Synapse
Energy Economics, Inc.

Electricity Energy Efficiency Benefits of RGGI Proceeds: An Initial Analysis

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The Regulatory Assistance Project provided support to Synapse Energy Economics for this report. In this report, we attempt to quantify at a high level the energy efficiency benefits across the ten Regional Greenhouse Gas Initiative (RGGI) states. In compiling data for this report, we have relied upon publicly available data from energy efficiency programs in each state. In addition, we also contacted numerous individuals across state agencies and energy efficiency program administrators to clarify questions that we had. Any error or omission in this report is on our part.

1. Executive Summary

Energy efficiency (EE) program investments have been a cornerstone of the Regional Greenhouse Gas Initiative (RGGI) since the inception of the greenhouse gas cap and trade program in September 2008. Since then, the first nine allowance auctions have generated $729 million that the ten RGGI states have used for efficiency investments and related activities such as clean technologies and rate relief. This report however focuses solely on electric energy efficiency investments. [1]

The purpose of this report is to analyze the investment of the RGGI auction proceeds for energy efficiency in 2009 and to quantify the **electricity** savings benefits. We recognize that some states have chosen to use its RGGI proceeds to fund programs that may provide incidental electric savings, but are not focused on this goal.[2] This report is not a comparative and detailed evaluation of the energy efficiency programs funded through RGGI in each state, but an attempt to use reasonably consistent assumptions to estimate some, not all, of the electricity benefits associated with EE programs across all ten states.

With more than a year of experience with RGGI, we now have:

(1) An opportunity to review the results of the allowance auctions,
(2) The opportunity to assess the use of proceeds to promote energy efficiency, and
(3) Data to assess the effectiveness of investing auction proceeds in energy efficiency.

In 2009 RGGI revenues of $295 million were invested in energy efficiency programs.[3] Our analysis indicates that those RGGI funded EE programs will provide over $443 million dollars in lifetime avoided cost electricity benefits. Focusing on the RGGI states with primarily electric energy efficiency programs, our analysis shows that the electricity savings range from $2.17 to $3.76 for every dollar of program cost.[4] If other benefits such as market price effects[5] and non-electric benefits were included, such as reduced consumption of water resources and an avoided cost of carbon, the benefits would increase.[6] Also not calculated are the economic benefits of energy efficiency spending in the local economy.

These EE programs have also reduced carbon emissions at a lower cost than possible under a cap program that relied solely on a carbon price. For RGGI states with electricity energy efficiency programs, the costs of reducing carbon emissions range from approximately -$53 to -$100 per (short) ton of carbon dioxide (CO_2), with a weighted average cost of -$73 per ton.[7] A negative cost occurs because the program economic benefits are greater than the program costs. As a result, the CO_2 emission reductions from the EE programs are effectively free, or even a net benefit. For comparison carbon reductions achieved through switching electric generation from coal to natural gas would be much more expensive. An analysis by PJM and others has found that significant CO_2 reductions through fuel substitution in electric generation will only occur when carbon prices reach the neighborhood of $50/ton CO_2.[8]

These findings are significant and important in showing the benefits of energy efficiency (EE) spending through RGGI funding. Investments of auction proceeds in energy efficiency programs in 2009 should yield benefits that far exceed the initial investment.

While our analysis only examined the benefits associated with the reduction in CO_2, there are also other pollutants (such as nitrogen oxides, sulfur dioxide, ozone, particulates, and mercury) that are associated with fossil fuel based electricity generation that would be avoided through increased energy efficiency. Additionally, we did not examine reduced emissions associated with the fuel supply chain through the extraction, processing, and delivery of fossil fuels that could be avoided through increased energy efficiency.

Incorporating energy efficiency is an integral component of the RGGI program results in CO_2 emissions reductions at a much lower cost to consumers than other approaches. In our analysis we found that the reporting quality and the information reported varied across the RGGI states. We anticipate that improvements in tracking and reporting of the use of RGGI funds for energy efficiency investment will show even more compelling results.

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[1] Through auction seven, approximately $582.3 million have been raised. The most recent quarterly auction occurred on September 8, 2010 (Auction 9). Auctions 8 and 9 raised an additional $146.8 million.

[2] Attempting to quantify the benefits of these fossil fuel and/or clean energy programs is outside the scope of this report; however, we acknowledge that properly designed and implemented programs can provide significant benefits to consumers

[3] $494 million raised through auctions one through six (December 2009) covering our analysis period. Of this total, $295 million, in our analysis, was designated by the individual states for energy efficiency programs in 2009. This amount reflects 1) actual expenditures for states where data is available, or 2) budgeted amounts where data is not available or where planned expenditures did not occur.

[4] Including states such as New York, New Hampshire, and Vermont that have programs focused on other fuels efficiency programs the benefit range increases to $0.79 to $3.76 for every dollar of program costs.

[5] For example Demand Reduction Induced Price Effects (DRIPE) where reduced energy use lowers the market prices for all customers.

[6] This figure actually leaves out some major benefit streams that add to these figures. Vermont, New York, New Jersey, Maryland, and New Hampshire are pursing further carbon reductions and consumer benefits by using the RGGI funding for non-ratepayer funded programs energy efficiency programs. These programs are focused on fossil fuel and transportation efficiencies. Naturally, when examining these measures based primarily on electrical benefits, these programs appear less positive than traditional energy efficiency programs. When including DRIPE impacts, the range of benefits increases to $0.99 to $4.71 for every dollar with an average of $1.81 across the ten states.

[7] The mitigation cost range is based upon our calculation incorporating: program costs, avoided cost of electricity benefits, and lifetime carbon dioxide savings as used within this analysis. Negative costs per ton occur when avoided cost of electricity benefits exceed program costs. As detailed in the report, state programs such as Vermont, New York, and New Hampshire that target greenhouse gas reduction and/or thermal efficiency programs that do not focus specifically on electricity efficiency savings resulting in lesser avoided cost electricity benefits than other programs that target electricity efficiency benefits. Including New York and New Hampshire increases the range from approximately $4 to negative $100 per ton of CO_2 and a weighted mean mitigation cost of approximately negative $13 per ton of CO_2.

[8] PJM; Potential Effects of Proposed Climate Change Policies on PJM's Energy Market; PJM Interconnection; January 23, 2009.

2. Introduction and Background

The Regional Greenhouse Gas Initiative (RGGI) is an effort of ten Northeast and Mid-Atlantic states to limit greenhouse gas emissions and is the first market-based CO_2 emissions reduction program in the United States. Participating states have agreed to a mandatory cap on CO_2 emissions from the power sector with the goal of achieving a ten percent reduction in these emissions from levels at the start of the program by 2018.[9]

The RGGI program was developed over the course of several years among states in the Northeast U.S. beginning in 2003.[10] The states adopted a Memorandum of Understanding in December 2005 wherein they agreed to auction a portion of allowances[11] and use the proceeds for consumer benefit or strategic energy purposes, including funding state programs that promote energy efficiency and renewable resources.[12] The states also collectively developed a Model Rule in 2006 that served as the foundation for each state's CO_2 Budget Trading Program.[13]

Each state has a CO_2 Budget Trading Program, and the ten programs function together to create a regional market for carbon emissions. The states have collectively auctioned approximately 90 percent of the CO_2 allowances. Auctions are conducted by RGGI, Inc. and are independently monitored by Potomac Economics. The first auction occurred on September 25, 2008, and the first compliance period began on January 1, 2009. Allowances through the first six auctions that are the scope of this report have generated approximately $494.4 million for the ten participating states. The proceeds and allocation of the first six auctions through December 2009 are detailed below.

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[9] Currently emissions are capped at 188 million tons per year for the fossil-fuelled plants under the RGGI cap. The cap on emissions starts to decrease in 2015, and will be approximately 169 million tons by 2018, a 10% reduction.

[10] The ten states are: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.

[11] Under RGGI, one allowance represents one short ton of CO_2. The portion allocated to energy efficiency varies state to state, but across the ten states up to 55% of the proceeds of Auctions one through six were planned for energy efficiency.

[12] For more information on RGGI auctions, see RGGI Auction Fact Sheet available at http://www.rggi.org/docs/RGGI_Auctions_in_Brief.pdf.

[13] Information on the RGGI program, including history, important documents, and auction results is available on the RGGI Inc website at www.rggi.org.

Table 1: Results from RGGI Auctions 1-6, September 2008- December 2009

State	Cumulative Current Control Period Allowances Sold (000's)	Cumulative Future Control Period Allowances Sold (000's)	Cumulative Proceeds ($000's)
Connecticut	8,996	449	$26,539
Delaware	3,811	249	$11,499
Maine	5,038	236	$15,247
Maryland	31,991	1,494	$96,272
Massachusetts	17,510	1,228	$79,095
New Hampshire	6,120	324	$18,161
New Jersey	16,956	1,058	$55,356
New York	60,430	2,901	$180,679
Rhode Island	2,633	123	$7,923
Vermont	1,214	57	$3,652
Total	**154,699**	**8,119**	**$494,423**
Source: RGGI Inc. and Environment Northeast			

The auction of allowances and use of auction proceeds for consumer benefit is a signature component of the RGGI program, although each state implements this differently. Early in the development of the RGGI program, analysis projected that a RGGI cap and trade program that incorporated aggressive energy efficiency would be less costly than a program that did not.[14] RGGI Inc asserts that:[15]

> Improving electricity end-use efficiency is a low-cost means of avoiding CO_2 emissions. End-use energy efficiency investments provide net economic benefits to ratepayers through bill savings, less need for investment in transmission and distribution, and lower wholesale electricity prices, especially during peak demand periods.[16]

A recent policy brief issued by the National Association of Regulatory Utility Commissioners (NARUC) and a 2008 paper by Richard Cowart from the Regulatory Assistance Project expands on the importance of incorporating energy efficiency expenditures as an integral part of a greenhouse gas cap and trade program in order to achieve consumer benefits through lower cost carbon mitigation.[17,18] Both make the following points:

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[14] Prindle, Shipley, and Elliott; Energy Efficiency's Role in a Carbon Cap-and-Trade System: Modeling Results from the Regional Greenhouse Gas Initiative; American Council for an Energy Efficient Economy, May 2006. Report Number E064.

[15] RGGI Inc. is the non-profit entity that provides technical and administrative support for the program. RGGI Inc. does not have regulatory nor enforcement authority over the program.

[16] Regional Greenhouse Gas Initiative; *RGGI Benefits*; www.rggi.org/about/benefits; accessed June 10, 2010.

[17] NARUC Climate Issue Brief #4 [http://www.naruc.org/Publications/ClimateIssueBrief4_Jul2009.pdf] July 2009

[18] Cowart, Richard. Carbon Caps and Efficiency Resources: How Climate Legislation Can Mobilize Efficiency and Lower the Cost of Greenhouse Gas Emission Reduction; Vermont Law Review, Vol. 33:201, 2008; pp. 201-223.

(a) Carbon reductions in a cap and trade program are expected to come from demand reductions by consumers and changes in generation mix.

(b) Two problems exist with a cap and trade program that relies on price signal alone: (1) carbon prices will not deliver adequate consumer conservation response and (2) carbon prices must be quite high to significantly alter generation dispatch.

(c) Applying a high carbon price across all generation can greatly raise the price of power, especially if total cost to consumers is measured in terms of cost per ton of GHG emissions.

(d) For a given cost to consumers, society can reduce much more carbon pollution through energy efficiency programs than it can through cap and trade programs that focus on the supply side.

(e) Investments in energy efficiency will reduce power sector GHG emissions at a lower cost than other options.

With more than a year of experience as the first greenhouse gas cap and trade program to start with auction of a substantial portion of allowances, the RGGI program provides (1) an opportunity to review the results of the allowance auctions, (2) the opportunity to assess the use of proceeds to promote energy efficiency, and (3) actual data to assess the effectiveness of investing auction proceeds in energy efficiency to lower the cost of the RGGI program.

EE programs have a number of benefits that can be viewed from a variety of perspectives. The first category of savings comes from the reduction in energy use. Production and consumption costs are reduced in direct proportion to the energy savings both for the producer and consumer. For the end-user the economic savings are based on the rates that they pay, whereas for the supplier the savings are based on the wholesale market prices.

Another savings category comes from the avoided infrastructure costs such as the building of new power plants or transmission lines.[19] These costs are somewhat episodic and depend on the aggregate savings of the EE programs over years. Other benefits include the reductions in pollutant emissions associated with using less energy and the economic benefits from the program spending itself.[20]

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[19] Depending on the technology and transmission addition and the location of the resource addition, these costs may be substantial.

[20] For the New England states, the avoided cost values associated with energy efficiency are documented in the 2009 New England Avoided Cost Report. Other pollutants associated with fossil fuel based electricity generation include sulfur dioxides, nitrogen oxides, particulates, mercury, and ozone.

3. Study Approach

We undertook several steps for this study. First we reviewed information available from RGGI and Environment Northeast to determine cumulative auction proceeds for each state. We next compiled available data on spending on RGGI funded EE programs in the ten RGGI states. Then we analyzed energy efficiency program budgets along with projections of energy savings and corresponding CO_2 emission reductions.

While some estimates exist, it was more difficult than anticipated to determine specifically how RGGI auction proceeds had been used to fund energy efficiency programs because of differences in state approaches to expenditures and tracking expenditures. In addition, in a number of states, RGGI funded EE programs are different from utility rate funded EE programs. We supplemented our review of public data with personal contacts (see Appendix II) with individuals familiar with the use of RGGI proceeds in most, but not all ten states.[21] Subsequently we reviewed existing research assessing the benefits and costs of energy efficiency programs in the RGGI states. For calculations of avoided costs (see Appendix I), we relied primarily on the 2009 Avoided Energy Supply Cost in New England report to determine avoided cost of electricity for the ten states.[22]

We also performed calculations for comparative and aggregation purposes of per ton carbon costs: (a) a price that would be sufficient to trigger changes in the generation fuel mix, and (b) a price that incorporates the benefits of energy efficiency investments in the RGGI region. Finally, we identified issues for more in-depth future analysis.

[21] Appendix II contains a list of individuals whom we contacted in conjunction with this report.
[22] Hornby et al. 2009, Avoided Energy Supply Costs in New England 2009 Report. October 23, 2009. Available at http://www.synapse-energy.com/Downloads/SynapseReport.2009-10.AESC.AESC-Study-2009.09-020-Appendices.pdf

4. Avoided Cost Calculation Results

One of the signature features of the RGGI program is the states' agreement to auction a significant portion of allowances, and to use auction proceeds to fund energy efficiency programs. In order to quantify the benefits associated with this use of RGGI funds, we calculated what costs have been avoided due to expenditures on energy efficiency programs. Avoided cost calculations are a standard measure of the energy costs benefits associated with retail customers' reduction of their annual energy use. To estimate the avoided costs we need two components: the quantity of electricity saved (or avoided new generation) and the value of electricity that will be avoided.

Based on the availability and consistency of the available data, we focused on the benefits associated with the avoided cost of electricity. Other benefits including capacity, and transmission and distribution benefits are important, but not examined and quantified within this analysis.

A. EE Savings Based on RGGI Funding

States report with varying degree of detail on the EE programs funded through RGGI proceeds. During our research of publicly available information we found that a number of states had not disbursed, or had delayed disbursements of, allocated RGGI proceeds to EE projects as planned. In addition, we also found that reporting of EE program results varied by state.

The states of Maine and Connecticut have developed reports containing information that were incorporated directly into our analysis. Massachusetts, Rhode Island, and New Hampshire have data available on RGGI proceeds and uses thereof, but they required some processing as described below in order to enable comparison with other states.

In the remaining states (Delaware, Maryland, New York, New Jersey, and Vermont), we used proxy programs that include utility sponsored programs or programs sponsored by other third party agencies to estimate the potential benefits associated with RGGI funded EE programs.[23] For those states, we have assumed for the purposes of analysis that auction proceeds were invested in energy efficiency as planned by the state. Appendix II provides details of state specific adjustments that we used to approximate RGGI funding. The following table summarizes available information on RGGI funding, *pro rata* energy, and *pro rata* CO_2 savings for EE programs utilizing and/or representing RGGI proceeds. *Pro rata* values are based on RGGI proceeds relative to the program costs. For this analysis, we relied on available data supplied by state programs and Environment Northeast's RGGI Allowance Allocations and Auction Proceeds Distribution Plans dated March 15, 2010.[24]

[23] We recognize that proxy programs may not be reflective of actual savings attributable to an individual program. In some cases the proxy values will overstate actual savings. For instance, we understand that using Efficiency Vermont's savings values will overstate the state's fossil fuel efficiency program and that using the savings reported by New Jersey's Clean Energy Program will overstate the savings attributed to the loans dispersed by the New Jersey's Global Warming Solutions Fund. Nevertheless, we believe the use of proxy data provides a starting point to identify areas for future refinement and further analysis.

[24] The ENE Report is available at http://www.env-ne.org/public/resources/pdf/ENE_Auction_Tracker_20100315.pdf

Table 2: 2009 Planned or Actual Budget and Savings for RGGI Funded Energy Efficiency Programs

	Amount Funded by RGGI as Budgeted ($000s)	Pro Rata Lifetime Electricity Savings (MWh)	Pro Rata Lifetime CO_2 Savings (000s tons)
Connecticut[1]	$17,300	614,657	449
Delaware(P,B)[2]	***$7,474***	***289,433***	***165***
Maine[3]	$4,766	247,495	127
Maryland(P,B)[4]	***$26,648***	***1,031,953***	587
Massachusetts(B)[5]	***$44,535***	***1,419,842***	***731***
New Hampshire[6]	$17,661	186,739	1,513
New Jersey(P,B)[7]	***$11,071***	***398,383***	207
New York(B)[8]	***$153,964***	***1,880,193***	***7,427***
Rhode Island(B)[9]	***$7,922***	283,565	146
Vermont(P,B)[10]	***$3,652***	***141,103***	***99***
RGGI Total	**$294,993**	**6,493,363**	**11,451**

Notes

Pro Rata based on program cost and RGGI proceeds. Program cost for EE programs utilizing and/or representing RGGI proceeds.

Bolded and italicized cells indicate proxy **(P)** or budgeted **(B)** values were used in the analysis. Specific details associated with each value are noted.

Program budgets do not include participant costs. Values in 2009 dollars. Detailed state specific information, along with program budget details including available incentive and participant costs are described in Appendix II.

1 Connecticut budget and savings based on 2009 Annual Report filed to the State Legislature

2 Delaware RGGI proceeds reflect allocated budgets. Savings data unavailable for Delaware and therefore based upon Maryland values prorated based on Delaware RGGI proceeds allocated to energy efficiency

3 2009 Efficiency Maine report

4 Maryland RGGI proceeds reflect allocated spending, while savings are based on utility sponsored programs for 2009. Maryland CO_2 savings calculated using reported lifetime kilowatt-hours savings multiplied by a PJM emission rate of 1,137 lbs per MWh available at http://www.pjm.com/documents/~/media/documents/reports/co2-emissions-report.ashx

5 Massachusetts RGGI spending based on allocation of RGGI proceeds and savings reflect 2009 Energy Efficiency plans filed by electric Program Administrators. CO_2 lifetime emission based on emission factor of 0.515 tons per MWh from the Synapse AESC 2009 report.

6 New Hampshire savings and budget based 2009 RGGI report filed with the New Hampshire State Legislature

7 New Jersey RGGI spending based on planned allocation of RGGI proceeds, while savings are based on New Jersey Office of Clean Energy programs for 2009. New Jersey uses its RGGI proceeds to fund loan applications through the state's Global Warming Solutions Fund that is administered by the New Jersey Economic Development Authority. Specific savings are detailed in specific loan applications.

8 New York budget and savings reflect a "fully funded" scenario as described in the April 16 2009 Operating Plan

9 Rhode Island reflects budgeted RGGI spending, while savings reflect National Grid's Energy Efficiency Programs. CO_2 lifetime emission based on emission factor of 0.515 tons per MWh from AESC 2009.

10 Vermont reflects budgeted RGGI spending, and savings data from Efficiency Vermont Year 2009 Savings Claim, dated April 1, 2010

B. Avoided Electricity Supply Cost Benefits of RGGI-funded EE

The calculations of the avoided electricity cost benefits for energy efficiency programs funded by RGGI are based on the avoided cost of electricity for each of the ten states. A more detailed discussion may be found in Appendix I.[25] For this analysis, we relied upon estimates from the 2009 Avoided-Energy-Supply-Costs (AESC), a report prepared by Synapse Energy Economics for the New England Energy Efficiency Program Administrators. [26] The Synapse 2009 AESC report provides projections of marginal energy supply costs that will be avoided due to reductions in the use of electricity, natural gas, and other fuels resulting from energy efficiency programs throughout New England. These are the most readily available and generally accepted calculations of avoided costs in New England, and can be adapted for use in non-New England states in the RGGI region.

We used the avoided costs directly from AESC analysis for New England states.[27] These values include an adjustment of a wholesale risk premium of 11.1% for Vermont and 9% for the remaining New England states.[28] For the non-New England states we scaled those values based on the ratio of the near term (2009) energy price in those states to the near term energy price in New England.[29] For New York we used a longer stream of avoided costs that corresponds to the longer measure life of relevant programs in the state.[30]

Using the state-specific avoided electricity supply cost values and the available estimates of lifetime energy savings, we roughly estimate the benefits of the electricity use avoided through RGGI-funded energy efficiency in the 10 RGGI states. Appendix II provides details of our calculation method. These benefits are summarized in the following table.[31]

[25] The values used in this analysis approximate a retail avoided cost. However, this analysis does not represent specific analyses to determine specific retail electric costs across the ten states.

[26] Hornby et al. 2009, Avoided Energy Supply Costs in New England 2009 Report. October 23, 2009. Available at http://www.synapse-energy.com/Downloads/SynapseReport.2009-10.AESC.AESC-Study-2009.09-020-Appendices.pdf

[27] Specifically we levelized the avoided costs over an 11 year period. We then applied that levelized cost to the reported program energy savings. The 11 year levelization period was chosen since the average measure life across available programs is 10.4 years. Thus this approach is appropriate and consistent for this high level analysis.

[28] The Vermont risk premium is mandated by the Vermont Public Service Board and was incorporated into the calculations of avoided cost.

[29] Prices for PJM from Monthly Day-Ahead LMP Prices available at http://www.pjmenergy.com/markets/jsp/lmpmonthly.jsp. Prices for New York from NYISO monthly report data available at http://www.nyiso.com/public/webdocs/documents/studies_reports/monthly_reports/December_2009_Monthly_Report.pdf

[30] In New York, an average 18 year avoided cost was used since the majority of the benefits (61%) of the reported energy savings were for Electrified Rail and Photovoltaic projects that typically have longer than 11 year measure lives.

[31] A more detailed treatment of calculating the benefits of avoided costs generation would aggregate measure or program level benefits to determine the statewide benefits. However, this analysis would have occurred during the screening process conducted in each state under varying rules.

Table 3: Avoided Electricity Benefits to RGGI Funding Ratio

	Levelized Avoided Cost of Electricity ($/MWh)	Pro-Rata Lifetime Electricity Savings From Table 2 (MWh)	Pro-Rata Avoided Cost of Electricity ($000s)	RGGI Funding Amount From Table 2 ($000s)	Avoided Electricity Benefit to RGGI Funding Ratio
	(1)	(2)	(3)=(1)x(2)	(4)	(5)=(3)/(4)
Connecticut	$80.99	614,657	$49,781	$17,300	2.88
Delaware(P,B)	$56.05	***289,433***	***$16,223***	***$7,474***	2.17
Maine	$72.44	247,495	$17,929	$4,766	3.76
Maryland(P,B)	$57.18	1,031,953	***$59,007***	***$26,648***	2.21
Massachusetts(B)	$77.77	***1,419,842***	***$110,421***	***$44,535***	2.48
New Hampshire[1]	$74.89	186,739	$13,985	$17,661	0.79
New Jersey(P,B)	$55.84	398,383	***$22,246***	***$11,071***	2.01
New York[1](B)	$65.08	***1,880,193***	***$122,368***	***$153,964***	0.79
Rhode Island (B)	$71.23	283,565	$20,198	***$7,922***	2.55
Vermont[2](P,B)	$76.73	***141,103***	***$10,827***	***$3,652***	2.96
RGGI Total		**6,493,363**	**$442,985**	**$294,993**	**1.50**

Bolded and italicized cells indicate proxy (P) or budgeted (B) values were used in the analysis. Specific details associated with each value are as noted in Table 2 of this report.

1. Both New Hampshire and New York fund measures that do not primarily focus on electricity efficiency, hence when viewed through the lens of avoided electricity cost benefits, these programs appear to have higher costs relative to benefits.

2. Results reported for Efficiency Vermont are portfolio wide savings, although Vermont funds an all fuels (thermal) efficiency program.

As described in detail herein, we have used a 20-year levelized Avoided Cost of Electricity for New York that accounts for longer measure life associated with this program.

The ratio of avoided electricity benefits to program costs for the RGGI states range from $0.79 to $3.76 of benefits for every dollar of program cost. The two states of New York and New Hampshire have programs that do not focus on electricity savings, thus for electricity focused EE programs in the other states the benefits range from $2.17 to $3.76 for every dollar of program costs.[32]

One limitation to our analysis is that it does not specifically incorporate other benefits resulting from energy efficiency into the benefits calculation. For instance, if one were to include other benefits such as Demand Reduction Induced Price Effect (DRIPE) or price mitigation, then the benefits would be expected to increase by 25%. As detailed more fully in Appendix I, the DRIPE impacts associated with EE programs and some of the difficulties in calculating specific values for each state. The increased DRIPE benefits are shown in the following table.

[32] These cost benefit ratios are a first order of approximation. State specific program cost benefit ratios may differ based on specific inputs required for regulatory approval in each jurisdiction. For example, Participant costs are not clearly labeled in the filings provided by states, so it would be difficult to obtain all the necessary inputs to evaluate program cost-effective across all ten states in a manner consistent with standard cost-effectiveness tests.

Table 4: Avoided Electricity Benefits and DRIPE Benefits Funding Ratio to RGGI Funding

RGGI State	Pro-Rata Avoided Cost of Electricity from Table 2 ($000s)	DRIPE Benefits (25% of Avoided Electricity Costs)	Total Avoided Cost of Electricity and DRIPE	RGGI Funding Amount from Table 2 ($000s)	Total Avoided Cost of Electricity and DRIPE Ratio to RGGI Funding
	(1)	(2)=(1)x0.25	(3)=(1)+(2)	(4)	(5)=(3)/(4)
Connecticut	$49,781	$12,445	$62,226	$17,300	3.60
Delaware (P,B)	***$16,223***	$4,056	$20,278.42	***$7,474***	2.71
Maine	$17,929	$4,482	$22,411	$4,766	4.70
Maryland (P,B)	***$59,007***	$14,752	$73,759	***$26,648***	2.77
Massachusetts (B)	***$110,421***	$27,605	$138,026	***$44,535***	3.10
New Hampshire	$13,985	$3,496	$17,481	$17,661	0.99
New Jersey (P,B)	***$22,246***	$5,561	$27,807	***$11,071***	2.51
New York (B)	***$122,368***	$30,592	$152,960	***$153,964***	0.99
Rhode Island (B)	$20,198	$5,050	$25,248	***$7,922***	3.19
Vermont (P,B)	***$10,827***	$2,707	$13,534	***$3,652***	3.71
RGGI Total	$442,984	$110,746	$553,730	$294,994	1.88
Bolded and italicized cells indicate proxy (P) or budgeted (B) values were used in the analysis. Specific details associated with each value are as noted in Table 2 of this report.					

Both of these tables, Tables 3 and 4 focus on avoided electricity benefits, which is appropriate for most of the EE programs. However, states that are using the allowance proceeds to achieve CO_2 emission reductions through other policy objectives may see fewer avoided electricity cost benefits than illustrated in this high level analysis. For example, New York had planned to invest some of its RGGI proceeds to fund EE projects that focused on transportation and electrified rail projects that typically have long measure lives and substantial upfront investments. New Hampshire focuses on greenhouse gas mitigation projects based on grant proposals submitted to the state for approval. Vermont uses its RGGI proceeds to fund a fossil fuel efficiency program that we understand will have incidental avoided electricity supply benefits. Also, New Jersey's Global Warming Solutions Fund uses RGGI proceeds to fund clean technology loans that are not captured in this analysis. These programs would not be considered "traditional" energy efficiency programs, and our high-level analysis of electricity benefits does not capture the full benefits of these programs. In addition, as discussed below, this high-level analysis does not capture substantial non-electric benefits associated with these energy efficiency programs that could be demonstrated within the context of a regulatory proceeding.

Notwithstanding, the avoided cost of electricity benefits associated with these programs is significant as shown in this high-level analysis. That said, understanding the policy objectives of the disbursement RGGI proceeds within each state would require a more in-depth state by state analysis beyond the scope of this paper.

5. CO_2 Mitigation Cost Comparisons

In his discussion of cap and trade programs, Cowart discusses the relative costs of achieving carbon emission reductions through 1) relying solely on a carbon price signal or 2) implementing a cap and trade program with energy efficiency investments as an integral component of the program design. Cowart states that "[a]pplying a high carbon price across all generation can greatly raise the price of power, particularly if the total cost to consumers is measured in terms of cost per ton of avoided GHG emissions."[33] Indeed, given market structures in the RGGI region where all generation resources receive a single market clearing price, energy efficiency can be a particularly cost-effective method for reducing emissions by reducing the overall amount of energy that is sold in the markets.

One way to think about the relative cost of achieving emissions reductions is to consider what carbon price is necessary to cause a change in the generation mix through re-dispatch from coal to combined-cycle natural gas. On an energy basis, natural gas is currently much more expensive than coal. In general the marginal generation cost difference between coal and natural gas plants is quite high, on the order of $30/MWh. However, there are some older coal plants and some newer more efficient gas plants that have similar marginal costs. A modest CO_2 price will increase the generation cost for those older less-efficient coal plants above the costs of the more efficient gas plants. Thus for some hours, when market prices are in a certain range, some coal generation will be displaced by natural gas generation with resulting CO_2 emission reductions. The CO_2 reductions will be small and limited to some hours, but the market prices will increase for all hours.

To get a major shift from coal to natural gas generation a fairly high CO_2 price is needed. The table below shows the CO_2 prices ($/ton) that would cause re-dispatch between typical coal and natural-gas fired power plants at different price levels for coal and natural gas using recent PJM data.[34] This illustrative calculation shown in **Table 5** does not take into account the total market costs associated with introduction of a price for CO_2, just the CO_2 cost necessary to change dispatch order among power plants.

[33] Cowart, p. 211

[34] The characteristics of the representative generating units used in this analysis were taken from Table 2, Potential Effects of Proposed Climate Change Policies on PJM's Energy Market. Dated January 23, 2009. The heatrate used for a typical coal plant was 10,000 Btu/kWh and for a natural gas plant 7,000 Btu/kWh.

Table 5: CO_2 Reduction Costs of Direct Re-dispatch (\$/ton CO_2)

CO_2 Costs (\$/ton CO_2) to Cause Switch from Coal to Natural Gas Generation		Coal Prices (\$/mmBtu)		
		Low (\$1.72)	Medium (\$2.29)	High (\$2.86)
Natural Gas Prices (\$/mmBtu)	Low (\$4.63)	\$24.7	\$15.4	\$6.2
	Medium (\$6.18)	\$42.2	\$33.0	\$23.7
	High (\$7.72)	\$59.7	\$50.5	\$41.2

Notes:
Mid-prices for Coal and Gas based on AEO 2010 Middle Atlantic 2011 Electric Power Sector prices in 2008\$
PJM Generating Characteristics taken from *Table 2 Characteristics of Representative Generating Units* from *Potential Effects of Proposed Climate Change Policies on PJM's Energy Market;* PJM Interconnection; January 23, 2009.

These results indicate that for the mid-range prices of \$6.18 per mmBtu for natural gas and \$2.29 per mmBtu for coal, the cost of CO_2 would have to be \$33 per ton to produce a major switch from coal to natural gas generation. Another way of interpreting these results is that a direct displacement of coal generation by natural gas generation would reduce CO_2 emissions at the net cost of \$33 per ton.[35] This net CO_2 cost varies in proportion to the relative price differences between coal and natural gas ranging from \$6/ton with low natural gas prices and high coal prices, to \$60/ton in the reverse situation.

The RGGI program, with its integration of efficiency investments, was designed with the idea that those investments would lower the cost of achieving a given emission reduction goal since efficiency offers lower carbon mitigation costs than other emission reduction approaches. Thus, another way to think about the investment of RGGI auction proceeds in energy efficiency programs is to calculate the effective CO_2 mitigation cost associated with those investments.

If only the total EE program budgets are taken into account, CO_2 reduction costs range between \$12/ton CO_2 and \$61/ton CO_2. However, a simple calculation that only incorporates total program costs ignores an important fact that energy efficiency investments avoid power plant operation and capital costs in addition to reducing CO_2 emissions. Thus, incorporating benefits associated with avoided electricity costs allows an estimation of *net* costs per ton of CO_2 reduction.

Using our data from the RGGI funded programs; we calculated the effective CO_2 mitigation costs incorporating avoided costs.[36] This analysis does not attempt to evaluate the emission calculations used by each state, we simply approximate the net cost of carbon abatement associated with energy efficiency across the ten states. For this calculation, we focused on energy efficiency program cost, avoided energy supply cost benefits, and CO_2 savings as shown in the table below.

[35] For example if there was a hard cap on CO2 emissions, then the incremental cost of running an natural gas plant rather than a coal plant to meet that cap would be \$33/ton-CO2.
[36] Note, these calculations include total program budgets and projected savings, not just those attributed to RGGI funded expenditures. This treatment may understate the effective mitigation cost per ton of CO_2 specific to a RGGI funded measure.

Table 6: Net CO_2 Mitigation Costs of RGGI Funded Energy Efficiency Programs

RGGI States	Reported 2009 Program Budget Total to be Funded by RGGI ($000s)	Benefit of Avoided Electricity Costs ($000s)	Net Cost of Programs ($000s)	Electricity Lifetime CO_2 savings (000 tons)	Net Cost of CO_2 Reductions ($/ton)
	(1)	*(2)*	*(3)=(1)-(2)*	*(4)*	*(5)=(3)÷(4)*
Connecticut	$17,300	$49,781	($32,481)	449	($72.31)
Delaware (P,B)	***$7,474***	***$16,223***	($8,749)	165	($53.17)
Maine	$4,766	$17,929	($13,162)	127	($103.78)
Maryland (P,B)	***$26,648***	$59,007	($32,359)	587	($55.16)
Massachusetts (B)	***$44,535***	***$110,421***	($65,886)	731	($90.10)
New Hampshire	$17,661	$13,985	$3,676	1,513	$2.43
New Jersey (P,B)	***$11,071***	***$22,246***	($11,175)	207	($53.98)
New York (B)	***$153,964***	**$122,368**	**$31,596**	7,427	$4.25
Rhode Island (B)	***$7,922***	$20,198	($12,276)	146	($84.06)
Vermont (P,B)	***$3,652***	***$10,827***	($7,175)	99	($72.77)
RGGI Total	$294,994	$442,984	($147,990)	11,450	($12.92)

Bolded and italicized cells indicate proxy (P) or budgeted (B) values were used in the analysis. Specific details associated with each value are as noted in Table 2 of this report.
The NH & NY programs produce non-electric related CO_2 savings which are not included here.

When the avoided costs are taken into account, CO_2 reductions through energy efficiency actually have a negative net cost (because the avoided costs are significantly greater than the program costs). For all ten states, the reductions range from $4.25/ton CO_2 to -$103/ton CO_2 based on available state data.[37] Excluding New York, New Hampshire, and Vermont, the mitigation cost range falls to approximately - $50 to - $100 per ton.[38]

These calculations illustrate that a cap-and- trade program that simply relies on a price signal and market effects to achieve emissions reductions is likely to have higher overall costs than one that incorporates energy efficiency investments as an integral program component. Integrating energy efficiency into the program design can achieve carbon reductions at much lower cost!

[37] New York's pro rata net mitigation cost is $4.25 per ton, but its program focuses on a number of transportation energy efficiency projects with long measure lives, and a number of pilot programs that do not report energy or CO_2 savings currently.
[38] As noted these states focus on programs that target fuel efficiency or greenhouse gas reduction strategies that would not include significant electricity efficiency benefits. On the other hand these programs may have larger targets of CO_2 reduction by the nature of their program design.

6. Other Non-Electric Benefits

Most electric efficiency measures also deliver non-electric benefits. Examples of non-electric benefits include insulation and air sealing measures that save on air conditioning costs and also reduce heating fuel consumption, water consumption reductions from high efficiency appliances, and reduced maintenance costs associated with high-efficiency lighting.

We have not included estimates for non-electric benefits since state specific estimates for other fuels and water pricing would require a more detailed analysis. Notwithstanding, non-electric benefits are significant. For example, in the three-year electric efficiency plans submitted by the Massachusetts program administrators, the non-electric benefits represented 55% for the Residential Sector, 63% for the Low-income Sector, 1% for the Commercial and Industrial Sector, and 20% of the overall $4.9 billion in total lifetime benefits across the three year plans. [39]

In addition to energy and non-electric benefits, energy-efficiency programs have economic development benefits. These benefits include both direct and indirect benefits through spending on energy efficiency and spending from energy efficiency. While economic benefits require state-specific analysis, the 2009 AESC study calculated economic benefits of EE for Massachusetts to be approximately $2.5 million in direct and value-added benefits for every $1 million in EE expenditures.[40] More recently, Environment Northeast (ENE) conducted a macroeconomic modeling assessment of total energy efficiency spending in the six New England states.[41] Their analysis indicates that each dollar of program funding results in a range of increase in an individual state's gross state product[42] of $3.7 to $5.6 dollars[43]. While the economic modeling addresses energy savings, the model also accounts for increased spending resulting from the energy savings from EE programs.

Many electric efficiency measures also deliver non-electric benefits in the form of fuel savings for heating fuels such as natural gas, oil, wood, propane, and other sources. Specific measures such as insulation and air sealing save on air conditioning costs in the summer months, but also heating costs in the winter. For these programs, the avoided costs of fuel would be an additional benefit not addressed in this specific analysis. Vermont, New Hampshire, and New York plan to use, or currently use, their RGGI proceeds to fund fuel efficiency programs. New Jersey uses a portion of its proceeds to fund loans for clean energy technologies that are not captured in this analysis.

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[39] In Massachusetts, non-electric benefits included values for amount of fossil fuels avoided, avoided water consumption, and non-resource savings. A detailed description list of NEB assumptions used in the Massachusetts proceedings may be found at http://www.env.state.ma.us/dpu/docs/electric/09-119/112009clcrag1-22j.pdf
Total and NEB benefits taken from Table 8, MA DPU Orders 09-116 through 09-120, dated January 29, 2010, page 178.

[40] AESC 2009, page 1-20.

[41] Howland, J. et al. Energy Efficiency: Engine of Economic Growth A Macroeconomic Modeling Assessment. Environment Northeast. October 2009. Available at: http://www.env-ne.org/resources/open/p/id/964

[42] ENE defines Gross State Product as the "value added" economic activity component through increased local labor and investment as a result of energy efficiency spending.

[43] Inputs and modeling methodology to ENE analysis differed to the economic impact analysis conducted for MA as part of the AESC 2009 study; however the general conclusion that EE expenditures have stimulated considerable direct and indirect economic impacts is consistent across the two methodologies.

7. Summary of Observations and Areas for Further Study

The purpose of this report is to estimate, using readily available data, the electricity-related benefits of using RGGI auction proceeds to support energy efficiency programs across the ten RGGI states. In states that have supplemented ratepayer funded EE programs with RGGI funding, not surprisingly we found that these programs provide significant benefits associated with reductions in annual electricity consumption due to the levels of funding derived from RGGI. In states where RGGI proceeds are used to fund fuel efficiency and/or greenhouse gas reduction programs, the avoided electricity cost benefits to program costs will not appear to be as pronounced. Overall, in the ten RGGI states, RGGI funds supported energy efficiency programs that provided over $442 million dollars in lifetime avoided electricity cost benefits (even with information lacking on a few key states).

In addition, this report also offers a broad brush estimate, for comparative purposes, of the relative costs of achieving carbon reductions through a carbon price signal and through energy efficiency investments. We found that energy efficiency programs offer an opportunity for carbon reductions at negative costs ranging from approximately -$50 to -$100/ton CO_2 for states focusing on electrical energy efficiency. In contrast, carbon reductions through changes from switching coal-fired to natural gas combustion generation are likely only when carbon prices reach the neighborhood of $50/ton CO_2.

The process of gathering information for this report has highlighted areas of potential improvement in available data across the ten RGGI states. We note the following:

- Limited information is available from states on use of RGGI auction proceeds. Better and more consistent data would permit better assessment, enable coordination and resource sharing among states to promote development of best practices, and provide a foundation for effective federal legislation.
- The first RGGI auction was in late 2008. 2009 programs (designed in 2008) may not have included a full year of RGGI implementation. The 2010 EE plans contain more certainty in the assumptions going forward for RGGI proceeds.

Overall, the transparency of data is crucial since $582 million of aggregate RGGI dollars is not trivial. Improving the reporting of this data will help all stakeholders better understand the benefits associated with RGGI funded programs both within and across states. It will also enhance RGGI's usefulness as a foundation for the development of a cost-effective federal carbon cap and reduction program that incorporates allowance auctions and investment of proceeds for the public benefit.

Appendix I: Avoided Cost Method, Components and Assumptions

Avoided costs are defined in the EPA's National Action Plan for Energy Efficiency (NAPEE Report) "as costs that would have been spent if the energy efficiency savings measure had not been put in place."[44] Electricity avoided costs are generally divided into energy and capacity. Energy avoided costs generally account for market prices of energy, fuel costs, and natural gas prices. Capacity avoided costs generally account for avoided infrastructure investments such as new generation plants, and transmission and distribution lines.[45]

A detailed listing of these components is summarized in the following table taken from the NAPEE Report.[46]

Table 7: Energy and Capacity Components in Avoided Costs from NAPEE Report

Electricity Energy Efficiency	
Energy Savings	**Capacity Savings**
Market purchases or fuel and operation and maintenance costs	Capacity purchases or generator construction
System losses	System losses (peak load)
Ancillary services related to energy	Transmission facilities
Energy market price reductions	Distribution facilities
Co-benefits in water, natural gas, fuel oil, etc.	Ancillary services related to capacity
Air emissions	Capacity market price reductions
Hedging costs	Land use
Natural Gas Energy Efficiency	
Energy Savings	**Capacity Savings**
Market purchases at city gate	Extraction facilities
Losses	Pipelines
Air emissions	Cold weather action/pressurization activities
Market price reductions	Storage facilities
Co-benefits in water, natural gas, fuel oil, etc.	LNG terminals
Hedging costs	

Note: More detail on each of these components can be found in Chapter 3 of the Action Plan's *Guide to Resource Planning with Energy Efficiency* (National Action Plan for Energy Efficiency, 2007b).

, Regulators generally factor in these avoided costs when evaluating EE programs. However, there are differences between what and how avoided costs are calculated within the ten RGGI states. In the six New England states, the Avoided Energy Supply Component Study Group has

[44] EPA, "Understanding Cost-Effectiveness" p. 4-1.
[45] EPA, "Understanding Cost-Effectiveness" p. ES-2.
[46] EPA, "Understanding Cost-Effectiveness" p. 4-2.

sponsored the bi-annual calculation of avoided costs associated with EE. Thus for this analysis, Synapse relied upon estimates published in the 2009 AESC Study for the New England states.[47]

Our analysis incorporated the following assumptions and caveats:

- 2009 energy prices are based on historic prices from ISO data.
- For our avoided electricity supply value, we used the 11 year levelized cost of avoided electricity from the 2009 AESC report for the six New England states. In addition, we chose 11 years as the weighted average life of energy efficiency programs.[48]
- Avoided cost values included a wholesale risk premium of 9% for New England States and 11.1% for Vermont as required by the Vermont Public Service Board. With this premium, the values are closer to an energy supply cost for consumers.
- This analysis does not include transmission and distribution losses, since that information is generally utility specific.
- For New York, New Jersey, Maryland, and Delaware, Synapse used existing published day-ahead price estimates from PJM and adjusted based on a regression of levelized prices from the six New England states.[49] Understandably, the PJM market has more coal on the margin than the New England markets where natural gas is generally the marginal resource. In addition, the potential development of offshore renewable resources in Delaware, New Jersey, and Massachusetts within the next 11 years may affect avoided costs. However for the purposes of this analysis, our approach is premised on the belief that the regional energy markets will follow similar macro-trends to model behavior from New England data in the near term, and not to examine factors influencing avoided costs specific to each of the RGGI states.
- Discount rate based on the AESC discount rate of 2.22% is applied to all states.[50] Because the avoided cost of electricity changes gradually during the time period, the calculation of the levelized costs will be fairly insensitive to changes in the discount rate. For example, changing the discount rate from 2.22% to 5% results in a decrease in the avoided electricity benefits of 0.6% to 1.0% across the states.

Based on these assumptions and caveats, the 11-year levelized value of our approximated avoided cost of electricity for each of the ten RGGI states is summarized in the table below.

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[47] Hornby et al. 2009 Avoided Energy Supply Costs in New England 2009 Report. October 23, 2009, page 6-52. Available at http://www.synapse-energy.com/Downloads/SynapseReport.2009-10.AESC.AESC-Study-2009.09-020-Appendices.pdf

[48] For the purposes of this analysis, and given the available aggregate information provided, we did not attempt to identify measure life information specific to each program that would be undertaken as part of a screening analysis.

[49] Day-ahead price estimates from PJM market at [49] Day-ahead price estimates from PJM market at http://www.pjmenergy.com/markets/energy-market/day-ahead.html

[50] Discount rates will vary based on regulatory requirements. We did not attempt to identify discount rates that would be used during the screening process for individual EE programs.

Table 8: Levelized Avoided Energy Costs for RGGI States

State	11-year Levelized Avoided Cost of Electricity ($/MWh)
Connecticut	$80.99
Delaware	$56.05
Maine	$72.44
Maryland	$57.18
Massachusetts	$77.77
New Hampshire	$74.89
New Jersey	$55.84
New York[1]	***$65.08***
Rhode Island	$71.23
Vermont	$76.73
New York is a 20 year levelized avoided cost of electricity to reflect April 16, 2009 Operating Plan	

A. Demand Reduction Induced Price Effect (DRIPE)

EE programs provide market price benefits that affect everyone, whether they are a program participant or not. The basic concept behind these benefits is that there is an upwardly sloping supply curve so that a reduction in demand reduces the market price. Or in other words, as demand for electricity decreases due to energy efficiency then electricity prices should decrease since higher cost generators are now no longer needed. Some markets are global in extent; consequently a regional demand reduction will have a negligible impact on prices. However, for some energy resources, especially electricity and perhaps to some extent natural gas, a modest demand reduction will appreciably reduce the market price. This can be seen clearly, for instance, if one looks at the hourly electricity demand and the wholesale market electricity price.

Such overall effects in both the energy and capacity markets are generally known as Demand-Reduction-Induced Price Effects (DRIPE). The 2009 AESC study discusses these in some detail in chapter 6, and we will only briefly summarize those findings here. DRIPE effects are very small when expressed as a fraction of the market price, but significant in terms of total cost impact. The effects will dissipate over time, but the length of the time frame depends on a variety of factors, including the overall growth in demand and the associated addition and retirement of resources.

In Exhibit 6-36 of the AESC report the energy DRIPE is presented as a multiple of the energy price in-state and for the remainder of New England.[51] For example in Massachusetts the annual on-peak factor is 1.00 which means that for each MWh saved there is an equivalent DRIPE effect equivalent to the full market price. Thus the customer reducing their load will reap the direct savings and all other Massachusetts customers will receive an equivalent savings as a side effect. The equivalent coefficient for the customers in the other NE states is 0.86 so their savings will be less. Coefficients for off-peak periods are less. Overall, the annual coefficients by state and period range from 0.12 to 1.42. For our present purposes we can use a coefficient of 0.50 for this effect.

[51] Hornby et al. 2009 Avoided Energy Supply Costs in New England 2009 Report. October 23, 2009, page 6-52. Available at http://www.synapse-energy.com/Downloads/SynapseReport.2009-10.AESC.AESC-Study-2009.09-020-Appendices.pdf

Also since the effects are likely to dissipate over the life of the measure savings we will further halve this effect to 0.25. We expect the dissipation of this price effect to occur, since over some period of time suppliers of electricity will respond to the new market demand for electricity thereby reaching some new equilibrium for the price of electricity. The length of how long this dissipation effect lasts is open to debate but nevertheless, we suggest that DRIPE savings would add an additional 25% to the direct energy savings associated with EE programs.

Appendix II: Data on RGGI Funding of Efficiency Programs

During our research, we found that states report with varying degree of detail about their RGGI funded EE programs. We should caution readers that in many cases, the RGGI funded EE programs are distinct from ratepayer funded programs, where information is more readily available. In Delaware, Maryland, New Jersey, New York, Vermont, and New Hampshire, there is a distinction between programs funded through RGGI and other rate-payer funded programs. As a result, there are reporting differences between the programs in these states compared to rate-payer funded reporting from other states.

The following table summarizes some of the reporting differences among the RGGI funded programs.

Table 9: RGGI Funded Energy Efficiency Programs Checklist

	EE Reports annual tons of CO_2 Reduced	EE Reports lifetime tons of CO_2 Reduced	Annual Energy Savings Reported	Lifetime Energy Savings	RGGI Funding Received in 2009
Connecticut	Yes	Yes	Yes	Yes	Yes
Delaware	NA	NA	NA	NA	No
Maine	No	Yes	Yes	Yes	Yes
Maryland	NA	NA	NA	NA	Yes
Massachusetts	No	No	Yes	Yes	Yes
New Hampshire	No	Yes	No	No	Yes
New Jersey	NA	NA	NA	NA	Yes
New York	NA	NA	NA	NA	No
Rhode Island	No	No	Yes	Yes	No
Vermont	NA	NA	NA	NA	No
Notes NA Not Available Data reported in short tons of CO_2.					

In addition, during our research we found that a number of states had either not disbursed or had delayed disbursements of allocated RGGI proceeds to intended EE projects. This report does not attempt to evaluate or codify reporting requirements across states; we simply tried to collect available and consistent information where possible. A recent Northeast Energy Efficiency Partnership report provides recommendation to standardize reporting requirements to energy efficiency programs.[52]

[52] NEEP's Regional EM&V Methods and Savings Assumption Guidelines (May 2010) and the companion KEMA consulting report provides detailed algorithms and assumption that would feed into reporting requirements that could be incorporated by the states consistently. Both reports are available at http://neep.org/emv-forum/forum-products-and-guidelines

Some state specific details are presented below.

Connecticut

Connecticut program and savings information taken from Connecticut Energy Efficiency Fund 2009 Program report.[53]

Delaware

Delaware will utilize its RGGI proceeds to fund energy efficiency programs through the Sustainable Energy Utility (SEU). We understand that 2009 was an initial start-up year for the SEU.[54] However, information about its 2009 plans or budgets is not available through the SEU website. In addition, we made numerous attempts to obtain this information through other agencies including the Department of Natural Resources, and working groups through Delmarva Power IRP process. As a result, we used Maryland's data as a proxy since the geographic proximity of the two states makes Maryland programs more likely compared to northern New England.

Maine

Maine program and savings information taken from Efficiency Maine 2009 Program report.[55]

Maryland

The Strategic Energy Investment Fund (SEIF) is responsible for 5% of savings under the 2008 EmPower Maryland Act signed by Governor O'Malley.[56] The Maryland Energy Administration's report for FY 2010 provides program detail, however target savings and budgets are not reported in the program plans.[57]

In the absence of available information for 2009, we used utility sponsored DSM program accessed through the Maryland Public Service Commission's website to serve as a proxy for SEIF funded programs.[58]

Massachusetts

Massachusetts data was taken from electric program administrator funded programs that received RGGI proceeds.[59] Program savings were taken from 2009 Plans submitted by each

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[53] Energy Conservation Management Board. Year 2009 Programs and Operations. March 1, 2010. Available at http://www.ctsavesenergy.org/files/Final%202009%20Legislative%20Report%202.19.10.pdf

[54] Personal Conversation with Sean Finneran, SEU on May 15, 2010.

[55] Efficiency Maine. 2009 Annual Report. December 4, 2009. Accessed June 22, 2010. Available at http://www.efficiencymaine.com/docs/em_annualreport2009_final.pdf

[56] EmPower Maryland commits the state to achieve 15% energy reduction by 2015. http://energy.maryland.gov/facts/empower/index.asp

[57] Maryland Energy Administration. Proposed FY 2009 Program from the Maryland Energy Administration. Accessed June 28, 2010. Available at: http://www.energy.state.md.us/documents/MEA_FY09.pdf

[58] http://www.psc.state.md.us/

Program Administrator.[60] Actual energy savings data for 2009 from the Massachusetts Program Administrators is not complete on the MA Department of Public Utilities' website.[61]

New Hampshire

New Hampshire uses its proceeds to fund projects through a Request for Proposal (RFP) process administered through the NH PUC in its Greenhouse Gas Emissions Reduction Fund. CO_2 savings were taken from the 2009 Annual Report submitted to the New Hampshire state legislature by the Department of Environmental Services (DES) and New Hampshire Public Utilities Commission (PUC).[62] Electricity savings estimates based on information provided in proposals submitted by grant recipients.[63]

New Jersey

In our analysis, we used savings results from the New Jersey Clean Energy Program as a proxy for the loan amounts distributed by Economic Development Authority (NJEDA) and via the New Jersey Global Warming Solutions Fund (GWSF).[64] This method may not accurately characterize savings and budgets achieved through the GWSF. We understand that loans in the C&I sector have predominantly funded clean energy projects (solar photovoltaics and combined heat and power). Some of the monies ($2.8 million) allocated for the GWSF have been allocated to provide assistance to low and moderate income ratepayers in the state.[65] In our analysis, we have taken the Environment Northeast March 15, 2010 RGGI Allocation and Auction Proceeds Distribution Plans report to represent energy efficiency allocations for the state.[66]

In February 2010, Governor Christie encumbered approximately $65 million from the GWSF to meet budget shortfalls within the state.[67] As a result, actual spending within New Jersey has been reduced.

New York

In our analysis, we have taken the New York Operating Plan budgets from April 16, 2009 as the basis of our savings for New York in the absence of litigation and policy impacts.[68] We realize

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[59] http://www.mass.gov/?pageID=eoeeasubtopic&L=3&L0=Home&L1=Energy,+Utilities+%26+Clean+Technologies&L2=Energy+Efficiency&sid=Eoeea. Accessed June 22, 2010.
http://www.mass.gov/?pageID=eoeeamodulechunk&L=3&L0=Home&L1=Air,+Water+%26+Climate+Change&L2=Climate+Change&sid=Eoeea&b=terminalcontent&f=doer_rggi_rggi-auction-proceeds&csid=Eoeea

[60] 2009 energy efficiency plans submitted by each electric program administrator are available at the MA DPU website, http://db.state.ma.us/dpu/qorders/frmDocketList.asp

[61] Electronic versions of the 2009 Energy Efficiency programs are available for the Cape Light Compact and NSTAR Electric. http://db.state.ma.us/dpu/qorders/frmDocketFind.asp. Accessed September 28, 2010.

[62] NH DES and PUC. RSA 125-O:21 RGGI annual report required of the Department of Environmental Services (DES) and the Public Utilities Commission (PUC). October 9, 2009. Available at http://des.nh.gov/organization/divisions/air/tsb/tps/climate/rggi/documents/rggi_annual_rept.pdf

[63] Grant proposals available at [63] Grant proposals available at http://www.puc.nh.gov/Sustainable%20Energy/GHGERF%202009%20Grantees.htm

[64] http://www.rggi.org/states/program_investments/New_Jersey

[65] http://www.njcleanenergy.com/files/file/Notice%20EO09010040.pdf

[66] http://www.env-ne.org/public/resources/pdf/ENE_Auction_Tracker_20100315.pdf

[67] http://www.newjerseynewsroom.com/science-updates/christie-cutting-65-million-for-global-warming-prevention

[68] NYSERDA. Operating Plan for Investments in New York under the CO_2 Budget Trading Program and the CO2 Allowance Auction Program. April 16, 2009.
http://www.nyserda.org/RGGI/Files/Final%202009-2011%20RGGI%20Operating%20Plan.pdf

that the reality of the RGGI funded programs in New York is vastly different than the intended plan for RGGI funding. In the case of New York, both litigation and a state budget crisis have impacted the state's RGGI funded programs.

Litigation over the RGGI process resulted in the suspension of RGGI funded program as summarized in the following statement from the state's 2nd Quarter RGGI Status Report:

> "Aside from this initial program activity, in consultation with the Chair of NYSERDA's Board of Directors, NYSERDA's President and CEO has determined that it would be prudent to delay the commencement of spending the RGGI auction proceeds on the entire Operating Plan portfolio due to pending litigation challenging the CO_2 Budget Trading Program regulations asserted by the owners of the Indeck electric generating facility in Corinth, New York."[69]

On October 15, 2009, Governor Patterson announced the transfer of $90 million of RGGI proceeds to the state's General Fund to address some of New York's fiscal difficulties.[70] On December 23, 2009, the parties issued a Consent Decree that addressed the concerns of the parties involved in the lawsuit.[71] These two events have resulted in virtually no spending of RGGI proceeds within the state.

The April 16, 2009, Operating Plan provides three-year aggregated data; our analysis disaggregated the energy savings for 2009 of the three year plan based on *pro rata* annual budgets.

Rhode Island

Data for Rhode Island are based upon National Grid's 2009 DSM program report since their energy efficiency programs serve virtually all of the state and also receive RGGI funding.[72] Under the Rhode Island Office of Energy Resources rules, National Grid is expected to receive at least 60% of RGGI funding.[73] However, we understand that National Grid was allocated, but did not actually receive, its allocated RGGI funding in 2009.[74] The 2010 DSM Plan filed by National Grid includes RGGI revenues that were collected in 2008 and 2009.

Vermont

[69] 2nd Quarter RGGI Status Report

[70] Anderson, Matt. "Governor Paterson Proposes Two-year, $5.0 Billion Deficit Reduction Plan To Address Current-Year Budget Gap, Improve New York's Long-term Fiscal Stability" State of New York Division of the Budget. October 15, 2009. Accessed June 18, 2010. http://www.budget.state.ny.us/pubs/press/2009/press_release09_deficitReductionPlan101509.html

[71] Notice of the consent decree is available at [71] Notice of the consent decree is available at http://www.nyserda.org/rgginotice.asp

[72] 2009 DSM Year-end Report for the Narragansett Electric Company d/b/a National Grid. Dated June 1, 2010.

[73] 2009 Plan for the Allocation and Distribution of Regional Greenhouse Gas Initiative Auction Proceeds, State of Rhode Island and Providence Plantations Office of Energy Resources. Dated September 30, 2009. http://sos.ri.gov/documents/archives/regdocs/released/pdf/OER/5617.pdf

[74] Personnel Communication with Bob Fagan, Synapse and email from Rachel Henschel of National Grid.

Vermont allocates RGGI proceeds to fund expanded fuel efficiency programs for low-income residential customers.[75] In 2009 these programs were administered by both Central Vermont Community Action Council (CVCAC) and Efficiency Vermont.[76] Unlike many of the other states whose proceeds go to electric EE programs, Vermont directs its RGGI proceeds to a program that targets unregulated fuels such as natural gas and fuel oils to achieve thermal efficiency. These results in smaller savings in electricity when compared to other programs offered within the state.

Initially, in the absence of available information from the VT PSB, we decided to incorporate Efficiency Vermont's unregulated fuel services program as a proxy for savings achieved by the fuel efficiency programs funded through RGGI. In conversations with Efficiency Vermont, we understand that the Efficiency Vermont program for unregulated fuel services (a) does not align with CVCAC programs and (b) started during 2009 with limited results.[77] Therefore, we have taken Efficiency Vermont's 2009 Energy Efficiency savings to represent Vermont.[78]

The following table summarizes available participant and incentive cost information based on budget information provided by each state.

Table 10: Participant and Incentive Costs Associated with Each State

State	Program Costs Including Incentives ($000's)	Incentives ($000's)	Participant Costs ($000's)
Connecticut	$73,179	Data Not Presented	Data Not Presented
Delaware	Not Available	Not Available	Not Available
Maine	$13,977	$7,867	$15,434
Maryland	$32,469	$11,122	Data Not Presented
Massachusetts	$184,570	$115,118	$48,404
New Hampshire	$17,661	$17,661	$8,503
New Jersey	$162,072	$123,636	Data Not Presented
New York	$153,964	Data Not Presented	Data Not Presented
Rhode Island	$25,125	Data Not Presented	$14,535
Vermont	$25,978	$9,533	$21,344

Below is a list of individuals whom we contacted to answer and clarify questions that we had in compiling available data. We are grateful for the time spent on educating us on specific details relating to energy efficiency programs funded through RGGI allowances.

75 http://www.rggi.org/states/program_investments/Vermont
76 In 2010, Efficiency Vermont will administer 100% of the funding for fuel efficiency programs.
77 Conversations with Jim Grevatt, Efficiency Vermont. The budget for the unregulated fuels services program in 2009 was $546,000. Most of the program costs were associated with the cost of introducing this new program in 2009. Very little in energy savings was attributed to the actual program.
78 Efficiency Vermont Year 2009 Savings Claim. Efficiency Vermont, Dated April 1, 2010. http://www.efficiencyvermont.org/stella/filelib/EfficiencyVermont2009_SavingsClaim_Final.pdf

Table 11: State Contact Information

State	Contact	Affiliation
Connecticut	Joel Gordes	Energy Conservation Management Board
Delaware	Phil Cherry	Department of Natural Resources and Environmental Control
	Bob Fagan	Synapse Energy Economics
	Sean Finneran	Delaware Sustainable Energy Utility
Rhode Island	Bob Fagan	Synapse Energy Economics
	Rachel Henschel	National Grid
Maryland	Terri Czarski	Office of People's Counsel
New York	Helen Kim	NYSERDA
	Carl Mas	NYSERDA
New Hampshire	Joe Fontaine	Department of Environmental Services
Vermont	Jim Grevatt	Efficiency Vermont