



# A Program that Works

How the Regional Greenhouse Gas Initiative  
Is Helping the Northeast Shift to Clean Energy  
and Reduce Pollution from Fossil Fuels



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# Executive Summary

The Northeast faces two fundamental and intertwined challenges: fossil fuel dependence and pollution from fossil fuels. Our dependence on coal, oil, and gas imposes economic costs, pollutes our air and water, and harms public health. It also contributes to global warming, which threatens the future of our coastal cities with sea-level rise, the future of our beloved ecosystems with the loss of habitats and species, and the well-being of our people with extreme weather events and new threats to public health.

In 2005, leaders in 10 northeastern states took a decisive step against global warming and fossil fuel dependence by agreeing to create a system to limit emissions of carbon dioxide from power plants. Known as the Regional Greenhouse Gas Initiative (RGGI), the system took full effect in 2009, becoming the first mandatory cap on global warming pollution implemented anywhere in the United States.

Two and a half years later, RGGI has largely been a success. It has achieved its goals of sparking investment in clean energy solutions in the region and demonstrating the workability of a program that caps emissions and requires polluters

to pay for the right to emit carbon dioxide. The program's pollution cap, however, will need to be lowered for it to reduce emissions as intended.

## **Fossil fuel consumption at power plants hurts the environment and is a drag on the Northeast's economy.**

- Unchecked global warming could bring floods as severe as today's 100-year floods to Boston and Atlantic City every one or two years by the end of this century.
- Winter recreation—a \$7.6 billion industry in the Northeast—could suffer as global warming cuts ski and snowboard seasons dramatically, potentially ending ski season outside of western Maine by late this century.
- All of the states in RGGI are net importers of fossil fuels. In total, the region imports 98.6 percent of its fossil fuels.

## **RGGI is succeeding at promoting clean energy and demonstrating that a**

**cap on global warming pollution can be implemented smoothly. However, the program needs to be improved in order for its emissions cap to be an effective pollution-fighting tool.**

**RGGI is helping northeastern states address important energy challenges** by providing needed investments in energy efficiency and renewable energy—cutting pollution, curbing dependence on fossil fuels, and creating pioneering clean energy approaches that can be adopted by other states and nationally.

- **Connecticut**, which has the highest electricity costs in the continental United States, is developing on-site distributed generation as an alternative to expensive fossil fuels, installing solar panels on schools, town halls, and other buildings across the state.
- **Delaware** is using RGGI funds to support its pioneering business model of a “sustainable energy utility.” Delaware’s Sustainable Energy Utility finances clean energy projects by claiming a share of the benefits over time to recoup its investment.
- **Maine** is using RGGI funds to fund large-scale efficiency projects at businesses, colleges, and factories. RGGI has allowed the state to fund projects that cut electricity usage by the equivalent of hundreds of average homes’ needs with single large projects—like motor replacements at a paper mill, or large-scale retrofits at a chemical plant.
- **Maryland**’s aging stock of apartment buildings has historically been difficult to reach with standard energy efficiency programs. RGGI

has enabled the state to create a new Strategic Energy Investment Fund, which has taken on projects such as renovating 1,600 apartment units for increased efficiency in 2009, measures that will produce \$68.5 million in lifetime energy savings.

- **Massachusetts** is helping cities and towns make long-term investments in clean energy programs. Through the RGGI-funded Green Communities program, Massachusetts provides clean energy grants to local governments such as Boston, which has used the funds to install energy-efficient LED streetlights that will save the city money for years to come while curbing pollution.
- **New Hampshire** has issued grants to a number of small programs, including a highly successful revolving loan fund that offers an example of a self-sustaining model for financing clean energy.
- **New Jersey** has long been dependent on power imported from other states. The state has used RGGI funds to build on its leadership in developing a home-grown source of renewable power: solar energy. RGGI-supported loans, for example, have helped pay for the largest solar energy system at a university anywhere in the country.
- **New York** has used its RGGI funds to pursue a mix of efficiency measures and workforce development—saving energy while creating local jobs, instead of importing fossil fuels.
- **Rhode Island** has used its RGGI funds to run a variety of pilot programs, testing promising new

approaches to improve energy efficiency. One pilot program, for instance, combines multiple residential retrofit measures into wholesale renovations for homes and small apartments.

- **Vermont** has used its RGGI funds to expand the program offerings of its energy efficiency utility, Efficiency Vermont, into heating fuels. Efficiency measures undertaken as part of that program will save \$10 million over their lifetime.

**RGGI has demonstrated that a program that caps emissions and auctions pollution allowances can operate smoothly.**

- As the first program in the United States to limit global warming emissions and auction pollution allowances, RGGI plays an important role in demonstrating that other states, other regions, and the nation as a whole could use a similar model to reduce emissions.
- After 11 auctions, RGGI's market monitor has seen no evidence of allowance-hoarding, speculation, market manipulation, or other flaws in the auction program. The program has raised \$872 million over this period.

**RGGI's pollution cap needs to be lowered to be effective.**

- In 2005, RGGI's initial cap on carbon dioxide emissions was set based on projected power plant emissions in 2009. Between 2005 and 2009, however, a number of unexpected factors, including milder weather and relatively cheap natural gas, caused emissions to decline 34 percent below the cap.
- Emissions from power plants in the RGGI states are now not expected to surpass the cap before 2030.

**The RGGI states should build on the program's success by tightening the cap and expanding their commitments to clean energy.**

- All RGGI funds should be spent on clean energy. To date, 32 percent of RGGI funds have been spent on purposes like deficit reduction and utility bill relief. Though these are worthwhile expenditures, they do not deliver the long-term environmental and economic benefits that clean energy investments offer.
- RGGI's cap should be lowered, setting actual 2009 emissions as its starting point and aiming to cut 20 percent below that level by 2020, and 40 percent below by 2030.



# Introduction

The Northeast is a region of incredible diversity. It is a place where one can enjoy the urban bustle of New York City or Boston just hours from the wilderness of the Great North Woods or the beaches of the Jersey Shore. It is a region of many kinds of people, where recent immigrants from around the globe live right down the road from families with centuries-old roots in the region. And it is a place with a diverse economic base, encompassing both the traditional farms of rural Vermont and the fast-paced knowledge-based industries arising from the region's many great universities.

But, for all the ways we are different, there are two things that all Northeast states share: dependence on fossil fuels for our energy supplies, and a near absence of those fuels within our borders. Our dependence on dirty fuels from outside the region has left us economically vulnerable and has resulted in pollution that threatens our health—as well as the future of the planet.

While the northeastern states face common energy challenges, our diversity means that those challenges aren't *exactly* alike. Residents of states such as Maine and

Vermont, for example, worry about how to reduce the demand for home heating oil that delivers an economic body blow to families in those states each winter, while states like New Jersey struggle to provide enough clean electricity to power their economies without having to invest in expensive new transmission lines or new fossil fuel power plants that pose dangers to the environment and public health.

How can the states of the Northeast work together to address our common energy challenges—while also enabling each state to prioritize its own, most critical problems?

In 2005, 10 northeastern governors—of both political parties—came together to provide an answer: the Regional Greenhouse Gas Initiative, or RGGI. RGGI is designed to curb global warming pollution from the region's fossil fuel-fired power plants and begin to transition the region toward a clean energy future.

By joining together, those governors knew that the northeastern states could achieve greater results in the drive toward clean energy, and do so at lower cost, than they ever could ever achieve separately.

At the same time, however, the archi-

tects of RGGI created a way for states to use proceeds from the program to invest in addressing their own clean energy priorities—a development that has unleashed the region’s tremendous creativity and innovation in the design of clean energy programs, while delivering cleaner air and lower utility bills for thousands of homeowners and businesses.

In this paper, we evaluate RGGI’s performance as a regional emission-reduction program and as a model program that can be adapted elsewhere. We also tell the

stories of how each of the Northeast states is using RGGI in its own unique way—expanding existing clean energy programs, focusing resources on key priorities, and developing revolutionary new approaches to integrating energy efficiency and renewable energy into our economy.

RGGI is not a perfect program. But it is delivering real results that are helping the region to break free of its dependence on fossil fuels and build a cleaner, healthier future.

# The Regional Greenhouse Gas Initiative Is Helping the Northeast Break its Dependence on Fossil Fuels

The Northeast has little to gain from our dependence on fossil fuels, and much to lose. No northeastern state possesses significant native fossil fuel resources, and all face serious consequences if global warming goes unchecked. The northeastern states do, meanwhile, have the resources to replace fossil fuels—renewable energy resources like wind and solar energy, and a skilled workforce that can go to work reducing energy needs through efficiency measures.

In order to jump-start the transition from imported fossil fuels to local clean energy solutions, 10 northeastern states have created the Regional Greenhouse Gas Initiative (RGGI)—the first binding cap on global warming pollution implemented in the United States. By auctioning off the right to pollute through the RGGI program, the states have also raised the money needed to fund a broad range of clean energy programs.

## Fossil Fuels Harm the Northeast's Environment and Economy

The Northeast has an energy problem. Our dependence on fossil fuels pollutes our air, weakens our economy, and damages the health of millions. Worse, it contributes to the problem of global warming, which threatens to wreak even more serious harm through rising sea levels, increasingly severe weather, and habitat and species loss.

Fossil fuels are the primary drivers of global warming, which has the potential to dramatically change large parts of the Northeast. Among the potential impacts:

- By the end of the century, coastal floods as large as today's hundred-year floods could occur once every one or two years in Boston and Atlantic City, and almost once every decade in New York City.<sup>1</sup>

- Maine’s spruce and fir forests—important to the state’s paper industry—could decline by the end of the century as temperatures warm. Sugar maples, the basis for New England’s maple syrup industry, could lose large amounts of habitat, pushing the industry north into Canada.<sup>2</sup>
- The Northeast’s \$7.6 billion winter recreation industry could be hard hit; by late this century, winter weather could be too warm to sustain a ski season anywhere in the region outside of western Maine, and snowmobiling seasons could be cut dramatically in length.<sup>3</sup>
- By mid-century, Baltimore could see 10 additional days every summer where temperatures rise high enough to cause heat-related deaths, leading to almost 100 additional deaths every summer.<sup>4</sup>

Fossil fuels are also responsible for other kinds of pollution that impact public health and the environment. Burning fossil fuels produces nitrogen oxides, a key component of smog; sulfur dioxide, the major contributor to acid rain; and mercury, a neurotoxin that can impair the mental development of fetuses, infants and children.<sup>5</sup>

Beyond their public health and environmental impacts, fossil fuels are a drag on the Northeast’s economy. All of the RGGI states consume more fossil fuels than they produce, and most lack fossil fuel resources of any significance. In total, the region imports 98.6 percent of its fossil fuels from other states or countries.<sup>6</sup> Six of the 10 RGGI states appeared on the Union of Concerned Scientists’ list of states most dependent on imported coal.<sup>7</sup> The Northeast states burn more oil for their electricity needs than any other region in the continental United States.<sup>8</sup> Replacing

fossil fuels with clean energy substitutes an engine of local jobs and economic growth for a persistent drain on state economies.

## RGGI Was Created to Cut Fossil Fuel Dependence in the Electricity Sector

In 2005, 10 governors in the Northeast created a cooperative effort to fight global warming and reduce fossil fuel dependence: the Regional Greenhouse Gas Initiative (RGGI). By acting together against the collective threat of global warming, the states aimed to make a dent in that problem and to spur the development of a clean energy economy across the region.

The structure of RGGI is simple. States issue allowances for the right to emit carbon dioxide, the most important global warming pollutant. Power plants that emit carbon dioxide have to purchase allowances to match their emissions. Over time, the number of allowances declines, putting pressure on utilities to reduce their emissions. At the same time, states reinvest the proceeds from auctioning allowances in clean energy improvements—from wind and solar energy facilities to building renovations that improve energy efficiency.

The program originated in 2003, when New York Governor George Pataki circulated a letter to the governors of 10 other northeastern states calling for the creation of a regional agreement to reduce global warming pollution from their states.<sup>9</sup> Nine of those states—Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont—began working together to develop a cap-and-trade program for power plants. In 2005, those states, with the exception of Massachusetts, signed a memorandum of understanding that created

the program. Before the first auction took place in 2008, Maryland and Massachusetts joined as participants.

## Goals of the Regional Greenhouse Gas Initiative

RGGI has three goals. First, it aims to cut emissions from power plants by imposing a cap on pollution. Second, it aims to spur the development of a clean energy economy by providing funds for clean energy investments—creating a dynamic in which fossil fuels are pushed out of the region’s electricity grid while clean energy is ushered in to replace them. Finally, as the first program of its kind targeting global warming pollution in the United States, RGGI aims to demonstrate how other states and regions can cut their own emissions.

### **Goal 1: Cut Emissions by Imposing a Cap on Global Warming Pollution**

Every year, power plants in the northeastern states emit over 120 million tons of carbon dioxide, the leading global warming pollutant. In 2009, power plants in the RGGI states alone accounted for 2 percent of the nation’s emissions of carbon dioxide (the electric power sector nationwide accounted for 39 percent of the nation’s total).<sup>10</sup> In 2007, power plants in the RGGI states emitted more carbon dioxide than the entire economies of all but 30 countries in the world, producing almost as much carbon dioxide as the entire nation of Pakistan.<sup>11</sup>

The central purpose of RGGI is to cut pollution by using a market-based emissions trading system to limit emissions from these power plants. At the time the program’s cap was set, it was intended first to stabilize emissions at 188 million tons of CO<sub>2</sub> annually, and then, after 2015, to

steadily reduce emissions by 2.5 percent per year.<sup>12</sup> As demand for allowances—essentially, permits to pollute—runs up against the limit imposed by the cap, prices for allowances should rise, encouraging utilities to pursue emissions reduction opportunities.

The program was designed so that even if demand for allowances remains significantly below the cap, the requirement to buy allowances will exert slight downward pressure on emissions. RGGI’s allowance auction system includes a price floor—currently \$1.89 per ton of carbon dioxide.<sup>13</sup>

### **Goal 2: Build a Clean Energy Economy**

For the Northeast to end its dependence on fossil fuels, just cutting emissions from existing dirty facilities will not be enough. We will also need to develop and implement alternatives to fossil fuels—efficiency improvements that reduce the overall need for energy, and renewable electricity sources like wind or solar power, which will help achieve necessary emissions cuts at the lowest cost. The second core goal of the RGGI program, therefore, is to jump-start the transition to a clean energy economy based around these energy technologies.

RGGI was intended to be an important complement to a series of policies—including renewable electricity standards requiring the development of wind, solar, and other renewable sources, and energy efficiency targets for utilities—that move the region toward a clean energy economy.

By taking the lead in investing in clean energy, the RGGI states hoped to secure a leading role in the growing clean energy industry, deriving economic benefits along with cleaner air.<sup>14</sup> Accordingly, each of the RGGI states, in their plan for spending RGGI proceeds, made clean energy the top priority.<sup>15</sup> RGGI funds allowed the states to expand successful existing programs, initiate new types of clean energy programs,

and incubate promising new approaches and technologies.

**Goal 3:  
Demonstrate a Working Cap on  
Global Warming Pollution**

America and the world have long sought effective policies to rein in global warming. Over the past several decades, policy-makers have proposed and implemented a variety of strategies for creating an enforceable cap on pollution, allocating the costs and benefits of pollution cuts fairly and efficiently, and financing the transition to a clean energy economy.

As the first market for greenhouse gas allowances in the nation, RGGI took a prominent role in demonstrating the feasibility of cap-and-trade as an approach for tackling global warming. Cap-and-trade had a history as a pollution reduction mechanism, dating to the successful sulfur dioxide emissions permit program that President George H. W. Bush signed into law in 1990, but skeptics argued that a cap-and-trade program for carbon dioxide would prove unfeasible.<sup>16</sup> Early observations of the RGGI process highlighted the fact that RGGI's success or failure would

be used to judge the viability of trading systems as an environmental solution for other regions.<sup>17</sup>

RGGI's carbon market hewed as closely as possible to the ideal design for a pollution reduction market. Unlike the carbon market in Europe—which enriched power plant owners by giving away emission allowances for free—the RGGI states chose to auction the vast majority of allowances.<sup>18</sup> By doing so, RGGI ensured that the value of the allowances would flow to public purposes, in most cases consistent with the emission reduction objectives of the program, rather than to utilities or other entrenched interests. The RGGI states also initially limited the extent to which utilities could reduce their allowance requirements by purchasing “offsets”—credits given for investing in projects that cut global warming pollution by means other than directly reducing emissions in the electric sector. Offsets are harder to track, verify, and account for than straightforward emissions reductions, so the RGGI states chose to allow them only in small numbers at first, with the possibility of scaling up their use over time.<sup>19</sup> As of May 2011, no offsets have been issued.<sup>20</sup>

# RGGI Is Bringing Clean Energy Progress, but Could Do Even More to Drive Emission Reductions and Clean Energy

After two years in operation, RGGI has contributed significantly to promoting clean energy, even as it has become apparent that the program needs to be improved by lowering its cap on emissions. Each state in the RGGI program has taken advantage of its RGGI funding to tackle its specific energy problems with appropriate clean energy programs. RGGI has also demonstrated that a cap-and-trade program for carbon dioxide can be run transparently and efficiently. Its cap, however, needs to be lowered in order to reduce emissions from present levels.

## RGGI Funding Has Helped Spark the Transition to a Clean Energy Economy

In 11 auctions through early 2011, RGGI has generated \$872 million for the member states to invest in clean energy. A report by Environment Northeast (ENE) found that states have spent \$440 million of that

income on energy efficiency, bringing in lifetime savings of \$1.1 billion.<sup>21</sup>

Clean energy has unique value as an economic investment, since it transfers consumer spending away from fossil fuels, which are imported from outside the region, toward locally developed clean energy alternatives. Efficiency has even further benefits, since it lowers electricity bills significantly, allowing consumers to spend money on other goods and stimulating the state's broader economy. In total, ENE found that efficiency spending of RGGI funds has created the equivalent of 20,000 job-years of employment, and increased the gross state product of the participating states by \$2.6 billion.<sup>22</sup>

Every state participating in RGGI faces its own energy challenges. In the northern portion of the RGGI region, Maine and Vermont are aiming to reduce their dependence on expensive home heating oil. New Jersey, meanwhile, has air quality issues and congested transmission lines that make it difficult to meet its electricity needs, and needs homegrown clean energy to replace dirty conventional generation. In Maryland, rising power costs prompted ambitious

**Table 1: Proceeds and Benefits from RGGI Allowance Sales by State<sup>23</sup>**

State	Revenue (\$m)	Energy Efficiency Funding (\$m)	Savings (\$m)	Job Years	Gross State Product Growth (\$m)
Connecticut	\$49.5	\$34.4	\$123.7	1,416	\$195.9
Delaware	\$21.3	\$9.0	\$24.5	412	\$53.4
Maine	\$26.0	\$24.0	\$113.0	1,397	\$117.8
Maryland	\$162.5	\$38.2	\$105.9	1,740	\$225.6
Massachusetts	\$136.3	\$120.6	\$373.8	5,233	\$771.6
New Hampshire	\$31.5	\$27.7	\$94.6	1,458	\$163.2
New Jersey	\$113.3	\$35.6	\$89.3	1,618	\$209.9
New York	\$312.3	\$137.3	\$136.0	6,249	\$810.3
Rhode Island	\$13.6	\$7.8	\$24.8	379	\$42.1
Vermont	\$6.3	\$6.2	\$22.9	307	\$26.6
Total	\$872.7	\$440.8	\$1,108.6	20,208	\$2,616.4

efficiency goals, which require the state to take advantage of all possible efficiency opportunities.

RGGI has allowed each of these states to pursue its own clean energy priorities. For some, that has meant cracking down on dependence on particular fuels; for others, it has meant promoting the growth of promising clean energy industries. That flexibility has been one of the program's strongest suits. Where better home heating efficiency is needed, RGGI has helped support weatherization measures. Where renewable energy alternatives are required, RGGI has become a source of financing for solar energy. Where states have needed to expand the reach of their efficiency efforts, RGGI has funded innovative efforts that take advantage of savings in places like municipal offices or apartment buildings.

Those investments have brought real progress toward clean energy. Connecticut, for instance, has installed efficiency measures with the support of its RGGI funds that save customers \$11.4 million annually, and reduce annual CO<sub>2</sub> emissions by 35,971 tons.<sup>25</sup> Maryland, meanwhile, has leveraged

its RGGI funds into efficiency investments that will save consumers \$68.5 million over their lifetime, and its combined RGGI investments in efficiency and renewable energy are reducing emissions by 21,000 tons of CO<sub>2</sub> annually.<sup>26</sup>

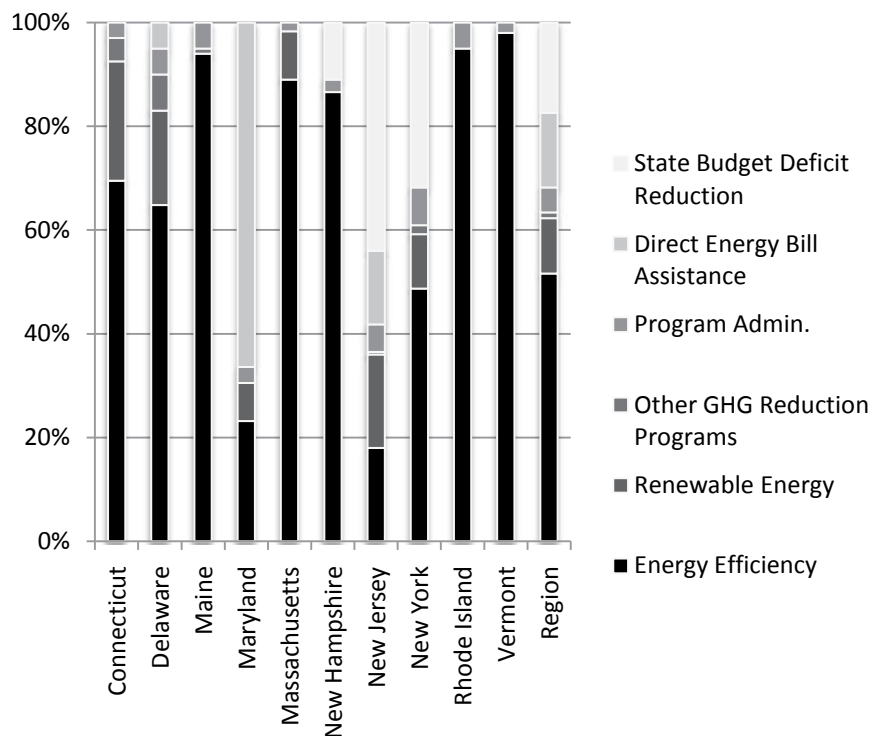
Meeting the challenge of global warming will require simultaneous efforts on a number of different fronts. The RGGI states, with the varied approaches that they have taken to their individual energy problems, are making steady progress while demonstrating to the rest of the country how customized clean energy programs can benefit states and steadily reduce emissions and dependence on fossil fuels.

### **Connecticut: Tackling High Electricity Costs with On-Site Generation**

Electricity in Connecticut is more expensive than in any other state in the continental United States.<sup>27</sup> The state depends on power from the New England regional market, where high-cost natural gas peaking power plants set the price of



**Figure 1: Investment of Proceeds from RGGI Allowances by State, 2009-2010<sup>24</sup>**



electricity on hot summer days.<sup>28</sup> With an already-congested transmission grid and no significant native fossil fuel resources, the state has limited choices for how to solve its energy problems.

Locally developed clean energy—from solar panels on rooftops to more efficient buildings that draw less from the grid—is one solution that can integrate smoothly into Connecticut’s existing infrastructure, without putting new stress on the electricity grid. RGGI has enabled Connecticut to channel funds into developing new clean energy sources in the communities where electricity is needed and consumed.

Solar panels are one of the best options for on-site distributed generation, since they can be installed unobtrusively on top of most buildings, and produce electricity during summer midday demand peaks, when residential and commercial customers are drawing most heavily from the grid.<sup>29</sup>

Connecticut has been able to use RGGI funds to bring solar energy to cities and towns across the state by targeting buildings like schools and town halls—which often have large, flat roofs and are centrally located in their communities.

As of June 2010, RGGI funds have paid for completed photovoltaic installations at 7 sites across Connecticut, and another 16 projects are underway—20 of the 23 at schools, town halls, or public libraries.<sup>30</sup> Those installations move the state towards greater reliance on clean, safe, local energy alternatives—and also make an immediate impact on school and town budgets. At Island Avenue Elementary School in Madison, for instance, solar panels installed in August of 2010 will save the school \$9,000 annually.<sup>31</sup> Projects like these are helping budget-stressed towns and school districts, while helping Connecticut as a whole escape from its expensive fossil fuel dependence.

## **Delaware: A “One Stop Shop” for Clean Energy**

Delaware has taken advantage of its participation in RGGI to launch a unique and innovative model for clean energy development. The state has created a “Sustainable Energy Utility,” (SEU) which aims to be a “one-stop shop” for energy efficiency and renewable energy for consumers in the state.<sup>32</sup> Through its Energize Delaware programs, the utility offers a range of renewable energy and energy efficiency options to all Delawareans. The SEU maintains a stable fund to invest in clean energy measures by claiming a portion of the savings from many of its investments. For instance, a homeowner who purchases a more efficient refrigerator with help from the SEU pays back the loan they receive in increments out of the energy savings they realize.<sup>33</sup> In certain cases, the SEU actually takes responsibility for hiring a contractor, who guarantees a certain amount of energy savings over time—in essence “purchasing efficiency” from the contractor.<sup>34</sup> The SEU recoups its investment through payments from the building owner taken out of the energy savings.

This model—a fund that replenishes itself through the savings it helps generate—has been copied by other jurisdictions. Washington, D.C., passed legislation modeled on the SEU in July 2008, and the National Council of State Legislators has endorsed the model as worthy of federal consideration.<sup>35</sup>

## **Maryland: Unlocking Efficiency Opportunities in Apartment Buildings**

Maryland joined RGGI at a time when rising energy costs had made the state’s need for strong efficiency measures clear. Between 1999 and 2008, power rates skyrocketed in Maryland, with average residential bills increasing by 30 percent,

as a result of both increased per capita use and higher rates.<sup>36</sup> In response, the state adopted efficiency goals that rank among the nation’s strongest through the EmPOWER Maryland Act, passed in 2008. The state aims to reduce per capita electricity usage 15 percent by 2015, with utilities and the state each responsible for achieving part of the goal.

To hit its ambitious energy savings goals, Maryland needs to reach beyond the savings that standard energy efficiency programs can readily deliver. For instance, while utility-administered efficiency programs do a good job of helping homeowners renovate their homes or purchase efficient appliances, such programs have greater difficulty taking advantage of efficiency opportunities in apartment buildings.

Apartment buildings are a particularly promising location for efficiency renovations, but are hard to reach with programs that are designed to target homeowners. Building owners have little incentive to invest in efficiency if their tenants pay the utility bills. Tenants, meanwhile, are disproportionately lower or middle income, and have limited resources and ability to invest in efficiency measures themselves. To address this need, the Maryland Energy Administration coupled its efficiency program for apartments with existing apartment renovation programs operated by the state’s Department of Housing and Community Development, carrying out efficiency renovations as an additional measure on apartments already undergoing work. Over the course of 2009, the state was able to renovate 1,600 apartment units, and continues to move ahead with more renovations.<sup>37</sup>

## **Massachusetts: Green Communities Leading the Way**

Massachusetts has used its participation in RGGI as an opportunity to bring energy efficiency measures to the infrastructure

owned and managed by cities and towns across the state. Like many of the other states in RGGI, Massachusetts has long had programs that effectively allow home and business owners to take advantage of efficiency, but municipal facilities present different challenges. On one hand, cities and towns own and maintain buildings and infrastructure—from schools, libraries and municipal office buildings to street lights—that represent some of society’s best candidates for efficiency improvements. On the other hand, municipal governments have limited resources—particularly during an economic downturn when tax receipts fall—and cannot take advantage of policies like tax incentives that are often used to incentivize efficiency. As a result, needed efficiency measures can be put off for years or decades—at a steep cost in accumulated energy bills.

Massachusetts has used its RGGI funds to provide the capital that municipal governments otherwise lack for valuable efficiency measures. The state’s Green Communities Program provides municipalities with grants to enable them to take advantage of clean energy opportunities. Cities and towns have received grants for purposes ranging from installing spark plugs on gas lights in Boston (allowing them to fully shut off in the daytime) to thorough efficiency renovations of police stations, libraries, and other public buildings.<sup>38</sup> Cities and towns frequently have the opportunity to take advantage of large-scale efficiency savings. Boston, for instance, plans to replace 20,000 street lights with LED lights this year, supported by a Green Communities grant.<sup>39</sup> In total, the city has 64,000 street lights; replacing them all with LED lights would cut the city’s carbon dioxide emissions by 4 percent.<sup>40</sup>

Many cities also operate aging municipal buildings that are ripe for efficiency renovations. In Athol, a town of 11,000 people in western Massachusetts, town

government had for years lacked funds to renovate the aging town hall, even though the 1920s-era building’s windows provided completely inadequate insulation.<sup>41</sup> After a RGGI-funded grant enabled the town to replace the windows, the building’s furnace use dropped—even as employees also stopped using the electric space heaters they had relied on to stay warm.<sup>42</sup>

### **Maine: Big Savings from Big Projects**

Maine is a cold state with old buildings, and relies heavily on expensive, inefficient fuels like fuel oil. That reliance is costly for both homeowners—who are vulnerable to fuel cost spikes in the winter—and businesses—which have to contend with out-of-state competitors that may have significantly lower energy costs. RGGI has helped Maine address the second of those concerns by investing in retrofits that help businesses cut energy costs and remain competitive.

Efficiency Maine, Maine’s energy efficiency utility, offers a range of efficiency programs suited for energy customers on all different scales—from residential lighting replacement initiatives to commercial building energy audits. RGGI funding has allowed Efficiency Maine to expand its programs to include a large projects grant program aimed at helping large scale energy users, like industrial facilities or very large buildings, undertake efficiency projects that can make a significant dent in their energy costs.

In Searsport, Maine, for instance, a RGGI grant helped GAC Chemical, a local company that had been looking to cut energy costs to remain competitive, undertake an efficiency retrofit that will save 275,000 gallons of heating oil—enough to heat 247 homes—and 223,000 kilowatts of electricity—enough to power 35 homes—annually.<sup>43</sup> Another project—upgrading drives at a paper mill in Madawaska—will save enough

electricity to power over 900 homes annually.<sup>44</sup> By allowing Maine to take advantage of large scale opportunities like these, RGGI is making the state's industries more efficient and nationally competitive.

### **New Hampshire: A Self-Sustaining Model for Efficiency Funding**

Innovation is the name of the game for New Hampshire's approach to energy efficiency. Unlike most of the RGGI states, which have focused their efforts on a small number of flagship programs, New Hampshire has chosen to experiment—investing relatively small sums in a number of different programs, each promoting energy efficiency in a different way.

One of the successful programs launched with New Hampshire's RGGI funds has been a revolving loan fund operated by the state's Business Finance Authority (BFA). Revolving loan funds are a form of financing that allows an initial grant to fund multiple improvements over time. The fund issues low-interest loans to businesses to enable cost-saving improvements like energy efficiency measures. As the loan recipients realize the savings from those improvements, they pay back the loan fund with a portion of the savings, allowing the fund to issue more loans.

The New Hampshire BFA's efficiency loan fund began with a \$2 million grant from New Hampshire's RGGI funds. In 2009, the BFA's loan fund made one of its first loans to Foss Manufacturing Company, a manufacturer of advanced fibers and fabrics located in the town of Hampton. The \$750,000 loan allowed the company to invest in more efficient motors, replace its lighting fixtures with efficient alternatives, and rewire a poorly configured electrical system, and led to a \$65,000 reduction in the company's energy bill in just two months. In total, Foss expects that the project will save it \$750,000 annually

on electricity—an impressive return on investment and a quick return for the BFA, which will be able to recoup its loan and assist other businesses.<sup>45</sup> To build on this success, the BFA received a second \$2 million grant in 2010.<sup>46</sup>

In 2009, through this and other efforts, New Hampshire implemented efficiency measures which will reduce energy costs for customers in the state by \$1.5 million annually, and prevent the emission of over 4,000 metric tons of greenhouse gases every year. In the program's second year, the results of which haven't been evaluated yet, the program's managers expect those figures to increase to \$4.2 million in savings annually, and annual greenhouse gas reductions of over 13,000 metric tons.<sup>47</sup>

### **New Jersey: Turning to Solar to Solve an Energy Crunch**

New Jersey is a state with unique energy challenges. As one of the most densely populated states in the country, it needs to deliver huge amounts of electricity to its residents. At the same time, it relies on already congested power lines to bring that power into the state, and has elevated levels of air pollution; in 2009, air quality monitors in New Jersey detected potentially unhealthy levels of pollution in at least one location on 18 days and moderate levels on nearly one out of every two days of the year.<sup>48</sup>

To meet its power needs without overburdening its transmission grid or impairing its air quality, New Jersey needs to develop local clean energy options. Solar energy—which can be installed on rooftops, requiring no new land area for development or transmission resources for delivery—provides an option that is ready to use right now.

To meet its energy challenges, New Jersey has become one of the leading solar energy states in the country. In fact, the state ranks second only to California

for quantity of solar generation capacity installed—surpassing even southwestern desert states like Nevada and Arizona.<sup>49</sup> RGGI funds have allowed New Jersey to build on its success with solar energy, as well as to invest in efficiency opportunities. The state's Clean Energy Solutions Capital Investment (CESCI) program has issued a number of grants to allow businesses and municipalities to invest in clean energy, with solar energy receiving particular attention.<sup>50</sup>

In one project, a CESCI loan helped finance the installation of solar panels over a parking lot at William Paterson University—the largest solar installation at a university in the country.<sup>51</sup> With a CESCI loan of \$5 million, the state was able to attract an additional \$10 million of private investment.<sup>52</sup> Three megawatts (MW) worth of solar panels began producing electricity in 2010, and an additional 500 kilowatts worth will be installed in 2011, resulting in 3.5 MW of production capacity in total. Over its lifetime, the system is expected to save the university \$4.3 million on energy—and, because of the use of a financing model in which the outside developer owns the panels, required no upfront investment from the school.<sup>53</sup>

### **New York: Developing a Workforce for the Clean Energy Economy**

As the Northeast's largest state, and the home of the nation's largest urban area, New York has one inexhaustible resource with which to meet its energy needs: its people. In recognition of that fact, New York has combined efficiency efforts with workforce training through its Green Jobs-Green New York (GJGNY) program to ensure that RGGI funds help it create a sustainable basis for an energy economy based around local jobs instead of imported fuels.

A skilled efficiency workforce, is, in essence, an energy resource in and of itself;

in place of extracting fossil fuels, a state can rely on the brainpower and skill of its residents to save energy where possible, and produce it from renewable sources where needed. The GJGNY program aims to foster the development of that resource by providing New Yorkers with the resources they need to make valuable efficiency investments, at the same time as training the workforce that will become a homegrown solution for New York's energy needs.

GJGNY aims to take advantage of savings potential in space heating and water heating—a source of potentially enormous savings in a cold state like New York, but one which existing programs have not fully utilized.<sup>54</sup> Job training programs, meanwhile, ensure that New Yorkers who go shopping for efficiency will find a workforce ready to serve them. With that combination—lowering barriers to investment on one end and developing a clean energy workforce on the other—New York is taking advantage of RGGI to jump start a wholesale transformation of its energy economy.

### **Rhode Island: Doubling Down on Energy Efficiency**

In the near future, Rhode Island will face an important choice; the state can either invest in high-cost, polluting energy sources such as new peaking power plants and spend money on new distribution infrastructure capable of carrying larger amounts of electricity, or it can pursue distributed resources like energy efficiency and distributed, on-site renewables.<sup>55</sup> Whichever strategy the state chooses will shape its electricity grid for years. Right now, Rhode Islanders are vulnerable to price fluctuations in the fossil fuel market, since the state's main source of power is natural gas—a fuel with historically volatile prices.<sup>56</sup>

In 2006, Rhode Island passed a comprehensive energy law aimed at meeting

the state's energy challenges in a way that benefits consumers and the environment.<sup>57</sup> The law set out a strategy of “least-cost procurement”—emphasizing resources like energy efficiency that allow the state to meet its energy needs without driving up costs or requiring costly infrastructure replacement.

RGGI funds have helped Rhode Island build on this strategy by expanding its existing suite of utility programs, offered through the state's major utility, National Grid. RGGI programs have financed several pilot programs that National Grid has used to test new approaches for implementing efficiency measures. In 2010, for instance, the state gave National Grid approval to start a pilot program aimed at performing deep energy retrofits on houses and small multi-family dwellings.<sup>58</sup> The program aims to achieve large energy savings at relatively low cost by carrying out super-insulation upgrades and other measures at the same time as measures like roof or siding replacement—allowing workers to complete the projects at less cost than would be required to undertake each separately.

The state has achieved impressive results; in 2010, National Grid's programs achieved a 3.4 to 1 benefit to cost ratio—\$123 million worth of benefits from a \$26 million investment.<sup>59</sup>

### **Vermont: Building on Success to Cut Heating Costs**

Vermont is a cold weather state with great potential to save energy and money by investing in heating efficiency. It was the first state in the country to create an “efficiency utility,” Efficiency Vermont, pioneering a model that Maine has now also adopted. Efficiency Vermont is operated by an independent nonprofit, and delivers energy efficiency services to utility customers across the state.<sup>60</sup> By offering efficiency programs for the whole state through a

single provider, Vermont has ensured that all utility customers can take advantage of similar efficiency opportunities. Efficiency Vermont has been operating since 2000, and has delivered energy savings with a lifetime value of over \$643 million.<sup>61</sup>

While Efficiency Vermont has been delivering electricity savings since 2000, for years it lacked the ability to attack the problem of heating oil dependence—a serious energy problem in Vermont and other northern New England states. With RGGI funds, however, Efficiency Vermont was able to implement efficiency programs that targeted heating oil and other liquid fuels beginning in 2009. Those include expensive fuels like home heating oil and propane, which are used to heat most homes in Vermont.<sup>62</sup>

In 2011, Vermont established a loan loss reserve fund with \$1 million from RGGI proceeds. The fund will facilitate property owners investing in energy upgrades and is projected to leverage more than \$20 million in private capital. By investing \$2.7 million—just under half its RGGI proceeds from the program's first ten auctions—in these fuel efficiency programs, Vermont has achieved savings with a lifetime economic value of over \$10 million.<sup>63</sup>

### **RGGI's Cap-and-Trade Program Has Worked Effectively**

RGGI's auction program, which held its first auction in 2008, was the first of its kind in the United States, establishing a market in which utilities and other power plant owners paid for the right to emit global warming pollution. As such, it provided an important test case for caps on global warming pollution. Policymakers and the media observed the first auction

with interest to see if a pollution cap could operate smoothly.<sup>64</sup>

After 11 auctions between September 2008 and April 2011, the technical functions of RGGI's carbon market have been an unqualified success. The RGGI auctions are overseen by an independent, professional market oversight company, Potomac Economics, which also monitors several of the nation's major electric power spot markets.<sup>65</sup> In its reports on RGGI auctions and accompanying secondary markets, Potomac Economics has found a smoothly functioning market, free of manipulation and excessive concentration.<sup>66</sup> Among the evidence that RGGI's market is functioning as designed:

- RGGI allowances have been purchased primarily by the utilities and other companies that need them, evidence that outside speculators are not interfering in the market.<sup>67</sup>
- RGGI's auctions have been competitive, with a large number of companies bidding for the available allowances. Markets with large numbers of bidders are more competitive and less susceptible to manipulation.<sup>68</sup>
- Firms' holdings of allowances have been in line with their expected need for allowances, indicating that market participants are purchasing allowances almost exclusively for their own future use, not hoarding them.<sup>69</sup>

In addition to ensuring that the RGGI market is transparent to the public, the market monitor reports have shown that the market is functioning well. Other governments considering market-based mechanisms for restricting global warming pollution should be encouraged by this result, and the RGGI states can trust that they have an efficiently functioning tool at their disposal should they choose

to pursue more aggressive savings targets by lowering their emission cap in the future.

## RGGI's Cap Needs to Be Strengthened

While RGGI has succeeded at establishing a smoothly functioning cap-and-trade program and driving clean energy investment, improvements are needed in order for the program to deliver on its third aim—driving down global warming pollution through the use of its cap.

Global warming emissions from the RGGI states have declined, but not because of RGGI's cap. In 2005, emissions from power plants in the RGGI states peaked at 184 million tons; by 2008, the year before RGGI took effect, emissions had already fallen to 153 million tons. In 2009 the RGGI states emitted only 123 million tons of carbon dioxide from their power plants—34 percent below the cap. In 2010, emissions rebounded slightly but were still 27 percent below the cap.<sup>70</sup> That decline stems in part from the economic downturn that took place during those years, but other factors—in particular, lower prices for natural gas, increased usage of energy efficiency measures, and greater availability of clean energy generation options—likely accounted for more than half of the decline in emissions between 2005 and 2009, according to a draft report prepared for RGGI, Inc.<sup>71</sup>

The RGGI cap—which is above 180 million tons for the first several years of the program—is too high to have any effect on emissions at their current level. The structural changes in the region's electricity sector that have helped bring down emissions in recent years will hold pollution below the cap for the foreseeable future. Recent analyses find that emission

from RGGI states will remain below the RGGI cap until 2030.<sup>72</sup> That means that, while clean energy investments made with RGGI funds will continue to drive down emissions in the RGGI states, the market-based cap mechanism that sits at the center of the program will have only a slight effect on emissions.

The decline in emissions since 2005 represents an opportunity to set RGGI's cap at the level where it needs to be to prevent the worst impacts of global warming. Developed countries need to cut emissions quickly and sharply—25 to 40 percent below 1990 levels by 2020 and 80 to 95

percent by 2050—for the world to be able to prevent the worst impacts of climate change.<sup>73</sup>

Lowering the RGGI cap will make the cap itself an effective tool for cutting emissions in the RGGI states, and will also allow the states to expand the successful programs they have implemented to promote clean energy. One of the program's strongest features is the virtuous cycle created by assigning its proceeds to clean energy programs. As the cap brings in revenue, states use it to cut emissions, speeding their transition to clean energy and making even further reductions possible.



# Policy Recommendations

**A**fter two years of operation, the RGGI program has contributed significantly to the northeastern states' transition to clean energy. Even better, it has established a platform from which further advances can be made. The “machinery” of RGGI—the carbon allowance market the program created, and the funding stream it provides for state efficiency efforts—provides a framework for further efforts at reducing pollution and promoting clean energy. By strengthening RGGI, using its funds wisely, and implementing complementary policies that support its clean energy goals, states can build on RGGI's success and maintain their leadership in the march towards clean energy. Specifically, the RGGI states should:

- **Strengthen RGGI's cap on carbon emissions.** RGGI's greatest weakness to date has been the failure to cut power plant emissions through its cap. RGGI's cap should be reset to start from the actual level of emissions in 2009, and then require emission reductions of **20 percent by 2020 and 40 percent by 2030.** A stronger cap

will allow RGGI to function better as a market-based mechanism for emissions reduction, and also increase the proceeds available for investment in the region's highly successful clean energy programs.

- **Allocate all RGGI funds to clean energy programs.** In their initial strategies for allocating their RGGI funds, all the states assigned the majority of their funds to a mixture of renewable energy and energy efficiency programs. Since that time, state budget crises and the economic downturn have led several states to reallocate funds to emergency purposes including filling gaps in state budgets and providing energy bill assistance to families. To date, 32 percent of RGGI funding has been used for these purposes.<sup>74</sup> But while these purposes are worthwhile uses of funds, neither offers the long-term benefits associated with clean energy investments. Moreover, larger investments in energy efficiency produce more “bang for the buck” since they allow for economies

of scale that cut the per-unit cost of energy savings.<sup>75</sup> In the future, RGGI states should spend their full share of RGGI auction revenues on clean energy.

- **Expand RGGI to include additional states.** RGGI has proven itself as a framework for capping pollution and funding clean energy. One of the best ways to build on that success would be to bring additional states on board with the effort. RGGI has inspired the

creation of similar initiatives in other parts of the country—states associated with the Western Climate Initiative, a consortium of western states, and the Midwestern Greenhouse Gas Reduction Accord (MGGRA) have been investigating a range of opportunities to reduce emissions, including power sector emission caps. As those states move forward with their plans, linking up with RGGI should be considered as an option for their emission reduction strategies.

# Notes

- 1 Union of Concerned Scientists, *Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions*, July 2007.
- 2 Ibid.
- 3 Ibid.
- 4 Laurence S. Kalkstein and Scott J. Greene, *An Analysis of Potential Heat-Related Mortality Increases in U.S. Cities Under a Business-As-Usual Climate Change Scenario*, September 2007.
- 5 Union of Concerned Scientists, *The Hidden Costs of Fossil Fuels*, 29 October 2002, downloaded from [www.ucsusa.org/clean\\_energy/technology\\_and\\_impacts/impacts/the-hidden-cost-of-fossil.html](http://www.ucsusa.org/clean_energy/technology_and_impacts/impacts/the-hidden-cost-of-fossil.html) on 10 May 2010.
- 6 U.S. Department of Energy, Energy Information Administration, "Table P3: Energy Production and Consumption Estimates in Trillion BTU by State, 2008," in *State Energy Data System 2008*, 30 June 2010.
- 7 Jeff Deyette and Barbara Freese, Union of Concerned Scientists, *Burning Coal, Burning Cash: Ranking the States that Import the Most Coal*, May 2010.
- 8 Based on Department of Energy, Energy Information Administration, "Electricity and Renewable Fuels" (Tables 73-120) in *Annual Energy Outlook 2011*, 26 April 2011.
- 9 New York Office of the Governor, *N.Y. Gov. Pataki Announces Power Plant CO<sub>2</sub> Emissions Agreement* (press release), 17 February 2006.
- 10 Based on 124 million tons of CO<sub>2</sub> from RGGI facilities in 2009, from RGGI, Inc., *RGGI CO<sub>2</sub> Allowance Tracking System*, accessed at [rggi-coats.org/eats/rggi/index.cfm?fuseaction=reportsv2.annual\\_emissions\\_rpt&clearfuseattribs=true](http://rggi-coats.org/eats/rggi/index.cfm?fuseaction=reportsv2.annual_emissions_rpt&clearfuseattribs=true), 10 May 2011, and 5,502 million tons nationwide, from U.S. Environmental Protection Agency, *Inventories of US Greenhouse Gas Emissions and Sinks, 1990-2009*, April 2011.
- 11 Based on 171 million tons of CO<sub>2</sub> in 2007, from RGGI, Inc., *The RGGI CO<sub>2</sub> Cap*, downloaded from [www.rggi.org/design/overview/cap](http://www.rggi.org/design/overview/cap) on 10 May 2011, and global 2007 emissions data from United Nations Millennium Development Goals, *Carbon Dioxide Emissions (CO<sub>2</sub>), Thousand Metric Tons of CO<sub>2</sub> (CDIAC)*, downloaded from [mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=749](http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=749), 25 April 2011.
- 12 RGGI, Inc., *The RGGI CO<sub>2</sub> Cap*, downloaded from [www.rggi.org/design/overview/cap](http://www.rggi.org/design/overview/cap), 10 May 2011.
- 13 RGGI, Inc., *Reserve Price*, downloaded from [www.rggi.org/design/program\\_review/cmpr](http://www.rggi.org/design/program_review/cmpr), 10 May 2011.
- 14 RGGI, Inc., *Memorandum of Understanding*, 20 December 2005.

- 15 RGGI, Inc., *Investment of Proceeds from RGGI CO<sub>2</sub> Allowances*, February 2011.
- 16 John Buntin, "A Cap and Trade Program that Works," *Governing Magazine*, December 2010.
- 17 Jim Efstathiou, Jr., "Air-Pollution Market Debut Tests Cap-and-Trade Model," *Bloomberg*, 23 September 2008.
- 18 Felicity Barringer and Kate Galbraith, "States Aim to Cut Gases by Making Polluters Pay," *New York Times*, 15 September 2008.
- 19 Ibid.
- 20 Based on data from RGGI CO<sub>2</sub> Allowance Tracking Program, accessed at [rggi-coats.org/eats/rggi/index.cfm?fuseaction=search.project\\_offset&clearfuseattribs=true](http://rggi-coats.org/eats/rggi/index.cfm?fuseaction=search.project_offset&clearfuseattribs=true) on 20 May 2011.
- 21 Environment Northeast, *Economy-wide Benefits of RGGI: Economic Growth Through Energy Efficiency*, March 2011.
- 22 Ibid.
- 23 Ibid.
- 24 See note 15.
- 25 Estimate of annual carbon dioxide emission reductions from RGGI-funded Connecticut energy efficiency programs assumes that 9.1% of program funding comes from RGGI. Based on 2009 and 2010 energy savings data from: Connecticut Energy Conservation Management Board, *An Investment in Connecticut: Energy Efficiency: Report of the Energy Conservation Management Board: Year 2009 Programs and Operations*, 1 March 2010; Connecticut Energy Efficiency Board, *Connecticut's Investment in Energy Efficiency: 2010 Report of the Energy Efficiency Board*, 1 March 2011.
- 26 Maryland Energy Administration, *Maryland State Energy Investment Fund: Clean Energy Accomplishments FY 2009 and 2010*, downloaded from [www.energy.state.md.us/documents/FY09andFY10SEIFAccomplishmentsbook.pdf](http://www.energy.state.md.us/documents/FY09andFY10SEIFAccomplishmentsbook.pdf), 22 May 2011.
- 27 U.S. Department of Energy, Energy Information Administration, *State Electricity Profiles 2009*, April 2011.
- 28 Kevin McCarthy, Connecticut Office of Legislative Research, *Factors Behind Connecticut's High Electric Rates*, 5 August 2008.
- 29 Paul Denholm and Robert M. Margolis, "Evaluating the Limits of Solar Photovoltaics (PV) in Electrical Power Systems Utilizing Energy Storage and Other Enabling Technologies," *Energy Policy*, 2007.
- 30 Connecticut Clean Energy Fund, *RGGI Project Benefit Details Report*, 10 June 2011.
- 31 Gabrielle Karol, "Ad-Hoc Energy Committee Discusses Retrofitting of High School," *Madison Patch*, 16 December 2010.
- 32 Saqib Rahim, "State and Local Governments Innovate to Cut Energy and Waste," *New York Times*, 11 February 2010.
- 33 John Byrne and Celia Martinez, "Delaware's Sustainable Energy Utility," *Delaware Lawyer*, Summer 2009.
- 34 See note 32.
- 35 See note 33.
- 36 Elizabeth Ridlington and Rob Kerth, Frontier Group; Johanna Neumann, Maryland PIRG, *Utility Work Ahead: A First Look at Progress Toward Meeting EmPOWER Maryland Goals*, April 2010.
- 37 Maryland Energy Administration, *Maryland Energy Administration Delivers Results for a Smart, Green, and Growing Maryland*, downloaded from [www.rrggi.org/docs/MEA\\_2009\\_Successes.pdf](http://www.rrggi.org/docs/MEA_2009_Successes.pdf), 10 May 2010; Timothy B. Wheeler, "Cap-and-Trade Emissions Reduction Programs Catch On," *Baltimore Sun*, 16 December 2009.
- 38 Massachusetts Department of Energy and Environmental Affairs, *Patrick-Murray Administration Awards \$3.6 Million to 18 New "Green Communities"* (press release), 21 March 2011.
- 39 Gintautas Dumcius, "New Street Lights Get Applause," *Dorchester Reporter*, 14 April 2011.
- 40 City of Boston, *LEDs: A Bright New Idea!*, downloaded from [www.cityofboston.gov/environment/LED/](http://www.cityofboston.gov/environment/LED/) on 10 May 2010.
- 41 See note 16.
- 42 "Town Hall Window Upgrade Made Possible by Regional Cap-and-Trade Program," *Word on Windows*, Spring 2011.
- 43 "Energy Efficiency Makes Searsport Firm More Competitive," *Republican Journal (Waldo, ME)*, 18 October 2010.
- 44 Jen Lynds, "Energy Efficiency Aids Twin Rivers' Recovery," *Bangor Daily News*, 15 December 2010.

- 45 New Hampshire Greenhouse Gas Emissions Reduction Fund, *A Case Study: Foss Manufacturing Company LLC, Hampton*, downloaded from [www.puc.state.nh.us/sustainable%20Energy/GHGERF/2009%20Case%20Studies/Foss%20case%20study%20final.pdf](http://www.puc.state.nh.us/sustainable%20Energy/GHGERF/2009%20Case%20Studies/Foss%20case%20study%20final.pdf), 10 May 2010.
- 46 New Hampshire Greenhouse Gas Emissions Reduction Fund, *2010 Grant Awards*, downloaded from [www.puc.nh.gov/Sustainable%20Energy/GHGERF/2010%20Grant%20Awards.html](http://www.puc.nh.gov/Sustainable%20Energy/GHGERF/2010%20Grant%20Awards.html) on 10 May 2010.
- 47 Carbon Solutions New England, *New Hampshire Greenhouse Gas Emissions Reduction Fund: Year 1 (July 2009 – June 2010) Report*, February 2011.
- 48 Congested transmission: Department of Energy, *National Transmission Grid Study*, May 2002. Air pollution: New Jersey Department of Environmental Protection, *2009 Air Quality Index Summary*, downloaded from [www.njainow.net/App\\_Files/09rpt.htm](http://www.njainow.net/App_Files/09rpt.htm) on 26 April 2010.
- 49 Solar Energy Industries Association, *2009 Solar Industry Year in Review*, 15 April 2010.
- 50 Based on information provided by New Jersey Economic Development Agency to Matt Elliott, Environment New Jersey Research and Policy Center.
- 51 William Paterson University, *William Paterson University Dedicates Installation of Largest Solar Energy Facility on a University Campus in U.S.* (press release), 21 October 2010.
- 52 New Jersey Economic Development Agency, Information on CESCO Loans, personal communication to Matt Elliott, 6 April 2011.
- 53 See note 51.
- 54 See note 15.
- 55 Rhode Island Energy Efficiency and Resource Management Council, *Annual Report to the General Assembly*, April 2011.
- 56 U.S. Department of Energy, Energy Information Administration, “Rhode Island” in *State Electricity Profiles*, April 2011.
- 57 Robert Olson and David J. Shulock, “Rhode Island Enacts Comprehensive Energy Legislation,” *Power Marketers Association Online Magazine*, July 2006.
- 58 National Grid, *Docket 4209 – The Narragansett Electric Company, d/b/a National Grid Energy Efficiency Program Plan for 2011* (submitted to Rhode Island Public Utilities Commission in Docket 4209), 1 November 2010.
- 59 See note 55.
- 60 Efficiency Vermont, *How Efficiency Vermont Works*, downloaded from [www.encyvermont.com/about\\_us/information\\_reports/how\\_we\\_work.aspx](http://www.encyvermont.com/about_us/information_reports/how_we_work.aspx), 12 April 2011.
- 61 Ibid.
- 62 Efficiency Vermont, *Annual Report 2009*, November 2010.
- 63 Efficiency Vermont, *Year 2010 Savings Claim*, 1 April 2011.
- 64 See note 17.
- 65 RGGI Inc., *RGGI States’ First CO<sub>2</sub> Auction Off to a Strong Start* (press release), 29 September 2008.
- 66 Potomac Economics for RGGI, Inc., *Annual Report on the Market for RGGI CO<sub>2</sub> Allowances, 2010*, April 2011.
- 67 Ibid.
- 68 Potomac Economics for RGGI, Inc., *Market Monitor Report for Auction 9*, 9 September 2010.
- 69 See note 66.
- 70 RGGI Inc., *RGGI CO<sub>2</sub> Allowance Tracking System*, accessed at [rggi-coats.org/eats/rggi/index.cfm?fuseaction=reportsv2.annual\\_emissions\\_rpt&clearfuseattribs=true](http://rggi-coats.org/eats/rggi/index.cfm?fuseaction=reportsv2.annual_emissions_rpt&clearfuseattribs=true), 10 May 2010.
- 71 New York State Energy Research and Development Authority, *Relative Effects of Various Factors on RGGI Electricity Sector CO<sub>2</sub> Emissions: 2009 Compared to 2005*, draft white paper, 2 November 2010.
- 72 ICF International for RGGI, Inc., *RGGI Reference Case Results and Assumptions* (presentation), 5 November 2010.
- 73 Sujata Gupta et al., “Policies, Instruments and Co-operative Arrangements” in *Climate Change 2007: Mitigation, Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, 2007.
- 74 See note 15.
- 75 Doug Hurley et al., Synapse Energy Economics for Northeast Energy Efficiency Council, *Costs and Benefits of Electric Utility Energy Efficiency in Massachusetts*, August 2008.