Motor

Cost of high efficiency pool pump & motor	Connecticut Study (GDS)
Cost of standard pool pump & motor	Connecticut Study (GDS)
Energy use of high efficiency pool pump & motor	Connecticut Study (GDS)
Energy use of standard pool pump & motor	Connecticut Study (GDS)
Useful life of high efficiency pool pump & motor	Connecticut Study (GDS)
Baseline saturation of high efficiency pool pump & motor	Connecticut Study (GDS)
Market barrier information	SMUD, PG&E
National and regional programs	SMUD, PG&E, SDG&E

1.10 Programmable Thermostats

1.10.1 Description of Measure – Programmable Thermostats

Programmable thermostats automatically adjust the home's temperature setting on a set schedule, allowing for daily energy conservation during periods when normal cooling and heating is unnecessary (i.e. when the house in unoccupied or at night). Programmable thermostats can store and repeat multiple daily settings (six or more temperature settings a day) that you can manually override without affecting the rest of the daily or weekly program. However, programmable thermostats have to be set and used properly to deliver the advertised energy savings. Routine deviation from the programmed default settings and schedules can significantly lower actual energy savings.

1.10.2 Market Barriers

Among the market barriers in this market are lack of consumer awareness of high efficiency equipment, a high incremental cost and lack of information about this equipment. In addition, energy savings are highly dependent on consumer usage of product and actual savings are sometimes negligible, creating concerns about the measure's efficacy.

[69] GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.

[70] "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region, Appendix B." June, 2004, by GDS Associates.

1.10.3 Programmable Thermostats - Measure Data

Description – Programmable thermostats are ENERGY STAR® qualified in 3 different models. The 7 day model provides the most flexibility, allowing several different daily temperature settings for each day of the week. The 5 + 2 model uses the same temperature control setting for each weekday, and another for the weekends. Finally, the 5-1-1 models are similar to the previous models; wit the exception of allowing different schedules for each weekend day.

Measure savings – An Energy Star labeled programmable thermostat saves an average of 296 kWh per year based on climate data specific to Vermont.[71]

Measure incremental cost – The comparison between a programmable thermostat unit and a conventional unit yields about a $50 incremental cost.[72]

Measure useful life – According to ACEEE, the useful life of a programmable thermostat is 10 years.[73]

Estimated baseline saturation in Vermont – The saturation of programmable thermostats is estimated to be 11% in Vermont homes with central air conditioning.[74]

Table A-35 - Summary of Data Sources for Programmable Thermostats

Cost of Programmable Thermostat	Home Depot
Cost of standard Thermostat	Home Depot
Energy use of Programmable Thermostat	National Grid
Energy use of standard Thermostat	Connecticut Study (GDS)
Useful life of Programmable Thermostat	Honeywell
Baseline saturation of Programmable Thermostat	Connecticut Study (GDS)
Market barrier information	ACEEE, CEE
National and regional programs	NEEP, MEEA, NEEA

1.11 High Efficiency Central Air Conditioners

1.11.1 Description of Measure – High Efficiency Central Air Conditioners

While 4.2 percent of homes in Vermont have central air conditioning, about one-sixth of all the electricity generated in the US is used to air condition buildings.

[71] "2002 DSM Performance Measurement Report" National Grid for the MA Department of Telecommunications and Energy. July 2003.

[72] GDS in store visit to Home Depot. 2005.

[73] Dick Spellman phone call with Honeywell. 2001.

[74] "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region. Appendix B." June, 2004, by GDS Associates

Central air conditioners are more efficient than room air conditioners. In addition, they are out of the way, quiet, and convenient to operate. Today's best air conditioners use 30%–50% less energy to produce the same amount of cooling as air conditioners made in the mid 1970s. Even if an air conditioner is only 10 years old, one may save 20%–40% of cooling energy costs by replacing it with a newer, more efficient model.

The installation of oversized air conditioning units in an effort to avoid problems involving inadequate cooling capacity is common. Oversized units have also been utilized as a method of compensating for potential distribution problems such as uninsulated or leaky ductwork. However, these oversized units also create increased costs and reduced efficiency levels.

A central A/C unit that is too big will cycle on and off much more often spending a greater proportion of time running in an inefficient start-up mode. This results in "blasts" of cold air, reducing efficiency, and increasing stress on components. In addition, moisture removal and interior air mixing are also reduced during short run times.[75] Consequently, oversized air conditioning units can do poor job of lowering the humidity, which is also an important component to comfort. Often, a slightly undersized air conditioner is just as comfortable, if not more, than an oversized air conditioner.

Central air conditioners are rated according to their seasonal energy efficiency ratio (SEER). SEER indicates the relative amount of energy needed to provide a specific cooling output. Many older systems have SEER ratings of 6 or less. The minimum SEER allowed today is 10 for a split system and 9.7 for a single-package system. ENERGY STAR® labeled central air conditioners possess SEER ratings of 12 or greater. Air conditioning equipment with SEER ratings of 14 or greater achieve performance levels greater than 30% savings.

New residential central air conditioner standards went into effect in January 2006. Air conditioners manufactured after January 2006 must achieve a Seasonal Energy Efficiency Ratio (SEER) of 13 or higher. SEER 13 is 30% more efficient than the current minimum SEER of 10. The standard applies only to appliances manufactured after January 23, 2006. Equipment with a rating less than SEER 13 manufactured before this date may still be sold and installed.

1.11.2 Market Barriers

Among the market barriers in this market are lack of consumer awareness of high efficiency equipment, a high incremental cost and lack of information about this equipment. In addition, lengthy useful life, and high initial product costs largely prevent retrofitting before replacement is necessary.

---

[75] "How Contractors Really Size Air Conditioning Systems." Presented at the 1996 ACEEE Summer Study on Energy Efficiency in Buildings. American Council for an Energy-Efficient Economy. Washington, D.C.

1.11.3 ENERGY STAR® Central Air Conditioners - Measure Data

Description – Central air conditioners circulate cool air through a system of supply and return ducts. Supply ducts and registers (i.e., openings in the walls, floors, or ceilings covered by grills) carry cooled air from the air conditioner to the home. This cooled air becomes warmer as it circulates through the home; then it flows back to the central air conditioner through return ducts and registers. This analysis compared savings between the current minimum standard (SEER=13) for operating units and a more efficient commercially available air conditioning unit (SEER=15).

Measure savings – An ENERGY STAR® labeled central A/C Unit saves an average of 311.5 kWh per year based on climate data specific to Vermont.[76]

Measure incremental cost – The comparison between a very high efficiency central air conditioning unit and a conventional unit yields about a $379 incremental cost.[77]

Measure useful life – The useful life of a central A/C is 18 years.[78]

Estimated baseline saturation in Vermont – 4.2% of homes in Vermont have central a/c. The saturation of efficient central air conditioners is estimated to be 24% of homes with central a/c in the Vermont area.[79]

Table A-36 - Summary of Data Sources for Central AC Technology

Cost of high efficiency Central AC	Efficiency Vermont
Cost of standard efficiency Central AC	Efficiency Vermont
Energy use of high efficiency Central AC	Efficiency Vermont
Energy use of standard efficiency Central AC	-
Useful life of Central AC	EVT TRM
Baseline saturation of residential Central AC	KEMA
Market barrier information	ACEEE, CEE
National and regional programs	NEEP, MEEA, NEEA

1.12 Residential Lighting - Fluorescent Technologies

1.12.1 Description of Measure

Residential fluorescent bulbs and fixtures present a significant opportunity for energy and maintenance savings. On a per lamp basis, compact

[76] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 491.
[77] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 492.
[78] ibid.
[79] GDS calculation based on Vermont Residential Appliance Saturation Survey.

fluorescent lamps are generally 70 percent more efficient than incandescent lamps and last up to ten times longer. Poor quality, selection, appearance and reliability of residential fluorescent fixtures have in the past contributed to consumer aversion to fluorescent lighting. Additionally, the lack of brand loyalty among consumers coupled with the large number of manufacturers (500 including foreign companies) led to a proliferation of inferior fluorescent fixtures in the 1990's. According to Calwell et al., the existing stock of residential fixtures in 1996 was approximately 15 percent fluorescent and 85 incandescent,[80] More recent data shows that approximately 20% of existing lighting is fluorescent, suggesting that fluorescent share is increasing, but considerable technical potential for energy savings remains.[81]

In considering possible energy efficiency or market transformation initiatives, the fixture market can and should be separated into two end-use categories: hard-wired and portable units, which differ in both the supply chain and in consumer purchasing patterns. Hard-wired fixtures are most frequently purchased for new construction and major renovations, whereas portable fixtures are most often a retrofit, replacement or remodeling purchase. During recent years, national chain stores such as Home Depot and Lowe's have featured displays of compact fluorescent bulbs and have increased the market share of this technology in homes across the U.S.

Installing hard-wired fluorescent fixtures reduces the likelihood of reversion to incandescent lamps. Consequently, hard-wired fixtures (indoor and outdoor) that are characterized by energy efficiency, quality and safety present a significant opportunity to reduce energy consumption. Since the point-of-sale for hard-wired fixtures is relatively concentrated (and generally limited to showrooms, contractors and distributors), a fixture initiative can target these markets more effectively than lamp suppliers for which sales locations are more diffuse.

In contrast, portable fixtures represent less of an opportunity for market transformation because the target market is diffuse, and influencing purchasing decisions may take considerably more resources. However, new developments in torchiere lamps provide a unique market transformation opportunity. The 40 million halogen torchieres in American homes, dorms and offices consume up to 600 watts of power each, and often account for 30 to 50 percent of lighting retailers' sales.[82] The typical compact fluorescent alternative to halogen torchieres consumes 55 to 100 watts of power, representing an efficiency improvement of 6 times the halogen at full light output. Incandescent torchieres

---

[80] Calwell, Chris, Chris Granda, Charlie Stephens and My Ton. 1996. *Energy Efficient Residential Luminaires: Technologies and Strategies for Market Transformation*. Final Report. Submitted to the U.S.E.P.A., Office of Air and Radiation, Energy Star Programs, under grant #CX824685. San Francisco, CA: Natural Resources Defense Council.

[81] "Energy Efficiency Lighting In the Residential Market." Brad Kates and Steve Bonnano. Powerpoint Presentation, April 2005.

[82] Calwell, Chris, Chris Granda, Charlie Stephens and My Ton. 1996. *Energy Efficient Residential Luminaires: Technologies and Strategies for Market Transformation*. Final Report. Submitted to the U.S.E.P.A., Office of Air and Radiation, Energy Star Programs, under grant #CX824685. San Francisco, CA: Natural Resources Defense Council

are becoming more popular as well, with consumption rates of 100 to 150 watts. In addition, some non-torchiere portable fixtures that use only compact fluorescent lamps are now available.

The costs of residential fluorescent fixtures vary widely. For this analysis of fluorescent and incandescent technologies, a Home Depot store located in Vermont has been used as the primary source of up-to-date cost and wattage data.

1.12.2 Market Barriers – Fluorescent Lighting Technologies

The primary market barriers to the penetration of fluorescent fixtures include product availability, quality of residential grade fixtures, consumer aversion to fluorescent lighting, and the first cost (purchase price) for high quality fixtures and bulbs. For hard-wired fixtures, specifier and commercial grade units are of better quality than residential fixtures. Consequently, making these fixture grades available to homeowners at a reasonable cost is an important market transformation strategy.

Market transformation programs for lighting fixtures exist nationally and regionally. Launched in March of 1997, the ENERGY STAR® Fixture program promotes the adoption of high quality, efficient fixtures through its labeling program. Two regional fixture initiatives sponsored by the Northeast Energy Efficiency Partnerships (NEEP) and the Northwest Energy Efficiency Alliance (NEEA) have recently been adopted and several states also fund their own residential lighting programs. Most of these initiatives coordinate with the ENERGY STAR® program, targeting both hard-wired and portable fixtures, and encourage active retail promotions and consumer education. Similarly, a coalition of California utilities, coordinating with the Northwest, selected the ENERGY STAR® Fixtures specification as the basis of a regional lighting fixture program and plans to offer performance-based incentives to fixture manufacturers, wholesalers, and large and small retailers. In addition to the above market transformation initiatives, another force advancing lighting efficiency is the banning of halogen torchieres by a number of universities due to the fire hazard they pose.[83]

1.12.3 Compact Fluorescent Bulb Measure Data

Description – The purchase price of compact fluorescent bulbs (CFLs) most commonly purchased for residential applications is now in the range of $3-$5 per bulb. These bulbs can be found in hardware stores as well as in chain stores such as Home Depot and Lowe's. CFL bulbs range in size and shape, and their

[83] Chris Calwell, "Big Lamp on Campus: An Energy and Environmental Curriculum Module for Colleges Concerned about Halogen Lamp Use," submitted by Ecos Consulting to the US Environmental Protection Agency, Office of Air and Radiation, Energy Star Programs, under Grant # CX820578-01-0 to the Natural Resources Defense Council, April 15, 1997.

appearance can be a spiral shaped fluorescent tube, or they can appear as a standard shape such as the R-30 floodlight for use in recessed cans.

Measure savings – Energy savings for a CFL are approximately 75% as compared to a standard incandescent light bulb (for example, a 19 watt compact fluorescent can replace a 75 watt incandescent bulb). For this report, GDS has calculated an average annual energy savings based on different wattages and 986 hours of annual operation. The average annual kilowatt-hour savings associated with installing more CFL bulbs in a home using partial compact fluorescent lighting is approximately 25.97 kWh per year. GDS assumed homes with partial CFL installation had previously installed the efficient bulbs in their most commonly used fixtures. The remaining fixtures, then, are used less frequently and fewer annual hours. Consequently, homes with no prior CFL installation would be able to install efficient lighting in their most commonly used fixtures and would realize greater average savings. Homes with no CFL bulbs presently installed would save an average of 31.164 kWh per year.[84]

Measure incremental cost – The incremental purchase price of a CFL at Home Depot/Lowe's in 2006 ranges from $4.71 to $12.02. Because lower wattage CFL bulbs are purchased at a greater frequency than higher wattage CFL bulbs (with higher associated incremental costs) a weighted average incremental cost was calculated. The weighted average incremental cost of a CFL bulb (after an estimate effect of multi-pack price savings) used in this analysis is $5.00.[85]

Measure useful life – The useful life of a CFL bulb is approximately 7,500 hours, or 7.6 years.[86]

Estimated baseline saturation in Vermont – Based on recent market assessment data collected in Vermont, homes with efficient lighting have an average of 5.9 CFL bulbs (out of 30.5 CFL-compatible sockets), or an estimated saturation of 19.34%. Homes without compact fluorescent lighting have an estimated saturation of 0% for this efficiency measure.[87]

[84] GDS calculation from Efficiency Maine Residential Lighting Program (2003-2005)

[85] ibid

[86] Manufacturer data

[87] "Phase 2 Evaluation of the Efficiency Vermont Residential Programs." KEMA, Inc. Dececember 2005, Pages 1-23.

Table A-37 - Summary of Data Sources for CFL Technology

Cost of CFL bulb	Home Depot store
Cost of incandescent bulb	Home Depot store
Energy use of CFL bulb	GDS Calculation
Energy use of incandescent bulb	GDS Calculation
Useful life of CFL bulb	Manufacturer data on product package
Useful life of incandescent bulb	Manufacturer data on product package
Baseline saturation of CFL bulbs	KEMA, Inc., December 2005 Market Assessment Report
Baseline saturation of incandescent bulbs	KEMA, Inc., December 2005 Market Assessment Report
Market barrier information	ACEEE, CEE
National and regional programs	ACEEE, CEE, NEEP, NEEA, MEEA

1.13 High Efficiency Water Heaters & Water Heater Efficiency Options

1.13.1 Measure Description

The average standard efficiency stand alone electric water heater sold today has an Energy Factor (EF) of approximately 0.87. Higher efficiency models are available with thicker insulation (up to 3 inches thick) and with heat traps, which limit heat losses through inlet and outlet pipes. These models most commonly have an EF of 0.93. These efficiency values particularly apply to the 50 to 55 gallon size class, which represents a majority of all electric water heater sales. Energy savings with high efficiency water tanks are essentially all in reduced standby losses.

In addition to the traditional stand alone storage tank water heaters, heat pump water heaters are also commercially available. Heat pumps, commonly used for space heating purposes, can also apply the principle of transferring heat from surrounding air and deliver it to water. Some models comes as a complete package including tank and back-up resistance heating elements while others work as an accessory to a conventional water heater.

As this unit extracts heat from the surrounding air (indoor, exhaust, or outdoor air), a heat pump water heater delivers about twice the heat for the same electricity costs as a conventional stand alone water heater.[88] In addition, the transfer of heat from neighboring air also serves to cool and dehumidify a space, creating additional benefits during the cooling season, but drawbacks during the heating season. In recent years, the market for heat pump water heating systems has been stagnant due to competition with gas waters heaters enjoying

[88] "Heat Pump Water Heaters-Residential" Energy Efficiency Factsheet, Washington State University Energy Program. Accessed April 2006. (www.energy.wsu.edu)

favorable gas prices and the failure of electric rates to rise as fast as initially projected in many areas.[89]

While most water heater systems are stand-alone systems, they can also be integrated with the boiler used to heat the home. There are two styles of integrated systems; Tankless Coil and Indirect. Tankless Coil systems heat water as it is needed just as a demand system, the only difference being that the boiler is used to heat the water. Indirect systems also heat water in the boiler, but the water is then stored in a tank. The advantage of a tankless coil system is the avoided cost of purchasing a separate water heating system. The disadvantage is that during the non-heating season water heating is inefficient since the heating system must operate solely for heating water.

Indirect systems have the added cost of a tank, but since the hot water is stored in an insulated tank, the boiler or furnace does not have to turn on and off as frequently, improving its fuel economy. This increased efficiency generally offsets the cost of a tank. According to ACEEE, when used in combination with new, high efficiency boilers or furnaces, indirect water heaters are generally the least expensive way to provide hot water.[90] Gas, oil, and propane-fired systems are available.

Although ENERGY STAR does not include water heaters in their label program, utilities in the Northwest, for example, have been promoting high efficiency electric water heaters for many years. The typical program pays incentives of $25 to $60 for water heaters with an EF of 0.93 or more. Participation rates of 40 to 60 percent of water heater sales have been achieved.

In lieu of replacing a water heater with a more efficient model, there are several alternative measures that can be used to help in the conservation of water and energy loss within the residential sector. The installation of water heater blankets, pipe wrap, low flow shower heads, and faucet aerators are all energy efficient measures that will save energy and money on an existing water heating system. Other techniques for increasing water heater efficiency is the addition of a solar water heating system as well as fuel-switching, or eliminating electric water heating systems for more efficient non-electric systems.

1.13.2 Market Barriers

Among the market barriers in this market are lack of consumer awareness of high efficiency equipment, a long measure useful life, and lack of information about this equipment and the efficiency options.

---

89 "Heat Pump Water Heaters-Residential" Energy Efficiency Factsheet, Washington State University Energy Program. Accessed April 2006. (www.energy.wsu.edu)

90 "Consumer Guide to Home Energy Savings, 8th edition." ACEEEE. pg. 100

1.13.3 Water Heater Blanket - Measure Data

Description – Water heater jackets are designed to wrap around an existing water heater tank to improve insulation, prevent heat loss and save energy. Installing an insulating blanket will reduce standby heat loss - heat lost through the walls of the tank- by 25-40%.[91]

Measure savings – Water heater insulation blankets save approximately 250 kWh per year.[92]

Measure incremental cost – The incremental cost to consumers of water heater insulation blankets is $35.[93]

Measure useful life – The useful life of a water heater blanket is 7 years.[94]

Estimated baseline saturation in Vermont – Approximately 61.6% of all electric water heaters in Vermont have installed an insulation blanket around their water heater.[95]

Table A-38 - Summary of Data Sources for Water Heater Blanket

Cost of installing WH blanket	Efficiency Vermont
Energy use of WH w/ blanket	Efficiency Vermont
Energy use of standard WH	Efficiency Vermont
Useful life of WH blanket	Efficiency Vermont
Baseline saturation of WH blanket	KEMA, Inc.

1.13.4 Low Flow Shower Head - Measure Data

Description – Low flow showerheads are another measure that is low-cost, and in addition to faucet aerators can reduce home water consumption by as much as 50%.[96]

Measure savings – Low flow shower heads can save approximately 340 kWh per year.[97]

---

91 "Consumer Guide to Home Energy Savings." 8th ed. ACEEE. 2003. Page 112.

92 Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 367.

93 Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 368.

94 ibid.

95 GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.

96 "Low-Flow Aerators" (www.eartheasy.com)

97 Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 379.

Measure incremental cost – The incremental cost to consumers of low flow shower heads is around $15.[98]

Measure useful life – The useful life of a low flow shower head is 9 years.[99]

Estimated baseline saturation in Vermont – Approximately 58.6% of all homes with electric water heaters in Vermont have installed a low flow shower head in their home.[100]

Table A-39 - Summary of Data Sources for Low-Flow Shower Head

Cost of Low-Flow Shower Head	Efficiency Vermont
Energy use of Low-Flow Shower Head	Efficiency Vermont
Energy use of standard Shower Head	Efficiency Vermont
Useful life of Low-Flow Shower Head	Efficiency Vermont
Baseline saturation of Low-Flow Shower Head	KEMA, Inc.

1.13.5 Pipe Wrap - Measure Data

Description – Insulating hot water pipes will reduce losses as the hot water is flowing to the faucet and, more importantly, it will reduce standby losses when the tap is turned off and then back on within an hour or so. Pipe wrap will conserve energy and water that would normally be lost waiting for the hot water to reach the tap. Energy loss still occurs after pipe wrap has been installed, though to a smaller degree than the losses observed in non-insulated pipes.

Measure savings – Pipe wrapping can save approximately 33 kWh per year.[101]

Measure incremental cost – The incremental cost to consumers of water heater pipe-wrap is $15.[102]

Measure useful life – The useful life of a pipe wrap is 13 years.[103]

Estimated baseline saturation in Vermont – Approximately 60% of all electric water heaters in Vermont have installed insulation wrap around their hot water pipes.[104]

---

[98] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 380.
[99] ibid.
[100] GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.
[101] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 371.
[102] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 372.
[103] ibid.
[104] GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.

Table A-40 - Summary of Data Sources for Water Heater Pipe Wrap

Cost of Pipe Wrap	Efficiency Vermont
Energy use of WH w/ Pipe Wrap	Efficiency Vermont
Energy use of standard WH	Efficiency Vermont
Useful life of Pipe Wrap	Efficiency Vermont
Baseline saturation of Pipe Wrap	GDS

1.13.6 Faucet Aerators - Measure Data

Description – Faucet aerators are attachments used to increase spray velocity, reduce splash and save water and energy. There are many variations of aerators yet they all should have a water usage of 2.75 gallons or less. These different models include swiveling, dual spray, vandal proof (requires a key to remove) and a one touch on/off tap saver. This model is equipped with a control lever to temporarily reduce the water flow without disturbing the temperature setting. This feature allows you to reduce the flow of water while shaving, brushing teeth, or washing dishes to save water.[105]

Measure savings – Faucet aerators can save approximately 57 kWh per year.[106]

Measure incremental cost – The incremental cost to consumers of a faucet aerator is $6.[107]

Measure useful life – The useful life of a faucet aerator is 9 years.[108]

Estimated baseline saturation in Vermont – Approximately 58.6% of homes in Vermont with electric water heaters have installed faucet aerator to conserve energy.[109]

Table A-41 - Summary of Data Sources for Faucet Aerators

Cost of FA	Efficiency Vermont
Energy use of FA	Efficiency Vermont
Energy use of home without FA	Efficiency Vermont
Useful life of FA	Efficiency Vermont
Baseline saturation of FA	KEMA, Inc.

[105] Faucet Aerators, AM Conservation Group, Inc. (www.amconservationgroup.com)

[106] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 382.

[107] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 383.

[108] ibid.

[109] GDS Calculation based on similar assumptions found in the Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.

1.13.7 Solar Water Heaters - Measure Data

Description – Solar water heaters are designed to serve as pre-heaters for conventional storage or demand water heaters. As the solar system preheats the water, the extra temperature boost required by the storage or demand water heater is relatively low, and high flow rate can be achieved. Although less common than they were two to three decades ago, solar water heating units are considerably less expensive and more reliable.[110] Solar water heaters can be particularly effective if they are designed for three-season use, with a home's heating system providing hot water during the winter months.

Measure savings – Solar water heating units save approximately 1,665 kWh per year.[111]

Measure incremental cost – The incremental cost per home to consumers of a solar water heating system is $4,500.[112]

Measure useful life – The useful life of a solar water heater is 20 years.[113]

Estimated baseline saturation in Vermont – Approximately 0% of all electric water heaters in Vermont are pre-heated with solar power.[114]

Table A42 - Summary of Data Sources for Solar Water Heater Technology

Cost of Solar WH	John Plunkett
Cost of standard WH	Connecticut Study (GDS)
Energy use of Solar WH	Connecticut Study (GDS)
Energy use of standard WH	Connecticut Study (GDS)
Useful life of Solar WH	ACEEE
Baseline saturation of Solar WH	Connecticut Study (GDS)

1.13.8 High Efficiency Water Heaters - Measure Data

Description – Ranging in size from 20 to 80 gallons (75.7 to 302.8 liters), storage water heaters remain the most popular type for residential heating needs in the United States. A storage heater operates by releasing hot water from the

110 "Consumer Guide to Home Energy Savings" 8th ed. ACEEE. 2003. Page 101.

111 "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region, Appendix B." June, 2004, by GDS Associates.

112 Incremental cost based on estimation given in "Supplemental Findings on GDS Draft Potential Study – Residential Sector" by John Plunkett

113 "Consumer Guide to Home Energy Savings" 8th ed. Table 6-6. ACEEE. 2003

114 "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region, Appendix B." June, 2004, by GDS Associates.

top of the tank when the hot water tap is turned on. To replace that hot water, cold water enters the bottom of the tank, ensuring that the tank is always full.[115]

Measure savings – Based on the DOE test procedure, energy savings associated with the switch from 0.87 EF to a 0.93 EF tank are approximately 326 kWh annually per high efficiency water heater installed.[116]

Measure incremental cost – The incremental cost to consumers of high efficiency electric water heaters is $90.[117]

Measure useful life – The useful life of an electric water heater is 13 years.[118]

Estimated baseline saturation in Vermont – Approximately 6% of all electric water heaters in Vermont can currently be classified as energy efficient.[119]

Table A-43 - Summary of Data Sources for High Efficiency Water Heater Technology

Cost of high efficiency WH	ACEEE
Cost of standard WH	ACEEE
Energy use of high efficiency WH	DOE
Energy use of standard WH	DOE
Useful life of WH	ACEEE
Baseline saturation of WH	Connecticut Study (GDS)
Market barrier information	ACEEE, CEE
National and regional programs	NEEP, MEEA, NEEA

1.14 Efficient Furnace Fan Motors

1.14.1 Description of Measure – Efficient Furnace Fan Motors

In general, a forced-air furnace is a relatively simple device, similar to a gas oven that's hooked up to a fan. First, natural gas is piped to a burner inside a combustion chamber where the gas is mixed with air and ignited by a pilot light, a spark or a related device at the request of a thermostat. Next, a blower in the furnace pulls cool air in from rooms through air ducts, passes it through a metal "heat exchanger" where it's heated by the burner, and blows the warm air back

[115] U.S. Department of Energy website http://www.eren.doe.gov/erec/factsheets/watheath.html

[116] Energy calculations based on DOE energy assumptions.

[117] "Consumer Guide to Home Energy Savings" 8th ed. Table 6-6. ACEEE. 2003.

[118] ibid.

[119] "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region, Appendix B." June, 2004, by GDS Associates.

into rooms through ductwork. Finally, exhaust gasses from the burners are vented outside through a flue.[120]

Over the past several years, manufacturers have used several new technologies to boost efficiency. One advancement was the move from the standing pilot light -- which burns gas even when the furnace is dormant -- to electronic spark ignition that fires the furnace on demand. Yet another step forward is "hot surface ignition," a method said to be more reliable than the electronic spark. Rather than using a spark plug that can corrode, it ignites the gas mixture with a coil that glows white hot.

Many gas-fired, high-efficiency furnaces also save on the electricity required to power the fan. They can do this by coupling a sophisticated, programmable thermostat to a variable-speed motor. Unlike a conventional system, where the furnace goes on, blows hot air into the house at full force for a few minutes, then shuts off, a variable-speed or "variable capacity" system runs the blower for longer periods at lower speeds. It provides more even, quiet, comfortable heat than a conventional furnace and doesn't consume electricity unnecessarily because it rarely runs at full speed[121].

1.14.2 Market Barriers

Furnace fan energy use, which is disclosed in public databases, is not regulated so little attention is generally paid to it. As a result, although attention to efficiency can save consumers money in life cycle costs, few have a firm understanding of the benefits. Additionally, in a retrofit market, dealer training and experience, stocking practices and availability, and related factors have limited the willingness of many dealers to recommend the higher price but more efficient products.

1.14.3 Efficient Furnace Fan Motor - Measure Data

Description – This measure examines the installation of high efficiency brushless permanent magnet fan motor in a qualified natural gas, propane, or fuel-oil fired furnace.

Measure savings – An efficient furnace fan motor can create an annual savings of 462 kWh.[122]

Measure incremental cost – According to Efficiency Vermont, the incremental cost of a high efficiency furnace fan motor is approximately $200.[123]

---

[120] "High Efficiency Furnaces: A Buying & Care Guide." High Efficiency Furnaces & Forced Air Heating. (www.hometips.com)
[121] "High Efficiency Furnaces: A Buying & Care Guide." High Efficiency Furnaces & Forced Air Heating. (www.hometips.com)
[122] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 550.

Measure useful life – The useful life of an efficient furnace fan motor is 18 years.[124]

Estimated baseline saturation in Vermont – The saturation of efficient furnace fans in homes that operate central forced air gas-fired furnaces is estimated to be 10%.[125]

Table A-44 - Summary of Data Sources for Efficient Furnace Fan Motors

Cost of high efficiency furnace fan motor	Efficiency Vermont
Cost of standard furnace fan motor	Efficiency Vermont
Energy use of high efficiency furnace fan motor	Efficiency Vermont
Energy use of standard furnace fan motor	Efficiency Vermont
Useful life of high efficiency furnace fan motor	Efficiency Vermont
Baseline saturation of high efficiency furnace fan motor	GDS
Market barrier information	ACEEE
National and regional programs	ACEEE

1.15 High Efficiency Energy Star Windows

1.15.1 Description of Measure

Typical residential windows in existing residential construction have aluminum or wood frames, high U-values, and are single or double-glazed. U-value is a measure of energy transmittance, the inverse of R-value, so more efficient windows have lower U-values. However, in many areas of the country, heat gains through windows are a major contributor to building cooling load in the summer, and heat loss in the winter contributes to space heating costs. An additional measure of window performance is its Solar Heat Gain Coefficient (SHGC), which considers heat gains that affect cooling energy. SHGC depends primarily on a window's ability to block infrared wavelengths of light through tints and selective coatings. More efficient windows have lower SHGC values.

To be eligible for the ENERGY STAR®, products must be rated, certified, and labeled for both U-Factor and Solar Heat Gain Coefficient (SHGC) in accordance with the procedures of the National Fenestration Rating Council at levels which meet the following ENERGY STAR® qualification criteria in one or more Climate Zone.

---

[123] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 552.

[124] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 552.

[125] GDS estimate

1.15.2 Market Barriers

High costs are the primary market barrier to customers purchasing or adopting efficient windows in new homes or existing homes. In a recent study, both manufacturers and retailers were uniform in their opinion that price is the overriding barrier to ENERGY STAR® windows adoption, and that new home builders will often take tradeoff approaches to meet code so they can save money on materials. A perceived uncertainty amongst consumers about potential savings generated by ENERGY STAR® windows is another remaining market barrier. Research and development aimed at reducing manufacturing costs, as well as increased education efforts may be helpful. Regional approaches, in particular, appear to be productive.

Two recent activities that address market barriers to increased window efficiency include DOE's ENERGY STAR® labeling program (labels are expected to be found in stores in mid-1998) and the formation of the Efficient Windows Collaborative (EWC). The EWC is a coalition of manufacturers, researchers, and government agencies that aims to expand the market for high efficiency fenestration products. To achieve its goals, the EWC:

- Provides consumer education
- Offers training and education to company sales forces and trade ally audiences
- Develops demonstration projects for regional marketing and education opportunities;
- Works to strengthen national and state building codes to incorporate efficient window standards; and
- Communicates information on market trends, technical information, training opportunities and demonstration results to a broad audience.

In addition, the EWC can offer both technical and logistical support to utility planning efforts, emphasizing information on the energy and peak demand performance of windows, as well as liaison with on-going national activities, such as the NFRC rating and labeling procedures, or the ENERGY STAR® Window and ENERGY STAR Builder programs.

Regional groups and utilities can take advantage of these national efforts. PG&E, for example, plans to work collaboratively with NFRC, and the ENERGY STAR® program to promote high efficiency windows (particularly spectrally selective glazing products) for new and existing homes. The EWC project includes a comprehensive awareness campaign, sales training for manufacturers, and technical assistance for builders. As market share for efficient windows increases, incorporating more aggressive efficiency requirements for windows into building codes will become a viable approach to sustaining the market.

1.15.3 High Efficiency Windows - Measure Data

Description – In a typical house, over 40% of the annual energy budget is consumed by heating and cooling. Proper selection of windows, doors and skylights can significantly effect how much money is spent or saved every year on keeping homes bright and comfortable. In Vermont, ENERGY STAR® qualified windows have a U-value of less than .35. ENERGY STAR® does not specify a required SHGC value for the northern climate zone.[126]

Measure savings – The annual electric energy savings derived from the installation of ten ENERGY STAR® qualified windows in a single family home with electric heating is approximately 5,000 kWh. The savings due to installation of ten ENERGY STAR® qualified windows in a multi family home with electric heating is approximately 2,500 kWh per year.[127]

Measure incremental cost – The incremental cost of ENERGY STAR® qualified windows in a household is $200 ($20 per window).[128]

Measure useful life – The useful life of a high efficiency window is 35 years.[129]

Estimated baseline saturation in Vermont – ENERGY STAR® qualified windows are currently installed in approximately 60% of electric heated households in Vermont.[130]

Table A-45 - Summary of Data Sources for High Efficiency Window Technology

Incremental cost information	NEEP
Annual Energy savings information	GDS, John Plunkett
Useful life of high efficiency window	ACEEE
Baseline saturation of HE window	KEMA
Market barrier information	ACEEE, CEE
National and regional programs	NEEP, MEEA, NEEA, EPA

[126] Energy Star website. (www.energystar.gov/products/windows)

[127] Annual savings based on figures derived from “Supplemental Findings on GDS Draft Potential Study – Residential Sector” comments by John Plunkett in April 2006.

[128] "Baseline Characterization of the Residential Market for Energy Star Windows in the Northeast." The study was prepared for NEEP by Quantec LLC and Nexus Market Research in October of 2002. Table V.10 on page V-11

[129] "Selecting Targets for Market Transformation Programs, A National Analysis", ACEEE Report. August 1998, page 60.

[130] “Phase 2 Evaluation of the Efficiency Vermont Residential Programs.” KEMA, Inc. December 2005. pg 3-33.

1.16 Weatherization Technologies

1.16.1 Description of Measure – Residential Weatherization Technologies

Weatherization measures address the reduction of thermal transfer through the "shell" between the interior and exterior of a heated/cooled structure. These measures can appear in the form of air-sealing to prevent air infiltration and heat loss through gaps in the building shell, or in the form of insulation to reduce the amount of heat flow between conditioned and unconditioned spaces.

Heat moves from warmer spaces to cooler spaces. In a typical home heat moves directly from heated living spaces to adjacent unheated spaces such as attics, basements and crawl spaces. The degree to which this heat transfer takes place depends upon the R-value of various building shell components such as ceilings, walls and floors. The R-value represents a material's resistance to *thermal* conductance or heat flow and depends upon three factors: the material's type, density, and thickness.

Recommended R-values are suggested from two different points of view: those R-values recommended for maximum comfort and those recommended for maximum energy efficiency. Most R-values established by local building codes are set based on comfort, while those proposed by the U.S. Department of Energy focus on energy efficiency. For this reason, even newer homes can receive added insulated and produce a payback within a few years. Recommended R-values for a particular home are dependent upon the building shell component being considered, the climactic zone and the heat fuel type.

Air infiltration accounts for one of the largest contributions to excess energy usage in existing residential structures. Air infiltration is typically measured by either the number of air changes per hour (ACH) or cubic feet per minute (CFM). These quantities are usually expressed at an assumed pressure (50 pascals).[131]

Factors affecting the air infiltration include the following:

- the temperature differential between the indoor and outdoor air temps,
- wind speed,
- terrain and
- the degree to which air moves through the building shell.

Of these factors, the later is the one most commonly addressed with DSM measures.

To ascertain the leakiness of a structure, a blower door test can be performed. While the blower door has the home depressurized a technician will seek out points of air infiltration using a smoke puffer. Once areas of air infiltration are

[131] Suozzo, Margaret and Steven Nadel, "Selecting Targets for Market Transformation programs: A National Analysis", ACEEE, 1998.

located they are addressed using caulking, sealants and weather stripping. Typical points of air infiltration include areas around windows and doors, and areas where plumbing and electrical infrastructure penetrate the buildings shell between heated and unheated spaces.

1.16.2 Market Barriers – Weatherization

Market barriers for weatherization in residential settings may include the following[132]:

High First Cost – The cost of installing weather stripping is not expensive. However, to insulate large attic spaces and walls can be more costly. Often areas needing additional insulation are not accessible and require additional light construction expense for creating access to certain areas. Also, usually the installation of loose fill insulation requires hiring a professional insulation company with specialized equipment.

Information or research costs - The costs of researching and identifying energy efficient products or services. This includes the value of the time spent locating a product or service or the cost of hiring someone to do this research.

Performance uncertainties – The uncertainty that energy efficiency investment will actually return stated savings.

Transaction Costs – This refers to the indirect cost and hassle of hiring contractors or purchasing energy efficient equipment.

In addition, a large segment of the residential market is within rental housing where if the tenant pays for the heat and electricity there is little incentive for the property owner to invest in their property without foreseeing a direct return on investment. Similarly, in cases where units are master metered and therefore individual household consumption is not monitored, there is little incentive for tenants to alter their behavior to save energy.

1.16.3 Weatherization/Insulation

Description – Inadequate insulation and air leakage are leading causes of energy waste in most homes. Properly installed weatherization measures can reduce a home's energy expenses by over 30 percent.[133] The following measures were used in the Vermont weatherization and insulation program modeled in this study: attic insulation, wall insulation, floor insulation, and air sealing. The base home R-value assumptions are based on survey results conducted by GDS in February 2006 with three contractors in Vermont that have

[132] New York Energy $mart[SM] Program Evaluation and Status Report, Interim Report, 9/2000.

[133] "Energy Savers: Insulation and Sealing Air Leaks" DOE Energy Efficiency and Renewable Energy. March 2006. (www.eere.energy.gov)

experience providing insulation and weatherization upgrades to existing homes. The objective of this survey was to determine the "base" home to be used for conducting an analysis of potential energy savings by upgrading to an "improved" home.

Low-Income Homes were also included in this analysis. Low-Income homes receive 100% incentive for the cost of the measures, and qualify based on income. Eligible households have an annual income of 60% (or more) below the state median income for households.

Table A-46 – R-value upgrades for Weatherization/Insulation Program Measures

Base Home	Upgraded Home
Attic insulation R-19	Attic insulation to R-38
Wall insulation R-0	Wall insulation to R-13
Floor insulation R-0	Floor insulation to R-19
Air infiltration to .75 ACH	Reduced air infiltration to .50 ACH

Measure savings – Energy savings for the addition of insulation will depend upon change in R-Value between the insulation that already exists and what is being added. Savings are calculated based upon this change in R-value, the heating-degree-days (HDD) at the project's location and the square footage of the area to be insulated. In a typical house in Vermont, the weatherization/insulation program would save an average of 6000 kWh annually in single-family houses, and 3000 kWh annually in multi-family houses.[134] Low income housing would also benefit from insulation/weatherization measures. A low income single family house would save an average of 6000 kWh per year, while a multi family home would realize an estimated annual savings of 3000 kWh.[135]

Measure incremental cost – The incremental cost of all measures combined is approximately $2,000.[136]

Measure useful life – The useful life of building shell measures are typically 20 years.[137]

Estimated baseline saturation in Vermont – Approximately 75% of non low-income homes in Vermont with electric heating have been properly insulated and

[134] Annual savings based on figures derived from "Supplemental Findings on GDS Draft Potential Study – Residential Sector" comments by John Plunkett in April 2006.
[135] ibid.
[136] GDS calculation based on program incentive figures from KeySpan Weatherization program completed in February 2006
[137] GDS calculation based on useful life of insulation/weatherization individual measures.

weatherized.[138] Nearly 40% of low-income homes have also been properly weatherized and insulated with the help of a weatherization assistance program.[139]

Table A-47 - Summary of Data Sources for Weatherization/Insulation Technology

Incremental cost information	GDS
Annual Energy savings information	GDS, John Plunkett
Useful life of high efficiency window	GDS
Baseline saturation of HE window	GDS
Market barrier information	ACEEE, CEE
National and regional programs	DOE, EPA

1.17 Residential New Construction

1.17.1 Description of Measure – Residential New Construction

ENERGY STAR® qualified new homes are new residential construction projects that have been independently verified to be at least 30% more energy efficient than homes built to the 1993 national Model Energy Code or 15% more efficient than state energy code, whichever is more rigorous. Only recently, have newer standards and a new Home Energy Rating System (HERS) come into effect. These new guidelines and new HERS rating system must be used to qualify homes for the ENERGY STAR® label that are not enrolled in a state or utility program before December 31, 2005 or permitted before July 1, 2006.

The new system evaluates the energy efficiency of a home compared to a computer-simulated reference house of identical size and shape as the rated home that meets minimum requirements of the 2004 International Energy Conservation Code (IECC). The HERS rating results in a HERS Index score between 0 and 100, with the reference house assigned a score of 100 and a zero energy house assigned a score of 0. Each 1 percent reduction in energy usage (compared to the reference house) results in a one point decrease in the HERS score. Thus, an ENERGY STAR® Qualified Home, required to be approximately 15 percent more energy efficient than 2004 IECC in the south requires a HERS Index of 85; and an ENERGY STAR® Qualified Home, required to be approximately 20 percent more energy efficient than 2004 IECC in the north requires a HERS Index of 80.[140]

[138] GDS Assumption based on meeting with Efficiency Vermont and Vermont Department of Public Services

[139] GDS Calculation based on figures provided by the Vermont OEO Weatherization Program and poverty statistics from the US Census.

[140] "September 2005 Update: EPA Releases Final New Guidelines for ENERGY STAR Qualified Homes." (www.energystar.gov)

Savings are based on heating, cooling, and hot water energy use and typically achieved through a combination of: high performance windows, controlled air infiltration, upgraded heating and conditioning systems, tight duct systems, high efficiency water-heating equipment, and high efficiency building envelope standards. These features contribute to improved home quality and homeowner comfort, and to lower energy demand and reduced air pollution. ENERGY STAR® also encourages the use of energy-efficient lighting and appliances, as well as features designed to improve indoor air quality.

Any single-family or multi-family residential home that is three stories or less in height can qualify to receive the ENERGY STAR® label. This includes traditional site-constructed homes as well as modular, systems-built (e.g., insulated concrete forms, structurally insulated panels), and HUD-code manufactured homes.

1.17.2 Market Barriers

An initial evaluation of the New Construction Program by KEMA, Inc found that most builders and customers were confused regarding program benefits and procedures. This confusion may have been due to frequent changes in the program name and features between 1999 and 2003. Targeted mail and phone call campaigns to builders statewide, as well as outreach to municipal officials and builders of manufactured homes are some of the efforts that are underway to educate and increase interest in the ENERGY STAR® new homes program. Increasing builder awareness of non-energy benefits of energy efficient equipment (including increased comfort and lower equipment maintenance costs) is also important to the success of program.

1.17.3 Vermont ENERGY STAR® Homes- Measure Data

Description – To qualify for the Vermont ENERGY STAR® Homes designation, a house has to achieve a Home Energy Rating of 86, which is equivalent to the EPA's 5-star ENERGY STAR® home rating. Homes must contain high levels of insulation, efficient heating and hot water equipment, and high quality air sealing measures to meet this rating. Homes that meet these standards will use approximately 20% less energy for heating, cooling, and hot water than those that meet the minimum requirements of Vermont's Residential Energy Building Standard. In addition, qualifying homes need to contain at least 10 energy efficient lighting fixtures of 30% of fixtures (whichever is lower), and efficient mechanical ventilation systems.

Measure savings – An ENERGY STAR® qualified home saves an average of 1671 kWh per year based on previously collected program data.[141] In addition,

[141] Efficiency Vermont 2004 Annual Report. Nov. 2005. pg 49

these new construction projects will also save approximately 32 mmbtu and 1331 gallons annually and gas and water savings, respectively.[142]

Measure incremental cost – The incremental cost of building a new home to meet the ENERGY STAR® Homes criteria is approximately $998.[143]

Measure useful life – The useful life of an ENERGY STAR® qualified home is 18 years.[144]

Estimated baseline saturation in Vermont – 20% of newly constructed homes in Vermont already participate in the ENERGY STAR® Homes program.[145]

Table A-48 - Summary of Data Sources for ENERGY STAR® Homes program

Cost of ENERGY STAR® qualified home	Efficiency Vermont
Cost of standard new home	Efficiency Vermont
Energy use of ENERGY STAR® qualified home	Efficiency Vermont
Energy use of standard new home	Efficiency Vermont
Useful life of ENERGY STAR® qualified home	Efficiency Vermont
Baseline saturation of ENERGY STAR® qualified home	KEMA
Market barrier information	KEMA
National and regional programs	EPA

1.18 Fuel-Switching Options

1.18.1 Description of Measure – Fuel Switching Options

Replacing, upon burnout, an electric consuming appliance with an efficient non-electric appliance is another option to reduce electric consumption. In addition to eliminating the electric use, non-electric fuels are generally a more cost effective energy source as the fuel source is burned directly at the house for heating rather than being first converted to electricity at the power plant.[146]

1.18.2 Market Barriers

The incremental cost of replacing an electric-based system with a non-electric based system is one potential barrier to fuel-switching. Non electric high efficiency appliances are generally more costly than their electric counterparts.

---

[142] Efficiency Vermont 2004 Annual Report. Nov. 2005. pg 50 & Efficiency Vermont 2003 Annual Report. Nov. 2004. pg 48

[143] Efficiency Vermont 2004 Annual Report. Nov. 2005. pg 49

[144] ibid.

[145] GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.

[146] "Home Energy Briefs: #5 Water Heating." Rocky Mountain Institute. 2004 (www.rmi.org)

In addition, the cost effectiveness of fuel-switching is also challenged by changes in residential gas prices. The decrease in electric consumption may be offset by the rise in gas consumption and the accompanying cost. While some early programs have claimed success with fuel-switching, other programs have recently claimed no long term economic advantage.[147,148] The type of fuel a residence has access to switch to will limit consumer options for fuel-switching.

1.18.3 Fuel Switching (Electric Water Heater to Natural Gas) - Measure Data

Description – This measure examines the installation of an efficient natural gas water heater upon burnout of an electric water heater. All estimates are based on the installation of a standard tank size natural gas water heater with an efficiency rating of .59 in lieu of a high efficiency electric water heater with an efficiency rating of .88.

Measure savings – The saving derived from fuel-switching is the entire electric energy consumption of the electric unit.[149] Conversely, there is an increase in gas consumption from the installation of a high efficiency natural gas water heater.[150] The following table displays the kWh savings and increased gas consumption for each household size.

Table A-49 - Summary of Measure Savings for Fuel Switching (Electric Water Heater to Natural Gas)

Num. of Bedrooms	Annual kWh Savings	Increased mmbtu consumption
1	2400	12.22
2	3000	15.27
3	3600	18.33
4	4500	22.91
5 or more	5400	27.49

Measure incremental cost – The incremental cost to consumers from switching a high efficiency electric water heater to an efficient natural gas water heater is roughly $500.[151]

Measure useful life – The useful life of a natural gas water heater is 13 years.[152]

---

147 "Making Low Income Housing Affordable: The Northgate Retrofits." Home Energy Magazine Online March/April 1993. Accessed April 2006. (www.homeenergy.org)

148 "Smart Choices for Consumers: Analysis of the Best Ways to Reduce Heating Costs." Consumer Energy Council of America. CECA Heating Fuels Report, Nov. 2005. (www.cecarf.org)

149 Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 574.

150 Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 579.

151 Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 577.

152 Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 576.

Estimated baseline saturation in Vermont – Approximately 37% of all water heaters in single family homes in Vermont are heated with electricity (41.6% of all multi-family homes). These electric water heaters are candidates for fuel-switching to a non-electric fuel source. 5% of homes with electric water heaters utilize natural gas as their primary heating source.[153] Table A-50 displays the percent of Vermont homes, broken down by number of bedrooms that have electric water heaters and the ability to fuel-switch to a natural gas water heater.

Table A-50 – Percent of Homes in Vermont with Fuel Switching Ability (Electric Water Heater to Natural Gas)

Num. of Bedrooms	Single Family Natural Gas	Multi Family Natural Gas
1	0.10%	0.50%
2	0.40%	0.80%
3	0.90%	0.60%
4	0.40%	0.10%
5 or more	0.10%	< .01%

Table A-51 - Summary of Data Sources for WH Fuel Switching Opportunity

Cost of high efficiency natural gas WH	Efficiency Vermont
Cost of high efficiency electric WH	Efficiency Vermont
Energy use of HE natural gas WH	Efficiency Vermont
Energy use of HE electric WH	Efficiency Vermont
Useful life of HE natural gas WH	Efficiency Vermont
Baseline saturation of fuel switching candidates to a natural gas WH	KEMA
Market barrier information	CECA, ACEEE, Home Energy
National and regional programs	ACEEE, RMI

1.18.4 Fuel Switching (Electric Water Heater to Fuel Oil) - Measure Data

Description – This measure examines the installation of an efficient fuel oil water heater upon burnout of a standard electric water heater. All estimates are based on the installation of a standard tank size fuel oil water heater with an efficiency rating of .64 in lieu of a high efficiency electric water heater with an efficiency rating of .88.

Measure savings – The saving derived from fuel-switching is the entire electric energy consumption of the electric unit.[154] Conversely, there is an increase in

[153] GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.

[154] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 574.

gas consumption from the installation of a high efficiency fuel oil water heater.[155] The following table displays the kWh savings and increased gas consumption for each household size.

Table A-52 - Summary of Measure Savings for Fuel Switching (Electric Water Heater to Fuel Oil)

Num. of Bedrooms	Annual kWh Savings	Increased mmbtu consumption
1	2400	11.26
2	3000	14.08
3	3600	16.89
4	4500	21.12
5 or more	5400	25.34

Measure incremental cost – The incremental cost to consumers from switching a high efficiency electric water heater to an efficient fuel oil water heater is roughly $1,575.[156]

Measure useful life – The useful life of a fuel oil water heater is 10 years.[157]

Estimated baseline saturation in Vermont – Approximately 37% of all water heaters in single family homes in Vermont are heated with electricity (41.6% of all multi-family homes). These electric water heaters are candidates for fuel-switching to a non-electric fuel source. 51% of homes with electric water heaters utilize fuel oil as their primary heating source.[158] Table A-53 displays the percent of Vermont homes, broken down by number of bedrooms that have electric water heaters and the ability to fuel-switch to a fuel oil water heater.

Table A-53 – Percent of Homes in Vermont with Fuel Switching Ability (Electric Water Heater to Fuel Oil)

Num. of Bedrooms	Single Family Fuel Oil	Multi Family Fuel Oil
1	0.70%	4.80%
2	3.70%	8.40%
3	9.00%	6.30%
4	4.20%	1.40%
5 or more	1.20%	.20%

[155] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 579.
[156] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 577.
[157] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 576.
[158] GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.

Table A-54 - Summary of Data Sources for WH Fuel Switching Opportunity

Cost of high efficiency fuel oil WH	Efficiency Vermont
Cost of high efficiency electric WH	Efficiency Vermont
Energy use of HE fuel oil WH	Efficiency Vermont
Energy use of HE electric WH	Efficiency Vermont
Useful life of HE fuel oil WH	Efficiency Vermont
Baseline saturation of fuel switching candidates to a fuel oil WH	KEMA
Market barrier information	CECA, ACEEE, Home Energy
National and regional programs	ACEEE, RMI

1.18.5 Fuel Switching (Electric Water Heater to Propane) - Measure Data

Description – This measure examines the installation of an efficient propane water heater upon burnout of a standard electric water heater. All estimates are based on the installation of a standard tank size propane water heater with an efficiency rating of .61 in lieu of a high efficiency electric water heater with an efficiency rating of .88.

Measure savings – The saving derived from fuel-switching is the entire electric energy consumption of the electric unit.[159] Conversely, there is an increase in gas consumption from the installation of a high efficiency propane water heater.[160] The following table displays the kWh savings and increased gas consumption for each household size.

Table A-55 - Summary of Measure Savings for Fuel Switching (Electric Water Heater to Propane)

Num. of Bedrooms	Annual kWh Savings	Increased mmbtu consumption
1	2400	11.82
2	3000	14.77
3	3600	17.73
4	4500	22.16
5 or more	5400	26.59

Measure incremental cost – The incremental cost to consumers from switching a high efficiency electric water heater to an efficient propane water heater is roughly $800.[161]

Measure useful life – The useful life of a propane water heater is 13 years.[162]

[159] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 574.
[160] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 579.
[161] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 577.

Estimated baseline saturation in Vermont – Approximately 37% of all water heaters in single family homes in Vermont are heated with electricity (41.6% of all multi-family homes). These electric water heaters are candidates for fuel-switching to a non-electric fuel source. 14% of homes with electric water heaters utilize propane as their primary heating source.[163] Table A-56 displays the percent of Vermont homes, broken down by number of bedrooms that have electric water heaters and the ability to fuel-switch to a propane water heater.

Table A-56 – Percent of Homes in Vermont with Fuel Switching Ability (Electric Water Heater to Propane)

Num. of Bedrooms	Single Family Fuel Oil	Multi Family Fuel Oil
1	0.20%	1.30%
2	1.00%	2.30%
3	2.50%	1.70%
4	1.10%	0.40%
5 or more	0.30%	0.10%

Table A-57 - Summary of Data Sources for WH Fuel Switching Opportunity

Cost of high efficiency propane WH	Efficiency Vermont
Cost of high efficiency electric WH	Efficiency Vermont
Energy use of HE propane WH	Efficiency Vermont
Energy use of HE electric WH	Efficiency Vermont
Useful life of HE propane WH	Efficiency Vermont
Baseline saturation of fuel switching candidates to a propane WH	KEMA
Market barrier information	CECA, ACEEE, Home Energy
National and regional programs	ACEEE, RMI

1.18.6 Fuel Switching (Electric Water Heater to Kerosene - Instantaneous) - Measure Data

Description – This measure examines the installation of an efficient instantaneous kerosene water heater upon burnout of a standard electric water heater. All estimates are based on the installation of a standard size instantaneous kerosene water heater with an efficiency rating of .88 in lieu of a high efficiency electric water heater with an efficiency rating of .88.

Measure savings – The saving derived from fuel-switching is the entire electric energy consumption of the electric unit.[164] Conversely, there is an increase in

[162] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 576.

[163] GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.

[164] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 574.

gas consumption from the installation of a high efficiency kerosene water heater.[165] The following table displays the kWh savings and increased gas consumption for each household size.

Table A-58 - Summary of Measure Savings for Fuel Switching (Electric Water Heater to Kerosene)

Num. of Bedrooms	Annual kWh Savings	Increased mmbtu consumption
1	2400	8.19
2	3000	10.24
3	3600	12.29
4	4500	15.36
5 or more	5400	18.43

Measure incremental cost – The incremental cost to consumers from switching a high efficiency electric water heater to an efficient kerosene water heater is roughly $2,000.[166]

Measure useful life – The useful life of a kerosene water heater is 15 years.[167]

Estimated baseline saturation in Vermont – Approximately 37% of all water heaters in single family homes in Vermont are heated with electricity (41.6% of all multi-family homes). These electric water heaters are candidates for fuel-switching to a non-electric fuel source. 16% of homes with electric water heaters utilize kerosene as their primary heating source.[168] Table A-59 displays the percent of Vermont homes, broken down by number of bedrooms that have electric water heaters and the ability to fuel-switch to a kerosene water heater.

Table A-59 – Percent of Homes in Vermont with Fuel Switching Ability (Electric Water Heater to Kerosene)

Num. of Bedrooms	Single Family Fuel Oil	Multi Family Fuel Oil
1	0.20%	1.50%
2	1.20%	2.60%
3	2.80%	2.00%
4	1.30%	0.50%
5 or more	0.40%	0.10%

[165] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 579.
[166] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 577.
[167] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 576.
[168] GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.

Table A-60 - Summary of Data Sources for WH Fuel Switching Opportunity

Cost of high efficiency kerosene WH	Efficiency Vermont
Cost of high efficiency electric WH	Efficiency Vermont
Energy use of HE kerosene WH	Efficiency Vermont
Energy use of HE electric WH	Efficiency Vermont
Useful life of HE kerosene WH	Efficiency Vermont
Baseline saturation of fuel switching candidates to a propane WH	KEMA
Market barrier information	CECA, ACEEE, Home Energy
National and regional programs	ACEEE, RMI

1.18.7 Fuel Switching (Electric Water Heater to Kerosene – Stand Alone) - Measure Data

Description – This measure examines the installation of an efficient stand alone kerosene water heater upon burnout of a standard electric water heater. All estimates are based on the installation of a standard tank size kerosene water heater with an efficiency rating of .68 in lieu of a high efficiency electric water heater with an efficiency rating of .95.

Measure savings – The saving derived from fuel-switching is the entire electric energy consumption of the electric unit. A high efficiency electric water heater consumes an average of 3,068.25 kWh per year in a single family home, 2524.22 kWh per year for multi-family homes.[169] Conversely, there is an increase in gas consumption (an annual average of 152.6 therms for single family homes and 128.7 therms) from the installation of a high efficiency kerosene water heater.[170]

Measure incremental cost – The incremental cost to consumers from switching a high efficiency electric water heater to an efficient kerosene water heater is roughly $1880.[171]

Measure useful life – The useful life of a kerosene water heater is 10 years.[172]

Estimated baseline saturation in Vermont – Approximately 37% of all water heaters in single family homes in Vermont are heated with electricity (41.6% in multi family homes). These electric water heaters are candidates for fuel-

[169] Energy end use computer model developed by Energy Center of Wisconsin; model run by GDS on April 6, 2006.
[170] Energy end use computer model developed by Energy Center of Wisconsin; model run by GDS on April 6, 2006.
[171] GDS Calculation based on list price of kerosene water heater models made by John Wood and Bradford-White. April 18, 2006.
[172] GDS estimate based on similar model assumptions.

switching to a non-electric fuel source. 16% of homes with electric water heaters utilize kerosene as their primary heating source.[173]

Table A-61 - Summary of Data Sources for WH Fuel Switching Opportunity

Cost of high efficiency kerosene WH	GDS
Cost of high efficiency electric WH	GDS
Energy use of HE kerosene WH	GDS
Energy use of HE electric WH	GDS
Useful life of HE kerosene WH	GDS
Baseline saturation of fuel switching candidates to a kerosene WH	KEMA
Market barrier information	CECA, ACEEE, Home Energy
National and regional programs	ACEEE, RMI

1.18.8 Fuel Switching (Electric Water Heater to Wood) - Measure Data

Description – This measure examines the installation of an efficient wood water heater upon burnout of a standard electric water heater. All estimates are based on the installation of a standard tank size wood consuming water heater with an efficiency rating of .50 in lieu of a high efficiency electric water heater with an efficiency rating of .95.

Measure savings – The saving derived from fuel-switching is the entire electric energy consumption of the electric unit. A high efficiency electric water heater consumes an average of 3,068.25 kWh per year in a single family home, 2524.22 kWh per year for multi-family homes.[174] Conversely, there is an increase in wood consumption (an annual average of 207.5 therms for single family homes and 174.8 therms) from the installation of a high efficiency wood water heater.[175]

Measure incremental cost – The incremental cost to consumers from switching a high efficiency electric water heater to an efficient wood water heater is roughly $1320.[176]

Measure useful life – The useful life of a wood water heater is 10 years.[177]

Estimated baseline saturation in Vermont – Approximately 37% of all water heaters in single family homes in Vermont are heated with electricity (41.6% in multi family homes). These electric water heaters are candidates for fuel-

[173] GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.
[174] Energy end use computer model developed by Energy Center of Wisconsin; model run by GDS on April 6, 2006.
[175] Energy end use computer model developed by Energy Center of Wisconsin; model run by GDS on April 6, 2006.
[176] GDS phone call with Black Stove Shop (Maine) on March 28, 2006.
[177] GDS estimate based on similar model assumptions.

switching to a non-electric fuel source. 14% of homes with electric water heaters utilize wood as their primary heating source.[178]

Table A-62 - Summary of Data Sources for WH Fuel Switching Opportunity

Cost of high efficiency wood WH	GDS
Cost of high efficiency electric WH	GDS
Energy use of HE wood WH	GDS
Energy use of HE electric WH	GDS
Useful life of HE wood WH	GDS
Baseline saturation of fuel switching candidates to a wood WH	KEMA
Market barrier information	CECA, ACEEE, Home Energy
National and regional programs	ACEEE, RMI

1.18.9 Fuel Switching (Electric Space Heating to Non-Electric Space Heating) - Measure Data

Description – This measure examines the installation of an efficient non-electric space heater upon burnout of a standard electric space heater.

Measure savings – The saving derived from fuel-switching is the entire electric energy consumption of the electric unit. An electric space heater consumes an average of 20,000 kWh per year in a single family home, 10,000 kWh per year for multi-family homes.[179] Conversely, there is an increase in fuel consumption (an annual average of 853.3 therms for single family homes and 426.6 therms) from the installation of a high efficiency non-electric space heater.[180]

Measure incremental cost – The incremental cost to consumers from switching an electric space heater to an efficient non-electric space heater is roughly $6,500.[181]

Measure useful life – The useful life of a high efficiency non-electric space heater is 20 years.[182]

Estimated baseline saturation in Vermont – Approximately 2% of all homes in Vermont are heated with electricity.[183]

---

[178] GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.

[179] GDS calculation based on figures derived from "Supplemental Findings on GDS Draft Potential Study-Residential Sector" comments by John Plunkett

[180] GDS calculation based on figures derived from "Supplemental Findings on GDS Draft Potential Study-Residential Sector" comments by John Plunkett.

[181] Optimal Energy Model Input Assumptions, 2003.

[182] GDS estimate based on known space heating measures.

[183] GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.

Table A-63 - Summary of Data Sources for Space Heating Fuel Switching Opportunity

Cost of high efficiency non-electric space heating unit	Optimal Energy
Cost of electric space heating unit	Optimal Energy
Energy use of high efficiency non-electric space heating unit	GDS
Energy use of electric space heating unit	GDS
Useful life of high efficiency non-electric space heating unit	GDS
Baseline saturation of homes with electric space heating	KEMA
Market barrier information	CECA, ACEEE, Home Energy
National and regional programs	ACEEE, RMI

1.18.10 Fuel Switching (Electric Clothes Dryer to Natural Gas/Propane) - Measure Data

Description – This measure examines the installation of an efficient clothes dryer heated with natural gas or propane upon burnout of a standard electric clothes dryer.

Measure savings – The saving derived from fuel-switching is the entire electric energy consumption of the electric unit. An electric clothes dryer consumes an average of 942 kWh per year.[184] Conversely, there is an increase in gas consumption (an annual average of 33.8 therms) from the installation of a high efficiency non-electric clothes dryer.[185]

Measure incremental cost – The incremental cost to consumers from switching an electric clothes dryer to an efficient non-electric clothes dryer is roughly $375.[186]

Measure useful life – The useful life of a clothes dryer is 14 years.[187]

Estimated baseline saturation in Vermont – Approximately 15% of all single family homes in Vermont are equipped with electric clothes dryers and have access to natural gas or propane for fuel-switching (19% in multi family

[184] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 36.
[185] ibid.
[186] ibid.
[187] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37. Page 37.

homes).[188] These electric clothes dryers are candidates for fuel-switching to a non-electric fuel source.

Table A-64 - Summary of Data Sources for Electric Clothes Dryer Fuel Switching Opportunity

Cost of high efficiency non-electric clothes dryer	Efficiency Vermont
Cost of electric clothes dryer	Efficiency Vermont
Energy use of HE non-electric clothes dryer	Efficiency Vermont
Energy use of electric clothes dryer	Efficiency Vermont
Useful life of HE non-electric clothes dryer	Efficiency Vermont
Baseline saturation of fuel switching candidates to a non-electric clothes dryer	KEMA
Market barrier information	CECA, ACEEE, Home Energy
National and regional programs	ACEEE, RMI

1.19 Emerging Technologies

1.19.1 Emerging Technologies – LED Lighting

Highly efficient light-emitting diodes (LED's) are a relatively old technology (1970's) and currently dominate the exit sign market as well as being adopted in many cities for replacement of incandescent lamps in traffic signals. In the residential market the white light LED has opened the eyes of many lighting experts; however, they currently do not produce enough lumen output to enable them to be on a competitive level with many general light sources.

By 2020, solid-state lighting devices such as LED's could cut electricity used for illumination by 50 percent, according to a US Department of Energy study and with continued studies and analyses on this technology, commercial availability should increase to a substantial level within the near future.[189]

1.19.2 Emerging Technologies – Residential Cogeneration Systems

Cogeneration systems in the residential sector have the ability to produce both useful thermal energy and electricity from a single source of fuel such as oil or natural gas. This means that the efficiency of energy conversion to useful heat and power is potentially significant greater than by using the traditional alternatives of boilers or furnaces and conventional fossil fuel fired central electricity generation systems.[190] In one testing case, a collaborative effort between American Honda Motor Company and Massachusetts-based Climate

[188] GDS Calculation based on Vermont Residential Appliance Saturation Study completed by Kema, Inc. 2005.

[189] "LED There Be Light" David Pescovitz. Berkeley Engineering Lab Notes. Vol. 2(8): 2002.

[190] Residential Cogeneration Systems: A Review of Current Technologies. International Energy Agency. April 2005.

Energy, LLC has resulting in the residential installation of a micro-sized combined heat and power system combined with a furnace or boiler. This complete system results in more than 85% efficiency in converting fuel energy into useful heat and electric power. The unit quietly generates up to three kilowatts of thermal output per hour and one kilowatt of electricity.[191] However, as residential scale cogeneration technologies are still in their infancy, the actual potential for residential cogeneration energy and emissions savings is yet to be firmly established.

1.19.3 Emerging Technologies – Drainwater Heat Recovery Systems

The Gravity Film Heat Exchanger (GFX) is an energy efficiency system designed to capture the heat in the warm drainwater that falls down a vertical section of copper drainpipe. Heat transfer, which occurs because the water tends to cling to the inside of the vertical pipe like a film, can be transferred to cold water circulating around the outside of the drainpipe. If the drainwater is produced at the same time as the incoming water (such as the constant flow that occurs from a shower), the GFX can capture more than half the drainwater energy.[192] This saves energy otherwise used to generate hot water and effectively extends the recovery performance of the water heater itself, saving money and increasing shower capacity in the process.

Drainwater Heat Recovery Systems will be most effective in multi-family applications to quantify the energy savings and enhanced performance. Although the technology is suited for single family homes too, the greater throughput of drainwater from multifamily dwellings is expected to save more energy and improve the economics of introducing this technology into this sector.[193]

Preliminary findings from a field test utilizing the efficiency measure in one triplex housing unit determined the drain recovery system would save between 25%-30% of the total energy needed for hot water production based on the measured efficiency of the resistance water heater in the triplex. Over the year of this experiment, the system saved the equivalent of 2800 kWh of electricity.[194]

1.19.4 Emerging Technologies – Cool Roofs

Cool Roofs are roofs consisting of materials that effectively reflect the sun's energy from the roof surface. Cool materials for low-slope roofs are mainly bright

---

[191] "Honda and Climate Energy Provide Innovative and Energy Efficient Heating Solution. " Published March 2006. Accessed April 2006. (www.hondanews.com)

[192] "Emerging Technologies. Building Technologies Program." DOE Energy Efficiency and Renewable Energy. April 2006. (www.eere.energy.gov)

[193] ibid.

[194] "Preliminary Findings of the GFX Drainwater Recovery System. (Memo)" Prepared by ORNL. Submitted to DOE. Aug. 2000. (www.eere.doe.org)

white in color, although non-white colors are becoming available for sloped roof applications. Cool Roofs must also have high emissivity, allowing them to emit infrared energy. Unfortunately bare metals and metallic coatings tend to have low emissivity and are not considered cool materials.

Cool roofs reduce the roof surface temperature by up to 100 degrees Fahrenheit, thereby reducing the heat transferred into the building below.[195] This helps to reduce energy costs (by keeping attics and ducts cooler), improve occupant comfort, cut maintenance costs, increase the life cycle of the roof, and reduce urban heat islands along with associated smog.

Products for sloped roofs, usually found on residences, are currently available in clay, or concrete tiles. These products stay cooler by the use of special pigments that reflect the sun's infrared heat. Lower priced shingles or coated metal roofing products are not yet available in "cool" versions.

[195] "Cool Roofs." Consumer Energy Center. Accessed April 2006. (www.consumerenergycenter.org)

APPENDIX B

Commercial Sector

APPENDIX B-1

Input Assumptions for Commercial Sector

Vermont Energy Efficiency Potential Study

Commercial Sector Measure Database

#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	Annual kWh Savings	kWh Savings Source	kW demand savings	kW demand source	Annual MMBtu savings
100			***Space Heating***					
101	2	Space Heating	High Efficiency Heat Pump	195	21	0.1	21	
102	2	Space Heating	Hydronic Heating Pump	10,875	5	1.7	19	
103	2	Space Heating	Ground Source Heat Pump - Heating	18,121	9	11.7	26	
150			***Water Heating End Use***					
151	2	Water Heating	Heat Pump Water Heater	14,155	21	6.1	26	
152	2	Water Heating	Booster Water Heater	625	21	0.3	26	
153	1	Water Heating	Point of Use Water Heater	345	21	0.1	26	
154	1	Water Heating	Solar Water Heating System	62,500	14	26.9	26	
155	1	Water Heating	Solar Pool Heating	108,644	14	46.8	26	
200			***Envelope***					
201	2	Space Heating	Integrated Building Design	530,000	21	364.1	26	
202	2	Space Heating	Double Pane Low Emissivity Windows	7	21	0.0	26	0.0
300			***Space Cooling - Chillers***					
301	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 300 tons	21,600	5	23.5	5	0.0
302	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 500 tons	36,000	5	39.1	5	0.0
303	2	Space Cooling - Chillers	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 to	80,000	5	86.9	5	0.0
320			***Space Cooling - Packaged AC***					
321	2	Space Cooling - Packaged	Electric HVAC	3,160	18	1.0	18	
322	2	Space Cooling - Packaged	DX Packaged system EER = 10.9, 10 tons	1,859	5	1.9	5	0.0
323	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, <20 Tons	2,789	5	3.0	5	0.0
324	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, >20 Tons	5,578	5	6.1	5	0.0
325	2	Space Cooling - Packaged	Packaged AC - 3 tons, Tier 2	491	5	0.5	5	0.0
326	2	Space Cooling - Packaged	Packaged AC - 7.5 tons, Tier 2	1,115	5	1.2	5	0.0
327	2	Space Cooling - Packaged	Packaged AC - 15 tons, Tier 2	2,550	5	2.8	5	0.0
328	2	Space Cooling - Packaged	Ground Source Heat Pump - Cooling	5,585	9	4.1	26	
340			***Space Cooling - Maintenance***					
341	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 300 ton	15,200	5	16.5	5	0.0
342	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 500 ton	25,600	5	27.8	5	0.0
343	1	Space Cooling - Maint.	DX Tune Up/ Advanced Diagnostics	1,200	5	1.3	5	0.0
360			***HVAC Controls***					
361	1	HVAC Controls	Retrocommissioning	1.2	1	0.0	26	0.0
362	1	HVAC Controls	Programmable Thermostats	1,637	5	1.3	5	
363	1	HVAC Controls	EMS install	0.50	21	0.0	5	0.0
364	1	HVAC Controls	EMS Optimization	0.05	9	0.0	26	0.0
380			***Ventilation***					
381	2	HVAC	Dual Enthalpy Economizer - from Fixed Damper	3,400	18	0.8	18	
382	2	HVAC	Dual Enthalpy Economizer - from Dry Bulb	2,500	18	0.6	18	
383	2	HVAC	Comprehensive Track Proper HVAC Sizing	1,000	18	0.0	18	
384	2	HVAC	Demand-Controlled Ventilation			0.0	26	
385	2	HVAC	Heat Recovery	7	20	0.0	26	
386	2	HVAC	Fan Motor, 40hp, 1800rpm, 94.1%	2,354	5	0.4	5	
387	2	HVAC	Fan Motor, 15hp, 1800rpm, 92.4%	1,053	5	0.2	5	
388	2	HVAC	Fan Motor, 5hp, 1800rpm, 89.5%	393	5	0.1	5	
389	2	HVAC	Variable Speed Drive Control, 15 HP	12,000	5	1.9	5	
390	2	HVAC	Variable Speed Drive Control, 5 HP	4,000	5	0.6	5	
391	2	HVAC	Variable Speed Drive Control, 40 HP	32,000	5	5.0	5	
400			***Motors***					
401	2	Motors	Efficient Motors	1,540	18	0.3	18	
402	2	Motors	Variable Frequency Drives (VFD)	4,833	18	4.6	18	
403	2	Motors	Variable Frequency Drives (VFD) for Environmental	20,120	18	2.3	18	
404	2	Motors	Efficient Environmental Remediation Motors	1,232	18	0.1	18	
405	2	Motors	Variable Frequency Drives (VFD) for Dairy Farms	7,469	18	2.8	18	

Vermont Energy Efficiency Potential Study

Commercial Sector Measure Database

#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	Incremental Cost	Cost Source	Cost/Unit Descriptor	Cost/Unit	Persistence Factor	Measure Life	Effective Measure Life	Measure Life Source
100			***Space Heating***								
101	2	Space Heating	High Efficiency Heat Pump	$48	21	$/Unit	$48	1	15	15	21
102	2	Space Heating	Hydronic Heating Pump	$3,465	5	$/Unit	$3,465	1	20	20	15
103	2	Space Heating	Ground Source Heat Pump - Heating	$33,000	9	$/Unit	$33,000	1	15	15	
150			***Water Heating End Use***								2
151	2	Water Heating	Heat Pump Water Heater	$4,067.01	21	$/Unit	$4,067.01	1	14	14	21
152	2	Water Heating	Booster Water Heater	$951.37	21	$/Unit	$951.37	1	10	10	21
153	1	Water Heating	Point of Use Water Heater	$106.88	21	$/Unit	$106.88	1	10	10	21
154	1	Water Heating	Solar Water Heating System	$11,500.00	14	$/unit	$11,500.00	1	15	15	14
155	1	Water Heating	Solar Pool Heating	$33,750.00	14	$/unit	$33,750.00	1	10	10	14
200			***Envelope***								
201	2	Space Heating	Integrated Building Design	$166,226.40	21	$/unit	$166,226.40	1	30	30	21
202	2	Space Heating	Double Pane Low Emissivity Windows	$0.51	21	$/sf-window	$0.51	1	30	30	21
300			***Space Cooling - Chillers***								
301	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 300 tons	$16,200	5	$/unit	$16,200.00	1	25	25	18
302	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 500 tons	$27,000	5	$/unit	$27,000.00	1	25	25	18
303	2	Space Cooling - Chillers	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 to	$60,000	5	$/unit	$60,000.00	1	25	25	18
320			***Space Cooling - Packaged AC***								
321	2	Space Cooling - Packaged	Electric HVAC	$500	18	$/unit	$500	1	15	15	18
322	2	Space Cooling - Packaged	DX Packaged system EER = 10.9, 10 tons	$607		$/unit	$607	1	15	15	
323	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, <20 Tons	$612		$/unit	$612	1	15	15	
324	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, >20 Tons	$1,813		$/unit	$1,813	1	15	15	
325	2	Space Cooling - Packaged	Packaged AC - 3 tons, Tier 2	$345	18	$/unit	$345	1	15	15	18
326	2	Space Cooling - Packaged	Packaged AC - 7.5 tons, Tier 2	$683	18	$/unit	$683	1	15	15	18
327	2	Space Cooling - Packaged	Packaged AC - 15 tons, Tier 2	$1,485	18	$/unit	$1,485	1	15	15	18
328	2	Space Cooling - Packaged	Ground Source Heat Pump - Cooling	$33,000	9	$/unit	$33,000	1	15	15	21
340			***Space Cooling - Maintenance***								
341	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 300 ton	$5,100	5	$/unit	$5,100.00	1	10	10	5
342	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 500 ton	$8,500	5	$/unit	$8,500.00	1	10	10	5
343	1	Space Cooling - Maint.	DX Tune Up/ Advanced Diagnostics	$340	5	$/unit	$340.00	1	2	2	5
360			***HVAC Controls***								
361	1	HVAC Controls	Retrocommissioning	$0.09	10	$/sq ft	$0.09	1	7	7	10
362	1	HVAC Controls	Programmable Thermostats	$28	5	$/unit	$28	1	5	5	5
363	1	HVAC Controls	EMS install	0.29	21	$/sq ft	$0.29	1	10	10	11
364	1	HVAC Controls	EMS Optimization	0.06	9	$/sq ft	$0.06	1	5	5	3
380			***Ventilation***								
381	2	HVAC	Dual Enthalpy Economizer - from Fixed Damper	$800	18	$/unit	$800	0.7	10	7	18
382	2	HVAC	Dual Enthalpy Economizer - from Dry Bulb	$400	18	$/unit	$400	0.7	10	7	18
383	2	HVAC	Comprehensive Track Proper HVAC Sizing	$225	9	$/unit	$225	1	15	15	18
384	2	HVAC	Demand-Controlled Ventilation					1	10	10	18
385	2	HVAC	Heat Recovery	$14	20	$/sq ft	$14	1	23	23	
386	2	HVAC	Fan Motor, 40hp, 1800rpm, 94.1%	$286	5	$/unit	$286	1	12	12	5
387	2	HVAC	Fan Motor, 15hp, 1800rpm, 92.4%	$46	5	$/unit	$46	1	12	12	5
388	2	HVAC	Fan Motor, 5hp, 1800rpm, 89.5%	$34	5	$/unit	$34	1	12	12	5
389	2	HVAC	Variable Speed Drive Control, 15 HP	$3,465	5	$/unit	$3,465	1	20	20	5
390	2	HVAC	Variable Speed Drive Control, 5 HP	$1,925	5	$/unit	$1,925	1	20	20	5
391	2	HVAC	Variable Speed Drive Control, 40 HP	$6,280	5	$/unit	$6,280	1	20	20	5
400			***Motors***								
401	2	Motors	Efficient Motors	$201	18	$/unit	$201	1	20	20	18
402	2	Motors	Variable Frequency Drives (VFD)	$3,600	18	$/unit	$3,600	1	15	15	18
403	2	Motors	Variable Frequency Drives (VFD) for Environmental	$3,361	18	$/unit	$3,361	1	12	12	18
404	2	Motors	Efficient Environmental Remediation Motors	$319	18	$/unit	$319	1	10	10	18
405	2	Motors	Variable Frequency Drives (VFD) for Dairy Farms	$2,500	18	$/unit	$2,500	1	10	10	18

Vermont Energy Efficiency Potential Study

Commercial Sector Measure Database

#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	Measure Life Source Notes	Annualized cost	Levelized cost per kWh saved	Societal Test	TRC B/C Ratios
100			***Space Heating***					
101	2	Space Heating	High Efficiency Heat Pump		$3.17	$0.0163	5.26	4.31
102	2	Space Heating	Hydronic Heating Pump		$173.25	$0.0159	3.79	3.01
103	2	Space Heating	Ground Source Heat Pump - Heating		$2,200.00	$0.1214	0.57	0.45
150			***Water Heating End Use***					
151	2	Water Heating	Heat Pump Water Heater		$290.50	$0.0205	5.97	5.03
152	2	Water Heating	Booster Water Heater		$95.14	$0.1522	0.89	0.74
153	1	Water Heating	Point of Use Water Heater		$10.69	$0.0310	4.35	3.66
154	1	Water Heating	Solar Water Heating System		$766.67	$0.0123	9.78	8.23
155	1	Water Heating	Solar Pool Heating		$3,375.00	$0.0311	4.34	3.65
200			***Envelope***					
201	2	Space Heating	Integrated Building Design		$5,540.88	$0.0105	5.53	4.74
202	2	Space Heating	Double Pane Low Emissivity Windows		$0.02	$0.0024	24.21	20.70
300			***Space Cooling - Chillers***					
301	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 300 tons		$648.00	$0.0300	4.39	3.77
302	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 500 tons		$1,080.00	$0.0300	4.39	3.77
303	2	Space Cooling - Chillers	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 to		$2,400.00	$0.0300	4.39	3.77
320			***Space Cooling - Packaged AC***					
321	2	Space Cooling - Packaged	Electric HVAC		$33.33	$0.0105	15.29	13.10
322	2	Space Cooling - Packaged	DX Packaged system EER = 10.9, 10 tons		$40.47	$0.0218	7.41	6.35
323	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, <20 Tons		$40.80	$0.0146	11.02	9.45
324	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, >20 Tons		$120.87	$0.0217	7.44	6.38
325	2	Space Cooling - Packaged	Packaged AC - 3 tons, Tier 2		$23.00	$0.0468	3.44	2.95
326	2	Space Cooling - Packaged	Packaged AC - 7.5 tons, Tier 2		$45.50	$0.0408	3.95	3.39
327	2	Space Cooling - Packaged	Packaged AC - 15 tons, Tier 2		$99.00	$0.0388	4.15	3.56
328	2	Space Cooling - Packaged	Ground Source Heat Pump - Cooling		$2,200.00	$0.3939	0.41	0.35
340			***Space Cooling - Maintenance***					
341	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 300 ton		$510.00	$0.0336	5.37	4.60
342	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 500 ton		$850.00	$0.0332	5.43	4.65
343	1	Space Cooling - Maint.	DX Tune Up/ Advanced Diagnostics		$170.00	$0.1417	1.00	0.83
360			***HVAC Controls***					
361	1	HVAC Controls	Retrocommissioning		$0.01	$0.0101	6.09	4.94
362	1	HVAC Controls	Programmable Thermostats		$5.50	$0.0034	17.54	14.45
363	1	HVAC Controls	EMS install		$0.03	$0.0584	1.74	1.38
364	1	HVAC Controls	EMS Optimization		$0.01	$0.2250	1.00	0.79
380			***Ventilation***					
381	2	HVAC	Dual Enthalpy Economizer - from Fixed Damper		$114.29	$0.0336	3.20	2.63
382	2	HVAC	Dual Enthalpy Economizer - from Dry Bulb		$57.14	$0.0229	4.70	3.86
383	2	HVAC	Comprehensive Track Proper HVAC Sizing	TRM "15	$15.00	$0.0150	5.71	4.67
384	2	HVAC	Demand-Controlled Ventilation		$0.00	#DIV/0!	**N/A**	**N/A**
385	2	HVAC	Heat Recovery		$0.60	$0.0855	0.76	0.62
386	2	HVAC	Fan Motor, 40hp, 1800rpm, 94.1%		$23.83	$0.0101	9.09	7.44
387	2	HVAC	Fan Motor, 15hp, 1800rpm, 92.4%		$3.83	$0.0036	25.27	20.68
388	2	HVAC	Fan Motor, 5hp, 1800rpm, 89.5%		$2.83	$0.0072	12.76	10.44
389	2	HVAC	Variable Speed Drive Control, 15 HP		$173.25	$0.0144	5.33	4.37
390	2	HVAC	Variable Speed Drive Control, 5 HP		$96.25	$0.0241	3.20	2.62
391	2	HVAC	Variable Speed Drive Control, 40 HP		$314.00	$0.0098	7.85	6.43
400			***Motors***					
401	2	Motors	Efficient Motors		$10.05	$0.0065	11.80	9.67
402	2	Motors	Variable Frequency Drives (VFD)	TRM "15	$240.00	$0.0497	1.73	1.41
403	2	Motors	Variable Frequency Drives (VFD) for Environmental		$280.08	$0.0139	6.61	5.41
404	2	Motors	Efficient Environmental Remediation Motors		$31.90	$0.0259	3.76	3.08
405	2	Motors	Variable Frequency Drives (VFD) for Dairy Farms		$250.00	$0.0335	2.91	2.38

Vermont Energy Efficiency Potential Study

Commercial Sector Measure Database

#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	lookup	1 Dairy	2 Light Manufac	3 Retail	4 Food Sales	5 Office	6 Lodging	7 Health Care	8 Ski Areas	9 Schools	10 Other
					Cost Units by Building Type									
100			***Space Heating***		8,000	7,400	8,289	5,950	19,432	43,370	29,722	10,000	54,290	38,176
101	2	Space Heating	High Efficiency Heat Pump	1	2	1	2	1	4	5	5	2	5	5
102	2	Space Heating	Hydronic Heating Pump	2	1	1	1	1	1	1	1	1	1	1
103	2	Space Heating	Ground Source Heat Pump - Heating	3	0.5	0.5	0.6	0.4	1.3	2.9	2.0	0.7	3.6	2.5
150			***Water Heating End Use***	4										
151	2	Water Heating	Heat Pump Water Heater	5	1	1	1	1	1	1	1	1	1	1
152	2	Water Heating	Booster Water Heater	6	1	1	1	1	1	1	1	1	1	1
153	1	Water Heating	Point of Use Water Heater	7	2	1	2	1	4	9	6	2	11	8
154	1	Water Heating	Solar Water Heating System	8	1	1	1	1	1	1	1	1	1	1
155	1	Water Heating	Solar Pool Heating	9	1	1	1	1	1	1	1	1	1	1
200			***Envelope***	10										
201	2	Space Heating	Integrated Building Design	11	1	1	1	1	1	1	1	1	1	1
202	2	Space Heating	Double Pane Low Emissivity Windows	12	800	740	1,575	833	3,109	4,337	2,972	1,400	6,515	4,581
300			***Space Cooling - Chillers***	13										
301	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 300 tons	14	1	1	1	1	1	1	1	1	1	1
302	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 500 tons	15	1	1	1	1	1	1	1	1	1	1
303	2	Space Cooling - Chillers	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 to	16	1	1	1	1	1	1	1	1	1	1
320			***Space Cooling - Packaged AC***	17										
321	2	Space Cooling - Packaged	Electric HVAC	18	3	3	3	2	8	17	12	4	22	15
322	2	Space Cooling - Packaged	DX Packaged system EER = 10.9, 10 tons	19	2	1	2	1	4	9	6	2	11	8
323	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, <20 Tons	20	1	1	1	1	3	6	4	1	7	5
324	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, >20 Tons	21	1	1	1	1	2	4	3	1	5	4
325	2	Space Cooling - Packaged	Packaged AC - 3 tons, Tier 2	22	5	5	6	4	13	29	20	7	36	25
326	2	Space Cooling - Packaged	Packaged AC - 7.5 tons, Tier 2	23	2	2	2	2	5	12	8	3	14	10
327	2	Space Cooling - Packaged	Packaged AC - 15 tons, Tier 2	24	1	1	1	1	3	6	4	1	7	5
328	2	Space Cooling - Packaged	Ground Source Heat Pump - Cooling	25	0.5	0.5	0.6	0.4	1.3	2.9	2.0	0.7	3.6	2.5
340			***Space Cooling - Maintenance***	26										
341	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 300 ton	27	1	1	1	1	1	1	1	1	1	1
342	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 500 ton	28	1	1	1	1	1	1	1	1	1	1
343	1	Space Cooling - Maint.	DX Tune Up/ Advanced Diagnostics	29	1	1	1	1	1	1	1	1	1	1
360			***HVAC Controls***	30										
361	1	HVAC Controls	Retrocommissioning	31	8,000	7,400	8,289	5,950	19,432	43,370	29,722	10,000	54,290	38,176
362	1	HVAC Controls	Programmable Thermostats	32	1	2	3	2	4	15	2	25	35	12
363	1	HVAC Controls	EMS install	33	8,000	7,400	8,289	5,950	19,432	43,370	29,722	10,000	54,290	38,176
364	1	HVAC Controls	EMS Optimization	34	8,000	7,400	8,289	5,950	19,432	43,370	29,722	10,000	54,290	38,176
380			***Ventilation***	35										
381	2	HVAC	Dual Enthalpy Economizer - from Fixed Damper	36	1	1	1	1	1	1	1	1	1	1
382	2	HVAC	Dual Enthalpy Economizer - from Dry Bulb	37	1	1	1	1	1	1	1	1	1	1
383	2	HVAC	Comprehensive Track Proper HVAC Sizing	38	2	2	2	2	5	12	8	3	14	10
384	2	HVAC	Demand-Controlled Ventilation	39										
385	2	HVAC	Heat Recovery	40	8,000	7,400	8,289	5,950	19,432	43,370	29,722	10,000	54,290	38,176
386	2	HVAC	Fan Motor, 40hp, 1800rpm, 94.1%	41	0	0	0	0	0	2	1	0	2	1
387	2	HVAC	Fan Motor, 15hp, 1800rpm, 92.4%	42	0	0	0	0	1	3	2	0	3	2
388	2	HVAC	Fan Motor, 5hp, 1800rpm, 89.5%	43	1	1	1	1	2	4	3	1	4	3
389	2	HVAC	Variable Speed Drive Control, 15 HP	44	0	0	0	0	1	3	2	0	3	2
390	2	HVAC	Variable Speed Drive Control, 5 HP	45	1	1	1	1	2	4	3	1	4	3
391	2	HVAC	Variable Speed Drive Control, 40 HP	46	0	0	0	0	0	2	1	0	2	1
400			***Motors***	47										
401	2	Motors	Efficient Motors	48	1	10	1	4	1	5	1	10	5	2
402	2	Motors	Variable Frequency Drives (VFD)	49	1	1	1	1	1	1	1	1	1	1
403	2	Motors	Variable Frequency Drives (VFD) for Environmental	50	1	1	1	1	1	1	1	1	1	1
404	2	Motors	Efficient Environmental Remediation Motors	51	1	1	1	1	1	1	1	1	1	1
405	2	Motors	Variable Frequency Drives (VFD) for Dairy Farms	52	1	1	1	1	1	1	1	1	1	1

Vermont Energy Efficiency Potential Study

Commercial Sector Measure Database

#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	Total Installed Cost Per Prototypical Building									
				Dairy	Light Manufac	Retail	Food Sales	Office	Lodging	Health Care	Ski Areas	Schools	Other
100			***Space Heating***	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	$10
101	2	Space Heating	High Efficiency Heat Pump	$95	$48	$95	$48	$190	$238	$238	$95	$238	$238
102	2	Space Heating	Hydronic Heating Pump	$3,465	$3,465	$3,465	$3,465	$3,465	$3,465	$3,465	$3,465	$3,465	$3,465
103	2	Space Heating	Ground Source Heat Pump - Heating	$16,500	$16,500	$19,800	$13,200	$42,900	$95,700	$66,000	$23,100	$118,800	$82,500
150			***Water Heating End Use***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
151	2	Water Heating	Heat Pump Water Heater	$4,067	$4,067	$4,067	$4,067	$4,067	$4,067	$4,067	$4,067	$4,067	$4,067
152	2	Water Heating	Booster Water Heater	$951	$951	$951	$951	$951	$951	$951	$951	$951	$951
153	1	Water Heating	Point of Use Water Heater	$214	$107	$214	$107	$428	$962	$641	$214	$1,176	$855
154	1	Water Heating	Solar Water Heating System	$11,500	$11,500	$11,500	$11,500	$11,500	$11,500	$11,500	$11,500	$11,500	$11,500
155	1	Water Heating	Solar Pool Heating	$33,750	$33,750	$33,750	$33,750	$33,750	$33,750	$33,750	$33,750	$33,750	$33,750
200			***Envelope***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
201	2	Space Heating	Integrated Building Design	$166,226	$166,226	$166,226	$166,226	$166,226	$166,226	$166,226	$166,226	$166,226	$166,226
202	2	Space Heating	Double Pane Low Emissivity Windows	$408	$377	$803	$425	$1,586	$2,212	$1,516	$714	$3,323	$2,336
300			***Space Cooling - Chillers***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
301	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 300 tons	$16,200	$16,200	$16,200	$16,200	$16,200	$16,200	$16,200	$16,200	$16,200	$16,200
302	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 500 tons	$27,000	$27,000	$27,000	$27,000	$27,000	$27,000	$27,000	$27,000	$27,000	$27,000
303	2	Space Cooling - Chillers	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 to	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000
320			***Space Cooling - Packaged AC***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
321	2	Space Cooling - Packaged	Electric HVAC	$1,500	$1,500	$1,500	$1,000	$4,000	$8,500	$6,000	$2,000	$11,000	$7,500
322	2	Space Cooling - Packaged	DX Packaged system EER = 10.9, 10 tons	$1,214	$607	$1,214	$607	$2,428	$5,463	$3,642	$1,214	$6,677	$4,856
323	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, <20 Tons	$612	$612	$612	$612	$1,836	$3,672	$2,448	$612	$4,284	$3,060
324	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, >20 Tons	$1,813	$1,813	$1,813	$1,813	$3,626	$7,252	$5,439	$1,813	$9,065	$7,252
325	2	Space Cooling - Packaged	Packaged AC - 3 tons, Tier 2	$1,725	$1,725	$2,070	$1,380	$4,485	$10,005	$6,900	$2,415	$12,420	$8,625
326	2	Space Cooling - Packaged	Packaged AC - 7.5 tons, Tier 2	$1,365	$1,365	$1,365	$1,365	$3,413	$8,190	$5,460	$2,048	$9,555	$6,825
327	2	Space Cooling - Packaged	Packaged AC - 15 tons, Tier 2	$1,485	$1,485	$1,485	$1,485	$4,455	$8,910	$5,940	$1,485	$10,395	$7,425
328	2	Space Cooling - Packaged	Ground Source Heat Pump - Cooling	$16,500	$16,500	$19,800	$13,200	$42,900	$95,700	$66,000	$23,100	$118,800	$82,500
340			***Space Cooling - Maintenance***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
341	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 300 ton	$5,100	$5,100	$5,100	$5,100	$5,100	$5,100	$5,100	$5,100	$5,100	$5,100
342	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 500 ton	$8,500	$8,500	$8,500	$8,500	$8,500	$8,500	$8,500	$8,500	$8,500	$8,500
343	1	Space Cooling - Maint.	DX Tune Up/ Advanced Diagnostics	$340	$340	$340	$340	$340	$340	$340	$340	$340	$340
360			***HVAC Controls***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
361	1	HVAC Controls	Retrocommissioning	$680	$629	$705	$506	$1,652	$3,686	$2,526	$850	$4,615	$3,245
362	1	HVAC Controls	Programmable Thermostats	$28	$55	$83	$55	$110	$413	$55	$688	$963	$330
363	1	HVAC Controls	EMS install	$2,337	$2,162	$2,422	$1,738	$5,678	$12,672	$8,684	$2,922	$15,862	$11,154
364	1	HVAC Controls	EMS Optimization	$450	$416	$466	$335	$1,093	$2,440	$1,672	$563	$3,054	$2,147
380			***Ventilation***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
381	2	HVAC	Dual Enthalpy Economizer - from Fixed Damper	$800	$800	$800	$800	$800	$800	$800	$800	$800	$800
382	2	HVAC	Dual Enthalpy Economizer - from Dry Bulb	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400
383	2	HVAC	Comprehensive Track Proper HVAC Sizing	$450	$450	$450	$450	$1,125	$2,700	$1,800	$675	$3,150	$2,250
384	2	HVAC	Demand-Controlled Ventilation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
385	2	HVAC	Heat Recovery	$110,345	$102,069	$114,338	$82,069	$268,031	$598,212	$409,962	$137,931	$748,832	$526,572
386	2	HVAC	Fan Motor, 40hp, 1800rpm, 94.1%	$0	$0	$0	$0	$0	$572	$286	$0	$572	$286
387	2	HVAC	Fan Motor, 15hp, 1800rpm, 92.4%	$0	$0	$0	$0	$46	$138	$92	$0	$138	$92
388	2	HVAC	Fan Motor, 5hp, 1800rpm, 89.5%	$34	$34	$34	$34	$68	$136	$102	$34	$136	$102
389	2	HVAC	Variable Speed Drive Control, 15 HP	$0	$0	$0	$0	$3,465	$10,395	$6,930	$0	$10,395	$6,930
390	2	HVAC	Variable Speed Drive Control, 5 HP	$1,925	$1,925	$1,925	$1,925	$3,850	$7,700	$5,775	$1,925	$7,700	$5,775
391	2	HVAC	Variable Speed Drive Control, 40 HP	$0	$0	$0	$0	$0	$12,560	$6,280	$0	$12,560	$6,280
400			***Motors***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
401	2	Motors	Efficient Motors	$201	$2,010	$201	$804	$201	$1,005	$201	$2,010	$1,005	$402
402	2	Motors	Variable Frequency Drives (VFD)	$3,600	$3,600	$3,600	$3,600	$3,600	$3,600	$3,600	$3,600	$3,600	$3,600
403	2	Motors	Variable Frequency Drives (VFD) for Environmental	$3,361	$3,361	$3,361	$3,361	$3,361	$3,361	$3,361	$3,361	$3,361	$3,361
404	2	Motors	Efficient Environmental Remediation Motors	$319	$319	$319	$319	$319	$319	$319	$319	$319	$319
405	2	Motors	Variable Frequency Drives (VFD) for Dairy Farms	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500

Vermont Energy Efficiency Potential Study

Commercial Sector Measure Database

#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	Annual kWh Savings	kWh Savings Source	kW demand savings	kW demand source	Annual MMBtu savings
500			***Lighting End Use***					
501	2	Lighting - Flor	Super T8 Fixture - from 34W T12	173	19	0.0	19	(0.0)
502	2	Lighting - Flor	Super T8 Fixture - from standard T8	77	19	0.0	19	(0.0)
503	2	Lighting - High Bay	T5 Fluorescent High-Bay Fixtures	418	18	0.1	18	(0.0)
504	2	Lighting - Flor	T5 Troffer/Wrap	92	18	0.0	18	(0.0)
505	2	Lighting - Flor	T5 Industrial Strip	84	18	0.0	18	(0.0)
506	2	Lighting - Flor	T5 Indirect	92	18	0.0	18	(0.0)
507	2	Lighting - Flor	CFL Fixture	197	18	0.1	18	(0.0)
508	2	Lighting	Exterior HID	55	18	0.0	18	
509	2	Lighting	LED Exit Sign	88	18	0.0	18	(0.0)
510	1	Lighting	Lighting Controls	291	18	0.1	18	(0.0)
511	2	Lighting	LED Traffic / Pedestrian Signals	354	18	0.1	18	
512	2	Lighting - High Bay	Electronic HID Fixture Upgrade	385	19	0.1	19	(0.0)
513	2	Lighting	Halogen Infra-Red Bulb	52	19	0.0	19	(0.0)
514	2	Lighting	Integrated Ballast MH 25W	223	19	0.1	19	(0.0)
515	2	Lighting	Induction Fluorescent 23W	230	19	0.1	19	(0.0)
516	2	Lighting	CFL Screw-in	155	18	0.1	18	(0.0)
517	2	Lighting	Dairy Farm Hard-Wired Vapor-Proof CFL Fixture with E	85	18	0.0	18	
518	2	Lighting	Dairy Farm Vapor Proof T8 Fixture with Electronic Ball	196	18	0.1	18	
519	2	Lighting	Metal Halide Track	360	18	0.1	18	(0.0)
520	2	Lighting	Lighting Power Density	17,100	18	4.5	18	(0.0)
550			***Lighting Controls***					
551	1	Lighting Controls	Bi-Level Switching	83	19	0.0	19	(0.0)
552	1	Lighting Controls	Occupancy Sensors	302	5	0.1	5	
553	1	Lighting Controls	Daylight Dimming	353	5	0.1	5	
554	1	Lighting Controls	Daylight Dimming - New Construction	252	5	0.1	5	
555	2	Lighting Controls	5% More Efficient Design	9,000	5	2.1	5	
556	2	Lighting Controls	10% More Efficient Design	18,000	5	4.1	5	
557	1	Lighting Controls	15% More Efficient Design - New Construction	27,000	5	6.2	5	
558	1	Lighting Controls	30% More Efficient Design - New Construction	54,000	5	12.3	5	
600			***Refrigeration End Use***					
601	1	Refrigeration	Vending Miser for Soft Drink Vending Machines	1,635	18	0.2	18	
602	2	Refrigeration	Refrigerated Case Covers	2,900	18	0.3	18	
603	1	Refrigeration	Refrigeration Economizer	600	18	0.2	18	
604	1	Refrigeration	Commercial Reach-In Refrigerators	800	18	0.1	18	
605	1	Refrigeration	Commercial Reach-In Freezer	700	18	0.1	18	
606	1	Refrigeration	Commercial Ice-makers	300	18	0.1	18	
607	2	Refrigeration	Evaporator Fan Motor Controls	2,600	18	0.3	18	
608	2	Refrigeration	Permanent Split Capacitor Motor	550	18	0.1	18	
609	2	Refrigeration	Zero-Energy Doors	800	18	0.1	18	
610	1	Refrigeration	Door Heater Controls	3,500	18	0.7	18	
611	2	Refrigeration	Discus and Scroll Compressors	1,500	18	0.3	18	
612	1	Refrigeration	Floating Head Pressure Control	2,000	18	0.3	18	
613	1	Refrigeration	Anti-sweat (humidistat) controls (refrigerator)	190	5	0.0	5	
614	1	Refrigeration	Anti-sweat (humidistat) controls (freezer)	375	5	0.1	5	
615	2	Refrigeration	High Efficiency Ice Maker	437	18	0.1	18	
700			***Compressed Air End Use***					
701	2	C Air	Compressed Air – Non-Controls	13,473	22	1.5	23	
702	1	C Air	Compressed Air – Controls	10,064	23	1.1	18, 22	
720			***Snow Making End Use***					
721	2	Snow making	Snow Making	3,357	9	22.4	9	38
740			***Monitor Power Management***					
741	1	Monitors	EZ Save Monitor Power Management Software	30	18	0.1	18	
760			***Water/Wastewater Treatment***					
761	1	Pumping and aeration	Improved equipment and controls	158,000	9	18.0	9	
780			***Transformer End Use***					
781	2	Transformer	Energy Star Transformers	4,853	18	0.6	18	
800			***Dairy Farms***					
801	1	Dairy Farms	VFDs for Milk Transfer Pumps	8000	18	3.0	18	0.0
802	1	Dairy Farms	VFDs for Milk Vacuum Pumps	7,300	18	1.7	18	0.0

Vermont Energy Efficiency Potential Study

Commercial Sector Measure Database

#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	Incremental Cost	Cost Source	Cost/Unit Descriptor	Cost/Unit	Persistence Factor	Measure Life	Effective Measure Life	Measure Life Source
500			***Lighting End Use***								
501	2	Lighting - Flor	Super T8 Fixture - from 34W T12	$65	19	$/unit	$65	1	15	15	18
502	2	Lighting - Flor	Super T8 Fixture - from standard T8	$25	19	$/unit	$25	1	15	15	18
503	2	Lighting - High Bay	T5 Fluorescent High-Bay Fixtures	$100	19	$/unit	$100	1	15	15	18
504	2	Lighting - Flor	T5 Troffer/Wrap	$40	19	$/unit	$40	1	15	15	18
505	2	Lighting - Flor	T5 Industrial Strip	$40	19	$/unit	$40	1	15	15	18
506	2	Lighting - Flor	T5 Indirect	$40	19	$/unit	$40	1	15	15	18
507	2	Lighting - Flor	CFL Fixture	$35	18	$/unit	$35	1	15	15	18
508	2	Lighting	Exterior HID	$30	18	$/unit	$30	1	15	15	18
509	2	Lighting	LED Exit Sign	$25	18	$/unit	$25	1	10	10	18
510	1	Lighting	Lighting Controls	$55	18	$/unit	$55	1	10	10	18
511	2	Lighting	LED Traffic / Pedestrian Signals	$140	18	$/unit	$140	1	10	10	18
512	2	Lighting - High Bay	Electronic HID Fixture Upgrade	$100	19	$/unit	$100	1	15	15	19
513	2	Lighting	Halogen Infra-Red Bulb	$6	19	$/unit	$6	1	1.3	1.303781	19
514	2	Lighting	Integrated Ballast MH 25W	$40	19	$/unit	$40	1	3.4	3.422425	19
515	2	Lighting	Induction Fluorescent 23W	$22	19	$/unit	$22	1	4.9	4.8891786	19
516	2	Lighting	CFL Screw-in	$13	18	$/unit	$13	1	3.4	3.4	18
517	2	Lighting	Dairy Farm Hard-Wired Vapor-Proof CFL Fixture with E	$70	18	$/unit	$70	0.67	15	10.05	18
518	2	Lighting	Dairy Farm Vapor Proof T8 Fixture with Electronic Ball	$70	19	$/unit	$70	1	15	15	18
519	2	Lighting	Metal Halide Track	$150	18	$/unit	$150	1	15	15	18
520	2	Lighting	Lighting Power Density	$1	18	$/unit	$1	1	20	20	18
550			***Lighting Controls***								
551	1	Lighting Controls	Bi-Level Switching	$40	19	$/unit	$40	1	10	10	18
552	1	Lighting Controls	Occupancy Sensors	$55	18	$/unit	$55	1	10	10	18
553	1	Lighting Controls	Daylight Dimming	$181	5	$/unit	$181	1	10	10	18
554	1	Lighting Controls	Daylight Dimming - New Construction	$181	5	$/unit	$181	1	10	10	18
555	2	Lighting Controls	5% More Efficient Design	$4,000	5	$/unit	$4,000	1	20	20	5
556	2	Lighting Controls	10% More Efficient Design	$8,000	5	$/unit	$8,000	1	20	20	5
557	1	Lighting Controls	15% More Efficient Design - New Construction	$4,000	5	$/unit	$4,000	1	20	20	5
558	1	Lighting Controls	30% More Efficient Design - New Construction	$8,000	5	$/unit	$8,000	1	20	20	5
600			***Refrigeration End Use***								
601	1	Refrigeration	Vending Miser for Soft Drink Vending Machines	$160	18	$/unit	$160	0.7	15	10	18
602	2	Refrigeration	Refrigerated Case Covers	$90	18	$/unit	$90	1	4	4	18
603	1	Refrigeration	Refrigeration Economizer	$2,558	18	$/unit	$2,558	1	15	15	18
604	1	Refrigeration	Commercial Reach-In Refrigerators	$100	18	$/unit	$100	1	9	9	18
605	1	Refrigeration	Commercial Reach-In Freezer	$100	18	$/unit	$100	1	9	9	18
606	1	Refrigeration	Commercial Ice-makers	$45	18	$/unit	$45	1	9	9	18
607	2	Refrigeration	Evaporator Fan Motor Controls	$1,050	18	$/unit	$1,050	1	15	15	18
608	2	Refrigeration	Permanent Split Capacitor Motor	$235	18	$/unit	$235	1	15	15	18
609	2	Refrigeration	Zero-Energy Doors	$800	18	$/unit	$800	1	10	10	18
610	1	Refrigeration	Door Heater Controls	$250	18	$/unit	$250	1	10	10	18
611	2	Refrigeration	Discus and Scroll Compressors	$650	18	$/unit	$650	1	13	13	18
612	1	Refrigeration	Floating Head Pressure Control	$734	18	$/unit	$734	1	10	10	18
613	1	Refrigeration	Anti-sweat (humidistat) controls (refrigerator)	$6,500	5	$/unit	$6,500	1	12	12	19
614	1	Refrigeration	Anti-sweat (humidistat) controls (freezer)	$6,500	5	$/unit	$6,500	1	12	12	19
615	2	Refrigeration	High Efficiency Ice Maker	$45	18	$/unit	$45	1	9	9	18
700			***Compressed Air End Use***								
701	2	C Air	Compressed Air – Non-Controls	$1,347	23	$/unit	$1,347	1	7	7	*GDS estimate*
702	1	C Air	Compressed Air – Controls	$4,313	23	$/unit	$4,313	0.85	7	5.95	*GDS estimate*
720			***Snow Making End Use***								
721	2	Snow making	Snow Making	$2,500	9	$/unit	$2,500	1	10	10	9
740			***Monitor Power Management***								
741	1	Monitors	EZ Save Monitor Power Management Software	$26		$/unit	$26	0.85	2	1.7	18
760			***Water/Wastewater Treatment***								
761	1	Pumping and aeration	Improved equipment and controls	$75,200	9	$/unit	$75,200	1	17	17	17
780			***Transformer End Use***								
781	2	Transformer	Energy Star Transformers	$856		$/unit	$856	1	30	30	18
800			***Dairy Farms***								
801	1	Dairy Farms	VFDs for Milk Transfer Pumps	$2,230	18	$/unit	$2,230	1	10	10	18
802	1	Dairy Farms	VFDs for Milk Vacuum Pumps	$1,875	18	$/unit	$1,875	1	10	10	18

Vermont Energy Efficiency Potential Study

Commercial Sector Measure Database

#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	Measure Life Source Notes	Annualized cost	Levelized cost per kWh saved	Societal Test	TRC B/C Ratios
500			***Lighting End Use***					
501	2	Lighting - Flor	Super T8 Fixture - from 34W T12		$4.33	$0.0250	2.89	2.28
502	2	Lighting - Flor	Super T8 Fixture - from standard T8		$1.67	$0.0217	3.28	2.92
503	2	Lighting - High Bay	T5 Fluorescent High-Bay Fixtures		$6.67	$0.0160	4.46	3.58
504	2	Lighting - Flor	T5 Troffer/Wrap		$2.67	$0.0289	2.46	1.97
505	2	Lighting - Flor	T5 Industrial Strip		$2.67	$0.0317	2.24	1.80
506	2	Lighting - Flor	T5 Indirect		$2.67	$0.0289	2.46	1.97
507	2	Lighting - Flor	CFL Fixture		$2.33	$0.0119	6.00	4.81
508	2	Lighting	Exterior HID		$2.00	$0.0363	1.96	1.57
509	2	Lighting	LED Exit Sign		$2.50	$0.0283	2.87	2.30
510	1	Lighting	Lighting Controls		$5.50	$0.0189	4.30	3.45
511	2	Lighting	LED Traffic / Pedestrian Signals	TRM	$14.00	$0.0396	2.06	1.65
512	2	Lighting - High Bay	Electronic HID Fixture Upgrade		$6.67	$0.0173	4.11	3.30
513	2	Lighting	Halogen Infra-Red Bulb		$4.60	$0.0893	1.42	1.17
514	2	Lighting	Integrated Ballast MH 25W		$11.69	$0.0523	2.18	1.78
515	2	Lighting	Induction Fluorescent 23W		$4.50	$0.0195	5.21	4.23
516	2	Lighting	CFL Screw-in		$3.82	$0.0247	4.61	3.78
517	2	Lighting	Dairy Farm Hard-Wired Vapor-Proof CFL Fixture with E		$6.97	$0.0822	0.99	0.79
518	2	Lighting	Dairy Farm Vapor Proof T8 Fixture with Electronic Ball		$4.67	$0.0238	2.99	2.40
519	2	Lighting	Metal Halide Track		$10.00	$0.0278	2.56	2.06
520	2	Lighting	Lighting Power Density		$0.06	$0.0000	NA	NA
550			***Lighting Controls***					
551	1	Lighting Controls	Bi-Level Switching		$4.00	$0.0481	1.69	1.36
552	1	Lighting Controls	Occupancy Sensors		$5.50	$0.0182	4.47	3.59
553	1	Lighting Controls	Daylight Dimming		$18.10	$0.0513	1.11	0.89
554	1	Lighting Controls	Daylight Dimming - New Construction		$18.10	$0.0718	0.71	0.64
555	2	Lighting Controls	5% More Efficient Design		$200.00	$0.0222	2.88	2.31
556	2	Lighting Controls	10% More Efficient Design		$400.00	$0.0222	2.88	2.31
557	1	Lighting Controls	15% More Efficient Design - New Construction		$200.00	$0.0074	8.64	6.93
558	1	Lighting Controls	30% More Efficient Design - New Construction		$400.00	$0.0074	8.64	6.93
600			***Refrigeration End Use***					
601	1	Refrigeration	Vending Miser for Soft Drink Vending Machines		$16.00	$0.0098	11.16	9.24
602	2	Refrigeration	Refrigerated Case Covers		$22.50	$0.0078	17.64	14.69
603	1	Refrigeration	Refrigeration Economizer		$170.53	$0.2842	0.34	0.28
604	1	Refrigeration	Commercial Reach-In Refrigerators		$11.11	$0.0139	8.10	6.70
605	1	Refrigeration	Commercial Reach-In Freezer		$11.11	$0.0159	7.09	5.87
606	1	Refrigeration	Commercial Ice-makers		$5.00	$0.0167	6.74	5.58
607	2	Refrigeration	Evaporator Fan Motor Controls		$70.00	$0.0269	1.68	1.39
608	2	Refrigeration	Permanent Split Capacitor Motor		$15.67	$0.0285	3.40	2.81
609	2	Refrigeration	Zero-Energy Doors		$80.00	$0.1000	1.21	1.01
610	1	Refrigeration	Door Heater Controls		$25.00	$0.0071	7.65	6.33
611	2	Refrigeration	Discus and Scroll Compressors		$50.00	$0.0333	3.04	2.51
612	1	Refrigeration	Floating Head Pressure Control		$73.40	$0.0367	2.98	2.46
613	1	Refrigeration	Anti-sweat (humidistat) controls (refrigerator)		$541.67	$2.8509	0.04	0.03
614	1	Refrigeration	Anti-sweat (humidistat) controls (freezer)		$541.67	$1.4444	0.07	0.06
615	2	Refrigeration	High Efficiency Ice Maker		$5.00	$0.0114	9.82	8.13
700			***Compressed Air End Use***					
701	2	C Air	Compressed Air – Non-Controls		$192.43	$0.0143	7.60	6.25
702	1	C Air	Compressed Air – Controls		$724.87	$0.0720	1.57	1.29
720			***Snow Making End Use***					
721	2	Snow making	Snow Making		$250.00	$0.0745	1.32	1.08
740			***Monitor Power Management***					
741	1	Monitors	EZ Save Monitor Power Management Software		$15.53	$0.5176	0.27	0.23
760			***Water/Wastewater Treatment***					
761	1	Pumping and aeration	Improved equipment and controls	Predominent	$4,423.53	$0.0280	2.93	2.40
780			***Transformer End Use***					
781	2	Transformer	Energy Star Transformers		$28.53	$0.0059	10.75	8.82
800			***Dairy Farms***					
801	1	Dairy Farms	VFDs for Milk Transfer Pumps		$223.00	$0.0279	3.56	2.91
802	1	Dairy Farms	VFDs for Milk Vacuum Pumps		$187.50	$0.0257	3.87	3.16

Vermont Energy Efficiency Potential Study

Commercial Sector Measure Database

#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	lookup	1 Dairy	2 Light Manufac	3 Retail	4 Food Sales	5 Office	6 Lodging	7 Health Care	8 Ski Areas	9 Schools	10 Other
					Cost Units by Building Type									
500			***Lighting End Use***	53										
501	2	Lighting - Flor	Super T8 Fixture - from 34W T12	54	38	57	74	53	116	258	177	66	388	250
502	2	Lighting - Flor	Super T8 Fixture - from standard T8	55	38	57	74	53	116	258	177	66	388	250
503	2	Lighting - High Bay	T5 Fluorescent High-Bay Fixtures	56	13	19	25	18	39	87	59	22	130	84
504	2	Lighting - Flor	T5 Troffer/Wrap	57	56	84	109	78	170	380	260	96	570	367
505	2	Lighting - Flor	T5 Industrial Strip	58	56	84	109	78	170	380	260	96	570	367
506	2	Lighting - Flor	T5 Indirect	59	56	84	109	78	170	380	260	96	570	367
507	2	Lighting - Flor	CFL Fixture	60	64	59	66	48	155	347	238	80	434	305
508	2	Lighting	Exterior HID	61										
509	2	Lighting	LED Exit Sign	62	21	20	22	16	52	116	79	27	145	102
510	1	Lighting	Lighting Controls	63	8	7	8	6	19	43	30	10	54	38
511	2	Lighting	LED Traffic / Pedestrian Signals	64	0	0	0	0	0	0	0	0	0	1
512	2	Lighting - High Bay	Electronic HID Fixture Upgrade	65	2	2	2	2	5	12	8	3	15	11
513	2	Lighting	Halogen Infra-Red Bulb	66	31	29	32	23	75	168	115	39	210	148
514	2	Lighting	Integrated Ballast MH 25W	67	74	69	77	55	180	403	276	93	504	354
515	2	Lighting	Induction Fluorescent 23W	68	81	75	84	60	196	438	300	101	548	385
516	2	Lighting	CFL Screw-in	69	93	86	96	69	225	503	345	116	630	443
517	2	Lighting	Dairy Farm Hard-Wired Vapor-Proof CFL Fixture with E	70	25	0	0	0	0	0	0	0	0	0
518	2	Lighting	Dairy Farm Vapor Proof T8 Fixture with Electronic Ball	71	35	0	0	0	0	0	0	0	0	0
519	2	Lighting	Metal Halide Track	72	24	22	25	18	58	129	88	30	162	114
520	2	Lighting	Lighting Power Density	73	1	1	1	1	1	1	1	1	1	1
550			***Lighting Controls***	74										
551	1	Lighting Controls	Bi-Level Switching	75	38	57	74	53	116	258	177	66	388	250
552	1	Lighting Controls	Occupancy Sensors	76	8	7	8	6	19	43	30	10	54	38
553	1	Lighting Controls	Daylight Dimming	77	4	6	7	5	12	26	18	7	39	25
554	1	Lighting Controls	Daylight Dimming - New Construction	78	4	6	7	5	12	26	18	7	39	25
555	2	Lighting Controls	5% More Efficient Design	79	1	1	1	1	1	1	1	1	1	1
556	2	Lighting Controls	10% More Efficient Design	80	1	1	1	1	1	1	1	1	1	1
557	1	Lighting Controls	15% More Efficient Design - New Construction	81	1	1	1	1	1	1	1	1	1	1
558	1	Lighting Controls	30% More Efficient Design - New Construction	82	1	1	1	1	1	1	1	1	1	1
600			***Refrigeration End Use***	83										
601	1	Refrigeration	Vending Miser for Soft Drink Vending Machines	84	2	2	2	1	4	18	6	2	11	8
602	2	Refrigeration	Refrigerated Case Covers	85	1	1	1	2	1	1	1	1	1	1
603	1	Refrigeration	Refrigeration Economizer	86	1	1	1	1	1	1	1	1	1	1
604	1	Refrigeration	Commercial Reach-In Refrigerators	87	1	1	1	2	1	1	1	1	1	1
605	1	Refrigeration	Commercial Reach-In Freezer	88	1	1	1	2	1	1	1	1	1	1
606	1	Refrigeration	Commercial Ice-makers	89	1	1	1	2	1	1	1	1	1	1
607	2	Refrigeration	Evaporator Fan Motor Controls	90	1	1	1	1	1	1	1	1	1	1
608	2	Refrigeration	Permanent Split Capacitor Motor	91	1	1	1	2	1	1	1	1	1	1
609	2	Refrigeration	Zero-Energy Doors	92	1	1	1	2	1	1	1	1	1	1
610	1	Refrigeration	Door Heater Controls	93	1	1	1	1	1	1	1	1	1	1
611	2	Refrigeration	Discus and Scroll Compressors	94	1	1	1	2	1	1	1	1	1	1
612	1	Refrigeration	Floating Head Pressure Control	95	1	1	1	1	1	1	1	1	1	1
613	1	Refrigeration	Anti-sweat (humidistat) controls (refrigerator)	96	1	1	1	1	1	1	1	1	1	1
614	1	Refrigeration	Anti-sweat (humidistat) controls (freezer)	97	1	1	1	1	1	1	1	1	1	1
615	2	Refrigeration	High Efficiency Ice Maker	98	1	1	1	1	1	1	1	1	1	1
700			***Compressed Air End Use***	99										
701	2	C Air	Compressed Air – Non-Controls	100	1	1	1	1	1	1	1	1	1	1
702	1	C Air	Compressed Air – Controls	101	1	1	1	1	1	1	1	1	1	1
720			***Snow Making End Use***	102										
721	2	Snow making	Snow Making	103	0	0	0	0	0	0	0	15	0	0
740			***Monitor Power Management***	104										
741	1	Monitors	EZ Save Monitor Power Management Software	105	2	6	6	6	65	6	20	6	25	6
760			***Water/Wastewater Treatment***	106										
761	1	Pumping and aeration	Improved equipment and controls	107	0	0	0	0	0	0	0	0	0	1
780			***Transformer End Use***	108										
781	2	Transformer	Energy Star Transformers	109	1	1	1	1	1	1	1	1	1	1
800			***Dairy Farms***	110										
801	1	Dairy Farms	VFDs for Milk Transfer Pumps	111	1	0	0	0	0	0	0	0	0	0
802	1	Dairy Farms	VFDs for Milk Vacuum Pumps	112	1	0	0	0	0	0	0	0	0	0

Vermont Energy Efficiency Potential Study

Commercial Sector Measure Database

#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	Total Installed Cost Per Prototypical Building									
				Dairy	Light Manufac	Retail	Food Sales	Office	Lodging	Health Care	Ski Areas	Schools	Other
500			***Lighting End Use***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
501	2	Lighting - Flor	Super T8 Fixture - from 34W T12	$2,475	$3,713	$4,805	$3,458	$7,535	$16,780	$11,502	$4,259	$25,225	$16,271
502	2	Lighting - Flor	Super T8 Fixture - from standard T8	$952	$1,428	$1,848	$1,330	$2,898	$6,454	$4,424	$1,638	$9,702	$6,258
503	2	Lighting - High Bay	T5 Fluorescent High-Bay Fixtures	$1,288	$1,904	$2,464	$1,792	$3,864	$8,680	$5,936	$2,184	$13,048	$8,400
504	2	Lighting - Flor	T5 Troffer/Wrap	$2,240	$3,360	$4,346	$3,114	$6,810	$15,187	$10,394	$3,853	$22,803	$14,694
505	2	Lighting - Flor	T5 Industrial Strip	$2,240	$3,360	$4,346	$3,114	$6,810	$15,187	$10,394	$3,853	$22,803	$14,694
506	2	Lighting - Flor	T5 Indirect	$2,240	$3,360	$4,346	$3,114	$6,810	$15,187	$10,394	$3,853	$22,803	$14,694
507	2	Lighting - Flor	CFL Fixture	$2,243	$2,071	$2,324	$1,665	$5,440	$12,139	$8,323	$2,801	$15,205	$10,688
508	2	Lighting	Exterior HID	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
509	2	Lighting	LED Exit Sign	$533	$493	$553	$397	$1,296	$2,891	$1,982	$667	$3,619	$2,545
510	1	Lighting	Lighting Controls	$440	$385	$440	$330	$1,045	$2,365	$1,650	$550	$2,970	$2,090
511	2	Lighting	LED Traffic / Pedestrian Signals	$0	$0	$0	$0	$0	$0	$0	$0	$0	$140
512	2	Lighting - High Bay	Electronic HID Fixture Upgrade	$228	$204	$228	$168	$540	$1,212	$828	$276	$1,512	$1,068
513	2	Lighting	Halogen Infra-Red Bulb	$186	$172	$193	$137	$451	$1,006	$689	$231	$1,260	$886
514	2	Lighting	Integrated Ballast MH 25W	$2,970	$2,749	$3,074	$2,204	$7,215	$16,101	$11,032	$3,712	$20,149	$14,175
515	2	Lighting	Induction Fluorescent 23W	$1,774	$1,640	$1,837	$1,321	$4,313	$9,627	$6,597	$2,220	$12,045	$8,473
516	2	Lighting	CFL Screw-in	$1,206	$1,116	$1,252	$897	$2,929	$6,541	$4,483	$1,508	$8,188	$5,757
517	2	Lighting	Dairy Farm Hard-Wired Vapor-Proof CFL Fixture with E	$1,750	$0	$0	$0	$0	$0	$0	$0	$0	$0
518	2	Lighting	Dairy Farm Vapor Proof T8 Fixture with Electronic Ball	$2,450	$0	$0	$0	$0	$0	$0	$0	$0	$0
519	2	Lighting	Metal Halide Track	$3,567	$3,306	$3,698	$2,654	$8,657	$19,358	$13,268	$4,481	$24,230	$17,052
520	2	Lighting	Lighting Power Density	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1
550			***Lighting Controls***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
551	1	Lighting Controls	Bi-Level Switching	$1,523	$2,285	$2,957	$2,128	$4,637	$10,326	$7,078	$2,621	$15,523	$10,013
552	1	Lighting Controls	Occupancy Sensors	$440	$385	$440	$330	$1,045	$2,365	$1,650	$550	$2,970	$2,090
553	1	Lighting Controls	Daylight Dimming	$724	$1,086	$1,267	$905	$2,172	$4,706	$3,258	$1,267	$7,059	$4,525
554	1	Lighting Controls	Daylight Dimming - New Construction	$724	$1,086	$1,267	$905	$2,172	$4,706	$3,258	$1,267	$7,059	$4,525
555	2	Lighting Controls	5% More Efficient Design	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000
556	2	Lighting Controls	10% More Efficient Design	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000
557	1	Lighting Controls	15% More Efficient Design - New Construction	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000
558	1	Lighting Controls	30% More Efficient Design - New Construction	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000
600			***Refrigeration End Use***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
601	1	Refrigeration	Vending Miser for Soft Drink Vending Machines	$320	$320	$320	$160	$640	$2,880	$960	$320	$1,760	$1,280
602	2	Refrigeration	Refrigerated Case Covers	$90	$90	$90	$180	$90	$90	$90	$90	$90	$90
603	1	Refrigeration	Refrigeration Economizer	$2,558	$2,558	$2,558	$2,558	$2,558	$2,558	$2,558	$2,558	$2,558	$2,558
604	1	Refrigeration	Commercial Reach-In Refrigerators	$100	$100	$100	$200	$100	$100	$100	$100	$100	$100
605	1	Refrigeration	Commercial Reach-In Freezer	$100	$100	$100	$200	$100	$100	$100	$100	$100	$100
606	1	Refrigeration	Commercial Ice-makers	$45	$45	$45	$90	$45	$45	$45	$45	$45	$45
607	2	Refrigeration	Evaporator Fan Motor Controls	$1,050	$1,050	$1,050	$1,050	$1,050	$1,050	$1,050	$1,050	$1,050	$1,050
608	2	Refrigeration	Permanent Split Capacitor Motor	$235	$235	$235	$470	$235	$235	$235	$235	$235	$235
609	2	Refrigeration	Zero-Energy Doors	$800	$800	$800	$1,600	$800	$800	$800	$800	$800	$800
610	1	Refrigeration	Door Heater Controls	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250
611	2	Refrigeration	Discus and Scroll Compressors	$650	$650	$650	$1,300	$650	$650	$650	$650	$650	$650
612	1	Refrigeration	Floating Head Pressure Control	$734	$734	$734	$734	$734	$734	$734	$734	$734	$734
613	1	Refrigeration	Anti-sweat (humidistat) controls (refrigerator)	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500
614	1	Refrigeration	Anti-sweat (humidistat) controls (freezer)	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500
615	2	Refrigeration	High Efficiency Ice Maker	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45
700			***Compressed Air End Use***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
701	2	C Air	Compressed Air – Non-Controls	$1,347	$1,347	$1,347	$1,347	$1,347	$1,347	$1,347	$1,347	$1,347	$1,347
702	1	C Air	Compressed Air – Controls	$4,313	$4,313	$4,313	$4,313	$4,313	$4,313	$4,313	$4,313	$4,313	$4,313
720			***Snow Making End Use***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
721	2	Snow making	Snow Making	$0	$0	$0	$0	$0	$0	$0	$37,500	$0	$0
740			***Monitor Power Management***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
741	1	Monitors	EZ Save Monitor Power Management Software	$53	$158	$158	$158	$1,716	$158	$528	$158	$660	$158
760			***Water/Wastewater Treatment***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
761	1	Pumping and aeration	Improved equipment and controls	$0	$0	$0	$0	$0	$0	$0	$0	$0	$75,200
780			***Transformer End Use***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
781	2	Transformer	Energy Star Transformers	$856	$856	$856	$856	$856	$856	$856	$856	$856	$856
800			***Dairy Farms***	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
801	1	Dairy Farms	VFDs for Milk Transfer Pumps	$2,230	$0	$0	$0	$0	$0	$0	$0	$0	$0
802	1	Dairy Farms	VFDs for Milk Vacuum Pumps	$1,875	$0	$0	$0	$0	$0	$0	$0	$0	$0

Sources

1 American Council for an Energy Efficient Economy (ACEEE), Selecting Targets for Market Transformation Programs: A National Analysis, 1998.

2 California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-3.

3 CALIFORNIA STATEWIDE COMMERCIAL SECTOR NATURAL GAS ENERGY EFFICIENCY POTENTIAL STUDY, Study ID #SW061, Prepared for Pacific Gas & Electric Company, Prepared by Mike Rufo and Fred Coito KEMA-XENERGY Inc., May 14, 2003

4 California Urban Water Conservation Council, http://www.cuwcc.org/sprayvalves.lasso

5 Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region, GDS Associates, June 2004

6 Database for Energy Efficient Resources (DEER) 2001 Update, California Energy Commission, http://www.energy.ca.gov/deer/index.html

7 EIA - Technology Forecast Updates - Residential and Commercial Building Technologies - Reference Case, September 2004, Navigant Consulting, Reference No. 117943

8 Federal Energy Management Program (FEMP) brochure: "How to Buy an Energy-Efficient Family-Sized Commercial Clothes Washer", http://www.eere.energy.gov/femp/procurement/comm_clotheswashers.html#cost

9 GDS Associates Estimate/Calculation

10 The Maximum Achievable Cost Effective Potential for Natural Gas Energy Efficiency In the Service Territory of PNM, GDS Associates, May 2005

11 Keyspan Energy, 2004. Program data provided via email.

12 Maine Cost Effectiveness Model, March 2003.

13 National Grid, 2000 Energy Initiative Program Data, 2000 DSM Performance Measurement Report, Appendix 3, December 2001 15 hp motor (725 KWh per hp)

14 KeySpan Energy, 2005. Cost benefit analysis conducted for solar measures.

15 Northeast Utilities, Action Program C&I Persistence Study, Oct. 2001, p. 39

16 Quantum Consulting - Pilot program experience from Oakland CA per email communication from Mike Rufo on 2/3/04. and American Council for an Energy Efficient Economy (ACEEE), Selecting Targets for Market Transformation Programs: A National Analysis, 1998.

17 RS Means CostWorks 2005, construction cost estimating database for Albequerque

18 Efficiency Vermont Technical Reference User Manual (TRM) No. 2004-31

19 Efficiency Vermont Technical Reference User Manual (TRM) Update - Portfolio of New and Revised Measures - Portfolio Update No. 38

20 WI Focus on Energy Cost Data (VA Hospital)

21 Energy Efficiency and Renewable Energy Resource Development Potential in New York State - Final Report, Volume 5 Energy Efficiency Technical Appendices, August 2003.

22 National Grid, RFP LJR 05-07, Prescriptive Compressed Air Impcat Study p. 10

23 NYSERDA final report for Agreement number 5035, Turnkey Pump and Compressed Air System Efficiency Program, Final Report, November 2003, p.12

24 Draft Final Report: Phase 2 Evaluation of the Efficiency Vermont Business Programs, December 2005.

25 Dairy Farm Energy Audit Summary Report for FlexTech Services, NYSERDA, July 2003.

26 GDS Benefit Cost Model with Vermont Avoided Costs

27 Email from Efficiency Vermont on March 12, 2006 responding to GDS questions on market penetrations of efficient measures.

28 Energy Trust of Oregon - personal communication, noted that they expect 20-50% savings from water and wastewater project.

#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	1 Dairy	2 Light Manufac	3 Retail	4 Food Sales	5 Office	6 Lodging	7 Health Care	8 Ski Areas	9 Schools	10 Other	Source
100			***Space Heating***											
101	2	Space Heating	High Efficiency Heat Pump	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	21
102	2	Space Heating	Hydronic Heating Pump	34%	34%	34%	34%	34%	34%	34%	34%	34%	34%	5
103	2	Space Heating	Ground Source Heat Pump - Heating	29%	29%	29%	29%	29%	29%	29%	29%	29%	29%	21
150 *Act 250*			***Water Heating End Use***											
151	2	Water Heating	Heat Pump Water Heater	43%	43%	43%	43%	43%	43%	43%	43%	43%	43%	
152	2	Water Heating	Booster Water Heater	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	21
153	1	Water Heating	Point of Use Water Heater	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	21
154	1	Water Heating	Solar Water Heating System	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	14
155	1	Water Heating	Solar Pool Heating	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	14
200			***Envelope***											
201	2	Space Heating	Integrated Building Design	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	21
202	2	Space Heating	Double Pane Low Emissivity Windows	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	21
300			***Space Cooling - Chillers***											
301	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 300 tons	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	5
302	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 500 tons	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	5
303	2	Space Cooling - Chillers	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 tons	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	5
320			***Space Cooling - Packaged AC***											
321	2	Space Cooling - Packaged	Electric HVAC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
322	2	Space Cooling - Packaged	DX Packaged system EER = 10.9, 10 tons	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	5
323	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, <20 Tons	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	5
324	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, >20 Tons	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	5
325	2	Space Cooling - Packaged	Packaged AC - 3 tons, Tier 2	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	5
326	2	Space Cooling - Packaged	Packaged AC - 7.5 tons, Tier 2	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	5
327	2	Space Cooling - Packaged	Packaged AC - 15 tons, Tier 2	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%	5
328	2	Space Cooling - Packaged	Ground Source Heat Pump - Cooling	36%	36%	36%	36%	36%	36%	36%	36%	36%	36%	9
340			***Space Cooling - Maintenance***											
341	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 300 ton	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	5
342	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 500 ton	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	5
343	1	Space Cooling - Maint.	DX Tune Up/ Advanced Diagnostics	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	5
360			***HVAC Controls***											
361	1	HVAC Controls	Retrocommissioning	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	21
362	1	HVAC Controls	Programmable Thermostats	3%	4%	4%	3%	10%	4%	4%	4%	4%	4%	5
363	1	HVAC Controls	EMS install	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	21, 5
364	1	HVAC Controls	EMS Optimization	1%	1%	6%	8%	7%	1%	2%	1%	5%	1%	10
380			***HVAC End Use***											
381	2	HVAC	Dual Enthalpy Economizer - from Fixed Damper	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	21
382	2	HVAC	Dual Enthalpy Economizer - from Dry Bulb	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%	9
383	2	HVAC	Comprehensive Track Proper HVAC Sizing	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	18
384	2	HVAC	Demand-Controlled Ventilation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
385	2	HVAC	Heat Recovery	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
386	2	HVAC	Fan Motor, 40hp, 1800rpm, 94.1%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	12
387	2	HVAC	Fan Motor, 15hp, 1800rpm, 92.4%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	5
388	2	HVAC	Fan Motor, 5hp, 1800rpm, 89.5%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	12
389	2	HVAC	Variable Speed Drive Control, 15 HP	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	5
390	2	HVAC	Variable Speed Drive Control, 5 HP	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	5
391	2	HVAC	Variable Speed Drive Control, 40 HP	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	5

400			***Motors End Use***										
401	2	Motors	Efficient Motors	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	
402	2	Motors	Variable Frequency Drives (VFD)	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	
403	2	Motors	VFD for Environmental Remediation Projects	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.23%	18
404	2	Motors	Efficient Environmental Remediation Motors	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.01%	18
405	2	Motors	Variable Frequency Drives (VFD) for Dairy Farms	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.00%	
500			***Lighting End Use***											
501	2	Lighting	Super T8 Fixture - from 34W T12 - Early Replacement	43%	43%	43%	43%	43%	43%	43%	43%	43%	43%	5
502	2	Lighting	Super T8 Fixture - from standard T8	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	5
503	2	Lighting	T5 Fluorescent High-Bay Fixtures	49%	49%	49%	49%	49%	49%	49%	49%	49%	49%	5
504	2	Lighting	T5 Troffer/Wrap	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	19
505	2	Lighting	T5 Industrial Strip	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	19
506	2	Lighting	T5 Indirect	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	19
507	2	Lighting	CFL Fixture	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	21
508	2	Lighting	Exterior HID	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	18
509	2	Lighting	LED Exit Sign	82%	82%	82%	82%	82%	82%	82%	82%	82%	82%	18
510	1	Lighting	Lighting Controls	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	18
511	2	Lighting	LED Traffic / Pedestrian Signals	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	18
512	2	Lighting	Electronic HID Fixture Upgrade	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	19
513	2	Lighting	Halogen Infra-Red Bulb	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	19
514	2	Lighting	Integrated Ballast MH 25W	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	19
515	2	Lighting	Induction Fluorescent 23W	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	19
516	2	Lighting	CFL Screw-in	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	21
517	2	Lighting	Dairy Farm Hard-Wired Vapor-Proof CFL Fixture with Electronic Ballast	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	21
518	2	Lighting	Dairy Farm Vapor Proof T8 Fixture with Electronic Ballast	29%	29%	29%	29%	29%	29%	29%	29%	29%	29%	5
519	2	Lighting	Metal Halide Track	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	18
520	2	Lighting	Lighting Power Density	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
550			***Lighting Controls***											
551	1	Lighting Controls	Bi-Level Switching	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	19
552	1	Lighting Controls	Occupancy Sensors	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	5
553	1	Lighting Controls	Daylight Dimming	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	5
554	1	Lighting Controls	Daylight Dimming - New Construction	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	5
555	2	Lighting Controls	5% More Efficient Design	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5
556	2	Lighting Controls	10% More Efficient Desigh	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	5
557	1	Lighting Controls	15% More Efficient Design - New Construction	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	5
558	1	Lighting Controls	30% More Efficient Desigh - New Construction	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	5
600			***Refrigeration End Use***											
601	1	Refrigeration	Vending Miser for Soft Drink Vending Machines	46%	46%	46%	46%	46%	46%	46%	46%	46%	46%	18
602	2	Refrigeration	Refrigerated Case Covers	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	5
603	1	Refrigeration	Refrigeration Economizer	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	18
604	1	Refrigeration	Commercial Reach-In Refrigerators	26%	26%	26%	26%	26%	26%	26%	26%	26%	26%	18
605	1	Refrigeration	Commercial Reach-In Freezer	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	18
606	1	Refrigeration	Commercial Ice-makers	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	18
607	2	Refrigeration	Evaporator Fan Motor Controls	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	18
608	2	Refrigeration	Permanent Split Capacitor Motor	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	5
609	2	Refrigeration	Zero-Energy Doors	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	18
610	1	Refrigeration	Door Heater Controls	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	18
611	2	Refrigeration	Discus and Scroll Compressors	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	5
612	1	Refrigeration	Floating Head Pressure Control	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	5
613	1	Refrigeration	Anti-sweat (humidistat) controls (refrigerator)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5
614	1	Refrigeration	Anti-sweat (humidistat) controls (freezer)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5
615	2	Refrigeration	High Efficiency Ice Maker	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	18
700			***Compressed Air End Use***											
701	2	C Air	Compressed Air – Non-Controls	0%	20%	1%	0%	0%	0%	20%	20%	0%	20%	13
702	1	C Air	Compressed Air – Controls	0%	15%	1%	0%	0%	0%	15%	15%	0%	15%	13
720			***Snow Making End Use***											
721	2	Snow making	Snow Making	0%	0%	0%	0%	0%	0%	0%	80%	0%	80%	9
740			***Office Equipment***											
741	1	Monitors	EZ Save Monitor Power Management Software	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	18
760			***Water/Wastewater Treatment***											
761	1	Pumping and aeration	Improved equipment and controls	0%	0%	0%	0%	0%	0%	0%	0%	0%	35%	28
780			***Transformer End Use***											
781	2	Transformer	Energy Star Transformers	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	18
800			***Dairy Farms***											
801	1	Dairy Farms	VFDs for Milk Transfer Pumps	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	25
802	1	Dairy Farms	VFDs for Milk Vacuum Pumps	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	25

				1	2	3	4	5	6	7	8	9	10	
#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	Dairy	Light Manufac	Retail	Food Sales	Office	Lodging	Health Care	Ski Areas	Schools	Other	Source
100			***Space Heating***											
101	2	Space Heating	High Efficiency Heat Pump	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
102	2	Space Heating	Hydronic Heating Pump	23%	23%	24%	23%	33%	23%	40%	23%	40%	23%	5
103	2	Space Heating	Ground Source Heat Pump - Heating	77%	77%	77%	77%	67%	77%	60%	77%	60%	77%	9
150	*Act 250*		***Water Heating End Use***											
151	2	Water Heating	Heat Pump Water Heater	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
152	2	Water Heating	Booster Water Heater	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
153	1	Water Heating	Point of Use Water Heater	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
154	1	Water Heating	Solar Water Heating	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
155	1	Water Heating	Solar Pool Heating	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
200			***Envelope***											
201	2	Space Heating	Integrated Building Design	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
202	2	Space Heating	Double Pane Low Emissivity Windows	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
300			***Space Cooling - Chillers***											
301	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 300 tons	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
302	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 500 tons	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
303	2	Space Cooling - Chillers	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 tons	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
320			***Space Cooling - Packaged AC***											
321	2	Space Cooling - Packaged	Electric HVAC	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
322	2	Space Cooling - Packaged	DX Packaged system EER = 10.9, 10 tons	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
323	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, <20 Tons	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
324	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, >20 Tons	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
325	2	Space Cooling - Packaged	Packaged AC - 3 tons, Tier 2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
326	2	Space Cooling - Packaged	Packaged AC - 7.5 tons, Tier 2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
327	2	Space Cooling - Packaged	Packaged AC - 15 tons, Tier 2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
328	2	Space Cooling - Packaged	Ground Source Heat Pump - Cooling	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
340			***Space Cooling - Maintenance***											
341	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 300 ton	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
342	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 500 ton	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
343	1	Space Cooling - Maint.	DX Tune Up/ Advanced Diagnostics	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
360			***HVAC Controls***											
361	1	HVAC Controls	Retrocommissioning	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
362	1	HVAC Controls	Programmable Thermostats	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
363	1	HVAC Controls	EMS install	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
364	1	HVAC Controls	EMS Optimization	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
380			***HVAC End Use***											
381	2	HVAC	Dual Enthalpy Economizer - from Fixed Damper	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
382	2	HVAC	Dual Enthalpy Economizer - from Dry Bulb	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
383	2	HVAC	Comprehensive Track Proper HVAC Sizing	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
384	2	HVAC	Demand-Controlled Ventilation	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	5
385	2	HVAC	Heat Recovery	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	5
386	2	HVAC	Fan Motor, 40hp, 1800rpm, 94.1%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
387	2	HVAC	Fan Motor, 15hp, 1800rpm, 92.4%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
388	2	HVAC	Fan Motor, 5hp, 1800rpm, 89.5%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
389	2	HVAC	Variable Speed Drive Control, 15 HP	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	5
390	2	HVAC	Variable Speed Drive Control, 5 HP	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	5
391	2	HVAC	Variable Speed Drive Control, 40 HP	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	5
400			***Motors End Use***											
401	2	Motors	Efficient Motors	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
402	2	Motors	Variable Frequency Drives (VFD)	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	5
403	2	Motors	VFD for Environmental Remediation Projects	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
404	2	Motors	Efficient Environmental Remediation Motors	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
405	2	Motors	Variable Frequency Drives (VFD) for Dairy Farms	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9

Base Case Factor

#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	1 Dairy	2 Light Manufac	3 Retail	4 Food Sales	5 Office	6 Lodging	7 Health Care	8 Ski Areas	9 Schools	10 Other	Source
500			***Lighting End Use***											
501	2	Lighting	Super T8 Fixture - from 34W T12	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
502	2	Lighting	Super T8 Fixture - from Standard T8	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
503	2	Lighting	T5 Fluorescent High-Bay Fixtures	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	5
504	2	Lighting	T5 Troffer/Wrap	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
505	2	Lighting	T5 Industrial Strip	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
506	2	Lighting	T5 Indirect	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
507	2	Lighting	CFL Fixture	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	5
508	2	Lighting	Exterior HID	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5
509	2	Lighting	LED Exit Sign	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	5
510	1	Lighting	Lighting Controls	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
511	2	Lighting	LED Traffic / Pedestrian Signals	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	5
512	2	Lighting	Electronic HID Fixture Upgrade	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	5
513	2	Lighting	Halogen Infra-Red Bulb	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	5
514	2	Lighting	Integrated Ballast MH 25W	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	5
515	2	Lighting	Induction Fluorescent 23W	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	5
516	2	Lighting	CFL Screw-in	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	5
517	2	Lighting	Dairy Farm Hard-Wired Vapor-Proof CFL Fixture with Electronic Ballast	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	5
518	2	Lighting	Dairy Farm Vapor Proof T8 Fixture with Electronic Ballast	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
519	2	Lighting	Metal Halide Track	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	5
520	2	Lighting	Lighting Power Density	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
550			***Lighting Controls***											
551	1	Lighting Controls	Bi-Level Switching	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
552	1	Lighting Controls	Occupancy Sensors	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
553	1	Lighting Controls	Daylight Dimming	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
554	1	Lighting Controls	Daylight Dimming - New Construction	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
555	2	Lighting Controls	5% More Efficient Design	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
556	2	Lighting Controls	10% More Efficient Desigh	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
557	1	Lighting Controls	15% More Efficient Design - New Construction	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
558	1	Lighting Controls	30% More Efficient Desigh - New Construction	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
600			***Refrigeration End Use***											
601	1	Refrigeration	Vending Miser for Soft Drink Vending Machines	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5
602	2	Refrigeration	Refrigerated Case Covers	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	5
603	1	Refrigeration	Refrigeration Economizer	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	5
604	1	Refrigeration	Commercial Reach-In Refrigerators	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	5
605	1	Refrigeration	Commercial Reach-In Freezer	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	5
606	1	Refrigeration	Commercial Ice-makers	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	5
607	2	Refrigeration	Evaporator Fan Motor Controls	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	5
608	2	Refrigeration	Permanent Split Capacitor Motor	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	5
609	2	Refrigeration	Zero-Energy Doors	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	5
610	1	Refrigeration	Door Heater Controls	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	5
611	2	Refrigeration	Discus and Scroll Compressors	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	5
612	1	Refrigeration	Floating Head Pressure Control	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	5
613	1	Refrigeration	Anti-sweat (humidistat) controls (refrigerator)	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	5
614	1	Refrigeration	Anti-sweat (humidistat) controls (freezer)	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	5
615	2	Refrigeration	High Efficiency Ice Maker	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	5
700			***Compressed Air End Use***											
701	2	C Air	Compressed Air – Non-Controls	0%	15%	0.25%	0%	0%	0%	0%	20.000%	0%	15%	9
702	1	C Air	Compressed Air – Controls	0%	15%	0.25%	0%	0%	0%	0%	20.000%	0%	15%	9
720			***Snow Making End Use***											
721	2	Snow making	Snow Making	0%	0%	0%	0%	0%	0%	0%	80%	0%	11%	9
740			***Office Equipment***											
741	1	Monitors	EZ Save Monitor Power Management Software	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	5
760			***Water/Wastewater Treatment***											
761	1	Pumping and aeration	Improved equipment and controls	0%	0%	0%	0%	0%	0%	0%	0%	0%	23%	9
780			***Transformer End Use***											
781	2	Transformer	Energy Star Transformers	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	5
800			***Dairy Farms***											
801	1	Dairy Farms	VFDs for Milk Transfer Pumps	13%	0%	0%	0%	0%	0%	0%	0%	0%	0%	25
802	1	Dairy Farms	VFDs for Milk Vacuum Pumps	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%	25

				1	2	3	4	5	6	7	8	9	10	
#	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	Dairy	Light Manufac	Retail	Food Sales	Office	Lodging	Health Care	Ski Areas	Schools	Other	Source
100			***Space Heating***											
101	2	Space Heating	High Efficiency Heat Pump	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	24
102	2	Space Heating	Hydronic Heating Pump	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	24
103	2	Space Heating	Ground Source Heat Pump - Heating	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	9
150	*Act 250*		***Water Heating End Use***											
151	2	Water Heating	Heat Pump Water Heater	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	9
152	2	Water Heating	Booster Water Heater	73%	73%	73%	73%	73%	73%	73%	73%	73%	73%	24
153	1	Water Heating	Point of Use Water Heater	73%	73%	73%	73%	73%	73%	73%	73%	73%	73%	24
154	1	Water Heating	Solar Water Heating System	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	9
155	1	Water Heating	Solar Pool Heating	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	9
200			***Envelope***											
201	2	Space Heating	Integrated Building Design	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
202	2	Space Heating	Double Pane Low Emissivity Windows	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	27
300			***Space Cooling - Chillers***											
301	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 300 tons	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	24
302	2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 500 tons	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	24
303	2	Space Cooling - Chillers	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 tons	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	24
320			***Space Cooling - Packaged AC***											
321	2	Space Cooling - Packaged	Electric HVAC	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	24
322	2	Space Cooling - Packaged	DX Packaged system EER = 10.9, 10 tons	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	24
323	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, <20 Tons	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	24
324	2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, >20 Tons	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	24
325	2	Space Cooling - Packaged	Packaged AC - 3 tons, Tier 2	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	24
326	2	Space Cooling - Packaged	Packaged AC - 7.5 tons, Tier 2	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	24
327	2	Space Cooling - Packaged	Packaged AC - 15 tons, Tier 2	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	24
328	2	Space Cooling - Packaged	Ground Source Heat Pump - Cooling	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	9
340			***Space Cooling - Maintenance***											
341	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 300 ton	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	5
342	1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 500 ton	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	5
343	1	Space Cooling - Maint.	DX Tune Up/ Advanced Diagnostics	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	5
360			***HVAC Controls***											
361	1	HVAC Controls	Retrocommissioning	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	10
362	1	HVAC Controls	Programmable Thermostats	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	24
363	1	HVAC Controls	EMS install	73%	73%	73%	73%	73%	73%	73%	73%	73%	73%	24
364	1	HVAC Controls	EMS Optimization	73%	73%	73%	73%	73%	73%	73%	73%	73%	73%	24
380			***HVAC End Use***											
381	2	HVAC	Dual Enthalpy Economizer - from Fixed Damper	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	24
382	2	HVAC	Dual Enthalpy Economizer - from Dry Bulb	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	24
383	2	HVAC	Comprehensive Track Proper HVAC Sizing	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	24
384	2	HVAC	Demand-Controlled Ventilation	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	24
385	2	HVAC	Heat Recovery	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	24
386	2	HVAC	Fan Motor, 40hp, 1800rpm, 94.1%	75%	75%	75%	100%	75%	75%	75%	75%	75%	75%	5
387	2	HVAC	Fan Motor, 15hp, 1800rpm, 92.4%	75%	75%	75%	100%	75%	75%	75%	75%	75%	75%	5
388	2	HVAC	Fan Motor, 5hp, 1800rpm, 89.5%	75%	75%	75%	100%	75%	75%	75%	75%	75%	75%	5
389	2	HVAC	Variable Speed Drive Control, 15 HP	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	24
390	2	HVAC	Variable Speed Drive Control, 5 HP	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	24
391	2	HVAC	Variable Speed Drive Control, 40 HP	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	24
400			***Motors End Use***											
401	2	Motors	Efficient Motors	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	9
402	2	Motors	Variable Frequency Drives (VFD)	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	24
403	2	Motors	VFD for Environmental Remediation Projects	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	9
404	2	Motors	Efficient Environmental Remediation Motors	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	9
405	2	Motors	Variable Frequency Drives (VFD) for Dairy Farms	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9

500			***Lighting End Use***											
501	2	Lighting	Super T8 Fixture - from 34W T12 - Early Replacement	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	27, 9
502	2	Lighting	Super T8 Fixture - from standard T8	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	24
503	2	Lighting	T5 Fluorescent High-Bay Fixtures	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	24, 27
504	2	Lighting	T5 Troffer/Wrap	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	27
505	2	Lighting	T5 Industrial Strip	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	27
506	2	Lighting	T5 Indirect	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	27
507	2	Lighting	CFL Fixture	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	24
508	2	Lighting	Exterior HID	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	9
509	2	Lighting	LED Exit Sign	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	24
510	1	Lighting	Lighting Controls	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%	
511	2	Lighting	LED Traffic / Pedestrian Signals	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	27
512	2	Lighting	Electronic HID Fixture Upgrade	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
513	2	Lighting	Halogen Infra-Red Bulb	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
514	2	Lighting	Integrated Ballast MH 25W	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
515	2	Lighting	Induction Fluorescent 23W	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
516	2	Lighting	CFL Screw-in	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	24
517	2	Lighting	Dairy Farm Hard-Wired Vapor-Proof CFL Fixture with Electronic Ballast	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	9
518	2	Lighting	Dairy Farm Vapor Proof T8 Fixture with Electronic Ballast	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	9
519	2	Lighting	Metal Halide Track	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	9
520	2	Lighting	Lighting Power Density	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
550			***Lighting Controls***											
551	1	Lighting Controls	Bi-Level Switching	95%	75%	95%	95%	75%	95%	95%	95%	75%	75%	9
552	1	Lighting Controls	Occupancy Sensors	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	24
553	1	Lighting Controls	Daylight Dimming	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	24
554	1	Lighting Controls	Daylight Dimming - New Construction	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	24
555	2	Lighting Controls	5% More Efficient Design	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	
556	2	Lighting Controls	10% More Efficient Desigh	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	
557	1	Lighting Controls	15% More Efficient Design - New Construction	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	
558	1	Lighting Controls	30% More Efficient Desigh - New Construction	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%	
600			***Refrigeration End Use***											
601	1	Refrigeration	Vending Miser for Soft Drink Vending Machines	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	5
602	2	Refrigeration	Refrigerated Case Covers	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	24
603	1	Refrigeration	Refrigeration Economizer	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	5
604	1	Refrigeration	Commercial Reach-In Refrigerators	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	24
605	1	Refrigeration	Commercial Reach-In Freezer	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	24
606	1	Refrigeration	Commercial Ice-makers	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	5
607	2	Refrigeration	Evaporator Fan Motor Controls	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	5
608	2	Refrigeration	Permanent Split Capacitor Motor	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	24
609	2	Refrigeration	Zero-Energy Doors	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	24
610	1	Refrigeration	Door Heater Controls	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	5
611	2	Refrigeration	Discus and Scroll Compressors	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	24
612	1	Refrigeration	Floating Head Pressure Control	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	24
613	1	Refrigeration	Anti-sweat (humidistat) controls (refrigerator)	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	24
614	1	Refrigeration	Anti-sweat (humidistat) controls (freezer)	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	24
615	2	Refrigeration	High Efficiency Ice Maker	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	5
700			***Compressed Air End Use***											
701	2	C Air	Compressed Air – Non-Controls	0%	60%	75%	0%	0%	0%	75%	75%	0%	60%	24
702	1	C Air	Compressed Air – Controls	0%	60%	75%	0%	0%	0%	75%	75%	0%	60%	24
720			***Snow Making End Use***											
721	2	Snow making	Snow Making	0%	0%	0%	0%	0%	0%	0%	58%	0%	58%	27
740			***Office Equipment***											
741	1	Monitors	EZ Save Monitor Power Management Software	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	
760			***Water/Wastewater Treatment***											
761	1	Pumping and aeration	Improved equipment and controls	0%	0%	0%	0%	0%	0%	0%	0%	0%	75%	
780			***Transformer End Use***											
781	2	Transformer	Energy Star Transformers	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	27
800			***Dairy Farms***											
801	1	Dairy Farms	VFDs for Milk Transfer Pumps	48%	0%	0%	0%	0%	0%	0%	0%	0%	0%	27
802	1	Dairy Farms	VFDs for Milk Vacuum Pumps	48%	0%	0%	0%	0%	0%	0%	0%	0%	0%	27

Vermont Energy Efficiency Potential Study - Convertible Factor

					1	2	3	4	5	6	7	8	9	10	
#	TRM Measure Number	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	Dairy	Light Manufac	Retail	Food Sales	Office	Lodging	Health Care	Ski Areas	Schools	Other	Source
100				***Space Heating***											
101	I-L-1-a	2	Space Heating	High Efficiency Heat Pump	77%	77%	77%	77%	67%	77%	60%	77%	60%	77%	21
102		2	Space Heating	Hydronic Heating Pump	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	5
103		2	Space Heating	Ground Source Heat Pump - Heating	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	21
150	III-D-1-b	*Act 250*		***Water Heating End Use***											
151	I-K-1-a	2	Water Heating	Heat Pump Water Heater	0%	0%	0%	29%	0%	30%	30%	0%	30%	15%	21
152		2	Water Heating	Booster Water Heater	0%	0%	0%	75%	0%	75%	75%	75%	75%	75%	21
153		1	Water Heating	Point of Use Water Heater	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	21
154		1	Water Heating	Solar Water Heating System	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	9
155		1	Water Heating	Solar Pool Heating	0%	0%	0%	0%	0%	25%	0%	0%	25%	0%	9
200				***Envelope***											
201	I-M-1-a	2	Space Heating	Integrated Building Design	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	21
202		2	Space Heating	Double Pane Low Emissivity Windows	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	21
300				***Space Cooling - Chillers***											
301		2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 300 tons	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	5
302		2	Space Cooling - Chillers	Centrifugal Chiller, 0.51 kW/ton, 500 tons	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	5
303		2	Space Cooling - Chillers	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 tons	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
320				***Space Cooling - Packaged AC***											
321	I-B-1-g	2	Space Cooling - Packaged	Electric HVAC	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
322		2	Space Cooling - Packaged	DX Packaged system EER = 10.9, 10 tons	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	2
323		2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, <20 Tons	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	2
324		2	Space Cooling - Packaged	DX Packaged System, CEE Tier 2, >20 Tons	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	2
325		2	Space Cooling - Packaged	Packaged AC - 3 tons, Tier 2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
326		2	Space Cooling - Packaged	Packaged AC - 7.5 tons, Tier 2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
327		2	Space Cooling - Packaged	Packaged AC - 15 tons, Tier 2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
328		2	Space Cooling - Packaged	Ground Source Heat Pump - Cooling	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	21
340				***Space Cooling - Maintenance***											
341		1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 300 ton	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	5
342		1	Space Cooling - Maint.	Chiller Tune Up/Diagnostics - 500 ton	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	5
343		1	Space Cooling - Maint.	DX Tune Up/ Advanced Diagnostics	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	5
360				***HVAC Controls***											
361		1	HVAC Controls	Retrocommissioning	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	21
362		1	HVAC Controls	Programmable Thermostats	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	5
363		1	HVAC Controls	EMS install	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
364		1	HVAC Controls	EMS Optimization	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
380				***HVAC End Use***											
381	I-B-2-c	2	HVAC	Dual Enthalpy Economizer - from Fixed Damper	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	5
382	I-B-2-c	2	HVAC	Dual Enthalpy Economizer - from Dry Bulb	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	5
383	I-A-3-a	2	HVAC	Comprehensive Track Proper HVAC Sizing	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	9
384	I-J-1-a	2	HVAC	Demand-Controlled Ventilation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
385	BREC	2	HVAC	Heat Recovery	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
386	BREC	2	HVAC	Fan Motor, 40hp, 1800rpm, 94.1%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
387	BREC	2	HVAC	Fan Motor, 15hp, 1800rpm, 92.4%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
388	BREC	2	HVAC	Fan Motor, 5hp, 1800rpm, 89.5%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
389	BREC	2	HVAC	Variable Speed Drive Control, 15 HP	55%	55%	19%	0%	71%	7%	86%	7%	67%	35%	2
390	BREC	2	HVAC	Variable Speed Drive Control, 5 HP	6%	6%	19%	0%	24%	4%	18%	4%	23%	10%	2
391	BREC	2	HVAC	Variable Speed Drive Control, 40 HP	0%	0%	68%	0%	87%	30%	88%	30%	45%	55%	2
400				***Motors End Use***											
401	I-A-1-e	2	Motors	Efficient Motors	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	21
402	I-A-2-a	2	Motors	Variable Frequency Drives (VFD)	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	21
403	I-A-3-a	2	Motors	VFD for Environmental Remediation Projects	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	9
404	I-A-4-a	2	Motors	Efficient Environmental Remediation Motors	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	9
405	I-A-5-b	2	Motors	Variable Frequency Drives (VFD) for Dairy Farms	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9
500				***Lighting End Use***											
501	I-C-12-d	2	Lighting	Super T8 Fixture - from 34W T12 - Early Replacement	5%	20%	20%	20%	20%	20%	20%	20%	20%	20%	27, 9
502	I-C-12-d	2	Lighting	Super T8 Fixture - from standard T8	5%	75%	75%	75%	75%	75%	75%	75%	75%	75%	27, 9
503	I-C-14-a	2	Lighting	T5 Fluorescent High-Bay Fixtures	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
504	I-C-14-a	2	Lighting	T5 Troffer/Wrap	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
505	I-C-14-a	2	Lighting	T5 Industrial Strip	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
506	I-C-14-a	2	Lighting	T5 Indirect	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
507	I-C-2-e	2	Lighting	CFL Fixture	85%	15%	15%	15%	15%	15%	15%	15%	15%	15%	21
508	I-C-3-d	2	Lighting	Exterior HID	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
509	I-C-4-d	2	Lighting	LED Exit Sign	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
510	I-C-5-g	1	Lighting	Lighting Controls	59%	59%	59%	59%	73%	73%	73%	73%	71%	71%	9

Vermont Energy Efficiency Potential Study - Convertible Factor

					1	2	3	4	5	6	7	8	9	10	
#	TRM Measure Number	Cost Type: 1=Full 2=Inc.	End Use	Measure Name	Dairy	Light Manufac	Retail	Food Sales	Office	Lodging	Health Care	Ski Areas	Schools	Other	Source
511	I-C-6-b	2	Lighting	LED Traffic / Pedestrian Signals	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
512	I-C-17-a	2	Lighting	Electronic HID Fixture Upgrade	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
513	I-C-15-a	2	Lighting	Halogen Infra-Red Bulb	5%	75%	75%	75%	75%	75%	75%	75%	75%	75%	21
514	I-C-16-a	2	Lighting	Integrated Ballast MH 25W	5%	15%	15%	15%	15%	15%	15%	15%	15%	15%	21
515	I-C-16-a	2	Lighting	Induction Fluorescent 23W	5%	75%	75%	75%	75%	75%	75%	75%	75%	75%	21
516	I-C-8-c	2	Lighting	CFL Screw-in	5%	85%	75%	85%	85%	85%	75%	85%	85%	83%	21
517	I-C-9-b	2	Lighting	Dairy Farm Hard-Wired Vapor-Proof CFL Fixture with Electronic Ballast	85%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9
518	I-C-10-b	2	Lighting	Dairy Farm Vapor Proof T8 Fixture with Electronic Ballast	95%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9
519	I-C-11-a	2	Lighting	Metal Halide Track	5%	10%	10%	10%	10%	10%	10%	10%	10%	10%	21
520	I-C-14-a	2	Lighting	Lighting Power Density	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9
550				***Lighting Controls***											
551		1	Lighting Controls	Bi-Level Switching	59%	59%	25%	59%	73%	25%	73%	73%	71%	71%	27
552		1	Lighting Controls	Occupancy Sensors	20%	20%	10%	10%	40%	20%	50%	20%	50%	20%	5
553		1	Lighting Controls	Daylight Dimming	28%	28%	28%	28%	28%	28%	28%	28%	28%	28%	5
554		1	Lighting Controls	Daylight Dimming - New Construction	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	9
555		2	Lighting Controls	5% More Efficient Design	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	5
556		2	Lighting Controls	10% More Efficient Desigh	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	5
557		1	Lighting Controls	15% More Efficient Design - New Construction	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
558		1	Lighting Controls	30% More Efficient Desigh - New Construction	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	9
600				***Refrigeration End Use***											
601	I-E-1-b	1	Refrigeration	Vending Miser for Soft Drink Vending Machines	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
602	I-E-2-a	2	Refrigeration	Refrigerated Case Covers	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	5
603	I-E-6-a	1	Refrigeration	Refrigeration Economizer	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
604	I-E-3-a	1	Refrigeration	Commercial Reach-In Refrigerators	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	5
605	I-E-4-a	1	Refrigeration	Commercial Reach-In Freezer	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
606	I-E-5-a	1	Refrigeration	Commercial Ice-makers	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
607	I-E-7-a	2	Refrigeration	Evaporator Fan Motor Controls	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
608	I-E-8-a	2	Refrigeration	Permanent Split Capacitor Motor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
609	I-E-9-a	2	Refrigeration	Zero-Energy Doors	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	9
610	I-E-10-a	1	Refrigeration	Door Heater Controls	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	5
611	I-E-11-a	2	Refrigeration	Discus and Scroll Compressors	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
612	I-E-12-a	1	Refrigeration	Floating Head Pressure Control	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
613		1	Refrigeration	Anti-sweat (humidistat) controls (refrigerator)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
614		1	Refrigeration	Anti-sweat (humidistat) controls (freezer)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
615	I-E-5-a	2	Refrigeration	High Efficiency Ice Maker	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	5
700				***Compressed Air End Use***											
701	I-F-1-b	2	C Air	Compressed Air – Non-Controls	0%	95%	95%	0%	0%	0%	95%	50%	0%	95%	9
702	I-F-2-b	1	C Air	Compressed Air – Controls	0%	95%	95%	0%	0%	0%	95%	50%	0%	95%	9
720				***Snow Making End Use***											
721	I-G-1-a	2	Snow making	Snow Making	0%	0%	0%	0%	0%	0%	0%	95%	0%	95%	9
740				***Office Equipment***											
741	I-H-1-a	1	Monitors	EZ Save Monitor Power Management Software	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
760				***Water/Wastewater Treatment***											
761	I-I-1-a	1	Pumping and aeration	Improved equipment and controls	0%	0%	0%	0%	0%	0%	0%	0%	0%	75%	
780				***Transformer End Use***											
781	I-D-1-d	2	Transformer	Energy Star Transformers	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	21
800				***Dairy Farms***											
801	I-A-5-b	1	Dairy Farms	VFDs for Milk Transfer Pumps	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9
802		1	Dairy Farms	VFDs for Milk Vacuum Pumps	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9

APPENDIX C

Industrial Sector

APPENDIX C-1

Assumptions for Energy Efficiency Measures

TABLE C-1: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - ALL MEASURES

4/14/2006 15:33

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			34.00%	41.00%	25.00%			20.00%							40.00%	
	Percent Savings by End Use for General Industry			45.52%	35.12%	29.18%	7.12%	7.12%	10.12%	7.12%	6.80%	6.80%	6.80%	6.80%	19.00%	83.80%	3.80%
NAICS CODE		Annual kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	8,095,807	6,316,970	1,750,823	0	0	7,003,293	0	0	0	0	0	0	3,921,844	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	63,899,205	37,547,129	25,723,260	13,500,815	21,139,506	11,214,648	2,554,740	1,896,964	2,446,687	6,286,050	679,177	34,279,216	129,714,926	4,729,163
311	Food Manufacturing	219,248,861	11.84%	11,646,932	4,109,507	5,117,795	677,844	2,978,368	5,548,641	744,517	3,500	0	416,470	0	2,499,437	16,535,749	333,258
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	2,002,590	3,862,717	641,781	2,585,105	2,036,749	0	0	448,706	0	0	0	1,253,736	6,451,241	250,747
322	Paper	276,323,958	14.92%	36,479,377	16,673,242	5,643,806	1,263,741	3,629,650	468,155	1,810,223	294,823	0	98,274	0	1,575,047	9,262,379	210,006
323	Printing	42,960,719	2.32%	811,616	716,732	520,206	546,226	582,948	0	0	175,280	0	0	0	0	9,576,288	284,873
326	Plastic and Rubber	83,228,627	4.49%	3,263,420	1,224,911	791,451	1,159,265	966,054	690,593	0	4,231	0	892,638	0	1,469,008	5,335,728	224,672
327	Mineral Products	125,490,549	6.78%	2,562,683	1,600,609	2,563,094	1,871,258	2,263,551	0	0	33,485	1,109,336	256,001	559,682	1,245,541	4,708,705	284,695
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	1,170,618	1,806,367	1,500,618	1,355,436	2,014,838	205,325	0	231,023	458,598	537,904	13,792	2,055,341	10,764,850	565,219
333	Machinery	63,234,461	3.41%	613,016	709,454	922,528	803,321	762,396	195,956	0	0	211,617	137,929	45,347	2,206,754	8,110,788	216,262
334	Computers	358,117,803	19.34%	2,815,961	3,476,221	5,224,581	1,101,536	2,835,007	3,625,227	0	403,258	0	3,165,761	0	17,879,750	39,429,554	1,496,932
335	Electric Products	36,839,147	1.99%	362,411	559,233	464,576	419,629	623,773	63,566	0	71,522	141,977	166,530	4,270	636,313	3,332,687	174,986
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	1,169,210	1,262,936	1,049,168	557,987	722,639	241,547	0	33,515	132,864	154,409	44,288	1,700,111	6,998,491	204,013
337	Furniture	53,676,682	2.90%	528,054	814,833	676,913	611,423	908,872	92,620	0	104,212	206,869	242,643	6,222	927,143	4,855,910	254,964
339	Misc. Manufacturing	48,112,660	2.60%	473,317	730,369	606,745	548,044	814,660	83,019	0	93,410	185,425	217,491	5,577	831,037	4,352,556	228,535
	Total Industrial kWh Sales in 2015 from VDPS Load Forecast (kWh Sales at the level of the Customer Meter)	1,851,792,067		71,995,012	43,864,100	27,474,084	13,500,815	21,139,506	18,217,941	2,554,740	1,896,964	2,446,687	6,286,050	679,177	34,279,216	133,636,770	4,729,163

Technical Potential Annual kWh Savings by 2015	382,700,223
% of 2015 kWh Sales	20.67%

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			34.00%	41.00%	25.00%	0.00%	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	40.00%	0.00%
	Percent Savings by End Use for General Industry			43.42%	33.02%	29.18%	7.12%	7.12%	8.02%	7.12%	4.70%	4.70%	4.70%	4.70%	19.00%	83.80%	3.80%

Differences				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Percent Savings by End Use for General Industry			-2.10%	-2.10%	0.00%	0.00%	0.00%	-2.10%	0.00%	-2.10%	-2.10%	-2.10%	-2.10%	0.00%	0.00%	0.00%
				2.10%	2.10%	0.00%	0.00%	0.00%	2.10%	0.00%	2.10%	2.10%	2.10%	2.10%	0.00%	0.00%	0.00%

Table C-2: Summary of Industrial Sector Energy Efficiency Potential in Vermont		
	Estimated Cumulative Annual Savings by 2015 (kWh)	Savings in 2015 as a Percent of Total 2015 Industrial Sector kWh Sales
Technical Potential	382,700	20.7%
Maximum Achievable Potential	306,160	16.5%
Maximum Achievable Cost Effective Potential	306,160	16.5%

Table C-3: Industrial Sector Technical Savings Potential (kWh) by Type of Energy Efficiency Measure By 2015			
Measure #	Industrial Energy Efficiency Measure	Technical Potential Savings by 2015 (annual kWh)	Percent of Total
1	Efficient industrial lamps and fixtures	127,754,709	33.4%
2	Motor system optimization (including ASD)	74,404,424	19.4%
3	Electric supply system improvements	47,830,845	12.5%
4	Pump system efficiency improvements	31,115,972	8.1%
5	Air compressor system management	20,484,776	5.4%
6	Advanced motor designs	16,704,811	4.4%
7	Other industrial energy efficiency measures	13,356,056	3.5%
8	Transformers (NEMA Tier II)	12,754,892	3.3%
9	Fan system improvements	12,731,080	3.3%
10	Industrial motor management	9,683,948	2.5%
11	Sensor and Controls	9,378,023	2.5%
12	Advanced lubricants	5,791,001	1.5%
13	Advanced Air compressor Controls	709,686	0.2%
	Total Industrial Sector Savings Potential	382,700,223	100.0%

Table C-4: Industrial Sector Maximum Achievable Cost Effective Savings Potential (kWh) by Type of Energy Efficiency Measure by 2015			
Measure #	Industrial Energy Efficiency Measure	Technical Potential Savings by 2015 (annual kWh)	Percent of Total
1	Efficient industrial lamps and fixtures	102,203,767	33.4%
2	Motor system optimization (including ASD)	59,523,539	19.4%
3	Electric supply system improvements	38,264,676	12.5%
4	Pump system efficiency improvements	24,892,777	8.1%
5	Air compressor system management	16,387,821	5.4%
6	Advanced motor designs	13,363,848	4.4%
7	Other industrial energy efficiency measures	10,684,845	3.5%
8	Transformers (NEMA Tier II)	10,203,914	3.3%
9	Fan system improvements	10,184,864	3.3%
10	Industrial motor management	7,747,159	2.5%
11	Sensor and Controls	7,502,419	2.5%
12	Advanced lubricants	4,632,801	1.5%
13	Advanced Air compressor Controls	567,749	0.2%
	Total Industrial Sector Savings Potential	306,160,178	100.0%

Table C-5: ESTIMATES OF INDUSTRIAL SECTOR KWH SALES BY END USE IN VERMONT FOR THE YEAR 2015

		Annual kWh Sales in 2015	Percent of Total	Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Agriculture	140,065,859	7.56%	23,811,196	15,407,245	7,003,293	0	0	35,016,465	9,804,610	0	0	33,615,806	0	0	9,804,610	5,602,634
	Mining	12,914,634	0.70%								0	0	0	0	0	0	0
	Construction	38,981,455	2.11%								0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	140,366,859	106,901,829	88,159,779	189,538,325	296,778,120	110,783,835	35,866,066	27,896,526	35,980,685	92,441,918	9,987,901	180,416,927	154,791,081	124,451,651
311	Food Manufacturing	219,248,861	11.84%	25,584,720	11,700,329	17,539,909	9,516,268	41,813,390	54,812,215	10,452,294	51,467	0	6,124,557	0	13,154,932	19,732,397	8,769,954
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	4,399,074	10,997,684	2,199,537	36,292,357	28,593,978	0	0	6,598,610	0	0	0	6,598,610	7,698,379	6,598,610
322	Paper	276,323,958	14.92%	80,133,948	47,471,008	19,342,677	17,741,690	50,956,767	4,624,669	25,413,772	4,335,627	0	1,445,209	0	8,289,719	11,052,958	5,526,479
323	Printing	42,960,719	2.32%	1,782,870	2,040,634	1,782,870	7,668,488	8,184,017	0	0	2,577,643	0	0	0	0	11,427,551	7,496,645
326	Plastic and Rubber	83,228,627	4.49%	7,168,728	3,487,489	2,712,492	16,274,950	13,562,458	6,822,019	0	62,213	0	13,127,023	0	7,731,621	6,367,217	5,912,416
327	Mineral Products	125,490,549	6.78%	5,629,424	4,557,153	8,784,338	26,270,645	31,778,052	0	0	492,430	16,313,771	3,764,716	8,230,618	6,555,476	5,618,980	7,491,973
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	2,571,488	5,142,976	5,142,976	19,029,011	28,286,368	2,028,297	0	3,397,398	6,744,088	7,910,359	202,830	10,817,585	12,845,883	14,874,180
333	Machinery	63,234,461	3.41%	1,346,608	2,019,912	3,161,723	11,277,841	10,703,305	1,935,749	0	0	3,112,017	2,028,368	666,861	11,614,493	9,678,744	5,691,101
334	Computers	358,117,803	19.34%	6,185,798	9,897,277	17,905,890	15,464,495	39,800,742	35,811,780	0	5,930,265	0	46,555,314	0	94,103,948	47,051,974	39,392,958
335	Electric Products	36,839,147	1.99%	796,106	1,592,213	1,592,213	5,891,186	8,757,169	627,940	0	1,051,800	2,087,901	2,448,966	62,794	3,349,013	3,976,953	4,604,893
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	2,568,394	3,595,751	3,595,751	7,833,600	10,145,155	2,386,121	0	492,871	1,953,881	2,270,726	651,294	8,947,952	8,351,422	5,368,771
337	Furniture	53,676,682	2.90%	1,159,971	2,319,942	2,319,942	8,583,786	12,759,681	914,943	0	1,532,530	3,042,187	3,568,279	91,494	4,879,698	5,794,642	6,709,585
339	Misc. Manufacturing	48,112,660	2.60%	1,039,731	2,079,461	2,079,461	7,694,007	11,437,037	820,102	0	1,373,671	2,726,840	3,198,398	82,010	4,373,878	5,193,980	6,014,083
	Total Industrial kWh Sales	1,851,792,067		164,178,055	122,309,073	95,163,072	189,538,325	296,778,120	145,800,300	45,670,676	27,896,526	35,980,685	126,057,724	9,987,901	180,416,927	164,595,691	130,054,285

Table C-6: Calculations Provided by Neal Elliott of ACEEE to determine industrial kWh sales by NAICS Code for Vermont

							Calculated	Fraction	Apportioned				Percent Electricity by End Use																		
	Detailed Break Down only for industry groups with > 5% total industrial energy	2002 VoS		Intensity	2002 Purchased Electricity	2002 Electricity Price	2002 Electricity Consumption		2004 Electricity Consumption	Annual Change in Intensity	Compund Annual Growth in VoS		Motors							Process Heating										
		($1,000)		(mill. kWh/ $1000 vos)	($1,000)	$/kWh	(mill. kWh)		MWh				Total Motors	Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other			
	Total Industry						1,735		1,576,738																						
	Agriculture				14,563	0.111	131	7.6%	119,261		3.46%		65%	17%	11%	5%	0%	0%	25%	7%	0%	0%	24%	0%	0%	7%	4%	100%		
	Mining				1,003		12	0.7%	10,996																						
	Construction				4,053	0.111	37	2.1%	33,191																						
31-33	**Manufacturing**	9,660,529					1,554.75	89.6%	1,413,289																						
311	Food Manufacturing	1,316,462	14%	1.560E-07			205.37	11.8%	186,683	-0.30%	0.60%	78%	78%	12%	5%	8%	4%	19%	25%	5%	0%	0%	3%	0%	6%	9%	4%	100.00%	0.00%	99.50%
3115	*Dairy*	709,591	*54%*	*1.560E-07*			*110.70*	6.4%	100,625																			0.00%		0.00%
321	Wood Products	419,942	4%	2.453E-07			103.01	5.9%	93,642	-0.50%	1.09%	77%	77%	4%	10%	2%	33%	26%	0%	0%	6%	0%	0%	0%	6%	7%	6%	100.00%	0.00%	102.00%
322	Paper	325,982	3%	7.940E-07			258.83	14.9%	235,280	-1.80%	1.31%	89%	89%	29%	17%	7%	6%	18%	2%	9%	2%	0%	1%	0%	3%	4%	2%	100.00%	0.00%	100.04%
323	Printing	270,862	3%	1.486E-07			40.24	2.3%	36,580	-0.50%	1.87%	50%	50%	4%	5%	4%	18%	19%	0%	0%	6%	0%	0%	0%	0%	27%	17%	100.00%	0.00%	100.05%
326	Plastic and Rubber	237,681	2%	3.280E-07			77.96	4.5%	70,866	-1.30%	1.14%	60%	60%	9%	4%	3%	20%	16%	8%	0%	0%	0%	16%	0%	9%	8%	7%	100.00%	0.00%	100.00%
327	Mineral Products	273,362	3%	4.300E-07			117.55	6.8%	106,851	-1.04%	7.14%	61%	61%	4%	4%	7%	21%	25%	0%	0%	0%	13%	3%	7%	5%	4%	6%	100.00%	0.00%	99.67%
327991	*Cut Stone*	144,264	*53%*	*4.300E-07*			*62.03*	3.6%	56,389		7.14%																	0.00%		0.00%
332	Fabricated metal	546,372	6%	2.040E-07			111.46	6.4%	101,319	-0.30%	1.68%	52%	52%	2%	4%	4%	16%	24%	2%	0%	3%	6%	7%	0%	9%	11%	13%	100.00%	0.00%	100.00%
333	Machinery	586,446	6%	1.010E-07			59.23	3.4%	53,842	-0.30%	5.02%	48%	48%	2%	3%	5%	18%	17%	3%	0%	0%	5%	3%	1%	18%	15%	9%	100.00%	0.00%	100.11%
334	Computers	3,666,067	38%	9.150E-08			335.45	19.3%	304,925	-1.30%	4.18%	35%	35%	2%	3%	5%	4%	11%	10%	0%	2%	0%	13%	0%	26%	13%	11%	100.00%	0.00%	100.20%
335	Electric Products	248,401	3%	1.389E-07			34.51	2.0%	31,367	-0.30%	2.40%	52%	52%	2%	4%	4%	16%	24%	2%	0%	3%	6%	7%	0%	9%	11%	13%	100.00%	0.00%	100.00%
335929	*Wire manufacturing*	91,236	*37%*	*1.389E-07*			*12.67*	0.7%	11,521																			0.00%		0.00%
336	Transportation	574,072	6%	9.490E-08			54.48	3.1%	49,523	-0.50%	-6.92%	52%	52%	4%	6%	6%	13%	17%	4%	0%	1%	3%	4%	1%	15%	14%	9%	100.00%	0.00%	100.00%
337	Furniture	405,548	4%	1.240E-07			50.28	2.9%	45,704	-0.50%	1.37%	52%	52%	2%	4%	4%	16%	24%	2%	0%	3%	6%	7%	0%	9%	11%	13%	100.00%	0.00%	100.00%
339	Misc. Manufacturing	408,315	4%	1.104E-07			45.07	2.6%	40,966	-0.50%	-1.10%	52%	52%	2%	4%	4%	16%	24%	2%	0%	3%	6%	7%	0%	9%	11%	13%	100.00%	0.00%	100.00%
339920	*Sporting Goods*	251,809	62%	*1.104E-07*			*27.79*	1.6%	25,264																						
	Other	381,017	4%				61	4%	62,187																						
	Sum manufacturing	9,279,512.00	96%				1,493.43																								

Figure					
Agriculture				131.1981982	8%	119,261
Food Manufacturing	1316462	14%	0.00000016	205.368072	12%	186,683
Wood Products	419942	4%	0.00000025	103.0141338	6%	93,642
Paper	325982	3%	0.00000079	258.829708	15%	235,280
Mineral Products	273362	3%	0.00000043	117.54566	7%	106,851
Fabricated metal	546372	6%	0.00000020	111.459888	6%	101,319
Computers	3666067	38%	0.00000009	335.4451305	19%	304,925
Transportation	574072	6%	0.00000009	54.4794328	3%	49,523
Other					24%	379,254

Table C-7: Industrial Energy Efficiency Measure Data Provided by Neal Elliott of ACEEE

	Measures	Measure life (years)	Technical Savings Potenital as a percent of appropriate end use	Levelized Cost ($/kWh)	Notes
	Ag/Dairy				
	Pumps	10	34%		
	Fans	10	41%		
	Compressed air/vacuum pumps	10	25%		
	Refrigeration	10	20%		
	Lighting	5	40%		

						Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	General Industry																		
1	Sensor and Controls	10	3.0%	(0.5000)	Assumes 30% applicability - eligability varies by but assumes assumes applies to:Pumps, Fan, Refrigeration, Drying and Curing, Heat Treating, Heating, Melting and Casting	0.90%	0.90%	0.00%	0.00%	0.00%	0.90%	0.00%	0.90%	0.90%	0.90%	0.90%	0.00%	0.00%	0.00%
2	Advanced lubricants	0.5	2.6%	(0.0636)	Applies to 23% of motor loads	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3	Electric supply system improvements	5	3.0%	(0.0060)	Applies to all electrical service	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
4	Pump system efficiency improvements	10	16.4%	(0.0007)	Applies to all Pump energy	16.40%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5	Advanced Air compressor Controls	15	3.5%	0.0002	Applies to multi-compressor systems -- ~23% of compressed air	0.00%	0.00%	0.81%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
6	Industrial motor management	20	1.0%	0.0013	Applies to all motors	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
7	Air compressor system management	1.5	25.0%	0.0015	Applies to larger systems -- ~85% of CA loads			21.25%											
8	Fan system improvements	10	6.0%	0.0023	Applies to all fan energy		6.00%												
9	Advanced motor designs	10	2.3%	0.0025	Applies to general purpose, integral HP induction motors represent about 75% of motor installed HP	1.73%	1.73%	1.73%	1.73%	1.73%	1.73%	1.73%							
10	Motor system optimization (including ASD)	10	19.0%	0.0025	Applies to all pumps, fans and 80% of HVAC	19.00%	19.00%										15.20%		
11	Transformers (NEMA Tier II)	30	1.6%	0.0050	Applies to all electrical service with onsite transformers -- ~20%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%
12	Efficient industrial lamps and fixtures	20	50.0%	0.0105	There is signification interaction between these measures so cannot be treated indepently -- suggest looking at a these as a combined measure with 50% acheivable potential on lighting													80.00%	
13	Efficient lighting design	20	80.0%	0.0114															
					total	43.42%	33.02%	29.18%	7.12%	7.12%	8.02%	7.12%	4.70%	4.70%	4.70%	4.70%	19.00%	83.80%	3.80%
				(0.555)															

TABLE C-8: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - SENSORS AND CONTROLS
4/14/2006 15:42

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Percent Savings by End Use for General Industry			0.90%	0.90%	0.00%	0.00%	0.00%	0.90%	0.00%	0.90%	0.90%	0.90%	0.90%	0.00%	0.00%	0.00%
NAICS CODE		Annual Industrial kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	0	0	0	0	0	7,003,293	0	0	0	0	0	0	0	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	1,263,302	962,116	0	0	0	997,055	0	251,069	323,826	831,977	89,891	0	0	0
311	Food Manufacturing	219,248,861	11.84%	230,262	105,303	0	0	0	493,310	0	463	0	55,121	0	0	0	0
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	39,592	98,979	0	0	0	0	0	59,387	0	0	0	0	0	0
322	Paper	276,323,958	14.92%	721,206	427,239	0	0	0	41,622	0	39,021	0	13,007	0	0	0	0
323	Printing	42,960,719	2.32%	16,046	18,366	0	0	0	0	0	23,199	0	0	0	0	0	0
326	Plastic and Rubber	83,228,627	4.49%	64,519	31,387	0	0	0	61,398	0	560	0	118,143	0	0	0	0
327	Mineral Products	125,490,549	6.78%	50,665	41,014	0	0	0	0	0	4,432	146,824	33,882	74,076	0	0	0
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	23,143	46,287	0	0	0	18,255	0	30,577	60,697	71,193	1,825	0	0	0
333	Machinery	63,234,461	3.41%	12,119	18,179	0	0	0	17,422	0	0	28,008	18,255	6,002	0	0	0
334	Computers	358,117,803	19.34%	55,672	89,075	0	0	0	322,306	0	53,372	0	418,998	0	0	0	0
335	Electric Products	36,839,147	1.99%	7,165	14,330	0	0	0	5,651	0	9,466	18,791	22,041	565	0	0	0
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	23,116	32,362	0	0	0	21,475	0	4,436	17,585	20,437	5,862	0	0	0
337	Furniture	53,676,682	2.90%	10,440	20,879	0	0	0	8,234	0	13,793	27,380	32,115	823	0	0	0
339	Misc. Manufacturing	48,112,660	2.60%	9,358	18,715	0	0	0	7,381	0	12,363	24,542	28,786	738	0	0	0
	Total Industrial kWh Sales	1,851,792,067		1,263,302	962,116	0	0	0	8,000,347	0	251,069	323,826	831,977	89,891	0	0	0

Technical Potential Annual kWh Savings by 2015	11,722,529
% of 2015 kWh Sales	0.63%

TABLE C-9: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - ADVANCED LUBRICANTS
4/14/2006 15:42

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Percent Savings by End Use for General Industry			0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NAICS CODE		Annual Industrial kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	839,394	639,273	527,195	1,133,439	1,774,733	662,487	214,479	0	0	0	0	0	0	0
311	Food Manufacturing	219,248,861	11.84%	152,997	69,968	104,889	56,907	250,044	327,777	62,505	0	0	0	0	0	0	0
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	26,306	65,766	13,153	217,028	170,992	0	0	0	0	0	0	0	0	0
322	Paper	276,323,958	14.92%	479,201	283,877	115,669	106,095	304,721	27,656	151,974	0	0	0	0	0	0	0
323	Printing	42,960,719	2.32%	10,662	12,203	10,662	45,858	48,940	0	0	0	0	0	0	0	0	0
326	Plastic and Rubber	83,228,627	4.49%	42,869	20,855	16,221	97,324	81,104	40,796	0	0	0	0	0	0	0	0
327	Mineral Products	125,490,549	6.78%	33,664	27,252	52,530	157,098	190,033	0	0	0	0	0	0	0	0	0
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	15,377	30,755	30,755	113,793	169,152	12,129	0	0	0	0	0	0	0	0
333	Machinery	63,234,461	3.41%	8,053	12,079	18,907	67,441	64,006	11,576	0	0	0	0	0	0	0	0
334	Computers	358,117,803	19.34%	36,991	59,186	107,077	92,478	238,008	214,154	0	0	0	0	0	0	0	0
335	Electric Products	36,839,147	1.99%	4,761	9,521	9,521	35,229	52,368	3,755	0	0	0	0	0	0	0	0
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	15,359	21,503	21,503	46,845	60,668	14,269	0	0	0	0	0	0	0	0
337	Furniture	53,676,682	2.90%	6,937	13,873	13,873	51,331	76,303	5,471	0	0	0	0	0	0	0	0
339	Misc. Manufacturing	48,112,660	2.60%	6,218	12,435	12,435	46,010	68,393	4,904	0	0	0	0	0	0	0	0
	Total Industrial kWh Sales	1,851,792,067		839,394	639,273	527,195	1,133,439	1,774,733	662,487	214,479	0	0	0	0	0	0	0

Technical Potential Annual kWh Savings by 2015	5,791,001
% of 2015 kWh Sales	0.31%

TABLE C-10: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - SUPPLY SYSTEM IMPROVEMENTS
4/14/2006 15:43

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Percent Savings by End Use for General Industry			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
NAICS CODE		Annual Industrial kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	4,211,006	3,207,055	2,644,793	5,686,150	8,903,344	3,323,515	1,075,982	836,896	1,079,421	2,773,258	299,637	5,412,508	4,643,732	3,733,550
311	Food Manufacturing	219,248,861	11.84%	767,542	351,010	526,197	285,488	1,254,402	1,644,366	313,569	1,544	0	183,737	0	394,648	591,972	263,099
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	131,972	329,931	65,986	1,088,771	857,819	0	0	197,958	0	0	0	197,958	230,951	197,958
322	Paper	276,323,958	14.92%	2,404,018	1,424,130	580,280	532,251	1,528,703	138,740	762,413	130,069	0	43,356	0	248,692	331,589	165,794
323	Printing	42,960,719	2.32%	53,486	61,219	53,486	230,055	245,521	0	0	77,329	0	0	0	0	342,827	224,899
326	Plastic and Rubber	83,228,627	4.49%	215,062	104,625	81,375	488,249	406,874	204,661	0	1,866	0	393,811	0	231,949	191,017	177,372
327	Mineral Products	125,490,549	6.78%	168,883	136,715	263,530	788,119	953,342	0	0	14,773	489,413	112,941	246,919	196,664	168,569	224,759
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	77,145	154,289	154,289	570,870	848,591	60,849	0	101,922	202,323	237,311	6,085	324,528	385,376	446,225
333	Machinery	63,234,461	3.41%	40,398	60,597	94,852	338,335	321,099	58,072	0	0	93,361	60,851	20,006	348,435	290,362	170,733
334	Computers	358,117,803	19.34%	185,574	296,918	537,177	463,935	1,194,022	1,074,353	0	177,908	0	1,396,659	0	2,823,118	1,411,559	1,181,789
335	Electric Products	36,839,147	1.99%	23,883	47,766	47,766	176,736	262,715	18,838	0	31,554	62,637	73,469	1,884	100,470	119,309	138,147
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	77,052	107,873	107,873	235,008	304,355	71,584	0	14,786	58,616	68,122	19,539	268,439	250,543	161,063
337	Furniture	53,676,682	2.90%	34,799	69,598	69,598	257,514	382,790	27,448	0	45,976	91,266	107,048	2,745	146,391	173,839	201,288
339	Misc. Manufacturing	48,112,660	2.60%	31,192	62,384	62,384	230,820	343,111	24,603	0	41,210	81,805	95,952	2,460	131,216	155,819	180,422
	Total Industrial kWh Sales	1,851,792,067		4,211,006	3,207,055	2,644,793	5,686,150	8,903,344	3,323,515	1,075,982	836,896	1,079,421	2,773,258	299,637	5,412,508	4,643,732	3,733,550

Technical Potential Annual kWh Savings by 2015	47,830,845
% of 2015 kWh Sales	2.58%

TABLE C-11: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - PUMP SYSTEMS
4/14/2006 15:43

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			34.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Percent Savings by End Use for General Industry			16.40%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NAICS CODE		Annual kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	8,095,807	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	23,020,165	0	0	0	0	0	0	0	0	0	0	0	0	0
311	Food Manufacturing	219,248,861	11.84%	4,195,894	0	0	0	0	0	0	0	0	0	0	0	0	0
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	721,448	0	0	0	0	0	0	0	0	0	0	0	0	0
322	Paper	276,323,958	14.92%	13,141,967	0	0	0	0	0	0	0	0	0	0	0	0	0
323	Printing	42,960,719	2.32%	292,391	0	0	0	0	0	0	0	0	0	0	0	0	0
326	Plastic and Rubber	83,228,627	4.49%	1,175,671	0	0	0	0	0	0	0	0	0	0	0	0	0
327	Mineral Products	125,490,549	6.78%	923,226	0	0	0	0	0	0	0	0	0	0	0	0	0
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	421,724	0	0	0	0	0	0	0	0	0	0	0	0	0
333	Machinery	63,234,461	3.41%	220,844	0	0	0	0	0	0	0	0	0	0	0	0	0
334	Computers	358,117,803	19.34%	1,014,471	0	0	0	0	0	0	0	0	0	0	0	0	0
335	Electric Products	36,839,147	1.99%	130,561	0	0	0	0	0	0	0	0	0	0	0	0	0
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	421,217	0	0	0	0	0	0	0	0	0	0	0	0	0
337	Furniture	53,676,682	2.90%	190,235	0	0	0	0	0	0	0	0	0	0	0	0	0
339	Misc. Manufacturing	48,112,660	2.60%	170,516	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Industrial kWh Sales	1,851,792,067		31,115,972	0	0	0	0	0	0	0	0	0	0	0	0	0

Technical Potential Annual kWh Savings by 2015	31,115,972
% of 2015 kWh Sales	1.68%

TABLE C-12: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - ADVANCED COMPRESSOR CONTROLS

4/14/2006 15:44

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Percent Savings by End Use for General Industry			0.00%	0.00%	0.81%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NAICS CODE		Annual Industrial kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	0	0	709,686	0	0	0	0	0	0	0	0	0	0	0
311	Food Manufacturing	219,248,861	11.84%	0	0	141,196	0	0	0	0	0	0	0	0	0	0	0
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	0	0	17,706	0	0	0	0	0	0	0	0	0	0	0
322	Paper	276,323,958	14.92%	0	0	155,709	0	0	0	0	0	0	0	0	0	0	0
323	Printing	42,960,719	2.32%	0	0	14,352	0	0	0	0	0	0	0	0	0	0	0
326	Plastic and Rubber	83,228,627	4.49%	0	0	21,836	0	0	0	0	0	0	0	0	0	0	0
327	Mineral Products	125,490,549	6.78%	0	0	70,714	0	0	0	0	0	0	0	0	0	0	0
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	0	0	41,401	0	0	0	0	0	0	0	0	0	0	0
333	Machinery	63,234,461	3.41%	0	0	25,452	0	0	0	0	0	0	0	0	0	0	0
334	Computers	358,117,803	19.34%	0	0	144,142	0	0	0	0	0	0	0	0	0	0	0
335	Electric Products	36,839,147	1.99%	0	0	12,817	0	0	0	0	0	0	0	0	0	0	0
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	0	0	28,946	0	0	0	0	0	0	0	0	0	0	0
337	Furniture	53,676,682	2.90%	0	0	18,676	0	0	0	0	0	0	0	0	0	0	0
339	Misc. Manufacturing	48,112,660	2.60%	0	0	16,740	0	0	0	0	0	0	0	0	0	0	0
	Total Industrial kWh Sales	1,851,792,067		0	0	709,686	0	0	0	0	0	0	0	0	0	0	0

Technical Potential Annual kWh Savings by 2015	709,686
% of 2015 kWh Sales	0.04%

TABLE C-13: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - INDUSTRIAL MOTOR MANAGEMENT

4/14/2006 15:44

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Percent Savings by End Use for General Industry			1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NAICS CODE		Annual Industrial kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	1,403,669	1,069,018	881,598	1,895,383	2,967,781	1,107,838	358,661	0	0	0	0	0	0	0
311	Food Manufacturing	219,248,861	11.84%	255,847	117,003	175,399	95,163	418,134	548,122	104,523	0	0	0	0	0	0	0
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	43,991	109,977	21,995	362,924	285,940	0	0	0	0	0	0	0	0	0
322	Paper	276,323,958	14.92%	801,339	474,710	193,427	177,417	509,568	46,247	254,138	0	0	0	0	0	0	0
323	Printing	42,960,719	2.32%	17,829	20,406	17,829	76,685	81,840	0	0	0	0	0	0	0	0	0
326	Plastic and Rubber	83,228,627	4.49%	71,687	34,875	27,125	162,750	135,625	68,220	0	0	0	0	0	0	0	0
327	Mineral Products	125,490,549	6.78%	56,294	45,572	87,843	262,706	317,781	0	0	0	0	0	0	0	0	0
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	25,715	51,430	51,430	190,290	282,864	20,283	0	0	0	0	0	0	0	0
333	Machinery	63,234,461	3.41%	13,466	20,199	31,617	112,778	107,033	19,357	0	0	0	0	0	0	0	0
334	Computers	358,117,803	19.34%	61,858	98,973	179,059	154,645	398,007	358,118	0	0	0	0	0	0	0	0
335	Electric Products	36,839,147	1.99%	7,961	15,922	15,922	58,912	87,572	6,279	0	0	0	0	0	0	0	0
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	25,684	35,958	35,958	78,336	101,452	23,861	0	0	0	0	0	0	0	0
337	Furniture	53,676,682	2.90%	11,600	23,199	23,199	85,838	127,597	9,149	0	0	0	0	0	0	0	0
339	Misc. Manufacturing	48,112,660	2.60%	10,397	20,795	20,795	76,940	114,370	8,201	0	0	0	0	0	0	0	0
	Total Industrial kWh Sales	1,851,792,067		1,403,669	1,069,018	881,598	1,895,383	2,967,781	1,107,838	358,661	0	0	0	0	0	0	0

Technical Potential Annual kWh Savings by 2015	9,683,948
% of 2015 kWh Sales	0.52%

TABLE C-14: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - AIR COMPRESSOR SYSTEM MANAGEMENT
4/14/2006 15:46

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			0.00%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Percent Savings by End Use for General Industry			0.00%	0.00%	21.25%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NAICS CODE		Annual Industrial kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	0	0	1,750,823	0	0	0	0	0	0	0	0	0	0	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	0	0	18,733,953	0	0	0	0	0	0	0	0	0	0	0
311	Food Manufacturing	219,248,861	11.84%	0	0	3,727,231	0	0	0	0	0	0	0	0	0	0	0
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	0	0	467,402	0	0	0	0	0	0	0	0	0	0	0
322	Paper	276,323,958	14.92%	0	0	4,110,319	0	0	0	0	0	0	0	0	0	0	0
323	Printing	42,960,719	2.32%	0	0	378,860	0	0	0	0	0	0	0	0	0	0	0
326	Plastic and Rubber	83,228,627	4.49%	0	0	576,404	0	0	0	0	0	0	0	0	0	0	0
327	Mineral Products	125,490,549	6.78%	0	0	1,866,672	0	0	0	0	0	0	0	0	0	0	0
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	0	0	1,092,882	0	0	0	0	0	0	0	0	0	0	0
333	Machinery	63,234,461	3.41%	0	0	671,866	0	0	0	0	0	0	0	0	0	0	0
334	Computers	358,117,803	19.34%	0	0	3,805,002	0	0	0	0	0	0	0	0	0	0	0
335	Electric Products	36,839,147	1.99%	0	0	338,345	0	0	0	0	0	0	0	0	0	0	0
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	0	0	764,097	0	0	0	0	0	0	0	0	0	0	0
337	Furniture	53,676,682	2.90%	0	0	492,988	0	0	0	0	0	0	0	0	0	0	0
339	Misc. Manufacturing	48,112,660	2.60%	0	0	441,886	0	0	0	0	0	0	0	0	0	0	0
	Total Industrial kWh Sales	1,851,792,067		0	0	20,484,776	0	0	0	0	0	0	0	0	0	0	0

Technical Potential Annual kWh Savings by 2015	20,484,776
% of 2015 kWh Sales	1.11%

TABLE C-15: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - FAN SYSTEM IMPROVEMENTS

4/14/2006 15:47

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			0.00%	41.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Percent Savings by End Use for General Industry			0.00%	6.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NAICS CODE		Annual Industrial kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	0	6,316,970	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	0	6,414,110	0	0	0	0	0	0	0	0	0	0	0	0
311	Food Manufacturing	219,248,861	11.84%	0	702,020	0	0	0	0	0	0	0	0	0	0	0	0
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	0	659,861	0	0	0	0	0	0	0	0	0	0	0	0
322	Paper	276,323,958	14.92%	0	2,848,260	0	0	0	0	0	0	0	0	0	0	0	0
323	Printing	42,960,719	2.32%	0	122,438	0	0	0	0	0	0	0	0	0	0	0	0
326	Plastic and Rubber	83,228,627	4.49%	0	209,249	0	0	0	0	0	0	0	0	0	0	0	0
327	Mineral Products	125,490,549	6.78%	0	273,429	0	0	0	0	0	0	0	0	0	0	0	0
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	0	308,579	0	0	0	0	0	0	0	0	0	0	0	0
333	Machinery	63,234,461	3.41%	0	121,195	0	0	0	0	0	0	0	0	0	0	0	0
334	Computers	358,117,803	19.34%	0	593,837	0	0	0	0	0	0	0	0	0	0	0	0
335	Electric Products	36,839,147	1.99%	0	95,533	0	0	0	0	0	0	0	0	0	0	0	0
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	0	215,745	0	0	0	0	0	0	0	0	0	0	0	0
337	Furniture	53,676,682	2.90%	0	139,197	0	0	0	0	0	0	0	0	0	0	0	0
339	Misc. Manufacturing	48,112,660	2.60%	0	124,768	0	0	0	0	0	0	0	0	0	0	0	0
	Total Industrial kWh Sales	1,851,792,067		0	12,731,080	0	0	0	0	0	0	0	0	0	0	0	0

Technical Potential Annual kWh Savings by 2015	12,731,080
% of 2015 kWh Sales	0.69%

TABLE C-17: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - MOTOR SYSTEM OPTIMZATION
4/14/2006 15:48

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Percent Savings by End Use for General Industry			19.00%	19.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.20%	0.00%	0.00%
NAICS CODE		Annual Industrial kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	26,669,703	20,311,348	0	0	0	0	0	0	0	0	0	27,423,373	0	0
311	Food Manufacturing	219,248,861	11.84%	4,861,097	2,223,063	0	0	0	0	0	0	0	0	0	1,999,550	0	0
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	835,824	2,089,560	0	0	0	0	0	0	0	0	0	1,002,989	0	0
322	Paper	276,323,958	14.92%	15,225,450	9,019,491	0	0	0	0	0	0	0	0	0	1,260,037	0	0
323	Printing	42,960,719	2.32%	338,745	387,720	0	0	0	0	0	0	0	0	0	0	0	0
326	Plastic and Rubber	83,228,627	4.49%	1,362,058	662,623	0	0	0	0	0	0	0	0	0	1,175,206	0	0
327	Mineral Products	125,490,549	6.78%	1,069,591	865,859	0	0	0	0	0	0	0	0	0	996,432	0	0
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	488,583	977,165	0	0	0	0	0	0	0	0	0	1,644,273	0	0
333	Machinery	63,234,461	3.41%	255,855	383,783	0	0	0	0	0	0	0	0	0	1,765,403	0	0
334	Computers	358,117,803	19.34%	1,175,302	1,880,483	0	0	0	0	0	0	0	0	0	14,303,800	0	0
335	Electric Products	36,839,147	1.99%	151,260	302,520	0	0	0	0	0	0	0	0	0	509,050	0	0
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	487,995	683,193	0	0	0	0	0	0	0	0	0	1,360,089	0	0
337	Furniture	53,676,682	2.90%	220,394	440,789	0	0	0	0	0	0	0	0	0	741,714	0	0
339	Misc. Manufacturing	48,112,660	2.60%	197,549	395,098	0	0	0	0	0	0	0	0	0	664,829	0	0
	Total Industrial kWh Sales	1,851,792,067		26,669,703	20,311,348	0	0	0	0	0	0	0	0	0	27,423,373	0	0

Technical Potential Annual kWh Savings by 2015	74,404,424
% of 2015 kWh Sales	4.02%

TABLE C-18: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - NEMA TIER II MOTORS
4/14/2006 15:48

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Percent Savings by End Use for General Industry			0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%	0.80%
NAICS CODE		Annual Industrial kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	1,122,935	855,215	705,278	1,516,307	2,374,225	886,271	286,929	223,172	287,845	739,535	79,903	1,443,335	1,238,329	995,613
311	Food Manufacturing	219,248,861	11.84%	204,678	93,603	140,319	76,130	334,507	438,498	83,618	412	0	48,996	0	105,239	157,859	70,160
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	35,193	87,981	17,596	290,339	228,752	0	0	52,789	0	0	0	52,789	61,587	52,789
322	Paper	276,323,958	14.92%	641,072	379,768	154,741	141,934	407,654	36,997	203,310	34,685	0	11,562	0	66,318	88,424	44,212
323	Printing	42,960,719	2.32%	14,263	16,325	14,263	61,348	65,472	0	0	20,621	0	0	0	0	91,420	59,973
326	Plastic and Rubber	83,228,627	4.49%	57,350	27,900	21,700	130,200	108,500	54,576	0	498	0	105,016	0	61,853	50,938	47,299
327	Mineral Products	125,490,549	6.78%	45,035	36,457	70,275	210,165	254,224	0	0	3,939	130,510	30,118	65,845	52,444	44,952	59,936
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	20,572	41,144	41,144	152,232	226,291	16,226	0	27,179	53,953	63,283	1,623	86,541	102,767	118,993
333	Machinery	63,234,461	3.41%	10,773	16,159	25,294	90,223	85,626	15,486	0	0	24,896	16,227	5,335	92,916	77,430	45,529
334	Computers	358,117,803	19.34%	49,486	79,178	143,247	123,716	318,406	286,494	0	47,442	0	372,443	0	752,832	376,416	315,144
335	Electric Products	36,839,147	1.99%	6,369	12,738	12,738	47,129	70,057	5,024	0	8,414	16,703	19,592	502	26,792	31,816	36,839
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	20,547	28,766	28,766	62,669	81,161	19,089	0	3,943	15,631	18,166	5,210	71,584	66,811	42,950
337	Furniture	53,676,682	2.90%	9,280	18,560	18,560	68,670	102,077	7,320	0	12,260	24,337	28,546	732	39,038	46,357	53,677
339	Misc. Manufacturing	48,112,660	2.60%	8,318	16,636	16,636	61,552	91,496	6,561	0	10,989	21,815	25,587	656	34,991	41,552	48,113
	Total Industrial kWh Sales	1,851,792,067		1,122,935	855,215	705,278	1,516,307	2,374,225	886,271	286,929	223,172	287,845	739,535	79,903	1,443,335	1,238,329	995,613

Technical Potential Annual kWh Savings by 2015	12,754,892
% of 2015 kWh Sales	0.69%

TABLE C-19: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - EFFICIENT LAMPS AND FIXTURES AND EFFICIENT LIGHTING DESIGN
4/14/2006 15:49

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	40.00%	0.00%
	Percent Savings by End Use for General Industry			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	80.00%	0.00%
NAICS CODE		Annual Industrial kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	0	0	0	0	0	0	0	0	0	0	0	0	3,921,844	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	0	0	0	0	0	0	0	0	0	0	0	0	123,832,865	0
311	Food Manufacturing	219,248,861	11.84%	0	0	0	0	0	0	0	0	0	0	0	0	15,785,918	0
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	0	0	0	0	0	0	0	0	0	0	0	0	6,158,703	0
322	Paper	276,323,958	14.92%	0	0	0	0	0	0	0	0	0	0	0	0	8,842,367	0
323	Printing	42,960,719	2.32%	0	0	0	0	0	0	0	0	0	0	0	0	9,142,041	0
326	Plastic and Rubber	83,228,627	4.49%	0	0	0	0	0	0	0	0	0	0	0	0	5,093,774	0
327	Mineral Products	125,490,549	6.78%	0	0	0	0	0	0	0	0	0	0	0	0	4,495,184	0
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	0	0	0	0	0	0	0	0	0	0	0	0	10,276,706	0
333	Machinery	63,234,461	3.41%	0	0	0	0	0	0	0	0	0	0	0	0	7,742,995	0
334	Computers	358,117,803	19.34%	0	0	0	0	0	0	0	0	0	0	0	0	37,641,579	0
335	Electric Products	36,839,147	1.99%	0	0	0	0	0	0	0	0	0	0	0	0	3,181,563	0
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	0	0	0	0	0	0	0	0	0	0	0	0	6,681,137	0
337	Furniture	53,676,682	2.90%	0	0	0	0	0	0	0	0	0	0	0	0	4,635,713	0
339	Misc. Manufacturing	48,112,660	2.60%	0	0	0	0	0	0	0	0	0	0	0	0	4,155,184	0
	Total Industrial kWh Sales	1,851,792,067		0	0	0	0	0	0	0	0	0	0	0	0	127,754,709	0

Technical Potential Annual kWh Savings by 2015	127,754,709
% of 2015 kWh Sales	6.90%

TABLE C-20: ESTIMATES OF INDUSTRIAL SECTOR KWH SAVINGS BY END USE IN VERMONT BY 2015 - OTHER INDUSTRIAL ENERGY EFFICIENCY MEASURES

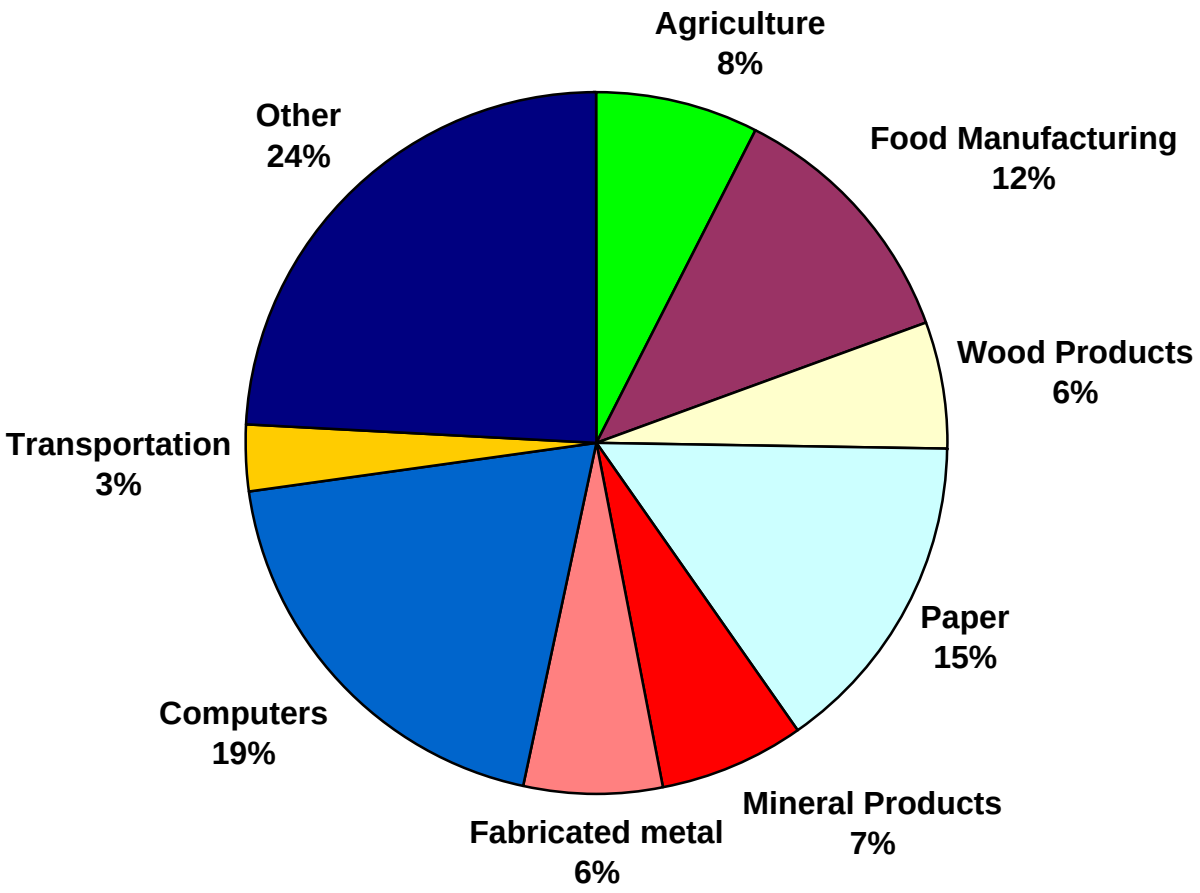
4/14/2006 15:49

				Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other
	Percent Savings by End Use for Agriculture			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Percent Savings by End Use for General Industry			2.10%	2.10%	0.00%	0.00%	0.00%	2.10%	0.00%	2.10%	2.10%	2.10%	2.10%	0.00%	0.00%	0.00%
NAICS CODE		Annual Industrial kWh Sales in 2015	Percent of Total														
	Agriculture	140,065,859	7.56%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	12,914,634	0.70%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	38,981,455	2.11%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-33	**Manufacturing**	1,659,830,119	89.63%	2,947,704	2,244,938	0	0	0	2,326,461	0	585,827	755,594	1,941,280	209,746	0	0	0
311	Food Manufacturing	219,248,861	11.84%	537,279	245,707	0	0	0	1,151,057	0	1,081	0	128,616	0	0	0	0
3115	*Dairy*	118,178,131	6.38%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
321	Wood Products	109,976,839	5.94%	92,381	230,951	0	0	0	0	0	138,571	0	0	0	0	0	0
322	Paper	276,323,958	14.92%	1,682,813	996,891	0	0	0	97,118	0	91,048	0	30,349	0	0	0	0
323	Printing	42,960,719	2.32%	37,440	42,853	0	0	0	0	0	54,131	0	0	0	0	0	0
326	Plastic and Rubber	83,228,627	4.49%	150,543	73,237	0	0	0	143,262	0	1,306	0	275,667	0	0	0	0
327	Mineral Products	125,490,549	6.78%	118,218	95,700	0	0	0	0	0	10,341	342,589	79,059	172,843	0	0	0
327991	*Cut Stone*	66,226,354	3.58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332	Fabricated metal	118,993,440	6.43%	54,001	108,002	0	0	0	42,594	0	71,345	141,626	166,118	4,259	0	0	0
333	Machinery	63,234,461	3.41%	28,279	42,418	0	0	0	40,651	0	0	65,352	42,596	14,004	0	0	0
334	Computers	358,117,803	19.34%	129,902	207,843	0	0	0	752,047	0	124,536	0	977,662	0	0	0	0
335	Electric Products	36,839,147	1.99%	16,718	33,436	0	0	0	13,187	0	22,088	43,846	51,428	1,319	0	0	0
335929	*Wire manufacturing*	13,530,768	0.73%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	Transportation	58,161,687	3.14%	53,936	75,511	0	0	0	50,109	0	10,350	41,031	47,685	13,677	0	0	0
337	Furniture	53,676,682	2.90%	24,359	48,719	0	0	0	19,214	0	32,183	63,886	74,934	1,921	0	0	0
339	Misc. Manufacturing	48,112,660	2.60%	21,834	43,669	0	0	0	17,222	0	28,847	57,264	67,166	1,722	0	0	0
	Total Industrial kWh Sales	1,851,792,067		2,947,704	2,244,938	0	0	0	2,326,461	0	585,827	755,594	1,941,280	209,746	0	0	0

Technical Potential Annual kWh Savings by 2015	11,011,551
% of 2015 kWh Sales	0.59%

Table C-21: Percent Electricity by End Use for the Agriculture Sector in Vermont															
Motors															
Pumps	Fans and Blowers	Compressed Air	Material Handling	Material Processing	Refrigeration	Total Motors	Other Motors	Drying and Curing	Heat Treating	Heating	Melting and Casting	HVAC	Lighting	Other	
0.0323	0.0209	0.0095			0.0475	0.1235	0.0133			0.0456			0.0133	0.0076	0.19
17%	11%	5%	0%	0%	25%	65%	7%	0%	0%	24%	0%	0%	7%	4%	1

TABLE C-22: Breakdown of Industrial kWh Sales in Vermont



APPENDIX D

Annual MWH and MW Savings

APPENDIX D-1

Cumulative Annual MWH Savings

Table D-1
Vermont Electric Energy Efficiency Potential Study
Cumulative Annual MWH Savings

Appendix D - Maximum Achievable Cost Effective Potential - Cumulative Annual MWH Savings by Year - Based on Screeing with Vermont Societal Test State of Vermont													
	VDPS mWh Sales Growth Assumption for Vermont Before DSM Impacts			Residential Energy Efficiency Savings		Commercial Energy Efficiency Savings		Industrial Energy Efficiency Savings		Total Energy Efficiency Savings (mWh)		Vermont Load Forecast Before DSM	Vermont Load Forecast After DSM
Year	Res. Sector mWh Sales	Comm. Sector mWh Sales	Ind. Sector mWh Sales	mWh Savings	% of Projected Res. mWh Sales	mWh Savings	% of Projected Comm. mWh Sales	mWh Savings	% of Projected Ind. mWh Sales	mWh Savings	% of Projected Total kWh Sales	mWh	mWh
2006	2,202,847	1,937,851	1,657,144	56,751	3%	45,038	2%	30,616	2%	132,405	2%	5,840,336	5,707,930
2007	2,249,698	1,956,990	1,677,887	113,502	5%	90,077	5%	59,949	4%	263,528	4%	5,927,941	5,664,413
2008	2,297,488	1,976,268	1,698,846	170,253	7%	135,115	7%	88,463	5%	393,832	7%	6,016,860	5,623,028
2009	2,346,235	1,995,687	1,720,025	227,004	10%	180,153	9%	116,977	7%	524,135	9%	6,107,113	5,582,978
2010	2,395,957	2,015,247	1,741,425	283,756	12%	225,192	11%	145,491	8%	654,439	11%	6,198,720	5,544,281
2011	2,446,672	2,034,947	1,763,047	340,507	14%	270,230	13%	170,179	10%	780,915	13%	6,291,700	5,510,785
2012	2,498,398	2,054,789	1,784,894	397,258	16%	315,269	15%	194,866	11%	907,392	14%	6,386,076	5,478,684
2013	2,551,154	2,074,773	1,806,965	454,009	18%	360,307	17%	219,554	12%	1,033,869	16%	6,481,867	5,447,998
2014	2,604,959	2,094,899	1,829,264	510,760	20%	405,345	19%	244,241	13%	1,160,346	18%	6,579,095	5,418,749
2015	2,659,832	2,115,167	1,851,792	567,511	21%	450,384	21%	268,929	15%	1,286,823	19%	6,677,781	5,390,958

APPENDIX D-2

Cumulative Annual Summer and Winter Peak MW Savings

Table D-2
Vermont Electric Energy Efficiency Potential Study
Cumulative Annual Summer and Winter Peak MW Savings

Appendix D - Maximum Achievable Cost Effective Potential - Cumulative Annual Summer and Winter Peak MW Savings - Based on Screening with the Vermont Societal Test

State of Vermont

	Residential		Commercial		Industrial		Total Savings		Vermont Peak Load Forecast Before DSM		Vermont Peak Load Forecast After EE Programs		Percent Savings	
Year	Winter Peak MW Savings	Summer Peak MW Savings	Winter Peak MW Savings	Summer Peak MW Savings	Winter Peak MW Savings	Summer Peak MW Savings	Winter Peak MW Savings	Summer Peak MW Savings	Winter Peak Load (MW)	Summer Peak Load (MW)	Winter Peak Load (MW)	Summer Peak Load (MW)	Winter Peak MW Savings	Summer Peak MW Savings
2006	22	10	10	9	9	6	41	25	1,056	979	1,014.9	953.8	3.9%	2.5%
2007	43	20	20	18	19	12	82	50	1,072	993	989.7	943.7	7.7%	5.0%
2008	66	30	30	27	27	18	123	75	1,088	1,008	964.7	933.8	11.3%	7.4%
2009	88	41	40	36	36	23	164	100	1,104	1,023	939.9	923.8	14.9%	9.7%
2010	111	52	49	44	45	29	205	125	1,121	1,039	915.4	914.0	18.3%	12.0%
2011	134	63	57	52	53	33	245	149	1,138	1,054	892.7	905.6	21.5%	14.1%
2012	158	75	66	60	61	38	285	173	1,155	1,070	870.1	897.1	24.6%	16.2%
2013	181	86	74	68	69	43	323	196	1,172	1,086	849.1	889.8	27.6%	18.1%
2014	203	98	81	75	77	47	362	220	1,190	1,103	828.0	882.5	30.4%	20.0%
2015	227	110	89	81	85	52	400	243	1,207	1,119	807.3	875.7	33.1%	21.7%

APPENDIX E

Modeling Assumptions

APPENDIX E-1

Modeling Assumptions

Table E-1
Vermont Electric Energy Efficiency Potential Study
Modeling Assumptions

Inflation Rate:	2.25%			
Discount Rate:	7.98%			
Reserve Margin Assumption:	13.80%			
Energy Line Loss Factors:	Winter On-Peak	Winter Off-Peak	Summer On-Peak	Summer Off-Peak
	1.212	1.124	1.195	1.145
Demand Line Lost Factors:	Winter	Summer		
	1.152	1.152		
Electric Externality Adders:	$0.0081 per kWh saved			
Fossil Fuel Externality Adders:	Residential Distillate	Residential Propane	Residential Natural Gas	Commercial Distillate
	$ 1.72	$ 1.31	$ 1.08	$ 1.72
	Commercial Propane	Commercial Natural Gas	Kerosene	
	$ 1.31	$ 1.08	$ 1.72	
Emmisions Factors:	SOX: 2.03 lbs/MWH			
	NOX: 0.53 lbs/MWH			
	CO_2: 1102 lbs/MWH			

APPENDIX F

Avoided Costs & Retail Rates

APPENDIX F-1

Electric Avoided Costs

Table F-1
Vermont Electric Energy Efficiency Potential Study
Electric Avoided Costs

		Electric Energy - Region - Vermont				Electric Capacity - Region Vermont	
		Seasonal Avoided Energy in Nominal $				Seasonal Avoided	
		Winter Peak Energy	Winter Off-Peak Energy	Summer Peak Energy	Summer Off-Peak Energy	Summer Generation	Winter Generation
	Years	(¢/kWh)	(¢/kWh)	(¢/kWh)	(¢/kWh)	($/kW)	($/kW)
1	*2005*	8.5576	7.2112	8.1787	6.0479	3.6164	0.0000
2	*2006*	9.8296	8.2013	9.1375	7.0557	37.1674	0.0000
3	*2007*	10.3045	8.5883	9.6917	7.3476	43.1614	0.0000
4	*2008*	8.9473	7.2735	8.7129	6.2834	66.9585	0.0000
5	*2009*	7.6327	6.2052	7.2136	5.2887	73.1956	0.0000
6	*2010*	6.8399	5.6276	6.4466	4.8366	78.0962	0.0000
7	*2011*	7.1666	5.9376	6.7272	5.1222	83.3323	0.0000
8	*2012*	7.5095	6.2658	7.0205	5.4261	88.9259	0.0000
9	*2013*	7.7429	6.4705	7.2570	5.6020	91.1303	0.0000
10	*2014*	7.9836	6.6821	7.5016	5.7837	93.5531	0.0000
11	*2015*	8.2319	6.9006	7.7546	5.9714	96.0403	0.0000
12	*2016*	8.4879	7.1265	8.0162	6.1653	98.5936	0.0000
13	*2017*	8.9011	7.5057	8.4826	6.5389	100.1788	0.0000
14	*2018*	9.3353	7.9063	8.9776	6.9369	101.7894	0.0000
15	*2019*	9.7914	8.3294	9.5031	7.3609	103.4259	0.0000
16	*2020*	10.2706	8.7763	10.0609	7.8128	105.0888	0.0000
17	*2021*	10.6042	9.0542	10.4043	8.0848	107.9468	0.0000
18	*2022*	10.9487	9.3410	10.7597	8.3665	110.8825	0.0000
19	*2023*	11.3045	9.6370	11.1274	8.6582	113.8980	0.0000
20	*2024*	11.6720	9.9425	11.5078	8.9603	116.9956	0.0000
21	*2025*	12.0516	10.2577	11.9014	9.2731	120.1773	0.0000
22	*2026*	12.4437	10.5831	12.3086	9.5970	123.4457	0.0000
23	*2027*	12.8486	10.9190	12.7300	9.9326	126.8029	0.0000
24	*2028*	13.2669	11.2656	13.1660	10.2800	130.2514	0.0000
25	*2029*	13.6990	11.6233	13.6171	10.6399	133.7937	0.0000
26	*2030*	14.1453	11.9926	14.0839	11.0126	137.4323	0.0000
27	*2031*	14.4579	12.2315	14.4672	11.2254	130.1015	0.0000
28	*2032*	14.7774	12.4753	14.8610	11.4424	123.1616	0.0000
29	*2033*	15.1040	12.7239	15.2656	11.6635	116.5920	0.0000
30	*2034*	15.4377	12.9775	15.6812	11.8890	110.3728	0.0000
31	*2035*	15.7789	13.2361	16.1081	12.1188	104.4853	0.0000
32	*2036*	16.1276	13.5000	16.5467	12.3531	98.9119	0.0000
33	*2037*	16.4840	13.7690	16.9973	12.5919	93.6358	0.0000
34	*2038*	16.8483	14.0435	17.4602	12.8353	88.6411	0.0000
35	*2039*	17.2206	14.3235	17.9357	13.0835	83.9129	0.0000
36	*2040*	17.6080	14.6457	18.3393	13.3779	79.4368	0.0000
37	*2041*	18.0042	14.9753	18.7519	13.6789	81.2242	0.0000
38	*2042*	18.4093	15.3122	19.1738	13.9867	83.0517	0.0000
39	*2043*	18.8235	15.6567	19.6052	14.3014	84.9204	0.0000
40	*2044*	19.2471	16.0090	20.0463	14.6232	86.8311	0.0000
41	*2045*	19.6801	16.3692	20.4974	14.9522	88.7848	0.0000
42	*2046*	20.1229	16.7375	20.9586	15.2886	90.7824	0.0000
43	*2047*	20.5757	17.1141	21.4301	15.6326	92.8250	0.0000
44	*2048*	21.0386	17.4992	21.9123	15.9844	94.9136	0.0000

Table F-1
Vermont Electric Energy Efficiency Potential Study
Electric Avoided Costs

		Electric Energy - Region - Vermont				Electric Capacity - Region Vermont	
		Seasonal Avoided Energy in Nominal $				Seasonal Avoided	
		Winter Peak Energy	Winter Off-Peak Energy	Summer Peak Energy	Summer Off-Peak Energy	Summer Generation	Winter Generation
	Years	(¢/kWh)	(¢/kWh)	(¢/kWh)	(¢/kWh)	($/kW)	($/kW)
45	*2049*	21.5120	17.8929	22.4053	16.3440	97.0492	0.0000
46	*2050*	21.9960	18.2955	22.9095	16.7117	99.2328	0.0000
47	*2051*	22.4909	18.7072	23.4249	17.0878	101.4655	0.0000
48	*2052*	22.9970	19.1281	23.9520	17.4722	103.7485	0.0000
49	*2053*	23.5144	19.5584	24.4909	17.8654	106.0828	0.0000
50	*2054*	24.0435	19.9985	25.0420	18.2673	108.4697	0.0000
51	*2055*	24.5845	20.4485	25.6054	18.6783	110.9102	0.0000
52	*2056*	25.1376	20.9086	26.1815	19.0986	113.4057	0.0000
53	*2057*	25.7032	21.3790	26.7706	19.5283	115.9574	0.0000
54	*2058*	26.2815	21.8600	27.3729	19.9677	118.5664	0.0000
55	*2059*	26.8729	22.3519	27.9888	20.4170	121.2341	0.0000
56	*2060*	27.4775	22.8548	28.6186	20.8764	123.9619	0.0000
57	*2061*	28.0958	23.3690	29.2625	21.3461	126.7510	0.0000
58	*2062*	28.7279	23.8948	29.9209	21.8264	129.6029	0.0000
59	*2063*	29.3743	24.4325	30.5941	22.3175	132.5190	0.0000
60	*2064*	30.0352	24.9822	31.2825	22.8196	135.5007	0.0000
61	*2065*	30.7110	25.5443	31.9863	23.3330	138.5495	0.0000

APPENDIX F-2

Gas Avoided Costs

Table F-2
Vermont Electric Energy Efficiency Potential Study
Gas Avoided Costs

		Natural Gas in Nominal $ - Region Vermont						
		Commerical & Industrial			Residential			
		Non-Heating	Heating	All	Heating Retrofit	New Heating	Hot Water	All
	Years	($/MMBtu)	($/MMBtu)	($/MMBtu)	($/MMBtu)	($/MMBtu)	($/MMBtu)	($/MMBtu)
1	*2005*	11.3708	11.3705	11.3707	12.4793	12.4035	12.4038	12.4290
2	*2006*	12.1158	12.0922	12.1040	13.2267	13.1484	13.1721	13.1824
3	*2007*	12.0340	11.9385	11.9863	13.0942	13.0185	13.1141	13.0754
4	*2008*	10.2037	10.1836	10.1936	11.3610	11.2879	11.3080	11.3190
5	*2009*	9.3719	9.3980	9.3849	10.6000	10.5271	10.5010	10.5429
6	*2010*	8.7558	8.8378	8.7968	10.0664	9.9924	9.9104	9.9901
7	*2011*	9.0226	9.1069	9.0647	10.3633	10.2874	10.2031	10.2850
8	*2012*	9.4646	9.5521	9.5084	10.8378	10.7592	10.6717	10.7566
9	*2013*	9.9066	9.9974	9.9520	11.3128	11.2317	11.1408	11.2289
10	*2014*	10.8182	10.9149	10.8665	12.2626	12.1769	12.0802	12.1737
11	*2015*	10.5596	10.6556	10.6076	12.0317	11.9461	11.8500	11.9431
12	*2016*	10.8257	10.9241	10.8749	12.3313	12.2436	12.1451	12.2405
13	*2017*	11.0335	11.1339	11.0837	12.5726	12.4830	12.3826	12.4799
14	*2018*	11.4779	11.5817	11.5298	13.0535	12.9612	12.8574	12.9579
15	*2019*	11.9828	12.0903	12.0365	13.5962	13.5008	13.3933	13.4973
16	*2020*	12.4329	12.5439	12.4884	14.0843	13.9861	13.8752	13.9824
17	*2021*	13.1321	13.2479	13.1900	14.8247	14.7227	14.6068	14.7186
18	*2022*	13.5604	13.6796	13.6200	15.2923	15.1875	15.0683	15.1833
19	*2023*	14.3906	14.5154	14.4530	16.1665	16.0572	15.9324	16.0527
20	*2024*	14.8572	14.9857	14.9215	16.6745	16.5622	16.4338	16.5574
21	*2025*	15.9319	16.0674	15.9997	17.7971	17.6795	17.5439	17.6741
22	*2026*	16.2904	16.4290	16.3597	18.1975	18.0772	17.9387	18.0718
23	*2027*	16.6569	16.7986	16.7278	18.6070	18.4840	18.3423	18.4784
24	*2028*	17.0317	17.1766	17.1042	19.0256	18.8999	18.7550	18.8942
25	*2029*	17.4149	17.5631	17.4890	19.4537	19.3251	19.1770	19.3193
26	*2030*	17.8068	17.9582	17.8825	19.8914	19.7599	19.6085	19.7540
27	*2031*	18.2074	18.3623	18.2849	20.3390	20.2045	20.0497	20.1985
28	*2032*	18.6171	18.7754	18.6963	20.7966	20.6591	20.5008	20.6529
29	*2033*	19.0360	19.1979	19.1169	21.2645	21.1240	20.9621	21.1176
30	*2034*	19.4643	19.6298	19.5471	21.7430	21.5993	21.4337	21.5928
31	*2035*	19.9022	20.0715	19.9869	22.2322	22.0852	21.9160	22.0786
32	*2036*	20.3500	20.5231	20.4366	22.7324	22.5822	22.4091	22.5754
33	*2037*	20.8079	20.9849	20.8964	23.2439	23.0902	22.9133	23.0833
34	*2038*	21.2761	21.4570	21.3666	23.7669	23.6098	23.4288	23.6027
35	*2039*	21.7548	21.9398	21.8473	24.3017	24.1410	23.9560	24.1338
36	*2040*	22.2443	22.4335	22.3389	24.8484	24.6842	24.4950	24.6768
37	*2041*	22.7448	22.9382	22.8415	25.4075	25.2396	25.0461	25.2320
38	*2042*	23.2565	23.4543	23.3554	25.9792	25.8075	25.6096	25.7997
39	*2043*	23.7798	23.9821	23.8809	26.5637	26.3881	26.1859	26.3802
40	*2044*	24.3149	24.5217	24.4183	27.1614	26.9819	26.7750	26.9738
41	*2045*	24.8619	25.0734	24.9677	27.7725	27.5889	27.3775	27.5807
42	*2046*	25.4213	25.6376	25.5294	28.3974	28.2097	27.9935	28.2012
43	*2047*	25.9933	26.2144	26.1039	29.0364	28.8444	28.6233	28.8358
44	*2048*	26.5782	26.8042	26.6912	29.6897	29.4934	29.2674	29.4846
45	*2049*	27.1762	27.4073	27.2917	30.3577	30.1570	29.9259	30.1480

Table F-2
Vermont Electric Energy Efficiency Potential Study
Gas Avoided Costs

		Natural Gas in Nominal $ - Region Vermont						
		Commerical & Industrial			Residential			
		Non-Heating	Heating	All	Heating Retrofit	New Heating	Hot Water	All
	Years	($/MMBtu)	($/MMBtu)	($/MMBtu)	($/MMBtu)	($/MMBtu)	($/MMBtu)	($/MMBtu)
46	*2050*	27.7876	28.0240	27.9058	31.0408	30.8356	30.5992	30.8263
47	*2051*	28.4129	28.6545	28.5337	31.7392	31.5294	31.2877	31.5199
48	*2052*	29.0521	29.2992	29.1757	32.4533	32.2388	31.9917	32.2291
49	*2053*	29.7058	29.9585	29.8321	33.1835	32.9641	32.7115	32.9542
50	*2054*	30.3742	30.6325	30.5034	33.9301	33.7058	33.4475	33.6957
51	*2055*	31.0576	31.3218	31.1897	34.6936	34.4642	34.2000	34.4539
52	*2056*	31.7564	32.0265	31.8915	35.4742	35.2397	34.9696	35.2291
53	*2057*	32.4709	32.7471	32.6090	36.2723	36.0325	35.7564	36.0217
54	*2058*	33.2015	33.4839	33.3427	37.0885	36.8433	36.5609	36.8322
55	*2059*	33.9486	34.2373	34.0929	37.9229	37.6723	37.3835	37.6609
56	*2060*	34.7124	35.0077	34.8600	38.7762	38.5199	38.2246	38.5083
57	*2061*	35.4934	35.7953	35.6444	39.6487	39.3866	39.0847	39.3748
58	*2062*	36.2920	36.6007	36.4464	40.5408	40.2728	39.9641	40.2607
59	*2063*	37.1086	37.4242	37.2664	41.4529	41.1789	40.8633	41.1666
60	*2064*	37.9436	38.2663	38.1049	42.3856	42.1054	41.7827	42.0928
61	*2065*	38.7973	39.1273	38.9623	43.3393	43.0528	42.7228	43.0399

APPENDIX F-3

Retail Rates

Table F-3
Vermont Electric Energy Efficiency Potential Study
Retail Rates

		Electric Retail Rate			Nat. Gas Retail Rate	Central New England Forecast by Sector and Fuel					Other in Nominal $ Central New England Forecast by Sector					Other
						Fuel Oil in Nominal $					Propane in Nominal $			Wood in Nominal $		
	Years	Residential (¢/kWh)	Commercial (¢/kWh)	Industrial (¢/kWh)	All ($/MMBtu)	Res. Distillate ($/MMBtu)	Com. #2 Oil ($/MMBtu)	Com. #4 Oil ($/MMBtu)	Ind. #6 Oil ($/MMBtu)	Kerosene ($/MMBtu)	Residential ($/MMBtu)	Commercial ($/MMBtu)	Industrial ($/MMBtu)	Greenwood ($/MMBTU)	Seasoned ($/MMBTU)	Water ($/gallon)
1	*2005*	13.0600	11.3500	8.0800	11.9528	14.0512	12.0230	11.0927	9.5213	14.0373	20.5518	16.5942	14.6046	8.04	10.54	0.0114
2	*2006*	13.0017	11.2994	8.0439	12.6971	14.5201	12.4463	11.4951	9.8883	14.3081	21.1671	17.1204	15.0860	8.39	10.99	0.0114
3	*2007*	13.5226	11.7520	8.3662	12.5853	14.4748	12.3543	11.3817	9.7388	14.2580	21.2713	17.1335	15.0534	8.75	11.47	0.0117
4	*2008*	13.7886	11.9832	8.5308	10.8126	14.6103	12.4421	11.4476	9.7677	14.3886	21.5597	17.3288	15.2019	9.13	11.96	0.0120
5	*2009*	13.8035	11.9962	8.5400	10.0218	15.1578	12.9408	11.9239	10.2063	14.9311	22.2636	17.9375	15.7627	9.52	12.47	0.0122
6	*2010*	14.1003	12.2541	8.7236	9.4531	16.0209	13.7540	12.7142	10.9579	15.7891	23.2865	18.8631	16.6394	9.93	13.01	0.0125
7	*2011*	14.3373	12.4600	8.8702	9.7359	16.0408	13.7229	12.6597	10.8639	15.8037	23.4699	18.9470	16.6732	10.35	13.57	0.0128
8	*2012*	15.3064	13.3023	9.4698	10.1949	16.0618	13.6917	12.6046	10.7684	15.8194	23.6580	19.0333	16.7084	10.80	14.15	0.0131
9	*2013*	15.5136	13.4823	9.5980	10.6543	16.0755	13.6521	12.5406	10.6630	15.8277	23.8427	19.1139	16.7367	11.26	14.76	0.0134
10	*2014*	15.8287	13.7562	9.7930	11.5855	16.0816	13.6037	12.4672	10.5474	15.8282	24.0236	19.1884	16.7577	11.75	15.39	0.0137
11	*2015*	16.1845	14.0654	10.0131	11.3421	16.0583	13.5246	12.3625	10.3995	15.7992	24.1789	19.2350	16.7496	12.25	16.05	0.0140
12	*2016*	16.7048	14.5176	10.3350	11.6260	16.4800	13.8893	12.7010	10.6939	16.2151	24.7834	19.7282	17.1869	12.78	16.74	0.0143
13	*2017*	17.2610	15.0009	10.6791	11.8516	17.0100	14.3610	13.1460	11.0937	16.7391	25.5002	20.3313	17.7327	13.32	17.46	0.0146
14	*2018*	17.8057	15.4743	11.0161	12.3152	17.5554	14.8468	13.6045	11.5060	17.2784	26.2366	20.9514	18.2944	13.90	18.21	0.0149
15	*2019*	18.3902	15.9823	11.3777	12.8400	18.1167	15.3472	14.0769	11.9312	17.8335	26.9933	21.5891	18.8724	14.49	18.99	0.0153
16	*2020*	19.0176	16.5275	11.7659	13.3101	18.6943	15.8625	14.5636	12.3696	18.4047	27.7706	22.2449	19.4670	15.12	19.81	0.0156
17	*2021*	19.5101	16.9556	12.0706	14.0307	19.2887	16.3932	15.0651	12.8217	18.9926	28.5692	22.9191	20.0788	15.77	20.66	0.0160
18	*2022*	20.0142	17.3936	12.3824	14.4798	19.9003	16.9396	15.5816	13.2878	19.5976	29.3896	23.6124	20.7081	16.44	21.55	0.0163
19	*2023*	20.5332	17.8447	12.7035	15.3328	20.5296	17.5023	16.1138	13.7683	20.2200	30.2324	24.3253	21.3556	17.15	22.47	0.0167
20	*2024*	21.0676	18.3092	13.0342	15.8212	21.1771	18.0817	16.6619	14.2637	20.8605	31.0982	31.0982	22.0217	17.89	23.44	0.0171
21	*2025*	21.6180	18.7875	13.3747	16.9206	21.8432	18.6782	17.2264	14.7743	21.5196	31.9876	31.9876	22.7068	18.65	24.44	0.0175
22	*2026*	22.2529	19.3393	13.7675	17.3014	22.3347	19.0984	17.6140	15.1067	22.0038	32.7073	26.3924	23.2177	19.07	24.99	0.0179
23	*2027*	22.9065	19.9073	14.1719	17.6906	22.8372	19.5282	18.0103	15.4466	22.4988	33.4432	26.9862	23.7401	19.50	25.56	0.0183
24	*2028*	23.5793	20.4919	14.5881	18.0887	23.3511	19.9675	18.4156	15.7941	23.0051	34.1957	27.5934	24.2743	19.94	26.13	0.0187
25	*2029*	24.2718	21.0938	15.0166	18.4957	23.8765	20.4168	18.8299	16.1495	23.5227	34.9651	28.2142	24.8204	20.39	26.72	0.0191
26	*2030*	24.9847	21.7133	15.4576	18.9118	24.4137	20.8762	19.2536	16.5129	24.0519	35.7518	28.8491	25.3789	20.85	27.32	0.0195
27	*2031*	25.7185	22.3510	15.9116	19.3373	24.9630	21.3459	19.6868	16.8844	24.5931	36.5562	29.4982	25.9499	21.32	27.94	0.0200
28	*2032*	26.4738	23.0075	16.3789	19.7724	25.5247	21.8262	20.1298	17.2643	25.1465	37.3787	30.1619	26.5338	21.80	28.56	0.0204
29	*2033*	27.2513	23.6832	16.8599	20.2173	26.0990	22.3173	20.5827	17.6528	25.7123	38.2197	30.8405	27.1308	22.29	29.21	0.0209
30	*2034*	28.0517	24.3788	17.3551	20.6722	26.6862	22.8194	21.0458	18.0500	26.2908	39.0797	31.5344	27.7413	22.79	29.86	0.0213
31	*2035*	28.8756	25.0948	17.8648	21.1373	27.2867	23.3328	21.5193	18.4561	26.8823	39.9590	32.2439	28.3654	23.30	30.54	0.0218
32	*2036*	29.7237	25.8318	18.3895	21.6129	27.9006	23.8578	22.0035	18.8713	27.4872	40.8581	32.9694	29.0037	23.83	31.22	0.0223
33	*2037*	30.5967	26.5905	18.9296	22.0992	28.5284	24.3946	22.4986	19.2959	28.1056	41.7774	33.7112	29.6562	24.36	31.93	0.0228
34	*2038*	31.4953	27.3715	19.4856	22.5964	29.1703	24.9435	23.0048	19.7301	28.7380	42.7174	34.4697	30.3235	24.91	32.64	0.0233
35	*2039*	32.4203	28.1754	20.0579	23.1049	29.8266	25.5047	23.5224	20.1740	29.3846	43.6785	35.2453	31.0058	25.47	33.38	0.0238
36	*2040*	33.3725	29.0029	20.6470	23.6247	30.4977	26.0786	24.0517	20.6279	30.0458	44.6613	36.0383	31.7034	26.04	34.13	0.0244
37	*2041*	34.3526	29.8547	21.2534	24.1563	31.1839	26.6654	24.5928	21.0921	30.7218	45.6661	36.8492	32.4167	26.63	34.90	0.0249
38	*2042*	35.3616	30.7315	21.8776	24.6998	31.8855	27.2653	25.1462	21.5666	31.4130	46.6936	37.6783	33.1461	27.23	35.68	0.0255
39	*2043*	36.4001	31.6341	22.5201	25.2555	32.6029	27.8788	25.7120	22.0519	32.1198	47.7442	38.5261	33.8919	27.84	36.49	0.0261
40	*2044*	37.4692	32.5632	23.1816	25.8238	33.3365	28.5061	26.2905	22.5481	32.8425	48.8185	39.3929	34.6545	28.47	37.31	0.0266
41	*2045*	38.5697	33.5196	23.8624	26.4048	34.0866	29.1475	26.8820	23.0554	33.5815	49.9169	40.2792	35.4342	29.11	38.15	0.0272
42	*2046*	39.7025	34.5041	24.5632	26.9989	34.8535	29.8033	27.4869	23.5741	34.3371	51.0400	41.1855	36.2315	29.76	39.00	0.0279
43	*2047*	40.8685	35.5175	25.2847	27.6064	35.6377	30.4739	28.1053	24.1046	35.1097	52.1884	42.1122	37.0467	30.43	39.88	0.0285
44	*2048*	42.0688	36.5606	26.0273	28.2275	36.4396	31.1595	28.7377	24.6469	35.8996	53.3627	43.0597	37.8802	31.12	40.78	0.0291

Table F-3
Vermont Electric Energy Efficiency Potential Study
Retail Rates

		Electric Retail Rate			Nat. Gas Retail Rate	Central New England Forecast by Sector and Fuel					Other in Nominal $ Central New England Forecast by Sector					Other
						Fuel Oil in Nominal $					Propane in Nominal $			Wood in Nominal $		
	Years	Residential (¢/kWh)	Commercial (¢/kWh)	Industrial (¢/kWh)	All ($/MMBtu)	Res. Distillate ($/MMBtu)	Com. #2 Oil ($/MMBtu)	Com. #4 Oil ($/MMBtu)	Ind. #6 Oil ($/MMBtu)	Kerosene ($/MMBtu)	Residential ($/MMBtu)	Commercial ($/MMBtu)	Industrial ($/MMBtu)	Greenwood ($/MMBTU)	Seasoned ($/MMBTU)	Water ($/gallon)
45	*2049*	43.3044	37.6344	26.7917	28.8627	37.2595	31.8606	29.3843	25.2015	36.7074	54.5633	44.0286	38.7325	31.82	41.70	0.0298
46	*2050*	44.5763	38.7397	27.5786	29.5121	38.0978	32.5775	30.0454	25.7685	37.5333	55.7910	45.0192	39.6040	32.53	42.63	0.0305
47	*2051*	45.8855	39.8775	28.3886	30.1761	38.9550	33.3105	30.7215	26.3483	38.3778	57.0463	46.0321	40.4951	33.27	43.59	0.0311
48	*2052*	47.2331	41.0487	29.2223	30.8551	39.8315	34.0600	31.4127	26.9411	39.2413	58.3298	47.0679	41.4062	34.01	44.57	0.0318
49	*2053*	48.6204	42.2543	30.0806	31.5493	40.7277	34.8263	32.1195	27.5473	40.1242	59.6423	48.1269	42.3379	34.78	45.58	0.0326
50	*2054*	50.0483	43.4953	30.9641	32.2592	41.6441	35.6099	32.8422	28.1671	41.0270	60.9842	49.2097	43.2905	35.56	46.60	0.0333
51	*2055*	51.5183	44.7728	31.8735	32.9850	42.5811	36.4111	33.5811	28.8009	41.9501	62.3564	50.3170	44.2645	36.36	47.65	0.0340
52	*2056*	53.0313	46.0877	32.8096	33.7272	43.5392	37.2304	34.3367	29.4489	42.8940	63.7594	51.4491	45.2605	37.18	48.72	0.0348
53	*2057*	54.5889	47.4413	33.7732	34.4860	44.5188	38.0680	35.1093	30.1115	43.8591	65.1940	52.6067	46.2788	38.02	49.82	0.0356
54	*2058*	56.1922	48.8347	34.7651	35.2619	45.5205	38.9246	35.8992	30.7890	44.8459	66.6608	53.7904	47.3201	38.87	50.94	0.0364
55	*2059*	57.8425	50.2690	35.7862	36.0553	46.5447	39.8004	36.7069	31.4818	45.8550	68.1607	55.0006	48.3848	39.75	52.09	0.0372
56	*2060*	59.5414	51.7454	36.8372	36.8666	47.5919	40.6959	37.5329	32.1901	46.8867	69.6943	56.2382	49.4735	40.64	53.26	0.0380
57	*2061*	61.2901	53.2651	37.9191	37.6961	48.6627	41.6115	38.3773	32.9144	47.9417	71.2624	57.5035	50.5866	41.56	54.46	0.0389
58	*2062*	63.0902	54.8295	39.0328	38.5442	49.7576	42.5478	39.2408	33.6550	49.0203	72.8658	58.7973	51.7248	42.49	55.68	0.0398
59	*2063*	64.9431	56.4399	40.1792	39.4115	50.8772	43.5051	40.1238	34.4122	50.1233	74.5053	60.1203	52.8886	43.45	56.94	0.0407
60	*2064*	66.8505	58.0975	41.3593	40.2983	52.0219	44.4840	41.0265	35.1865	51.2511	76.1817	61.4730	54.0786	44.43	58.22	0.0416
61	*2065*	68.8139	59.8038	42.5740	41.2050	53.1924	45.4849	41.9496	35.9782	52.4042	77.8958	62.8561	55.2954	45.42	59.53	0.0425

APPENDIX G

Early Replacement Scenario

APPENDIX G-1

Early Replacement Scenario Tables & Figures

Appendix G Index
Vermont Electric Energy
Tables and Figures for Appendix G

Table G-1
Vermont Electric Energy Efficiency Potential Study
Comparison of Benefits, Costs, and Savings for Replace on Burnout vs. Early Replacement Programs - All Sectors

TABLE G-1: COMPARISON OF BENEFITS, COSTS AND SAVINGS FOR REPLACE ON BURNOUT VERSUS EARLY REPLACEMENT PROGRAMS - ALL SECTORS - August 2006

Indicator	(Column 1) - Replace on Burnout Base Case	(Column 2) - Early Replacement Scenario	(Column 3) Difference of Column 2 and Column 1 (Column 2 - Column 1)	(Column 4) - Percent Difference
Total Incentives Paid for 2006 to 2015 (Present Value)	$214,251,884	$290,457,037	$ 76,205,153	35.57%
Total Administrative Costs Paid from 2006 to 2015 (Present Value)	$133,800,997	$ 97,443,174	$ (36,357,824)	-27.17%
Present Value of Total Utility Energy Efficiency Program Budget 2006 to 2015	$348,052,882	$387,900,211	$ 39,847,329	11.4%
Average Annual Budget (2006-2015)	$34,805,288	$38,790,021	$3,984,733	11%
Cumulative Annual mWh Savings by 2015	1,286,823	1,166,144	(120,679)	-9.4%
Cumulative Annual Winter Peak MW Savings by 2015	379	389	10	2.6%
Cumulative Annual Summer Peak MW Savings by 2015	225	244	19	8.5%
NPV Benefits (Vermont Societal Test)	$ 1,358,463,742	$ 1,675,495,161	$ 317,031,419	23.3%
NPV Costs (Vermont Societal Test)	$ 393,994,396	$ 526,653,726	$ 132,659,330	33.7%
NPV Savings	$ 964,469,346	$ 1,148,841,435	$ 184,372,089	19.1%
B/C Ratio	3.45	3.18	(0.27)	-7.7%

Table G-2
Vermont Electric Energy Efficiency Potential Study
kWh Savings by Costing Period, KW Savings, and Utility Budgets

Table G-2: Cumulative Annual kWh Savings by Costing Period, Cumulative Annual Summer and Winter kW Savings, Annual Utility Energy Efficiency Budgets by Sector											
Vermont - All Sectors Combined - Early Replacement Scenario	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Total for 10 Years**
Year by Year Program Savings Data - All Measures (1 to 13)											
Energy Savings - kWh											
Cumulative savings from installations with decay in a particular year - Total annual kWh	248,868,227	496,749,349	744,106,646	988,709,337	1,063,178,585	1,074,074,742	1,084,771,169	1,088,199,728	1,097,055,228	1,166,143,894	9,051,856,904
a. Winter On-Peak kWh	80,174,124	160,032,026	239,712,692	317,936,852	344,638,569	358,482,350	372,225,141	385,000,393	400,000,554	426,813,807	3,085,016,508
b. Winter Off-Peak kWh	58,125,422	115,839,291	173,313,019	230,544,766	255,704,202	268,960,226	282,124,786	292,760,238	304,399,412	326,620,571	2,308,391,933
c. Summer On-Peak kWh	64,855,246	129,598,360	194,298,834	258,164,525	269,578,348	260,886,454	252,184,041	240,963,694	231,134,038	240,975,948	2,142,639,488
d. Summer Off-Peak kWh	45,713,435	91,279,672	136,782,100	182,063,194	193,257,466	185,745,712	178,237,201	169,475,404	161,521,224	171,733,567	1,515,808,975
Peak Demand Savings											
a. Winter - KW savings	61,313	122,624	184,058	245,197	274,575	295,953	317,608	337,843	359,467	388,728	2,587,367
b. Summer - KW savings	83,032	166,062	249,214	332,602	347,876	319,288	290,954	260,286	230,592	244,393	2,524,299
	-										-
Projected Annual Program Budget - in nominal dollars (Administrative and incentives)	$ 87,062,238	$ 87,807,775	$ 88,609,143	$ 89,259,374	$ 18,264,842	$ 18,691,813	$ 19,446,854	$ 20,225,779	$ 21,029,341	$ 21,858,312	$ 472,255,471

Net present value of Total Budget for All Sectors - 2006 to 2015	$387,900,211

Vermont - Residential Sector - Early Replacement Scenario	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Year by Year Program Savings Data - All Measures (1 to 13)										
Energy Savings - kWh										
Cumulative savings from installations with decay in a particular year - Total annual kWh	108,184,298	216,664,162	325,439,592	434,510,589	488,050,133	493,498,113	498,746,362	498,638,771	498,826,746	547,633,294
a. Winter On-Peak kWh	29,736,453	59,541,486	89,415,100	119,357,294	140,288,749	154,054,755	167,719,771	179,961,105	192,271,019	211,861,590
b. Winter Off-Peak kWh	28,476,974	57,016,984	85,620,028	114,286,107	130,812,133	137,858,170	144,812,743	149,565,111	154,380,514	168,781,975
c. Summer On-Peak kWh	24,511,516	49,103,301	73,775,355	98,527,678	107,319,456	101,403,584	95,477,193	88,876,948	82,356,971	90,693,428
d. Summer Off-Peak kWh	25,459,354	51,002,391	76,629,110	102,339,511	109,629,795	100,181,604	90,736,656	80,235,608	69,818,242	76,296,301
Peak Demand Savings										
a. Winter - KW savings	27,592	55,527	83,806	112,429	134,457	151,454	168,728	184,982	201,581	223,888
b. Summer - KW savings	51,226	102,796	154,710	206,967	217,210	187,016	157,076	127,142	97,552	109,075

Projected Annual Program Budget - in nominal dollars (Administrative costs and incentive costs)	$ 40,168,778	$ 40,777,810	$ 41,406,443	$ 42,055,307	$ 14,731,158	$ 15,416,201	$ 16,123,346	$ 16,853,297	$ 17,606,783	$ 18,384,551

Vermont - Commercial Sector - Early Replacement Scenario	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Year by Year Program Savings Data - All Measures (1 to 13)										
Energy Savings - kWh										
Cumulative savings from installations with decay in a particular year - Total annual kWh	110,067,911	220,135,822	330,203,733	437,221,471	429,637,219	410,397,909	391,158,599	370,007,261	353,987,298	349,581,928
a. Winter On-Peak kWh	40,569,493	81,138,987	121,708,480	160,752,887	157,285,591	149,273,748	141,261,905	133,706,204	128,306,833	127,439,897
b. Winter Off-Peak kWh	19,116,781	38,233,563	57,350,344	76,162,109	75,041,615	72,913,492	70,785,370	68,330,343	66,816,004	66,297,592
c. Summer On-Peak kWh	35,353,197	70,706,394	106,059,591	140,497,736	138,444,556	131,567,280	124,690,004	115,968,650	108,557,717	105,961,917
d. Summer Off-Peak kWh	15,028,439	30,056,879	45,085,318	59,808,740	58,865,457	56,643,388	54,421,320	52,002,064	50,306,744	49,882,521
Peak Demand Savings										
a. Winter - KW savings	24,263	48,527	72,790	96,416	94,876	91,399	87,923	84,046	81,213	80,309
b. Summer - KW savings	25,622	51,244	76,867	102,381	101,795	98,818	95,840	90,524	85,837	83,532

Projected Annual Program Budget - in nominal dollars (Administrative and incentives)	$43,626,081	$43,807,979	$43,993,969	$43,946,438	$226,057	$228,636	$231,274	$233,971	$236,728	$239,548

Vermont Industrial Sector - Early Replacement Scenario	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Year by Year Program Savings Data - All Measures (1 to 13)										
Energy Savings - kWh										
Cumulative savings from installations with decay in a particular year - Total annual kWh	30,616,018	59,949,365	88,463,320	116,977,276	145,491,232	170,178,720	194,866,208	219,553,696	244,241,184	268,928,672
a. Winter On-Peak kWh	9,868,177	19,351,553	28,589,112	37,826,670	47,064,229	55,153,847	63,243,465	71,333,083	79,422,702	87,512,320
b. Winter Off-Peak kWh	10,531,666	20,588,744	30,342,647	40,096,550	49,850,454	58,188,564	66,526,674	74,864,784	83,202,894	91,541,004
c. Summer On-Peak kWh	4,990,533	9,788,665	14,463,889	19,139,112	23,814,336	27,915,589	32,016,843	36,118,096	40,219,350	44,320,603
d. Summer Off-Peak kWh	5,225,642	10,220,402	15,067,673	19,914,943	24,762,214	28,920,720	33,079,226	37,237,732	41,396,239	45,554,745
Peak Demand Savings										
a. Winter - KW savings	9,458	18,570	27,461	36,352	45,243	53,100	60,958	68,815	76,673	84,530
b. Summer - KW savings	6,184	12,021	17,638	23,254	28,870	33,454	38,037	42,620	47,203	51,786

Projected Annual Program Budget - in nominal dollars (Administrative and incentives) - for the base case	$3,267,379	$3,221,986	$3,208,731	$3,257,629	$3,307,628	$3,046,975	$3,092,234	$3,138,511	$3,185,830	$3,234,213

Table G-3
Vermont Electric Energy Efficiency Potential Study
Summary of Overall Electric Energy Efficiency Potential in Vermont

Table G-3: Summary of Overall Electric Energy Efficiency Potential in Vermont for all Sectors for **Early Replacement** Scenario (Residential, Commercial and Industrial Combined)		
	Estimated Cumulative Annual Savings by 2015 (kWh)	Savings in 2015 as a Percent of Total 2015 kWh Sales
Technical Potential	2,115,871	31.9%
Achievable Potential	1,451,903	21.9%
Achievable Cost Effective Potential	1,166,144	17.6%

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 Residential Sector kWh Sales
Technical Potential	1,057,749	39.8%
Achievable Potential	687,737	25.9%
Achievable Cost Effective Potential	547,633	20.6%

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 Commercial Sector kWh Sales
Technical Potential	675,422	31.9%
Achievable Potential	495,237	23.4%
Achievable Cost Effective Potential	349,582	16.5%

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%

Table G-4
Vermont Electric Energy Efficiency Potential Study
Annual Fuel Conversion and Total Budget Amounts for the Early Replacement Scenario

Table G-4: Annual Fuel Conversion and Total Utility Budgets for Energy Efficiency - Early Replacement Scenario						
	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Year	Annual Program Budget for Conversion of Electric End Uses to Fossil Fuels	Percent of Total Vermont Program Budget	Annual Program Budget for Energy Efficiency - Residential	Annual Program Budget for Energy Efficiency - Commercial	Annual Program Budget for Energy Efficiency - Industrial	Early Replacement Annual Program Budgets for Energy Efficiency - All Sectors
2006	$7,282,076	8%	$40,168,778	$43,626,081	$3,267,379	$87,062,238
2007	$7,333,022	8%	$40,777,810	$43,807,979	$3,221,986	$87,807,775
2008	$7,385,115	8%	$41,406,443	$43,993,969	$3,208,731	$88,609,143
2009	$7,438,380	8%	$42,055,307	$43,946,438	$3,257,629	$89,259,374
2010	$7,492,843	41%	$14,731,158	$226,057	$3,307,628	$18,264,842
2011	$7,548,532	40%	$15,416,201	$228,636	$3,046,975	$18,691,813
2012	$7,605,474	39%	$16,123,346	$231,274	$3,092,234	$19,446,854
2013	$7,663,696	38%	$16,853,297	$233,971	$3,138,511	$20,225,779
2014	$7,723,229	37%	$17,606,783	$236,728	$3,185,830	$21,029,341
2015	$7,784,102	36%	$18,384,551	$239,548	$3,234,213	$21,858,312
Sum	$75,256,468	16%	$263,523,675	$176,770,680	$31,961,115	$472,255,471
Average annual budget	$7,525,647	16%	$26,352,368	$17,677,068	$3,196,112	$47,225,547
NPV of annual budgets	$54,333,622	14%	$206,970,947	$157,696,960	$23,232,304	$387,900,211

Table G-5
Vermont Electric Energy Efficiency Potential Study
Comparison of Annual Budget Amount for ROB vs. ER Scenario

Table G-5: Comparison of Annual Budget Amounts for Replace on Burnout vs. Early Replacement Scenario				
	Column 1	Column 2	Column 3	Column 4
Year	Annual Program Budget for Energy Efficiency - All Sectors - Replace on Burnout	Annual Program Budget for Energy Efficiency - All Sectors - Early Replacement	Difference	% Difference
2006	$31,537,767	$87,062,238	$55,524,470	64%
2007	$32,174,445	$87,807,775	$55,633,330	63%
2008	$32,864,503	$88,609,143	$55,744,640	63%
2009	$33,638,628	$89,259,374	$55,620,747	62%
2010	$34,436,453	$18,264,842	-$16,171,611	-89%
2011	$34,946,938	$18,691,813	-$16,255,125	-87%
2012	$35,787,372	$19,446,854	-$16,340,518	-84%
2013	$36,653,612	$20,225,779	-$16,427,833	-81%
2014	$37,546,453	$21,029,341	-$16,517,112	-79%
2015	$38,466,711	$21,858,312	-$16,608,399	-76%
Sum	$348,052,882	$472,255,471	$124,202,589	26%
Average annual budget - nominal $	$34,805,288	$47,225,547	$12,420,259	36%
NPV of annual budgets	$249,005,011	$387,900,211	$138,895,200	56%

Table G-6
Vermont Electric Energy Efficiency Potential Study
Benefit/Cost Test Results from the Societal Test for the Early Replacement Scenario

Table G-6: VERMONT SOCIETAL TEST - ELECTRICITY SAVINGS POTENTIAL FOR EARLY REPLACEMENT SCENARIO FOR VERMONT (August 2006)						
Column #	1	2	3	4	5	6
	Present Value of Total Resource Benefits ($2006)	Present Value of Total Measure Incremental Costs ($2006)	Present Value of Vermont Implementation Costs (Staffing, Marketing, Data Tracking & Reporting, etc., $2006)	Present Value Of Total Costs (Col 2 + Col 3)	Net Present Value savings ($2006)	Vermont Societal Test Benefit/Cost Ratio
Residential Sector	$859,405,581	$224,479,122	$51,611,577	$276,090,699	$583,314,882	3.11
Commercial Sector	$526,476,880	$189,710,087	$30,109,964	$219,820,051	$306,656,829	2.40
Industrial Sector	$289,612,700	$15,021,343	$15,721,632	$30,742,975	$258,869,725	9.42
Total	$1,675,495,161	$429,210,552	$97,443,174	$526,653,726	$1,148,841,435	3.18

Table G-7
Vermont Electric Energy Efficiency Potential Study
Benefits and Costs for Energy Star Appliances Only - ROB vs. ER

Table G-7: Benefits and Costs for Energy Star Appliances Only - Replace on Burnout Scenario Compared to Early Replacement

Energy Star Appliances - Replace on Burnout Benefits and Costs

	NPV of BENEFITS				NPV of COSTS					B/C Ratio
	Electric	Non-Electric	Other	Program Total	Administrative	Rebates	Customer	Incentive	Program Total	VT Societal
SUM	$38,839,074.80	$ 107,616,561.65	$ -	$ 146,455,636.45	$ 1,242,472.85	$ 23,480,978.40	$ 18,784,509.18	$ -	$ 43,507,960.44	3.37

Energy Star Appliances - Early Replacement Scenario Benefits and Costs

	NPV of BENEFITS				NPV of COSTS					B/C Ratio
	Electric	Non-Electric	Other	Program Total	Administrative	Rebates	Customer	Incentive	Program Total	VT Societal
SUM	$211,252,508	$135,427,313	$0	$346,679,821	$939,522	$99,174,362	$18,129,678	$0	$118,243,563	2.93

Table G-8
Vermont Electric Energy Efficiency Potential Study
Cumulative Annual MWH Savings for the Early Replacement Scenario

Table G-8: Early Replacement Scenario - Cumulative Annual MWH Savings by Year - Based on Screeing with Vermont Societal Test State of Vermont - August 2006													
	VDPS mWh Sales Growth Assumption for Vermont Before DSM Impacts			Residential Energy Efficiency Savings		Commercial Energy Efficiency Savings		Industrial Energy Efficiency Savings		Total Energy Efficiency Savings (mWh)		Vermont Load Forecast Before DSM	Vermont Load Forecast After DSM
Year	Res. Sector mWh Sales	Comm. Sector mWh Sales	Ind. Sector mWh Sales	mWh Savings	% of Projected Res. mWh Sales	mWh Savings	% of Projected Comm. mWh Sales	mWh Savings	% of Projected Ind. mWh Sales	mWh Savings	% of Projected Total kWh Sales	mWh	mWh
2006	2,202,847	1,937,851	1,657,144	108,184	5%	110,068	6%	30,616	2%	248,868	4%	5,840,336	5,591,468
2007	2,249,698	1,956,990	1,677,887	216,664	10%	220,136	11%	59,949	4%	496,749	8%	5,927,941	5,431,192
2008	2,297,488	1,976,268	1,698,846	325,440	14%	330,204	17%	88,463	5%	744,107	12%	6,016,860	5,272,753
2009	2,346,235	1,995,687	1,720,025	434,511	19%	437,221	22%	116,977	7%	988,709	16%	6,107,113	5,118,404
2010	2,395,957	2,015,247	1,741,425	488,050	20%	429,637	21%	145,491	8%	1,063,179	17%	6,198,720	5,135,541
2011	2,446,672	2,034,947	1,763,047	493,498	20%	410,398	20%	170,179	10%	1,074,075	17%	6,291,700	5,217,626
2012	2,498,398	2,054,789	1,784,894	498,746	20%	391,159	19%	194,866	11%	1,084,771	17%	6,386,076	5,301,305
2013	2,551,154	2,074,773	1,806,965	498,639	20%	370,007	18%	219,554	12%	1,088,200	17%	6,481,867	5,393,667
2014	2,604,959	2,094,899	1,829,264	498,827	19%	353,987	17%	244,241	13%	1,097,055	17%	6,579,095	5,482,040
2015	2,659,832	2,115,167	1,851,792	547,633	21%	349,582	17%	268,929	15%	1,166,144	18%	6,677,781	5,511,638

Table G-9
Vermont Electric Energy Efficiency Potential Study
Cumulative Annual Summer and Winter Peak MW Savings for the Early Replacement Scenario

Table G-9: Early Replacement Scenario - Cumulative Annual Summer and Winter Peak MW Savings - Based on Screening with the Vermont Societal Test

State of Vermont - August 2006

	Residential		Commercial		Industrial		Total Savings		Vermont Peak Load Forecast Before DSM		Vermont Peak Load Forecast After EE Programs		Percent Savings	
Year	Winter Peak MW Savings	Summer Peak MW Savings	Winter Peak MW Savings	Summer Peak MW Savings	Winter Peak MW Savings	Summer Peak MW Savings	Winter Peak MW Savings	Summer Peak MW Savings	Winter Peak Load (MW)	Summer Peak Load (MW)	Winter Peak Load (MW)	Summer Peak Load (MW)	Winter Peak MW Savings	Summer Peak MW Savings
2006	28	51	24	26	9	6	61	83	1,056	979	994.7	895.7	5.8%	8.5%
2007	56	103	49	51	19	12	123	166	1,072	993	949.2	827.3	11.4%	16.7%
2008	84	155	73	77	27	18	184	249	1,088	1,008	903.8	759.1	16.9%	24.7%
2009	112	207	96	102	36	23	245	333	1,104	1,023	859.0	690.8	22.2%	32.5%
2010	134	217	95	102	45	29	275	348	1,121	1,039	846.2	690.9	24.5%	33.5%
2011	151	187	91	99	53	33	296	319	1,138	1,054	841.6	735.1	26.0%	30.3%
2012	169	157	88	96	61	38	318	291	1,155	1,070	837.0	779.2	27.5%	27.2%
2013	185	127	84	91	69	43	338	260	1,172	1,086	834.1	825.9	28.8%	24.0%
2014	202	98	81	86	77	47	359	231	1,190	1,103	830.1	871.9	30.2%	20.9%
2015	224	109	80	84	85	52	389	244	1,207	1,119	818.7	874.7	32.2%	21.8%