FINAL

SUMMARY REPORT OF RECENTLY COMPLETED POTENTIAL STUDIES AND RECOMMENDATIONS FOR MAINE'S ENERGY EFFICIENCY PROGRAMS

Submitted To:

The Maine Public Utilities Commission

ACEEE
American Council for an Energy-Efficient Economy

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EXECUTIVE SUMMARY

E.1 Report Objectives

This report presents the results of a study that extrapolated and summarized the energy efficiency achievable potential for Maine over a 10 year period from 2010-2019. The report was based on a review of 10 recently completed potential studies in northeast states since 2004, and extrapolating the achievable potential results for Maine. Extrapolated achievable potential estimates for Maine are calculated for electricity, natural gas, fuel oil, and propane. The study was completed by Summit Blue Consulting and the American Council for an Energy-Efficient Economy (ACEEE) on behalf of the Maine Public Utilities Commission and completed between August 2009-December 2009.

The major objectives of this study were:

- To identify and summarize completed electrical and or fossil fuel potential studies, or other similar documents, in the northeast and mid-Atlantic states from January 2004 to present.
- Through analysis and modeling, to extrapolate how the results of those studies may be used to estimate Maine's achievable potential and assess current efficiency spending compared to estimated amount required to meet achievable potential.
- To assess fuel-neutral delivery of efficiency services and comment on pros and cons of this implementation approach.
- To review workforce training and extrapolated job creation estimates from efficiency investments.

It is important to note that this study is not a traditional potential study which would have included Maine specific research and field work to estimate energy efficiency potential. A traditional potential study would have taken more time and at a greater expense. Rather, the approach used for this report summarized findings from other regional potential studies and extrapolated results for Maine.

E.2 Summary of Recent Studies and Extrapolation of Potential Energy Savings in Maine

Summit Blue reviewed 10 potential studies completed for Northeastern states since 2004 and prepared a summary of potential study results for electricity, natural gas, oil and propane. A list of these studies is presented in Table 1 below. Data collected from these studies was used to extrapolate the potentially achievable savings by program and sector area for Maine over the next 10 years and gauge the ability of Maine to achieve the potential given current funding levels and existing program designs.

Table 1. List of Studies Reviewed

State	Study Year	Study Title	Fuel Types
Connecticut	Jul-05	Connecticut Natural Gas Commercial and Industrial Energy-Efficiency Potential Study	Natural Gas
Massachusetts	Jul-05	Natural Gas Energy Efficiency Potential in Massachusetts	Natural Gas
New Hampshire	Jul-05	Additional Opportunities for Energy Efficiency in New Hampshire	Electricity, Natural Gas, Oil, Propane
Pennsylvania	Jul-05	Potential for Energy Efficiency, Demand Response, and Onsite Solar Energy in Pennsylvania	Electricity, Natural Gas, Oil, Propane
Rhode Island	Jun-05	Rhode Island Energy Efficiency and Resources Management Council (EERMC): Opportunity Report - Phase I	Electricity
Maine	Jun-05	Maine Power Reliability Program Electric Energy Efficiency and Demand Response Potential Study	Electricity
Vermont	Jun-05	Vermont Energy Efficiency Potential Study for Oil, Propane, Kerosene, and Wood Fuels	Oil, Propane, Kerosene, Wood
Vermont	Jun-05	Vermont Energy Efficiency Potential Study for Electricity	Electricity
Connecticut	Jun-05	Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region	Electricity
New England	Jun-05	Economically Achievable Energy Efficiency Potential in New England	Electricity, Natural Gas

Figure 1 below, shows the estimate from each study of achievable potential for all fuel types on an incremental annual basis (annual first-year savings as opposed to total lifetime savings). As shown in Figure 1, the median annual achievable potential for electricity is 1.3% of forecast annual sales, the median for natural gas is 1.2%, the median for propane is 0.8% and the median for fuel oil is 1.1% per year. Estimates presented in the graph below illustrate a range of potential savings for each fuel type. For instance, the 2009 study of natural gas potential in Massachusetts estimates savings of 2.5% per year, while the 2009 Pennsylvania study estimates natural gas savings potential of only 0.6%, less than one-fourth that of Massachusetts.

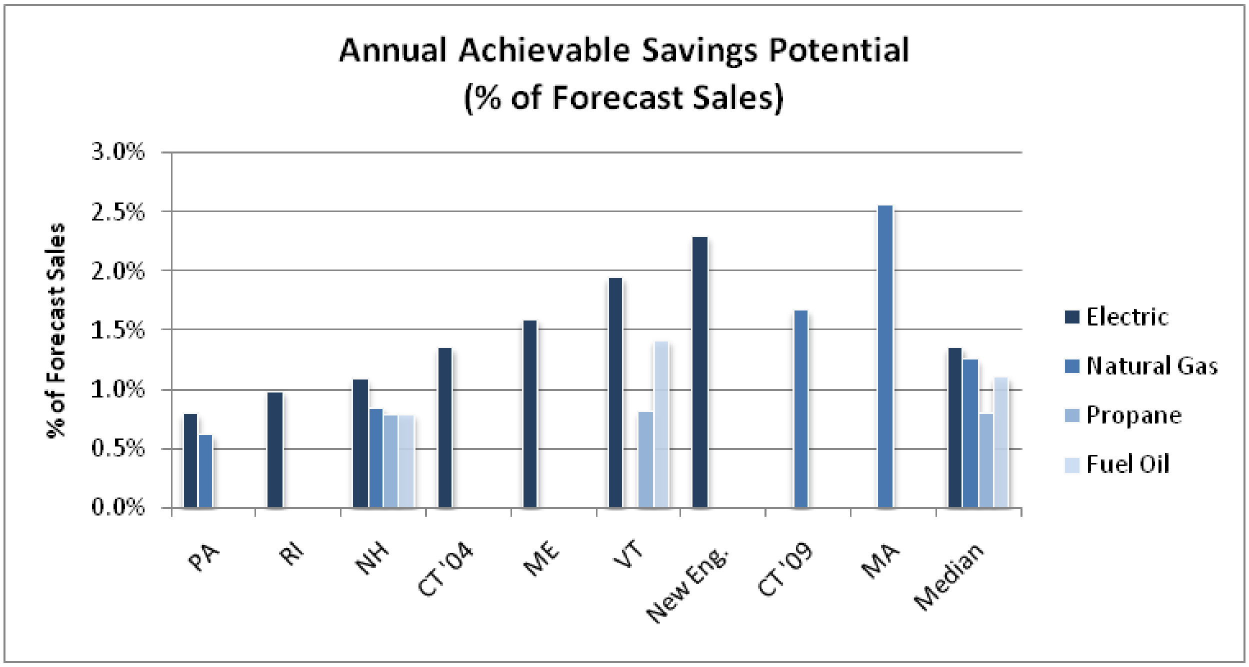

Figure 1. Annual Achievable Savings Potential for All Fuel Types

In addition to potential energy savings, most studies also estimate the potential cost of capturing those savings. Figure 2 below shows the annual cost of achievable potential savings for each fuel type. The results have been normalized here for the sake of comparison across all fuel types by presenting the cost ($2009) per MMBtu of savings.

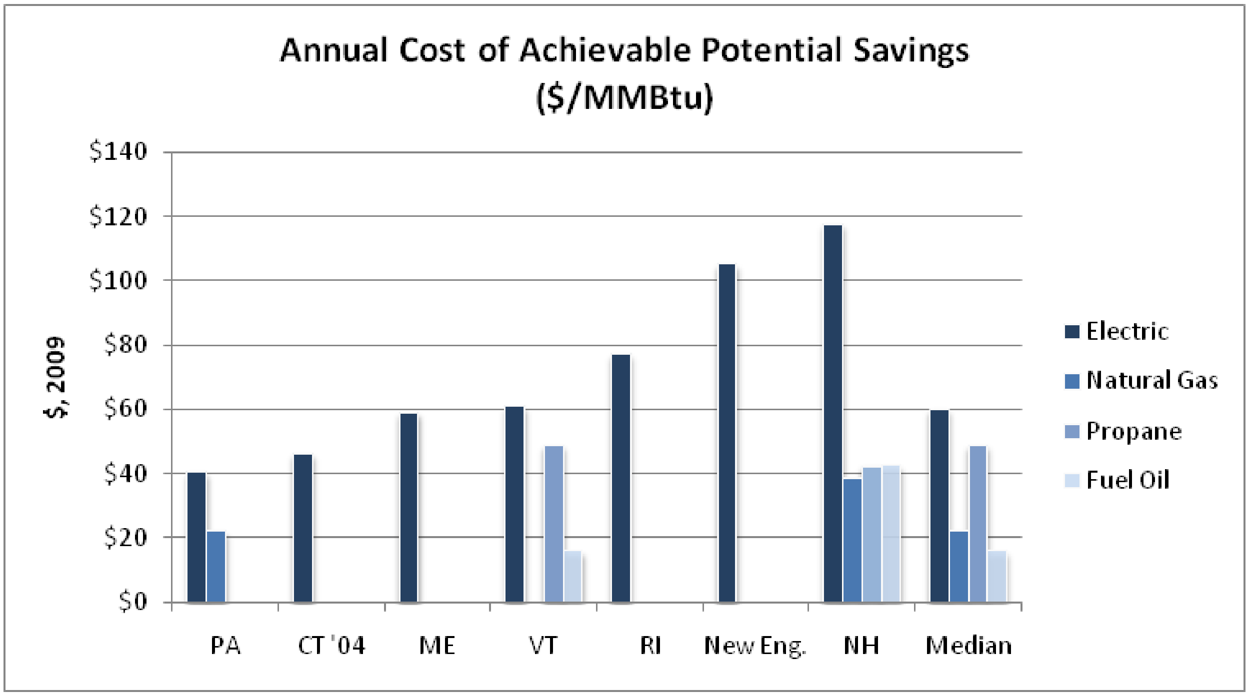

Figure 2. Annual Cost of Achievable Potential Savings for All Fuel Types

Data collected from the studies summarized above were used to extrapolate the achievable potential savings by program and sector area for Maine over the next 10 years. The data were also used to gauge the ability of Maine to achieve the potential at current funding levels with existing program designs and at higher funding levels with enhanced program designs.

This study employed two approaches to extrapolating the achievable potential energy savings for Maine, a "simple approach" based on the median values from the studies reviewed above and a "best fit-high" approach based on a selection of results from specific studies.

Simplified Approach

For each study identified in Section 2, Summit Blue detailed key study inputs and results including: study area, study period, estimated potential for study period, potential as percent of forecast sales for study period, and averaged annual potential as percent of sales. Median values of energy savings potential as a percentage of total forecast sales were calculated for each fuel type, as reported in Section 2 above. The median achievable potential savings (as percentage of forecast sales) was then applied to the forecast sales for Maine. The median first year cost per unit of energy saved was applied to the estimated savings results to estimate the total cost of capturing the potential savings.

Best Fit-High Approach

Given the limitations inherent in the simplified approach, an additional extrapolation was conducted to gauge the achievable potential extrapolated for Maine based on a selective application of results that the Summit Blue team believe to be both realistic and most appropriate for Maine, yet, on the aggressive and high side of reported savings potential. This approach recognized and defined the relationship between key features of Maine with those of the other study areas and, thus, the relationship between Maine's potential and the other study results.

This approach involved collecting additional data for the most relevant studies on appliance and technology saturation data, building stock, energy use, and avoided costs and considered key features of each study such as the method (cost-effectiveness test) used to define economic potential and the scope. Summit Blue also identified relevant DSM program history and results for each study area. Summit Blue then collected similar data for Maine (from Efficiency ME, Unitil, and EIA) and determined the study areas that are most applicable to Maine.

Table 2, below, compares the actual potential savings and cost ($2009) associated with each approach to extrapolating the potential for Maine. Using the simplified approach, Summit Blue estimates the cost to achieve potential is approximately $558 million over 10 years. Applying the best-fit high approach, which will yield larger savings, the estimated cost over 10 years is 686 million.

Table 2. Savings and Cost to Achieve Maine Potential (2010-2019)

Fuel Type	Average Annual Savings	Average Annual Cost ($ Millions)	10 Year Total Savings	10 Year Total Cost ($ Millions)
SIMPLE APPROACH				
Electricity (MWh)	170,032	$35.30	1,700,325	$353
Natural Gas (MCf)	53.3	$1.60	533	$16.10
Fuel oil/Propane (Gal)	4,684,153	$18.91	46,841,532	$189.10
TOTAL	**---**	**$55.81**	**---**	**$558**
BEST FIT-HIGH APPROACH				
Electricity (MWh)	250,778	$51.00	2,507,882	$510
Natural Gas (MCf)	109	$3.30	1,090	$33
Fuel oil/Propane (Gal)	5,767,188	$14.30	57,671,888	$143
TOTAL	**---**	**$68.60**	**---**	**$686**

Figure 3 below shows a comparison of the existing DSM budgets versus the budget required to achieve the "Best Fit-High" potential savings, as shown in Table 2 above. The stacked bar graph shows the estimated budget that is needed to achieve the best fit-high potential for each fuel type. It is estimated that roughly $51 million for electricity, $3.3 million for gas, and $14.3 million for fuel oil and propane will be needed per year to achieve the potential energy savings projected under the best fit-high approach. The overlaid line graph, however, shows current levels of DSM spending, demonstrating a substantial shortfall totaling roughly $42 million per year.

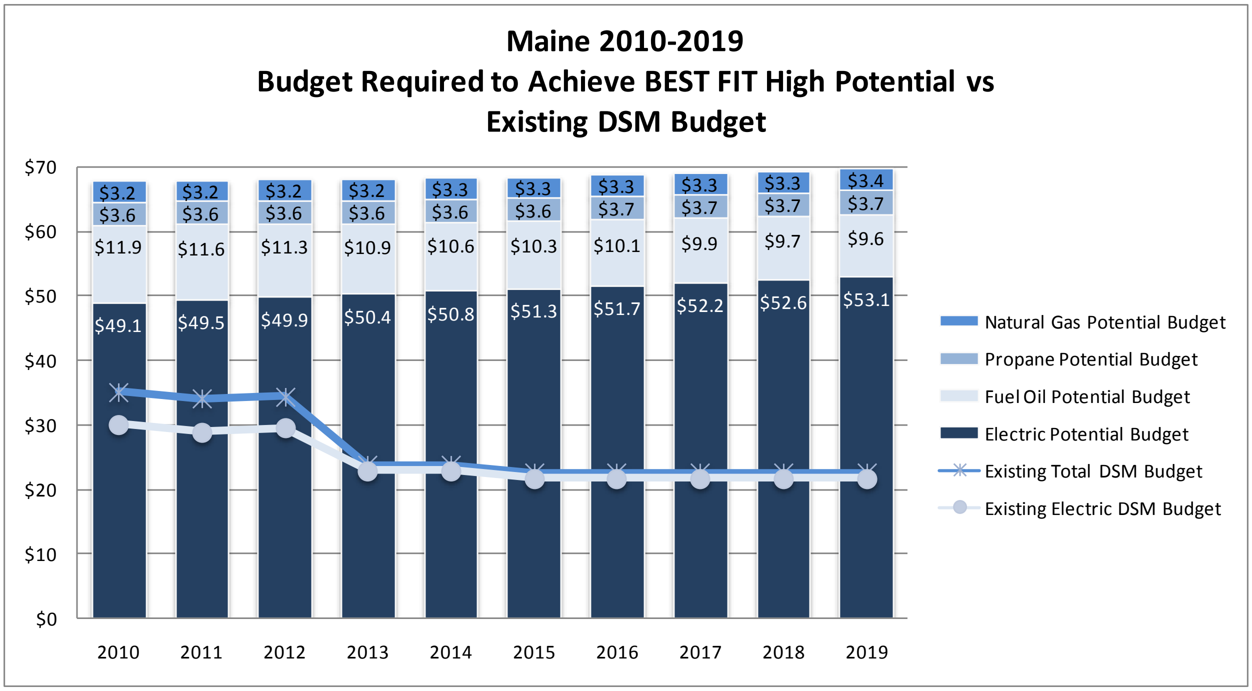

Figure 3. Comparison of Existing DSM Budgets vs. Budget Required to Achieve Best Fit High Potential

E.3 Benchmarking Maine's 2007 Program Results

This section of the report presents the results from a benchmarking analysis process to compare the DSM savings as a percent of sales and the DSM costs as a percent of revenue, across a sample of electric and natural gas DSM programs. To identify common best practices of top performers, the analysis compares detailed program results by customer sector of those utilities identified as achieving high levels of DSM savings for near or below median costs.

Table 3 shows the median results for all the reviewed organizations and the Northeastern organizations as well as Efficiency ME's results for electricity DSM spending, savings, costs, and electric energy costs over all customer sectors.

Table 3. Overall Results for Electric Utilities in 2007

	Spending as % of Revenue	Electric Energy Savings as % of Sales	Peak Demand Savings as % of Peak Demand	Cost of Energy $/kWh	Cost of First Year Savings	
					$/kWh	$/kW
All Region Median	1.5%	0.8%	0.6%	$0.10	$0.18	$774
Northeast Median	1.6%	0.9%	0.6%	$0.13	$0.25	$1,413
Efficiency ME	1.1%	0.8%	0.4%	$0.10	$0.14	$1,588

For the 20 electricity DSM programs reviewed, the overall median electric energy savings as a percentage of annual sales is 0.8%, and the median first year costs for electric energy savings is $0.18/kWh, but the best practice organizations, i.e., those with the largest relative energy savings and below median costs achieved their energy savings at about 1.5% of annual sales. The median for peak demand savings as a percentage of peak demand 0.6%, and the median cost is $774/kW; however, the organizations with the largest relative peak demand savings and below median costs saved about 1.2% of peak demand.

The scatter plot in Figure 4 below illustrates where each organization falls relative to median electric energy savings and median costs of savings. Energy savings as a percentage of sales is on the horizontal axis; first year cost of energy savings is on the vertical axis; and the axes are set at the median values. Thus, the organizations in the bottom right quadrant are the ones that achieved above median energy savings at costs below the median, i.e. high savings, low costs.

Figure 4. Scatter Plot of 2007 Electric Energy Savings and First Year Costs ($/kWh)

Efficiency ME's overall results for electric DSM are close to the typical results of the organizations reviewed. Efficiency ME achieved electric energy savings, as a percentage of sales, of 0.77%, just below the median for all the utilities and the median for the Northeastern utilities, at first year costs of $0.14/kWh, also below the median cost for all utilities and the median cost for the Northeastern utilities.

Most of the benchmarked organizations have been conducting electricity DSM programs for an extended period. Since these organizations have been conducting electricity DSM programs, savings have been realized from a lot of the ―low hanging fruit among DSM measures, such as T12 lighting system conversions to T8 systems.

Table 4 shows the median results for all the reviewed organizations and the Northeastern organizations as well as Unitil (ME) 08's results for natural gas DSM spending, savings, costs, and energy costs over all customer sectors.

Table 4. Overall Results for Natural Gas Utilities in 2007[1]

	Spending as % of Revenue	Natural Gas Savings as % of Sales	Cost of Energy $/Mcf	First Year Cost of Savings $/Mcf
All Region Median	1.4%	0.6%	$12	$32
Northeast Median	1.4%	0.5%	$15	$55
Unitil (ME) 08	1.2%	0.5%	$17	$41

For the 14 natural gas DSM programs reviewed, the overall median DSM spending as percentage of revenue is 1.4%, the median energy savings as a percentage of annual sales is 0.6%, and the median first year costs for energy savings is $32/MCF, but the organizations with the largest relative energy savings and below median costs achieved their energy savings at about 1.0% of annual sales.

The scatter plot in Figure 4 below illustrates where each organization falls relative to median natural gas savings and median costs of savings. Natural gas savings as a percentage of sales is on the horizontal axis; first year cost of natural gas savings is on the vertical axis; and the axes are set at the median values. Thus, the organizations in the bottom right quadrant are the ones that achieved above median natural gas savings at costs below the median, i.e. high savings, low costs.

[1] 2008 data was used for Unitil (ME) because at the time of collection its 2008 annual report was available as well as its revenue and sales data from the EIA176 database.

Figure 5. Scatter Plot of 2007 Natural Gas Savings and First Year Costs ($/MCF)

E.4 Assessment of the Pros/Cons of Electric and Fossil Fuel Joint DSM Delivery

As the Maine Public Utilities Commission (PUC) considers the most effective approach to implementing enhanced demand-side management (DSM) programs throughout the state, it is important to examine best practices and lessons learned from DSM programs in other states. The question of whether fuel and electric programs should be administered jointly is one issue that several states and utilities have attempted to address over the past several years, and one that Maine is rightfully taking into account in its deliberations.

Summit Blue/ACEEE has examined combined electric-fuel programs[2] in several states, and recommends that electric and fuel efficiency programs be administered in coordination with each other for all customer classes, and preferably as closely as possible to maximize efficiency in program delivery and simplicity in

[2] *Combined Electric-fuel programs* are energy efficiency programs that seek efficiency improvements for both electricity consumption and fuel (including natural gas, fuel oil, propane, or other fuels) consumption.

customer communications. We find that some of the most successful electric and fuel programs are administered by a single entity. However, some states have shown that combined electric-fuel programs can still be very successfully executed by separate entities, as long as all associated financial and political issues are thoughtfully and thoroughly ironed out. While having dedicated funding sources for both electricity *and* fuel is highly beneficial, historically, energy efficiency charges have been politically difficult to mandate. Even if a state includes a system benefit charge (SBC) on electric ratepayer bills, a lack of similar funding from fuel ratepayers may very well preclude successfully integrated combined electric-fuel programs. A program with a dedicated source of funding for both electricity and fuel programs is likely to have the most success. Heating fuel funding could come from a SBC, allocation of RGGI proceeds, or some other source to be determined. In Vermont, Efficiency Vermont undertakes programs that address both electricity and fuel consumption, though natural gas efficiency funds come exclusively from Vermont Gas ratepayers, only 15 percent of the heating fuel consumers in the state. Efficiency Vermont runs fuel-blind programs for oil and propane users as well, with no dedicated funding, and can therefore not achieve savings as deeply as it would be able to with a dedicated funding source from oil consumption expenditures. Similarly, Massachusetts offers fuel-blind services to oil customers who are also electric IOU customers. Connecticut supplements its non-natural gas fuel services with a flat service charge to all *Home Energy Solutions* program participants. And New Jersey has recently begun offering oil and propane services because of a new surge funding through ARRA. In order for all consumers to continue to remain eligible for fuel-blind services, efficiency programs for all fuel types should have some form of allocated funding.

As one program administer noted, energy consumers care about how much they are paying for their energy, typically not about what fuel source their energy is coming from. Consumers should be given an array of savings opportunities from a simple, one-stop shop vendor. This streamlined process will facilitate program implementation, help to achieve savings goals, make customer participation more simplified and favorable, and therefore increase participation, enhancing all such programs while augmenting efficiency gains.

E.5 DSM Workforce and Delivery Recommendations

Achieving aggressive DSM goals in Maine depends on a highly skilled and capable Maine-based workforce to design, install, and deliver efficient products and services. As the demand for energy efficiency and renewable energy services in the residential and commercial sectors grows it will bring new opportunities for existing companies, provide start-up opportunities for new Maine based companies, and motivate out-of-state companies to establish offices in Maine to deliver services to Maine customers.

Maine can capitalize on this opportunity to create lasting "green jobs" by identifying the necessary skill sets to deliver the potential DSM programs and investing in training to build a workforce with the proper skills and certifications. Summit Blue recognizes that a comprehensive assessment on the workforce requirements in the near and long-term future is beyond the scope of this study, so we have utilized a multi-pronged approach to identify priorities and model estimated workforce needs. This section of the report includes:

- An overview of the workforce development needs including job certifications, workforce sectors and examples of successful training programs.
- Estimates of the job creation impacts of Maine's potential DSM initiatives.

In summary, achieving Maine's potential for DSM implementation will benefit the economy through the creation of jobs and increased economic activity, but a strong focus on workforce certification, training and continued support of traditional skilled occupations will be required. Expenditures on energy efficiency programs, at a level to achieve the potential identified from this study, in the state of Maine has the potential to create between 900 -1500 jobs in the next ten years, as shown in Table 5.

Table 5. Summary of Maine DSM Job Creation Estimates

Job Creation Model	Jobs/$M	Maine Jobs Created (10 Yr Total)
RDEE Toolkit	16 (Residential) 11 (Commercial & Industrial)	900
PERI Report: Green Recovery	9.4 (Direct) 5.9 (Indirect) 5.0 (Induced)	1300
AESC New England	22.9 (Electric DSM) 19.1 (Gas DSM)	1500
Average		**1200**

Geographic challenges also exist in Maine, as a large part of the population is situated along the southern coast. In the interest of rapidly and aggressively achieving DSM potential, Summit Blue recommends that Maine focus workforce development and training on these areas of higher population density first.

Increased spending on DSM programs and greater penetration of energy efficient products and services in Maine's economy will spur a response from the private sector. Trained contractors currently working in neighboring states with aggressive DSM programs are likely to move into the state and create a local, sustainable workforce. One of the important tasks and challenges for Maine is to help facilitate this evolution of a statewide DSM workforce. The recommendations found in this chapter and provided by referenced organizations for training programs and industry events should be investigated in greater detail so Maine can boost its economy and remain among leading states in the area of energy efficiency.

1 INTRODUCTION

Over the past decade, U.S. ratepayer-funded energy efficiency programs for electricity and natural gas customers has entered a new era of renewed focus. From 1998 to 2007, for example, funding on electricity efficiency programs more than doubled from $900 million to $2.2 billion (Eldridge et al. 2009). This growth can mostly be attributed to a small group of states, with fifteen states typically accounting for 80% of spending in recent years. Many signs point to a growing number of states contributing more substantially to the national energy efficiency landscape. A recent analysis of state-level energy efficiency policies estimates that ratepayer-funding for electric and natural gas energy efficiency programs will rise from $3.1 billion in 2008 to between $5.4 billion and $12.4 billion by 2020 and that a large portion of the projected increased spending will come from states that have been relatively minor players in the industry (Barbose, Goldman, and Schlegel 2009).

Maine has already showed signs that it is part of this rising groups of states. In *The 2009 State Energy Efficiency Scorecard*, Maine jumped 9 spots to 10th overall, putting the state in the "most improved" category (Eldridge et al. 2009). The report rates states on a comprehensive set of policies and programs to encourage greater energy efficiency, including ratepayer-funded efficiency programs, building energy codes and compliance efforts, transportation policies, combined heat and power (CHP), state government initiatives, and appliance efficiency standards. Several recent efforts by Maine contributed to the state's improvement on the scorecard, including adoption of the most recent national model building energy codes for residential (IECC) and commercial (ASHRAE 90.1) construction statewide and land-use planning management. The efforts of Efficiency Maine also moved the state up in the rankings for the category of ratepayer-funded energy efficiency programs and policies. Maine's spending on electricity programs, measured as a percentage of utility revenues from electricity sales, increased from about 0.75% in 2006 to 1% in 2007, which moved the state to 15th in this category. As other states continue to raise the bar, however, Maine will have to step up the pace to stay in this top tier of states on energy efficiency accomplishments.

This report presents the results of a study that extrapolated and summarized the energy efficiency achievable potential for Maine over a 10 year period from 2010-2019. The report was based on a review of 10 recently completed potential studies in northeast states since 2004, and extrapolating the achievable potential results for Maine. Extrapolated achievable potential estimates for Maine are calculated for electricity, natural gas, fuel oil, and propane. The study was completed by Summit Blue Consulting and the American Council for an Energy-Efficient Economy (ACEEE) on behalf of the Maine Public Utilities Commission and completed between August 2009-December 2009.

The major objectives of this study were:

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- Through analysis and modeling, to extrapolate how the results of those studies may be used to estimate Maine's achievable potential and assess current efficiency spending compared to estimated amount required to meet achievable potential.
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It is important to note that this study is not a traditional potential study which would have included Maine specific research and field work to estimate energy efficiency potential. A traditional potential study would have taken more time and at a greater expense. Rather, the approach used for this report summarized findings from other regional potential studies and extrapolated results for Maine.

1.1 Report Organization

The remainder of this report is divided into the following sections:

Section 2 Review of Recent Potential Studies and Extrapolation of Achievable Potential Savings in Maine presents a summary of the results from recently completed potential studies in the Northeast.

Section 3 Benchmarking Maine's 2007 Program Results provides a discussion of benchmarking of Maine's current efficiency programs in terms of savings and costs compared to other regional and nationally acclaimed energy efficiency programs.

Section 4 Assessment of Pros/Cons of Electric and Fossil Fuel Joint DSM Delivery discusses the pros and cons of joint and targeted delivery of both electric and fossil fuel efficiency programs.

Section 5 Workforce Development and Job Creation reviews available training opportunities and essential industry related certifications and estimates job creation through energy efficiency investments.

Section 6 Findings and Recommendations presents a summary of the results of this study

Appendix A: Comparative Matrix of Potential Studies presents a comparative matrix of data collected from the potential studies reviewed in Section 2.

Appendix B: Potential Study Summaries presents a detailed summary of data collected from each of the potential studies reviewed in Section 2.

2 REVIEW OF RECENT POTENTIAL STUDIES AND EXTRAPOLATION OF ACHIEVABLE POTENTIAL SAVINGS IN MAINE

The following section details the results from Summit Blue's review of energy efficiency potential studies conducted in the Northeast since 2004, and the resulting extrapolation of achievable potential energy savings for Maine. In order to extrapolate potential energy savings for Maine over the next ten years, we first prepared a comparative matrix summarizing potential savings for electricity and fossil fuels from each of the studies selected (see Appendix A: Comparative Matrix of Potential Studies). From each study we collected the actual savings estimates, forecast sales at the end of the study period, cost to achieve those savings, as well as information about study scope, methodology, assumptions, and limitations. This analysis, by design, was restricted only to include potential savings resulting from utility program activities. Savings from codes and standards, combined heat and power opportunities, or demand response programs were excluded from the analysis. Table 6below presents a summary of the studies included in this analysis.

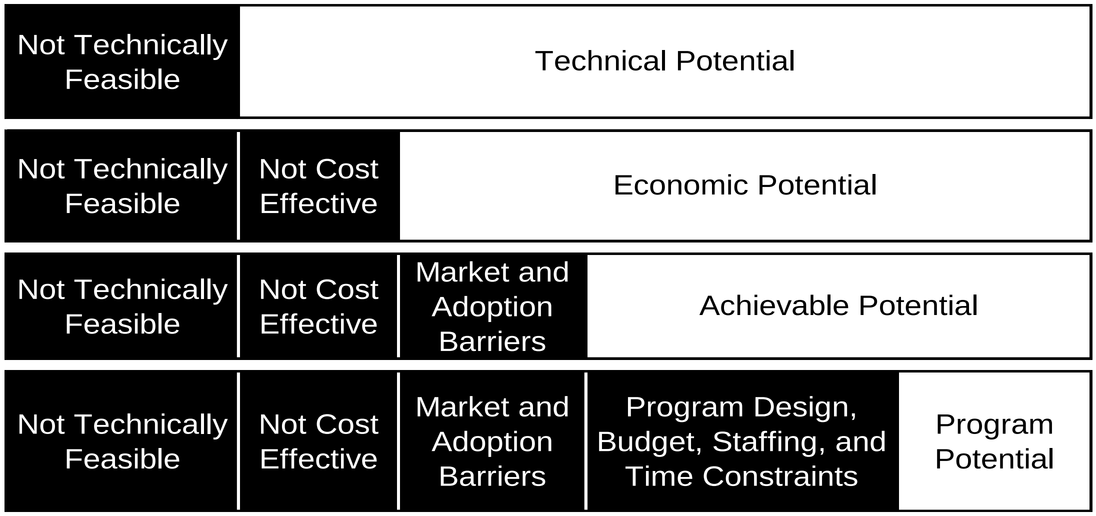
Table 6. Summary of Potential Studies Reviewed

State	Study Year	Study Period	Study Title	Sector	Fuel Types	Author
CT	2009	2009-2018	Connecticut Natural Gas Commercial and Industrial Energy-Efficiency Potential Study	C, I	Natural Gas	Kema
MA	2009	2009-2018	Natural Gas Energy Efficiency Potential in Massachusetts	R, C, I	Natural Gas	GDS
NH	2009	2008-2018	Additional Opportunities for Energy Efficiency in New Hampshire	R, C, I	Electricity, Natural Gas, Oil, Propane	GDS
PA	2009	2008-2025	Potential for Energy Efficiency, Demand Response, and Onsite Solar Energy in Pennsylvania	R, C, I	Electricity, Natural Gas, Oil, Propane	ACEEE
RI	2008	2009-2018	Rhode Island Energy Efficiency and Resources Management Council (EERMC): Opportunity Report - Phase I	R, C, I	Electricity	Kema
ME	2008	2007-2017	Maine Power Reliability Program Electric Energy Efficiency and Demand Response Potential Study	R, C, I	Electricity	GDS

State	Study Year	Study Period	Study Title	Sector	Fuel Types	Author
VT	2007	2007-2016	Vermont Energy Efficiency Potential Study for Oil, Propane, Kerosene, and Wood Fuels	R, C, I	Oil, Propane, Kerosene, Wood	GDS
VT	2007	2007-2016	Vermont Energy Efficiency Potential Study for Electricity	R, C, I	Electricity	GDS
CT	2004	2003-2012	Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region	R, C, I	Electricity	GDS
New Eng.	2004	2004-2013	Economically Achievable Energy Efficiency Potential in New England	R, C, I	Electricity, Natural Gas	OEI

2.1 Types of Potential

As detailed in Figure 6, there are four major types of energy efficiency potential: (1) *technical* potential, the amount of energy efficiency achieved from all technically feasible efficiency opportunities/measures (2) *economic* potential, the amount of energy efficiency available that is cost effective, (3) *achievable* potential, the amount of energy efficiency available under current market conditions and available investments, and (4) *program* potential, the amount of energy efficiency available given limited resources, available time and duration of the efficiency program planning period. This study is focused on estimating cost-effective *achievable potential*.



Reproduced from "Guide to Resource Planning with Energy Efficiency November 2007" written by the US EPA.

Figure 6. The Four Stages of Energy Efficiency Potential

Where available, savings estimates for each of these types were analyzed in this study, though the focus was on achievable potential. Many of the potential studies reviewed define and quantify efficiency potential in slightly different ways. Some studies analyze different measures and program types, different energy prices and avoided costs influence cost-effectiveness, and some employ different timelines which affect the measures chosen and savings estimated. The methodology employed for calculating technical and economic potential was similar for most of the studies reviewed. Estimates of achievable potential, however, varied from study-to-study according to various program parameters, such as forecasted market adoption barriers, even in the context of aggressive DSM budgets.

The differences between the types of potential estimates (technical, economic, achievable) are noteworthy because they indicate the extent to which current technologies, policies and programs are capable of capturing the total amount of achievable potential. The technical potential results show the highest potential savings estimates, as expected, since it is a measure of the amount of energy efficiency achieved from all technically feasible efficiency opportunities/measures, absent consideration of cost or market considerations. The economic potential defines that portion of the technical potential that is cost-effective (typically according to the Total Resource Cost). Achievable potential is that portion of the economic potential that is obtainable given current market conditions and aggressive budgets and comprehensive program designs. For instance, most studies reviewed estimated that the average achievable potential for electric savings tended to be roughly 80% of the economic potential. The average achievable potential for natural gas, however, was estimated to be only 57% of the cost-effective economic potential.

In calculating achievable energy savings potential, most studies followed a general approach outlined below:

- Forecast baseline energy consumption over the study period
- Characterize efficiency measures (determine energy savings, cost, etc)
- Screen measures using a common cost-effectiveness test (most used the TRC)
- Estimate realistic market penetration of each measure by the end of the study period
- Calculate total savings for all cost-effective measures over study period, given penetration rate

For the sake of comparison, this analysis has chosen the most appropriate type of achievable potential from each study, while accounting for key differences between the studies as noted in the section below.

2.2 Similarities and Differences

The following section discusses a high level overview of similarities and differences between the potential studies reviewed for this report.

Study Length: Most of the studies reviewed in this analysis estimated potential savings for all sectors (residential, commercial and industrial) over a 10-year period.

Data Sources: The majority of studies used secondary data to characterize measures, determine measure saturation rates, fuel consumption forecasts and utility avoided costs. For its 2009 New Hampshire potential study, GDS Associates conducted phone surveys and site visits that collected data on measure penetration and customers' likelihood of purchasing efficiency measures. This data was used to develop a "potentially obtainable" scenario that discounts the achievable potential scenario to account for customer behavior. This resulted in estimates of achievable potentially that were noticeably lower than the other studies, which did not account for customer behavior.

Scope of Measures: The Total Resource Cost (TRC) test was the cost-effectiveness test most often employed to screen measures. The actual number of measures included, however, varied widely from 91 measures in Pennsylvania 2009 (electric) to 278 in Connecticut 2004 (electric). While most studies only included measures currently commercially available, other studies accounted for new technologies, reductions in measure costs, or the projected impacts of building codes and standards.

Authorship: Of the ten different studies reviewed in this analysis, there were only four different study authors. GDS Associates alone conducted six of those studies.

Program Penetration Rates: Studies conducted by GDS Associates (and most other studies) assumed an achievable penetration rate of 80% of the economically achievable potential at the end of the study period for each sector across all fuel types. The authors cite prior experience and surveys of industry experts in justifying this high rate of penetration.

2.3 Summary of Potential Results

Figure 7, below, shows the estimate from each study of achievable potential for all fuel types on an incremental annual basis (annual first-year savings as opposed to total lifetime savings). For the sake of comparison, the savings estimates have been normalized to account for different study lengths and service territories by presenting energy savings potential as an annual percentage of total forecast sales. Results are reported using median values as it is a better indication of central tendency than the average values.

As shown in Figure 7, the median annual achievable potential for electricity is 1.3% of forecast annual sales, the median for natural gas is 1.2%, the median for propane is 0.8% and the median for fuel oil is 1.1% per year. Estimates presented in the graph below illustrate a range of potential savings for each fuel type. For instance, the 2009 study of natural gas potential in Massachusetts estimates savings of 2.5% per year, while the 2009 Pennsylvania study estimates natural gas savings potential of only 0.6%, less than one-fourth that of Massachusetts. Variations between studies can be partially explained by examining the particular methodology employed by each study, history or prior DSM investment, avoided costs, role of fuel-switching, and other factors which influence achievable potential. These variations in potential savings estimates will be discussed further in Section 2.4.

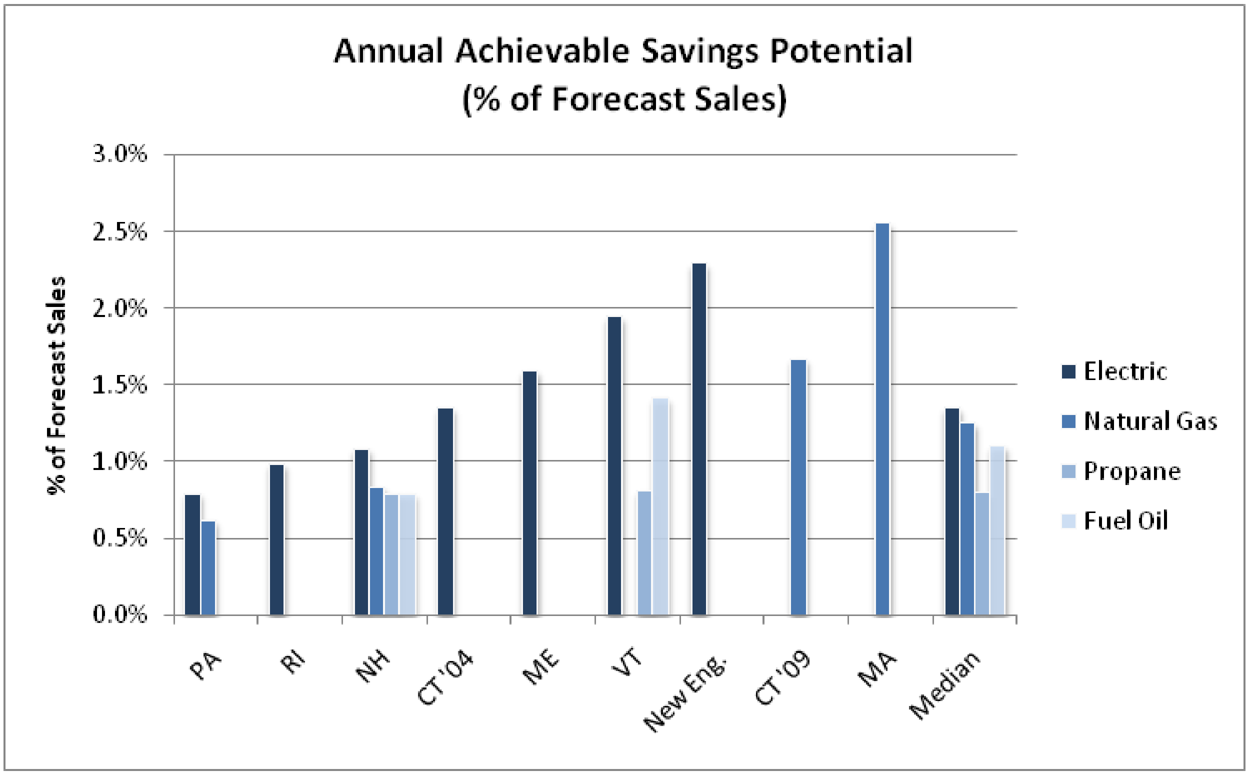


Figure 7. Estimates of Achievable Potential for all Fuel Types

Summary Table Interpretation

The following presents an overview of the contents of the summary tables seen throughout the rest of this section:

- **State:** State the study was conducted in.
- **Study Year:** Year the study was published.
- **Study Period:** Time period analyzed in study.
- **Analysis Period:** Duration of study analysis
- **Energy Savings Potential:** Estimate of potential energy savings reported by "technical", "economic" and "achievable" potential types. Savings estimates are represented as a percentage of the forecast future sales for each state so that estimates can be compared across states with different sized service territories.
- **Annual Achievable Energy Saving by Sector:** Estimate of energy savings potential shown by sector (customer class). Savings estimates are presented as a percentage of the total forecast sales to demonstrate the portion of total savings potential attributed to each sector.
- **Cost of Achievable Potential Savings:** Estimates of the costs to achieve potential savings on an annual and cumulative basis, including administrative, incentive and customer costs. The cost of potential savings are also presented as the cost per unit of conserved energy (ex. $/kWh) so that savings and cost estimates can be compared for different service territories. Costs per unit saved are reported as first year costs per unit of energy saved in that first year. This is as opposed to reporting lifetime costs, which would reflect initial cost, however, adjusted on the basis of lifetime energy savings.

2.3.1 Electric Potential Savings and Cost

Table 7 below summarizes the results of seven different studies that included estimates of electric efficiency potential. Technical, economic and achievable estimates of "Energy Savings Potential" are shown below for each study, where available, along with the cost of achievable potential savings.

The technical potential results show the highest potential savings estimates, as expected, since it is a measure of the amount of energy efficiency achieved from all technically feasible efficiency opportunities/measures, absent consideration of cost or market considerations. The range of estimates from studies that reported technical potential was between 24% in Connecticut to 35% in Vermont, with a median value of 28%. Most studies generally agree on how to define technical potential, which is partly reflected in the relatively narrow range of technical potential results. Summit Blue believes the difference with the Vermont study is the result of the studies' inclusion of potential savings from aggressive fuel switching, a measure that was not addressed in most of the other studies. Estimates of achievable potential ranged from 7.9% (0.8% annually) of forecast sales in PA to 22.9% (2.3% annual) in New England as a whole, with a median of 13.4% (1.3% annually) of forecast sales per year.

Table 7. Summary of Results from Electric Potential Study Review

Fuel Type: Electricity				Energy Savings Potential (% of Total Forecast Sales)				Annual Achievable Energy Savings by Sector (% of Total Sales)			Cost of Achievable Potential Savings		
				Tech.	Econ.	Achievable		Res	Com	Ind	Annual	Total	Total $/kWh
State	Study Year	Study Period	Analysis Period (years)	TOTAL	TOTAL	TOTAL	ANNUAL				($M, 2009)	($M, 2009)	($M, 2009)
PA	2009	2008-2025	10	--	27.3%	7.9%	0.8%	0.3%	0.3%	0.2%	$203	$3,663	$0.14
RI	2008	2009-2018	10	28.0%	24.0%	9.8%	1.0%	0.4%	0.5%	0.2%	$20	$201	$0.26
NH	2009	2009-2018	10	27.6%	20.5%	10.8%	1.1%	0.5%	0.4%	0.2%	$56	$565	$0.40
CT	2004	2003-2012	10	24.0%	--	13.4%	1.3%	0.5%	0.6%	0.2%	$70	$702	$0.16
ME	2008	2008-2017	10	--	--	15.9%	1.6%	0.5%	0.8%	0.3%	$30	$305	$0.20
VT	2007	2006-2015	10	34.6%	--	19.4%	1.9%	0.9%	0.7%	0.4%	$27	$267	$0.21
New Eng.	2004	2004-2013	10	--	--	22.9%	2.3%	0.8%	1.4%		$1,205	$12,050	$0.36
Median				**27.8%**	**24.0%**	**13.4%**	**1.3%**	**0.5%**	**0.6%**	**0.2%**	**$56**	**$565**	**$0.21**
Mean				**28.5%**	**23.9%**	**14.3%**	**1.4%**	**0.6%**	**0.7%**	**0.2%**	**$230**	**$2,536**	**$0.25**

Figure 8 below more clearly illustrates the variation in cumulative annual energy savings as a percent of total forecast sales across all studies, as reported in Table 7. Results are presented on a "cumulative annual" basis, which refers to the sum of each year's first-year savings over the entire study period. These results are meant to show a comparison between technical, economic and achievable potential for each study and have been normalized to account for different study lengths.

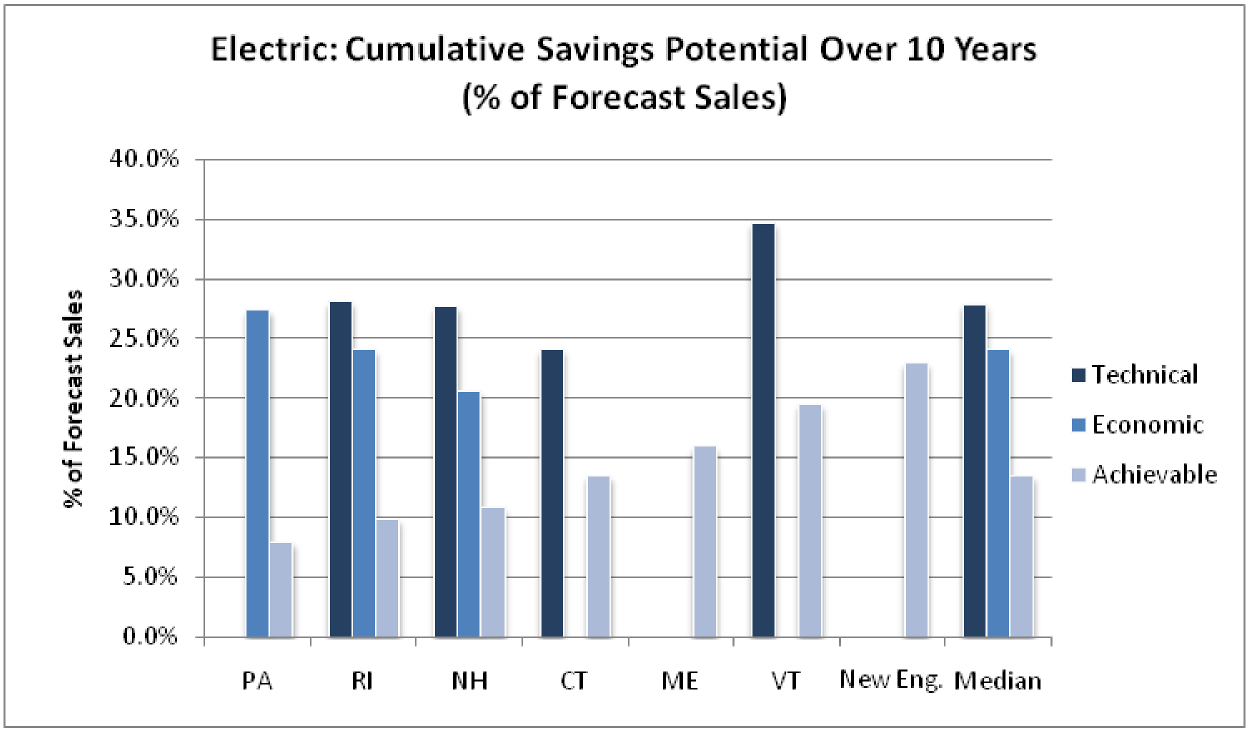


Figure 8. Cumulative Annual Electric Savings Potential

Figure 9 shows estimates of achievable potential, or that portion of the economic potential that is realistic given real-world barriers to measure adoption, and range from a low of 0.8% per year in Pennsylvania to a high of 2.3% per year in New England, while the median potential from these studies is 1.3% of the forecasted annual load. Unlike technical and economic estimates, achievable potential may vary widely from one study to the next based on actual differences in potential across different service territories, or based on differences in scope, method, and programmatic assumptions

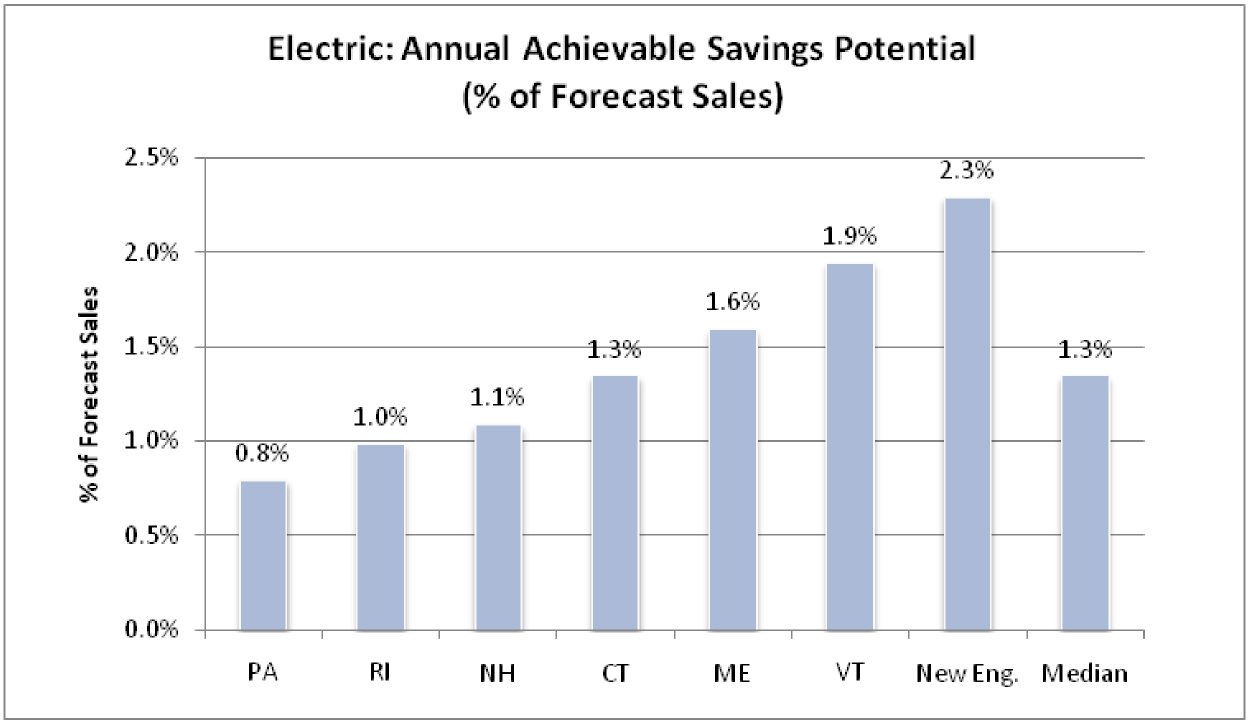


Figure 9. Annual Achievable Electric Savings Potential

All of the studies but one (PA) predict annual achievable savings levels greater than 1.0% of annual forecast sales as forecasted over a ten year period. Three of the seven studies estimate annual achievable greater than 1.5% per year, and only one study identified average annual achievable potential greater than 2% per year.

The 2004 study of economically achievable potential in New England, however, reported potential annual savings of 2.3%, though the report did not present any discussion of the methodology employed to determine those savings.

The 2009 study conducted in Pennsylvania reports the lowest potential savings (0.8% of annual forecast sales), which is due to the fact that achievable potential was calculated based a range of existing policies and programs, of which only a portion were utility DSM programmatic efforts. The savings estimates from these programs were constrained by legislative targets set for energy savings over an 18-year period, which the suite of policies and programs analyzed were specifically designed to meet. The method employed for this analysis is significantly different from all of the other studies as outlined Section 0 above, in which savings potential is based on estimates of market penetration of cost-effective efficiency measures over time.

The 2007 Vermont study also reported savings of a higher magnitude (1.9%) than the other estimates, due to the inclusion of residential fuel switching measures, which accounted for almost 50% of the residential sectors savings. As can be seen in Table 7 above, the median percent annual achievable energy savings for the residential sector is 0.5% of annual forecast sales, while the Vermont study reports 0.9% due to the addition of savings from fuel substitution.

Figure 10 summarizes the portion of the weighted average of total electric achievable potential for all studies attributed to each sector as is detailed in Table 7 above. Savings results as a percent of forecast sector sales were not consistently available for the studies reviewed; this analysis presents savings as a percent of total forecast sales to show the distribution of savings across sectors. This analysis excludes savings reported from New England, because the study did not disaggregate commercial and industrial savings. The figure below shows that the majority of the total savings come from the residential and commercial sectors in equal proportion at 41% per sector.

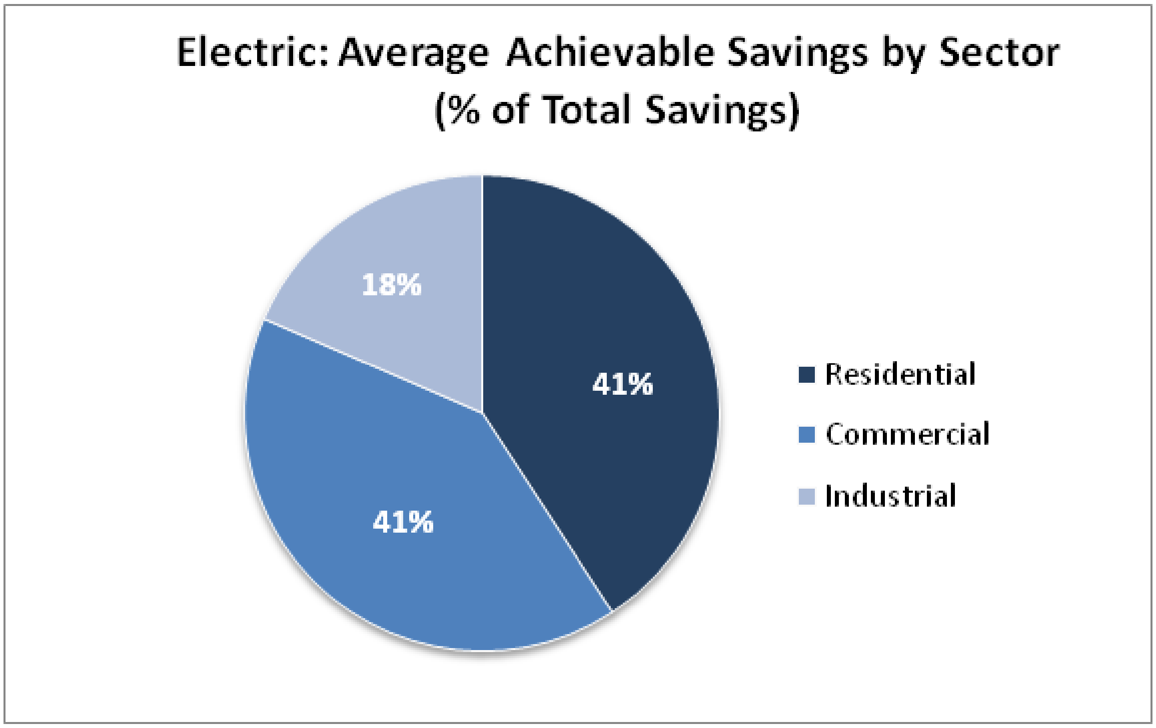


Figure 10. Weighted Average Achievable Savings by Sector

Figure 11 below illustrates the average annual cost per kWh of estimated achievable potential. Estimates of the cost to achieve the reported potential electric savings range from $0.14 per kilowatt hour annually in Pennsylvania to $0.40 per kilowatt hour annually in New Hampshire, with a median of $0.21 per kilowatt hour. The results have been normalized for the sake of comparison by presenting the cost of the first year of kWh savings, which is a measure of the savings achieved during the first year that the measure is installed, as opposed to over the entire lifetime of the measure.

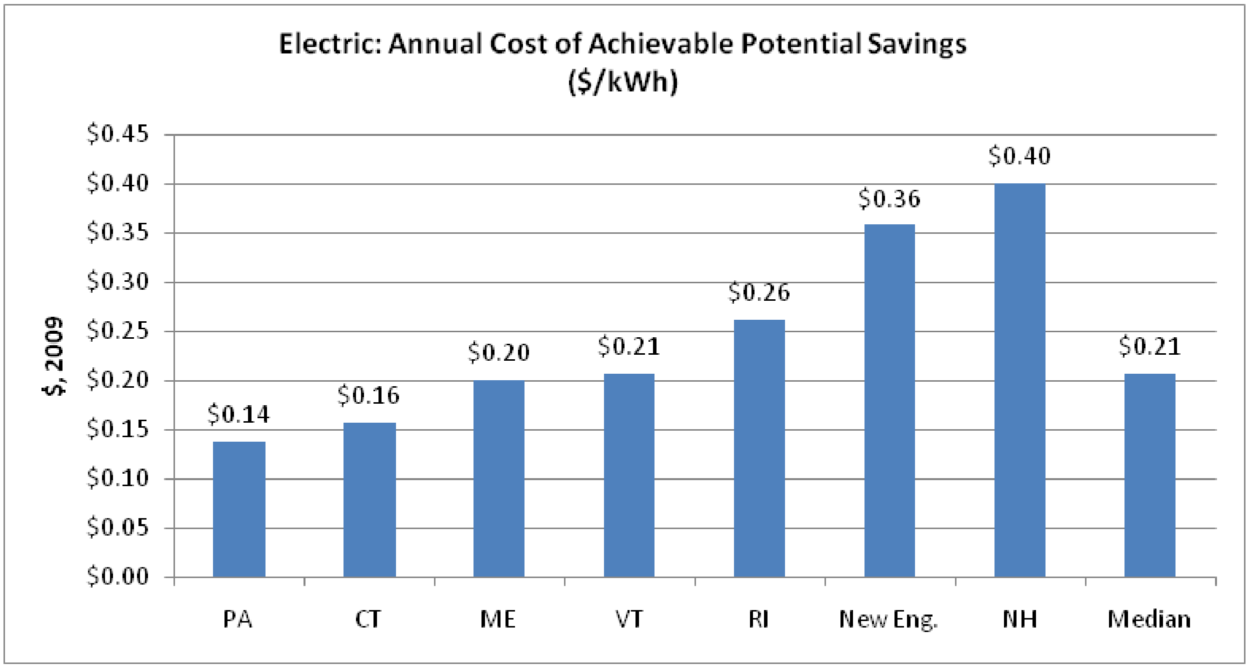


Figure 11. Annual First-Year Cost to Achieve Potential Electric Savings

2.3.2 Peak Demand Potential Savings and Cost

Table 8 below summarizes the results of seven different studies that included estimates of peak demand savings potential. Peak demand savings result from electric measures that capture savings during peak periods of daily consumption. Each study above reporting electric potential savings also reported savings during peak periods from those measures analyzed. The results below show reported savings estimates over a 10-year period. Estimates for Pennsylvania were reported over an 18-year period, but have been normalized here for the sake of comparison. The range of estimates from studies that reported technical peak demand savings potential was between 22% of forecast sales in New Hampshire to 27% in Rhode Island, with a median value of 24%. Estimates of achievable potential ranged from 7.5% (0.8% annually) of forecast sales in Pennsylvania to 33.2% (3.3% annual) in Vermont as a whole, with a median of 12.5% (1.3% annually) of forecast sales per year.

Table 8. Summary of Results from Peak Demand Potential Study Review

Fuel Type: Peak Demand				Energy Savings Potential (% of Total Forecast Sales)				Annual Achievable Energy Savings by Sector (% of Total Sales)			Cost of Achievable Potential Savings		
				Tech.	Econ.	Achievable		Res	Com	Ind	Annual	Total	Total $/kW
State	Study Year	Study Period	Analysis Period (years)	TOTAL	TOTAL	TOTAL	ANNUAL				($M, 2009)	($M, 2009)	($M, 2009)
PA	2009	2008-2025	10	--	--	7.5%	0.8%	0.3%	0.3%	0.1%	$203	$3,663	$648.26
NH	2009	2009-2018	10	21.6%	15.3%	8.5%	0.9%	0.1%	0.5%	0.3%	$56	$565	$2,228.27
RI	2008	2009-2018	10	26.6%	26.4%	9.8%	1.0%	0.5%	0.3%	0.1%	$20	$201	$927.11
CT	2004	2003-2012	10	24.1%	--	12.5%	1.3%	0.3%	0.8%	0.1%	$70	$702	$773.43
ME	2008	2008-2017	10	--	--	19.5%	2.0%	0.5%	1.1%	0.4%	$30	$305	$788.91
New Eng.	2004	2004-2013	10	--	--	28.3%	2.8%	0.6%	2.2%	0.0%	$1,205	$12,050	$1,474.53
VT	2007	2006-2015	10	--	--	33.2%	3.3%	1.9%	0.7%	0.7%	$27	$267	$665.21
Median				**24.1%**	**20.8%**	**12.5%**	**1.3%**	**0.5%**	**0.7%**	**0.1%**	**$56**	**$565**	**$788.91**
Mean				**24.1%**	**20.8%**	**17.1%**	**1.7%**	**0.6%**	**0.9%**	**0.2%**	**$230**	**$2,536**	**$1,072**

Figure 12, below, more clearly illustrates the variation in annual energy savings as a percent of total sales across all studies, as reported in Table 8. Results are presented on a “cumulative annual” basis, which refers to the sum of the first-year savings over the entire study period. These results are meant to show a comparison between technical, economic and achievable potential for each study and have been normalized to account for different study lengths.

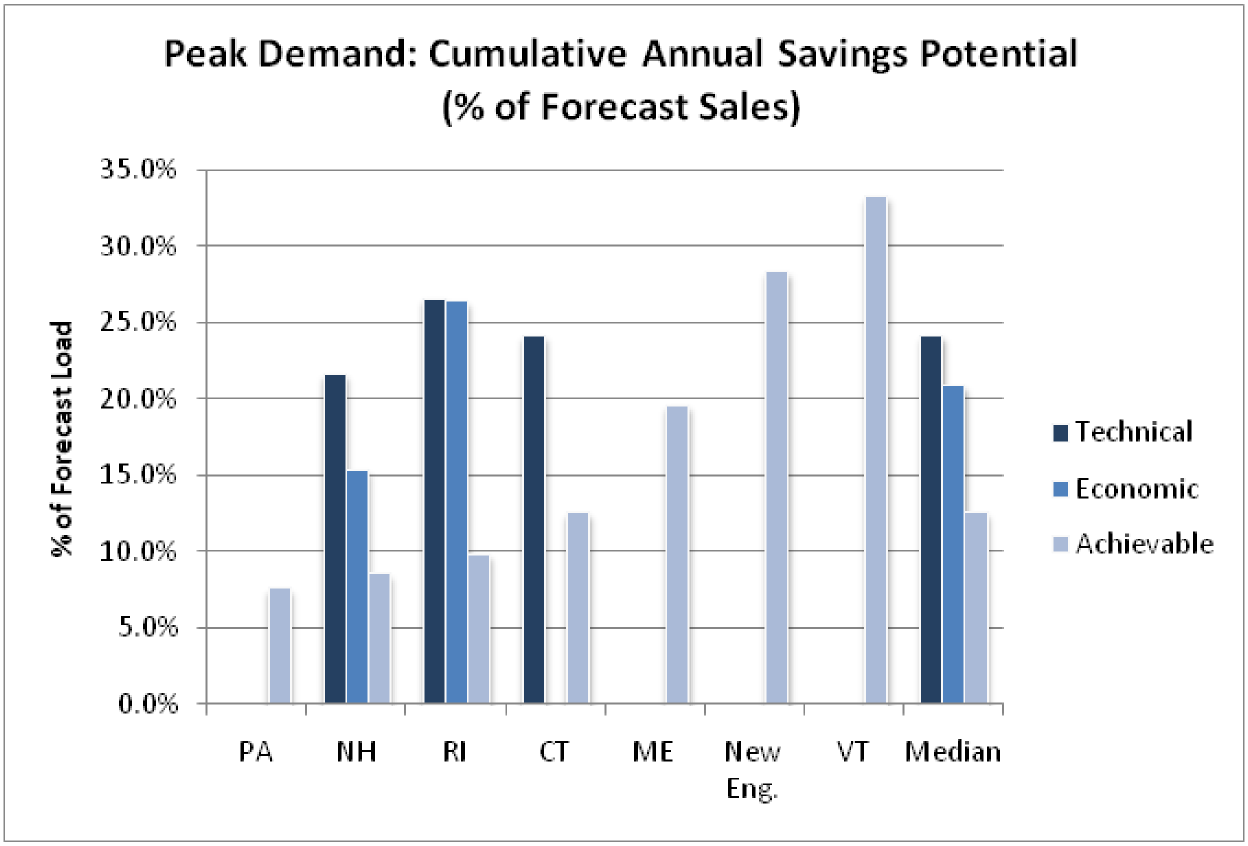


Figure 12. Cumulative Annual Peak Demand Savings Potential

Figure 13,below, shows estimates of annual achievable potential ranging from a low of 0.8% per year in Pennsylvania to a high of 3.3% per year in Vermont, with a median potential of 1.3% of the forecasted annual load.

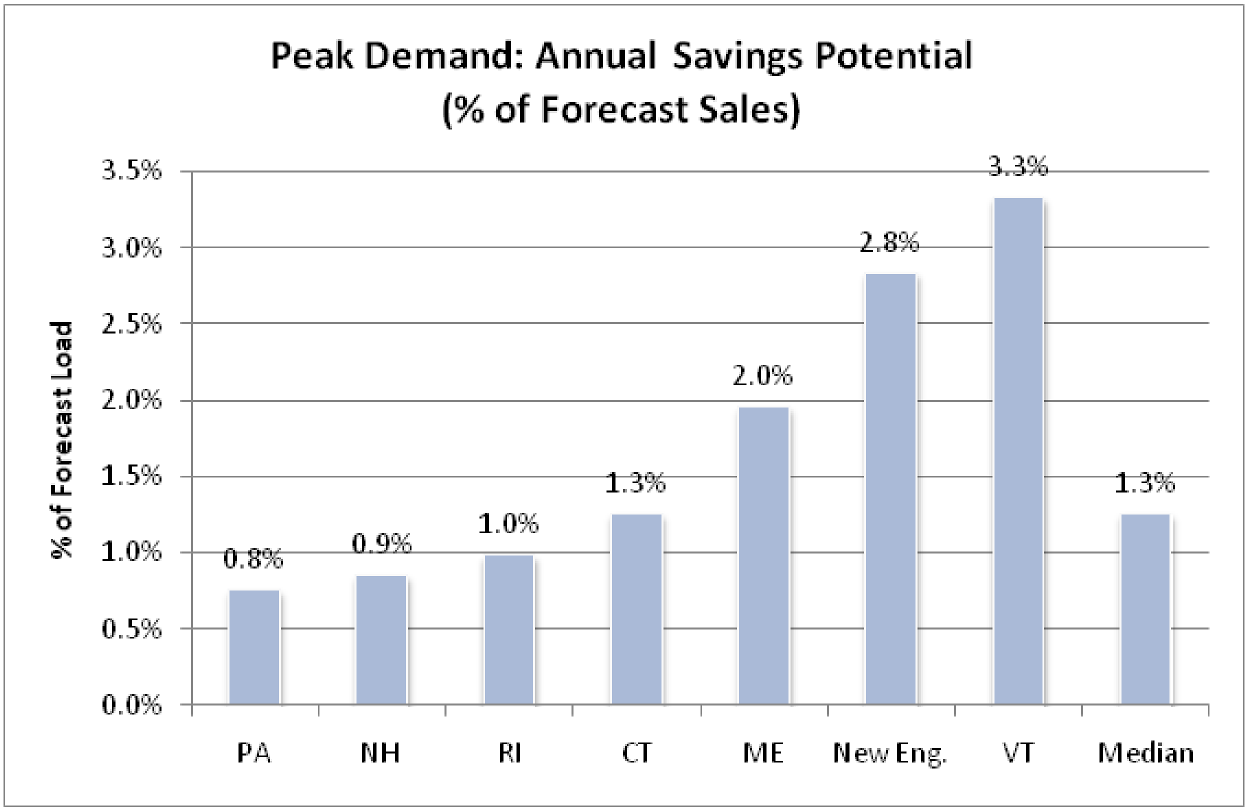


Figure 13. Annual Peak Demand Savings Potential

As with the electric energy efficiency potential, the Pennsylvania study reports the lowest potential savings (0.8% of forecast annual sales), which again is likely due the fact that achievable potential was calculated based a range of policies and programs, of which only a portion were utility DSM programmatic efforts. The savings estimate was further constrained by legislative targets set for energy savings over an 18-year period, which the suite of policies and programs analyzed in the study were specifically designed to meet. The method employed for this analysis is significantly different from all of the other studies as outlined Section 0 above, in which savings potential is based on estimates of realistic penetration of cost-effective efficiency measures.

The 2007 Vermont study also reported higher peak demand savings than the other estimates, due again to the inclusion of fuel-switching measures in the residential sector. As can be seen in Table 8above, the median percent annual achievable peak demand savings for the residential sector is 0.5% of annual forecast sales, while the Vermont study reports 1.9% due to the addition of savings from fuel substitution.

Figure 14 summarizes the portion of the weighted average achievable potential peak demand savings attributed to each sector as is detailed in Table 8 above. Savings results as a percent of forecast sector sales were not consistently available for the studies reviewed; this analysis presents savings as a percent of total forecast sales to show the distribution of savings across sectors. The results show that the majority of the total savings come from the residential and commercial sectors, with savings ranging annually from 0.1% (NH) to 1.4% (VT) for residential and 0.3% (PA) to 2.2% (New England) for commercial, and between 0.2% (RI, CT, PA) and 0.6% (VT) for the industrial sector.

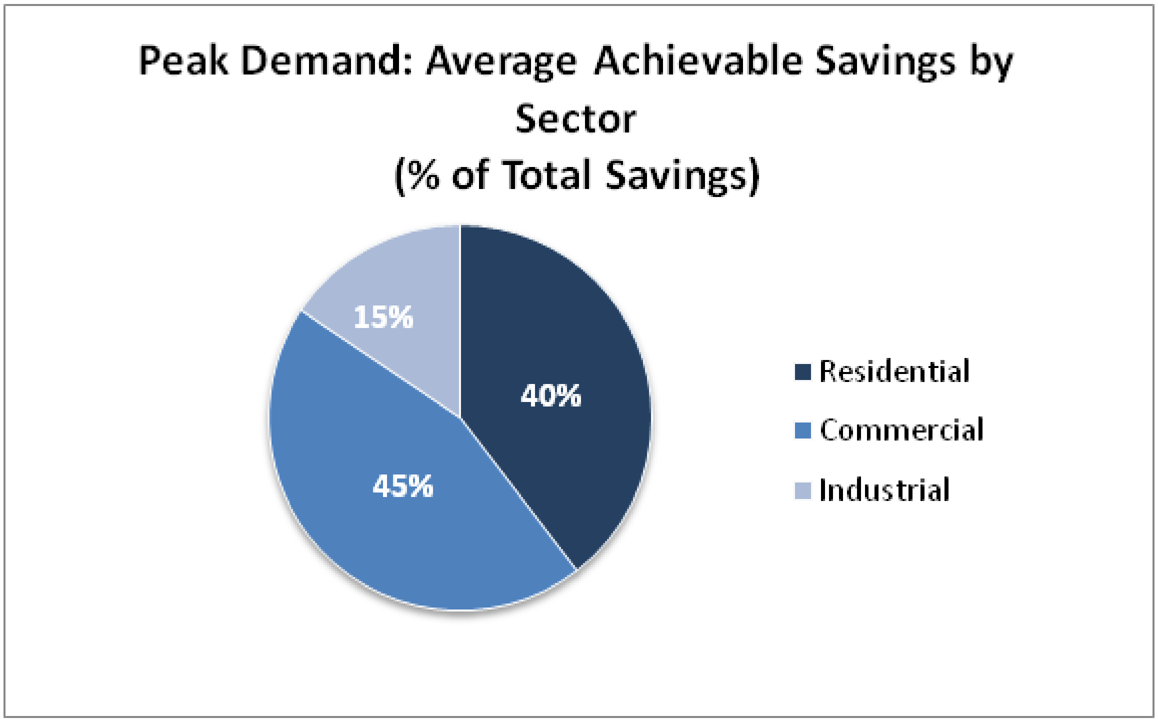


Figure 14. Weighted Average Achievable Savings by Sector

Figure 15 illustrates the annual cost per kW of estimated achievable potential. Estimates of the cost to achieve the reported peak demand savings range from $648 per kilowatt annually in Pennsylvania to $2,228 per kilowatt in New Hampshire, with a median cost of $789 per kilowatt. The results have been normalized for the sake of comparison by presenting the cost of the first year of kWh savings, which is a measure of the savings achieved during the first year that the measure is installed, as opposed to over the entire lifetime of the measure.

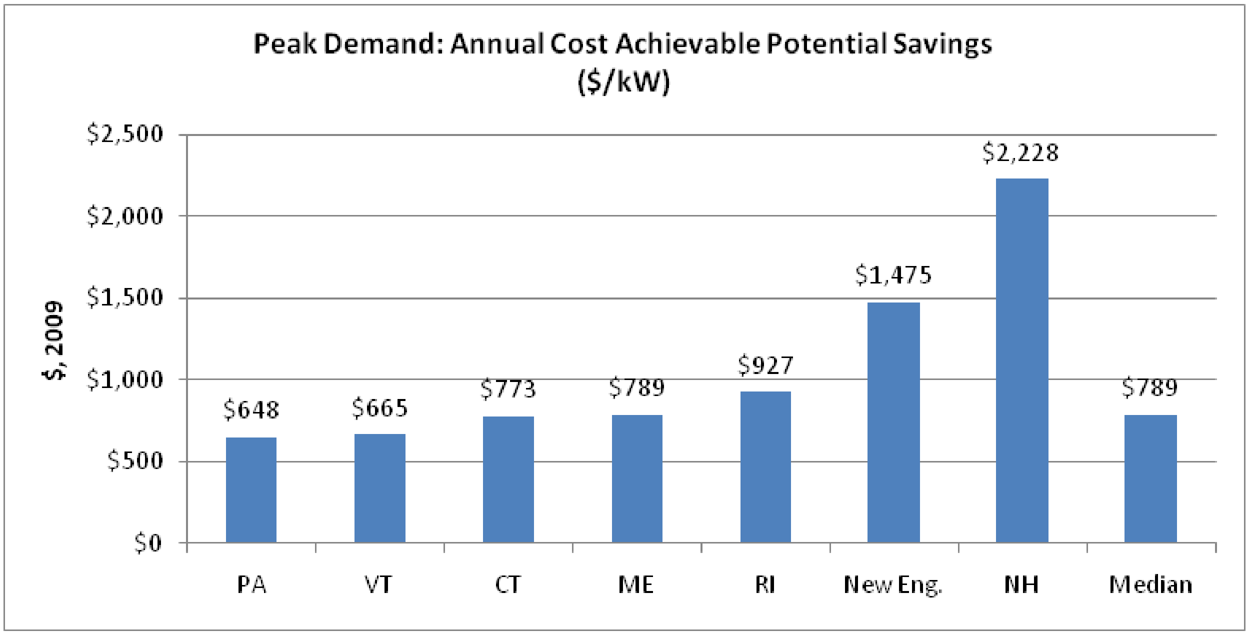


Figure 15. Annual First-Year Cost to Achieve Potential Peak Demand Savings

2.3.3 Natural Gas Potential Savings and Cost

Table 9 below summarizes the results of four different studies that included estimates of natural gas savings potential. The range of estimates from studies that reported technical potential was between 29% of the forecast annual load in New Hampshire and Connecticut to 44% per year in Massachusetts, with a median savings of 29% per year. Estimates of achievable potential savings ranged from 6.1% (0.6% annually) of forecast future sales in Pennsylvania to 25.5% (2.5% annually) in Massachusetts.

Table 9. Summary of Results from Natural Gas Potential Study Review

Fuel Type: Natural Gas				Energy Savings Potential (% of Total Forecast Sales)				Annual Achievable Energy Savings by Sector (% of Total Sales)			Cost of Achievable Potential Savings		
				Tech.	Econ.	Achievable		Res	Com	Ind	Annual	Total	Total $/MMBtu
State	Study Year	Study Period	Analysis Period (years)	TOTAL	TOTAL	TOTAL	ANNUAL				($M, 2009)	($M, 2009)	($M, 2009)
PA	2009	2008-2025	10	--	27.2%	6.1%	0.6%	0.2%	0.2%	0.2%	$85.2	$1,534	$21.9
NH	2009	2009-2018	10	29.2%	16.9%	8.3%	0.8%	0.4%	0.3%	0.1%	$8.5	$85	$38.3
CT	2009	2009-2018	10	28.8%	25.2%	16.6%	1.7%	--	--	--	--	--	--
MA	2009	2009-2018	10	44.0%	36.3%	25.5%	2.5%	1.8%	0.6%	0.2%	--	--	--
Median				**29.2%**	**26.2%**	**12.5%**	**1.2%**	**0.4%**	**0.3%**	**0.2%**	**$47**	**$809**	**$30.11**
Mean				**34.0%**	**26.4%**	**14.1%**	**1.4%**	**0.8%**	**0.3%**	**0.2%**	**$47**	**$809**	**$30.11**

Figure 16 below more clearly illustrates the variation in natural gas savings as a percent of total sales across all studies, as reported above in Table 9. Results are presented on a "cumulative annual" basis, which refers to the sum of first-year savings over the entire study period. These results are meant to show a comparison between technical, economic and achievable potential for each study and have been normalized to account for different study lengths.

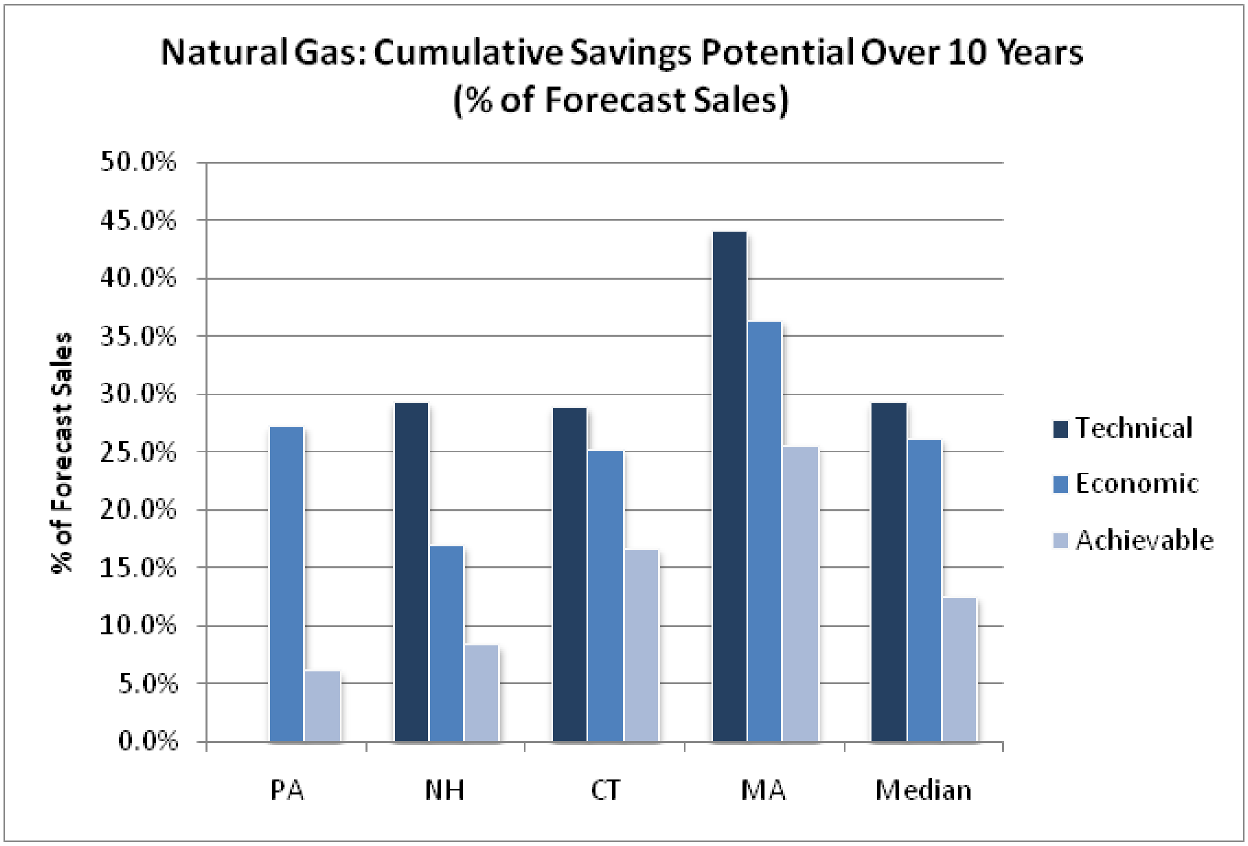


Figure 16. Cumulative Annual Natural Gas Savings Potential

Figure 17 below shows estimates of annual achievable potential range from a low of 0.6% of forecast sales in Pennsylvania to a high of 2.5% per year once again in Massachusetts, with a median potential of 1.2% of the forecasted annual load. These results show a wide distribution of savings. The Pennsylvania study again reports one of the lowest potential savings (0.8%), which as mentioned above is likely due to constraints placed on the estimate based on the legislative and policy goals analyzed.

The New Hampshire study results are also low, due to GDS Associates' addition of a new potential type for this study called "potentially obtainable" which discounted the achievable potential savings based on customers likelihood of purchasing energy efficiency products as reported in a survey conducted for the study. The "potentially obtainable" scenario most closely lined up with the definition of "achievable" potential reported in this study, though none of the other studies included this level of analysis.

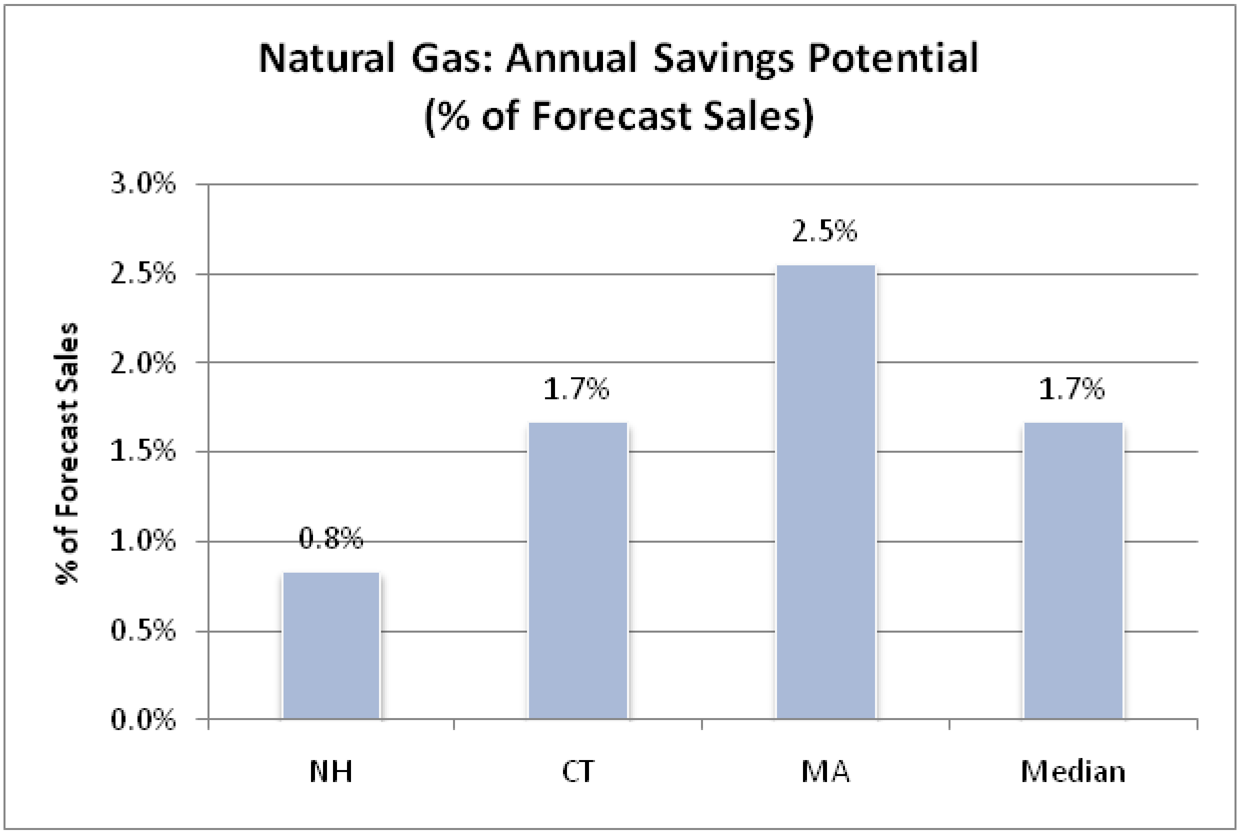


Figure 17. Annual Natural Gas Savings Potential

Figure 18 summarizes the portion of the weighted average achievable potential attributed to each sector as is detailed in Table 9 above. Savings results as a percent of forecast sector sales were not consistently available for the studies reviewed; this analysis presents savings as a percent of total forecast sales to show the distribution of savings across sectors. The results show a significant portion of the total savings coming from the residential sector, with savings ranging annually from 0.2% (PA) to 1.8% (MA) for residential and 0.2% (PA) to 0.6% (MA) for commercial, and from 0.1% (NH) to 0.2% (PA, MA) for the industrial sector.

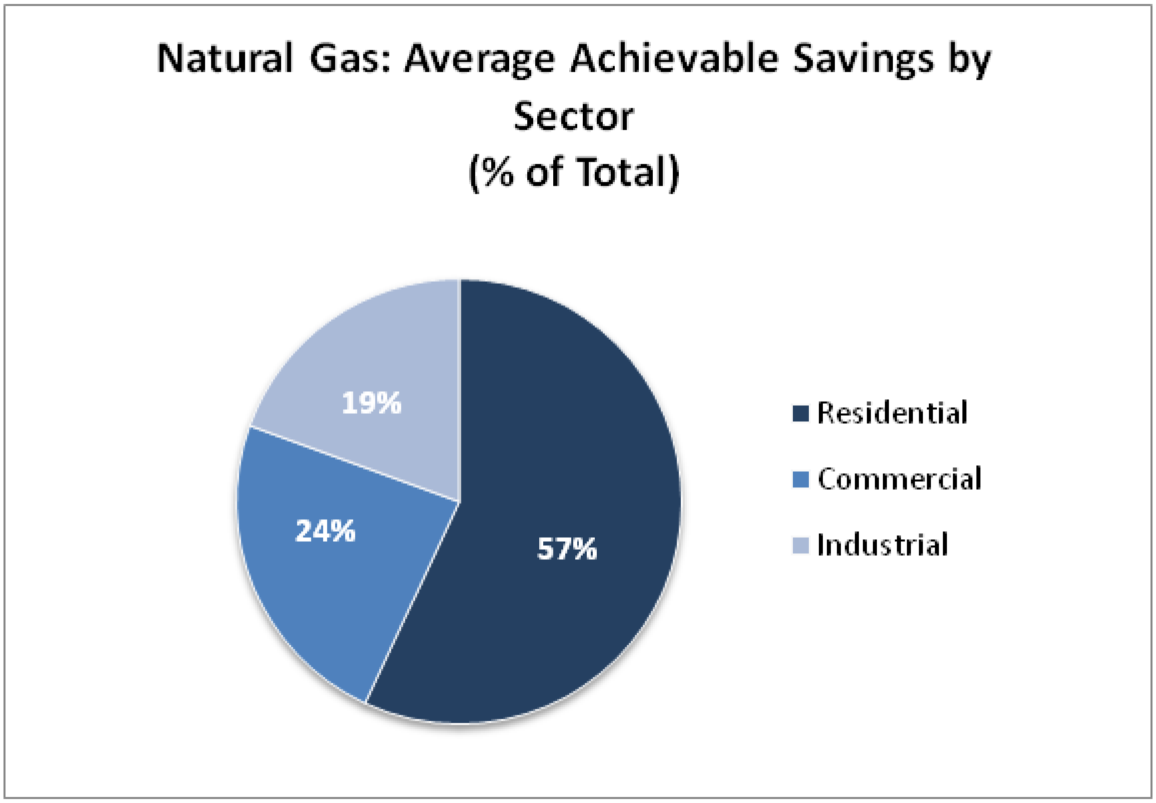


Figure 18. Weighted Average Achievable Savings by Sector

Figure 19 illustrates the annual cost per MMBtu of estimated achievable natural gas potential for the two studies that reported cost estimates. Estimates of the cost to achieve the reported natural gas savings were unavailable for both Connecticut and Massachusetts. The Pennsylvania study reported a cost of $21.9 per MMBtu annually compared to $38.3 per MMBtu in New Hampshire, with a median cost of $30.11 per MMBtu. The results have been normalized for the sake of comparison by presenting the cost of the first year of savings, which is a measure of the savings achieved during the first year that the measure is installed, as opposed to over the entire lifetime of the measure.

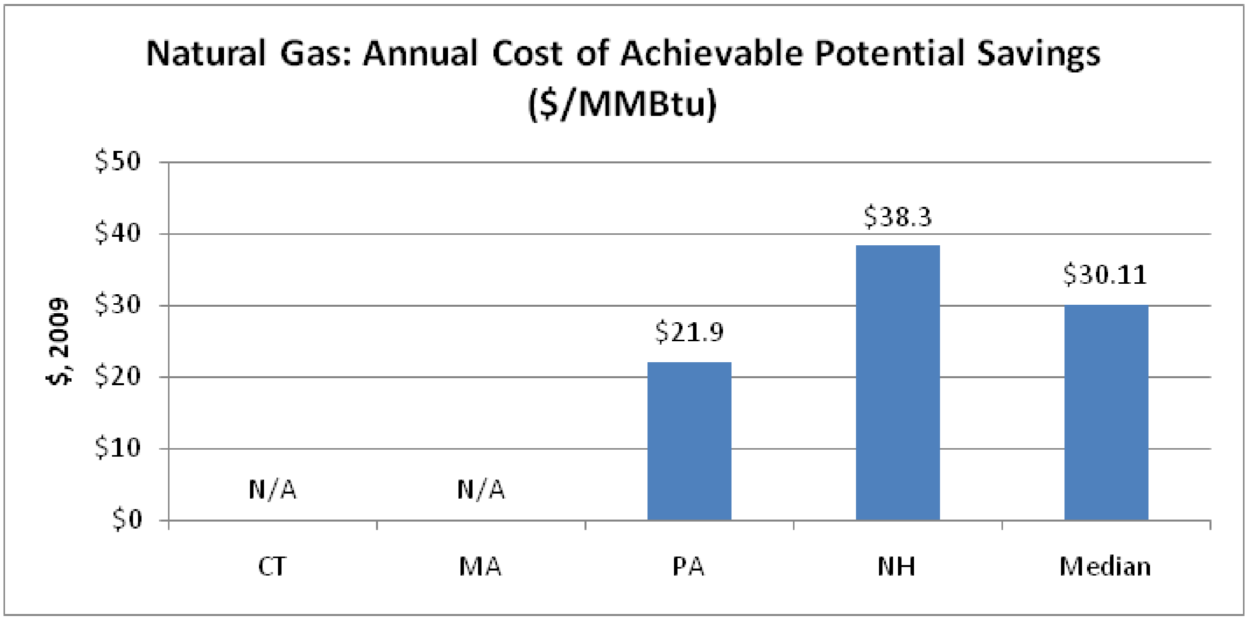


Figure 19. Annual Cost of Achievable Potential Savings

2.3.4 Fuel Oil Potential Savings and Cost

Table 10 below summarizes the results of the two studies that reported detailed results of fuel oil savings potential. The technical potential results ranged from 26% to 30% of the forecast annual load, with a median savings of 28% per year. Estimates of annual achievable potential range from 7.8% (0.8% annually) of forecast sales in New Hampshire to 14.1% (1.4% annually) in Vermont, with a median potential of 11.0% (1.1% annually) of the forecasted annual load.

Table 10. Summary of Results from Fuel Oil Potential Study Review

Fuel Type: Fuel Oil				Energy Savings Potential (% of Forecast Sales)				Annual Achievable Energy Savings (% of Total Sales by Sector)			Cost of Achievable Potential Savings		
				Tech.	Econ.	Achievable		Res	Com	Ind	Annual	Total	Total $/MMBtu
State	Study Year	Study Period	Analysis Period (years)	TOTAL	TOTAL	TOTAL	ANNUAL				($M, 2009)	($M, 2009)	($M, 2009)
NH	2009	2009-2018	10	26.5%	16.1%	7.8%	0.8%	0.4%	0.3%	0.1%	$16.7	$166.8	$42.3
VT	2007	2007-2016	10	29.7%	--	14.1%	1.4%	0.6%	0.7%	0.1%	$11.2	$112.1	$15.7
Median				**28.1%**	**16.1%**	**11.0%**	**1.1%**	**0.5%**	**0.5%**	**0.1%**	**$13.95**	**$139.45**	**$29.02**
Mean				**28.1%**	**16.1%**	**11.0%**	**1.1%**	**0.5%**	**0.5%**	**0.1%**	**$13.95**	**$139.45**	**$29.02**

Figure 20 below more clearly illustrates the variation in annual fuel oil savings (technical, economic, and achievable) as a percent of total sales across all studies, as reported above in Table 9. Results are presented on a "cumulative annual" basis, which refers to the sum of first-year savings over the entire study period. These results are meant to show a comparison between technical, economic and achievable potential for each study and have been normalized to account for different study lengths.

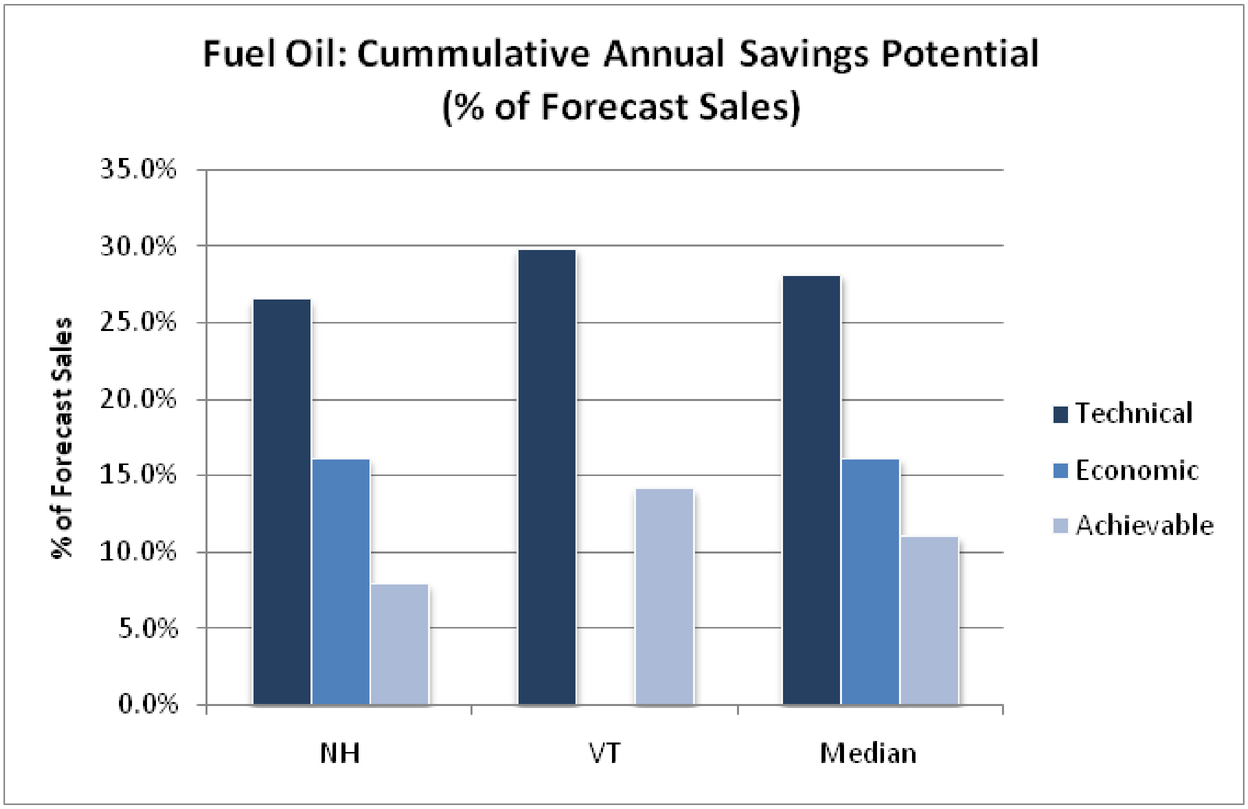


Figure 20. Cumulative Annual Fuel Oil Savings Potential

Figure 21 below shows estimates of annual achievable potential at a low of 0.8% of forecast sales in New Hampshire and a high of 1.4% per year in Vermont, with a median potential of 1.1% of the forecasted annual load. The New Hampshire study results for achievable fuel oil potential are low again, due to GDS Associates' analysis of customer behavior for the "potentially obtainable" scenario as discussed above.

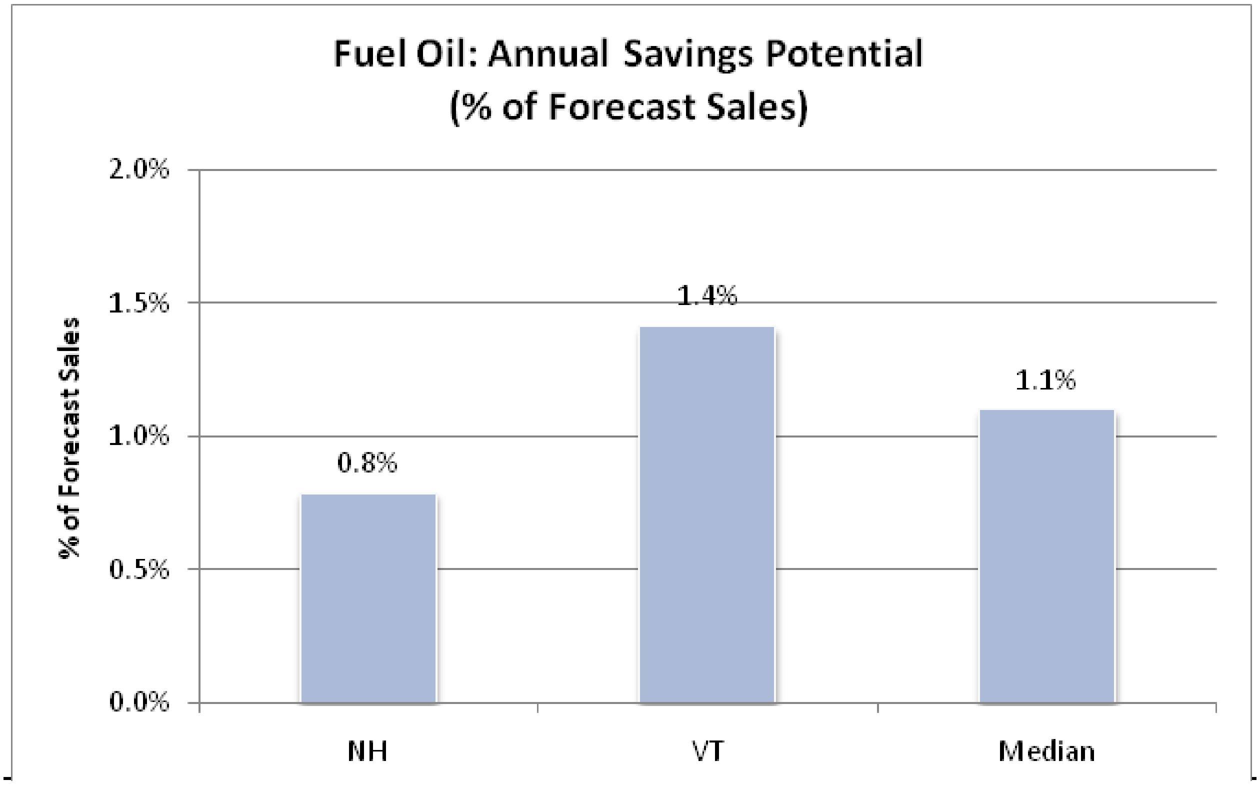


Figure 21. Annual Fuel Oil Savings Potential

Figure 22 summarizes the portion of the weighted average fuel oil achievable potential attributed to each sector as is detailed in Table 9 above. Savings results as a percent of forecast sector sales were not consistently available for the studies reviewed; this analysis presents savings as a percent of total forecast sales to show the distribution of savings across sectors. The results show that most of the total savings coming from the residential and commercial sectors.

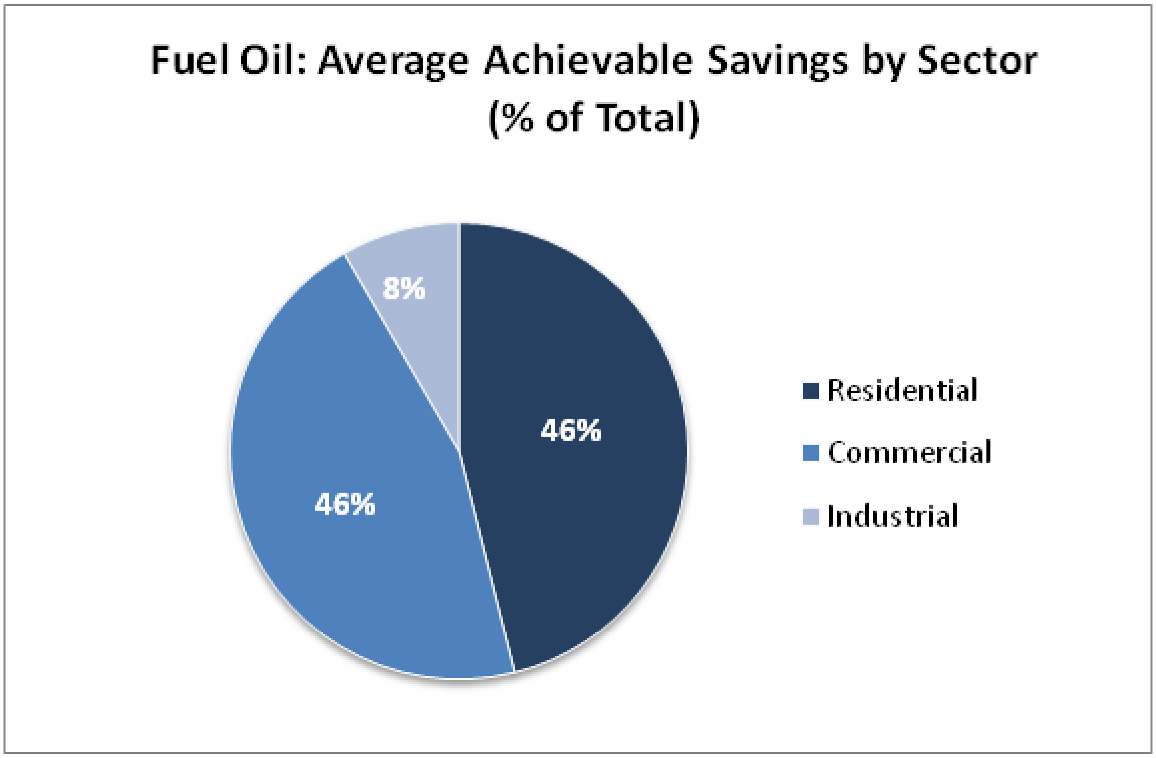


Figure 22. Weighted Average Achievable Fuel Oil Savings by Sector

Figure 23 illustrates the annual cost per MMBtu of estimated achievable fuel oil potential for the two studies that reported cost estimates. Estimates of the cost to achieve savings range from $15.7 per MMBtu annually in Vermont to $42.3 per MMBtu in New Hampshire, with a median cost of $29.02 per MMBtu.

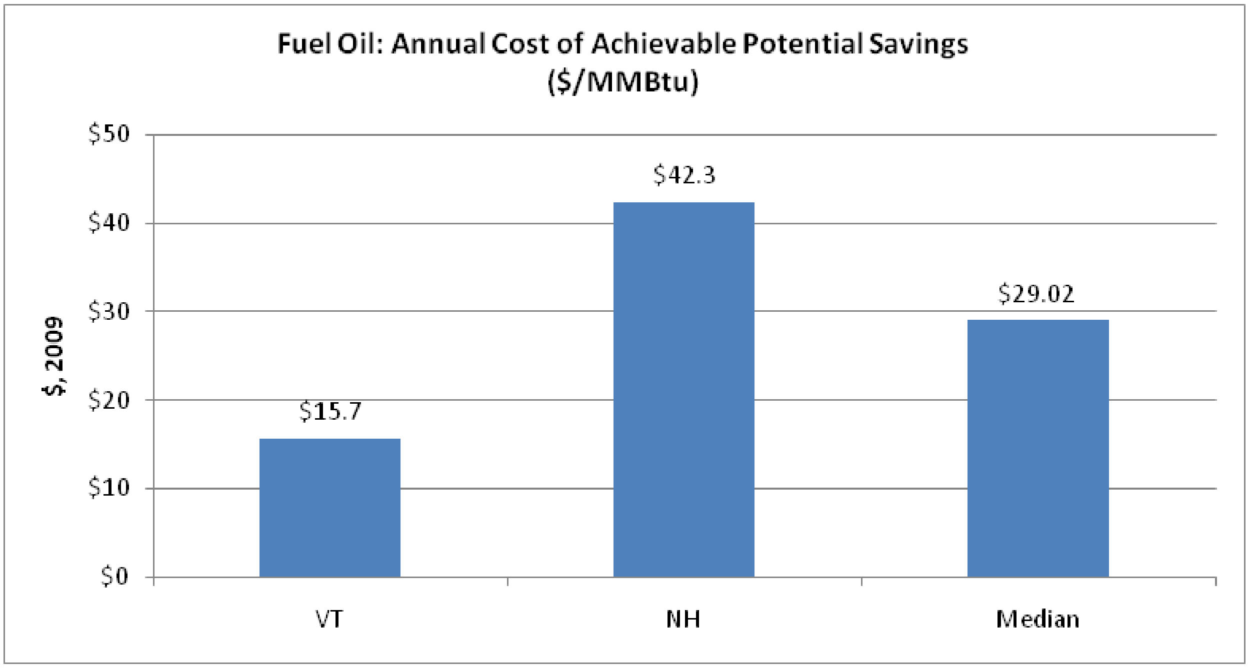


Figure 23. Annual First-Year Cost of Achievable Potential Savings

2.3.5 Propane Potential Savings and Cost

Table 11 below summarizes the results of the two studies that reported detailed results of propane savings potential. The ten year technical potential results ranged from 18% to 27% of the forecast annual load, with a median savings of 22% per year. Estimates of annual achievable potential are 7.9% (0.8% annually) of forecast sales for both studies.

Table 11. Summary of Results from Propane Potential Study Review

Fuel Type: Propane				Energy Savings Potential (% of Forecast Sales)				Annual Achievable Energy Savings (% of Total Sales by Sector)			Cost of Achievable Potential Savings		
				Tech.	Econ.	Achievable		Res	Com	Ind	Annual	Total	Total $/MMBtu
State	Study Year	Study Period	Analysis Period (years)	TOTAL	TOTAL	TOTAL	ANNUAL				($M, 2009)	($M, 2009)	($M, 2009)
NH	2009	2009-2018	10	26.5%	16.1%	7.8%	0.8%	0.4%	0.3%	0.1%	$6.0	$59.7	$42.2
VT	2007	2007-2016	10	17.8%	--	8.0%	0.8%	0.4%	0.3%	0.0%	$3.7	$37.4	$48.6
Median				**22.1%**	**16.1%**	**7.9%**	**0.8%**	**0.4%**	**0.3%**	**0.1%**	**$4.85**	**$48.53**	**$45.4**
Mean				**22.1%**	**16.1%**	**7.9%**	**0.8%**	**0.4%**	**0.3%**	**0.1%**	**$4.85**	**$48.53**	**$45.4**

Figure 24 below more clearly illustrates the variation in annual propane savings as a percent of total sales across all studies, as reported above in Table 11. Results are presented on a "cumulative annual" basis, which refers to the total first-year savings over the entire study period. These results are meant to show a comparison between technical, economic and achievable potential for each study and have been normalized to account for different study lengths.

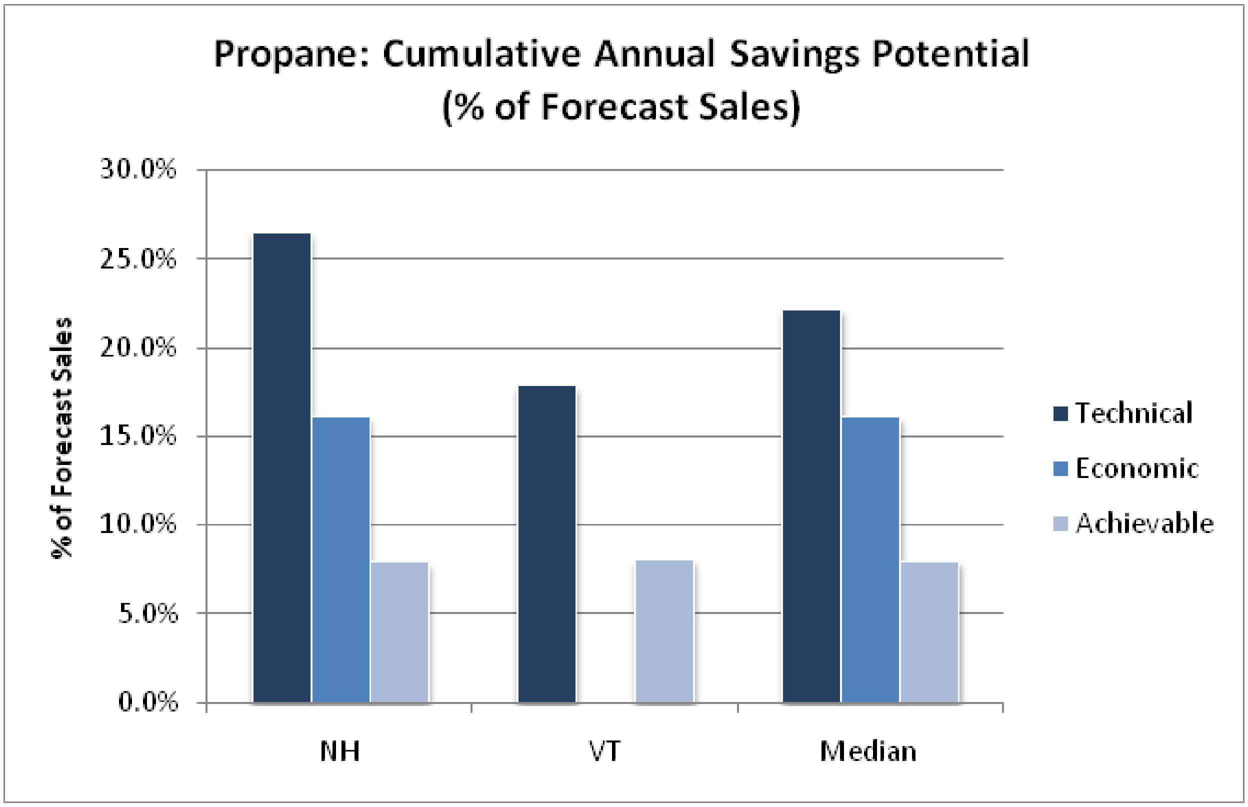


Figure 24. Cumulative Annual Propane Savings Potential

Figure 25 below shows estimates of annual achievable propane potential, with each study showing 0.8% of forecast annual sales.

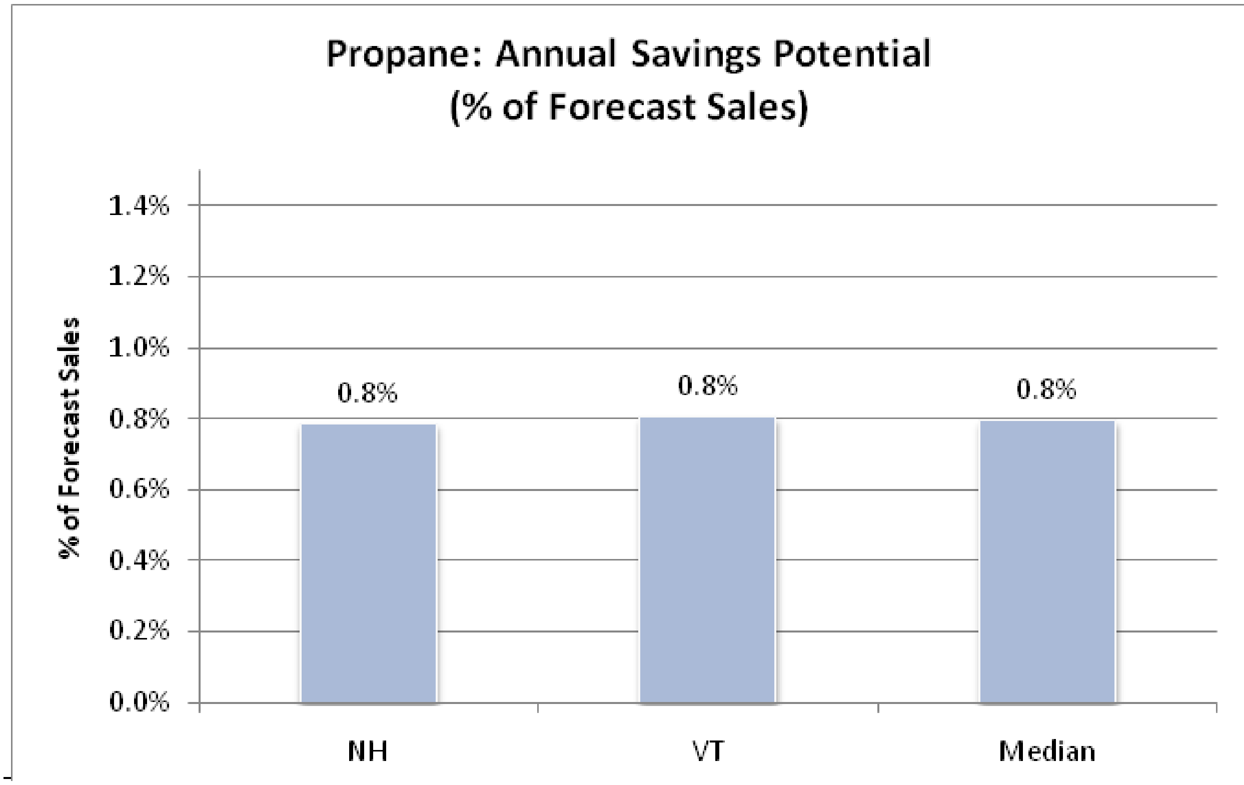


Figure 25. Annual Propane Savings Potential

Figure 26 summarizes the portion of the weighted average achievable propane savings potential attributed to each sector as is detailed in Table 11 above. Savings results as a percent of forecast sector sales were not consistently available for the studies reviewed; this analysis presents savings as a percent of total forecast sales to show the distribution of savings across sectors. The results show that a significant portion of the total savings comes from the residential sector.

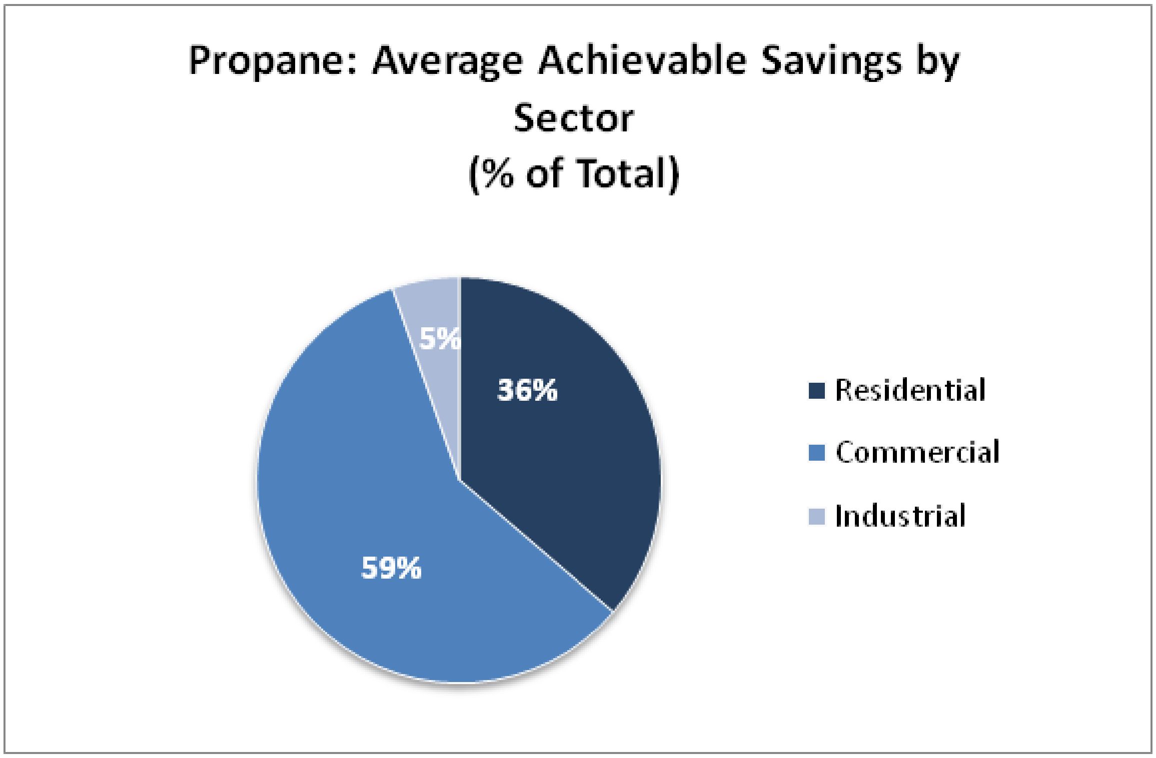


Figure 26. Weighted Average Achievable Propane Savings by Sector

Figure 27 illustrates the annual cost per MMBtu of estimated achievable propane potential for the both studies. Estimates of the cost to achieve savings range from $42.3 per MMBtu annually in New Hampshire to $48.6 per MMBtu in Vermont, with a median cost of $45.44 per MMBtu.

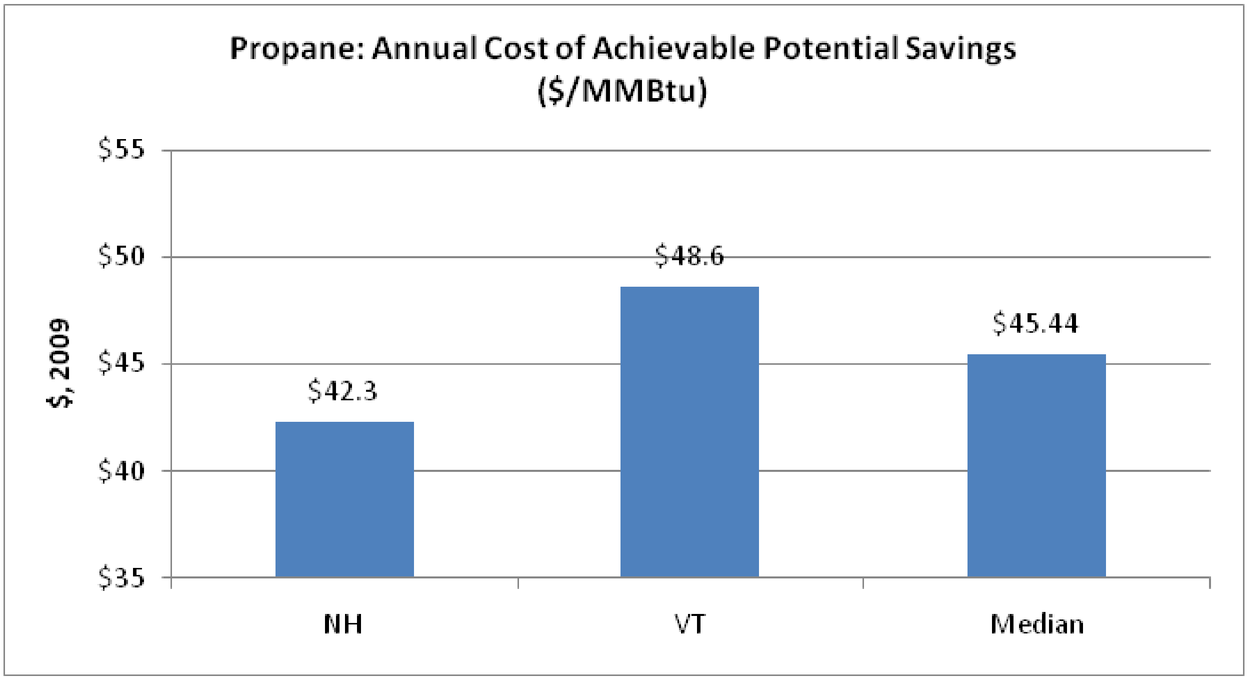


Figure 27. Annual First-Year Cost of Achievable Savings Potential

2.4 Estimating Economically Achievable Potential for Maine

Data collected from the studies summarized above were used to extrapolate the achievable potential savings by program and sector area for Maine over the next 10 years. The data were also used to gauge the ability of Maine to achieve the potential at current funding levels with existing program designs and at higher funding levels with enhanced program designs.

This study employed two approaches to extrapolating the achievable potential energy savings for Maine, a "simple approach" based on the median values from the studies reviewed above and a "best fit-high" approach based on a selection of results from specific studies which Summit Blue believe to be both reasonable and aggressive savings estimates.

Simple Approach

For each study identified in Section 2, Summit Blue collected or calculated key study inputs and results: study area, study period, estimated potential for study period, potential as percent of forecast sales for study period, and average annual potential as percent of sales. Median values of energy savings potential as a percentage of total forecast sales were calculated for each fuel type, as reported in Section 2 above. The median achievable potential savings (as percentage of forecast sales) was then applied to the forecast sales for Maine. The median first year cost per unit of energy saved was applied to the estimated savings results to estimate the total cost of capturing the potential savings.

The value of this approach is twofold: 1) it is definitive, that is, for each set of values, there is only one median and 2) it favors the middle values whereas the mean is pulled by an unmatched extreme value. The shortcomings of this approach are that it does not consider critical differences in territory features or in study methodology or scope and that it is vulnerable to bias in the selection of studies.

Best Fit-High Approach

Given the limitations inherent in the simple approach, an additional extrapolation was conducted. This approach recognized and defined the relationship between key features of Maine with those of the other study areas and, thus, the relationship between Maine's potential and the other study results.

This approach involved collecting additional data for the most relevant studies on appliance and technology saturation data, building stock, energy use, and avoided costs and considered key features of each study such as the method (cost-effectiveness test) used to define economic potential and the scope. Summit Blue also identified relevant DSM program history and results for each study area. Summit Blue then collected similar data for Maine (from Efficiency ME, Unitil, and EIA) and determined the study areas that are most applicable to Maine.

On the basis of the additional data and professional judgment, a best fit-high annual potential (as a percent of sales) was identified for the C&I and residential sectors and used to estimate 10-year potentials for Maine. A similar approach was also used to estimate the spending required to realize the potential energy savings.

The best fit-high approach selected results from the studies with service territories determined most applicable to Maine, based on

a. geography,
b. retail price,
c. saturation of electric space and water heating,
d. role of fuel switching,
e. sales by sector, and
f. sales by customer by sector.

The value of this approach is that it incorporates expert judgment on territory similarity and on study relevance. The main shortcoming of this approach is that expert judgment is vulnerable to bias.

The main shortcomings shared by the simple and best fit-high approach result from using studies mostly outside Maine: key features unique to Maine remain unstudied. There is a significant population of large energy consumers in Maine for which no primary data are available and for which no comparable secondary data are available: industrial customers in the northern region, outside CMP's territory, mostly pulp and paper industrials. These large energy consumers are not represented by any of the reviewed studies. No other state consumes fuel oil the way Maine does. Given these limitations, the achievable potential estimates of both methods for the industrial sector (for all fuels) and for fuel oil (for all sectors) have the greatest uncertainty.

The table below shows the studies chosen for each sector and fuel type. Studies were selected based on the criteria above; for example, for residential electricity, New Hampshire, CMP, and Vermont were considered most similar to Maine by the criteria, and Vermont was ultimately determined as best fit-high because the Vermont study was more comprehensive in that it included fuel switching measures. For C&I electricity, the CMP potential estimates were used. For all sectors of natural gas, potential estimates from the Massachusetts study were used. For all sectors of both fuel oil and propane, potential estimates from the Vermont study were used. For first year costs per unit of energy saved, the lesser of the best fit high study cost and the median cost was used.

Table 12. Best Fit-High Studies by Sector

Fuel Type	Customer Class		
	Residential	Commercial	Industrial
Electricity	VT	ME	ME
Natural Gas	MA	MA	MA
Fuel Oil	VT	VT	VT
Propane	VT	VT	VT

The following table compares the savings and cost values used in both the simple and best fit-high approaches to those actually reported for Maine in 2008.

In 2008 Maine achieved electricity DSM savings amounting to 0.7% of total 2008 sales. Our simple/median approach estimates Maine's averaged annual achievable potential to be 1.3% of sales while our best fit high approach estimates 2.0% of sales. Both approaches estimate higher costs per kWh than Maine's 2008 costs; this reflects the expected rise in DSM costs after the 2012 lighting standards.

In 2008 Maine achieved energy DSM savings amounting to 0.5% of total 2008 sales. Our simple/median approach estimates 1.2% and our best fit high approach estimates 2.5%.

For fuel oil, our simple approach estimates averaged annual achievable potential savings amounting to 1.1% of sales; our best fit high approach estimates 1.4%. For propane, both approaches estimate averaged annual achievable potential of 0.8% of sales. (Recent Maine energy savings data for fuel oil and propane were not available).

Table 13 Extrapolated Achievable Potential for Maine

Fuel Type	Maine 2008 Actual	Median	Best Fit-High
Electricity			
Annual Savings (% of Sales)	0.7%	1.3%	2.0%
First Year Cost ($/kWh)	$0.16	$0.21	$0.20
Natural Gas			
Annual Savings (% of Sales)	0.5%	1.2%	2.5%
First Year Cost ($/MMBtu)	$40.00	$30.10	$30.10
Fuel Oil			
Annual Savings (% of Sales)	n/a	1.1%	1.40%
First Year Cost ($/MMBtu)	n/a	$29.00	$16.00
Propane			
Annual Savings (% of Sales)	n/a	0.8%	0.8%
First Year Cost ($/MMBtu)	n/a	$45.40	$45.40

The simple approach estimates the potential to save about twice the electricity and natural gas, as a percentage of sales, that is currently saved in Maine while the best-fit high approach estimates the potential to save three times the electricity and five times the natural gas currently saved. The studies suggest these savings are achievable with comprehensive and agressive programming. While it may seem counter-intuitive that Maine achieve greater savings while spending less per unit saved, as with natural gas (Maine 2008 actual vs. median estimate) and fuel oil (median estimate vs. best fit high estimate); our benchmarking data suggest that this is likely, specifically, that organizations that save energy above the typical rate (as a percent of sales) are likely to do so at costs that are below typical. Our benchmarking together with our experience suggests that high savings at low costs are achieved after a ramp up period of a few yerars for comprehensive and aggressive programming changes as the delay between program costs and effects typically spans more than one year.

Table 14 below compares the estimated achievable potential savings and cost ($2009) resulting from each approach to extrapolating the potential for Maine. For electricity, the simple approach estimates 1,700 GWh achievable potential at a total cost of $353M for the ten years while the best fit high approach estimates 2,509 GWh at a total cost of $510M. For natural gas, the simple approach estimates 533 MCf natural gas achievable potential at a total cost of $16M for the ten years while the best fit high approach estimates 1,090 MCf natural gas achievable potential at a total cost of $33M. For fuel oil and propane, the simple approach estimates 46,842 MGal achievable potential at a cost of $189 M while the best fit high approach estimates 57,672 MGal achievable potential at a cost of $143 M.

Table 14. Savings and Cost to Achieve Maine Potential (2010-2019)

Fuel Type	Average Annual Savings	Average Annual Cost ($ Millions)	10 Year Total Savings	10 Year Total Cost ($ Millions)
SIMPLE APPROACH				
Electricity (MWh)	170,032	$35.30	1,700,325	$353.00
Natural Gas (MCf)	53.3	$1.60	533	$16.10
Fuel oil/Propane (Gal)	4,684,153	$18.91	46,841,532	$189.10
TOTAL	**---**	**$55.81**	**---**	**$558.00**
BEST FIT-HIGH APPROACH				
Electricity (MWh)	250,778	$51.00	2,507,882	$510.00
Natural Gas (MCf)	109	$3.30	1,090	$33.00
Fuel oil/Propane (Gal)	5,767,188	$14.30	57,671,888	$143.00
TOTAL	**---**	**$68.60**	**---**	**$686.00**

Figure 28 below shows a comparison of the existing DSM budgets versus the budget required to achieve the “Best Fit-High” potential savings, as shown in Table 14 above. The stacked bar graph shows the estimated budget that is needed to achieve the best fit-high potential for each fuel type. It is estimated that roughly $51 million for electricity, $3.3 million for gas, and $14.3 million for fuel oil and propane will be needed per year to achieve the potential energy savings projected under the best fit-high approach. The overlaid line graph, however, shows current levels of DSM spending, demonstrating a substantial shortfall totaling roughly $42 million per year. Appendix C: Existing and Forecast DSM Budgets shows the annual budgets needed to achieve the extrapolated achievable efficiency potential for Maine from 2010-2019.

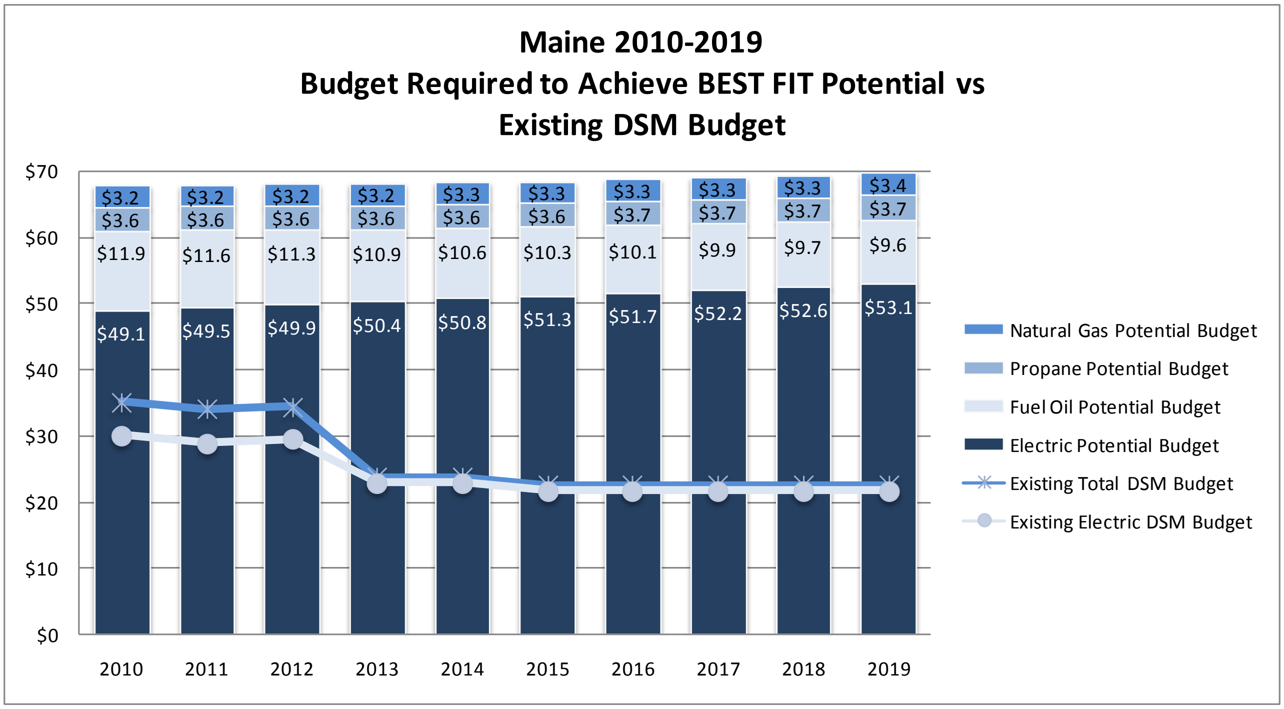


Figure 28. Comparison of Existing DSM Budgets vs. Budget Required to Achieve Best Fit-High Potential

As shown in Figure 29, if Maine allocated an electric DSM budget consistent with the "best-fit high" achievable potential, it would be a budget amount equivalent to 2.6% of utility revenues. This would put Maine in the very top tier of spending as a percent of utility revenue. The median achievable potential budget is equivalent to 1.8% of electric revenues. Based on 2007 actual electric DSM spending, Maine's budget was equivalent to 1% of electric revenues.

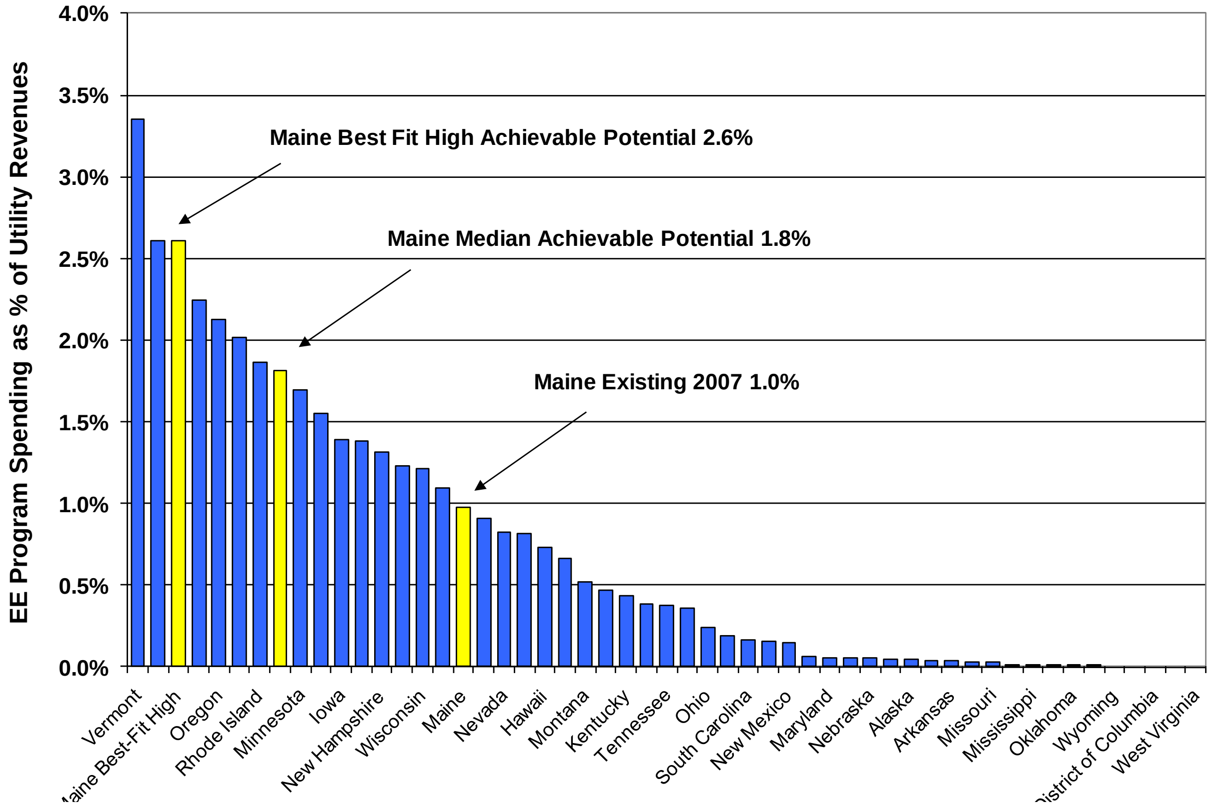


Figure 29. Comparison of Existing DSM Budgets vs. Budget Required to Achieve Best Fit-High Potential

3 BENCHMARKING MAINE'S 2007 PROGRAM RESULTS

This chapter presents the results from a benchmarking analysis process to compare the DSM savings as a percent of sales and the DSM costs as a percent of revenue, across a variety electric and natural gas DSM programs. Summit Blue collected information on selected national DSM programs that previous studies have identified as top performers. For the purposes of this project for Maine, we expanded the analysis to include additional Northeast utilities, some of whom are recognized national leaders, others who are not. 2007 incremental DSM program results and 2007 baseline data were collected for this study. Summit Blue regularly utilizes this high-level benchmarking approach to assist with development of DSM potential estimates, and to identify the best practices regarding DSM programs. To identify common best practices of top performers, the analysis compares detailed program results by customer sector of those utilities identified as achieving high levels of DSM savings for near or below median costs.

Table 15 shows the median results for all the reviewed organizations and the Northeastern organizations as well as Efficiency ME's results for electricity DSM spending, savings, costs, and electric energy costs over all customer sectors.

Table 15. Overall Results for Electric Utilities in 2007

	Spending as % of Revenue	Electric Energy Savings as % of Sales	Peak Demand Savings as % of Peak Demand	Cost of Energy $/kWh	Cost of First Year Savings	
					$/kWh	$/kW
All Region Median	1.5%	0.8%	0.6%	$0.10	$0.18	$774
Northeast Median	1.6%	0.9%	0.6%	$0.13	$0.25	$1,413
Efficiency ME	1.1%	0.8%	0.4%	$0.10	$0.14	$1,588

For the 20 electricity DSM programs reviewed, the overall median electric energy savings as a percentage of annual sales is 0.8%, and the median first year costs for electric energy savings is $0.18/kWh, but the best practice organizations, i.e., those with the largest relative energy savings and below median costs achieved their energy savings at about 1.5% of annual sales. The median for peak demand savings as a percentage of peak demand 0.6%, and the median cost is $774/kW; however, the organizations with the largest relative peak demand savings and below median costs saved about 1.2% of peak demand.

The scatter plot in Figure 29 below illustrates where each organization falls relative to median electric energy savings and median costs of savings. Energy savings as a percentage of sales is on the horizontal axis; first year cost of energy savings is on the vertical axis; and the axes are set at the median values. Thus, the organizations in the bottom right quadrant are the ones that achieved above median energy savings at costs below the median, i.e. high savings, low costs.

Figure 29. Scatter Plot of 2007 Electric Energy Savings and First Year Costs ($/kWh)

Efficiency ME's overall results for electric DSM are close to the typical results of the organizations reviewed. Efficiency ME achieved electric energy savings, as a percentage of sales, of 0.77%, just below the median for all the utilities and the median for the Northeastern utilities, at first year costs of $0.14/kWh, also below the median cost for all utilities and the median cost for the Northeastern utilities.

In the C&I sector, Efficiency ME achieved similar results: below median electric energy savings for all utilities and below median electric energy savings for the Northeastern utilities, 0.6%, at near median first year costs for all utilities and below median costs for the Northeastern utilities, $0.17/kWh. Its business program, comprised mostly of lighting rebates, achieved 85% of C&I energy savings at slightly higher than median cost for all utilities but below the median cost for the Northeastern utilities, $0.17/kWh.

In the residential sector, Efficiency ME is a best practice organization in terms of cost/savings achieved, having achieved above median electric energy savings as a percentage of sales, 1.1%, at below median first year costs, $0.11/kWh. Efficiency ME achieved similar results when compared to the Northeastern utilities: above median energy savings at below median first year costs. The agency's ENERGY STAR Lighting program achieved 92% of its residential energy savings at very low costs, $0.06/kWh.

Efficiency ME reported peak demand savings for only the business program in the C&I sector. This program conserved 0.6% of estimated C&I peak demand, above the median for all utilities and near the median for the Northeastern utilities, at below median costs for all the utilities and at below median costs for the Northeastern utilities, $794/kW.

Most of the benchmarked organizations have been conducting electricity DSM programs for an extended period. Since these organizations have been conducting electricity DSM programs, savings have been realized from a lot of the ―low hanging fruit among DSM measures, such as T12 lighting system conversions to T8 systems.

Table 16 shows the median results for all the reviewed organizations and the Northeastern organizations as well as Unitil (ME) 08's results for natural gas DSM spending, savings, costs, and energy costs over all customer sectors.

Table 16. Overall Results for Natural Gas Utilities in 2007[3]

	Spending as % of Revenue	Natural Gas Savings as % of Sales	Cost of Energy $/Mcf	First Year Cost of Savings $/Mcf
All Region Median	1.4%	0.6%	$12	$32
Northeast Median	1.4%	0.5%	$15	$55
Unitil (ME) 08	1.2%	0.5%	$17	$41

For the 14 natural gas DSM programs reviewed, the overall median DSM spending as percentage of revenue is 1.4%, the median energy savings as a percentage of annual sales is 0.6%, and the median first year costs for energy savings is $32/MCF, but the organizations with the largest relative energy savings and below median costs achieved their energy savings at about 1.0% of annual sales.

The scatter plot in Figure 30 below illustrates where each organization falls relative to median natural gas savings and median costs of savings. Natural gas savings as a percentage of sales is on the horizontal axis; first year cost of natural gas savings is on the vertical axis; and the axes are set at the median values. Thus, the organizations in the bottom right quadrant are the ones that achieved above median natural gas savings at costs below the median, i.e. high savings, low costs.

[3] 2008 data was used for Unitil (ME) because at the time of collection its 2008 annual report was available as well as its revenue and sales data from the EIA176 database.

Figure 30. Scatter Plot of 2007 Natural Gas Savings and First Year Costs ($/MCF)

Unitil (ME) 08 reported DSM spending at 1.2% of revenue, lower than the median for all the utilities as well as the median for the Northeastern utilities. Unitil (ME) 08's natural gas savings were 0.5% of annual sales, slightly below the median for all the organizations but the same as the median for the Northeastern utilities, and Unitil (ME) 08's cost of savings was slightly above the median for all the utilities but below the median for the Northeastern utilities at $41/MCF.

4 ASSESSMENT OF PROS/CONS OF ELECTRIC AND FOSSIL FUEL JOINT DSM DELIVERY

As the Maine Public Utilities Commission (PUC) considers the most effective approach to implementing enhanced demand-side management (DSM) programs throughout the state, it is important to examine best practices and lessons learned from DSM programs in other states. The question of whether fuel and electric programs should be administered jointly is one issue that several states and utilities have attempted to address over the past several years, and one that the Maine PUC is rightfully taking into account in its deliberations.

Summit Blue/ACEEE has examined combined electric-fuel programs[4] in several states, and recommends that electric and fuel efficiency programs be administered in coordination with each other for all customer classes, and preferably as closely as possible. We find that some of the most successful electric and fuel programs are administered by a single entity. However, some states have shown that combined electric-fuel programs can still be very successfully executed by separate entities, as long as all associated financial and political issues are thoughtfully and thoroughly ironed out.

Fuel switching is one issue associated with combined electric-fuel program that we do not address. This has been a contentious issue between electric and natural gas utilities for decades, with the gas industry suggesting that a shift from electricity to gas results in reduced primary energy use—often framed as "site versus source." The focus of this survey, however, was to identify combined or coordinated programs that produce both electric *and* fuel savings for the end user.

The diverse array of jointly administered combined electric-fuel programs around the country offers a useful basis for recognizing best practices and learning from other states' lessons. The following case studies provide some important insights into jointly administered or coordinated DSM programs, the advantages and disadvantages, and their potential applicability to Maine.

4.1 Case Studies

Various types of combined electric-fuel programs have emerged over the last several years and we classify these into three tiers: (1) programs administered jointly through a single entity; (2) collaboration and integration of separately administered programs; and (3) isolated, separately administered programs. We present here illustrative case studies that highlight both successful approaches to achieve electric and fuel savings, as well as some pitfalls that Maine may be able to address prior to the inception of its new programs. These case studies are not intended to be comprehensive.

Our case studies fall into tiers (1) and (2), and while we classify each case study under a specific tier, we recognize that states often employ multiple strategies, blurring the line between the three approaches. We did not analyze separately administered programs because they fall outside the scope of this review.

[4] *Combined Electric-fuel programs* are energy efficiency programs that seek efficiency improvements for both electricity consumption and fuel (including natural gas, fuel oil, propane, or other fuels) consumption.

First, we describe states that enlist single program administrators, such as state-administered efficiency entities, to implement combined electric-fuel programs. These entities reconcile cost attribution[5] issues in advance of implementation and reach customers more effectively, increasing the potential for energy savings. Second, we describe cases in which separate electric and natural gas utilities administer combined electric-fuel programs relatively smoothly through coordination.

4.1.1 Electric-Fuel Programs Administered by a Single Entity

Vermont

Efficiency Vermont was established in 1999 by the Vermont legislature and the Vermont Public Service Board to deliver energy efficiency programs. Upon its inception, all Vermont electric utilities—with the exception of Burlington Electric Department—ended their efficiency programs and Efficiency Vermont took over, streamlining the state's electricity programs and allowing consumers throughout the state to receive the same services. Even Burlington Electric Department, which accounts for about 5 percent of the electric load of the state, is required to provide the same exact services as Efficiency Vermont.

About 50 percent of the homes in Vermont use oil for heating, 15 percent use propane, and 14 percent use natural gas. Vermont Gas Systems, Inc. is the only natural gas utility, servicing customers in the northwest region surrounding the city of Burlington. Vermont Gas began offering energy efficiency programs in 1993. In 2000, when Efficiency Vermont took on electricity programs, they negotiated with Vermont Gas to develop a consensus for a single offering to customers of both natural gas and electricity. A few negotiating sessions were needed to hammer out a new program design that would cut across two utility services. Some of the issues that arose included: what the roles and responsibilities of each organization were to be with the joint implementation of programs; what the minimum electric and gas efficiency requirements would be for program participation; what the appropriate incentive levels from each organization would be; who would pay for energy ratings and marketing costs; and what the base incentive amount should be versus the supplemental incentive amount. These issues were all sorted out relatively quickly.

While Efficiency Vermont largely falls in the category of single-entity administration, this coordination with Vermont Gas is an example of collaboration and integration of separately administered programs, which demonstrates how a state can employ multiple strategies of electric-fuel program delivery. The collaboration between Efficiency Vermont and Vermont Gas has enabled Efficiency Vermont to take on some programs that do not offer the kind of large electricity savings that most single-fuel programs seek to achieve. For example, if Efficiency Vermont only spent electric ratepayer dollars in ways that impact the consumption of electricity, the *Energy Star Homes®* program, a residential new construction program, would not exist. Efficiency Vermont engages in these programs because they want to maintain a comprehensive portfolio of services, enabling them to penetrate more of the market and interact with more customers. Other than in Vermont Gas territory, however, there is no supplementary fuel fund matching the electric funds for these programs.

Joint programs between Efficiency Vermont and Vermont Gas include a residential Retrofit Program, a residential New Construction Program, a residential Equipment Replacement Program, a WorkPlace New Construction Program, and a WorkPlace Equipment Replacement and Retrofit Program. The New Construction programs are performance standards, wherein base incentives are granted if customers meet participation requirements. Supplemental incentives are granted for *Energy Star®* appliances and deeper

[5] *Cost attribution* refers to the allocation of cost to multiple parties (e.g., electric and fuel programs or utilities) in proportion to the electric and fuel savings that result from a given energy efficiency measure.

energy efficiency measures. Commercial and industrial (C&I) programs for large facilities are largely custom programs, where incentives are calculated ad hoc, and programs for smaller facilities are typically prescriptive incentives.

Last year, Efficiency Vermont's mandate was expanded beyond electricity to include unregulated fuels like fuel oil and propane. They have expanded and continue to expand their *Home Performance with Energy Star* and other initiatives to address this broader scope. However, the funding levels for this non-electric work are significantly lower than for their electric work. Non-electric funds are allotted from auction proceeds from the Regional Greenhouse Gas Initiative (RGGI) and the ISO-New England Forward Capacity Market revenue, both of which are quite modest and somewhat uncertain. As a result, there are constraints on what Efficiency Vermont can offer in the way of non-electric services.

The market penetration rate in the portion of state serviced by Vermont Gas is far higher than the regions serviced exclusively by Efficiency Vermont. Vermont Gas is able to leverage additional influence within the building community to reach out to more customers and make programs as effective as possible. According to a KEMA evaluation of Efficiency Vermont's residential programs in 2003,

> *Program participation continues to be concentrated in the Northwest to a greater extent than overall residential new construction activity*. In 2003, 68 percent of the completed units were located in the Northwest region v. 48 percent of permitted new single-family homes. This pattern may be attributed in part to the residual effects of having a strong program offered by Vermont Gas Service operating in the region which continues to partner with Efficiency Vermont (KEMA 2005).

With the integration of Efficiency Vermont and Vermont Gas's efficiency program offerings in Vermont Gas's service territory, customers have benefited from a single, simple, clear marketing message, which lessens the confusion about what programs customers can participate in and what they can get rewarded for doing. While individual customers' energy savings have not necessarily changed significantly, participation rates have clearly increased, largely because having one entity to interact with instead of two is less of a hassle, and customers participate who may otherwise be deterred by complexity.

(Source for this section: Neme 2009)

New Jersey

Energy efficiency programs in New Jersey are administered by the Office of Clean Energy (OCE) within the Board of Public Utilities (BPU) under the *New Jersey Clean Energy Program*. The state's electric and natural gas investor-owned utilities (IOU), which administered the efficiency programs until 2003, are still responsible for collecting revenues for the programs through a systems benefits charge, but they transfer these funds to a third-party fiscal agent supervised by OCE.

In 2006, OCE contracted New Jersey's energy programs out to market managers; its residential efficiency programs are implemented by Honeywell and its C&I efficiency programs are implemented by TRC Companies, Inc. Honeywell and TRC took over the programs of the state's seven electric and natural gas IOUs, and efficiency programs were shifted to a central administrator format. These contractors are able to easily implement combined electric-fuel programs, as they have taken over program responsibilities from both electric and gas utilities. For the first year of transition from utility-administered programs to market manager programs, in order to smooth the transition, BPU and OCE required market managers to resume previous utility program offerings, without beginning new programs. These included mostly rebate-type programs, as well as the *SmartStart Buildings* program, which is designed to increase energy efficiency for new construction and retrofit projects in the commercial and industrial sectors.

Currently, C&I incentives are on both a kWh and therm basis. For buildings larger than 200 kW, TRC programs offer energy reduction targets of 15 percent, allowing businesses to achieve those goals by reducing consumption of any fuels—or on a strictly Btu basis—as long as certain minimum thresholds are reached for electricity savings. For smaller buildings, a new program sends contractors to perform walk-through audits and retrofits to achieve energy savings. TRC also offers custom programs that can save both electric and gas, allowing firms with effective projects to apply for a TRC review to receive project incentives.

TRC and Honeywell continue to work closely with utilities, and some utilities are even beginning to offer complementary or parallel programs of their own. This is due in large part to increased funding through the American Recovery and Reinvestment Act (ARRA), RGGI, and increased system benefits charge (SBC) funds, and in part to IOUs wishing to retain some control over their customers' efficiency efforts. It is unclear how these parallel programs will be reconciled with market manager offerings, or even whether they need to be, but New Jersey is still in the process of sorting out its energy initiatives. In the past, New Jersey's residential programs have only been able to reach customers of electric and natural gas IOUs, and no explicit oil or propane incentives have been offered for either residential or C&I customers, but thanks to new ARRA funds, these programs will soon be able to offer similar incentives for oil and propane, as well as to customers of private utilities.

(Sources for this section: Rooney 2009, Deseve 2009 and Schmidt 2009)

Oregon

In 2002, Oregon *Senate Bill 1149* established a public purpose fund through charges on electric and gas utility ratepayers' bills for the largest IOUs in the state, and authorized the Public Utility Commission to direct energy efficiency funds to the Energy Trust of Oregon. Today, customers of Northwest Natural and Cascade Natural, which together account for 90 percent of the gas distribution in Oregon, help fund Energy Trust's efforts, along with customers of PacifiCorp and Portland General Electric (PGE), which provide electricity to about 70 to 75 percent of Oregon's electric customers.

The directives of *S.B. 1149* took substantial time to come to fruition. The Public Utility Commission worked with Energy Trust and the large utilities to reach agreements on funding and program implementation, a process that was aided by the utility restructuring stipulations put forward in the bill. Since 2002, another round of funding for Energy Trust has been provided through *Senate Bill 838*. Under this bill, the PUC is authorized to undergo separate negotiations with PacifiCorp and PGE after reviewing their integrated resource plans and determining whether there are potential cost-effective savings beyond investments made with funding from *S.B. 1149* surcharges. A separate tariff is accordingly added to ratepayer bills for both IOUs, While Energy Trust uses both gas and electric funds to reach out to consumers of both fuels, they employ a general accounting mechanism that allocates funds according to each utility's public purpose fund contribution. However, the organization is by no means required to use 100 percent of PGE funds in PGE territory; there is flexibility to use efficiency funds where they are needed.

Energy Trust is one of the country's most exemplary entities that administer integrated electric-fuel programs. There are no separate gas and electric programs implemented by Energy Trust; the organization implements combined electric-fuel programs by economic sector—residential, commercial, and industrial—and offers fuel-blind services, seeking to achieve efficiency gains among all fuels at once It should be noted, however, that the vast majority of home heating in Oregon is generated from electricity and natural gas. Energy Trust's vendors are knowledgeable about both electric and gas improvements, and assist consumers in both areas.

Energy Trust Programs are far reaching and penetrate much of the Oregon market. Consumers of both electricity and natural gas tend to have a higher probability of participating in programs, as there are more total offerings for their cohort. Energy Trust has reached approximately 15 percent of the residential consumers, 12 percent of the commercial consumers, and 20 to 25 percent of the industrial consumer load. Even in areas where utility service territory overlaps with a People's Utility District (PUD) or a municipal utility, Energy Trust works with consumers to enhance efficiency and reduce consumption, and partners with utilities when possible to serve mutual customers' needs.

(Source for this section: Degens 2009)

Wisconsin

Wisconsin operates one of the most successful examples of dual fuel programs in the country. The state's five largest IOUs are combined electric-fuel utilities. While the breakdown of electric and gas utility territories are not completely coincident with each other, the inherent integrated nature of Wisconsin's utilities has historically made such programs relatively smooth to implement. Wisconsin has been running gas programs for many years—some of them joint gas and electric—well before Focus on Energy (Focus) was established in 2001. These factors helped the state to achieve the level of success with electric and fuel program integration that it has. Integration in Wisconsin is so complete that, Focus, the statewide energy efficiency and renewable energy entity, does not diligently separate electric and gas funds and savings. Essentially, the combined electric-fuel nature of the state's largest utilities mitigates the potential for attribution disputes, which would arise in most states.

Originally created by the Wisconsin Legislature in 1999, Focus is currently funded by 1.2 percent of IOU contributions of both electric and natural gas operating revenues. Focus serves close to 90 percent of all Wisconsin energy consumers. IOUs are mandated to participate in Focus programs, and municipal utilities and electric cooperatives are required to collect ratepayer benefits funds and either run their own efficiency programs or join Focus. More than 90 percent of municipal utilities are currently participating in Focus, and about half of all electric cooperatives have joined, giving Focus the ability to penetrate the vast majority of the Wisconsin market.

In practice, Focus runs many of its programs in a multi-fuel environment, but is not authorized to offer programs to consumers of every fuel type. A significant portion of rural customers in some areas of the state use propane or fuel oil rather than natural gas and these customers are not eligible for Focus's gas services (their electric eligibility would depend on whether or not they are served by a participating electric utility). While there are some discussions in the state about expanding Focus to include unregulated fuels, this change would require legislative action.

Beyond the unregulated fuels, some customers also have access to utility programs in addition to the Focus offerings. Three Wisconsin IOUs chose to operate energy efficiency programs alongside Focus programs. IOU programs must be approved by the Public Service Commission of Wisconsin and must complement existing Focus programs. Funds for these IOU programs are auxiliary to their contribution to Focus. Another Wisconsin IOU contributes additional funds to Focus to implement programs in its service territory. This additional contribution is the result of a decoupling agreement. Municipal utilities and electric cooperatives that choose to opt out of Focus programs are required to use the funds collected from their customers to offer comparable services.

(Source for this section: Kuntz 2009)

4.1.2 Programs Administered by Separate Electric and Fuel Entities

Massachusetts

Massachusetts has been providing fuel-blind residential energy audits since the federal *Energy Policy and Conservation Act of 1975* (EPCA) required all states to do so, though few other states have continued these programs. In the early 2000s, Massachusetts officials acknowledged that home energy audits were not saving an adequate amount of energy and that there were particular problems among oil customers with regard to price shocks. Since then, *MassSAVE*, a collaboration of all Massachusetts IOUs, has implemented residential programs in the state, providing educational materials, installation guidance, utility-sponsored incentives, contractor-performed installations, and inspections. While oil customers, who comprise about 38 percent of Massachusetts homes, do not pay into a public benefits fund (PBF) through their fuel services, they do contribute to the electric PBF, and are thus offered fuel-blind efficiency services, partly under the justification of EPCA.

Despite the fact that Massachusetts electric utility service territories do not align exactly with gas territories, all electric IOUs are required to offer the same fuel-blind programs to their residential customers. For example, a residential oil heat costumer who is also an electric customer of National Grid would receive the same incentives and rebate opportunities as a natural gas customer from NSTAR or Bay State Gas. Because all Massachusetts electric IOU customers pay into the PBF, the programs view them all as eligible for services, regardless of their home's heating fuel (Massachusetts natural gas customers also pay into a PBF through five-year plan settlements). Electric energy savings implemented by a gas IOU program are reported back to the customer's electric utility, which is duly credited. This issue is more difficult in the commercial and industrial sectors for oil or propane consumers, as state legislative efforts have been unable to provide businesses with the same fuel-blind services as residences. Additionally, customers of a municipal electric utility and a gas IOU would receive services through their gas company, and would therefore not receive state-supervised electric efficiency services, as there would be no dedicated funding.

The 2008 Massachusetts *Green Communities Act* has begun to change the shape of energy efficiency programs in the state. It explicitly requires all cost-effective energy efficiency to be implemented, as well as the integration of gas and electric efficiency programs. Moving forward, Massachusetts officials are seeking to streamline state efficiency programs, further integrating various fuel programs, as well as open up the contracting process for program implementation. While programs currently give customers information about other program services, administrators are trying to take full advantage of the experience of being inside customers' homes to more effectively encourage further program participation. For example, residential heating and air conditioning programs are currently administered separately, whereas integration of the two would ensure that anyone who put a combination HVAC unit in their home would be aware of the installation best practices and incentives relating to both components of the equipment.

(Sources for this section: Bingham 2009, Sherman 2009, Huckabee 2009)

Connecticut

In Connecticut, the largest electric and gas utilities coordinate their program efforts, using common vendors and offering joint delivery of programs in order to maximize the efficacy of customer outreach and energy efficiency expenditures. Connecticut's electric IOUs are Connecticut Light and Power (CL&P) and United Illuminating (UI), and there are seven municipal electric companies in the state as well. The state's gas utilities include Yankee Gas, Connecticut Natural, and Southern Connecticut Gas. Yankee Gas and CL&P are both subsidiaries of Northeast Utilities.

All electric distribution utilities, natural gas companies, and municipal electric utilities are required by Connecticut statute to provide "conservation and load management" programs for their customers. Connecticut's Energy Conservation Management Board (ECMB) advises and assists the utilities in developing and implementing their efficiency program plans and is subject to the Department of Public Utility Control (DPUC) process and decisions to guide the operation of the Connecticut Energy Efficiency Fund. Most of these funds are raised through an electric bill surcharge. Connecticut's utilities administer the state's efficiency programs and are also accountable for achieving savings goals by the DPUC and ECMB. The utilities and their hired contractors implement the programs.

While electric programs are funded by a SBC, natural gas energy efficiency programs are supported by a monthly charge established in the gas companies' plans, plus funding based on the difference between the imposed tax and the approved tax.[6] However, natural gas is used to heat only about 15 percent of Connecticut homes. Fuel oil accounts for around 60 to 65 percent of homes, though there is currently no public benefits charge on fuel oil bills. This lack of oil efficiency funding is partially offset by a $75 overall fee for each participant in the fuel-blind *Home Energy Solutions* audit and direct installation program that is provided by both UI and CL&P. Money for oil efficiency programs is also being partially funded through the federal *American Recovery and Reinvestment Act of 2009* (ARRA).

Historically the DPUC and ECMB pushed for combined electric-fuel programs, recognizing their potential benefit for Connecticut energy consumers. That push came to fruition in 2005 under *Public Act 05-1*, when gas and electric utilities were charged with coordinating their energy efficiency services. It has taken a number of years for these program collaborations to reach their current level of coordination. Issues that needed to be addressed by this evolving program included: which entities would be paying for which costs; differences in contractor selection; joint RFPs leading to the question of who would be taking what responsibility; and adapting to the notion that certain programs would no longer operate under prior management. At this point, all of these issues have largely been ironed out, and efficiency program managers in Connecticut are generally pleased with how the programs are running.

While it may require more bulk administrative costs for Connecticut utilities to run programs jointly rather than separately, those costs are far less than the separate costs of three individual programs. Marketing literature for programs is consolidated for each fuel-blind program, eliminating the need for triplicate development of marketing materials. Consumers benefit from the simplicity of having one number to call for all energy efficiency program opportunities, rather than one for each fuel. The program coordination also allows certain economies of scale for technology procurement, and both customers and vendors benefit from the consistency of the delivery of the programs.

(Source for this section: Gordes 2009)

4.2 Discussion

In all states where combined electric-fuel programs operate, they serve to cut total program costs through joint marketing and administration, simplify efficiency programs for consumers, and, in most cases, increase market penetration and customer participation. While some of the examples detailed below subscribe to tier (2)—coordination between separate programs—all of the program administrators

[6] This funding mechanism is outlined in Connecticut Public Act 07-242, Section 115b.

surveyed for this analysis concurred that tier (1)—wherein programs are administered by a single entity—is the ideal in terms of maximizing energy efficiency impacts. Nonetheless, as indicated in our case studies, second tier programs can still be successful as long as negotiations of funding and cost attribution issues are hammered out thoughtfully and fully. Useful insights can be gained by comparing the program experiences in Massachusetts and Connecticut.

While some Massachusetts efficiency programs are administered by combined electric-fuel utilities and Connecticut programs are jointly administered by separate electric and fuel utilities, the two states are actually quite similar in their programs' structures, and both states' programs are extremely effective. In both states, the utilities have ceded some degree of ownership and control of program components, and have instead agreed to jointly select contracted vendors to deliver programs. Connecticut utilities have already contracted with one another and have come to agreements on respective portions of gas and electric costs and attributions. Once those issues are sorted out, which can be a formidable process, the vendors take over, and the program runs as if one entity is managing it.

Based on our research we see two general strategic directions for programs:

- Fuel-blind programs that are not specifically marketed as saving either electricity or fuel, and

- Combined electric and fuel programs that are marketed explicitly to seek to achieve both electricity and fuel savings.

In ACEEE's view, while the difference may appear semantic, the two approaches result in fundamentally different motivations for program administrators. Combined programs are a more logical extension of existing electric programs that focus on maximizing energy savings, while fuel-blind programs are more consistent with public programs intended to maximize economic total benefit to the consumer. While combined programs principally seek to maximize total achievable savings, fuel-blind programs seek to achieve the most cost-effective savings possible, which does not always translate to savings maximization.

The most significant benefit of operating a combined electric-fuel program is the reduction in program costs resulting from the elimination of redundant administrative and marketing infrastructure. Combined programs also offer the potential for much greater combined savings, since programs have the opportunity to achieve both electric *and* fuel savings. However, a combined program may not necessarily maximize the savings for electricity, as the program's marketing and messaging is not optimized specifically for electricity. It is important to understand that while individual fuel participation rates for combined programs may be somewhat lower, the combined Btu savings per participant are likely to more than offset the reduced participation.

Additionally, the combined marketing of electric and gas programs may not be equally effective for all market sectors. Different sectors deal with energy decisions differently. ACEEE research has shown that integrated marketing of electric and fuel programs resonates strongly with large industrial, commercial, and institutional consumers that often employ energy or facilities managers focused on actively managing all facilities' utility consumption (Chittum, Elliott and Kaufman 2009). The same combined marketing message may be less effective for residential and small commercial customers from whose perspective separate electric and fuel bills are not necessarily viewed as a single management issue. Some preliminary results from behavior programs operated by OPOWER for Puget Sound Energy suggest that higher participation rates are seen for a single-fuel message than for a combined-fuel message (Corcoran 2009). This finding should not be interpreted to suggest that combined administration of programs is less effective. Rather, it suggests that marketing strategies should be aware that seasonal marketing efforts for residential and small commercial customers that focus on savings measures for electricity in the spring and summer and for fuel in the fall and winter may be more effective than running combined electric-fuel marketing year-round.

4.3 Joint DSM Delivery Conclusions

The diverse array of electric-fuel programs around the country offers a useful basis for recognizing best practices and learning from other states' lessons. By examining the results and lessons learned from several combined electric-fuel programs in several states, we recommend that electric and fuel efficiency programs be closely administered in coordination with each other for all customer classes.

Adoption of DSM programs can be an inherently delicate issue because efficiency programs reduce energy demand, potentially adversely impacting a utility's revenue. Decoupling and other utility restructuring mechanisms, as well as state energy efficiency mandates, may help to minimize or alleviate this conflict of interest in some states (see Kihm 2009). However, even in states with more progressive energy policies and utilities, obstacles to DSM program consolidation remain difficult to overcome. The challenges are further complicated when electricity and fuels are considered together because of the potential for competition between the entities and concerns about savings and cost attribution.

While some states have been able to successfully coordinate programs offered between major publicly owned utilities, municipal utilities, and utility cooperatives, some utilities continue to oppose integration. In Vermont, for example, Efficiency Vermont offers electric efficiency services to the entire state with the exception of the Burlington Electric Department—though Burlington's services are required to exactly match those offered by Efficiency Vermont. In New Jersey, IOUs have recently begun to offer their own efficiency services outside the services of the Office of Clean Energy. Many PUCs have faced reluctance by utilities to cede control of programs and efficiency funds.

In some states, however, utilities have been able to run successful programs parallel to state-administered offerings. While this strategy may not be ideal for statewide coordination and consistency, such external programs may be as effective as state-administered programs, as long as they are held accountable to the same savings standards, and there is a strong measurement and verification process in place. In Wisconsin, for example, three IOUs continue to operate successful programs on their own, as do several municipal utilities and electric cooperatives.

While having dedicated funding sources for both electricity *and* fuel is highly beneficial, historically, energy efficiency charges have been politically difficult to mandate. Even if a state includes SBCs on electric ratepayer bills, a lack of similar funding from fuel ratepayers may very well preclude successfully integrated combined electric-fuel programs. A program with a dedicated source of funding for both electricity and fuel programs is likely to have the most success. Heating fuel funding could come from a SBC, allocation of RGGI proceeds, or some other source to be determined. In Vermont, Efficiency Vermont undertakes programs that address both electricity and fuel consumption, though natural gas efficiency funds come exclusively from Vermont Gas ratepayers, only 15 percent of the heating fuel consumers in the state. Efficiency Vermont runs fuel-blind programs for oil and propane users as well, with no dedicated funding, and can therefore not achieve savings as deeply as it would be able to with a dedicated funding source from oil consumption expenditures. Similarly, Massachusetts offers fuel-blind services to oil customers who are also electric IOU customers. Connecticut supplements its non-natural gas fuel services with a flat service charge to all *Home Energy Solutions* program participants. And New Jersey has recently begun offering oil and propane services because of a new surge funding through ARRA. In order for all consumers to continue to remain eligible for fuel-blind services, efficiency programs for all fuel types should have some form of allocated funding.

As one program administer noted, energy consumers care about how much they are paying for their energy, typically not about what fuel source their energy is coming from. Consumers should be given an array of savings opportunities from a simple, one-stop shop vendor. This streamlined process will facilitate program implementation, help to achieve savings goals, make customer participation more simplified and favorable, and therefore increase participation, enhancing all such programs while augmenting efficiency gains.

5 WORKFORCE DEVELOPMENT AND JOB CREATION

Achieving aggressive DSM goals in Maine depends on a highly skilled and capable Maine-based workforce to design, install, and deliver efficient products and services. As the demand for energy efficiency and renewable energy services in the residential and commercial sectors grows it will bring new opportunities for existing companies, provide start-up opportunities for new Maine based companies, and motivate out-of-state companies to establish offices in Maine to deliver services to Maine customers.

Maine can capitalize on this opportunity to create lasting "green jobs" by identifying the necessary skill sets to deliver the potential DSM programs and investing in training to build a workforce with the proper skills and certifications. Summit Blue recognizes that a comprehensive assessment on the workforce requirements in the near and long-term future is beyond the scope of this study, so we have utilized a multi-pronged approach to identify priorities and model estimated workforce needs. This chapter includes:

- An overview of the workforce development needs including job certifications, workforce sectors and examples of successful training programs.
- Estimates of the job creation impacts of Maine's potential DSM initiatives.

Summit Blue recommends that key decision-makers in the State of Maine review the findings included in the report *Green Jobs, Green Savings: Developing Maine's Economy by Securing Our Energy Future* published by Opportunity Maine in 2009. This report provides strategies for the development of a strong energy workforce in Maine through policy, training and economic development.

5.1 Workforce Development

The energy efficiency workforce comprises a wide range of traditional and new job classifications and skill sets. In general, the Maine workforce of today possesses all of the core capabilities required to delivery DSM, however, with an emphasis on training and certification, the quality of the work delivered will be improved.

5.1.1 Certifications

Table 17 and Table 18 provide descriptions and certification resources for jobs typically associated with residential and non-residential energy efficiency programs. Numerous national certifications and training programs are available focused on the DSM workforce industry. In some areas, Maine has already prepared the market (e.g. Building Performance Institute certified contractors for existing homes weatherization work), in other areas, opportunity exists to broaden and increase the level of certification of workers.

Table 17. Contractor Titles, Descriptions and Certification Resources for Residential DSM

Job Title	Description	Certifications Available
Home Energy Raters	A **Certified Home Energy Rater (HERS)** is a person trained and certified by an accredited Home Energy Rating Provider to inspect and evaluate a home's energy features, prepare a home energy rating and make recommendations for improvements that will save the homeowner energy and money. A HERS rating is required to demonstrate a residential new construction project complies with ENERGY STAR.	-Residential Energy Services Network (RESNET) Certified Home Energy Rater http://www.natresnet.org/
Residential Building Analysts and Professionals	Energy efficiency professionals in the residential sector perform a wide range of services. Job descriptions include but are not limited to: energy auditors, energy retrofit contractors, energy efficient green builders, insulation contractors, weatherization professionals and installers of energy efficiency materials and equipment	- The Building Performance Institute (BPI) provides nationally recognized and accredited training and certification to contractors in the residential building industry. BPI certifications include: Building Analysts, Envelope (Insulation/Air sealing) Professionals, Manufactured Housing Professionals, Heating Professionals, A/C/ Heat Pump Professionals, Multifamily Building Operations Specialists, Multifamily Hydronic Heating System Design Professionals, and Multifamily Advanced Heating Plant Technicians www.bpi.org -The Maine Association of Building Efficiency Professionals (MABEP) offers trainings and conferences for professionals interested in building science and energy efficiency http://www.efficiencypros.org/ -The Maine Energy Marketers Association offers BPI Certification Training for contractors and training programs for oil, gas, and propane technicians.

Job Title	Description	Certifications Available
		http://www.maineenergymarketers.com/
HVAC Technicians	Heating, Ventilation and Air Conditioning technicians provide a wide range of services on residential heating and cooling equipment, including system design, installation, maintenance, diagnosis and repair.	- The North American Technician Excellence (NATE) organization offers a Core exam and specialty exams covering 21 areas of heating, ventilation, air conditioning and refrigeration (HVAC/R). NATE certifications include electric, gas and oil heating specializations. http://www.natex.org/
Home Builders	Builders and developers can partner with the Environmental Protection Agency (EPA) Energy Star Program and have their new or manufactured homes certified by a Home Energy Rater. Certified homes receive the energy Star designation and the builders receive technical resources, marketing/promotional materials and increased visibility in a competitive industry.	-EPA Energy Star New Homes Partner http://www.energystar.gov/
Existing Home Performance Contractors	Maine Home Performance evaluators diagnose what is going on in the home around energy use and comfort, indoor air quality, moisture and combustion safety. Like a mechanic or a physician, home performance evaluators use technologically-advanced tools to diagnose the home before making suggestions for improvements.	- The Governor's Office of Energy Independence and Security developed the Maine Home Performance with Energy Star Program in close coordination with the Maine Housing Authority and Efficiency Maine and launched in October 2006. www.mainehomeperformance.org

Table 18. Contractor Titles, Descriptions and Certification Resources for Non-Residential DSM

Job Title	Description	Certifications Available
Architects	The American Institute of Architects (AIA) implemented a new policy in 2009 requiring all AIA members to take 4 hours of continuing education on sustainable design. The growing movement for energy efficient, green building has also led many architects to seek certification as a LEED AP (Leadership in Energy and Environmental Design Accredited Professional) through the Green Building Certification Institute (GBCI).	-American Institute of Architects (AIA) www.aia.org -Green Building Certification Institute (GBCI) LEED AP www.gbci.org
HVAC Technicians	Heating, Ventilation and Air Conditioning technicians provide a wide range of services on commercial heating and cooling equipment, including system design, installation, maintenance, diagnosis and repair.	- The North American Technician Excellence (NATE) organization offers a Core exam and specialty exams covering 21 areas of heating, ventilation, air conditioning and refrigeration (HVAC/R). NATE certifications include electric, gas and oil heating specializations. http://www.natex.org/
Engineers: Commissioning Agents	Building commissioning provides documented confirmation that building systems function according to criteria set forth in the project documents to satisfy the owner's operational needs. Commissioning existing systems may require developing new functional criteria to address the owner's current requirements for system performance. Engineers that perform building commissioning (Cx) on new buildings or retro-commissioning (RCx) on existing buildings are not required to attain certifications.	-Building Commissioning Association (BCA): Certified Commissioning Professional (CCP) www.bcxa.org -American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE): Commissioning Process Management Professional (CPMP) www.ashrae.org
Building Operators	Building operators and facility managers directly impact the energy use of commercial, industrial and institutional buildings. Operators that are	-The Building Operator Certification (BOC**)** course is currently offered through Efficiency Maine

Job Title	Description	Certifications Available
	knowledgeable about energy efficiency best practices can play a critical role in the successful adoption and implementation of DSM programs.	http://www.efficiencymaine.com/

5.1.2 Workforce Training Opportunities

Maine can promote the development of a strong energy efficiency workforce through industry trainings and conferences focused on building science, skills development and certification courses. Efficiency Maine currently offers a number of education and training opportunities aimed at advancing the knowledge of the energy efficiency workforce throughout Maine. Continuation and expansion of these activities will build a strong base of local and regional contractors to help Maine achieve its DSM potential.

Summit Blue recommends that Maine sponsor a high visibility annual or bi-annual event that brings together the key players in the residential and commercial energy efficiency fields, similar to Efficiency Vermont's Better Building by Design Conference (BBBD),[7] which includes training and networking opportunities. Table 19 shows that over 500 people attended the 2008 BBD conference. A simple projection based on state population projects attendance of over 1,100 people for a similar event in Maine.

Table 19. Attendance by Trade at Efficiency Vermont's Better Building by Design Conference with Projections for Maine

		Vermont	Maine
State Population		*621,270*	*1,316,456*
Profession	Share of Total Attendees	2008 Attendees	Projected Attendees
Architect	17%	95	201
Builder	18%	97	206
Contractor	21%	114	242
Developer	4%	20	42
Engineer	11%	59	125
Government	5%	28	59
Manufacturer	2%	13	28
Nonprofit	5%	25	53
Real Estate	2%	9	19
Student	1%	5	11
Supplier	3%	16	34
Other	12%	63	133
Total		**544**	**1153**

[7] Information can be found online at: http://www.efficiencyvermont.com/pages/Business/BuildingEfficiently/BetterBuildingByDesignConferen/

Opportunities already exist through several Maine organizations, and there are many excellent examples of successful programs throughout the country. Included below are some examples of training and workforce development programs:

- **Massachusetts Clean Energy Center: Energy Efficiency Skills Training Initiative**
  - The Massachusetts Clean Energy Center is offering nearly $1 million in grants targeted toward increasing the ability of Massachusetts vocational-technical high schools, colleges and universities, and community-based non-profit groups to meet the workforce development needs of the Commonwealth's clean energy sector. Working in collaboration with the Commonwealth Corporation - a quasi-public workforce development agency affiliated with the Executive Office of Labor and Workforce Development, the CEC plans to award grants of $75,000 to $200,000 for proposals to enhance, expand or create programs that build the clean energy workforce development capacity of higher education institutions, vocational technical high schools and community-based organizations.
    http://www.masscec.com/index.cfm?cdid=10527&pid=10225
- **Massachusetts Clean Energy Center: Online Workforce Development Resources**
  - To assist schools and other organizations with developing curriculum and career pathways in clean energy, the Clean Energy Center has created an online resource that links to examples of curriculum and courses targeted towards vocational and technical education and training for clean energy
    http://www.masscec.com/index.cfm?pid=10486
- **State of Connecticut: 21st Century Green Jobs Training Initiative**
  - Connecticut Governor M. Jodi Rell signed an Executive Order in February 2009 directing the Department of Labor to establish a 21st Century Green Jobs Training Initiative which shall provide training to meet the needs of the energy industry and other green industry workforce needs as identified by the Energy Workforce Development Consortium.
    http://www.ct.gov/governorrell/cwp/view.asp?A=1719&Q=433292
- **Efficiency Vermont: Better Building by Design Conference**
  - Better Buildings by Design is the region's premier design and construction conference, featuring interactive learning about building durability, efficiency, and value for both residential and commercial projects.
    http://www.efficiencyvermont.com/pages/Business/BuildingEfficiently/BetterBuildingByDesignConferen/
- **Northeast Sustainable Energy Association: Building Energy Conference**
  - Building Energy invites architects, designers, planners, builders, policymakers, manufacturers, and installers to work together to determine what's possible in the fields of building energy efficiency and renewable energy. The conference is held annually in Boston, MA.
    http://www.nesea.org/buildingenergy/

5.2 Job Creation Estimates

To estimate the job creation impacts of DSM spending in Maine Summit Blue examined the Rapid Deployment Energy Efficiency Toolkit (RDEE) developed by the US Department of Energy (DOE) and the US Environmental Protection Agency (EPA) as well as two key industry studies including *Avoided Energy Supply Costs in New England: 2009 Report* by the Avoided-Energy-Supply-Component (AESC)Study Group and *The Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy* by the Center for American Progress and Political Economy Research Institute (2008).

Based on extrapolation of jobs created per million dollars invested in energy efficiency from a review of these reports, Summit Blue estimates that achieving Maine's DSM potential can create between 900 – 1500 jobs.

Table 20. Summary of Maine DSM Job Creation Estimates

Job Creation Model	Jobs/$M	Maine Jobs Created (10 Yr Total)
RDEE Toolkit	16 (Residential) 11 (Commercial & Industrial)	900
PERI Report: Green Recovery	9.4 (Direct) 5.9 (Indirect) 5.0 (Induced)	1300
AESC New England	22.9 (Electric DSM) 19.1 (Gas DSM)	1500
Average		**1200**

The following sections provide more detail on the methodology and job creation estimates used in the three different studies.

5.2.1 Rapid Deployment Energy Efficiency (RDEE) Toolkit

Background

The RDEE toolkit was designed in 2009 to assist utilities and state agencies receiving American Recovery and Reinvestment Act (ARRA) funds in directing the funds towards programs with proven track records and documented paths to implementation. The RDEE toolkit provides detailed implementation plans and job creation estimates for 10 programs in the residential and commercial sectors. The toolkit is available on-line at http://www.epa.gov/RDEE/energy-resources/ee_toolkit.html.

Methodology

The methodology used for the RDEE toolkit centers on four studies. The first study developed conservative estimates for total (direct, plus indirect, and induced) job impacts (ACEEE, 2008) of approximately 5 jobs per million dollars in energy efficiency spending. The second study developed moderate estimates for direct and indirect job impacts (Bezdek, 2007) of approximately 8 jobs per million. A third study developed larger impacts of around 20 jobs per million, which includes induced job effects in addition to direct and indirect effects (PERI, 2008). A fourth study, published by the International Monetary Fund (IMF) in 2002, is a meta-study of 16 empirical macroeconomic models that each estimated induced economic effects of various Federal monetary policies.

Table 21 shows the job estimates by program type utilized by the RDEE Toolkit. The toolkit also provides estimated energy savings, and ranks each program for applicability to a broad range of constituents, simplicity and risk level, sustainability or the likelihood for achieving market transformation and the degree to which the program leverages other funding sources or programs.

Table 21. RDEE Toolkit Job Estimates by Program Type

Program	Approx Mbtu per $1000	Approx Jobs per $M	Applica-bility	Simplicity & Lack of Risk	Sustain-ability	Leverage
RESIDENTIAL						
ENERGY STAR Products	3	9	High	High	Moderate	High
Easy Audit and Direct Install	5	21	High	Moderate	High	Moderate
HPwES	60	20	High	Moderate	High	Moderate
Efficient Heating and Cooling	25	14	High	High	Moderate	High
NON-RESIDENTIAL						
Prescriptive	400	9	Moderate	High	Moderate	High
Retrocommissioning	5,800	12	Moderate	Moderate	Moderate	Moderate
Commercial Food Service	60	7	Moderate	Moderate	Moderate	Moderate
Custom	1,500	16	Moderate	Moderate	Moderate	Moderate
Commercial Benchmarking and Performance	2,900	12	Moderate	Moderate	High	Moderate
On-Site Energy Manager	4,500	8	Low	Moderate	High	Moderate

Source: U.S. EPA Rapid Deployment Energy Efficiency Toolkit. 2009

Results

Summit Blue utilized the job estimates provided by the RDEE Toolkit and derived an average number of jobs created for residential and commercial programs. The model projects approximately 900 jobs would be created over the next ten years, as shown in Table 22.

Table 22. Maine Job Creation Estimates - RDEE Toolkit

Job Creation Model	Jobs/$M	Maine Jobs Created (10 Yr Total)
RDEE Toolkit	16 (Residential) 11 (Commercial & Industrial)	900

5.2.2 AESC New England (2009)

Background

The Avoided Energy Supply Costs in New England: 2009 Report was prepared by Rick Hornby et al. at Synapse Energy Economics Inc. It was prepared for the Avoided-Energy-Supply-Component (AESC) Study Group. This report provides projections of marginal energy supply costs which will be avoided due to energy efficiency programs offered to customers throughout the state. One section elaborates on economic-development impact of Massachusetts energy-efficiency programs, specifically job creation. The methodology is explained in Appendix A. The study estimates overall net employment impact (jobs created) per $1 million spent on DSM for electric and gas DSM programs.

Methodology

An input-output model is used with three factors taken into consideration:

1. the *increase* in economic activity as a result of expenditures on energy efficiency programs (EE);
2. the *decrease* in economic activity as a result of decreased expenditures on energy supply (avoided supply);
3. *"respending,"* the *increase* in spending for other goods and services by "new workers" (respending).

Energy Efficiency net impacts are calculated by EE *minus* avoided supply *plus* respending. A multiplier is created (per $1 million DSM input) and then used on assumed expenditures to calculate actual impacts.

Results

Results are provided in job-years. The study assumes that one job-year equals to one full-time job for one person for one year. Table 23 shows the job creation estimates per million dollars of DSM investment and the projected number of jobs created in Maine.

Table 23. Maine Job Creation Estimates - AESC New England Report

Job Creation Model	Jobs/$M	Maine Jobs Created (10 Yr Total)
AESC New England	22.9 (Electric DSM) 19.1 (Gas DSM)	1500

The study concludes that efficiency leads to a reduction in cost of living and the expense of business operations and promotes more respending. It also makes the state more economically sound and more attractive for relocation. It also helps in the reduction of the unemployment rate.

5.2.3 PERI Report: Green Recovery (2008)

Background

The Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy was co-prepared by the Center for American Progress and Political Economy Research Institute in September 2008. This report outlines a green recovery program to strengthen the US economy over the next two years. The study recommends six key infrastructure investment strategies for short term economic recovery—retrofitting buildings, expanding mass transit and freight rail, constructing smart energy grids, and expanding production of wind power, solar power, and next-generation biofuels (i.e., grass, yeast, algae, engineered microorganisms, etc). One component of the study is emphasizing job creation through green spending.

Methodology

The authors assume a $100 billion program, which is comprised of $50 billion in tax credits, $46 billion in direct spending, and $4 billion to cover the cost of loan guarantees to generate $20 billion in net new lending.

The study uses an input-output model allowing for observation of relationships between different industries, between consumers of goods and services and also to estimate the effects on employment resulting from an increase in final demand for the products in a given industry. Thus the model allows the estimation of employment effects within each industry from a given level of spending.

Since the economy depends on an endless list of factors, the study estimates induced effects based on other studies' predictions. Some studies estimate that the number of induced jobs would be the same as generated directly and indirectly; thus doubling the number of jobs created. The authors use a more conservative estimate; induced jobs adding 1/3 to the total.

The authors also estimated how the $100 billion would be distributed between 34 states.[8] The authors estimate distribution of funds first by state GDP and then by population. They then balance these two approaches by using the midpoint of these two calculations.

Results

The report assumes a $100 billion dollars spent on green stimulus program all around the country would yield a total of 1,999,200 jobs. In the section where the proposed $100 billion green funding is divided to 34 states, Maine receives $396.3 million (based on GDP and population). From this funding, 9,132 jobs would be created.

The report utilizes the job impact estimates shown in Table 24.

[8] These 34 states were selected because they represent approximately 78% of the U.S. labor market

Table 24. Maine Job Creation Estimates - PERI Report

Job Creation Model	Jobs/$M	Maine Jobs Created (10 Yr Total)
PERI Report: Green Recovery	9.4 (Direct) 5.9 (Indirect) 5.0 (Induced)	1300

5.3 Workforce Development and Job Creation Conclusion

In summary, achieving Maine's potential for DSM implementation will benefit the economy through the creation of jobs and increased economic activity, but a strong focus on workforce certification, training and continued support of traditional skilled occupations will be required. Expenditures on energy efficiency programs in the state of Maine has the potential to create between 900 -1500 jobs in the next ten years, as shown in Table 25.

Table 25. Summary of Maine DSM Job Creation Estimates

Job Creation Model	Jobs/$M	Maine Jobs Created (10 Yr Total)
RDEE Toolkit	16 (Residential) 11 (Commercial & Industrial)	900
PERI Report: Green Recovery	9.4 (Direct) 5.9 (Indirect) 5.0 (Induced)	1300
AESC New England	22.9 (Electric DSM) 19.1 (Gas DSM)	1500
Average		**1200**

Geographic challenges also exist in Maine, as a large part of the population is situated along the southern coast. In the interest of rapidly and aggressively achieving DSM potential, Summit Blue recommends that Maine focus workforce development and training on these areas of higher population density first.

Increased spending on DSM programs and greater penetration of energy efficient products and services in Maine's economy will spur a response from the private sector. Trained contractors currently working in neighboring states with aggressive DSM programs are likely to move into the state and create a local, sustainable workforce. One of the important tasks and challenges for Maine is to help facilitate this evolution of a statewide DSM workforce. The recommendations found in this chapter and provided by referenced organizations for training programs and industry events should be investigated in greater detail so Maine can boost its economy and remain among leading states in the area of energy efficiency.

6 FINDINGS AND RECOMMENDATIONS

This report presents the results of a study conducted by Summit Blue our partner, American Council for an Energy-Efficient Economy (ACEEE) for the Maine Public Utilities to determine potential energy savings for Maine, along with recommendations on program delivery. The results of this report will inform Maine's forthcoming Triennial Plan and help to achieve savings and spending goals set by the Efficiency Maine Trust Act to capture all cost effective energy efficiency.

Data collected from 10 recent potential studies were used to extrapolate the achievable potential savings by program and sector area for Maine over the next 10 years. The data were also used to gauge the ability of Maine to achieve the potential at current funding levels with existing program designs and at higher funding levels with enhanced program designs. The results of this anlaysis estimate the potential to save between two and three times the electricity and up to five times the natural gas, as a percentage of sales, that is currently saved in Maine. The studies suggest these savings are achievable with comprehensive programming. To do so, however, Maine will have to increase spending on DSM programs by at least threefold over the next ten years.

This study also conducted a benchmarking analysis, which was used to compare detailed program results from a variety of electric and natural gas DSM program that previous studies have identified as top performers. This analysis found that Efficiency ME's overall results for electric DSM are close to the typical results of the organizations reviewed. However, compared to the 14 natural gas DSM programs reviewed, Maine (Unitil) reported DSM spending and savings lower than the median.

To addresses the question of whether fuel and electric programs should be administered jointly, Summit Blue/ACEEE examined combined electric-fuel programs in several states, and recommends that electric and fuel efficiency programs be administered in coordination with each other for all customer classes, and preferably as closely as possible. A program with a dedicated source of funding for both electricity and fuel programs is likely to have the most success. We find that some of the most successful electric and fuel programs are administered by a single entity even though some states have shown that combined electric-fuel programs can still be very successfully executed by separate entities, as long as all associated financial and political issues are thoughtfully and thoroughly ironed out.

Achieving aggressive DSM goals in Maine depends on a highly skilled and capable Maine-based workforce to design, install, and deliver efficient products and services. As the demand for energy efficiency and renewable energy services in the residential and commercial sectors grows it will bring new opportunities for existing companies, provide start-up opportunities for new Maine based companies, and motivate out-of-state companies to establish offices in Maine to deliver services to Maine customers.

Achieving Maine's potential for DSM implementation will benefit the economy through the creation of jobs and increased economic activity, but a strong focus on workforce certification, training and continued support of traditional skilled occupations will be required. Expenditures on energy efficiency programs in the state of Maine has the potential to create between 900 -1500 jobs in the next ten years. The recommendations found in this study should be investigated in greater detail so Maine can boost its economy and remain among leading states in the area of energy efficiency.

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APPENDIX A: COMPARATIVE MATRIX OF POTENTIAL STUDIES

Electricity

Electric Only		Cumulative Annual Energy Savings as % of Total Sales					Average Incremental Annual Energy Savings as % of Total Sales by Sector				Cumulative Annual Demand Savings as % of Total Sales				Average Incremental Annual Demand Savings as % of Total Sales by Sector				Total Cost ($Million)	Annual Cost ($Million)	Total First Year Cost/kWh ($)	Cost/kW ($)
		Tech	Econ	Achievable			Achievable				Tech	Econ	Achievable		Achievable				Achievable	Achievable	Achievable	Achievable
#	State	TOTAL	TOTAL	TOTAL	GWh	BBtu	Res	Com	Ind	Total	TOTAL	TOTAL	TOTAL	MW	Res	Com	Ind	TOTAL	TOTAL	ANNUAL	TOTAL	TOTAL
1	NH	27.6%	20.5%	10.8%	1,409	4809	0.5%	0.4%	0.2%	1.1%	21.6%	15.3%	8.5%	253	0.1%	0.5%	0.3%	0.9%	$564.8	$56.5	$0.40	$2,228
2	PA	n/a	27.3%	14.2%	26,700	91127	0.3%	0.3%	0.2%	0.8%	na	na	13.6%	5,650	0.3%	0.3%	0.1%	0.8%	$3,662.7	$203.5	$0.14	$648
3	ME	n/a	n/a	15.9%	1,518	5180	0.5%	0.8%	0.3%	1.6%	n/a	n/a	19.5%	386	0.5%	1.1%	0.4%	2.0%	$304.6	$30.5	$0.20	$789
4	RI	28.0%	24.0%	9.8%	764	2608	0.4%	0.5%	0.2%	1.0%	26.6%	26.4%	9.8%	216	0.5%	0.3%	0.1%	0.9%	$200.6	$20.1	$0.26	$927
5	CT	24.0%	n/a	13.4%	4,466	15242	0.5%	0.6%	0.2%	1.3%	24.1%	n/a	12.5%	907	0.3%	0.8%	0.1%	1.3%	$701.8	$70.2	$0.16	$773
6	VT	34.6%	n/a	19.4%	1,287	4392	0.9%	0.7%	0.4%	1.9%	na	na	33.2%	401	1.9%	0.7%	0.7%	3.3%	$266.8	$26.7	$0.21	$665
7	New Eng.	na	na	22.9%	33,668	114910	0.8%	1.4%		2.3%	na	na	28.3%	8,172	0.6%	2.2%		2.8%	$12,050.2	$1,205.0	$0.36	$1,475
	Median	27.8%	24.0%	14.2%	1517.8	5180	0.5%	0.6%	0.2%	1.3%	24.1%	20.8%	13.6%	401.0	0.5%	0.7%	0.2%	1.3%	$564.80	$56.48	$0.21	$789
	Mean	28.5%	23.9%	15.2%	9973.1	114910	0.6%	0.7%	0.2%	1.4%	24.1%	20.8%	17.9%	2283.8	0.6%	0.9%	0.3%	1.7%	$2,535.93	$230.34	$0.25	$1,072

Natural Gas

Fuel Type: Natural Gas					Cumulative Annual Potential Energy Savings as % of Total				Average Incremental Annual Potential as % of Annual Achievable				Total Cost ($Million)	Annual Cost ($Million)	Total Cost ($/MMBtu)	
					Tech	Econ	Achievable						Achievable	Achievable	Achievable	
#	State	Study Year	Study Period	Analysis Period (years)	TOTAL	TOTAL	TOTAL	Bbtu	Res	Com	Ind	Total	TOTAL	ANNUAL	Total	Author(s)
1	CT	2009	2009-2018	10	28.8%	25.2%	16.6%	6,667	na	na	na	1.7%	na	na	na	Kema
2	NH	2009	2009-2018	10	29.2%	16.9%	8.3%	2,215	0.4%	0.3%	0.1%	0.8%	$84.8	$8.48	$38.3	GDS
3	PA	2009	2008-2025	18	na	27.2%	11.0%	69,936	0.2%	0.2%	0.2%	0.6%	$1,534	$85.23	$21.9	ACEEE
4	MA	2009	2009-2018	10	44.0%	36.3%	25.5%	57,201	1.8%	0.6%	0.2%	2.5%	na	na	na	GDS
	Median				29.2%	26.2%	13.8%	31,934	0.4%	0.3%	0.2%	1.2%	$809.44	$46.85	$30.11	
	Mean				34.0%	26.4%	15.3%	34,004	0.8%	0.3%	0.2%	1.4%	$809.44	$46.85	$30.11	

Propane

Fuel Type: Propane					Cumulative Annual Potential Energy Savings as % of Total Sales				Average Incremental Annual Potential as % of Total Sales by Sector				Total Cost ($Million)	Annual Cost ($Million)	Total Cost ($/MMBtu)	
					Tech	Econ	Achievable		Annual Achievable				Achievable	Achievable	Achievable	
#	State	Study Year	Study Period	Analysis Period (years)	TOTAL	TOTAL	TOTAL	MMBtu	Res	Com	Ind	Total	TOTAL	ANNUAL	Total	Author
1	NH	2009	2009-2018	10	26.5%	16.1%	8%	5,354,984	0.4%	0.3%	0.1%	0.8%	$226.4	$22.6	$42	GDS
2	PA	2009	2008-2025	18	n/a	29%	na	na	na	na	na	na	na	na	na	ACEEE
3	VT	2007	2007-2016	10	17.8%	na	8.0%	768,832	0.4%	0.3%	0.05%	0.8%	$37.4	$3.7	$49	GDS

Fuel Oil

Fuel Type: Fuel Oil					Cumulative Annual Potential Energy Savings as % of Total Sales				Average Incremental Annual Potential as % of Total Sales by Sector				Total Cost ($Million)	Annual Cost ($Million)	Total Cost ($/MMBtu)	
					Tech	Econ	Achievable		Annual Achievable				Achievable	Achievable	Achievable	
#	State	Study Year	Study Period	Analysis Period (years)	TOTAL	TOTAL	TOTAL	BBtu	Res	Com	Ind	Total	TOTAL	ANNUAL	TOTAL	Author
1	NH	2009	2009-2018	10	26.5%	16.1%	8%	5,355	0.4%	0.3%	0.1%	0.8%	$226.4	$22.6	$42	GDS
2	PA	2009	2008-2025	18	n/a	29.4%	na	na	na	na	na	na	na	na	na	ACEEE
3	VT	2007	2007-2016	10	29.7%	na	14.1%	7,144	0.6%	0.7%	0.1%	1.4%	$112.1	$11.2	$16	GDS

APPENDIX B: POTENTIAL STUDY SUMMARIES

Maine 2008

Study Title	**Maine Power Reliability Program Electric Energy Efficiency and Demand Response Potential Study**
Study Year	2008
State	Maine
Author	GDS Associates Inc.
Service Territory	Central Maine Power
Analysis Period	10 years (2008-2017)
Fuel Types Covered	Electric
Sectors	Residential, Commercial, Industrial
Study Description	This study focuses on estimating the maximum achievable cost-effective electric potential and associated cost in the Central Maine Power service territory (approximately 80% of statewide sales) over a 10-year period (2008-2017). The study derives maximum achievable cost effective potential through a staged process of first estimating technical potential, followed by achievable potential, and the final layer of estimating cost effective achievable with an assumption that 80% of cost-effective achievable measures could be installed over the 10 year period with a sustained campaign.
Potential Types	**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. For the residential sector, two technical potential scenarios were developed: a technical potential (best) scenario, where "best" options are assumed to be installed in situations where good/better/best" options exist; and a technical potential (traditional) scenario, where "good/better/best" options are allocated for model installation across applicable populations.

Study Title	Maine Power Reliability Program Electric Energy Efficiency and Demand Response Potential Study
	Maximum Achievable potential is defined as the maximum penetration of an efficient measure that would be adopted absent consideration of cost or customer behavior. The term "achievable" refers to efficiency measure penetration, based on estimates of New Hampshire-specific building stock, energy using equipment saturations and realistic efficiency penetration levels that can be achieved by 2018 if all remaining standard efficiency equipment were to be replaced on burnout (at the end of its useful measure life) and where all new construction and major renovation activities in the state were done using energy efficient equipment and construction/installation practices. In certain circumstances, where early replacement of specific measures is becoming standard practice, maximum achievable potential includes the retrofit of measures before the end of their useful measure life (i.e., T8 lighting, thermostats, insulation and weatherization of existing homes). **Maximum Achievable Cost Effective (M.A.C.E.) potential** is defined as the portion of the maximum achievable potential that is cost effective according to the economic criteria currently used to determine energy efficiency program cost-effectiveness (New Hampshire Public Utility Commission's approved Total Resource Cost Test – NH TRC), before consideration of customer behavior. Application of the TRC test is based on the latest values for avoided cost (electric, natural gas and other fuels) and excludes environmental externalities not already captured with avoided cost values, consistent with current utility and PUC procedures. **Potentially Obtainable scenario** is a new output developed for this study and can be defined as an estimate of the potential for the realistic penetration over time of energy efficient measures that are cost effective according to the NH TRC, taking customer behavior into consideration (including consideration of priorities and price). To achieve this potential, a concerted, sustained campaign involving aggressive programs and market interventions would be required. As demonstrated later in this report, the State of New Hampshire and its electric and gas utilities would need to continue to undertake, and perhaps aggressively expand its efforts to achieve these levels of savings. The table below shows how the study's definitions of potential relate to Summit Blue's definitions.

Potential Type Designations

SBC Classification	Technical	Economic	Achievable
Study Classification	Technical	Max Achievable Cost Effective	Potentially Obtainable

Screening Test(s)	Modified Societal Test

Study Title	**Maine Power Reliability Program Electric Energy Efficiency and Demand Response Potential Study**
Method	• Study relied on secondary data for measure characterization, saturation, sales forecasts (utility provided), and end-use allocations, etc • For the residential sector, the study uses a "bottom-up" approach to calculating potential, where the equation inputs are displayed in terms of the number of homes or the number of high efficiency measures. 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. • Assumed 80% penetration rate of measures over 10 year period (funding levels ranging from 35% to 40% of measure costs)
Scope of Measures and Programs	• Study focused primarily on replace on burnout (ROB) efficiency opportunities, thus early retirement opportunities are not incorporated. This will underestimate both potential and cost. • Only included measures that were currently commercially available • Study includes a total of 130 measures: 29 residential measures, 89 commercial measures and 12 industrial measures
Key Results	The table below reports Maximum Achievable Cost Effective Potential for the residential, commercial and industrial sectors for Maine. As shown in the table below, the total achievable cost effective energy savings potential (savings as a percent of forecast sales) by the year 2017 is 15.9%, or 1.6% per year.

Maximum Achievable Cost-Effective Electric Energy Efficiency Potential by 2017	
	NTA Sub-Area
Residential	
Energy Efficiency - GWH	444.7
Energy Efficiency - Summer MW	95.5
Commercial	
Energy Efficiency - GWH	812.7
Energy Efficiency - Summer MW	220.0
Industrial	
Energy Efficiency - GWH	260.4
Energy Efficiency - Summer MW	70.6
Total	
Energy Efficiency - GWH	1517.8
Percent of Sales (1)	15.9%
Energy Efficiency - Summer MW	386.2
(1) Percent of the projected sales excluding Efficiency Maine Impacts	

The study projects total program costs would be $303.8 million over 10 years, or an average of $30.4 million per year. Total net benefits are estimated at $1.9 billion,

Study Title	Maine Power Reliability Program Electric Energy Efficiency and Demand Response Potential Study
	with an overall program benefit/cost ratio of 4.27. Study assumed future cost of efficiency savings would be consistent with past Efficiency Maine $/kWh saved. Given Efficiency Maine's program to date have focused on high-yield programs, this may be underestimating cost.

Vermont All Fuels 2007

Study Title	Vermont Energy Efficiency Potential Study for Oil, Propane, Kerosene, and Wood Fuels
Study Year	2007
State	Vermont
Author	GDS Associates
Service Territory	Statewide
Analysis Period	10 years (2007-2016)
Fuel Types Covered	Oil, Propane, Kerosene, Wood
Sectors	Residential, Commercial, Industrial
Study Description	This study estimates the "costs and benefits of establishing a coordinated and comprehensive program to maximize cost-effective energy efficiency savings in all buildings, regardless of a particular building's source of fuel and regardless of the income of the building owner." The study considers program options to reduce consumption of oil, kerosene, propane, and other fuels and estimates the achievable cost effective potential for energy savings in Vermont over the ten-year period from 2007 through 2016.
Potential	**Technical potential** is defined in this study as the complete and immediate penetration of all measures analyzed in applications where they were deemed

Types	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 table below shows how the study's definitions of potential relate to Summit Blue's definitions.

Potential Type Designations

SBC Classification	Technical	Economic	Achievable
Study Classification	Technical	na	Achievable Cost Effective

Screening Test(s)	Vermont Societal Test
Scope Differences	• Study focused primarily on replace on burnout (ROB) efficiency opportunities, thus early retirement opportunities are not incorporated. This will underestimate both potential and cost. • Program costs do not include EM&V.
Method	• For the residential sector, the study uses a "bottom-up" approach to calculating potential, where the equation inputs are displayed in terms of the number of homes or the number of high efficiency measures. 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. • Study relied on secondary data • Study used an achievable penetration rate of 80% by 2016 for Vermont's residential, commercial and industrial sectors across all fuel types.
Scope of Measures and	• Includes 63 measures – 24 residential, 19 commercial and 18 industrial measures

Programs	• Analysis only included measures that are currently available • The base case projection assumes incentive levels at 50% of measure incremental costs, as such, this cap will contribute to lower savings and costs projections.
Key Results	This study reports Technical and Achievable potential for the residential, commercial and industrial sectors. As detailed in the table below, the total achievable cost effective energy savings potential (savings as a percent of the forecast fuel consumption) by the year 2016 is 14% for fuel oil, 8% for propane, 5.9% for kerosene, and 14.2% for wood.

Table 1-1: Energy Efficiency **Achievable Cost Effective** Potential by Sector by Fuel Type

Year	Sector	Oil	Propane	Kerosene	Wood
2016	RES	10.2%	5.6%	3.3%	18.3%
2016	COMM	24.2%	21.7%	21.9%	16.0%
2016	IND	10.2%	6.7%	10.2%	9.7%
2016	TOTAL	14.0%	8.0%	5.9%	14.2%

In terms of savings as a percent of annual sales, the estimated savings are as follows: Oil 1.4%/year; Propane 0.8%; Kerosene 0.59% and Wood 1.4%. Overall, fuel oil presents the greatest opportunity for savings and the commercial sector presents the best opportunity for savings in percentage terms.

In terms of costs and benefits, the study projects total program costs would be $144 million over 10 years, or an average of $14.9 million per year, and total participant costs of $92 million. Total net benefits are estimated at $486 million, with an overall program societal benefit cost test result of 4.0.

Vermont Electric 2007

	Vermont Energy Efficiency Potential Study for Oil, Propane, Kerosene, and Wood Fuels
Study Year	2007
State	Vermont
Author	GDS Associates
Service Territory	Statewide
Analysis Period	10 years (2007-2016)
Fuel Types Covered	Electric
Sectors	Residential, Commercial, Industrial
Study Description	This study estimates the technical and achievable cost effective potential for electric energy and peak demand savings from energy-efficiency and fuel conversion measures in Vermont for the residential, commercial and industrial sectors. The primary cost effectiveness test used for screening of energy efficiency measures is the Vermont Societal Test. The study shows that there is still significant savings potential in Vermont for cost effective electric energy-efficiency and fuel conversion measures.
Potential Types	**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 2016.

	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 table below shows how the study's definitions of potential relate to Summit Blue's definitions. **Potential Type Designations** SBC Classification: Technical / Economic / Achievable Study Classification: Technical / N/A / Achievable Cost Effective
Screening Test(s)	Modified Societal Test
Method	• For the residential sector, the study uses a "bottom-up" approach to calculating potential, where the equation inputs are displayed in terms of the number of homes or the number of high efficiency measures. 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. • Study relies on secondary data • GDS used an achievable penetration rate of 80% by 2016 for Vermont's residential, commercial and industrial sectors across all fuel types.
Scope of Measures and Programs	• Includes 143 measures – 57 residential, 73 commercial and 13 industrial measures • Analysis only included measures that are currently available • Study analyzed both replace on burnout (ROB) efficiency opportunities and early retirement opportunities separately, though early retirement savings are not incorporated into the achievable potential estimates. • Study assumed an achievable penetration rate of 80% by 2016 for residential, commercial and industrial sectors across all fuel types. • The base case projection assumes incentive levels at 50% of measure incremental costs, as such, this cap will contribute to lower savings and costs projections.
Key Results	As detailed in the table below, the total achievable cost effective energy savings potential (savings as a percent of the forecast fuel consumption) by the year 2015 is 19.4%, or 1.9% per year.

Potential Type Designations

SBC Classification	Technical	Economic	Achievable
Study Classification	Technical	N/A	Achievable Cost Effective

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%

In terms of costs and benefits, the study projects total program costs would be roughly $250 million over 10 years, or an average of $25 million per year. The net present savings for the State of Vermont for long-term implementation of energy efficiency programs over the study period are $964 million**.** The Societal Test benefit/cost ratio for the achievable cost effective potential scenario is 3.45.

Connecticut, 2004

Study Title	**Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region**
Study Year	2004
State	Connecticut
Author	GDS Associates, Inc.
Service Territory	Three geographic areas: • Connecticut statewide • The 52 towns in the constrained area of Southwest Connecticut, and • The 16 critical constrained area towns in Southwest Connecticut (the Norwalk-Stamford area).
Analysis Period	2003-2012 (10 Years)
Fuel Types Covered	Electric
Sectors	Residential, Commercial, Industrial
Study Description	This study estimates the maximum achievable cost effective potential for electric energy and peak demand savings from energy-efficiency measures over the ten-year period from 2003 through 2012 for the residential, commercial and industrial sectors. The study shows that there is significant savings potential in Connecticut for implementation of additional and long-lasting energy-efficiency measures.
Potential Types	**Technical potential** is defined in this study as the complete penetration of all measures analyzed in applications where they were deemed technically feasible from an engineering perspective. **Maximum achievable potential** is defined as the maximum penetration of an efficient measure that would be adopted given unlimited funding, and by determining the maximum market penetration that can be achieved with a concerted, sustained campaign involving highly aggressive programs and market intervention. The term "maximum" refers to efficiency measure penetration, and means that the GDS Team has based our estimates of efficiency potential on the maximum realistic penetration that can be achieved by 2012. The term "maximum"

does not apply to other factors used in developing these estimates, such as measures energy savings or measure lives.

Maximum achievable cost effective potential is defined as the potential for maximum penetration of energy efficient measures that are cost effective according to the Total Resource Cost test, and would be adopted given unlimited funding, and by determining the maximum market penetration that can be achieved with a concerted, sustained campaign involving highly aggressive programs and market interventions.

The table below shows how the study's definitions of potential relate to Summit Blue's definitions.

Potential Type Designations

SBC Classification	Technical	Economic	Achievable
Study Classification	N/A	N/A	Max Achievable Cost Effective

Screening Test(s)

Total Resource Cost Test

Method

- For the residential sector, the study uses a "bottom-up" approach to calculating potential, where the equation inputs are displayed in terms of the number of homes or the number of high efficiency measures. 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.
- Study relied on secondary sources and utility-supplied avoided cost data
- Study assumed an achievable penetration rate of 80% by 2016 for Connecticut's residential, commercial and industrial sectors across all fuel types. This was based on prior experience and surveys of industry experts.

Scope of Measures and Programs

- Study considered savings opportunities from market driven retrofit, early placement and replace-on-burnout energy efficiency program strategies.
- Study included 278 measures: 68 residential measures, 104 commercial measures, and 106 industrial measures. *Study included all measures in the potential analysis, even those that did not pass TRC.

Key Results

As shown in the table below, capturing the maximum achievable cost effective potential for energy efficiency in Connecticut would reduce peak demand by 13% (908 MW) and electric energy use by 13% (4,466 GWh) by 2012, resulting in zero growth in electric load from 2003 through 2012.

Maximum Achievable Cost-Effective Electric Energy Efficiency Potential by 2017		
Residential		**% of Base**
Energy Savings - GWH	1,654.6	5.0%

Demand Savings - MW	239.7	3.3%
Commercial		
Energy Savings - GWH	2,088.4	6.3%
Demand Savings - MW	575.1	7.9%
Industrial		
Energy Savings - GWH	722.9	2.2%
Demand Savings - MW	92.6	1.3%
Total		
Energy Savings - GWH	4,465.8	13.4%
Demand Savings - MW	907.5	12.5%

In terms of costs and benefits, the study projects total program costs would be roughly $700 million over 10 years, or an average of $70 million per year. The net present savings for the State of Connecticut for long-term implementation of energy efficiency programs over the study period are over $1.9 billion, with a TRC ratio of 3.14.

New England

Study Title	Economically Achievable Energy Efficiency Potential in New England
Study Year	2004
States	Maine, Vermont, New Hampshire, Connecticut, Rhode Island, Massachusetts
Author	Optimal Energy, Inc.
Service Territory	New England
Analysis Period	2004-2013 (10 Years)
Fuel Types Covered	Electricity and Natural Gas
Sectors	Residential, Commercial, Industrial
Study Description	This study conducted an analysis of existing studies on energy efficiency potential and extrapolated the economically achievable energy efficiency potential of the region as a whole over a 10-year period for the residential, commercial and industrial sectors.
Potential Types	**Technical Potential** is the complete penetration of all measures analyzed in applications where they are deemed technically feasible from an engineering perspective. **Economic (or Cost-effective) Potential** represents a portion of Technical Potential based on what is cost-effective (either from customer, societal or total resource perspective). **Economically Achievable Energy Efficiency Potential** is defined as the potential for maximum market penetration of energy efficient measures that are cost-effective according to the Total Resource Cost test and that would be adopted through a concerted, sustained campaign involving proven programs and market interventions, and not bound by any budget constraints. The table below shows how the study's definitions of potential relate to Summit

	Blue's definitions.

Potential Type Designations

SBC Classification	Technical	Economic	Achievable
Study Classification	na	na	Economically Achiev Cost Effective

Screening Test(s)	Total Resource Cost Test
Method	Report does not detail study methodology
Scope of Measures and Programs	• Study does not disaggregate potential commercial and industrial savings • Study estimated natural gas potential savings, but only for codes and standards
Key Results	As shown in the table below, capturing the "Economically Achievable Cost Effective Potential" for energy efficiency in New England would reduce peak demand by 28% (8,172 MW) and electric energy use by 23% (33,668 GWh) by 2013.

Economically Achievable Cost Effective Electric Energy Efficiency Potential by 2013		
Residential		**% of Base**
Energy Savings - GWH	12,462	8.5%
Demand Savings - MW	1,739	6.0%
Commercial & Industrial		
Energy Savings - GWH	21,206	14.4%
Demand Savings - MW	6,433	22.3%
Total		
Energy Savings - GWH	33,668	22.9%
Demand Savings - MW	8,172	28.3%

The study projects total program costs would be roughly $12.1 billion over 10 years, or an average of $1.2 billion per year. The net present savings in New England for long-term implementation of energy efficiency programs over the study period are between $13-24 billion, with a TRC ratio of 3.2.

Pennsylvania, 2009

Study Title	**Potential for Energy Efficiency, Demand Response, and Onsite Solar Energy in Pennsylvania**
Study Year	2009
State	Pennsylvania
Author	ACEEE, Summit Blue, VEIC, ICF, Synapse
Service Territory	Statewide
Analysis Period	17 Years (2008-2025)
Fuel Types Covered	Electricity, Natural Gas, Fuel Oil, Propane
Sectors	Residential, Commercial, Industrial
Study Description	In 2004, Pennsylvania enacted the Alternative Energy Portfolio Standards Act, requiring the state's electric utilities to meet annual targets for "clean energy" resources, which start at about 4% per year and ramp up to 10% in years 15 and thereafter. Energy efficiency had been included as an eligible resource as part of the two-tiered alternative portfolio standard. This study assesses the total economic and achievable potential for energy efficiency over a 17-year period in Pennsylvania. By characterizing the incremental costs and energy savings for a number of efficient technologies or measures for residential, commercial, and industrial consumers, the study determines the cost-effectiveness for each measure and estimates the total energy efficiency "resource" potential.
Potential Types	***Energy Efficiency Resource Assessment:*** The energy efficiency resource assessment examines the overall potential in the state for increased cost-effective efficiency using technologies and practices of which we are currently aware (see Appendix B for detailed information). Cost-effectiveness is evaluated from the customer's perspective (i.e., a measure is deemed cost-effective if its cost of saved energy is less than the average retail rate of energy). We review specific, efficient technology measures that are technically feasible for each sector; analyze costs, savings, and current market

	share/penetration; and estimate total potential from implementation of the resource mix. The technology assessment is reported by sector (i.e., residential, commercial, and industrial) and includes an analysis of potential for expanded CHP, which is prepared by ICF International. ***Energy Efficiency Policy Analysis:*** For this analysis, we develop a suite of energy efficiency policy recommendations based on successful models implemented in other states and in consultation with stakeholders in Pennsylvania. This analysis assumes a reasonable program and policy penetration rate, and therefore is less than the overall resource potential (see Figure 2). We draw upon our resource assessment and evaluations of these policies in other states to estimate the energy savings and the investments required to realize the savings. The draft policy list for stakeholder review is presented after the reference forecast section in this document. The table below shows how the study's definitions of potential relate to Summit Blue's definitions.

Potential Type Designations

SBC Classification	Technical	Economic	Achievable	Program Achievable
Study Classification	N/A	EE Resource Assessment	N/A	EE Policy Analysis

Screening Test(s)	Total Resource Cost Test
Method	• Study relied on secondary data • Study used a bottom-up approach calibrated to legislative savings targets
Scope of Measures and Programs	• Analysis only included measures that are currently commercially available. • Electric measures - 36 residential, 37 commercial; 18 industrial • Gas measures – 47 residential, 26 commercial 36 industrial • Fuel Oil measures– 44 residential, 10 commercial • Propane measures – 12 residential measures
Key Results	Based on the findings of this analysis, it is estimate that about 30% of Pennsylvania's projected electricity, natural gas, fuel oil, and propane needs can be met through existing, cost-effective efficiency measures that are widely available today.

Achievable Cost Effective Energy Efficiency Potential in Pennsylvania by 2025

Residential		% of Base
Energy Savings - GWH	19,430	10.4%
Demand Savings - MW		
Natural Gas – BBtu	83,690	13.5%
Fuel Oil – MilGal	260	24%
Propane – MilGal	29	28%

Commercial		
Energy Savings - GWH	18,400	9.9%
Demand Savings - MW		
Natural Gas – BBtu	48,200	7.8%
Fuel Oil – MilGal	63	6%
Propane – MilGal	--	--
Industrial		
Energy Savings - GWH	13,000	7.0%
Demand Savings - MW		
Natural Gas – BBtu	36,759	5.9%
Fuel Oil – MilGal	--	--
Propane – MilGal	--	--
Total		
Energy Savings - GWH	50,830	27.3%
Demand Savings - MW		
Natural Gas – BBtu	168,649	27.2%
Fuel Oil – MilGal	323	29%
Propane – MilGal	29	29%

The study projects total program costs would be roughly $3.7 billion over 17 years, or an average of $234 million per year. The net present savings in Pennsylvania for long-term implementation of energy efficiency programs over the study period are between $10.1 billion, with a TRC ratio of 2.7.

New Hampshire, 2009

Study Title	Additional Opportunities for Energy Efficiency in New Hampshire
Study Year	2009
State	New Hampshire
Author	GDS Associates, Inc
Service Territory	Statewide and for each of the four New Hampshire retail electricity providers and two natural gas distribution companies.
Analysis Period	2009-2018 (10 years)
Fuel Types Covered	Electricity, Natural Gas, Fuel Oil, Propane
Sectors	Residential, Commercial, Industrial
Study Description	This study presents estimates of technical potential, maximum achievable potential, and maximum achievable cost effective potential by the year 2018 (a 10-year period) for electricity, natural gas and related propane and fuel oil savings at the state level and for each of the four New Hampshire retail electricity providers and two natural gas distribution companies. Results from a potentially obtainable savings scenario are also presented to estimate that portion of the cost effective potential that might be achievable after consideration of customer behavior.
Potential Types	**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. For the residential sector, two technical potential scenarios were developed: a technical potential (best) scenario, where "best" options are assumed to be installed in situations where "good/better/best" options exist; and a technical potential (traditional) scenario, where "good/better/best" options are allocated for model installation across applicable populations. **Maximum Achievable potential** is defined as the maximum penetration of an efficient measure that would be adopted absent consideration of cost or customer behavior. The

	term "achievable" refers to efficiency measure penetration, based on estimates of New Hampshire-specific building stock, energy using equipment saturations and realistic efficiency penetration levels that can be achieved by 2018 if all remaining standard efficiency equipment were to be replaced on burnout (at the end of its useful measure life) and where all new construction and major renovation activities in the state were done using energy efficient equipment and construction/installation practices. In certain circumstances, where early replacement of specific measures is becoming standard practice, maximum achievable potential includes the retrofit of measures before the end of their useful measure life (i.e., T8 lighting, thermostats, insulation and weatherization of existing homes). **Maximum Achievable Cost Effective (M.A.C.E.) potential** is defined as the portion of the maximum achievable potential that is cost effective according to the economic criteria currently used to determine energy efficiency program cost-effectiveness (New Hampshire Public Utility Commission's approved Total Resource Cost Test – NH TRC), before consideration of customer behavior. Application of the TRC test is based on the latest values for avoided cost (electric, natural gas and other fuels) and excludes environmental externalities not already captured with avoided cost values, consistent with current utility and PUC procedures. **Potentially Obtainable** scenario is a new output developed for this study and can be defined as an estimate of the potential for the *realistic penetration over time* of energy efficient measures that are cost effective according to the NH TRC, and would be adopted after consideration of customer behavior and 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 New Hampshire and its electric and natural gas utilities would need to continue to undertake, and perhaps aggressively expand its efforts to achieve these levels of savings. The table below shows how the study's definitions of potential relate to Summit Blue's definitions.

Potential Type Designations

SBC Classification	Technical	Economic	Achievable
Study Classification	Technical	M.A.C.E	Potentially Obtainable

Screening Test(s)	Total Resource Cost Test
Method	• Study draws from customer data collected through phone surveys and site visits, utility-provided data, and secondary sources. Primary data collection consisted of telephone surveys to determine measure penetration and customer behavior ("likelihood of purchase"). • For the residential sector, the study uses a "bottom-up" approach to calculating potential, where the equation inputs are displayed in terms of the number of homes or the number of high efficiency measures. 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.

Scope of Measures and Programs

- Analysis includes some emerging measures
- Study considered savings opportunities from market driven retrofit, replace-on-burnout, and some early replacement energy efficiency program strategies.
- Assumed that all new buildings are constructed to meet minimum energy code
- In Potentially Obtainable scenario, all cost-effective energy efficiency measures were assessed in light of customer priorities and estimated pricing behaviors (i.e. sensitivity to payback).
- Customers' responses to questions included in this projects' sector-specific telephone surveys and site visits were used to determine the percentage of customers that stated they were "extremely likely" to purchase energy efficient equipment (73% of residential customers, and 48% of commercial and industrial customers).
- Measures analyzed in "Potentially Obtainable" based on customers' surveyed likelihood of purchase, with incentives of 50% of measure incremental cost

Key Results

As shown in the table below, capturing the "Potentially Obtainable" savings for energy efficiency in New Hampshire would reduce peak demand by 8.5% (255 MW), electric energy use by 10.8% (1,404 GWh), and natural gas demand by 8.3% (2,215 BBtu) by 2018.

Potentially Obtainable Energy Savings in New Hampshire by 2018		
Residential		**% of Base**
Energy Savings - GWH	698.1	5.4%
Demand Savings - MW	26.3	0.9%
Natural Gas – BBtu	1,057.2	4.0%
Commercial		
Energy Savings - GWH	492.0	3.8%
Demand Savings - MW	146.3	4.9%
Natural Gas – BBtu	908.7	3.4%
Industrial		
Energy Savings - GWH	213.8	1.6%
Demand Savings - MW	81.9	2.7%
Natural Gas – BBtu	248.7	0.9%
Total		
Energy Savings - GWH	1,403.9	10.8%
Demand Savings - MW	254.5	8.5%
Natural Gas – BBtu	2,214.6	8.3%

The study projects total electric program costs would be roughly $84.8 million over 10 years, or an average of $8.5 million per year. The net present savings in New Hampshire for long-term implementation of energy efficiency programs over the study period is $195 million.

The study projects total natural gas program costs would be roughly $565 million over 10 years, or an average of $56.5 million per year. The net present savings in New Hampshire for long-term implementation of energy efficiency programs over the study period is $2.1 billion.

Massachusetts, 2009

Study Title	**Natural Gas Energy Efficiency Potential in Massachusetts**
Study Year	2009
State	Massachusetts
Author	GDS Associates, Inc.
Service Territory	Statewide
Analysis Period	2009-2018 (10 years)
Fuel Types Covered	Natural Gas
Sectors	Residential, Commercial, Industrial
Study Description	This study estimates the technical and cost-effective potential for natural gas energy efficiency potential in Massachusetts. The study examines the potential for an extensive list of energy efficiency measures (170 total) that are applicable to the residential, commercial and industrial customer segments. Energy efficiency potential was assessed over a ten-year period from 2009 through 2018.
Potential Types	**Technical Potential** is energy efficiency savings that would result from the complete and immediate penetration of all analyzed energy efficiency measures in applications where they are deemed to be technically feasible, from an engineering perspective. **Economic Potential** represents that portion of the total technical potential that is cost effective in accordance with the TRC test. **Achievable Economic Potential** is defined as savings that would result given an expected market penetration rate of all technically feasible and cost-effective measures over the ten year study horizon. Because market penetration is highly dependent on program design and delivery, including most importantly incentive levels, GDS did not

	attempt to estimate specific market penetration rates for individual measures. This can be done more appropriately when new programs are developed or existing programs are enhanced to target measures identified in this study. Instead this study presents a range of achievable potential assuming maximum market penetration rates of 60 and 80 percent. The 80 percent market penetration scenario would require very aggressive funding, and a concerted, sustained campaign involving highly aggressive programs and market interventions. It should be viewed as a best estimate of the maximum achievable cost effective potential for the natural gas measures included in this study. The table below shows how the study's definitions of potential relate to Summit Blue's definitions.

Potential Type Designations

SBC Classification	Technica l	Economic	Achievable
Study Classification	Technica l	Economic	Achievable Economic (80% Scenario)

Screening Test(s)	Total Resource Cost Test
Method	• Study relied exclusively on secondary data sources • GDS used an achievable penetration rate of 80% by 2018 for residential, commercial and industrial sectors. • For the residential sector, the study uses a "bottom-up" approach to calculating potential, where the equation inputs are displayed in terms of the number of homes or the number of high efficiency measures. 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.
Scope of Measures and Programs	• 150 measures were included • Retrofit measures are limited to the application of supplemental measures (such as the Natural Gas Energy Efficiency Potential in Massachusetts addition of a low-flow device to a showerhead or increased levels of insulation), and do not include the early replacement of operational equipment. • Analysis only included measures that are currently commercially available.

Key Results

As shown in the table below, capturing the "Achievable Economic Potential" savings for energy efficiency in Massachusetts would reduce natural gas demand by 25.5% (57,201 BBtu) by 2018.

Achievable Economic Natural Gas Savings in Massachusetts by 2018		
	BBtu	**% of Base**
Residential	40,075	17.8%
Commercial	12,391	5.5%
Industrial	4,735	2.1%
Total	**57,201**	**25.5%**

Study did not project cost of achieving savings

Connecticut, 2009

Study Title	**Connecticut Natural Gas Commercial and Industrial Energy-Efficiency Potential Study**
Study Year	2009
State	Connecticut
Author	Kema, Inc.
Service Territory	Statewide
Analysis Period	2009-2018 (10 years)
Fuel Types Covered	Natural Gas
Sectors	Commercial, Industrial
Study Description	This study assesses the natural gas energy-efficiency potential for the commercial and industrial sectors in Connecticut, served by Yankee Gas Services Company (Yankee Gas), the Southern Connecticut Gas Company (Southern Connecticut Gas) and Connecticut Natural Gas Corporation. The major objective of this study was to identify and characterize the remaining cost-effective natural gas efficiency-potential in Connecticut and to estimate the amount of savings achievable through energy efficiency programs.
Potential Types	**Technical Potential**, defined as the complete penetration of all measures analyzed in applications where they were deemed technically feasible. **Total Economic Potential** is an estimate of the technical potential of energy-efficiency measures that are expected to be cost-effective taking into account emerging technologies and reductions in measure costs that occur as technologies become more mainstream. **Achievable Potential** is an estimate of maximum energy efficiency savings from all sources.

Instantaneous Program Achievable Potential is an estimate of how much energy efficiency programs can save, taking into account the simultaneous effects of building codes, standards, and outside of program savings. The effects of building codes, standards, and other outside-of-program effects are netted out to yield the instantaneous achievable program potential. We refer to this potential as instantaneous because it is not associated with a specific program time frame, and therefore not limited by the turnover of replace-on-burnout measures. The program funding scenario savings we developed, in contrast, are based on a 10-year program and limited by the natural turnover of long-lived measures, such as boilers (20 years).

The table below shows how the study's definitions of potential relate to Summit Blue's definitions.

Potential Type Designations

SBC Classification	Technical	Economic	Achievable
Study Classification	Technical	Total Economic	Instant. Program Achievable

Screening Test(s)

Total Resource Cost Test

Method

- Study relied exclusively on secondary data sources
- The method used for estimating potential is a "bottom-up" approach in which energy efficiency costs and savings are assessed at the customer segment and energy-efficiency measure level.
- Potential estimates were developed based on "adjustment factors" below

Table 5-3 Values for Adjustment Factors Applied to Economic Potential

Factor	% Change from Initial Economic Potential
Economic Potential Growth	+7.5%
Not Achievable	-15%
Building Codes (applies to new construction only)	-35%
Standards	-0%
Outside of Program	-15%

These factors were applied as follows:

- Total economic potential was calculated to be 7.5 percent higher than initial economic potential (includes new technologies and additional cost effective measures due to measure cost reductions)
- Total achievable potential was estimated to be 15 percent below total economic potential, to account for cost effective potential that cannot be achieved through energy efficiency programs, codes, standards, or naturally occurring efficiency.
- Instantaneous program achievable potential takes into account a 35 percent reduction in total achievable potential for new construction. In addition, for all building types, the effect of standards (here assumed to be 0 percent) and outside-of-program effects (a 15% reduction) are taken into account.

Scope of Measures and Programs	• "Program Achievable" savings based on potential independent of stock turnover • Accounted for new technologies, reductions in measure costs, impacts of projected building codes and standards
Key Results	As shown in the table below, capturing the "Program Achievable Potential" savings for energy efficiency in Massachusetts would reduce commercial and industrial natural gas demand by 28.8% (11,568 BBtu) by 2018.

Program Achievable Natural Gas Savings in Massachusetts by 2018		
	BBtu	**% of Base**
Commercial	9,838	24.5%
Industrial	1,730	4.3%
Total	**11,568**	**28.8%**

Study did not project cost of achievable savings

Rhode Island 2008

Study Title	**Rhode Island Energy Efficiency and Resources Management Council (EERMC): Opportunity Report - Phase I**
Study Year	2008
State	Rhode Island
Author	Kema, Inc.
Service Territory	Statewide
Analysis Period	2009-2018 (10 years)
Fuel Types Covered	Electricity
Sectors	Residential, Commercial, Industrial
Study Description	This study estimates the technical, economic and achievable potential for energy and peak-demand savings from energy-efficiency measures in Rhode Island over the mid-term (3 years) and the long-term (10 years) for the residential, commercial and industrial sectors. This study demonstrates that significant additional and long-lasting cost-effective efficiency resources exist within the state, which can be procured by the distribution utility to save Rhode Island ratepayers money.
Potential Types	**Achievable Potential –** defined as the amount of potential that can be estimated from procurement and programmatic activity in the market. Namely it is an estimate of savings that will occur though efficiency procurement and program activity. This study calculated two scenarios of achievable potential – the Base Case – which is based on a funding level for energy efficiency that is comparable to 2008 and an Aggressive Case that is based on higher funding to go after cost-effective energy efficiency.

Screening Test(s)	Total Resource Cost Test
Method	• Study relied exclusively on secondary data sources • The method used for estimating potential is a "bottom-up" approach in which energy efficiency costs and savings are assessed at the customer segment and energy-efficiency measure level.
Scope of Measures and Programs	• Restricted to measures and practices that are presently commercially available. • Achievable potential based on two cases: base and aggressive, with aggressive having significantly increased marketing budgets for some program areas as well as increased incentives
Key Results	As shown in the table below, capturing the achievable potential for energy efficiency in Rhode Island would reduce peak demand by 9.4% (216 MW) and electric energy use by 9% (764 GWh) by 2018.

Achievable Electric Energy Efficiency Potential by 2018

Residential		**% of Base**
Energy Savings - GWH	273	3.5%
Demand Savings - MW	122.5	5.3%
Commercial		
Energy Savings - GWH	371	4.8%
Demand Savings - MW	67.9	2.9%
Industrial		
Energy Savings - GWH	120	1.5%
Demand Savings - MW	26.0	1.1%
Total		
Energy Savings - GWH	764	9.8%
Demand Savings - MW	216	9.4%

In terms of costs and benefits, the study projects total program costs would be roughly $200 million over 10 years, or an average of $20 million per year.

APPENDIX C: EXISTING AND FORECAST DSM BUDGETS

Table 26. Existing DSM Budgets

DSM Program Funding Fiscal	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010-2019
Electric											
System Benefit Charge Funding	$13,100,000	$13,100,000	$13,100,000	$13,100,000	$13,100,000	$13,100,000	$13,100,000	$13,100,000	$13,100,000	$13,100,000	**$131,000,000**
RGGI- Electric	$7,000,000	$8,000,000	$7,500,000	$7,500,000	$7,500,000	$7,500,000	$7,500,000	$7,500,000	$7,500,000	$7,500,000	**$75,000,000**
Forward Capacity Market	$3,411,160	$1,211,160	$2,347,500	$2,347,500	$2,347,500	$1,136,340	$1,136,340	$1,136,340	$1,136,340	$1,136,340	**$17,346,520**
ARRA- Electric	$6,547,467	$6,547,467	$6,547,467	$0	$0	$0	$0	$0	$0	$0	**$19,642,400**
Subtotal Electric	**$30,058,627**	**$28,858,627**	**$29,494,967**	**$22,947,500**	**$22,947,500**	**$21,736,340**	**$21,736,340**	**$21,736,340**	**$21,736,340**	**$21,736,340**	**$242,988,920**
Fossil Fuels											
Natural Gas- Unitil	$830,098	$830,098	$830,098	$830,098	$830,098	$830,098	$830,098	$830,098	$830,098	$830,098	**$8,300,980**
RGGI- Fossil Fuels (Unregulated)	$1,200,000	$1,400,000	$1,100,000	$0	$0	$0	$0	$0	$0	$0	**$3,700,000**
ARRA-Fossil Fuels (Unregulated)	$3,000,000	$3,000,000	$3,000,000	$0	$0	$0	$0	$0	$0	$0	**$9,000,000**
Subtotal Fossil Fuels	**$5,030,098**	**$5,230,098**	**$4,930,098**	**$830,098**	**$830,098**	**$830,098**	**$830,098**	**$830,098**	**$830,098**	**$830,098**	**$21,000,980**
TOTAL DSM Budget	**$35,088,725**	**$34,088,725**	**$34,425,065**	**$23,777,598**	**$23,777,598**	**$22,566,438**	**$22,566,438**	**$22,566,438**	**$22,566,438**	**$22,566,438**	**$263,989,900**

Table 27. Budget Needed to Achieve the Extrapolated Achievable Efficiency Potential for Maine

DSM Program Funding Fiscal Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010-2019
Budget to Achieve Electric DSM Potential	$49,064,237	$49,494,595	$49,928,727	$50,366,667	$50,808,448	$51,254,105	$51,703,670	$52,157,179	$52,614,666	$53,076,165	**$510,468,459**
Budget to Achieve Fossil Fuel DSM Potential											
Natural Gas	$3,230,406	$3,202,123	$3,218,273	$3,244,667	$3,273,260	$3,295,388	$3,316,113	$3,331,474	$3,347,301	$3,361,613	**$32,820,619**
Fuel Oil	$11,931,918	$11,618,602	$11,293,949	$10,910,270	$10,609,479	$10,340,460	$10,132,642	$9,918,737	$9,742,903	$9,598,872	**$106,097,833**
Propane	$3,586,625	$3,587,810	$3,614,723	$3,634,334	$3,640,248	$3,636,195	$3,655,152	$3,666,323	$3,685,383	$3,712,551	**$36,419,343**
Subtotal Budget to Achieve Fossil Fuel	$18,748,949	$18,408,535	$18,126,945	$17,789,272	$17,522,987	$17,272,044	$17,103,907	$16,916,535	$16,775,586	$16,673,036	**$175,337,796**
TOTAL DSM Budget	**$67,813,187**	**$67,903,129**	**$68,055,672**	**$68,155,939**	**$68,331,436**	**$68,526,148**	**$68,807,577**	**$69,073,714**	**$69,390,252**	**$69,749,200**	**$685,806,255**