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Energy Efficiency Potential on Cape Cod and Martha's Vineyard:

Long-Term Forecasts and Scenarios

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1. Introduction

The Cape Light Compact has received funding from the MTC to investigate electricity resource options available on Cape Cod and Martha's Vineyard over the mid- to long-term future (2003-2015). The Compact's investigation is addressing a variety of options for meeting growing electricity demand, including gas-fired power plants, renewable resources, distributed generation resources, and energy efficiency opportunities.

The purpose of this study is to provide the energy efficiency analysis portion of the MTC investigation. This study builds off of the analysis that the Compact has recently undertake in developing its Energy Efficiency Plan (the Plan), which describes the energy efficiency programs that the Compact implements as the municipal aggregator on Cape Cod and Martha's Vineyard.

The Compact's Energy Efficiency Plan includes a comprehensive set of programs that seek to address all cost-effective efficiency measures available to all customer types over the short-term future (2003-2007). The Compact's efficiency program budgets, however, are limited to the funds that are raised through the $2.5/MWh system benefits charge applied to all electricity customers. This study investigates the opportunity for achieving efficiency savings through activities and policies above and beyond those included in Compact's current Energy Efficiency Plan.

2. Methodology and Assumptions

2.1 Overall Approach

We begin with a Business-As-Usual (BAU) forecast of electricity demand on the Cape and Vineyard. This forecast represents the likely growth of electricity demand in the absence of additional efficiency programs, and acts as a reference case to compare with our energy efficiency forecasts. Based on the most recent load growth forecasts available from NSTAR, we assume that both energy and peak demand increase by three percent per year from 2002 through 2005, and by two percent per year from 2006 through 2015.

The Compact's Energy Efficiency Plan is used as the foundation for the efficiency forecasts in this study. The Plan contains detailed technical and economic assessments of the efficiency measures and programs that are being implemented by the Compact. Thus, it provides a highly-relevant wealth of data on the opportunities for achieving efficiency savings on Cape Cod and Martha's Vineyard.

We have developed several scenarios for the future development of energy efficiency on the Cape and Vineyard. These scenarios are designed to assess the various costs and benefits associated with different levels of efficiency savings. The scenarios studied include the following:

- Continuation of Current Efficiency Activities: assumes that the efficiency programs currently offered by the Compact will be continued essentially unchanged through 2015.

- Reduce Future Electricity Load Growth in Half: assumes that current efficiency activities will be increased to the point where new electricity load growth is only half of what would be expected without efficiency activities.
- Stabilize CO_2 Emissions from Electricity Generation: assumes that current efficiency activities will be increased enough to limit future CO_2 emissions to current levels.
- Eliminate Future Electricity Load Growth: assumes that current efficiency activities will be increased to the point where new electricity load growth is completely eliminated.

The efficiency scenarios are developed by assuming that the existing efficiency programs offered by the Compact are extended into the future, and, for the latter three, are expanded to achieve greater levels of savings. This is a simplifying assumption, because some future energy efficiency initiative may involve different types of activities, e.g., efficiency standards or building codes. However, the Compact's current efficiency programs are a good proxy for a variety of different types of efficiency activities, because they include such a broad range of efficiency measures and they address all customer types.

This methodology involves another simplifying assumption, because the Compact's energy efficiency programs do not account for several important changes that may happen to energy efficiency markets over time. One important change is that some technologies that are considered highly-efficient now may become standard practice over time. Ideally, electricity savings from these technologies should be considered part of the Business-As-Usual forecast, and not the efficiency scenarios. Another important change is that new efficiency technologies will develop over time, and the costs of existing technologies will be reduced over time. Ideally, electricity savings from these new technologies should be included in the efficiency scenarios. In effect, the first change will offset the second change, and thus our methodology of extending the Compact's programs is likely to represent a reasonable approximation of the potential for future efficiency savings.

In making energy efficiency forecasts for our future scenarios, we use the program funding levels as a proxy for additional efficiency initiatives and policies. In other words, we assume increased program funding levels, which leads to increased efficiency activities, which leads to increased efficiency savings and benefits.

In order to determine the efficiency opportunities for each of our future scenarios, we increase the system benefits charge (and thus the program budgets and activities), to the point where the particular scenario objective is achieved. This approach assumes that the current Compact efficiency programs will be expanded to reach additional participants, i.e., to increase the penetration rate of the efficiency measures and programs. For each scenario, we check the penetration rates of the programs to ensure that they do not turn out to be implausibly high. If any program's penetration rate turns out to be too high, we reduce that program's budget and shift the funding to another program within the same customer sector (residential, low-income, commercial & industrial).

2.2 The Cape Light Compact Energy Efficiency Plan

Portfolio of Efficiency Programs

The Compact's Energy Efficiency Plan is designed to comply with several state energy efficiency goals and policies.[1] One of the key goals of efficiency program design is that all efficiency measures must be cost-effective. In other words, the cost of achieving efficiency savings (including program administration costs, marketing costs, measure costs, installation and quality control costs) must be less than the electricity generation, transmission and distribution costs that are avoided by those savings.

Another key goal of efficiency program design is to distribute the programs equitably across all customer types. Thus, the Compact's Energy Efficiency Plan offers a range of efficiency programs for all customers, with programs specifically designed to address the unique needs of the low-income, residential, and commercial and industrial (C&I) sectors.

The Compact's Energy Efficiency Plan is also designed to achieve as much energy savings as possible from each program participant. Thus, the Plan offers technical and financial assistance to address a broad range of efficiency measures for each type of customer, home, building, or industry.

The programs contained in the Energy Efficiency Plan can be summarized as follows:

- The Residential ENERGY STAR® New Construction Program, which provides home buyers, home builders, and construction trade allies with technical assistance and financial incentives to increase the home energy rating of homes that are newly built or undergo major renovations.
- The Residential New Construction Demonstration Project, which provides home builders and buyers with enhanced financial incentives for building highly efficient, environmentally sensitive new homes.
- The Residential Massachusetts Home Energy Services Program, which provides all interested residential customers with a home energy audit and financial incentives for numerous electric and non-electric efficiency measures, including a no-interest loan to switch electric space heating systems to more efficient systems that use alternative fuels. This program represents the integration of the Residential Conservation Services and the Residential High Use Programs that were offered during Phase I.
- The Residential ENERGY STAR® Products and Services Program, which seeks to increase the availability and use of efficient lighting and appliances, including: clothes washers, water heaters, room air conditioners, dehumidifiers and refrigerators. This program is used to implement the Northeast Energy Efficiency Partnership (NEEP) initiatives and other regional market transformation efforts.

[1] The Compact's Energy Efficiency Plan can be downloaded from the Compact's web site, at www.capelightcompact.org

- The Low-Income Single Family Program, which provides low-income customers in single-family dwellings with assistance in purchasing and installing efficient lighting, appliances, and weatherization measures.
- The Low-Income Multi-Family Program, which provides owners and managers of low-income multi-family dwellings with assistance in purchasing and installing efficient lighting, appliances and space heating measures.
- The Low-Income New Construction Program, which provides low-income housing development agencies, weatherization assistance program (WAP) providers, and residential construction trade allies with incentives to increase the home energy rating of new low-income housing.
- The Commercial and Industrial New Construction Program, which provides technical assistance and financial incentives to increase the efficiency in the construction, renovation, or remodeling of all commercial, industrial, government and multi-family housing facilities.
- The Large Commercial and Industrial Retrofit Program, which provides technical and financial assistance to medium and large C&I customers (those with peak demands >100 kW) seeking to do discretionary replacements of existing operating equipment and processes in their facilities with high-efficiency alternatives.
- The Small Commercial and Industrial Retrofit Program, which provides technical assistance, financial incentives and direct installation to C&I customers whose peak demands are less than 100 kW to replace existing operating equipment and systems with high-efficiency equipment.
- The Government Agencies Program, which provides technical and financial energy efficiency assistance to all government facilities, including municipal, state and federal facilities.
- The Commercial and Industrial Products and Services Program, which seeks to increase the availability and use more efficient motors, lighting designs, and HVAC systems. This program is used to implement NEEP and other regional market transformation initiatives.

Efficiency Program Budgets

The amount of funding available for efficiency investments will be a key driver of efficiency opportunities in each scenario. The Compact efficiency programs are currently funded through a $2.5/MWh system benefits charge applied to all electricity customers. This charge provides the Compact with revenues of roughly $5 million per year to fund the efficiency programs. In 2003, there is also significant carryover funds form 2002, increasing the budget for 2003 to a total of $6.3 million. Each program is then allocated a portion of the funds, based on the customer sector's contribution to the fund, as well as the role of the program in addressing each sector. Table 2.1 provides a breakdown of the Compact's efficiency program budgets for 2003.

Table 2.1 Breakdown of Compact Efficiency Program Budgets for 2003

	Program Costs ($1000)	Program Costs (% of total)
Residential Programs:		
LI Single Family	358	6%
LI Multi-Family	214	3%
LI New Construction	133	2%
Total LI	705	11%
New Construction Demo	74	1%
New Construction	415	7%
Products & Services	832	13%
HomEnergy	1,383	22%
Total Non-LI	2,705	43%
Total Residential	3,409	54%
C&I Programs:		
New Construction	262	4%
Med & Large Retrofit	262	4%
Small Customers	1,609	26%
Government Agencies	762	12%
Total C&I	2,894	46%
Total Compact	6,304	100%

These budgets include carryover from 2002, which will not remain after 2003. Thus, the budgets, and associated savings, will be lower after 2003.

Efficiency Savings Forecasts

Table 2.2 presents a summary of the estimated efficiency savings available from the Compact's current energy efficiency programs. It shows that each year, the combined programs are expected to save roughly 13.4 GWh of energy, which is roughly 0.7% of the current electricity load for the Cape and Vineyard. The lifetime energy savings represents the amount of efficiency savings that can be expected over many years, during the full operating lives of the efficiency measures.

This table shows that roughly half of the efficiency savings are obtained from the residential sector, and roughly half come from C&I customers. It also shows that some programs offer much greater efficiency savings than others. The Residential HomEnergy and the Small C&I Programs offer significant savings, while the Low-Income Programs offer relatively small efficiency savings.[2]

[2] The Low-Income programs are important for equity and societal reasons. Throughout all the efficiency scenarios, we increase the Low-Income Programs proportionately with the other programs, in order to maintain equity and societal goals.

Table 2.2 Program Savings from Compact Efficiency Activities in 2003

	Annual Electricity Savings (MWh)	Lifetime Electricity Savings (MWh)	(% of total)
Residential Programs:			
LI Single Family	249	4,054	2%
LI Multi-Family	219	3,924	2%
LI New Construction	10	198	0%
Total LI	478	8,177	4%
New Construction Demo	13	348	0%
New Construction	69	1,372	1%
Products & Services	1,929	24,041	12%
HomEnergy	3,891	61,603	31%
Total Non-LI	5,902	87,364	44%
Total Residential	6,381	95,541	48%
C&I Programs:			
New Construction	730	11,242	6%
Med & Large Retrofit	886	12,144	6%
Small Customers	3,690	53,505	27%
Government Agencies	1,769	25,630	13%
Total C&I	7,075	102,521	52%
Total Compact	13,456	198,061	100%

In developing efficiency forecasts for each scenario, we assume that the energy efficiency savings from the Compact's EEP scale up linearly with budgets. In practice, the administration costs (which are included in all program budgets presented above) would not increase as much as the program costs would, because some administration costs are essentially fixed. On the other hand, there may be more marketing and promotional costs required in order to achieve the higher penetration rates of the more aggressive efficiency forecasts. These two effects will offset each other, suggesting that our assumption of scaling savings with budgets is reasonable.

Efficiency Program Costs and Benefits

Table 2.3 presents a summary of the costs and benefits of the Compact's energy efficiency programs, including the impacts of all efficiency measures installed over the five-year period of the Plan. On average, the Compact's programs are highly cost-effective, with a benefit-cost ratio of 2.0. This means that every dollar spent on energy efficiency will result in two dollars of reduced electricity generation, transmission and distribution costs. A total of $28.5 million is expected to be spent over the five-year period (by both the Compact and the participating customers), which will reduce electricity costs by $57.7 million, resulting in a net benefit of $29.1 million.

Table 2.3 Compact Efficiency Costs and Benefits: Impacts of Five-Year Plan

	Benefits (mil$)	Costs (mil$)	Net Benefits (mil$)	BCR
Residential Programs:				
LI Single Family	$1.0	$0.8	$0.1	1.18
LI Multi-Family	$0.9	$0.5	$0.4	1.68
LI New Construction	$0.4	$0.4	$0.1	1.17
Total LI	$2.3	$1.7	$0.6	1.33
New Construction Demo	$0.2	$0.3	$(0.2)	0.55
New Construction	$1.1	$0.8	$0.3	1.43
Products & Services	$7.8	$3.5	$4.3	2.23
HomEnergy	$14.5	$7.7	$6.8	1.87
Total Non-LI	$23.6	$12.3	$11.2	1.91
Total Residential	$25.9	$14.1	$11.8	1.84
C&I Programs:				
New Construction	$4.3	$1.3	$3.1	3.35
Med & Large Retrofit	$4.1	$1.8	$2.3	2.25
Small Customers	$15.4	$7.7	$7.7	1.99
Government Agencies	$7.9	$3.6	$4.3	2.20
Total C&I	$31.8	$14.5	$17.3	2.20
Total Compact	$57.7	$28.5	$29.1	2.02

All benefits and costs are in 2003 present value dollars.

In developing efficiency forecasts for each scenario, we assume that the benefits and costs will be increased proportionately with the increased budgets. This assumption is consistent with the assumption that energy savings will increase in direct proportion to program budgets. This assumption will understate the cost-effectiveness of the efficiency measures, to the extent that the avoided costs of electricity generation, transmission and distribution increase significantly over time.

2.3 Environmental Benefits

Energy efficiency programs provide a variety of environmental benefits as a result of avoiding electricity generation and avoiding the construction of new generation, transmission and distribution facilities. The benefits include reduced air emissions, reduced use of land and water, reduced thermal pollution from power plant cooling systems, and reduced liquid and solid wastes from fossil-fired power plants. Some efficiency measures will also result in environmental benefits by reducing the amount of water, oil or gas that is used in homes and businesses.

We focus this environmental analysis on reduced air emissions, because air emissions from power plants tend to result in the greatest environmental and human health impacts. We investigate CO_2, NO_X, and SO_2 emissions, which lead to global warming, acid rain, ozone and particulates. We begin with estimates of the emissions expected under the Business-As-Usual forecast, and then estimate the emission reductions associated with each of our efficiency scenarios.

The Cape and Vineyard are part of a region-wide electricity grid in New England, and thus the electricity consumed there is provided by power plants from all over New England. We use a recent study prepared for the Ozone Transport Commission (OTC) to obtain both average and marginal emission rates from New England power plants.[3] This OTC study was developed for the purpose of estimating the environmental benefits of energy efficiency programs, demand reduction programs, distributed generation, and renewable resources, and thus is directly relevant to our analysis. Table 2.4 presents the average and marginal emission rates from New England power plants for 2002 through 2015, from the OTC study.

For the estimates of air emissions in the Business-As-Usual case, we multiply the average emission rates by the total electricity sales to the Cape and Vineyard. This provides an estimate of the contribution that the Cape and Vineyard make to the total air emissions from the New England electricity industry.

For the estimates of air emissions from the efficiency scenarios, we multiply the marginal emission rates by the amount of electricity generation avoided by the efficiency activities. The marginal emission rates are the emission rates from those New England power plants that are the last to operate in any given hour. Thus, these rates provide the incremental difference in emissions associated with just the efficiency effects.

Table 2.4 Emission Rates from New England Power Plants (lb/MWh)

Year	Annual Average Emission Rates			Annual Marginal Emission Rates		
	NOx:	SO2:	CO2:	NOx:	SO2:	CO2:
2002	1.1	3.3	1000	1.1	2.4	1140
2003	1.1	3.3	1000	1.0	2.4	1099
2004	1.0	2.9	960	0.7	2.0	1030
2005	0.9	2.7	930	0.7	1.8	1013
2006	0.9	2.7	940	0.8	1.1	1018
2007	0.9	2.7	940	0.7	0.9	998
2008	0.9	2.7	950	0.6	0.7	973
2009	0.9	2.7	950	0.7	0.7	969
2010	0.9	2.7	950	0.7	0.5	968
2011	0.9	2.7	950	0.7	0.5	1040
2012	0.9	2.7	950	0.7	0.5	1040
2013	0.9	2.7	950	0.7	0.5	1040
2014	0.9	2.7	950	0.7	0.5	1040
2015	0.9	2.7	950	0.7	0.5	1040

[3] Ozone Transport Commission, *The OTC Emissions Reduction Workbook 2.1: Description and User's Manual*, prepared by Synapse Energy Economics, December 2002.

3. Summary of Findings

Table 3.1 presents a summary of our findings. It includes the key results for each of the four future efficiency scenarios. Results are presented for Cape Cod and Martha's Vineyard combined, for the year 2015. Additional results and details are provided in Sections 4, 5 and 6 below. The system benefits charge was an input to each scenario, while the other data are the outputs.

Table 3.1 Summary of Efficiency Impacts for the Cape & Vineyard Combined: 2015

	Continuation of Existing Programs	Reduce Load Growth in Half	Stabilize CO_2 Emissions	Eliminate New Load Growth
System Benefits Charge ($/MWh)	2.5	5.0	8.9	10.8
Annual Program Cost (mil. nominal $)	$5.9	$11.0	$17.9	$20.7
Cumulative Net Benefits (mil. 2003 PV$)	$77	$149	$252	$297
Annual Energy Savings (GWh)	147.5	284.4	479.7	567.8
Annual Energy Savings (% of load)	6.3%	12.9%	23.8%	29.5%
Capacity Savings (MW)	20.9	38.9	64.3	75.7
Capacity Savings (% of peak)	3.5%	6.5%	10.7%	12.6%
CO_2 Emissions:	---	---	---	---
Reductions (1000 tons/year)	77	148	249	295
Reductions (% relative to BAU)	6.5%	12.5%	21%	25%
Growth (% change relative to 2002)	17%	10%	0%	-6%

As indicated in the table, the continuation of existing Compact efficiency programs will save enough energy to reduce load in 2015 by 6.3%. The annual CO_2 emissions will be reduced by a comparable amount, but will still be roughly 17 % higher than current levels.

A doubling of the system benefits charge to $5/MWh will result in enough efficiency savings to reduce future electricity load growth in half. This level of efficiency savings will reduce load in 2015 by roughly 13%, and reduce annual CO_2 emissions by a comparable amount.

Increasing the system benefits charge to $8.9/MWh will result in enough efficiency savings to stabilize CO_2 emissions over time. This level of efficiency savings will reduce load in 2015 by roughly 24%, and reduce annual CO_2 emissions by a comparable amount.

Finally, we find that a system benefits charge of $10.8/MWh will result in enough efficiency savings to eliminate all new load growth in the future. This level of efficiency activities would represent nearly a four-fold increase in the Compact's current energy efficiency activities.

In order to check whether these levels of energy efficiency savings are achievable, we have estimated the penetration rates of the efficiency programs, for each of the four future scenarios. For many programs, the penetration rates remained within levels that

can be considered technically achievable, i.e., 40% to 60% penetration. In those programs where the penetration rates reached unrealistically high levels, the program funds were switched to another program within the same customer sector (low-income, residential, or commercial/industrial).

It is important to note that the Compact's current efficiency programs were not simply designed to achieve the maximum amount of efficiency savings from the available funding. They were also designed to achieve other important goals, such as maintaining customer equity, minimizing lost opportunities, and addressing a broad range of potential efficiency opportunities. Consequently, the savings results presented in this study do not necessarily represent the maximum amount of efficiency savings available from each scenario. Additional efficiency savings and emission reductions could be achieved by shifting some of the funding away from the high-cost programs (e.g., low-income programs and new construction programs) and into the low-cost programs (e.g., HomEnergy and Small C&I Retrofit).

It is also useful to note that as efficiency programs begin to reduce electricity load over time, there will be less revenues available from a particular system benefits charge. In our high efficiency scenarios, the reduced sales has a significant effect on the revenues raised from a particular system benefits charge. Therefore, a system benefits charge must be higher than it would otherwise, in order to offset its own long-term effects. In other words, a doubling of the system benefits charge does not result in twice as much efficiency revenues or twice as much efficiency activities.

4. Efficiency Forecasts for Cape Cod and Martha's Vineyard

Scenario 1: Continuation of Current Efficiency Programs

Table 4.1 summarizes the results of the Continuation Scenario for Cape Cod and Martha's Vineyard combined. It shows that by 2015 the annual energy savings from the efficiency programs will be roughly 148 GWh, which is 6.3% of the total forecasted energy load in that year. By the end of the study period the annual capacity savings will be roughly 21 MW, which is 3.5% of the forecasted peak demand for that year.

The programs are expected to cost a cumulative total of roughly $81 million dollars, but result in cumulative total benefits of $158 million, resulting in cumulative net benefits of $77 million (all in present value 2003 dollars).

This level of efficiency is expected to reduce NO_X, SO_2, and CO_2 emissions by 5%, 1% and 6%, respectively, by 2015. The CO_2 emissions are reduced by the highest percentage because the marginal CO_2 rates tend to be equal to or greater than the average CO_2 emission rates, while this is not always the case for SO_2 and NO_X.

The table below provides a summary of the penetration rates of the relevant Compact programs by the end of the study period, 2015. It also presents the year in which certain programs' budgets were scaled back in order to account for the fact that the customer sector is nearly saturated. As indicated, none of these customer sectors is likely to be saturated with efficiency measures by the end of the study period in this scenario.

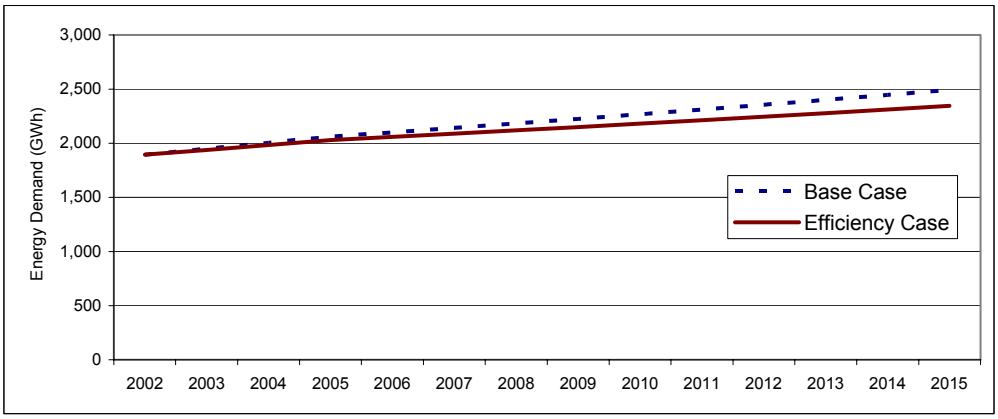
Program	Penetration Rate in 2015	Year in Which Program Budget is Scaled Back
Low-Income Single Family	12%	not scaled back
Low-Income Multi-Family	61%	not scaled back
Low-Income New Construction	30%	not scaled back
Residential New Construction	13%	not scaled back
Residential HomEnergy	8%	not scaled back
Large Commercial and Industrial	12%	not scaled back
Small Commercial and Industrial	10%	not scaled back
Government Agencies	59%	not scaled back

Note: given the uncertainties in the efficiency and eligible customer forecasts, these penetration rates should only be considered as roughly indicative of the extent to which a customer sector has been served.

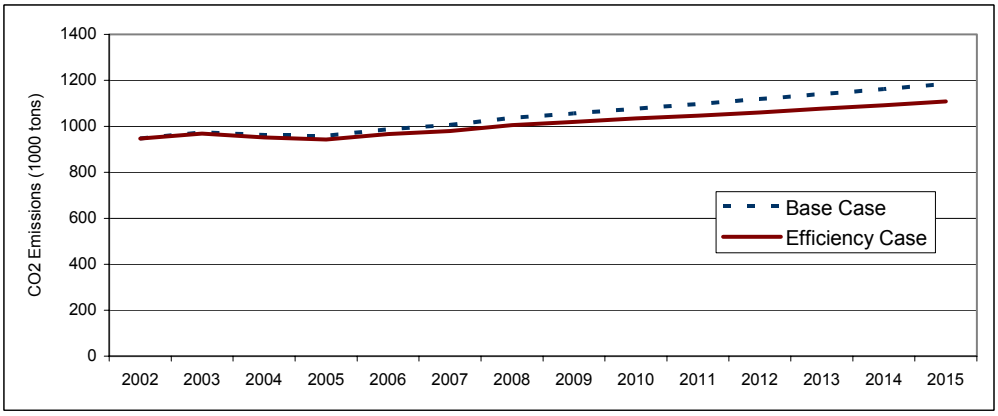
Table 4.1 Results for the Cape & Vineyard: Continuation Scenario

	2005	2010	2015
Business as Usual Case			
Energy Demand (MWh)	2,062,237	2,267,718	2,494,119
Annual Average Load Growth (from 2002)	2.9%	1.9%	1.9%
Efficiency Case			
Energy Demand (MWh)	2,030,803	2,180,340	2,346,601
Energy Savings (MWh)	31,434	87,378	147,518
Energy Savings (% of load)	1.5%	4.0%	6.3%
Energy Savings (% of BAU load)	1.5%	3.9%	5.9%
Average Annual Load Growth (from 2002)	2.3%	1.4%	1.5%
Cumulative Capacity Savings			
Capacity Savings (kW)	4,580	12,468	20,947
Capacity Savings (% of peak)	0.9%	2.3%	3.5%
Costs and Benefits			
Annual Program Costs (nominal $)	5,076,802	5,449,732	5,863,737
Cumulative Total Costs (2003 PV$)	17,185,212	47,770,263	80,648,928
Cumulative Benefits (2003 PV$)	33,625,429	93,469,638	157,801,646
Cumulative Net Benefits (2003 PV$)	16,440,216	45,699,375	77,152,718
Benefit-Cost Ratio	2.0	2.0	2.0
Emissions reductions			
NOx (tons/year)	12	31	52
NOx (% reduction relative to base case)	1.3%	3.0%	4.6%
SO2 (tons/year)	28	23	37
SO2 (% reduction relative to base case)	1.0%	0.7%	1.1%
CO2 (tons/year)	15,917	42,302	76,709
CO2 (% reduction relative to base case)	1.7%	3.9%	6.5%
CO2 (% change relative to 2002 emissions)	-0.4%	9.3%	17.0%

Impact of Efficiency Programs on Energy Demand:



Impact of Efficiency Programs on CO2 Emissions:



Scenario 2: Reduce New Electricity Load Growth in Half

This Scenario was developed by increasing the efficiency activities enough to reduce future electricity load growth rates by half. We find that a doubling of the system benefits charge to $5/MWh will support enough efficiency savings to achieve this goal. This results in load growth rates of roughly one percent per year, as opposed to the two percent per year growth rates expected for the Business-As-Usual case.

Table 4.2 summarizes the results of the Half Load Growth Scenario for Cape Cod and Martha's Vineyard combined. It shows that by 2015 the annual energy savings from the efficiency programs will be roughly 284 GWh, which is 13% of the total forecasted energy load in that year. By the end of the study period the annual capacity savings will be roughly 39 MW, which is 6.5% of the forecasted peak demand for that year.

This level of efficiency is expected to reduce NO_X, SO_2, and CO_2 emissions by 9%, 2% and 12%, respectively, by 2015.

The table below provides a summary of the penetration rates of the relevant Compact programs by the end of the study period, 2015. It also presents the year in which certain programs' budgets were scaled back in order to account for the fact that the customer sector is nearly saturated. As indicated, the Low-Income Multi-Family Program and the Government Agencies Program become nearly saturated by 2012.

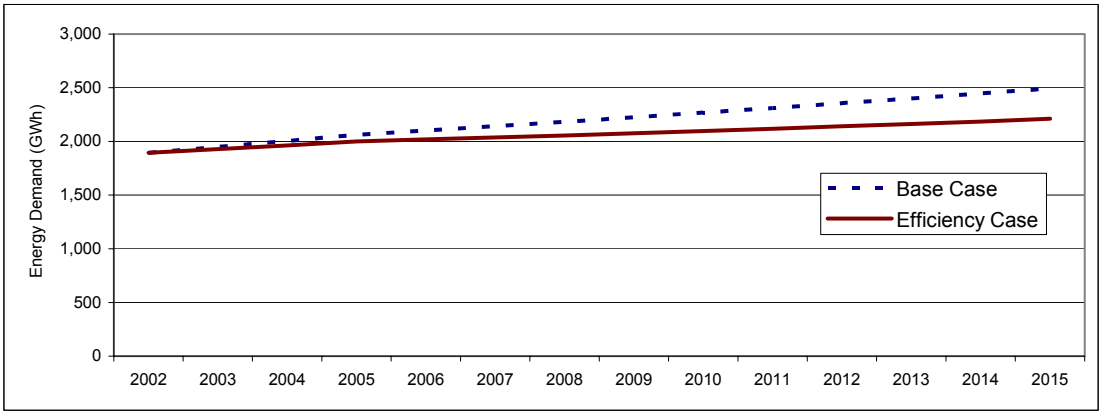
Program	Penetration Rate in 2015	Year in Which Program Budget is Scaled Back
Low-Income Single Family	27%	not scaled back
Low-Income Multi-Family	80%	2012
Low-Income New Construction	56%	not scaled back
Residential New Construction	24%	not scaled back
Residential HomEnergy	15%	not scaled back
Large Commercial and Industrial	22%	not scaled back
Small Commercial and Industrial	22%	not scaled back
Government Agencies	85%	2012

Note: given the uncertainties in the efficiency and eligible customer forecasts, these penetration rates should only be considered as roughly indicative of the extent to which a customer sector has been served.

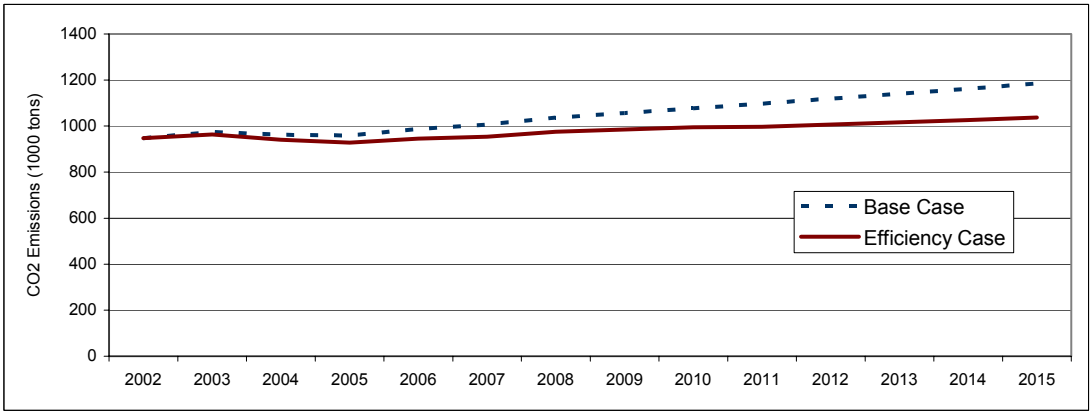
Table 4.2 Results for the Cape & Vineyard: Half Load Growth Scenario

	2005	2010	2015
Business as Usual Case			
Energy Demand (MWh)	2,062,237	2,267,718	2,494,119
Annual Average Load Growth (from 2002)	2.9%	1.9%	1.9%
Efficiency Case			
Energy Demand (MWh)	2,000,018	2,096,914	2,209,722
Energy Savings (MWh)	62,219	170,805	284,397
Energy Savings (% of load)	3.1%	8.1%	12.9%
Energy Savings (% of BAU load)	3.0%	7.5%	11.4%
Average Annual Load Growth (from 2002)	1.8%	1.0%	1.1%
Cumulative Capacity Savings			
Capacity Savings (kW)	7,492	22,802	38,896
Capacity Savings (% of peak)	1.5%	4.2%	6.5%
Costs and Benefits			
Annual Program Costs (nominal $)	9,999,269	10,480,113	11,037,618
Cumulative Total Costs (2003 PV$)	34,015,710	93,380,027	155,783,058
Cumulative Benefits (2003 PV$)	66,556,805	182,711,939	304,812,768
Cumulative Net Benefits (2003 PV$)	32,541,095	89,331,912	149,029,710
Benefit-Cost Ratio	2.0	2.0	2.0
Emissions reductions			
NOx (tons/year)	23	60	100
NOx (% reduction relative to base case)	2.5%	5.9%	8.9%
SO2 (tons/year)	56	45	71
SO2 (% reduction relative to base case)	2.0%	1.5%	2.1%
CO2 (tons/year)	31,506	82,691	147,886
CO2 (% reduction relative to base case)	3.3%	7.7%	12.5%
CO2 (% change relative to 2002 emissions)	-2.1%	5.0%	9.5%

Impact of Efficiency Programs on Energy Demand:



Impact of Efficiency Programs on CO2 Emissions:



Scenario 3: Stabilize CO_2 Emissions

This Scenario was developed by increasing the efficiency activities enough to reduce future CO_2 emissions to a constant level. We find that increasing the system benefits charge to $8.9/MWh will support enough efficiency savings to achieve this goal.

Table 4.3 summarizes the results of the Stabilize CO_2 Emissions Scenario for Cape Cod and Martha's Vineyard combined. It shows that by 2015 the annual energy savings from the efficiency programs will be roughly 480 GWh, which is 24% of the total forecasted energy load in that year. By the end of the study period the annual capacity savings will be roughly 64 MW, which is 11% of the forecasted peak demand for that year.

This level of efficiency is expected to reduce NO_X, SO_2, and CO_2 emissions by 15%, 4% and 21%, respectively, by 2015.

The table below provides a summary of the penetration rates of the relevant Compact programs by the end of the study period, 2015. It also presents the year in which certain programs' budgets were scaled back in order to account for the fact that the customer sector is nearly saturated. As indicated, the Low-Income Multi-Family Program and the Government Agencies Program become nearly saturated by 2008. The Low-Income New Construction Program is large enough to capture most of the new housing units each year, by as early as 2003.

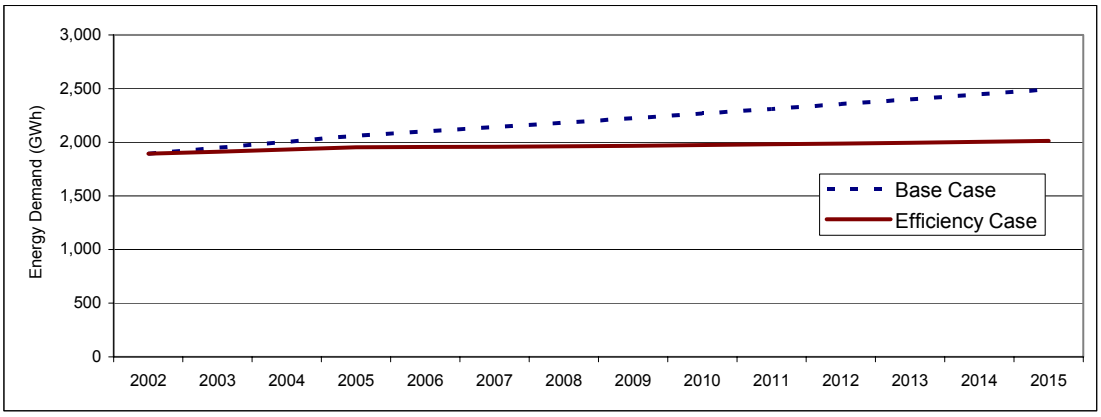
Program	Penetration Rate in 2015	Year in Which Program Budget is Scaled Back
Low-Income Single Family	53%	not scaled back
Low-Income Multi-Family	90%	2008
Low-Income New Construction	80%	2003
Residential New Construction	40%	not scaled back
Residential HomEnergy	25%	not scaled back
Large Commercial and Industrial	36%	not scaled back
Small Commercial and Industrial	42%	not scaled back
Government Agencies	90%	2008

Note: given the uncertainties in the efficiency and eligible customer forecasts, these penetration rates should only be considered as roughly indicative of the extent to which a customer sector has been served.

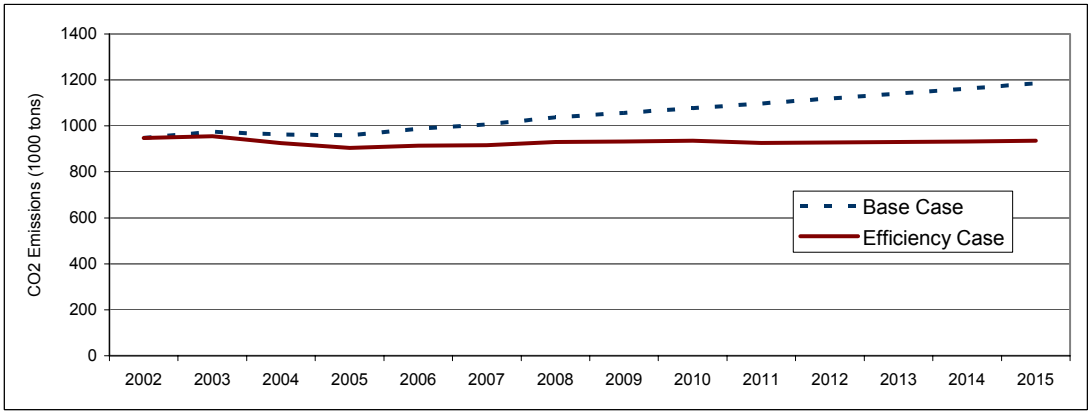
Table 4.3 Results for the Cape & Vineyard: Stabilize CO_2 Emissions

	2005	2010	2015
Business as Usual Case			
Energy Demand (MWh)	2,062,237	2,267,718	2,494,119
Annual Average Load Growth (from 2002)	2.9%	1.9%	1.9%
Efficiency Case			
Energy Demand (MWh)	1,953,161	1,974,498	2,014,396
Energy Savings (MWh)	109,076	293,220	479,723
Energy Savings (% of load)	5.6%	14.9%	23.8%
Energy Savings (% of BAU load)	5.3%	12.9%	19.2%
Average Annual Load Growth (from 2002)	1.0%	0.2%	0.4%
Cumulative Capacity Savings			
Capacity Savings (kW)	11,888	37,908	64,334
Capacity Savings (% of peak)	2.4%	7.0%	10.7%
Costs and Benefits			
Annual Program Costs (nominal $)	17,380,547	17,559,159	17,894,248
Cumulative Total Costs (2003 PV$)	59,582,721	160,473,864	262,942,543
Cumulative Benefits (2003 PV$)	116,582,472	313,991,030	514,486,270
Cumulative Net Benefits (2003 PV$)	56,999,751	153,517,165	251,543,726
Benefit-Cost Ratio	2.0	2.0	2.0
Emissions reductions			
NOx (tons/year)	40	103	168
NOx (% reduction relative to base case)	4.4%	10.1%	15.0%
SO2 (tons/year)	98	77	120
SO2 (% reduction relative to base case)	3.6%	2.5%	3.6%
CO2 (tons/year)	55,233	141,956	249,456
CO2 (% reduction relative to base case)	5.8%	13.2%	21.1%
CO2 (% change relative to 2002 emissions)	-4.6%	-1.3%	-1.3%

Impact of Efficiency Programs on Energy Demand:



Impact of Efficiency Programs on CO2 Emissions:



Scenario 4: Eliminate New Electricity Load Growth

This Scenario was developed by increasing the efficiency activities enough to eliminate all new growth in electricity demand. We find that increasing the system benefits charge to $10.8/MWh will support enough efficiency savings to achieve this goal.

Table 4.4 summarizes the results of the Eliminate New Load Growth Scenario for Cape Cod and Martha's Vineyard combined. It shows that by 2015 the annual energy savings from the efficiency programs will be roughly 568 GWh, which is 29% of the total forecasted energy load in that year. By the end of the study period the annual capacity savings will be roughly 76 MW, which is almost 13% of the forecasted peak demand for that year.

This level of efficiency is expected to reduce NO_X, SO_2, and CO_2 emissions by 18%, 4% and 25%, respectively, by 2015.

The table below provides a summary of the penetration rates of the relevant Compact programs by the end of the study period, 2015. It also presents the year in which certain programs' budgets were scaled back in order to account for the fact that the customer sector is nearly saturated. As indicated, the Low-Income Multi-Family Program and the Government Agencies Program become nearly saturated by 2007. The Low-Income New Construction Program is large enough to capture most of the new housing units each year, by as early as 2003.

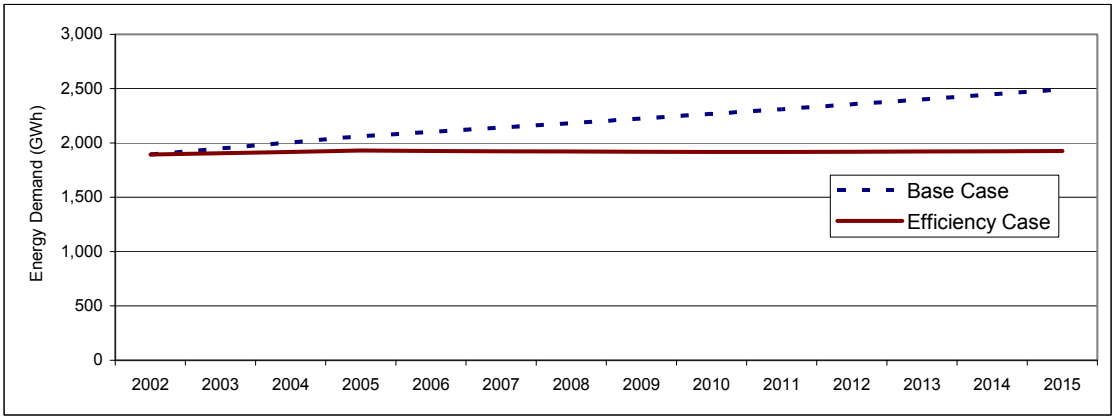
Program	Penetration Rate in 2015	Year in Which Program Budget is Scaled Back
Low-Income Single Family	59%	not scaled back
Low-Income Multi-Family	91%	2007
Low-Income New Construction	70%	2003
Residential New Construction	48%	not scaled back
Residential HomEnergy	30%	not scaled back
Large Commercial and Industrial	41%	not scaled back
Small Commercial and Industrial	52%	not scaled back
Government Agencies	90%	2007

Note: given the uncertainties in the efficiency and eligible customer forecasts, these penetration rates should only be considered as roughly indicative of the extent to which a customer sector has been served.

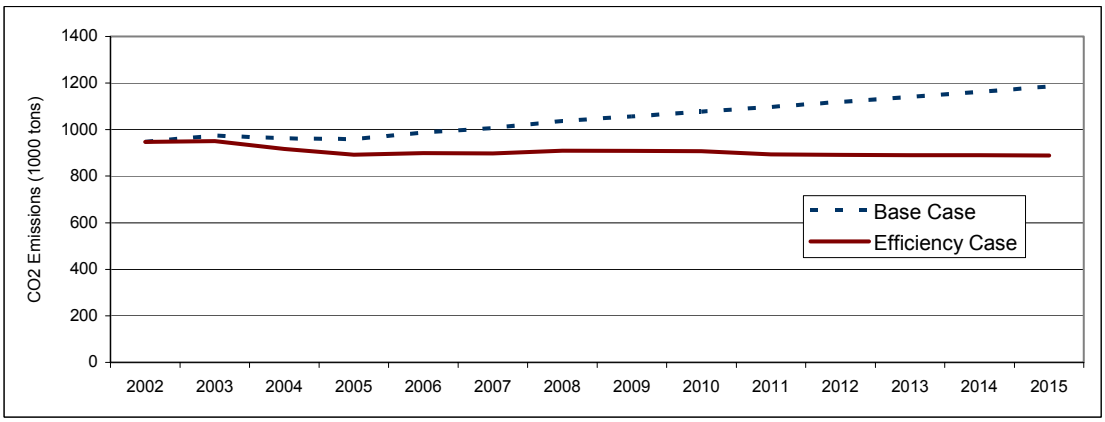
Table 4.4 Results for the Cape & Vineyard: Eliminate New Load Growth

	2005	2010	2015
Business as Usual Case			
Energy Demand (MWh)	2,062,237	2,267,718	2,494,119
Annual Average Load Growth (from 2002)	2.9%	1.9%	1.9%
Efficiency Case			
Energy Demand (MWh)	1,930,776	1,917,774	1,926,319
Energy Savings (MWh)	131,461	349,944	567,801
Energy Savings (% of load)	6.8%	18.2%	29.5%
Energy Savings (% of BAU load)	6.4%	15.4%	22.8%
Average Annual Load Growth (from 2002)	0.6%	-0.1%	0.1%
Cumulative Capacity Savings			
Capacity Savings (kW)	13,966	44,841	75,682
Capacity Savings (% of peak)	2.8%	8.2%	12.6%
Costs and Benefits			
Annual Program Costs (nominal $)	20,848,579	20,691,567	20,754,465
Cumulative Total Costs (2003 PV$)	71,740,816	191,460,642	311,043,701
Cumulative Benefits (2003 PV$)	140,371,597	374,621,278	608,603,352
Cumulative Net Benefits (2003 PV$)	68,630,781	183,160,636	297,559,651
Benefit-Cost Ratio	2.0	2.0	2.0
Emissions reductions			
NOx (tons/year)	49	122	199
NOx (% reduction relative to base case)	5.3%	12.0%	17.7%
SO2 (tons/year)	118	92	142
SO2 (% reduction relative to base case)	4.3%	3.0%	4.2%
CO2 (tons/year)	66,568	169,417	295,256
CO2 (% reduction relative to base case)	6.9%	15.7%	24.9%
CO2 (% change relative to 2002 emissions)	-5.8%	-4.2%	-6.1%

Impact of Efficiency Programs on Energy Demand:



Impact of Efficiency Programs on CO2 Emissions:



5. Efficiency Forecasts for Cape Cod Only

Scenario 1: Continuation of Current Efficiency Programs

Table 5.1 summarizes the results of the Continuation Scenario for only the towns on Cape Cod. It shows that by 2015 the annual energy savings from the efficiency programs will be roughly 136 GWh, which is 6.3% of the total forecasted energy load in that year. By the end of the study period the annual capacity savings will be roughly 19 MW, which is 3.2% of the forecasted peak demand for that year.

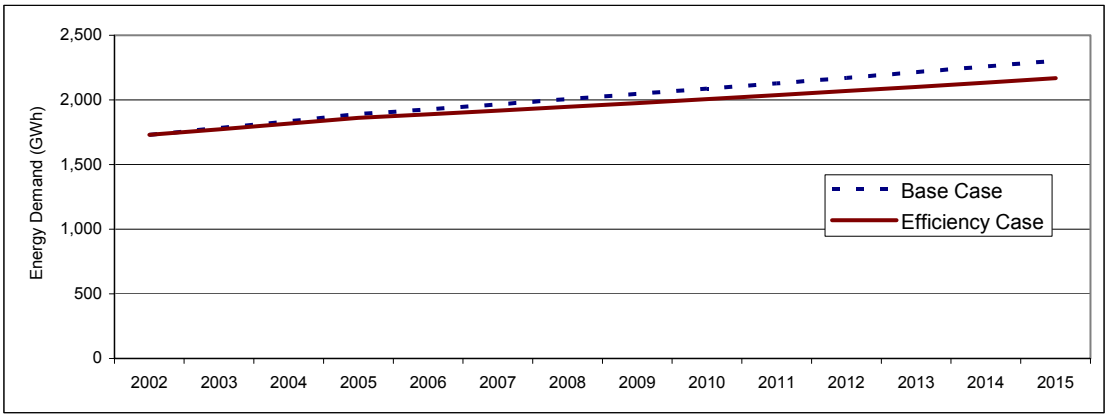
The programs are expected to cost a cumulative total of roughly $74 million dollars, but result in cumulative total benefits of $145 million, resulting in cumulative net benefits of $71 million (all in present value 2003 dollars).

This level of efficiency is expected to reduce NO_X, SO_2, and CO_2 emissions by 5%, 1% and 6%, respectively, by 2015. The CO_2 emissions are reduced by the highest percentage because the marginal CO_2 rates tend to be equal to or greater than the average CO_2 emission rates, while this is not always the case for SO_2 and NO_X.

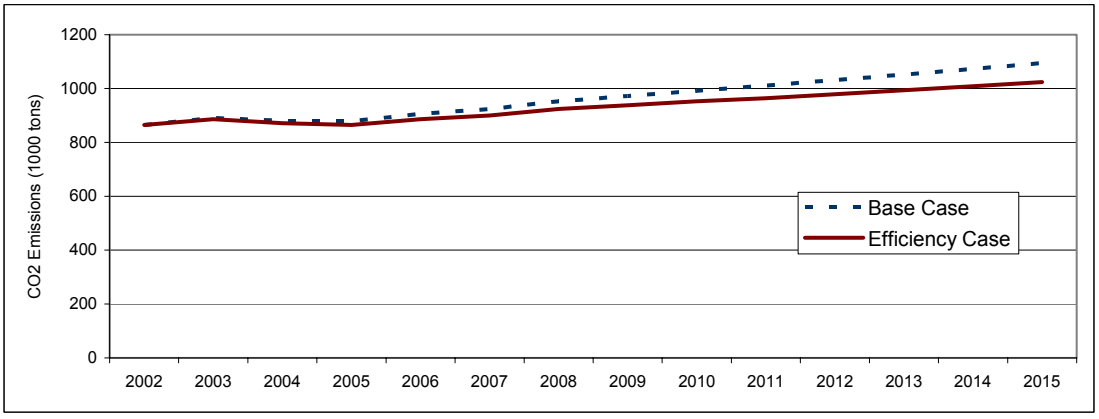
Table 5.1 Results for Cape Cod Only: Continuation Scenario

	2005	2010	2015
Business as Usual Case			
Energy Demand (MWh)	1,889,674	2,086,352	2,303,502
Annual Average Load Growth (from 2002)	3.0%	2.0%	2.0%
Efficiency Case			
Energy Demand (MWh)	1,860,904	2,006,184	2,167,842
Energy Savings (MWh)	28,769	80,169	135,659
Energy Savings (% of load)	1.5%	4.0%	6.3%
Energy Savings (% of BAU load)	1.5%	3.8%	5.9%
Average Annual Load Growth (from 2002)	2.5%	1.5%	1.6%
Cumulative Capacity Savings			
Capacity Savings (kW)	4,328	11,575	19,399
Capacity Savings (% of peak)	0.9%	2.1%	3.2%
Costs and Benefits			
Annual Program Costs (nominal $)	4,652,260	5,015,452	5,419,576
Cumulative Total Costs (2003 PV$)	15,728,457	43,828,729	74,165,875
Cumulative Benefits (2003 PV$)	30,775,069	85,757,439	145,116,587
Cumulative Net Benefits (2003 PV$)	15,046,613	41,928,710	70,950,712
Benefit-Cost Ratio	2.0	2.0	2.0
Emissions reductions			
NOx (tons/year)	11	28	47
NOx (% reduction relative to base case)	1.3%	3.0%	4.6%
SO2 (tons/year)	26	21	34
SO2 (% reduction relative to base case)	1.0%	0.7%	1.1%
CO2 (tons/year)	14,568	38,812	70,543
CO2 (% reduction relative to base case)	1.7%	3.9%	6.4%
CO2 (% change relative to 2002 emissions)	-0.1%	10.1%	18.4%

Impact of Efficiency Programs on Energy Demand:



Impact of Efficiency Programs on CO2 Emissions:



Scenario 2: Reduce New Electricity Load Growth in Half

This Scenario was developed by increasing the efficiency activities enough to reduce future electricity load growth rates by half. We find that a doubling of the system benefits charge, to $5/MWh, will support enough efficiency savings to achieve this goal. This results in load growth rates of roughly one percent per year, as opposed to the two percent pre year growth rates expected for the Business-As-Usual case.

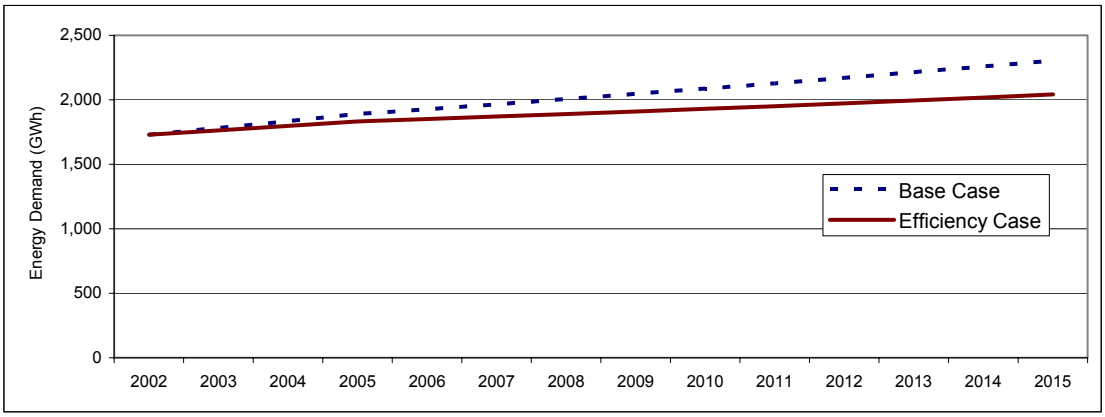
Table 5.2 summarizes the results of the Half Load Growth Scenario for Cape Cod only. It shows that by 2015 the annual energy savings from the efficiency programs will be roughly 262 GWh, which is 13% of the total forecasted energy load in that year. By the end of the study period the annual capacity savings will be roughly 36 MW, which is 6% of the forecasted peak demand for that year.

This level of efficiency is expected to reduce NO_X, SO_2, and CO_2 emissions by 9%, 2% and 11%, respectively, by 2015.

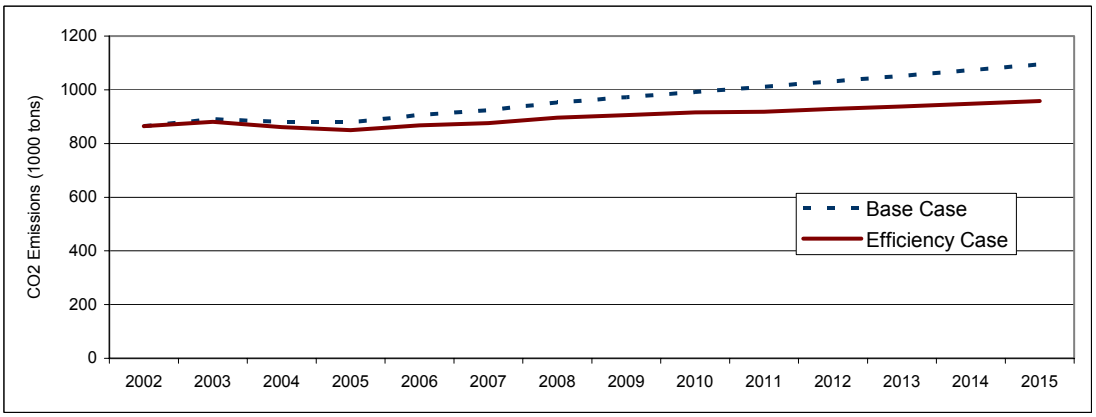
Table 5.2 Results for Cape Cod Only: Half Load Growth Scenario

	2005	2010	2015
Business as Usual Case			
Energy Demand (MWh)	1,889,674	2,086,352	2,303,502
Annual Average Load Growth (from 2002)	3.0%	2.0%	2.0%
Efficiency Case			
Energy Demand (MWh)	1,832,727	1,929,619	2,041,733
Energy Savings (MWh)	56,947	156,734	261,768
Energy Savings (% of load)	3.1%	8.1%	12.8%
Energy Savings (% of BAU load)	3.0%	7.5%	11.4%
Average Annual Load Growth (from 2002)	2.0%	1.0%	1.1%
Cumulative Capacity Savings			
Capacity Savings (kW)	6,996	21,065	35,924
Capacity Savings (% of peak)	1.4%	3.9%	6.0%
Costs and Benefits			
Annual Program Costs (nominal $)	9,163,687	9,648,744	10,209,446
Cumulative Total Costs (2003 PV$)	31,133,201	85,687,278	143,300,740
Cumulative Benefits (2003 PV$)	60,916,748	167,659,929	280,389,252
Cumulative Net Benefits (2003 PV$)	29,783,546	81,972,651	137,088,512
Benefit-Cost Ratio	2.0	2.0	2.0
Emissions reductions			
NOx (tons/year)	21	55	92
NOx (% reduction relative to base case)	2.5%	5.8%	8.8%
SO2 (tons/year)	51	41	65
SO2 (% reduction relative to base case)	2.0%	1.5%	2.1%
CO2 (tons/year)	28,836	75,879	136,119
CO2 (% reduction relative to base case)	3.3%	7.7%	12.4%
CO2 (% change relative to 2002 emissions)	-1.7%	5.8%	10.8%

Impact of Efficiency Programs on Energy Demand:



Impact of Efficiency Programs on CO2 Emissions:



Scenario 3: Stabilize CO_2 Emissions

This Scenario was developed by increasing the efficiency activities enough to reduce future CO_2 emissions to a constant level. We find that increasing the system benefits charge to $8.9/MWh will support enough efficiency savings to achieve this goal.

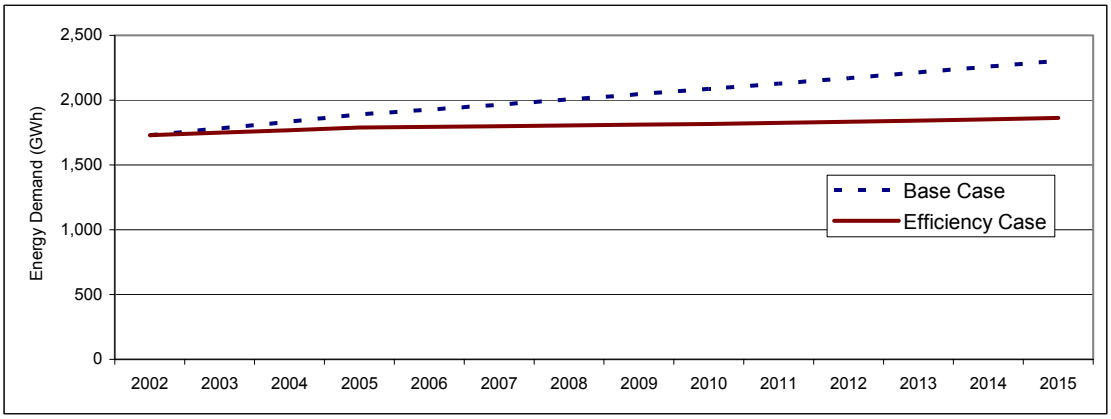
Table 5.3 summarizes the results of the Stabilize CO_2 Emissions Scenario for Cape Cod only. It shows that by 2015 the annual energy savings from the efficiency programs will be roughly 441 GWh, which is nearly 24% of the total forecasted energy load in that year. By the end of the study period the annual capacity savings will be roughly 59 MW, which is nearly10% of the forecasted peak demand for that year.

This level of efficiency is expected to reduce NO_X, SO_2, and CO_2 emissions by 15%, 3.5% and 21%, respectively, by 2015.

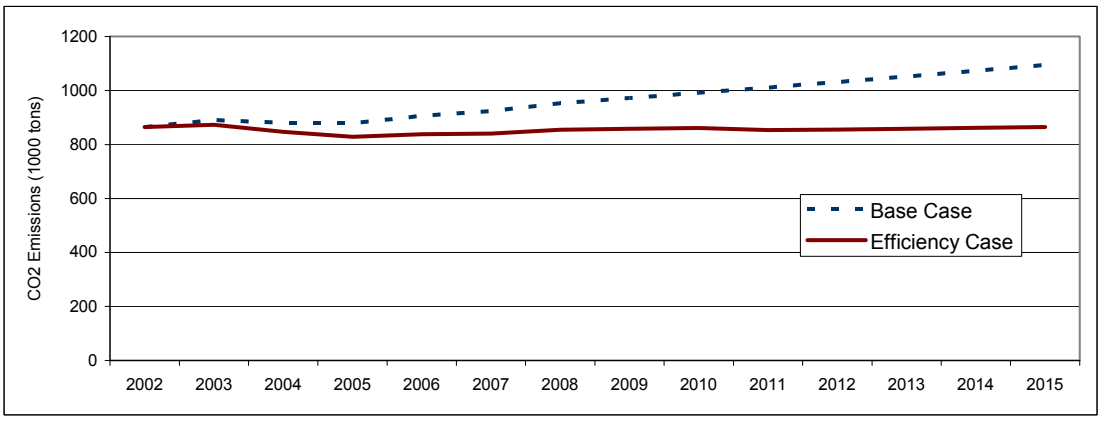
Table 5.3 Results for Cape Cod Only: Stabilize CO_2 Emissions Scenario

	2005	2010	2015
Business as Usual Case			
Energy Demand (MWh)	1,889,674	2,086,352	2,303,502
Annual Average Load Growth (from 2002)	3.0%	2.0%	2.0%
Efficiency Case			
Energy Demand (MWh)	1,789,917	1,817,408	1,862,364
Energy Savings (MWh)	99,756	268,944	441,138
Energy Savings (% of load)	5.6%	14.8%	23.7%
Energy Savings (% of BAU load)	5.3%	12.9%	19.2%
Average Annual Load Growth (from 2002)	1.2%	0.3%	0.5%
Cumulative Capacity Savings			
Capacity Savings (kW)	11,022	34,942	59,366
Capacity Savings (% of peak)	2.2%	6.4%	9.9%
Costs and Benefits			
Annual Program Costs (nominal $)	15,930,262	16,175,050	16,575,668
Cumulative Total Costs (2003 PV$)	54,537,451	147,285,879	241,990,137
Cumulative Benefits (2003 PV$)	106,710,650	288,186,770	473,489,764
Cumulative Net Benefits (2003 PV$)	52,173,199	140,900,892	231,499,627
Benefit-Cost Ratio	2.0	2.0	2.0
Emissions reductions			
NOx (tons/year)	37	94	154
NOx (% reduction relative to base case)	4.4%	10.0%	14.9%
SO2 (tons/year)	90	70	110
SO2 (% reduction relative to base case)	3.6%	2.5%	3.5%
CO2 (tons/year)	50,514	130,203	229,392
CO2 (% reduction relative to base case)	5.7%	13.1%	21.0%
CO2 (% change relative to 2002 emissions)	-4.2%	-0.4%	0.0%

Impact of Efficiency Programs on Energy Demand:



Impact of Efficiency Programs on CO2 Emissions:



Scenario 4: Eliminate New Electricity Load Growth

This Scenario was developed by increasing the efficiency activities enough to eliminate all new growth in electricity demand. We find that increasing the system benefits charge to $10.9/MWh will support enough efficiency savings to achieve this goal.

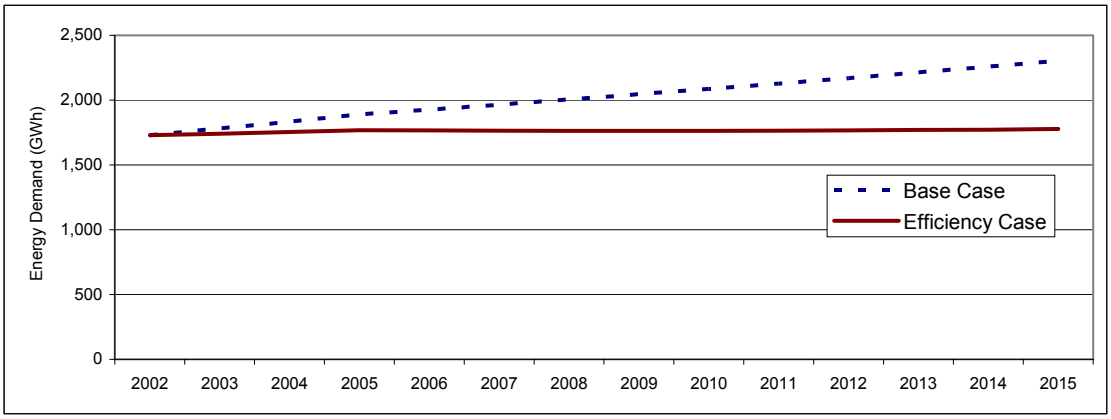
Table 5.4 summarizes the results of the Eliminate New Load Growth Scenario for Cape Cod only. It shows that by 2015 the annual energy savings from the efficiency programs will be roughly 526 GWh, which is nearly 30% of the total forecasted energy load in that year. By the end of the study period the annual capacity savings will be roughly 70 MW, which is 12% of the forecasted peak demand for that year.

This level of efficiency is expected to reduce NO_X, SO_2, and CO_2 emissions by 18%, 4% and 25%, respectively, by 2015.

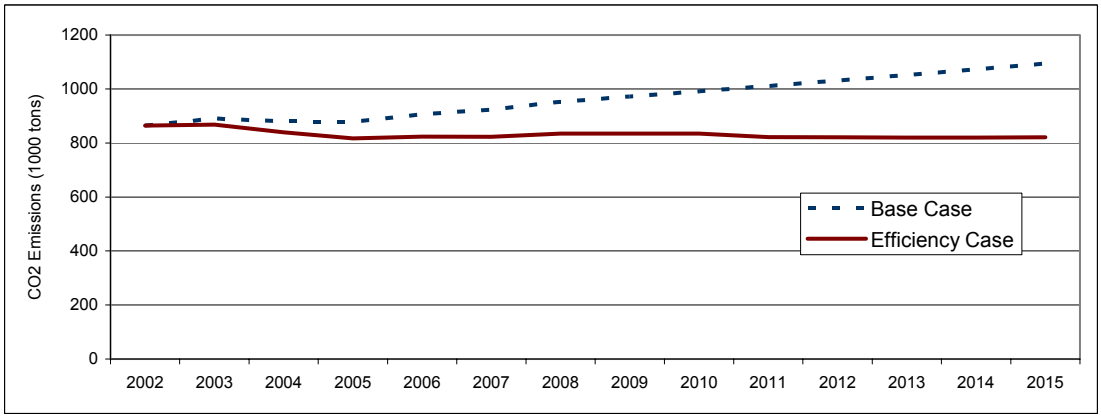
Table 5.4 Results for Cape Cod Only: Eliminate New Load Growth

	2005	2010	2015
Business as Usual Case			
Energy Demand (MWh)	1,889,674	2,086,352	2,303,502
Annual Average Load Growth (from 2002)	3.0%	2.0%	2.0%
Efficiency Case			
Energy Demand (MWh)	1,768,490	1,763,004	1,777,563
Energy Savings (MWh)	121,183	323,349	525,939
Energy Savings (% of load)	6.9%	18.3%	29.6%
Energy Savings (% of BAU load)	6.4%	15.5%	22.8%
Average Annual Load Growth (from 2002)	0.7%	-0.1%	0.2%
Cumulative Capacity Savings			
Capacity Savings (kW)	13,026	41,648	70,377
Capacity Savings (% of peak)	2.6%	7.6%	11.7%
Costs and Benefits			
Annual Program Costs (nominal $)	19,276,529	19,216,650	19,374,207
Cumulative Total Costs (2003 PV$)	66,251,753	177,232,542	288,628,795
Cumulative Benefits (2003 PV$)	129,631,427	346,781,879	564,745,249
Cumulative Net Benefits (2003 PV$)	63,379,674	169,549,337	276,116,454
Benefit-Cost Ratio	2.0	2.0	2.0
Emissions reductions			
NOx (tons/year)	45	113	184
NOx (% reduction relative to base case)	5.4%	12.1%	17.8%
SO2 (tons/year)	109	85	131
SO2 (% reduction relative to base case)	4.3%	3.0%	4.2%
CO2 (tons/year)	61,364	156,541	273,488
CO2 (% reduction relative to base case)	7.0%	15.8%	25.0%
CO2 (% change relative to 2002 emissions)	-5.5%	-3.5%	-5.1%

Impact of Efficiency Programs on Energy Demand:



Impact of Efficiency Programs on CO2 Emissions:



6. Efficiency Forecasts for Martha's Vineyard Only

Scenario 1: Continuation of Current Efficiency Programs

Table 6.1 summarizes the results of the Continuation Scenario for only the towns in Martha's Vineyard. It shows that by 2015 the annual energy savings from the efficiency programs will be roughly 12 GWh, which is 6.6% of the total forecasted energy load in that year. By the end of the study period the annual capacity savings will be roughly 3 MW, which is 6.5% of the forecasted peak demand for that year.

In the Business-As-Usual case, the energy and peak demand for Martha's Vineyard are expected to grow at roughly half of the growth rate on Cape Cod. With relatively lower growth rates for energy and peak demand, the energy and capacity savings will represent a larger portion of the total future energy and peak demands. This explains why the percentage energy and capacity savings for Martha's Vineyard are greater than for Cape Cod.

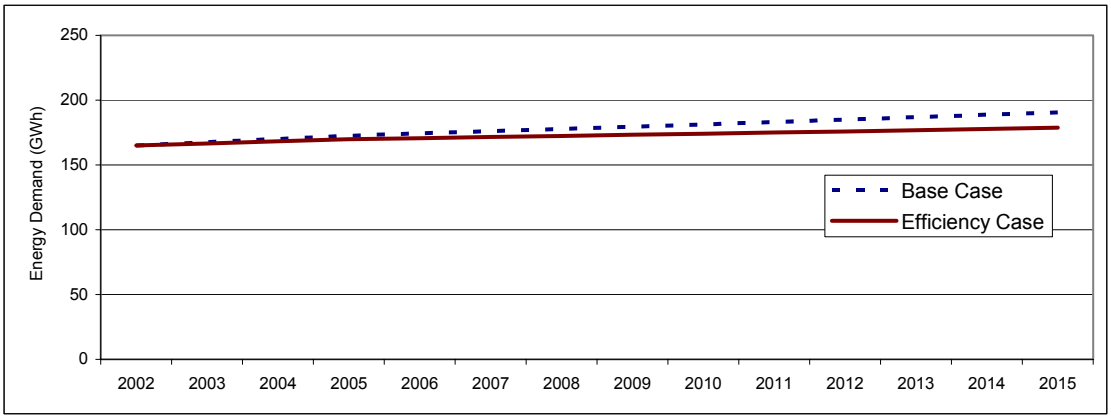
The programs are expected to cost a cumulative total of roughly $6.5 million dollars, but result in cumulative total benefits of $12.7 million, resulting in cumulative net benefits of $6.2 million (all in present value 2003 dollars).

This level of efficiency is expected to reduce NO_X, SO_2, and CO_2 emissions by 5%, 1% and 7%, respectively, by 2015. The CO_2 emissions are reduced by the highest percentage because the marginal CO_2 rates tend to be equal to or greater than the average CO_2 emission rates, while this is not always the case for SO_2 and NO_X.

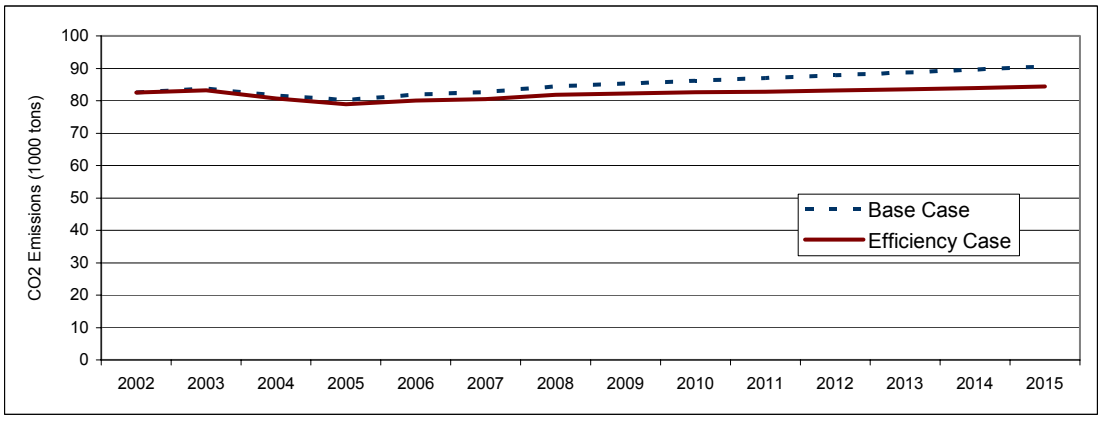
Table 6.1 Results for Martha's Vineyard Only: Continuation Scenario

	2005	2010	2015
Business as Usual Case			
Energy Demand (MWh)	172,563	181,366	190,617
Annual Average Load Growth (from 2002)	1.5%	1.0%	1.0%
Efficiency Case			
Energy Demand (MWh)	169,898	174,149	178,738
Energy Savings (MWh)	2,665	7,217	11,879
Energy Savings (% of load)	1.6%	4.1%	6.6%
Energy Savings (% of BAU load)	1.5%	4.0%	6.2%
Average Annual Load Growth (from 2002)	1.0%	0.5%	0.5%
Cumulative Capacity Savings			
Capacity Savings (kW)	1,843	2,484	3,143
Capacity Savings (% of peak)	4.2%	5.4%	6.5%
Costs and Benefits			
Annual Program Costs (nominal $)	424,739	435,297	446,539
Cumulative Total Costs (2003 PV$)	1,457,134	3,945,641	6,497,499
Cumulative Benefits (2003 PV$)	2,851,101	7,720,235	12,713,325
Cumulative Net Benefits (2003 PV$)	1,393,966	3,774,594	6,215,826
Benefit-Cost Ratio	2.0	2.0	2.0
Emissions reductions			
NOx (tons/year)	1	3	4
NOx (% reduction relative to base case)	1.3%	3.1%	4.8%
SO2 (tons/year)	2	2	3
SO2 (% reduction relative to base case)	1.0%	0.8%	1.2%
CO2 (tons/year)	1,350	3,494	6,177
CO2 (% reduction relative to base case)	1.7%	4.1%	6.8%
CO2 (% change relative to 2002 emissions)	-4.4%	0.2%	2.2%

Impact of Efficiency Programs on Energy Demand:



Impact of Efficiency Programs on CO2 Emissions:



Scenario 2: Reduce New Electricity Load Growth in Half

This Scenario was developed by identifying enough efficiency activities to reduce future electricity load growth rates by half. We find that a simple continuation of the Compact's efficiency programs at current levels will achieve this goal. As indicated in Table 6.1 above, the Continuation Scenario will result in load growth rates of roughly 0.5 percent per year, as opposed to the one percent per year growth rates expected for the Business-As-Usual case.

Thus, for Martha's Vineyard only the Continuation Scenario is the same as the Half Load Growth Scenario, and the results presented in Table 6.1 above apply to both scenarios.

The efficiency and emission goals of the Martha's Vineyard only analyses are easier to obtain than for the Cape Cod and combined analyses, because the energy and peak demands on Martha's Vineyard are expected to grow at half the rate of those on the Cape. Accordingly, less efficiency activities are required to achieve the same sorts of load growth and emission goals.

Scenario 3: Stabilize CO_2 Emissions

This Scenario was developed by increasing the efficiency activities enough to reduce future CO_2 emissions to a constant level. We find that increasing the system benefits charge to $5/MWh will support enough efficiency savings to achieve this goal.

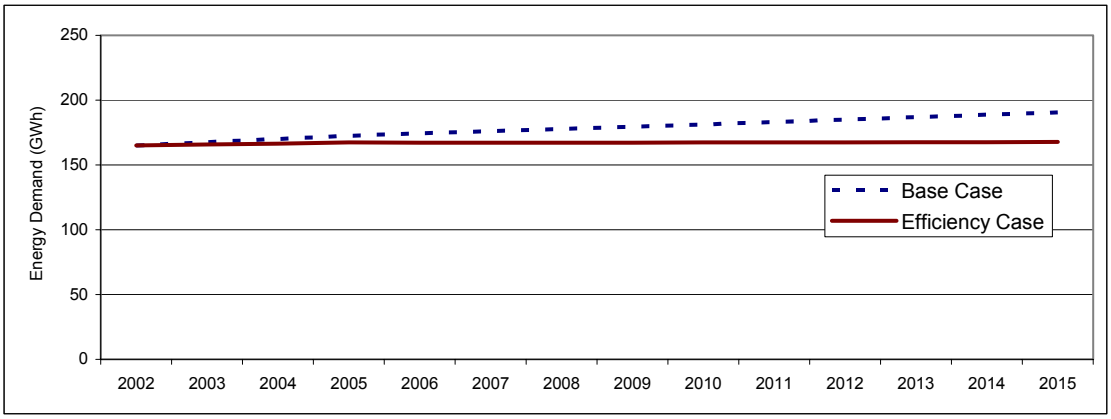
Table 6.2 summarizes the results of the Stabilize CO_2 Emissions Scenario for Martha's Vineyard only. It shows that by 2015 the annual energy savings from the efficiency programs will be roughly 23 GWh, which is nearly 14% of the total forecasted energy load in that year. By the end of the study period the annual capacity savings will be roughly 4.6 MW, which is roughly 9% of the forecasted peak demand for that year.

This level of efficiency is expected to reduce NO_X, SO_2, and CO_2 emissions by 9%, 2% and 13%, respectively, by 2015.

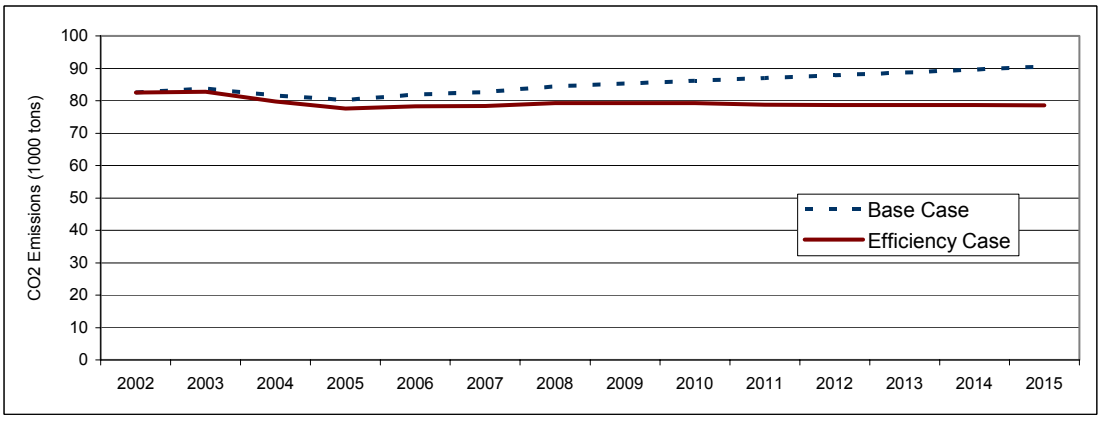
Table 6.2 Results for Martha's Vineyard Only: Stabilize CO_2 Emissions Scenario

	2005	2010	2015
Business as Usual Case			
Energy Demand (MWh)	172,563	181,366	190,617
Annual Average Load Growth (from 2002)	1.5%	1.0%	1.0%
Efficiency Case			
Energy Demand (MWh)	167,288	167,281	167,725
Energy Savings (MWh)	5,275	14,085	22,892
Energy Savings (% of load)	3.2%	8.4%	13.6%
Energy Savings (% of BAU load)	3.1%	7.8%	12.0%
Average Annual Load Growth (from 2002)	0.5%	0.0%	0.1%
Cumulative Capacity Savings			
Capacity Savings (kW)	2,088	3,333	4,580
Capacity Savings (% of peak)	4.8%	7.2%	9.4%
Costs and Benefits			
Annual Program Costs (nominal $)	836,418	836,270	838,291
Cumulative Total Costs (2003 PV$)	2,884,101	7,711,617	12,545,896
Cumulative Benefits (2003 PV$)	5,643,174	15,088,928	24,547,915
Cumulative Net Benefits (2003 PV$)	2,759,073	7,377,311	12,002,019
Benefit-Cost Ratio	2.0	2.0	2.0
Emissions reductions			
NOx (tons/year)	2	5	8
NOx (% reduction relative to base case)	2.6%	6.0%	9.3%
SO2 (tons/year)	5	4	6
SO2 (% reduction relative to base case)	2.1%	1.5%	2.2%
CO2 (tons/year)	2,671	6,819	11,904
CO2 (% reduction relative to base case)	3.3%	7.9%	13.1%
CO2 (% change relative to 2002 emissions)	-6.0%	-3.9%	-4.7%

Impact of Efficiency Programs on Energy Demand:



Impact of Efficiency Programs on CO2 Emissions:



Scenario 4: Eliminate New Electricity Load Growth

This Scenario was developed by identifying enough efficiency activities to eliminate all new growth in future electricity demand. We find that this goal can be achieved with the same level of efficiency activities as assumed in the Stabilize CO_2 Emissions Scenario. As indicated in Table 6.2 above, the Stabilize CO_2 Emissions Scenario will result in constant electricity demand of roughly 166 MWh per year throughout the study period.

Thus, for Martha's Vineyard only the Eliminate Load Growth Scenario is the same as the Stabilize CO_2 Emissions Scenario, and the results presented in Table 6.2 above apply to both scenarios.

7. Conclusions and Recommendations

7.1 Electricity Resource Planning Goals

- Any form of energy plan for the Cape and Vineyard, or for Massachusetts as a whole, should include energy efficiency as a top priority for meeting future electricity needs. It can reduce electricity costs, reduce the need for transmission and distribution upgrades, provide significant environmental benefits, and promote local economic development.
- Regional planning agencies should recognize how much energy efficiency can contribute to limiting greenhouse gases over the long-term. Ideally, such agencies should establish CO_2 emission targets for the Cape and Vineyard, which could be used to motivate efficiency activities.
- Regional planning agencies should also recognize other important goals regarding electricity demands and resources, including for example: fuel diversity, risk minimization, environmental preservation, sustainable development, and increased reliance upon local, appropriately-sized electricity resources.

7.2 Policy Recommendations

- Local representatives should provide support for the Compact's on-going energy efficiency programs and activities, at least in the form of promotional and marketing support.
- The Compact and local representatives should seek additional funding sources to enhance the current Compact programs. Options include:
    - Use a portion of revenues from power supply customers to supplement the efficiency programs.
    - Seek contributions from local agencies such as Barnstable and Duke Counties.
    - Seek contributions from foundations, such as the Massachusetts Technology Collaborative, to supplement on-going efficiency activities.

    - Seek contributions from national, state or local social service agencies to supplement the funds available for low-income efficiency programs.
- Local representatives and agencies should work to increase the standards embodied in the Massachusetts building code, or local building and planning codes.
- Local representatives and agencies should work to ensure that existing and future building codes are strictly adhered to.
- Local representatives should work to have the Massachusetts appliance efficiency standards made more stringent.
- Local representatives should work to have the system benefits charge increased from its current level.
- Local representatives should work to establish Massachusetts tax credits for major purchases and installations of efficiency measures.
- Each town on the Cape and Vineyard should establish a full- or part-time energy manager. This position could be used to reduce energy costs, implement energy efficiency measures, work with the various programs offered by the Compact, and seek to achieve CO_2 emission goals.
- Each town on the Cape and Vineyard should join the Cities for Climate Protection campaign promoted by the International Council for Local Environmental Initiatives (ICLEI) campaign. Participating in these campaigns can provide opportunities for mobilizing a town to reduce CO_2 emissions.