Energy Efficiency: Engine of Economic Growth

A Macroeconomic Modeling Assessment

ENE
Environment Northeast

October 2009

Authors:
Jamie Howland & Derek Murrow, ENE
Lisa Petraglia & Tyler Comings, Economic Development Research Group, Inc.

Acknowledgments

ENE would like to thank Lisa Petraglia and Tyler Comings of Economic Development Research Group, Inc. for their collaboration on this project; NESCAUM for agreeing to provide access to their regional version of the REMI model; and the following individuals who kindly lent us their time and insights as we developed assumptions for the analysis and finalized the report: Joan McDonald, Meredith Hatfield, Steve Eckberg, John Dorrer, Charles Colgan, Tim Woolf, Frank Gorke, Mike Sherman, Danielle Rathbun, John Moskal, Berl Hartman, Kevin Doyle, Wanda Reindorf, Dave Dayton, Shirley Bergert, Penn Loh, Mary Jo Connelly, Penni McLean-Conner, Pat McDonnell, Anthony Marone, Sue Coakley, and Skip Laitner.

We would like to extend our appreciation to the Energy Foundation for financially supporting this project.

Any errors, omissions or opinions expressed in this report are the responsibility of ENE alone.

To contact the authors directly:

Derek K. Murrow, Director, Energy and Climate Policy: 203-285-1946, dmurrow@env-ne.org

Jamie Howland, Policy Analyst: 860-246-7121, jhowland@env-ne.org

About ENE

ENE (Environment Northeast) is a non-profit organization that researches and advocates innovative policies that tackle our environmental challenges while promoting sustainable economies. ENE is at the forefront of state and regional efforts to combat global warming with solutions that promote clean energy, clean air and healthy forests.

ENE
Environment Northeast

Headquarters 8 Summer Street, POB 583, Rockport, ME 04856, 207-236-6470
www.env-ne.org | admin@env-ne.org | Daniel L. Sosland, Executive Director

Massachusetts: 101 Tremont Street, Suite 401, Boston, MA 02108, 617-742-0054

Rhode Island: 203 S. Main Street, Providence, RI 02903, 401-474-8876

Connecticut: 21 Oak Street, Suite 202, Hartford, CT 06106, 860-246-7121

Canada: 126 Richmond Street, Charlottetown, PE, C1A 1H9, 902-628-1493

Executive Summary

Energy efficiency is emerging as a key policy solution to address high energy costs and the threat of climate change. As investments in energy efficiency programs increase, there is a need to understand economic effects on individual program participants and on the economy as a whole. While microeconomic benefits to ratepayers and program participants are analyzed and verified through public program design processes, less is known about macroeconomic benefits of efficiency investments.

This study quantifies macroeconomic impacts of increased energy efficiency investments in New England, where efficiency has assumed a leading role in energy policy. Several New England states have increased efficiency investments significantly in recent years, and others are planning dramatic funding increases. As decision makers nationwide consider energy policy reform, New England's increasing focus on efficiency provides a prime case-study for evaluating efficiency's impact on economic output and job growth.

The study utilizes a multi-state policy forecasting model by Regional Economic Models, Inc. (REMI) to project macroeconomic impacts of expanded efficiency programs in comparison to a scenario where no programs exist. The study analyzes efficiency programs for electricity, natural gas, and "unregulated fuels," (fuel oil, propane, and kerosene), using very conservative estimates of investment levels needed to capture all cost-effective efficiency (efficiency that is lower cost than supplying additional energy). The investment levels modeled are significantly higher than present program budgets in most New England states, but two states (MA and CT) have recently proposed efficiency budgets that approach investment levels needed to capture all cost-effective efficiency. State efficiency program budgets were modeled to ramp up to the levels shown in Table ES1 below.

Table ES1: Modeled Efficiency Program Investment Targets

State	Annual Target Investment Level ($2008 Millions)			
	Electric	Natural Gas	Unregulated Fuels	Total
Connecticut	259	66	108	432
Maine	92	5	75	172
Massachusetts	475	158	131	763
New Hampshire	92	14	45	151
Rhode Island	67	26	24	117
Vermont	50	5	25	80
Six State Total	1,034	272	409	1,715

Modeled scenarios relied on representative efficiency programs for each fuel type, using assumptions about costs and savings for program measures in each market segment. Assumptions were based on data from current programs as well as program expansion proposals and state-level cost-effectiveness studies. Assumptions were also informed by discussions with program administrators and experts in the field of energy efficiency. Expanded efficiency programs were modeled over 15 years, and funding ramp-up periods were incorporated to reflect sustainable program growth rates. The model continues for another 20 years to capture the economic benefits achieved over the life of efficiency measures.

In order to investigate the complementary nature of efficiency programs across jurisdictions, two scenarios were modeled for each fuel: first where each state acts alone (the "individual" scenario); and second where all New England states implement at once (the "simultaneous" scenario). In all cases simultaneous action resulted in greater economic benefits to the region, as energy savings improved states' relative national competitiveness and increased trade among states and with the rest of the world.

Benefits from increased efficiency investments in New England are significant for each fuel type. Increasing efficiency program investments in all six states to levels needed to capture all cost-effective electric efficiency over 15 years ($16.8 billion invested by program administrators) would increase economic activity by $162 billion (2008 dollars),[1] as consumers spend energy bill savings in the wider economy. Sixty-one percent of increased economic activity ($99 billion) would contribute to gross state products (GSPs) in the region, with $73 billion returned to workers through increased real household income and employment equivalent to 767,000 job years (one full-time job for a period of one year). Over 15 years, increased natural gas efficiency ($4.1 billion invested by program administrators) would increase regional economic activity by $51 billion, boost GSPs by $31 billion, and increase real household income by $22 billion while creating 208,000 new job years of employment. Unregulated fuels efficiency programs ($6.3 billion invested by program administrators) would increase regional economic activity over 15 years by $86 billion, boosting GSPs by $53 billion, and increasing real household income by $37 billion while creating 417,000 job years of new employment.

The macroeconomic benefits of efficiency derive from changes in the economy that occur as a result of increased spending on efficiency measures and decreased spending on energy. The majority of these impacts (81-91%) result from the energy savings realized by households and business. Lower energy costs cause other forms of consumer spending (such dining out or discretionary purchasing) to increase. Lower energy bills reduce the costs of doing business in the region, bolstering the global competitiveness of local employers and promoting additional growth.

The effectiveness of efficiency investments can be evaluated by considering economic benefits relative to efficiency program dollars invested. The following table shows the absolute and relative economic benefits of the simultaneously-modeled energy efficiency investments for all six New England states.

Table ES2. Summary of New England Economic Impacts

	Electric	Natural Gas	Unregulated Fuels
Total Efficiency Program Costs ($Billions)	16.8	4.1	6.3
Increase in GSP ($Billions)	99.4	30.6	53.1
Maximum annual GSP Increase ($Billions)	5.6	1.8	2.9
Percent of GSP Increase Resulting from Efficiency Spending	12%	11%	9%
Percent of GSP Increase Resulting from Energy Savings	88%	89%	91%
Dollars of GSP Increase per $1 of Program Spending	5.9	7.4	8.5
Increase in Employment (Job Years)	767,011	207,924	417,061
Maximum annual Employment Increase (Jobs)	43,193	12,907	24,036
Percent of Employment Increase from Efficiency Spending	16%	15%	12%
Percent of Employment Increase from Energy Savings	84%	85%	88%
Job-Years per $Million of Program Spending	46	50	66

[1] 2008 is the dollar year basis for all figures unless otherwise indicated.

The modeled results of increased efficiency investments show that efficiency provides significant economy-wide benefits in addition to direct participant savings, upon which efficiency programs are often justified. Expanding analysis from micro-level, cost-benefit tests to macro-level assessments of the economic impacts of efficiency (including losses to electric generators and fuel suppliers) clearly illustrates that investing in energy efficiency is one of the most effective means of improving economic conditions widely, while saving consumers money and reducing emissions.

This study illustrates that the economic benefits of energy saved through efficiency programs supplement and exceed the impacts of spending on implementing efficiency measures, and that efficiency investments quickly pay for themselves through increased economic activity and job creation. New England is not unique in terms of availability of efficiency resources; cost-effective efficiency savings can be found in any energy system. However, to capture the economic benefits of efficiency, policies must be created that include programs and incentives to overcome initial costs and deliver lasting benefits. This report shows that the benefits are greater than commonly recognized even by program administrators and proponents.

The total energy savings and reduced greenhouse gas emissions associated with the modeled levels of efficiency investments are also very significant. The following table illustrates these savings.

Table ES3: Summary of New England Energy Saved and Greenhouse Gas Emissions Avoided

	Electric	Natural Gas	Unregulated Fuels
Energy Savings	**(GWh)**	**(TBTU)**	**(TBTU)**
Maximum annual savings	35,100	92	119
Maximum savings vs. Business as Usual	26%	21%	28%
Lifetime savings (15 years of programs)	489,300	1,173	1,439
Equivalent GHG Emissions Avoided	**(Millions short tons)**	**(Millions short tons)**	**(Millions short tons)**
Maximum annual avoided emissions	17.6	5.4	8.9
Maximum annual avoided emissions vs. 2005 total New England Emissions	8.3%	2.5%	4.2%
Lifetime avoided emissions (15 years of programs)	287	91	158

1.0 Introduction

Newly adopted policies in New England are leading to significant new investments in energy efficiency programs that reduce energy consumption in the residential, commercial, and industrial sectors.

Before evaluating energy efficiency programs it is it necessary to understand why efficiency policy mandates are needed to drive investments that save consumers money. Efficiency programs help correct market failures that inhibit consumers and businesses from investing money in efficiency measures that require an up-front investment to deliver lasting benefits. Examples of these market failures include:

- *Liquidity Constraints* – when a consumer or business has inadequate access to capital to purchase efficient equipment or improve building energy performance
- *Split Incentives* – when the owner of a piece of equipment or building (the landlord) does not pay the energy bill and is thus unlikely to invest in efficiency improvements that would benefit the resident/renter
- *Information Problems* – when purchasers do not know the future energy costs of a product or property and are thus unlikely to invest in the more efficient option with a higher upfront cost
- *Behavioral Problems,* such as bounded rationality – when the complexity of a decision is beyond the ability of a consumer to make an economically optimal choice

Existing efficiency programs in New England provide technical assistance, consumer outreach and education, and offer incentives for purchasing efficient equipment (such as appliances, high-performance lighting, insulation, efficient motors, and controls). Design and implementation of most efficiency programs in New England is a public process conducted under state oversight, and the direct economic impacts on consumers' energy bills are thoroughly evaluated. However, in addition to understanding the *direct* impacts of efficiency programs, it is important to understand the *non-direct* impacts of efficiency programs on economic activity in aggregate, both from energy savings and the implementation of efficiency measures. Efficiency programs deliver consumer savings, and these savings flow through state economies to impact overall economic conditions and job growth. This study seeks to quantify macroeconomic impacts that result from increased efficiency investments.

To evaluate these changes, expanded efficiency investment scenarios were developed for each of the six New England states and for the region as a whole. These scenarios ramp-up to conservative estimates of spending levels needed to capture all cost-effective efficiency (efficiency that is cheaper than supplying additional energy). The scenarios use assumptions based on existing programs and recent proposals to increase program investments in several states. Separate assumptions were developed to examine programs for electricity, natural gas, and "unregulated fuels" (fuel oil, propane, and kerosene).

The analysis used a detailed, spreadsheet-based model to evaluate efficiency program costs and energy sector benefits. These results were then fed into the Regional Economic Models, Inc. (REMI) economic model, which projected the macroeconomic impacts of the efficiency programs in relation to a scenario where no programs exist.

The project modeling team consisted of analysts from ENE and EDR Group, and the team was assisted by an informal advisory group of efficiency experts and program administrators from the region. Advisory group input was solicited in the development of the base assumptions and on the draft report.

2.0 Trends in New England Efficiency Investments

All New England states are increasing investments in energy efficiency programs. The degree of program expansion varies by state, but in the past few years legislative and regulatory developments have increased the attractiveness and financial viability of efficiency for utilities and regulators. Efficiency is increasingly viewed as a bona fide energy resource that allows utilities and regulators to meet consumer energy needs by improving energy usage rather than expanding energy supply.

2.1 Energy Efficiency Policy Reform

The details vary, but the energy policy reforms that New England states have adopted follow a consistent framework that requires procurement of cost-effective energy efficiency (*i.e.,* efficiency that costs less than supply options). New markets and funding sources have also been developed for energy efficiency program expansion. The following is an outline of policy changes that have been implemented in New England:

- ***Efficiency Procurement:*** A new legislative mandate implemented by utility regulators – often under the oversight of a stakeholder board – that requires electric and/or natural gas utilities to procure all cost-effective energy efficiency that is available at lower cost than energy supply options. On the basis of economic evaluations, this requirement is leading utilities and states in the region to plan significant increases in efficiency investments.

- ***Utility Decoupling & Incentive Reform:*** When utility profits are tied to consumption volumes utilities naturally resist efficiency programs that reduce consumption and decrease revenue. In order to remove this disincentive and support expansion of efficiency programs, legislators and regulators in the region have implemented regulatory approaches that "decouple" or break the link between sales and utility revenue. Policy makers have also been implementing or updating utility incentives to create business models in which utilities earn money by saving customers money.

- ***Efficiency Program Funding Sources:*** In the last few years new public policies and newly created markets have diversified sources of efficiency funding, allowing programs to ramp-up quickly. Some of these sources are:
    - ***Forward Capacity Market (FCM):*** Run by ISO New England, the Forward Capacity Market ensures that enough capacity is available to meet peak energy demand. Energy efficiency programs are qualified to participate in this market, providing a new stream of revenue to efficiency programs and buying down program costs.
    - ***Federal Stimulus Funds:*** New federal funding is flowing to the states to fund expanded energy efficiency programs as federal policy makers have come to understand that that efficiency investments are a reliable and effective way to grow the economy and create new green jobs.
    - ***SBC and Distribution Rates:*** Existing Societal Benefit Charges (SBC) in many cases are no longer fixed, and adjustments to these charges or to distribution rates are fulfilling any additional need for efficiency program funding.
    - ***Regional Greenhouse Gas Initiative (RGGI) Allowance Auction:*** RGGI states are directing the majority of the value of new CO_2 allowances under this carbon cap and trade program to energy efficiency programs as a way to reduce the cost of allowances and keep customers' energy bills low.

- ***Potential Funding from Federal CO_2 Allowances:*** Building on RGGI's precedent, the federal climate and energy bill being considered by Congress allocates allowances to energy efficiency through states and through utilities. (Utilities must sell allowances and invest proceeds in cost-effective energy efficiency programs.) As written, the federal cap and trade bill would preempt RGGI, making efficiency allocations particularly important to the RGGI region. In the RGGI region and beyond, efficiency allocations will deliver significant economic benefits by lowering energy demand and decreasing emissions, which, in turn, will lower the price of allowances and overall program costs.

The following table presents the status of policy changes in each New England state. All of the states, to varying degrees, take advantage of the energy efficiency funding sources noted above.

Table 1: New England Energy Efficiency Policy Update

State	Electric Efficiency Procurement	Natural Gas Efficiency Procurement	Utility Decoupling
Connecticut	Yes	Partial – Resource Planning	Inconsistent
Maine	TBD – PUC has the option	No – Set by SBC	Under Consideration
Massachusetts	Yes	Yes	Yes
New Hampshire	No	No	Under Consideration
Rhode Island	Yes	No – Set by SBC	Under Consideration
Vermont	Yes	Partial – Resource Planning	Partial

In addition to electric and natural gas efficiency investments, there is an increasing recognition that programs are needed for consumers of energy sources not regulated by the states, such as fuel oil, propane, kerosene, and even wood. Connecticut has established programs for oil users. These programs are coordinated with the electric and natural gas programs, but funding levels have been irregular due to state budget shortfalls. Maine has had extensive policy discussions about the development of programs for unregulated fuels, but has not succeeded in establishing a reliable funding source. Massachusetts treats some unregulated fuel use through existing utility run programs, but the state does not have a comprehensive commitment to provide programs for all users of unregulated fuels. Rhode Island does not have programs for oil users but is considering investing stimulus money in oil efficiency programs. Vermont has made the most sustainable commitment to efficiency programs for all fuels, using RGGI allowance value to help fund new comprehensive programs.

As this report shows, there are significant economic and environmental benefits associated with increased energy efficiency investments for users of fuel oil, propane, and kerosene, and yet funding these programs has proven very difficult. The U.S. House energy and climate bill (*The American Clean Energy and Security Act* or "ACES") would provide federal funding directly to the states to develop oil and propane energy efficiency programs, providing the best opportunity to date to develop meaningful unregulated fuel efficiency programs nationwide.

2.2 Current and Proposed Program Investments

As a result of new state laws and policy changes, utilities and efficiency program administrators in Connecticut, Massachusetts, Rhode Island, and Vermont have all proposed significant expansion of electric efficiency investments. Natural gas efficiency programs are expanding more slowly, with the exception of Massachusetts, where significant expansion has been proposed through 2012. The following figures illustrate increased program funding across the New England, with other leading states included for comparison. Electric efficiency investment levels are shown on a per capita basis in order to normalize the relative investment levels between states. Natural gas investment levels are shown per unit of energy (therms) delivered to customers, as not all energy consumers in a state use natural gas.

Figure 1: Per Capita Electric Efficiency Investments – 2008 Top 20 States and New Proposals

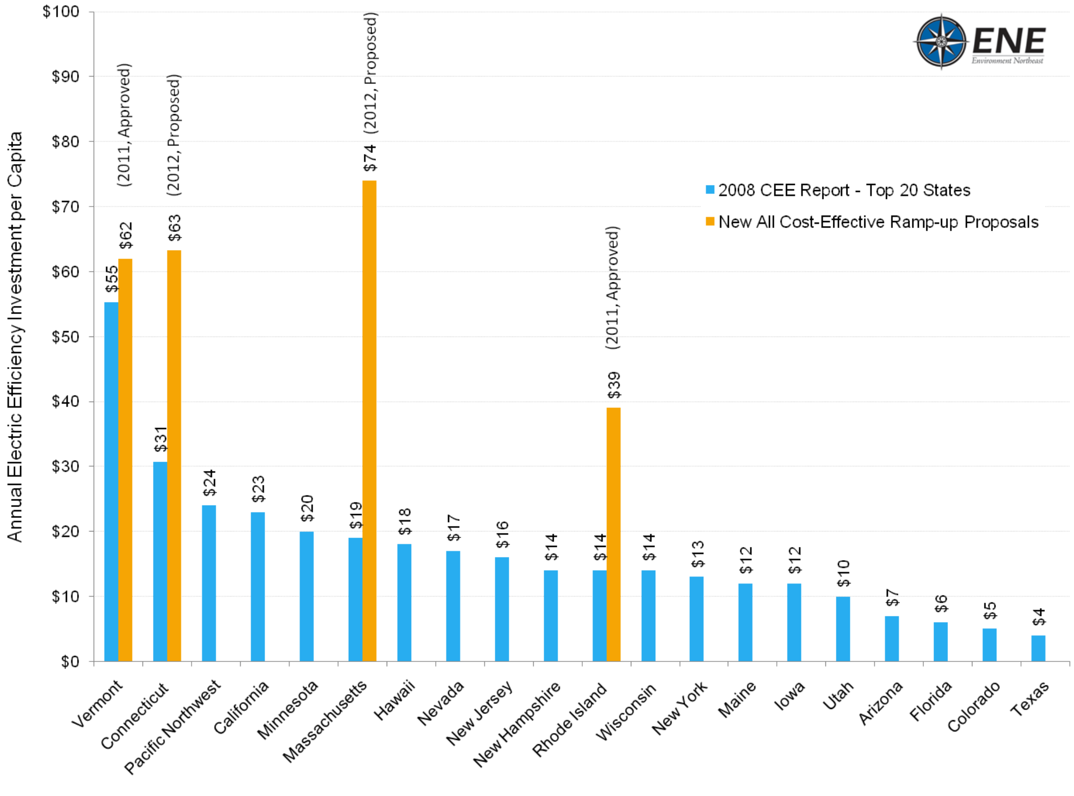


Figure 2: New England Electric Efficiency Investments – 2006 to 2012

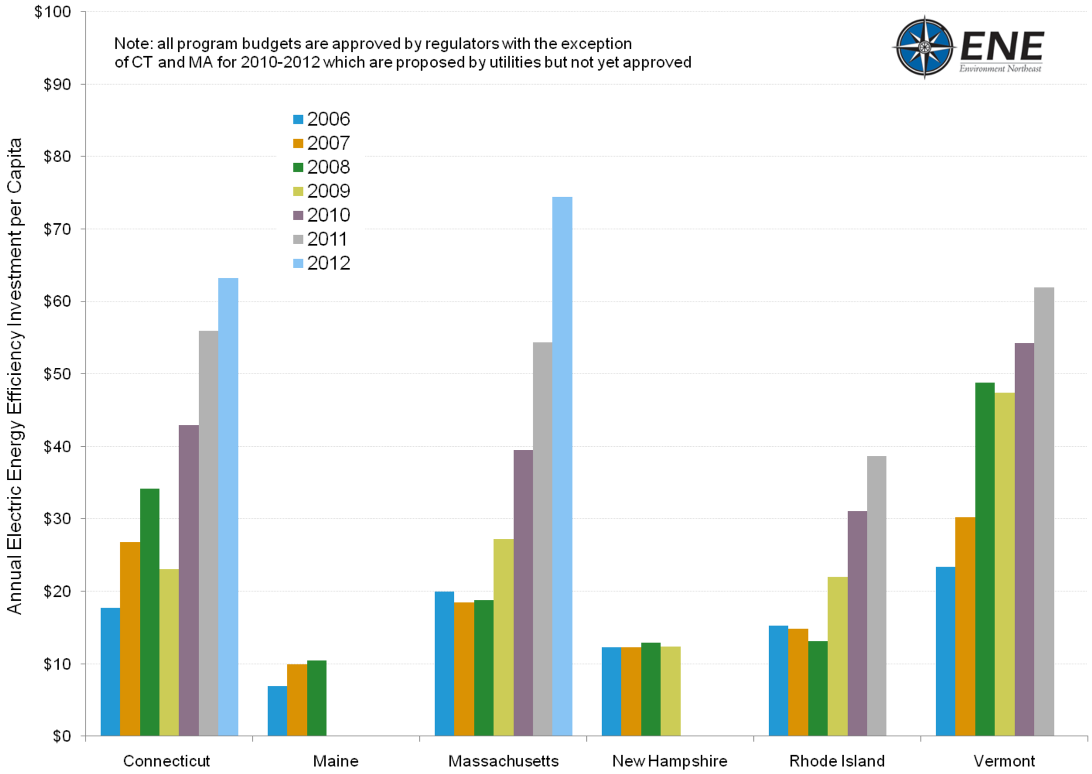
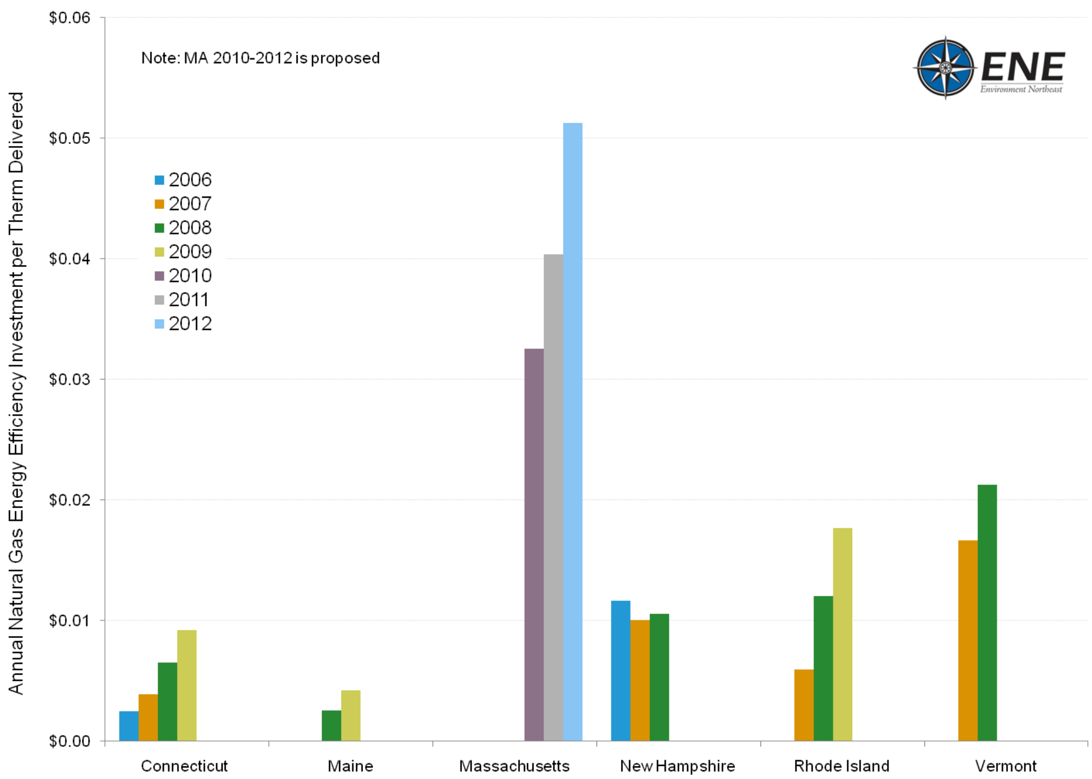


Figure 3: New England Natural Gas Efficiency Investments – 2006 to 2012



Approved or proposed annual investment levels for increased electric efficiency programs (after ramp-up) are:

- Connecticut: $228 million
- Maine: To be determined
- Massachusetts: $498 million
- New Hampshire: To be determined
- Rhode Island: $43 million
- Vermont: $41 million

3.0 Energy Efficiency Assumptions Development

In order to evaluate potential impacts of increased efficiency investment in New England states, assumptions were made about efficiency program budgets, costs to achieve energy savings, and energy prices and consumption levels during the modeled period. As described in detail below, all of these assumptions were based on conservative extrapolations from current and proposed efficiency program data, and appropriate adjustments for program expansions were made.

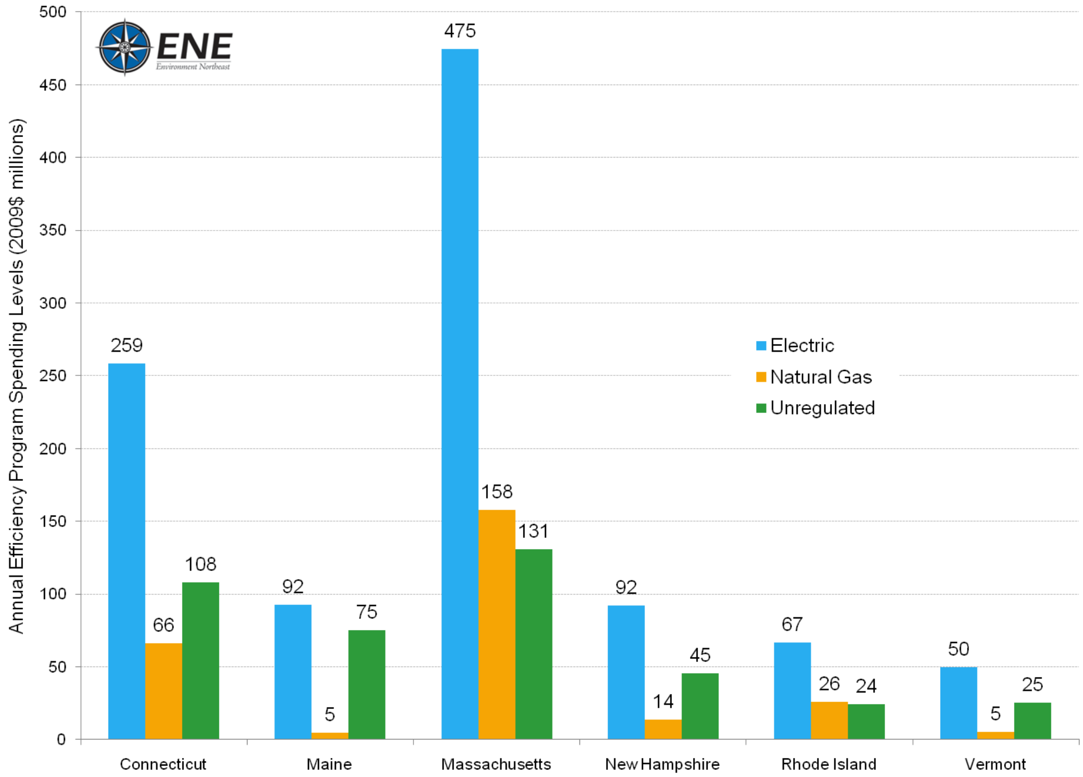
3.1 Investment Levels

The modeled efficiency investment levels were based on state plans for expanded efficiency investments and studies of cost-effective efficiency potential commissioned by several states. Modeled investment levels are generally lower than levels identified by many of the potential studies, and more closely match some new utility/program administrator proposals to capture all cost-effective efficiency. While optimum investment levels would vary among the New England states due to climate and demographic differences, in order to maintain consistency a single investment level was chosen based on annual state savings targets. It is important to note that while current or planned efficiency investments in a given state may not exactly match modeled investment levels, the goal of the analysis is to understand the overall macroeconomic benefits of expanded energy efficiency programs, and there is no need to match planned investments exactly.

Target savings for electric efficiency programs were modeled at a conservative level that achieves a 2% reduction in energy consumption per year. This would result in a target budget for Connecticut that is slightly higher than the $244 million recommended in the 2009 Integrated Resource Plan.[1] The target budget for Massachusetts is roughly equivalent to what has been proposed by program administrators,[2] taking into consideration the assumption in this analysis that measures that save more than one fuel are paid for proportionally by the consumers of each fuel. Consultants to the Massachusetts Energy Efficiency Advisory Council (EEAC) have recently recommended a goal of 2.7% electricity savings per year, which would result in an even larger annual efficiency budget.

For natural gas, the target savings level is 1.25% of annual consumption. This results in a higher Massachusetts budget than the 2012 proposal of $113 million,[3] but a substantially lower budget than would be required to meet the minimum 2% annual savings goal recommended by the EEAC's consultants.[4] Propane, heating oil, and kerosene ("unregulated fuels") were analyzed in a combined run of the REMI model. An annual savings target identical to natural gas (1.25%) was used for unregulated fuels, based on the similarity of efficiency measures for heating fuels and lack of fuel-specific studies. Target investment levels are shown below in Figure 4.

Figure 4: Modeled Expanded Efficiency Program Investment Levels (after ramp-up)



Modeled investment levels are ramped up from current budgets at 50% growth per year for electricity and natural gas, and at 100% per year for unregulated fuels, for which little or no program funding currently exists. This ramp-up schedule typically results in a 3-5 year expansion period before target levels are reached. After the target level is reached, modeled investment levels increase at the rate of inflation. In cases where no program currently exists, a conservative first year budget is assumed. Efficiency investments are modeled for a total of 15 years, including the ramp-up period. Program impacts are modeled for another 20 years to capture the full economic benefits achieved over the life of efficiency measures.

Modeled efficiency programs are further divided into three market segments: commercial, industrial, and residential. Following conventional program evaluation techniques, the commercial and industrial market segments use identical assumptions for efficiency measures and savings. The investment split between residential, commercial, and industrial segments is based on proportional energy consumption by each as reported in the U.S. Energy Information Agency (EIA) 826 database (2005-2008 average).[5] It is also assumed that 10% of C&I spending is on public buildings.

3.2 Program Costs and Energy Savings

The cost of a particular efficiency measure is tallied in the year it occurs, while savings associated with that measure accrue for the duration of the measure life. For example, a measure installed in 2010 will have its full cost reflected in that year, with per year energy savings occurring every year over its lifespan. This provides a more accurate model of the measure's real-world economic impacts.

Values used to calculate the economic benefits of efficiency measures are summarized in Table 2.

Table 2: Summary of Efficiency Investment Cost Assumptions

Electricity	**Residential**	**C&I**	**Units**
First-Year Program Costs per Annual Savings- Energy	425	375	$/MWh
Lifetime Program Cost per KWh	0.035	0.027	$/KWh
First-Year Program Costs - Capacity	3300	2500	$/KW
Average Participant Copay	12%	32%	%
Average Measure Life	12	14	Years
Natural Gas and Non-Regulated Fuels			
First-Year Program Costs per Annual Savings	80	30	$/MMBTU
Lifetime Program Cost per MMBTU - Energy	4.00	2.00	$/MMBTU
Average Participant Copay	20%	45%	%
Average Measure Life	20	15	Years

These cost values are based on recent efficiency potential studies and information provided by efficiency program administrators. The values for unregulated fuels are assumed to be the same as for natural gas, given the lack of existing programs and the similarity of measures between the fuels. It is important to note that while these values are informed by current programs in the region, they may not match the characteristics of existing efficiency programs exactly. The costs of additional efficiency measures modeled here are generally higher because the proposed programs are designed to capture a greater amount of efficiency than existing programs. Average first-year cost and measure life values for electric efficiency programs in this study are significantly larger than those for existing programs. This discrepancy reflects the fact that new lighting standards taking effect in 2012 will increase the cost of lighting efficiency improvements and a general commitment to use conservative assumptions this study.

Funding for energy efficiency measures can be divided into two main categories: program and participant. Program spending derives from state or utility efficiency program budgets. For the electric and natural gas scenarios funding is assumed to accrue exclusively from ratepayer funds. For the unregulated fuels scenario funding is assumed to accrue from fuel surcharges for all consumers of those fuels. Participant spending consists of customer co-pays required for most efficiency measures.

3.3 Avoided Energy Costs

The benefits of avoided spending on electricity and natural gas consumption are calculated using data from the *Avoided Energy Supply Costs in New England: 2007 Final Report* prepared by Synapse Energy Economics[6] for states and program administrators in the region. Avoided cost values are calculated separately for each state. For electricity in Connecticut and Massachusetts, the states are broken into two areas in the Synapse report. In this report, for both states the value from the larger (and less urban) area –the more conservative (lower avoided cost) figure– was used.

The savings for heating oil, propane, and kerosene are calculated using EIA projected energy prices from the Annual Energy Outlook (AEO) Reference Case.[7] For these unregulated fuels it is appropriate to use the full delivered cost of energy as the avoided cost because they do not have a fixed-cost delivery infrastructure.

The impact of reduced electricity consumption on overall energy and capacity prices, or Demand-Reduction-Induced Price Effects (DRIPE), is also based on the 2007 Synapse report. These additional savings to all ratepayers are included in the calculation of net electricity costs. Demand reduction-induced price effects are not considered for natural gas and unregulated fuels.

3.4 Efficiency Program Labor and Materials

The breakdown of spending on labor, materials, and program administration was assigned to categories in the REMI model based on information obtained from Massachusetts and Connecticut programs, as well as a prior study commissioned by the Connecticut Clean Energy Fund.

The contractor materials were further broken down to more accurately represent spending in efficiency programs. Most of this spending falls within the two broad REMI industry segments for general construction and construction trades. However, since the majority of economic activity in these categories is not related to energy efficiency, the REMI model inputs were adjusted to more accurately represent the impacts of energy efficiency spending on construction and construction trades. Details are shown in Appendix 1.

3.5 Scenarios Developed

Individual scenarios were developed for modeling each of the three main fuel types: electricity; natural gas; and unregulated fuels (which include #2 fuel oil, kerosene, and propane). For each fuel, two subsets of scenarios were developed: Business as Usual (BAU); and Expanded Efficiency. In the BAU scenario, it was assumed that there was no spending on energy efficiency, while the Expanded Efficiency scenario assumed spending levels described above. Cost and consumption of energy were calculated for each state for each scenario. Economic impacts for each scenario were calculated with each state acting individually and with all states acting simultaneously.

4.0 Energy Benefits of Efficiency Investments

Like existing efficiency programs, the modeled expanded efficiency scenario produces energy savings at a cost that is less than supply. The significantly higher levels of efficiency spending would produce substantial reductions in energy consumption and a corresponding reduction in energy costs for the region.

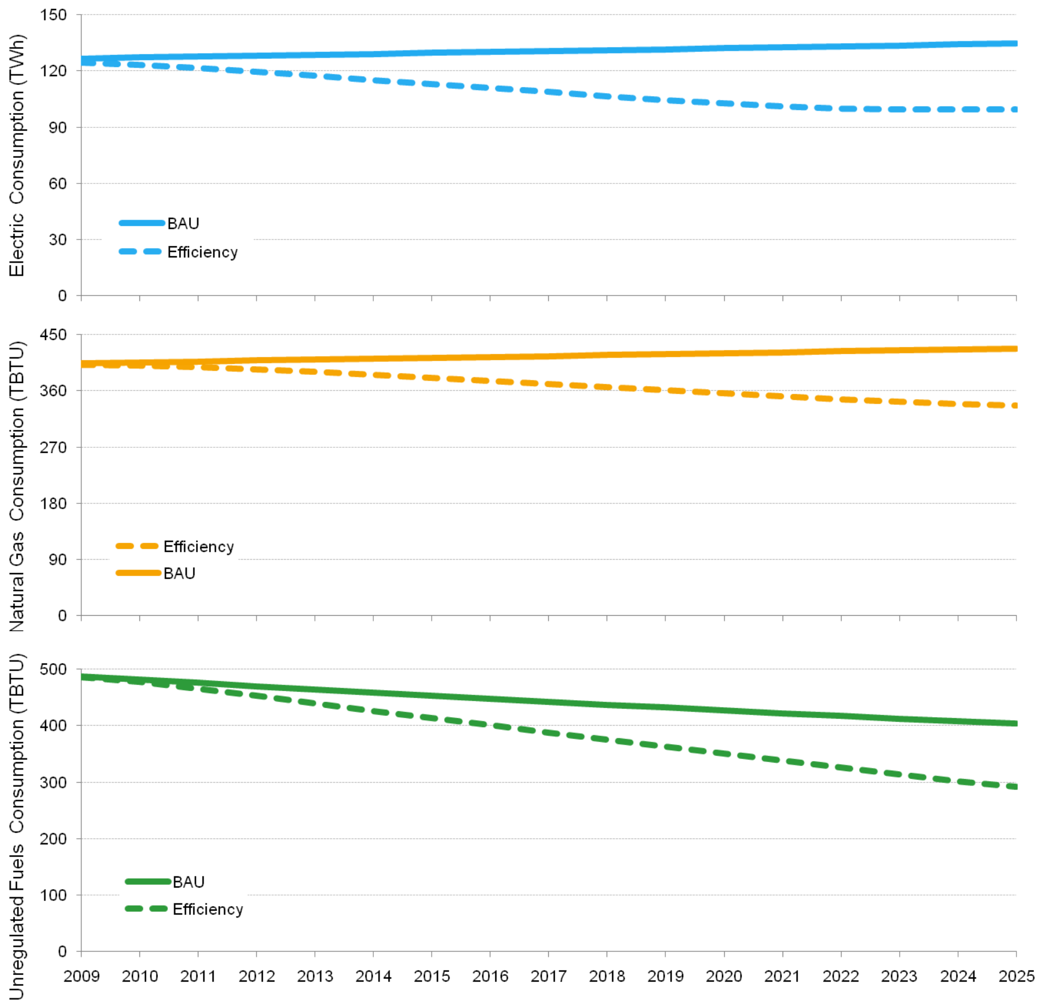
4.1 Energy Saved

The energy saved in each year of the analysis is the difference between the BAU scenario and the Expanded Efficiency scenario. BAU electricity consumption was based on the most recent 4-year average (2005-2008) of consumption by segment and state (EIA-826). Consumption was increased annually for each state by average load growth from the 2009 ISO-New England 10-year, base-case forecast.

BAU consumption levels for natural gas and unregulated fuels used the most recent EIA 4-year average (2003-2006) of consumption by segment and state for each fuel. This figure was increased annually by the average consumption growth for each fuel from the EIA Annual Energy Outlook (AEO) forecast through 2030 for the New England region.

Consumption reductions in the expanded efficiency scenario for a given year were obtained by adding annual savings of all efficiency measures that had not reached the end of their useful lives. At its peak, this efficiency investment would result in reductions in projected energy use in New England of 26% for electricity, 21% for natural gas, and 28% for unregulated fuels. BAU and Expanded Efficiency scenarios for each of the three fuel types are shown in Figure 5.

Figure 5: New England Energy Consumption for All Scenarios



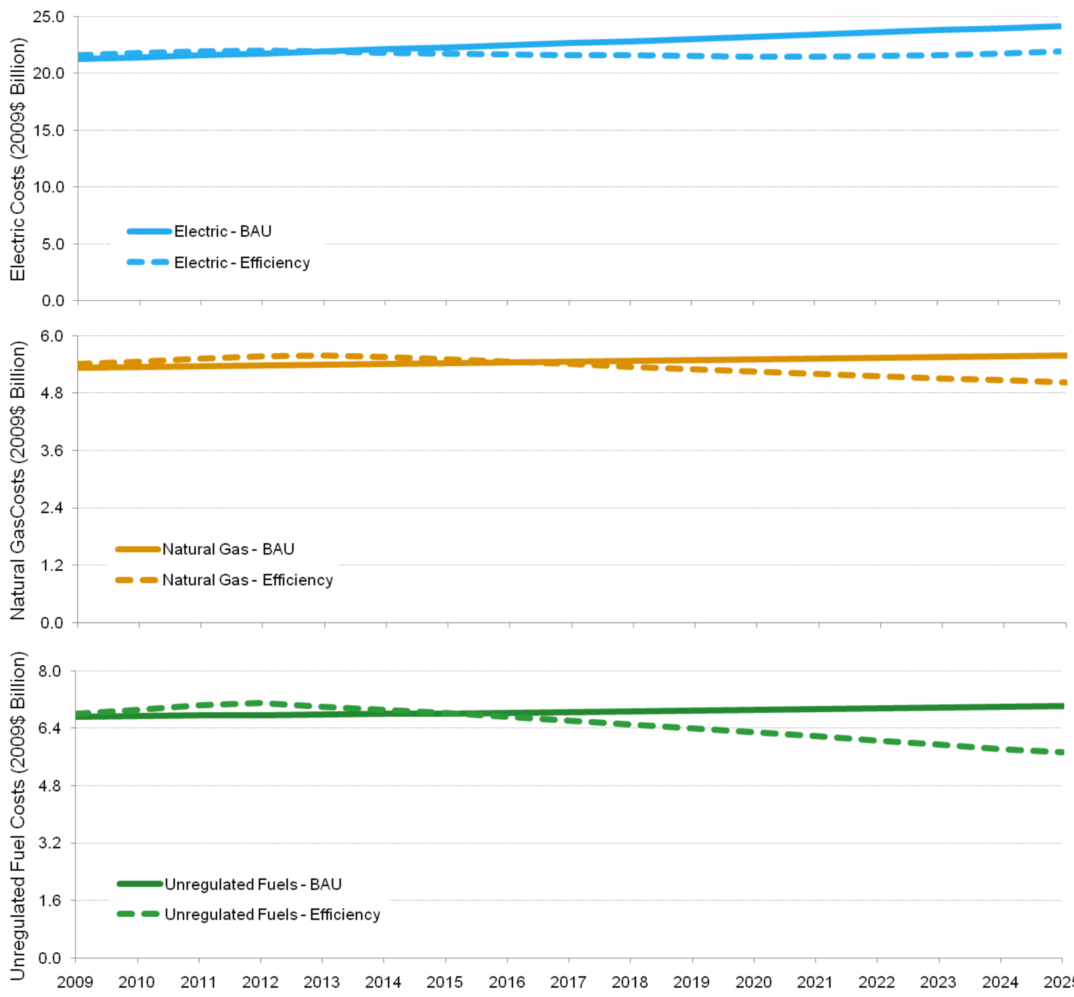
4.2 Reduced Energy Spending

BAU electricity costs were calculated using the most recent 4-year average (2005-2008) of EIA-826[8] reported delivered costs by segment and state. This cost was increased each year to account for the average load growth from the 2009 ISO-New England 10-year base-case forecast[9] for each state and by a real price increase of 0.43% per year; the estimated real generation price growth assumed in the 2008 Connecticut Integrated Resource Plan.[10] Transmission and distribution costs were also assumed to grow at 0.43% per year. While the growth rate in the ISO-New England forecast implicitly includes current efficiency program investments, this does not significantly affect the model's accuracy in projecting the difference in economic impacts between the BAU and Expanded Efficiency scenarios.

BAU costs for natural gas and unregulated fuels used the most recent 4-year average (2003-2006) of EIA reported costs by segment and state for each fuel.[11] In order to account for growth in average consumption and increasing fuel prices, costs were increased each year using the EIA Annual Energy Outlook forecast[12] through 2030 for the New England region.

These adjusted energy cost projections were used for both the BAU and Expanded Efficiency scenarios. In the latter scenario program and participant costs of efficiency investments were added, and the resulting savings were subtracted to obtain the net energy costs. Over the 2009-2030 period, the net decrease in projected energy costs in New England would be 5.8% for electricity, 5.1% for natural gas, and 9.6% for unregulated fuels (BAU and Efficiency scenario costs for each fuel are shown in Figure 6). These energy cost decreases would yield savings of $29 billion for electricity, $6 billion for natural gas, and $15 billion for unregulated fuel consumers, for a total of $50 billion in consumer savings

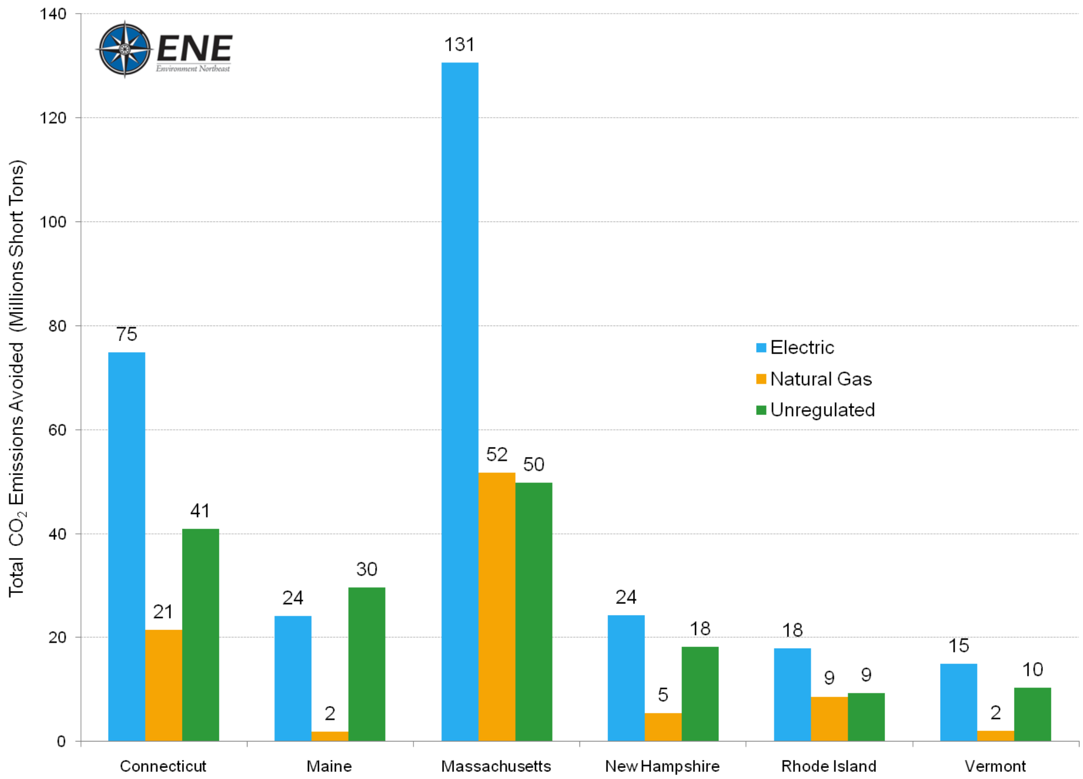
Figure 6: New England Energy Costs for all Scenarios



4.3 Avoided Emissions

Reductions in energy consumption also reduce emissions. Avoided emissions of CO_2 (the primary greenhouse gas pollutant from fossil fuel combustion) due to energy savings of expanded efficiency programs were calculated by multiplying the energy saved by the appropriate emissions factor. Results are shown in Appendix 2. The avoided emissions factors for natural gas and unregulated fuels were obtained from table A-34 of the U.S. EPA's *2009 U.S. Greenhouse Gas Inventory Report, Annex 2.*[13] For electricity, the average New England avoided emissions rate was derived from the ISO New England *2007 New England Marginal Emission Rate Analysis*.[14] The projected reduction in CO_2 emissions that would result from implementing the Expanded Efficiency spending scenario in all New England states is shown in Figure 7.

Figure 7: Avoided CO_2 Emissions



Reductions in annual emissions of CO_2 are projected to peak at 18 million short tons for electricity, 5 million short tons for natural gas, and 9 million short tons for unregulated fuels. Total lifetime emissions benefits from expanded efficiency programs for all three fuels would be 536 million short tons.

Lower emissions not only provide environmental benefit, they also reduce consumer costs in a cap and trade system. Energy efficiency investments decrease demand for electricity; lower electricity demand reduces emissions associated with energy production Reduced emissions lead to lower demand for emissions allowances, lower prices for allowances, and lower cap and trade costs.

5.0 Economic Benefits of Efficiency Investments

This chapter explores the economic benefits of expanding energy efficiency investments for electricity, natural gas and unregulated fuel consumers. Impacts are measured in terms of *jobs, output* ($ of business sales), *value-added* ($ of Gross State Product), and *real disposable income* generated annually by the modeled efficiency investments.

Economic impacts of increased efficiency investments are evaluated independently for each fuel in each state, under the assumption that the state acts alone. An additional scenario evaluates the net regional effect of all six New England states increasing efficiency investments simultaneously for a single fuel type.

5.1 Methodology

Economic impacts of energy efficiency spending are comprised of three major components:

- *Net Participant Savings* – the difference between the value of energy saved by a program participant and the cost of the energy-efficiency measure
- *Investment Spending* –annual dollars of new demand created through program-related spending and the participants' spending on energy-efficiency measures
- *Ratepayer (net) Costs* – the cost to offer the program, which may be defrayed by DRIPE savings, which benefit all ratepayers. (DRIPE is relevant only for the *electricity* scenario)

In order to distribute net savings and the ratepayer costs accurately, it is necessary to allocate savings and cost proportionately among market segments (Residential, Commercial and Industrial). For the investment spending component, industries that supply energy efficiency measures (specifically the manufactured components and installation services) receive a greater share of investment. In order to apportion savings/costs and investment shares proportionately it was necessary to use an economic analysis model capable of (a) recognizing these distributive effects of the proposed efficiency programs, and (b) forecasting economic change as a result of changes in household cost of living and industry cost of doing business. A brief description of REMI modeling framework applied follows.

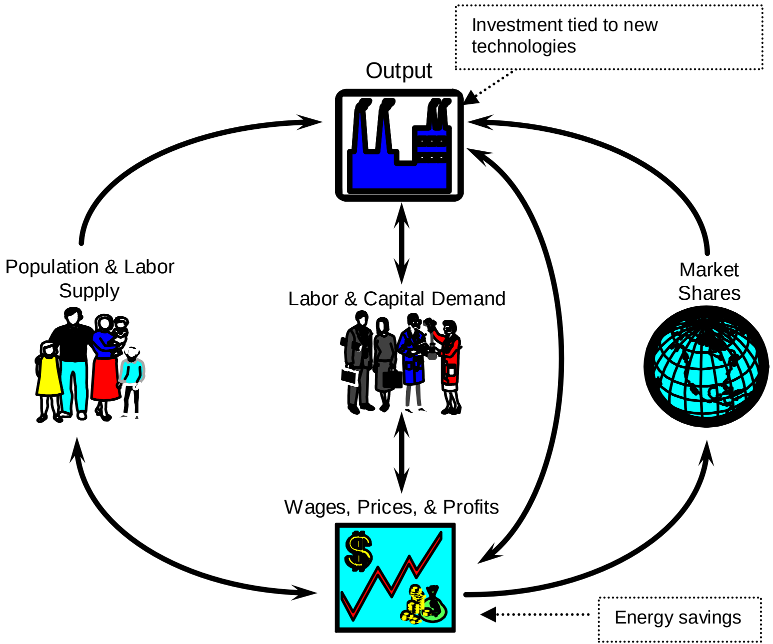
5.2 REMI Economic Impact Policy Insight Forecasting Tool

In order to ensure maximum, state-specific accuracy of results, a multi-state *Policy Insight* forecasting model[15] was used for this analysis. While the existing model contains 12 distinct states in the northeast air shed, six of those are the New England states for which the expanded efficiency scenarios are applicable. The modeling system allows the analyst to enter state-specific *annual* changes through select policy levers that pertain to the three components defined above and then resolve an economic forecast for the states in the model's configuration. The model used forecasts for 70 different industries (approximating 3-digit NAICS definitions of business activity) through the year 2050, though scenarios required only forecasting to the year 2038 to match analysis horizons utilized for this study.

A detailed presentation of the data underpinnings of the REMI model is included in Appendix 3. The REMI model was used because its structure (*i.e.*, internal *logic* or equation set) is capable of capturing how cost changes to households and businesses affect economic growth and incorporates feedback from economic stakeholders (households and businesses) when an energy efficiency program takes effect. Figure 8 portrays the basic concept of what the REMI model captures for a region's economy (a region can be a county/state or any combination thereof). There are five major "blocks" in a region's economy (see Figure 8, below). Multiple algorithms are used to model impacts on each block, and the arrows depict the feedback between different blocks of the economy. In a model of 6 New England states each state economy functions according to the interrelations portrayed in Figure 8. States also exert constant feedback between each other (inter-regionally) in terms of labor flows (commuters) and trade in manufactured goods and services.

Among regional economic models, the REMI model is unique in that it captures a *'market shares'* response from policies and/or investments that change the underlying *cost-of-doing business* for an industry. When this occurs industry's *relative competitiveness* (relative to the U.S. average for that industry) changes and the region's ability to retain/gain sales with other markets (local, extra-regional, or international) is influenced.

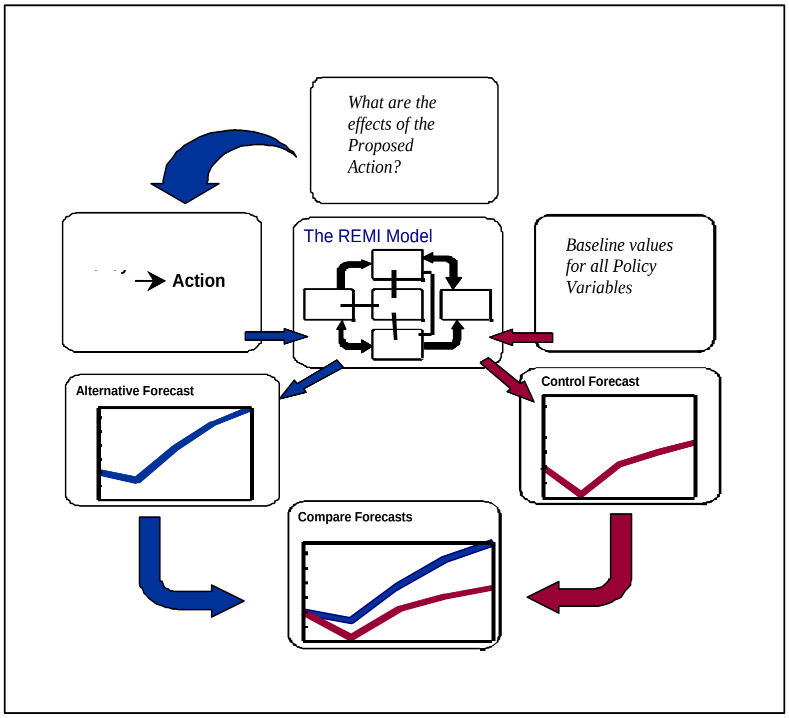
Figure 8: REMI Economic Forecasting Model – Basic Structure and Linkages



Source: EDR Group, Inc.

The REMI model *estimates* economic and demographic impacts by comparing the base case[16] annual forecast (using the above structure/feedbacks) to the annual forecast with increased energy-related savings/costs (the *alternative* forecast, or, in this case the Expanded Efficiency scenario). Figure 9 portrays this relationship.

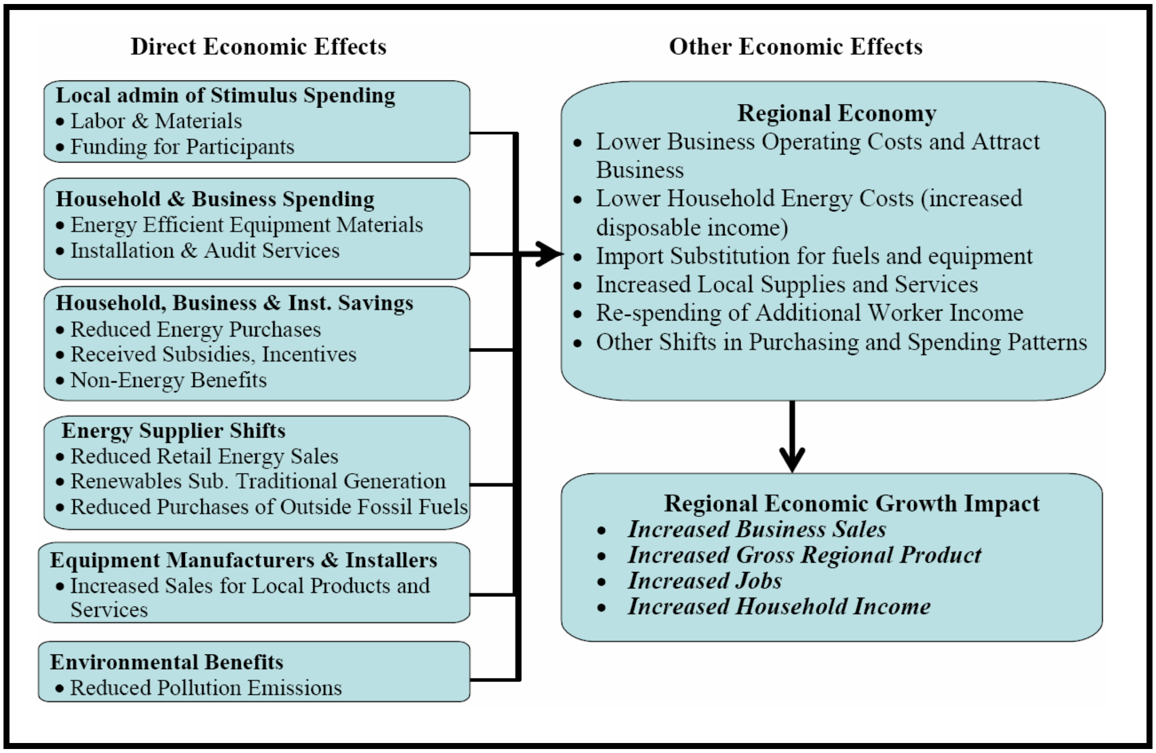
Figure 9: Identifying Economic Impacts in the REMI Framework



Source: EDR Group, Inc.

REMI analysis of macroeconomic impacts is based on the *direct effects* of the expanded efficiency scenario. Relevant direct effects are changes in energy purchases for various customer segments, shifts in consumption and investment, and regional economic self sufficiency (*i.e.,* replacing energy imports with *locally* provided energy conserving devices/services). Figure 10 lists possible direct effects of a broad range of energy policies/programs. Not all of the direct effects shown were applicable to the expanded efficiency scenarios analyzed. The REMI simulations excluded monetized environmental benefits, non-energy benefits (not identified), and renewable energy aspects (irrelevant). The forecast of *avoided generating costs* used to value conserved energy implicitly captures the value of imported fuel inputs.

Figure 10: REMI Model Capabilities to Capture Energy Program Elements in the Regional Economy



Source: EDR Group, Inc.

5.3 Assumptions used for REMI modeling

In addition to fuel-specific assumptions used to frame the expanded energy efficiency scenarios, the following limited assumptions were applied in order to properly incorporate program data into the REMI model's state-specific analysis.

- This version of the REMI model uses a current year basis of 2008. The scenario data were re-scaled from 2009$ to 2008$ using the REMI model's state-specific CPI concept.
- Each fuel's *program expenditures* and *participants' investment $*, once allocated to the capital supplying/service industries, are assumed to represent *new demand* in a state's economy. The extent to which $ of *new demand* become $ of *new local sales* depends upon the state-specific calibrated *regional purchase coefficients.*[2]
- The allocation of *program costs* to Residential, Commercial, and Industrial segments is based on recent state-specific consumption shares for each segment reported by EIA. All other allocations are based on previously described assumptions used for scenario development.

5.4 Energy Efficiency Scenarios – Direct Economic Effects

Before summarizing the direct effects for each of the three fuel programs, a brief explanation of how a scenario's direct effects are mapped into the REMI structure is warranted. The resulting *economic impacts* are discussed below.

[2] An industry-specific, region-specific proportion that describes what % of region k's demand for product associated with industry_i is fulfilled by within region firms belonging to industry_i.

There are three economic inputs to the expanded energy efficiency scenarios, regardless of fuel type: participant's net savings, efficiency investment spending, and net ratepayer costs. These three aspects are defined at the start of this chapter. They are incorporated into the REMI model as policy changes using the following mechanisms:

1. *Changes in Household Expenses* – direct participant savings and energy price savings are both expressed in the model as reallocations of consumer resources (*i.e.,* energy efficiency causes a household to spend less on energy, leaving more disposable income to spend on other purchases once the household pays off its energy efficiency investment – which occurs quickly because of the incentives offered by the efficiency program).

2. *Changes in Commercial/Industrial Customers Fuel Bills* – direct participant savings and energy price savings for businesses represent a *change in the cost of doing business* (after paying for installed energy efficiency components). Public fuel customers (*e.g.,* State/Local government facilities) are assumed to represent 10 percent of the Commercial participants. Changes in fuel expenses for state/local government facilities are modeled as an inverse change to the level of *State/Local Government Spending* for public programs.

3. *Program and Participant Purchases* – program and participant spending is allocated to select manufacturing and service industries, as well as wholesale or retail sectors to reflect where dollars of *new demand* (fostered by the efficiency programs) would present *local* economic opportunity *at the industry level.*

Tables detailing state-level direct effects of proposed fuel energy efficiency programs (in 2008$) are located in Appendix 4. This summary is provided to portray the relative scale of the energy efficiency adoption for New England and across fuel types. While the REMI modeling is done by proposing the direct effects as year-by-year changes, Table 3 presents the cumulative direct effects for each fuel type.

Table 3: Comparison of Fuel-Specific Direct Effects on New England (2008$)

sum over years for New England	Electric	Natural Gas	Unregulated Fuels
participant net savings	$45,907,484,637	$13,733,107,807	$31,295,224,304
RESIDENTIAL	$13,973,571,453	$5,320,151,233	$19,483,947,687
COMMERCIAL	22,598,507,020	$4,749,744,753	$8,083,118,898
INDUSTRIAL	$9,335,406,163	$3,663,211,821	$3,728,157,720
ratepayer burden	(9,767,304,099)	$(4,074,946,456)	$(6,200,479,280)
all investment	$22,387,026,734	$6,308,080,779	$8,737,481,601
SAVINGS: PROGRAM & PARTICIPANT INVESTMENT	2.05	2.18	3.58
SAVINGS:PROGRAM INVESTMENT	4.70	3.37	5.05
Program cost AS SHARE OF REQUIRED INVESTMENT	0.44	0.65	0.71
PARTICIPANT SHARE OF INVESTMENT	0.56	0.35	0.29

Among the three proposed fuel programs, the electric energy efficiency program would have the largest savings for participants in New England, and would require more investment (program and participant) than either natural gas or unregulated fuels. The *residential* customer segment would reap the most participant savings under natural gas and unregulated fuels programs, whereas the *commercial* customer segment would get the most participant savings under the electric energy efficiency program. In terms of net participant savings per $ invested (program and participant spending), unregulated fuels programs would have the highest return, at almost $3.6 saved per $1 invested. If just the program dollars are considered in relation to the net $ saved, unregulated fuels energy efficiency programs would return the highest net savings, $5.05 per $1 invested. Electric energy efficiency would return $4.7 in savings for every $1 invested and natural gas would return $3.37 in savings for every $1 invested. The proposed electric energy efficiency program as designed would require the highest contribution by participants in overall investment ($0.56 of every $1 invested). The unregulated fuels program would require the least, $0.29 of every $1 invested.

The estimated *total* economic impacts for each state depend on: the *relative importance* (in terms of scale) of the consumer (household), commercial and industrial sectors; the *industry composition* within the state (i.e. representation, scale, and the ability to fulfill new demand that arises in the region); and, which *customer segment* benefits the most.

5.5 Total Economic Impacts from Expanded Energy Efficiency Scenarios

Total economic impacts result from *direct* economic effects of increased efficiency investments. The *total* impact equals the *direct* plus *non-direct* impacts. A comprehensive region-specific set of *multiplier effects* in the REMI economic simulation model create additional economic responses once the *direct* effects have been introduced. In the simplest form of economic impact measurement, this occurs via two economic mechanisms after the direct effects take place: *changes in Consumer demand* (often labeled '*induced'* effects) and *changes in Intermediate demand or "B2B"* (often labeled *'indirect'* effects).

The most important feature here is who is changing demand/spending – if it is households (*induced*) then it is consumer commodity driven. If it is a business (*indirect*), then it is predicated on the business's production function (which describes what supplies and services the business requires to produce its Output). The REMI model reports a *total* impact concept, and although it does not report separate *induced* and *indirect* contributions, both are accounted for.

The *total* economic impacts (jobs, sales, gross state product or real household income) are expressed as a *difference* relative to what that value (in year t) would be without the program. This is shown in Figure 6-2, above.

For each fuel energy efficiency scenario, results are presented (i) when individual states implement a program independent of other states and (ii) when all six states implement the program simultaneously. Individual state results are shown in Appendix 5. Due to the length of analysis intervals, the results are shown *summed* in constant year 2008$. The results show a more pronounced economic impact for each state under (ii) because the REMI multi-regional analysis framework captures gains in *relative* national competitiveness for each state in the region when savings from energy efficiency programs increase trade between states and exports to the rest of the world.

5.6 Electric Scenario Results

Table 4. Electricity Expanded Energy Efficiency Scenario:
New England Region Results – Each State Implements Program in Isolation (2008$)

New England		**TOTAL for Interval**
ALL EFFECTS	Output	$140,229,558,000
subset of Output	GSP	$85,851,948,000
subset of GSP	Income	$60,764,802,000
	Jobs Years	661,779

This total for New England represents a summation of the results of the programs running in isolation for each state; this is done for the purpose of comparing the additional benefits of simultaneous implementation at the regional level (shown below) and does not represent a scenario that could actually occur.

Table 5: Electricity Expanded Energy Efficiency Scenario:
New England Region Results – Simultaneous Program Implementation Across New England (2008$)

New England		**TOTAL for Interval**
ALL EFFECTS	Output	$162,102,402,000
subset of Output	GSP	$99,432,648,000
subset of GSP	Income	$72,842,490,000
	Jobs Years	767,011

Detailed state tables can be found in Appendix 5.

As noted previously, the economic effects would greater when all states implemented the energy efficiency scenario simultaneously. The region's competitive synergy would lead to the following heightened impacts on Output: *MA (+18%), CT (no change), NH (+50%), ME (+14%), RI (+38%)* and *VT (+18%).*

Gross State Product (GSP) impacts are perhaps the most meaningful economic benefits since GSP leverages "local" labor and local investment (capital). The Expanded Efficiency scenario program spending levels would increase economic activity by $162 billion, as consumers spend energy bill savings in the wider economy. Sixty-one percent of increased economic activity ($99 billion) would contribute to gross state products (GSPs) in the region, with $73 billion returned to workers through increased real household income and employment equivalent to 767,011 job years (one full-time job for a period of one year).

5.7 Natural Gas Scenario Results

Table 6: Natural Gas Expanded Energy Efficiency Scenario:
New England Region Results – Each State Implements Program in Isolation (2008$)

New England		TOTAL for Interval
ALL EFFECTS	Output	$43,586,130,000
subset of Output	GSP	$26,187,000,000
subset of GSP	Income	$17,949,666,000
	Jobs Years	176,983

This total for New England represents a summation of the results of the programs running in isolation for each state; this is done for the purpose of comparing the additional benefits of simultaneous implementation at the regional level and does not represent a scenario that could actually occur.

Table 7: Natural Gas Expanded Energy Efficiency Scenario:
New England Region Results – Simultaneous Program Implementation Across New England (2008$)

New England		TOTAL for Interval
ALL EFFECTS	Output	$51,136,512,000
subset of Output	GSP	$30,582,762,000
subset of GSP	Income	$21,805,854,000
	Jobs Years	207,924

As noted previously, the economic effects would be more pronounced when all states implemented the energy efficiency scenario simultaneously. The region's competitive synergy leads to the following heightened impacts on Output: *MA (+13%), CT (12%), RI (+30%)* , *NH (+60%), ME (+50%)* and *VT (+43%)* over the single-state results.

Gross State Product (GSP) impacts are perhaps the most meaningful since a $ of GSP represents the state's productive contribution toward the level of output by leveraging "local" labor and local investment (capital). Over 15 years, increased natural gas efficiency would increase regional economic activity by $51 billion, boost GSPs by $31 billion, and increase real household income by $22 billion while creating 207,924 new job years of employment.

5.8 Unregulated Fuels Scenario Results

Table 8: Unregulated Fuels Expanded Energy Efficiency Scenario:
New England Region Results – – Each State Implements Program in Isolation (2008$)

New England		**TOTAL for Interval**
ALL EFFECTS	Output	$68,975,218,200
subset of Output	GSP	$43,272,373,200
subset of GSP	Income	$30,397,747,800
	Jobs Years	351,437

This total for New England represents a summation of the results of the programs running in isolation for each state; this is done for the purpose of comparing the additional benefits of simultaneous implementation at the regional level and does not represent a scenario that could actually occur.

Table 9: Unregulated Fuels Expanded Energy Efficiency Scenario:
New England Region Results – Simultaneous Program Implementation Across New England (2008$)

New England		**TOTAL for Interval**
ALL EFFECTS	Output	$85,990,800,000
subset of Output	GSP	$53,129,160,000
subset of GSP	Income	$37,169,706,000
	Jobs Years	417,061

As noted in advance of these tables, the economic effects are more pronounced when all states implement the energy efficiency scenario at the same time. The region's competitive synergy leads to the following heightened impacts on $ of Output: *MA (+37%), CT (13%), ME (+6%), NH (+38%), VT (+12%)* and *RI (+23%)* over the single-state results.

Gross State Product (GSP) impacts are perhaps the most meaningful since a $ of GSP represents the state's productive contribution toward the level of output by leveraging "local" labor and local investment (capital). Unregulated fuels efficiency programs would increase regional economic activity over 15 years by $86 billion, boosting GSPs by $53 billion, and increasing real household income by $37 billion while creating 417,061 job years of new employment.

5.9 Employment and Occupational Impacts

Efficiency's impact on employment is one of the most significant benefits of increasing efficiency program funding. For a look at job impact by *industry,* and by *occupation*, this report focuses on the New England region as a whole for a horizon year (2016) when all states have ramped up to expanded energy efficiency programs. For both industry and occupation detail, an aggregation of employment impacts is presented: 70 industries are classified by Major Sector, and 94 occupations are classified by Major Group. Employment impacts by industry also include nominal *average compensation per worker* to show which job impacts fall into higher-paying sectors.

Table 10: New England Employment Impacts by Sector, 2016

	New England Employment Impacts 2016			Average Annual Worker Compensation
	Electric	Natural Gas	Unregulated Fuels	
Total Increase in Jobs	18,971	2,056	5,150	
By Major Sector	Percent Allocation of Job Impact			
Forestry, Fishing, Related Activities, and Other	0.09%	-0.05%	0.09%	$27,360
Mining	0.02%	0.05%	0.02%	$55,616
Utilities	0.61%	1.10%	0.79%	$184,158
Construction	12.82%	15.25%	14.80%	$54,130
Manufacturing	4.34%	4.33%	4.45%	$121,088
Wholesale Trade	2.88%	3.07%	2.89%	$120,041
Retail Trade	14.40%	15.58%	15.31%	$43,154
Transportation & Warehousing	1.43%	1.37%	1.33%	$62,726
Information	1.52%	1.15%	1.41%	$117,052
Finance & Insurance	5.57%	1.81%	4.75%	$158,762
Real Estate & Rental & Leasing	4.20%	2.41%	3.73%	$22,939
Professional & Technical Services	11.41%	16.95%	11.22%	$92,003
Management of Companies and Enterprises	0.64%	0.38%	0.60%	$185,505
Administrative & Waste Services	5.92%	5.43%	5.48%	$46,433
Educational Services	1.70%	0.66%	1.43%	$55,686
Health Care & Social Assistance	14.46%	13.77%	14.11%	$69,193
Arts, Entertainment, & Recreation	2.66%	2.36%	2.55%	$27,723
Accommodation & Food Services	5.65%	4.33%	5.10%	$32,384
Other Services, except Public Administration	9.70%	10.04%	9.94%	$34,884

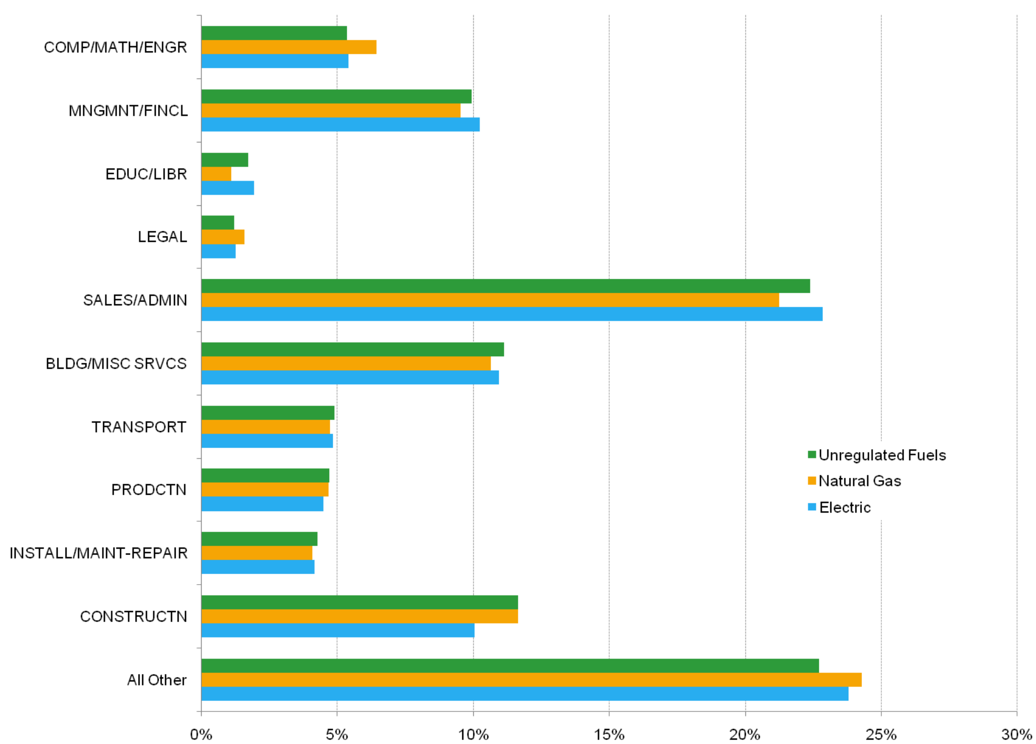
Across all three fuel scenarios, the three sectors – *construction, professional & technical services,* and *retail trade* – benefit most from the direct program and investment spending. Employment in *Healthcare*

Services also grows substantially, in proportion to the significant population increases the REMI model captures under the simulative programs across the region. Other job creation can be attributed to increases in consumer activity from *net* household savings, or to inter-industry trading resulting from lower costs of doing business from energy efficiency adoption. Of the three sectors with a large proportion of job impacts linked to direct effects, *professional & technical services* affords the most well-paying jobs, with annual average compensation (inclusive of fringe benefits) of over $92,000 per worker.

The *COMP/MATH/ENGR* occupational requirements are tied to the job impacts in the *Professional & Technical Services* industry group and *SALES/ADMIN* positions are strongly linked to *Retail Trade* job impacts. These two occupational groups along with the occupational requirements created for the *Construction* sector are most associated with the direct effects of energy efficiency programs. The *PRODCTN* class is associated with *Manufacturing*.

The occupational category labeled *"All Other"* includes two predominant occupational classes: *Healthcare Services* and *Food Preparation & Serving*, both the result of the REMI model capturing a population increase under the expanded efficiency scenarios for the New England region.

Figure 11: Distribution of Impacts on Occupational Requirements in New England, 2016



5.10 Components of Impacts

As described in Section 5.1, the macroeconomic impacts of the expanded efficiency scenario are the result of increased spending on efficiency measures, the savings delivered by those measures, and the ratepayer surcharges needed to fund the programs. In all cases the savings delivered by efficiency investments accounted for a substantial majority of the economic benefits listed above, while the efficiency program spending itself makes a much smaller contribution.

Table 11: Components of Economic Impacts for All Scenarios

New England (Simultaneous)	Electric	Natural Gas	Unregulated Fuels
Output			
Percent of Output Resulting from Efficiency Spending	12%	10%	9%
Percent of Output Resulting from Energy Savings	88%	90%	91%
GSP			
Percent of GSP Resulting from Efficiency Spending	12%	11%	9%
Percent of GSP Resulting from Energy Savings	88%	89%	91%
Income			
Percent of Income Resulting from Efficiency Spending	19%	18%	16%
Percent of Income Resulting from Energy Savings	81%	82%	84%
Employment			
Percent of Employment Resulting from Eff. Spending	16%	15%	12%
Percent of Employment Resulting from Energy Savings	84%	85%	88%

5.11 Analysis of Impacts

While the information in previous sections presents the absolute economic impacts of the expanded efficiency scenarios on different sectors, it is also possible to evaluate total economic impacts in terms relative to the investments required to create them. These are shown in the following figures for Gross State Product and job year gains.

Table 12: Dollars of GSP Increase per Dollar of Program Funding

	Electric		Natural Gas		Unregulated Fuels	
	Individual	Simultaneous	Individual	Simultaneous	Individual	Simultaneous
Connecticut	5.6	5.7	6.3	7.0	6.3	7.1
Massachusetts	5.5	6.4	6.7	7.5	8.0	10.9
Maine	4.3	4.9	8.4	12.4	6.6	7.0
New Hampshire	3.9	5.9	6.7	10.8	6.2	8.5
Rhode Island	4.0	5.4	4.4	5.7	6.2	7.6
Vermont	3.7	4.3	4.5	6.5	6.6	7.4
Six State Region	5.1*	5.9	6.4*	7.4	6.9*	8.5

Table 13: Dollars of GSP Increase per Dollar of Program and Participant Spending

	Electric		Natural Gas		Unregulated Fuels	
	Individual	Simultaneous	Individual	Simultaneous	Individual	Simultaneous
Connecticut	4.2	4.3	4.0	4.4	4.5	5.0
Massachusetts	4.1	4.8	4.4	4.9	5.7	7.8
Maine	3.2	3.6	4.8	7.1	4.6	4.9
New Hampshire	2.9	4.4	4.0	6.5	4.3	5.9
Rhode Island	3.0	4.1	2.9	3.8	4.5	5.5
Vermont	2.7	3.2	2.8	4.0	4.6	5.1
Six State Region	3.8*	4.4	4.1*	4.8	4.9*	6.0

Table 14: Job-Years per Million Dollars (2008) of Program Funding

	Electric		Natural Gas		Unregulated Fuels	
	Individual	Simultaneous	Individual	Simultaneous	Individual	Simultaneous
Connecticut	40.4	41.2	40.7	44.9	43.1	47.9
Massachusetts	37.0	43.4	41.8	46.5	52.7	69.9
Maine	51.5	58.1	92.1	133.4	74.7	78.9
New Hampshire	35.7	52.7	55.6	88.7	53.7	72.0
Rhode Island	36.2	48.7	38.5	48.2	58.3	64.9
Vermont	43.4	49.6	48.4	66.3	73.7	81.8
Six State Region	39.3*	45.5	42.9*	50.4	56.0*	66.5

Table 15: Job-Years per Million Dollars (2008) of Program and Participant Spending

	Electric		Natural Gas		Unregulated Fuels	
	Individual	Simultaneous	Individual	Simultaneous	Individual	Simultaneous
Connecticut	30.3	30.9	25.7	28.4	32.4	36.0
Massachusetts	27.4	32.2	27.4	30.6	32.3	42.8
Maine	38.2	43.1	52.4	75.8	71.5	75.5
New Hampshire	26.7	39.4	33.7	53.7	44.8	60.0
Rhode Island	27.0	36.3	25.5	31.9	37.6	41.9
Vermont	32.2	36.9	29.9	40.9	65.3	72.4
Six State Region	29.2*	33.9	27.7*	32.6	41.2*	48.9

*These totals for all six New England states represent summations of the results of the programs running in isolation for each state; this is done for the purpose of comparing the additional benefits of simultaneous implementation at the regional level and does not represent a scenario that could actually occur.

6.0 Conclusions

Increasing program investments for electricity, natural gas, and unregulated fuels to capture all cost-effective energy efficiency in New England would deliver significant economic benefits to the region. Efficiency investments increase gross state products, bolster trade, and create local employment. In essence, efficiency programs swap fossil fuel imports for local employment and economic growth.

Benefits from increased efficiency investments in New England are significant for each fuel type. Increasing efficiency program investments in all six states to levels needed to capture all cost-effective electric efficiency over 15 years ($16.8 billion invested by program administrators) would increase economic activity by $162 billion (2008 dollars),[3] as consumers spend energy bill savings in the wider economy. Sixty-one percent of increased economic activity ($99 billion) would contribute to gross state products (GSPs) in the region, with $73 billion returned to workers through increased real household income and employment equivalent to 767,000 job years (one full-time job for a period of one year). Over 15 years, increased natural gas efficiency ($4.1 billion invested by program administrators) would increase regional economic activity by $51 billion, boost GSPs by $31 billion, and increase real household income by $22 billion while creating 208,000 new job years of employment. Unregulated fuels efficiency programs ($6.3 billion invested by program administrators) would increase regional economic activity over 15 years by $86 billion, boosting GSPs by $53 billion, and increasing real household income by $37 billion while creating 417,000 job years of new employment.

The macroeconomic benefits of efficiency derive from changes in the economy that occur as a result of increased spending on efficiency measures and decreased spending on energy. The majority of these impacts (77-90%) result from the energy savings realized by households and businesses. Lower energy costs cause other forms of consumer spending (such dining out or discretionary purchasing) to increase.

[3] 2008 is the dollar year basis for all figures unless otherwise indicated.

Additionally, lower energy bills reduce the costs of doing business in the region, bolstering the global competitiveness of local employers and promoting additional growth.

The modeled results of increased efficiency investments show that efficiency provides significant economy-wide benefits in addition to the direct participant savings on which efficiency programs are often justified. Expanding analysis from micro-level cost-benefit tests to macro-level assessments of the economic impacts of efficiency (including losses to electric generators and fuel suppliers) clearly illustrates that investing in energy efficiency is one of the most effective means of improving economic conditions widely, while saving consumers money and reducing emissions.

This study shows that the economic benefits of energy saved through efficiency programs supplement and exceed the impacts of spending on implementing efficiency measures, and that efficiency investments quickly pay for themselves through increased economic activity and job creation. New England is not unique in terms of availability of efficiency resources; cost-effective efficiency savings can be found in any energy system. However, to capture the economic benefits of efficiency, policies must be created that include programs and incentives to overcome initial costs and deliver lasting benefits. This report shows that the benefits are greater than commonly recognized even by program administrators and proponents.

Energy efficiency investments produce economic benefits far greater than direct savings to consumers. While consumer savings are important, the wider economic impacts of increasing energy efficiency investments must be key considerations when evaluating different energy policy options. High energy costs and the threat of climate change have catapulted energy to the forefront of energy policy reform, and this study helps to show that efficiency delivers significant macroeconomic benefits in addition to reducing emissions and lowering energy bills.

End Notes

[1] Connecticut Light and Power and United Illuminating, prepared by The Brattle Group, "Integrated Resource Plan for Connecticut," http://www.ctenergy.org/pdf/REVIRP.pdf

[2] Nstar, National Grid, Western Massachusetts Electric, Unitil, Cape Light Compact, "Massachusetts Joint Statewide Three-Year Electric Energy Efficiency Plan," http://www.ma-eeac.org/docs/090716-ElecPlan.pdf

[3] Nstar, National Grid, Unitil, Cape Light Compact, Berkshire Gas, New England Gas Company, Baystate Gas, Blackstone Gas Company, "Massachusetts Joint Statewide Three-Year Gas Energy Efficiency Plan," http://www.ma-eeac.org/docs/090716-GasPlan.pdf

[4] Massachusetts Energy Efficiency Advisory Council, *"*Comments and Recommendations of the Consultants to the Voting Members of the Massachusetts Energy Efficiency Advisory Council (EE*AC)* on the July 16th Statewide Electric and Gas Energy Efficiency Plans," http://www.ma-energy efficiencyac.org/docs/090728-Consult-PlanCommentTxt.pdf

[5] U.S. Energy Information Agency, "Form EIA-826 Database Monthly Electric Utility Sales and Revenue Data," http://www.eia.doe.gov/cneaf/electricity/page/eia826.html

[6] Synapse Energy Economics, "Avoided Energy Supply Costs in New England: 2007 Final Report"

[7] U.S. Energy Information Agency, "2009 Annual Energy Outlook," http://www.eia.doe.gov/oiaf/aeo/supplement/stimulus/regionalarra.html

[8], U.S. Energy Information Agency, "Form EIA-826 Database Monthly Electric Utility Sales and Revenue Data," http://www.eia.doe.gov/cneaf/electricity/page/eia826.html

[9] ISO New England, "2009-2018 Forecast Report of Capacity, Energy, Loads, and Transmission (CELT)," http://www.iso-ne.com/trans/celt/report/2009/2009_celt_report_final_20090415.pdf

[10] Connecticut Light and Power and United Illuminating, prepared by The Brattle Group, "Integrated Resource Plan for Connecticut," http://www.ctenergy.org/pdf/REVIRP.pdf

[11] U.S. Energy Information Agency, "State Energy Data System, Expenditures for All States," http://www.eia.doe.gov/emeu/states/sep_sum/html/pdf/sum_ex_res.pdf, http://www.eia.doe.gov/emeu/states/sep_sum/html/pdf/sum_ex_com.pdf, http://www.eia.doe.gov/emeu/states/sep_sum/html/pdf/sum_ex_ind.pdf

[12] U.S. Energy Information Agency, "2009 Annual Energy Outlook," http://www.eia.doe.gov/oiaf/aeo/supplement/stimulus/regionalarra.html

[13] U.S. Environmental Protection Agency, "2009 U.S. Greenhouse Gas Inventory Report, Annex 2 - Methodology and Data for Estimating CO2 Emissions from Fossil Fuel Combustion," http://epa.gov/climatechange/emissions/downloads09/Annex2.pdf

[14] ISO New England, "2007 New England Marginal Emission Rate Analysis," http://www.iso-ne.com/genrtion_resrcs/reports/emission/2007_mea_report.pdf

[15] Under secondary-user status, EDR Group, Inc. ran the NESCAUM 12-state modeling system (with last history year through 2006). This is the same system that was used to evaluate the economic impacts from the Regional Greenhouse Gas Initiative (RGGI).

[16] The regionally-calibrated software model is delivered with a *standard Regional Control* forecast out to 2050. This analysis has assumed that forecast is a sufficient long-term representation of the base case economies.

APPENDIX 1 – REMI Efficiency Spending Allocations

Table A1-1. REMI Sector Allocation of Program Spending

	Residential	*Commercial*	*Industrial*
Wood product mfg	1%	0%	0%
Nonmetallic mineral prod mfg	1%	1%	0%
Paper	2%	0%	0%
Machinery mfg	3%	8%	15%
Computer, electronic prod mfg	1%	3%	3%
Electrical equip, appliance mfg	2%	10%	15%
Plastics, rubber prod mfg	2%	2%	0%
Wholesale trade	1%	2%	2%
Construction labor	63%	54%	45%
Retail	15%	0%	0%
Prof. Services	4%	14%	14%
Utilities	6%	6%	6%

Table A1-2. REMI Sector Allocation of Participant Spending

	Residential	*Commercial*	*Industrial*
Wood product mfg	1%	0%	0%
Nonmetallic mineral prod mfg	1%	1%	0%
Paper	2%	0%	0%
Machinery mfg	3%	9%	17%
Computer, electronic prod mfg	1%	3%	3%
Electrical equip, appliance mfg	2%	11%	17%
Plastics, rubber prod mfg	2%	2%	0%
Wholesale trade	1%	2%	2%
Construction	70%	60%	50%
Retail	17%	0%	0%
Prof. Services	0%	11%	11%
Utilities	0%	0%	0%

APPENDIX 2 – Avoided Emissions

Table A2-1. Avoided Emissions (Millions Short Tons CO_2)

	Electric	Natural Gas	Unregulated Fuels
Connecticut	75	21	41
Maine	24	2	30
Massachusetts	131	52	50
New Hampshire	24	5	18
Rhode Island	18	9	9
Vermont	15	2	10

REMI Policy Insight Model v9.5

Major Economic Data Sources

Employment

State

BEA SPI (summary industries; 1990-2006). The state and national BEA SPI data used for PI+ v1 is based on their 03/26/2008 release.

BLS QCEW (summary industries; 1990-2006)

CBP (detail industries; 2005)

National

BEA SPI (summary industries; 1990-2006). The state and national BEA SPI data used for PI+ v1 is based on their 03/26/2008 release.

BLS QCEW (summary industries; 1990-2006)

CBP (detail industries; 2005)

BLS EP (detail industries; 1998-2006 and 2016). The national BLS EP data used for PI+ v1 is based on their 12/04/2007 release.

Wages

State

BEA SPI (summary industries; 2001-2006)

BLS QCEW (summary industries; 1990-2006)

CBP (detail industries; 2005)

National

BEA SPI (summary industries; 2001-2006)

BLS QCEW (summary industries; 1990-2006)

CBP (detail industries; 2005)

Personal Income and Earnings

State

BEA SPI (components and summary industries; 1990-2006)

National

BEA SPI (components and summary industries; 1990-2006)

BLS EP (components; 1998-2006 and 2016)

Compensation

State

BEA SPI (components and summary industries; 2001-2006)

National

BEA SPI (components and summary industries; 2001-2006)

Commuter Flows

County to County Census (employees and wages; 2000)

BEA (income; 2006)

Technology Matrix

National BLS (detail sectors; 1998-2006 and 2016)

Final Demand

National

BEA (components; 1990-2006)

RSQE (components; 2007-2010). The November 2008 forecast from RSQE is used for PI+ v1.

BLS EP (components and industry value added; 1998-2006, 2016)

Occupation Matrix

National

BLS EP (employment by industry and occupation; 2006 and 2016)

Unit Electricity Cost

State-level data used: Energy Information Administration 1990 - 2004

Unit Natural Gas Cost

State-level data used: Energy Information Administration 1990 - 2004

Unit Residual Fuel Cost

State-level data used: Energy Information Administration 1990 - 2004

Purchased Fuel Weights

State-level data used: Energy Information Administration 2000

Major Demographic Data Sources

Population

County BEA (total; 1990-2006)

County Census (age, sex, race; 1990-2006)

Demographic Components of Change

County Census (1990-2006)

Labor Force

County BLS (total; 1990-2006)

Natality Rates

Nation Census (1999-2100)

Birth Rates

State CDC (1990-2006)

Survival Rates

Nation Census (1999-2100)

Net International Migrants

Nation Census (1999-2100)

Participation Rates

Nation BLS (1990-2050)

Active Military

Base DoD (total; 1994-2006)

Nation DoD (total, sex, race; 1990-2006)

Military Dependents

Nation DoD (total; 1990-2006)

Prisoners

County Census (sex, race, facility; 2000)

Nation Bureau of Justice Statistics (facility; 1990-2006)

APPENDIX 4 – State-Level Efficiency Spending

Table A4-1. Expanded Efficiency Annual Spending

State	Annual Efficiency Spending Level $(Millions)		
	Electric	Natural Gas	Unregulated
Connecticut	259	66	108
Maine	92	5	75
Massachusetts	475	158	131
New Hampshire	92	14	45
Rhode Island	67	26	24
Vermont	50	5	25
Total	1,034	272	409

APPENDIX 5 – Detailed State Results

Table A5-1. Electricity ENERGY EFFICIENCY Program Direct Effects by State

ELECTRICITY EE	CT	Total $ (2008)	Interval covers
Participant *net Savings*	RESID	$ 3,938,201,183	2008:2036
	COMM	$ 5,345,253,049	2008:2038
	INDSTRL	$ 2,088,820,603	
Ratepayer Cost	RESID	$ (957,599,442)	2008:2028
	COMM	$ (1,048,998,084)	
	INDSTRL	$ (368,935,186)	
New EE Spending	*to select sectors*	$ 5,845,427,233	2008:2025
ELECTRICITY EE	**ME**	**Total $ (2008)**	*Interval covers*
Participant *net Savings*	RESID	$ 1,135,563,145	2008:2036
	COMM	$ 1,317,644,023	2008:2038
	INDSTRL	$ 1,267,538,501	
Ratepayer Cost	RESID	$ (327,639,203)	2008:2028
	COMM	$ (306,833,735)	
	INDSTRL	$ (265,649,302)	
New EE Spending	*to select sectors*	$ 1,884,425,162	2008:2025
ELECTRICITY EE	**MA**	**Total $ (2008)**	*Interval covers*
Participant *net Savings*	RESID	$ 6,004,634,876	2008:2036
	COMM	$ 9,892,924,730	2008:2038
	INDSTRL	$ 3,922,367,411	
Ratepayer Cost	RESID	$ (1,556,415,957)	2008:2028
	COMM	$ (2,069,589,508)	
	INDSTRL	$ (738,499,644)	
New EE Spending	*to select sectors*	$ 10,189,003,114	2008:2025

Table A5-1. Electricity ENERGY EFFICIENCY Program Direct Effects by State (continued)

ELECTRICITY EE	NH	Total $ (2008)	Interval covers
Participant *net Savings*	RESID	$ 1,267,373,717	2008:2036
	COMM	$ 1,609,040,399	2008:2038
	INDSTRL	$ 837,968,177	
Ratepayer Cost	RESID	$ (364,846,483)	2008:2028
	COMM	$ (373,846,100)	
	INDSTRL	$ (175,224,949)	
New EE Spending	*to select sectors*	$ 1,901,319,716	2008:2025
ELECTRICITY EE	RI	Total $ (2008)	*Interval covers*
Participant *net Savings*	RESID	$ 909,200,771	2008:2036
	COMM	$ 1,331,544,940	2008:2038
	INDSTRL	$ 474,993,439	
Ratepayer Cost	RESID	$ (250,034,468)	2008:2028
	COMM	$ (295,540,058)	
	INDSTRL	$ (94,883,489)	
New EE Spending	*to select sectors*	$ 1,397,767,930	2008:2025
ELECTRICITY EE	VT	Total $ (2008)	*Interval covers*
Participant *net Savings*	RESID	$ 718,597,761	2008:2036
	COMM	$ 842,249,176	2008:2038
	INDSTRL	$ 743,718,032	
Ratepayer Cost	RESID	$ (212,314,513)	2008:2028
	COMM	$ (200,842,147)	
	INDSTRL	$ (159,611,832)	
New EE Spending	*to select sectors*	$ 1,169,083,577	2008:2025

Table A5-2. Natural Gas ENERGY EFFICIENCY Program Direct Effects by State

NGAS EE	CT	Total $ (2008)	Interval covers
Participant *net Savings*	RESID	$ 1,089,360,672	2008:2044
	COMM	$ 1,217,267,783	2008:2039
	INDSTRL	$ 817,845,970	
Ratepayer Cost	RESID	$ (397,214,466)	2008:2025
	COMM	$ (326,958,846)	
	INDSTRL	$ (197,706,520)	
New EE Spending	*to select sectors*	$ 1,458,404,586	2008:2025
NGAS EE	**ME**	**Total $ (2008)**	*Interval covers*
Participant *net Savings*	RESID	$ 22,689,595	2008:2044
	COMM	$ 145,032,416	2008:2039
	INDSTRL	$ 100,252,822	
Ratepayer Cost	RESID	$ (8,594,544)	2008:2025
	COMM	$ (36,568,940)	
	INDSTRL	$ (22,750,262)	
New EE Spending	*to select sectors*	$ 119,495,050	2008:2025
NGAS EE	**MA**	**Total $ (2008)**	*Interval covers*
Participant *net Savings*	RESID	$ 3,341,445,145	2008:2044
	COMM	$ 2,486,552,953	2008:2039
	INDSTRL	$ 2,158,429,287	
Ratepayer Cost	RESID	$ (1,265,698,918)	2008:2025
	COMM	$ (626,967,462)	
	INDSTRL	$ (489,809,974)	
New EE Spending	*to select sectors*	$ 3,629,548,947	2008:2025

Table A5-2. Natural Gas ENERGY EFFICIENCY Program Direct Effects by State (continued)

NGAS EE	NH	Total $ (2008)	Interval covers
Participant *net Savings*	RESID	$ 178,099,914	2008:2044
	COMM	$ 335,561,844	2008:2039
	INDSTRL	$ 283,363,335	
Ratepayer Cost	RESID	$ (67,462,089)	2008:2025
	COMM	$ (84,609,643)	
	INDSTRL	$ (64,303,329)	
New EE Spending	*to select sectors*	$ 357,334,725	2008:2025
NGAS EE	**RI**	**Total $ (2008)**	*Interval covers*
Participant *net Savings*	RESID	$ 614,193,732	2008:2044
	COMM	$ 481,434,223	2008:2039
	INDSTRL	$ 208,327,581	
Ratepayer Cost	RESID	$ (223,953,959)	2008:2025
	COMM	$ (129,313,517)	
	INDSTRL	$ (50,361,220)	
New EE Spending	*to select sectors*	$ 609,346,133	2008:2025
NGAS EE	**VT**	**Total $ (2008)**	*Interval covers*
Participant *net Savings*	RESID	$ 74,362,175	2008:2044
	COMM	$ 83,895,534	2008:2039
	INDSTRL	$ 94,992,826	
Ratepayer Cost	RESID	$ (30,197,838)	2008:2025
	COMM	$ (25,989,942)	
	INDSTRL	$ (26,484,989)	
New EE Spending	*to select sectors*	$ 133,951,337	2008:2025

Table A5-3. Unregulated Fuels ENERGY EFFICIENCY Program Direct Effects by State

UNREG FUELS EE	CT	Total $ (2008)	*Interval covers*
Participant *net Savings*	RESID	$ 5,130,769,404	2008:2044
	COMM	$ 1,739,388,116	2008:2039
	INDSTRL	$ 1,063,404,716	
Ratepayer Cost	RESID	$ (1,198,565,854)	2008:2025
	COMM	$ (260,958,653)	
	INDSTRL	$ (159,541,542)	
New EE Spending	*to select sectors*	$ 2,268,190,444	2008:2025
UNREG FUELS EE	**ME**	**Total $ (2008)**	*Interval covers*
Participant *net Savings*	RESID	$ 3,395,906,701	2008:2044
	COMM	$ 1,720,866,366	2008:2039
	INDSTRL	$ 643,662,536	
Ratepayer Cost	RESID	$ (787,219,225)	2008:2025
	COMM	$ (253,524,559)	
	INDSTRL	$ (94,826,806)	
New EE Spending	*to select sectors*	$ 1,617,138,897	2008:2025
UNREG FUELS EE	**MA**	**Total $ (2008)**	*Interval covers*
Participant *net Savings*	RESID	$ 6,365,946,750	2008:2044
	COMM	$ 2,527,941,100	2008:2039
	INDSTRL	$ 1,019,058,662	
Ratepayer Cost	RESID	$ (1,459,925,402)	2008:2025
	COMM	$ (360,961,732)	
	INDSTRL	$ (145,510,186)	
New EE Spending	*to select sectors*	$ 2,752,426,857	2008:2025

Table A5-3. Unregulated Fuels ENERGY EFFICIENCY Program Direct Effects by State (continued)

UNREG FUELS EE	NH	Total $ (2008)	*Interval covers*
Participant *net Savings*	RESID	$ 2,104,214,914	2008:2044
	COMM	$ 999,123,129	2008:2039
	INDSTRL	$ 461,343,740	
Ratepayer Cost	RESID	$ (491,069,468)	2008:2025
	COMM	$ (148,293,255)	
	INDSTRL	$ (68,474,208)	
New EE Spending	*to select sectors*	$ 1,008,969,921	2008:2025
UNREG FUELS EE	RI	Total $ (2008)	*Interval covers*
Participant *net Savings*	RESID	$ 1,236,013,601	2008:2044
	COMM	$ 468,751,335	2008:2039
	INDSTRL	$ 161,323,511	
Ratepayer Cost	RESID	$ (288,880,323)	2008:2025
	COMM	$ (63,735,773)	
	INDSTRL	$ (21,935,039)	
New EE Spending	*to select sectors*	$ 518,488,963	2008:2025
UNREG FUELS EE	VT	Total $ (2008)	*Interval covers*
Participant *net Savings*	RESID	$ 1,251,096,318	2008:2044
	COMM	$ 627,048,853	2008:2039
	INDSTRL	$ 379,364,556	
Ratepayer Cost	RESID	$ (266,199,576)	2008:2025
	COMM	$ (81,531,264)	
	INDSTRL	$ (49,326,415)	
New EE Spending	*to select sectors*	$ 572,266,520	2008:2025

Table A5-4. Electricity ENERGY EFFICIENCY Scenario: Results - Each State Implements Program in Isolation (2008$)

CT		TOTAL for Interval
ALL EFFECTS	Output	$40,185,474,000
subset of Output	GSP	$24,796,044,000
subset of GSP	Income	$17,271,240,000
	Jobs Years	178,983
MA		**TOTAL for Interval**
ALL EFFECTS	Output	$70,246,932,000
subset of Output	GSP	$41,869,968,000
subset of GSP	Income	$28,218,624,000
	Jobs Years	282,314
ME		**TOTAL for Interval**
ALL EFFECTS	Output	$9,104,550,000
subset of Output	GSP	$6,108,270,000
subset of GSP	Income	$5,259,324,000
	Jobs Years	72,783
NH		**TOTAL for Interval**
ALL EFFECTS	Output	$9,300,648,000
subset of Output	GSP	$5,662,482,000
subset of GSP	Income	$4,018,182,000
	Jobs Years	51,369
RI		**TOTAL for Interval**
ALL EFFECTS	Output	$6,230,070,000
subset of Output	GSP	$4,172,868,000
subset of GSP	Income	$3,306,870,000
	Jobs Years	38,221
VT		**TOTAL for Interval**
ALL EFFECTS	Output	$5,161,884,000
subset of Output	GSP	$3,242,316,000
subset of GSP	Income	$2,690,562,000
	Jobs Years	38,109

Table A5-5. Electricity ENERGY EFFICIENCY Scenario: State-level Results – Simultaneous Program Implementation Across New England (2008$)

CT		TOTAL for Interval
ALL EFFECTS	Output	$39,821,292,000
subset of Output	GSP	$25,362,414,000
subset of GSP	Income	$18,003,258,000
	Jobs Years	182,518
MA		**TOTAL for Interval**
ALL EFFECTS	Output	$82,996,956,000
subset of Output	GSP	$49,180,404,000
subset of GSP	Income	$33,566,862,000
	Jobs Years	331,493
ME		**TOTAL for Interval**
ALL EFFECTS	Output	$10,462,620,000
subset of Output	GSP	$6,954,780,000
subset of GSP	Income	$6,119,232,000
	Jobs Years	82,218
NH		**TOTAL for Interval**
ALL EFFECTS	Output	$14,075,208,000
subset of Output	GSP	$8,432,214,000
subset of GSP	Income	$7,077,798,000
	Jobs Years	75,793
RI		**TOTAL for Interval**
ALL EFFECTS	Output	$8,712,354,000
subset of Output	GSP	$5,744,088,000
subset of GSP	Income	$4,904,886,000
	Jobs Years	51,374
VT		**TOTAL for Interval**
ALL EFFECTS	Output	$6,038,844,000
subset of Output	GSP	$3,750,222,000
subset of GSP	Income	$3,164,364,000
	Jobs Years	43,618

Table A5-6. Natural Gas ENERGY EFFICIENCY Scenario: Results - Each State Implements Program in Isolation (2008$)

CT		**TOTAL for Interval**
ALL EFFECTS	Output	$9,333,534,000
subset of Output	GSP	$5,873,196,000
subset of GSP	Income	$4,104,660,000
	Jobs Years	37,986
MA		**TOTAL for Interval**
ALL EFFECTS	Output	$27,579,174,000
subset of Output	GSP	$16,098,306,000
subset of GSP	Income	$10,630,704,000
	Jobs Years	100,728
ME		**TOTAL for Interval**
ALL EFFECTS	Output	$867,216,000
subset of Output	GSP	$574,896,000
subset of GSP	Income	$476,238,000
	Jobs Years	6,331
NH		**TOTAL for Interval**
ALL EFFECTS	Output	$2,484,720,000
subset of Output	GSP	$1,464,036,000
subset of GSP	Income	$992,670,000
	Jobs Years	12,165
RI		**TOTAL for Interval**
ALL EFFECTS	Output	$2,710,050,000
subset of Output	GSP	$1,798,986,000
subset of GSP	Income	$1,432,368,000
	Jobs Years	15,724
VT		**TOTAL for Interval**
ALL EFFECTS	Output	$611,436,000
subset of Output	GSP	$377,580,000
subset of GSP	Income	$313,026,000
	Jobs Years	4,049

Table A5-7. Natural Gas ENERGY EFFICIENCY Scenario: State-level Results – Simultaneous Program Implementation Across New England (2008$)

CT		**TOTAL for Interval**
ALL EFFECTS	Output	$10,454,094,000
subset of Output	GSP	$6,552,840,000
subset of GSP	Income	$4,589,424,000
	Jobs Years	41,907
MA		**TOTAL for Interval**
ALL EFFECTS	Output	$30,907,968,000
subset of Output	GSP	$17,958,192,000
subset of GSP	Income	$12,024,096,000
	Jobs Years	112,188
ME		**TOTAL for Interval**
ALL EFFECTS	Output	$1,304,478,000
subset of Output	GSP	$853,818,000
subset of GSP	Income	$760,032,000
	Jobs Years	9,166
NH		**TOTAL for Interval**
ALL EFFECTS	Output	$4,052,286,000
subset of Output	GSP	$2,362,920,000
subset of GSP	Income	$2,009,700,000
	Jobs Years	19,426
RI		**TOTAL for Interval**
ALL EFFECTS	Output	$3,529,764,000
subset of Output	GSP	$2,322,726,000
subset of GSP	Income	$1,959,762,000
	Jobs Years	19,691
VT		**TOTAL for Interval**
ALL EFFECTS	Output	$878,178,000
subset of Output	GSP	$539,574,000
subset of GSP	Income	$453,096,000
	Jobs Years	5,546

Table A5-8. Unregulated Fuels ENERGY EFFICIENCY Scenario: Results - Each State Implements Program in Isolation (2008$)

CT		**TOTAL for Interval**
ALL EFFECTS	Output	$16,159,206,000
subset of Output	GSP	$10,316,460,000
subset of GSP	Income	$6,901,188,000
	Jobs Years	70,568
MA		**TOTAL for Interval**
ALL EFFECTS	Output	$26,697,220,200
subset of Output	GSP	$15,983,083,200
subset of GSP	Income	$10,321,453,800
	Jobs Years	104,863
ME		**TOTAL for Interval**
ALL EFFECTS	Output	$11,131,302,000
subset of Output	GSP	$7,534,548,000
subset of GSP	Income	$6,154,554,000
	Jobs Years	85,848
NH		**TOTAL for Interval**
ALL EFFECTS	Output	$7,273,896,000
subset of Output	GSP	$4,427,430,000
subset of GSP	Income	$2,959,740,000
	Jobs Years	38,471
RI		**TOTAL for Interval**
ALL EFFECTS	Output	$3,513,930,000
subset of Output	GSP	$2,362,920,000
subset of GSP	Income	$2,007,264,000
	Jobs Years	22,082
VT		**TOTAL for Interval**
ALL EFFECTS	Output	$4,199,664,000
subset of Output	GSP	$2,647,932,000
subset of GSP	Income	$2,053,548,000
	Jobs Years	29,605

Table A5-9. Unregulated Fuels ENERGY EFFICIENCY Scenario: State-level Results – Simultaneous Program Implementation Across New England (2008$)

CT		**TOTAL for Interval**
ALL EFFECTS	Output	$18,217,626,000
subset of Output	GSP	$11,577,090,000
subset of GSP	Income	$7,798,854,000
	Jobs Years	78,423
MA		**TOTAL for Interval**
ALL EFFECTS	Output	$36,698,340,000
subset of Output	GSP	$21,651,168,000
subset of GSP	Income	$13,795,068,000
	Jobs Years	139,003
ME		**TOTAL for Interval**
ALL EFFECTS	Output	$11,879,154,000
subset of Output	GSP	$8,002,260,000
subset of GSP	Income	$6,565,020,000
	Jobs Years	90,618
NH		**TOTAL for Interval**
ALL EFFECTS	Output	$10,096,002,000
subset of Output	GSP	$6,065,640,000
subset of GSP	Income	$4,426,212,000
	Jobs Years	51,556
RI		**TOTAL for Interval**
ALL EFFECTS	Output	$4,359,222,000
subset of Output	GSP	$2,865,954,000
subset of GSP	Income	$2,243,556,000
	Jobs Years	24,594
VT		**TOTAL for Interval**
ALL EFFECTS	Output	$4,745,328,000
subset of Output	GSP	$2,965,830,000
subset of GSP	Income	$2,337,342,000
	Jobs Years	32,860