



# From Pollution to Solutions

## Maximizing Clean Energy Progress from State Carbon-Pricing Investments



FRONTIER GROUP

# From Pollution to Solutions

## Maximizing Clean Energy Progress from State Carbon-Pricing Investments



FRONTIER GROUP

**Elizabeth Ridlington and Gideon Weissman**  
Frontier Group

**Andrea McGimsey**  
Environment America Research & Policy Center

Fall 2018

# Acknowledgments

Environment America Research & Policy Center thanks John Morrill of the Arlington County Department of Environmental Services, John Rogers of the Union of Concerned Scientists, and Jordan Stutt of the Acadia Center for their review of drafts of this document, as well as their insights and suggestions. Thanks also to Tony Dutzik, Susan Rakov and Gideon Weissman of Frontier Group for editorial support.

Environment America Research & Policy Center thanks the Energy Foundation for making this report possible.

The authors bear responsibility for any factual errors. The recommendations are those of Environment America Research & Policy Center. The views expressed in this report are those of the authors and do not necessarily reflect the views of our funders or those who provided review.

© 2018 Environment America Research & Policy Center. Some Rights Reserved. This work is licensed under a Creative Commons Attribution Non-Commercial No Derivatives 3.0 U.S. License. To view the terms of this license, visit <http://creativecommons.org/licenses/by-nc-nd/3.0/us>.

Environment America Research & Policy Center is a 501(c)(3) organization. We are dedicated to protecting America's air, water and open spaces. We investigate problems, craft solutions, educate the public and decision makers, and help Americans make their voices heard in local, state and national debates over the quality of our environment and our lives. For more information about Environment America Research & Policy Center or for additional copies of this report, please visit [www.environmentamericacenter.org](http://www.environmentamericacenter.org).

Frontier Group provides information and ideas to help citizens build a cleaner, healthier and more democratic America. We address issues that will define our nation's course in the 21st century – from fracking to solar energy, global warming to transportation, clean water to clean elections. Our experts and writers deliver timely research and analysis that is accessible to the public, applying insights gleaned from a variety of disciplines to arrive at new ideas for solving pressing problems. For more information about Frontier Group, please visit [www.frontiergroup.org](http://www.frontiergroup.org).

Layout: Harriet Eckstein Graphic Design  
Cover photo: Roland Balik/U.S. Air Force

# Contents

- Executive Summary ..... 4
- Introduction..... 7
- The Regional Greenhouse Gas Initiative Is Cutting Pollution and Encouraging Clean Energy ..... 8
  - Cleaner Air, Better Health and Consumer Savings: Benefits to Date..... 8
  - The Benefits of RGGI Will Grow Over Time ..... 10
- Smart Investment Choices Can Move States toward a Clean Energy Future ..... 12
  - Focus on Energy Efficiency..... 13
  - Unlock Private Investment in Clean Energy ..... 14
  - Extend the Benefits of Clean Energy to Low- and Middle-Income Households..... 15
  - Incentivize Local Governments to Adopt Clean Energy ..... 17
  - Cut Carbon Pollution Beyond the Electricity Sector ..... 18
  - Advance the Next Generation of Clean Energy Technologies ..... 20
- Short-Sighted Spending Decisions Slow the Clean Energy Transition ..... 24
  - Diverting Funds from Clean Energy Purposes ..... 24
  - Spending Funds on Polluting Fuels ..... 25
- Policy Recommendations ..... 26
  - Set Strong Caps on Pollution from Power Plants ..... 26
  - Use Auction Revenues to Accelerate the Transition to Clean Energy ..... 26
- Notes ..... 28

# Executive Summary

**T**he Regional Greenhouse Gas Initiative (RGGI), created more than a decade ago by Northeastern and Mid-Atlantic states, has been a clear success. The program has contributed to the 60 percent reduction in carbon pollution from power plants in those states since 2005, while fueling the transition to a clean energy future.

Smart investments in clean energy programs have been critical to the program's success. With the nine current RGGI states having recently tightened the program's limits on power plant pollution, and with New Jersey and Virginia aligning themselves with RGGI, it is important that the region invest revenue from the program in ways that move as quickly as possible toward a clean energy future.

Smart clean energy investments can make a big difference. Northeastern and Mid-Atlantic states saved 4.4 million megawatt-hours of electricity and cut global warming pollution by 2.4 million tons with their clean energy investments from 2009 through 2016.<sup>1</sup> If New Jersey were to rejoin RGGI, adopt a strong cap on power plant emissions, and follow the example of leading states by investing revenues from carbon pricing in clean energy, its investments from 2020 through 2030 could save nearly 9 million megawatt-hours of electricity, equal to the amount of electricity consumed by more than 96,000 households over that period.<sup>2</sup>

To maximize the benefits for the environment and residents of the region, every state should commit

to investing carbon revenue in clean energy and adopt the best practices for investment of carbon cap revenue developed by leading states in the Northeast and Mid-Atlantic.

**The Regional Greenhouse Gas Initiative has contributed to the 60 percent reduction in carbon emissions from power plants in the region from 2005 to 2017, while reducing energy bills for consumers in Northeastern and Mid-Atlantic states.**

- RGGI-funded investments in clean energy have cut energy use, saving residents, businesses and industries \$658 million on energy bills.<sup>3</sup>
- Health-threatening air pollution from power plants has fallen, reducing premature deaths, asthma attacks, and emergency room visits.<sup>4</sup> According to a 2017 study, in the first six years of the program, improved air quality resulted in an estimated 9,000 avoided asthma attacks and helped prolong between 300 and 830 lives.<sup>5</sup>
- Electricity generation from wind turbines and solar panels in the region increased nine-fold from 2008 to 2017, thanks to RGGI investments, other policies, and declines in the price of clean energy technologies.<sup>6</sup>

**Smart investments of revenue from RGGI are driving clean energy progress in the region. Among the most effective investments have been those that:**

- **Focus on energy efficiency.** Massachusetts dedicates most of its carbon auction revenues toward meeting the state’s ambitious energy efficiency goals. In 2017, Massachusetts’ efficiency investments enabled the state to avoid electricity consumption equal to 2.57 percent of electricity sales and cut global warming pollution.<sup>7</sup>
- **Help unlock private investments in clean energy.** Connecticut’s commercial property assessed clean energy (C-PACE) program, partially supported through mid-2017 by revenue from RGGI, provides loans to businesses to finance clean energy investments that are repaid over time on property tax bills. From 2011 to 2017, the program supported more than \$100 million in clean energy investments, saving customers nearly \$200 million in energy costs over the lifetime of the projects.<sup>8</sup>
- **Extend the benefits of clean energy to low- and middle-income households.** Maryland grants RGGI funds to local governments and community organizations that serve low- and moderate-income residents. In 2016 alone, these programs reduced energy use by 7.4 million kilowatt-hours and saved consumers \$1.2 million on their electricity bills.<sup>9</sup>
- **Incentivize local governments to adopt clean energy.** Massachusetts’ Green Communities program offers RGGI funds to cities and towns that reduce their environmental impact. More than 200 communities have committed to a set of clean energy policies, becoming eligible for \$39 million in funding and unlocking greater energy savings than could have been obtained through direct spending of RGGI funds alone.<sup>10</sup>
- **Reduce pollution from sources other than electricity generation.** Sometimes, the most important and cost-effective clean energy investments can be found outside the electricity sector. Maine, for example, for several years earmarked 35 percent of carbon auction funds for measures to reduce

pollution from home heating.<sup>11</sup> As a result, thousands of Mainers installed high-efficiency ductless heat pumps and reduced their home heating bills.<sup>12</sup>

- **Advance the next generation of clean energy technologies.** Because more than one-third of New York State’s global warming pollution results from heating, cooling and ventilating buildings, New York uses some of its carbon auction revenues to spur research into technologies that will help reduce building energy use and future emissions.<sup>13</sup>

**Not every investment made with carbon revenue has helped to move the region toward a clean energy future. States should avoid common pitfalls, including:**

- Diverting carbon revenue to cover budget deficits. New York, New Jersey (before it withdrew from RGGI in 2012) and other states have used money from RGGI fees to cover shortfalls in the state budget rather than reducing climate pollution. In New Jersey, for example, the diversion of \$65 million in fiscal year 2010 meant that consumers and businesses received less help improving energy efficiency.<sup>14</sup>
- Spending money on programs that do little or nothing to promote the region’s long-term transition to clean energy. Maryland used RGGI funds help purchase propane- and natural gas-powered vehicles, which, though they produce less carbon pollution than conventional vehicles, are not as clean as electric vehicles and commit the state to continued use of dirty fuels.<sup>15</sup>

**To maximize the benefits of the regional carbon program, states must make smart decisions to implement it—especially when it comes to investing revenue in clean energy.** To get the most benefit out of RGGI:

- New Jersey and Virginia should propose and other states should approve a strong cap on carbon pollution from the states’ power



plants. According to an analysis by the Natural Resources Defense Council (NRDC), for New Jersey a strong cap would be 12 to 13 million tons per year.<sup>16</sup> For Virginia, NRDC's analysis shows a strong cap would be 28 million tons.<sup>17</sup>

- States should spend revenues from the sale of pollution allowances to accelerate the region's transition to a clean energy future.
- Virginia should formally join the regional carbon program via legislative action so that it can ensure that auction revenues are spent on policies that will deliver the greatest carbon pollution reductions.
- States should not divert carbon revenues to unrelated purposes.



*Using carbon auction revenues, Delaware provided a low-interest loan that allowed the City of Lewes Public Library Board to install solar panels, LED lights and an efficient heating and cooling system at the town's new library. The clean energy measures will save the library \$47,500 annually.<sup>18</sup> Photo: Becker Morgan Group, Inc.*

# Introduction

**I**magine what a clean, carbon-free economy might look like in the Northeast and Mid-Atlantic.

We might live and work in highly efficient homes and buildings powered by electricity, with most of our energy coming from wind turbines on land and off our coasts, along with solar panels on our rooftops and over parking lots. Clean, efficient electric cars, trucks and buses would travel our streets. All of it would be made possible by a modern electric grid capable of balancing the supply of zero-carbon energy with daily energy demand.

It's an attractive future, to be sure. It is harder, however, to envision how we might get there, especially in the narrow window of time we have to prevent the worst impacts of climate change.

Making the leap to a clean energy future in the Northeast and Mid-Atlantic will require a steady and significant stream of investment—along with the wisdom to squeeze the most clean energy progress out of every scarce dollar.

States from Maryland to Maine are fueling this transition to clean energy by making smart investments of carbon revenue from the Regional Greenhouse Gas Initiative. Since the program began in 2009, nine Northeastern and

Mid-Atlantic states from Maine to Maryland have invested hundreds of millions of dollars in improving energy efficiency, expanding renewable energy, and reducing climate pollution.

Those investments have delivered results: a cleaner environment, monetary savings for thousands of households and businesses, and a speedier transition to clean energy. Moreover, the experience of the last decade has shown what works and what doesn't when it comes to carbon investments—revealing lessons for states as they plan to achieve future waves of carbon emission reductions.

By following the playbook of the most successful states, both current RGGI states and new program participants such as New Jersey and Virginia can get the most out the program—while avoiding missteps that waste money or delay the transition to a clean energy future.

This report highlights some of the best programs that Northeastern and Mid-Atlantic states have funded with revenues from the sale of carbon emission allowances. These experiences can inform the choices New Jersey, Virginia and other states make in investing the proceeds of carbon pollution auctions and ensure that the RGGI program continues to play an important role in preparing the region for a clean energy future.



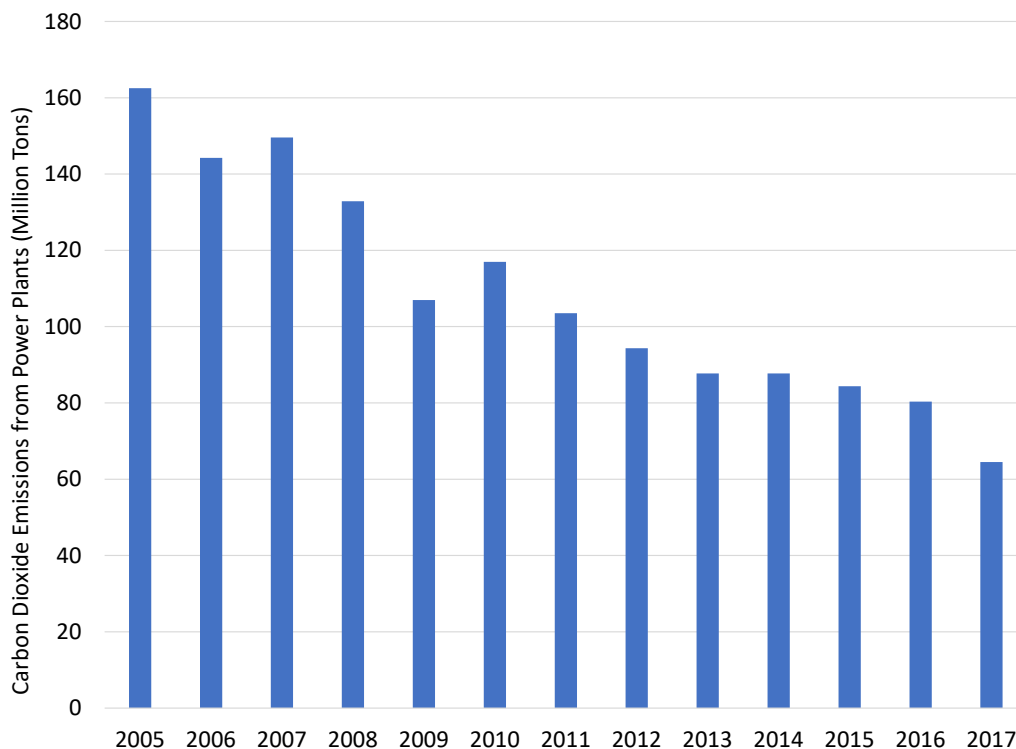
# The Regional Greenhouse Gas Initiative Is Cutting Pollution and Encouraging Clean Energy

**T**he Regional Greenhouse Gas Initiative (RGGI) is the nation's first multi-state policy to cut carbon pollution from power plants. The program limits carbon pollution from electric power plants and, by charging power plant owners a fee to emit pollution, generates revenue that states can reinvest in energy efficiency, clean energy and other programs to benefit the environment and consumers.

## Cleaner Air, Better Health and Consumer Savings: Benefits to Date

The program has helped slash climate pollution from power plants. Because of the Regional Greenhouse Gas Initiative—along with new environmental rules, changes in energy technology and increased use of gas instead of coal—climate pollution from electricity generation declined by 60 percent from 2005, the year the

**Figure 1. CO<sub>2</sub> Emissions from Power Plants in the RGGI States, 2005-2017<sup>20</sup> (RGGI was fully implemented beginning in 2009)**



program was announced, to 2017 in the nine states that currently participate—Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont.<sup>19</sup> (See Figure 1.)

The sale of pollution allowances has generated \$2.9 billion in revenue (through mid-2018).<sup>21</sup> States have invested much of that money into programs that protect the environment, public health and consumers. Data are available on the benefits from \$2.17 billion in investments made through 2016.

### Reduced Carbon Pollution

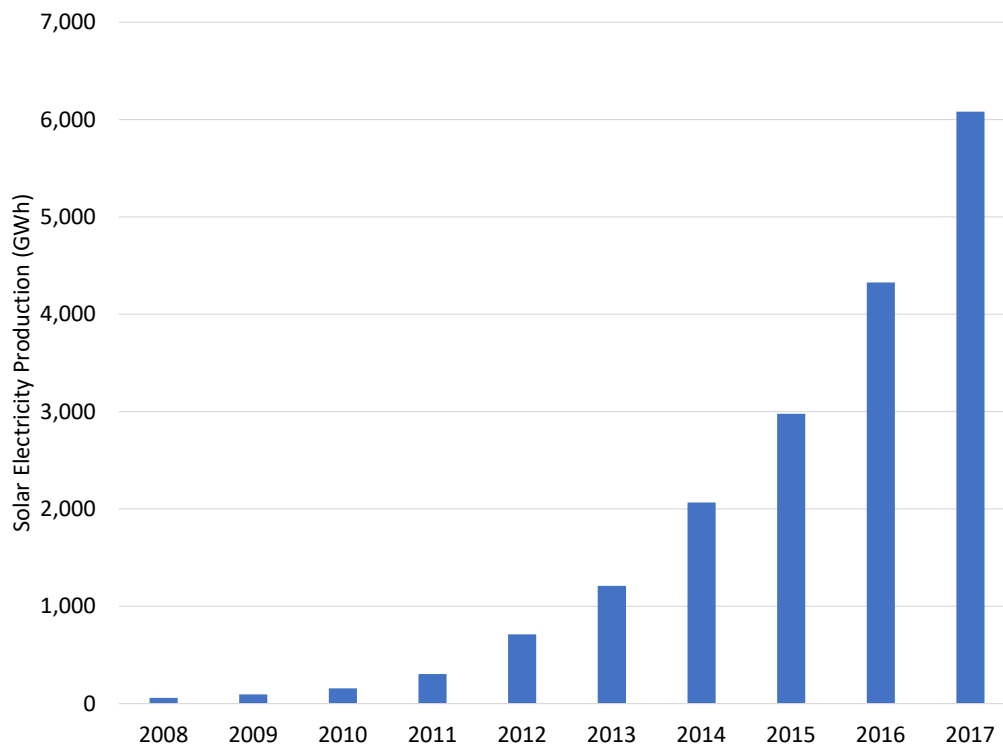
States have invested money in energy efficiency, clean energy and greenhouse gas abatement (such as efforts to reduce emissions from transportation and research to develop new technologies). These efforts reduced global warming pollution by a cumulative total of 2.4

million tons from 2009 to 2016, equal to the annual emissions of 450,000 cars.<sup>22</sup> (These savings partially overlap with the carbon pollution reductions that have occurred at power plants.) Over the lifetime of the investments made through 2016, they will avoid 27.8 million tons of carbon dioxide pollution, equal to annual emissions from 5.4 million cars.<sup>23</sup>

### Improved Public Health

By accelerating the region’s transition away from coal and oil, which produce health-threatening air pollution in addition to carbon dioxide pollution, the Regional Greenhouse Gas Initiative has helped protect the health of residents throughout the Northeast and Mid-Atlantic regions. According to a 2017 study, in the first six years of the program, between 300 and 830 lives were prolonged as a result of reduction in emissions.<sup>24</sup> Improved air quality also resulted in an estimated 9,000 avoided asthma attacks.<sup>25</sup>

**Figure 2. Solar Electricity Production Increased from 2008 to 2017 in the Nine RGGI States<sup>27</sup>**



### More Clean Energy

RGGI investments, in tandem with other clean energy policies and declines in the price of clean energy technologies, have spurred the growth of solar and wind energy. Electricity production from wind energy increased six-fold and generation from solar energy increased 100-fold from 2008 to 2017 in the nine RGGI states.<sup>26</sup> (See Figures 2 and 3.)

### Consumer Savings

The investment of carbon auction proceeds in clean energy saved residents, businesses and industries \$658 million by the end of 2016, and will save 10 times that over the lifetime of the efficiency, clean energy and greenhouse gas abatement measures already undertaken.<sup>29</sup> (This does not include benefits of direct bill relief.) These investments have boosted local economies: When consumers spend less money

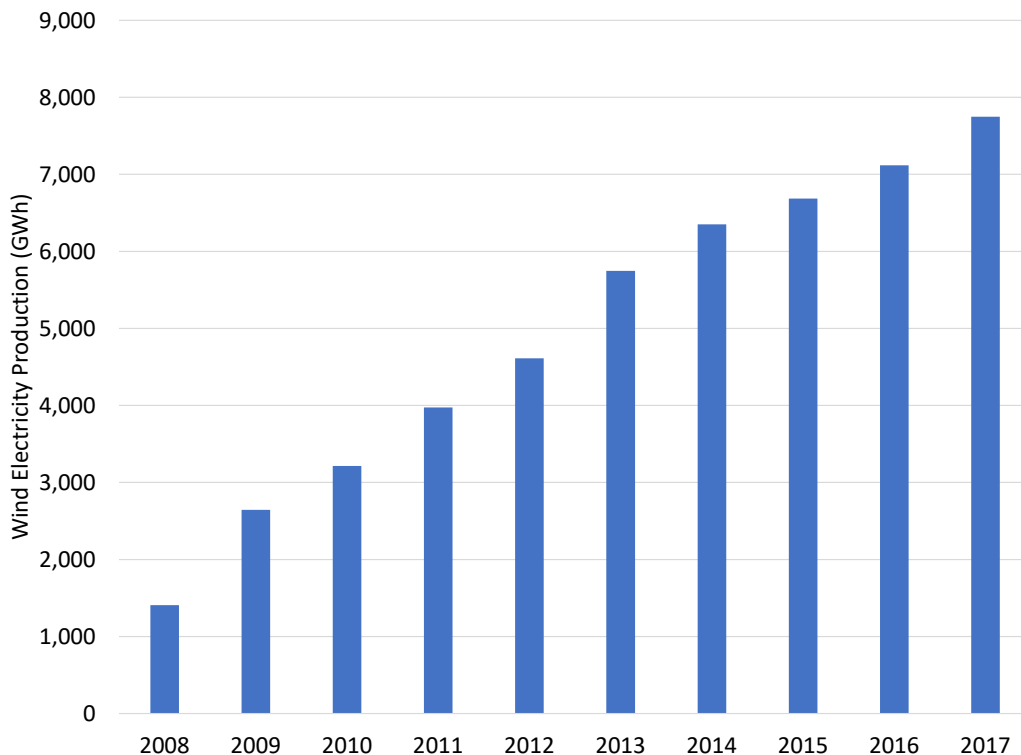
on energy that comes primarily from outside the region, they have more money to spend at local businesses.

These savings figures do not include benefits New Jersey experienced from the program from 2009 to 2011, before the state withdrew from the program.<sup>30</sup> New Jersey's 2012 exit from RGGI resulted in greater carbon pollution and missed opportunities for investing in clean energy.<sup>31</sup>

### The Benefits of RGGI Will Grow Over Time

In the years to come, RGGI will deliver greater benefits to participating states. According to a strengthened plan the nine states agreed upon in 2017, power plant emissions will fall an additional 30 percent from 2020 levels by 2030.<sup>32</sup> By 2030, emissions will be 66 percent lower than they were when the RGGI program was announced in 2005.<sup>33</sup>

**Figure 3. Wind Electricity Production Increased from 2008 to 2017 in the Nine RGGI States<sup>28</sup>**



The program will also continue to generate revenue for participating states to invest in clean energy efforts. Between 2020 and 2030, the sale of pollution allowances could generate billions of dollars for investment in renewable energy, energy efficiency and other emission-reduction efforts.<sup>34</sup>

The addition of New Jersey and Virginia to RGGI will result in further emission reductions. As New Jersey rejoins the program, it should establish a reasonable and achievable target, which an analysis by the Natural Resources Defense Council estimates is 12 to 13 million tons in 2020.<sup>35</sup> By 2030, the state's power plant carbon emissions could be more than 3 million tons lower than in 2020.<sup>36</sup> If Virginia joins the program and sets its cap at 28 million tons, as the state has proposed, emissions from electricity generation in the state could fall by 7 million tons from 2020 to 2030.<sup>37</sup>

By joining RGGI, both New Jersey and Virginia will receive revenue from the sale of pollution allowances that they can invest in clean energy

measures. If New Jersey adopts a strong pollution cap, carbon auction revenues could be tens of millions of dollars annually.<sup>38</sup> Virginia could also receive tens of millions for clean energy programs each year.<sup>39</sup>

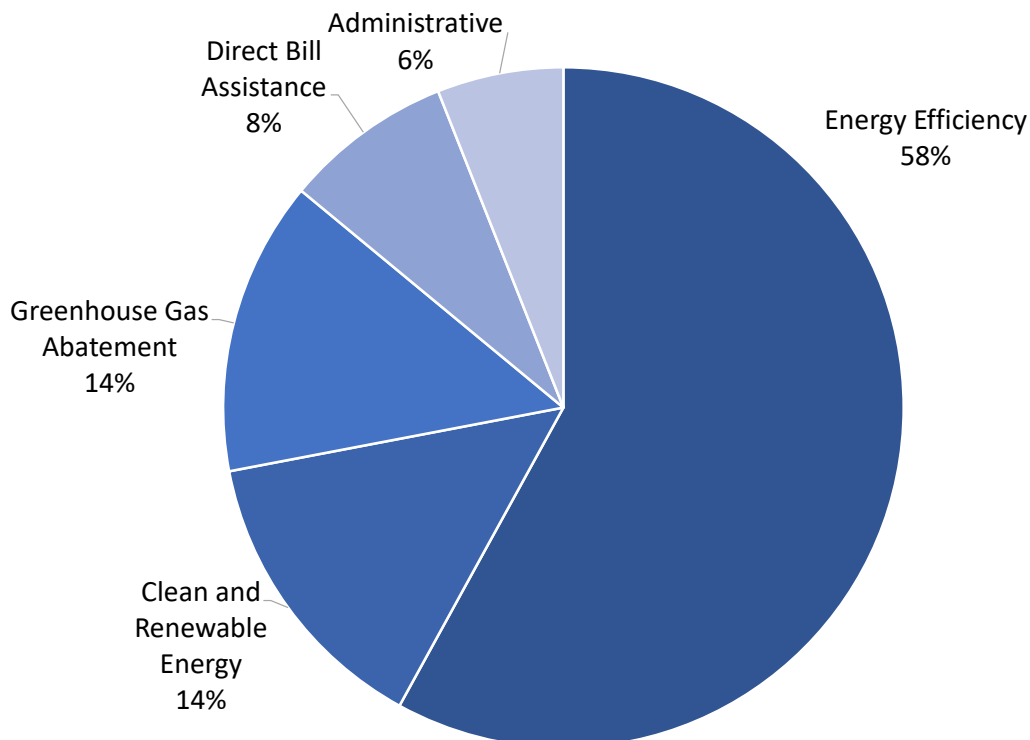
If New Jersey invests its auction proceeds in ways similar to other states, it could significantly cut emissions and energy use. New Jersey's investments from 2020 to 2030 could avoid emissions of more than 5 million tons of carbon dioxide and reduce energy use by nearly 9 million megawatt-hours of electricity and 28 million Btu of heating fuels (over the lifetime of the clean energy upgrades).<sup>40</sup> For context, 9 million megawatt-hours is how much electricity 97,000 households would consume over that same period.<sup>41</sup> Consumers would also save millions of dollars on their energy bills. These estimated savings are based on the benefits other states received from their 2016 investments in energy efficiency, renewable energy and greenhouse gas abatement efforts using RGGI funds.

# Smart Investment Choices Can Move States toward a Clean Energy Future

**N**ortheastern and Mid-Atlantic states have invested much of their carbon auction revenues in clean energy programs, delivering environmental, public health and consumer benefits. The best clean energy programs provide examples of how New Jersey, Virginia and other states can maximize benefits from their carbon revenues.

States have invested more RGGI proceeds in energy efficiency than in any other category. As of 2016, states had spent \$1.3 billion, 58 percent of invested RGGI auction funds, on energy efficiency efforts.<sup>42</sup> (See Figure 4.) That is one reason electricity consumption in New England has been declining since the mid-2000s and is projected to continue falling for the next decade.<sup>43</sup>

**Figure 4. States Have Invested Most 2009-2016 Auction Revenues on Energy Efficiency<sup>44</sup>**



Energy efficiency programs help homeowners, business owners and industrial operators to upgrade buildings so that they require less energy to heat, cool, light and operate. State efficiency programs offer financial assistance in the form of grants, rebates and loans to help defray the cost of installing energy-saving equipment. Energy efficiency programs also educate building owners about the benefits of efficiency and opportunities for improvements, and train contractors in how to evaluate and provide energy efficiency upgrades.

Northeastern and Mid-Atlantic states have also used auction revenues to support the installation of more wind and solar energy, spending more than \$300 million on clean, renewable energy (as of 2016).<sup>45</sup> Renewable energy can replace electricity from dirty sources and help reduce the need to build new, polluting power plants. RGGI-funded incentives for clean, renewable energy help homeowners, business owners and developers with the logistical and financial challenges of installing solar panels or adding wind turbines.

The nine RGGI states have also spent funds to reduce emissions from other sources, ensure future emission reductions, and help develop technologies that will be important in the future.

By reviewing the experiences of these programs, current RGGI states and those that aspire to align themselves with the program can develop a strategy to maximize the benefits of the investments they make with carbon revenue. That strategy should be built on the following principles.

### **Focus on Energy Efficiency**

Energy efficiency is inexpensive, clean and widely available, making it a smart use of carbon auction revenues. Maine, Massachusetts and Vermont have all chosen to invest 85 percent or more of their RGGI funds in energy efficiency, supplementing other energy efficiency efforts.<sup>46</sup> Rhode Island has spent more than 70 percent of its funds on energy efficiency. These investments have helped Vermont, Rhode Island and

Massachusetts earn rankings as the top three states in the nation for the amount of electricity and natural gas they save every year.<sup>47</sup> Unlike direct bill assistance or reductions in electricity rates, investments in energy efficiency provide long-term savings to utility customers by reducing their electricity and natural gas consumption and thus their utility bills.

### **Massachusetts: Committed to Saving Energy**

Massachusetts has long-term goals to reduce electricity and natural gas consumption and provides consistent funding for energy efficiency programs. From 2008 through 2016, the state spent \$338 million of its RGGI funds—more than 85 percent of its auction revenues—to support energy efficiency programs, supplementing ratepayer funding that provides the bulk of the money for energy efficiency efforts.<sup>48</sup> This steady focus on energy efficiency has enabled the state to reap large energy savings year after year.

In 2008, Massachusetts set a goal of pursuing all cost-effective energy efficiency.<sup>49</sup> To meet that target, it establishes ambitious, frequently updated goals for electricity and natural gas use reduction and requires utility companies to offer energy efficiency programs to achieve those goals.

Utilities market energy efficiency offerings under the Mass Save brand, making it straightforward for homeowners and businesses in different utility territories to know where to seek energy efficiency help. Offerings include energy audits that help identify where heat escapes from a building and assistance fixing problems identified during the audit.<sup>50</sup> Upgrades can include air sealing, better insulation, lighting upgrades, and replacement of inefficient appliances. Commercial and industrial facilities can receive financial incentives and technical advice for how to reduce energy use with efficient equipment and lighting, combined heat and power systems, and revamped manufacturing processes.<sup>51</sup>

In its quest for greater efficiency savings, Massachusetts has developed approaches that



have opened up new efficiency opportunities. For example, instead of requiring customers to mail in a rebate request for efficient equipment they have already purchased and then wait several months to receive payment, Massachusetts has worked with manufacturers and distributors to reduce the upfront cost to customers.<sup>52</sup> This makes efficient equipment more immediately appealing to consumers and has also encouraged retailers to offer more high-efficiency products. Massachusetts has also created several programs that provide enhanced energy efficiency services to hard-to-reach customers, such as low-income neighborhoods and business districts with a high share of small businesses.

In 2017, Massachusetts' efficiency investments enabled the state to shave off 2.57 percent of electricity sales and 1.08 percent of natural gas sales, reducing global warming pollution.<sup>53</sup> Even though the state has already tapped many of the easiest and most obvious energy efficiency possibilities, it continues to find cost-effective savings: for savings obtained from 2013 to 2015, the state gained more than \$4.50 in benefits for every dollar it spent on energy efficiency.<sup>54</sup> Massachusetts adopted new clean energy legislation in 2018 that broadens its energy efficiency goals to include new tools and technologies.<sup>55</sup> Massachusetts' commitment to energy efficiency has been recognized by the American Council for an Energy-Efficient Economy, which has ranked the state's energy efficiency policies and investments first in the country for eight years in a row.<sup>56</sup>

## Unlock Private Investment in Clean Energy

Energy efficiency upgrades and renewable energy technologies require an upfront investment that pays for itself over time through lower monthly energy bills. However, many homeowners, small businesses, non-profits and others need help with the initial capital costs. States can help to unlock these private investments in cost-effective clean energy improvements through loans and rebates funded by revenue from RGGI.

Connecticut has developed several programs to help overcome the financing hurdles that many energy consumers face.

## Connecticut: Using Energy Savings to Pay for Energy Efficiency Projects

In 2017, Metal Finishing Technologies, based in Bristol, Connecticut, invested \$657,000 in extensive energy efficiency improvements that will reduce the company's energy bill by nearly \$2 million over the lifetime of the upgrades and curb greenhouse gas pollution resulting from its use of energy.<sup>57</sup> The investment will clearly pay for itself, but it required a large amount of capital up front.

Connecticut has helped address this problem through its commercial property assessed clean energy (C-PACE) program, which provides loans for clean energy investments that are repaid over time on the building's property tax bill. The Connecticut Green Bank, partially supported through mid-2017 by funds from the sale of RGGI carbon pollution allowances, developed and administers the C-PACE program, and provides C-PACE financing to commercial and industrial property owners.

The Green Bank helped Metal Finishing Technologies combine a \$367,649 C-PACE loan with approximately \$282,000 in energy efficiency incentives from their utility, Eversource, and a \$17,600 grant through the Manufacturing Innovation Fund, a program operated by the state's Department of Economic and Community Development that encourages manufacturers to use the C-PACE program.<sup>58</sup>

The funds enabled the company to make multiple efficiency upgrades to its 70,000-square-foot manufacturing facility, where it provides surface preparation and metal finishing to customers in the automotive, marine, medical and other industries.<sup>59</sup> Upgrades included LED lighting and windows, more efficient compressors and heating/cooling equipment, and more efficient transformers.

Over the life of the new equipment, Metal Finishing Technologies will reduce its electricity

and natural gas consumption, saving nearly \$2 million on their energy bills over the life of the improvements and reducing its carbon footprint. Even after paying off the 5.5 percent C-PACE loan over the next 10 years, the company will have a net project savings of just over \$1.5 million.<sup>60</sup>

In addition to helping business owners obtain financing for energy efficiency upgrades, the Green Bank offers low-cost financing and programs for homeowners, owners of multi-family housing, municipal facilities and non-profits. It also provides loan loss reserves to local banks and credit unions to enable them to increase their lending for clean energy projects. All these measures help building owners overcome financial hurdles to improving energy efficiency or adding renewable energy.

From 2013 to 2017, the C-PACE program supported more than \$100 million in clean energy investments in commercial, industrial and non-profit operations, saving customers nearly \$200 million in energy costs over the lifetime of the projects.<sup>61</sup>

### **Connecticut: Attracting Private Financing for Clean Energy**

School officials at Reed Intermediate School in Newtown, Connecticut, wanted to install solar panels on their roof but needed help.<sup>62</sup> Potential solar projects like the one at Reed Intermediate are poorly served by traditional financing because they do not qualify for residential solar financing or tax credits and are too small to attract financing and project development assistance from bigger companies.<sup>63</sup> Connecticut's Green Bank, partially supported through mid-2017 by funds from the sale of RGGI carbon pollution allowances, addresses this gap in the market and helped Reed Intermediate reach its goal.

The Green Bank helped arrange financing and technical support that enabled Reed Intermediate School to install solar panels at no cost to the school. A 617 kW solar system now supplies 39 percent of the school's electricity needs and reduces the school's energy costs.<sup>64</sup> The solar installation is owned and maintained by a third party, with Reed Intermediate buying the electricity generated by the solar panels at a

pre-approved price. Over 25 years, electricity from the solar panels will cost the school about half as much as electricity from the grid—saving the school approximately \$1.5 million over two and a half decades.

Frederick Hurley, Director of Public Works for the Town of Newtown, said in a press release issued by the Connecticut Green Bank, "Installing the solar system on the school provides many opportunities for us.... We can show students, parents, and staff how the technology works, and it will provide significant savings to the town and its residents. Plus, we are using clean energy, which is good for the environment and future generations."<sup>65</sup>

The private investors who own the solar panels on the school recoup their investment with several sources of revenue.<sup>66</sup> The owner sells electricity from the panels to the school or, if the school doesn't need power at the time, into the electricity grid. The owner also receives payment from the local utility for producing clean, renewable electricity that helps the utility meet its renewable electricity production requirements. Solar investment tax credits and tax deductions for depreciation of the solar equipment also help repay the investor.

The Green Bank helps to smooth the way for small institutions like schools to take advantage of clean energy.<sup>67</sup> It helps build the capacity of solar installers to identify and develop medium-size projects and helps private investors understand the value of financing clean energy projects. The Green Bank also bundles together multiple small projects to attract the attention of private funders. By unlocking these opportunities, the Connecticut Green Bank has generated \$8 of investment in clean energy by homeowners, business owners, and private investors for every dollar it has spent.<sup>68</sup>

### **Extend the Benefits of Clean Energy to Low- and Middle-Income Households**

Inefficient energy use can create a financial burden for low- and middle-income households. Nearly half of low-income households struggle to pay their heating, cooling and energy bills.<sup>69</sup>

For these families, the upfront costs for energy efficiency improvements can be a challenge, even though such improvements usually deliver long-term cost savings while contributing to a cleaner environment.

Programs tailored to low- and middle-income customers, including those in multi-family buildings, are important for states seeking robust energy efficiency savings.

### **Maryland: Serving People Not Reached by Other Energy Efficiency Programs**

Since the start of the RGGI program, Maryland has used some of its carbon revenues to improve energy efficiency for nearly 17,000 low- to moderate-income households.<sup>70</sup> Energy efficiency upgrades for low-to moderate-income households in fiscal year 2016, for example, cut electricity use by 7.4 million kWh annually and also reduced

natural gas, propane and heating oil use, saving consumers a total of \$1.2 million on their electricity bills each year, avoiding 5,400 metric tons of carbon dioxide pollution annually.<sup>71</sup>

Maryland's Clean Energy Communities Low-to-Moderate Income Grant Program distributes funds to county and local governments, non-profit groups and other organizations across the state that serve the targeted population. Funded organizations provide energy efficiency assistance to homeowners, multi-family buildings, and other projects that benefit low- and moderate-income Marylanders.<sup>72</sup>

Low- and moderate-income households may not always be reached through typical advertising and outreach methods. That's why Maryland's approach of using community organizations can be so powerful. For example, grant recipient Civic Works uses trusted messengers within the



*Civic Works staff, shown here at a training facility, make home visits to educate low- and moderate-income residents about the benefits of improved efficiency and install simple efficiency measures. Photo: Dean Fisher/Maryland Energy Administration.*

community to help contact low- to moderate-income Baltimore City residents.<sup>73</sup> Civic Works staff also make home visits to educate residents about the benefits of improved efficiency and install simple efficiency measures, such as efficient light bulbs and water heater insulation. Based on these initial upgrades and personal interactions, Civic Works can help guide low- and moderate-income residents to other weatherization programs that provide further efficiency benefits.<sup>74</sup>

Building-wide grants help facilities that serve low- to moderate-income households and otherwise wouldn't qualify for energy efficiency assistance. Weatherization programs, for example, often require proof of cost effectiveness before improvements can be made. But in multi-story apartments, like the Harbour House Apartments in Annapolis, air leakage between floors may result in energy efficiency improvements in one unit delivering cost savings in another, making them ineligible for funding.<sup>75</sup> With a building-wide grant, Arundel Community Development Services improved efficiency throughout the Harbour House Apartments, a move that also unlocked bulk discounts on the purchase of new, efficient heating and cooling units. Overall, the efficiency upgrades and weatherization measures save each resident of the building an average of \$600 per year.

### **Incentivize Local Governments to Adopt Clean Energy**

The RGGI program is an important part of the Northeastern and Mid-Atlantic states' efforts to reduce global warming pollution, but states need to adopt additional policies if they are to cut pollution to the levels needed to maintain a stable climate. Several states use RGGI funds to encourage local governments to adopt policies that boost renewable energy production, improve energy efficiency, and cut climate pollution.

### **Massachusetts: Grants Encourage Adoption of Clean Energy Policies**

Making carbon auction funds to municipal governments contingent upon local adoption



*With funding from Maryland's Clean Energy Communities Low-to-Moderate Income Grant Program, Arundel Community Development Services improved efficiency throughout the Harbour House Apartments. Photo: Dean Fisher/Maryland Energy Administration.*

of smart clean energy policies has enabled Massachusetts to obtain additional benefit from grants to towns and cities.

Massachusetts launched the Green Communities Designation and Grant Program in 2009 to help cities and towns reduce their environmental impact and increase adoption of renewable energy. The program's primary funding source is revenue from the sale of carbon pollution allowances to power plants.<sup>76</sup> To be designated a Green Community and receive funding through the program, municipalities must demonstrate a commitment to renewable energy and energy efficiency. By using RGGI funds as an incentive, Massachusetts has been able to spur better clean energy policies in cities and towns across the state.

Municipalities seeking designation as a Green Community must do the following:<sup>77</sup>

- 1) Update zoning requirements to facilitate construction of commercial- or industrial-scale renewable energy generation, a clean energy research and development facility, or a clean energy manufacturing facility.



- 2) Process permit applications for clean energy facilities in one year or less.
- 3) Create a plan to reduce energy use in municipal buildings and facilities by 20 percent over five years.
- 4) Commit to buying fuel-efficient vehicles for the municipal vehicle fleet.
- 5) Reduce life-cycle energy costs in new public and private buildings by adopting a stronger energy code.

Massachusetts provides guidelines and, in some cases, model ordinances that communities can adopt to fulfill these various requirements.<sup>78</sup>

As of July 2018, 210 towns and cities—home to more than two-thirds of the state’s population—have earned the Green Communities designation and have received \$39 million in grant money to help cut energy use and reduce emissions.<sup>79</sup> Municipal governments have used RGGI-funded grants and other resources to upgrade lighting, heating, air conditioning and weatherization in buildings, replace inefficient equipment at water treatment facilities, install efficient streetlights, and other measures. By the end of 2016, the



*After being designated as a Green Community in 2017, the Town of Grafton received a grant of \$157,485 to reduce municipal energy consumption by retrofitting lighting at the police station and town hall, installing LED streetlights, and other measures. Photo: Town of Grafton.*

most recent year for which data are available, designated “Green Communities” reduced their energy use in municipal buildings by 12 percent and cut emissions from municipal governments by 96,000 metric tons of carbon dioxide equivalent.<sup>80</sup>

Green Communities have increased renewable energy production and development, issuing 41 permits for renewable energy facilities.<sup>81</sup> The adoption of tighter building energy codes has also contributed to the improved energy efficiency of new homes in Massachusetts.<sup>82</sup>

Massachusetts is not the only state to use revenue from the regional carbon program to encourage local leadership. New York’s Clean Energy Community program uses RGGI funds to spur local governments to make additional commitments and investments in clean energy.<sup>83</sup> Municipalities need to complete at least four “high-impact” actions (such as streamlining the solar permitting process, training city staff on how to enforce building energy codes, or organizing a community solar power purchase) to be designated a “Clean Energy Community” and become eligible for up to \$250,000 in funding for clean energy projects.<sup>84</sup>

## Cut Carbon Pollution Beyond the Electricity Sector

While the regional climate initiative’s primary target is carbon pollution from electricity generation, revenues from the program can help reduce climate pollution from other sources—often cost-effectively.

In the home heating sector, many northeastern residences are still heated with heating oil, which creates more climate pollution than other heating sources. Transportation is now the region’s leading source of carbon pollution and is not yet subject to a program like RGGI. Until other policies are adopted to drive emission reductions from those sources, funds from the sale of carbon pollution allowances may be an effective way to begin to reduce emissions. However, investments outside of the electric sector should be weighed against the benefits achieved from reducing

emissions from electricity through investing in energy efficiency and clean energy programs.

### **Maine: Reducing Emissions from Home Heating**

Sixty-four percent of homes in Maine are heated with heating oil, which has higher global warming emissions than other common home heating sources such as natural gas or electricity.<sup>85</sup> In 2013, Maine earmarked 35 percent of carbon auction revenues for “measures that lower residential heating energy demand and reduce greenhouse gas emissions.” The approved measures included “energy efficiency improvements to residential buildings and upgrades to efficient heating systems that will reduce residential energy costs.”<sup>86</sup>

Efficiency Maine, which administers ratepayer-funded energy efficiency programs for the whole state, combined funding from the carbon auction with money from other sources and broadened the heating-related incentives available through its Home Energy Savings Program (HESP).<sup>87</sup> (These incentives were subsequently scaled back when carbon auction revenues declined because of a surplus of carbon allowances in RGGI.<sup>88</sup>) Efficiency Maine also expanded its advertising and outreach to homeowners and contractors.

HESP offers owners of single-family homes and small multi-family buildings rebates and loans to finance measures to reduce energy used for home heating. The program supports building weatherization measures such as adding better insulation, sealing air leaks, and replacing oil furnaces and boilers with heating systems that use less-polluting fuels, such as heat pumps and pellet boilers.<sup>89</sup> While the program helps fund the purchase of more efficient oil-burning heating systems, which continue the state’s reliance on fossil fuels, it also helps fund electric heat pumps, which help Maine transition to truly clean energy sources. Electric-based heating options will become cleaner over time as more electricity is produced from clean, renewable sources, and improved energy efficiency delivers savings regardless of a home’s heat source.

Heat pumps, which use an electric-powered motor to extract warmth from outdoor air and bring it inside, have been especially popular with Maine homeowners. They can reduce home energy use by up to 40 percent, and are less expensive than heating with oil.<sup>90</sup> For example, owners of a home in Presque Isle, Maine, switched from an oil boiler to a ductless heat pump as their primary home and water heating source, reducing their energy bills by 75 percent.<sup>91</sup>

Heat pumps do not require ductwork and thus can be installed relatively easily. Some heat pumps are able to provide heat when outside temperatures fall as low as -15°F.<sup>92</sup> (A supplemental heat source, such as electric resistance heating or an oil boiler, may be needed during periods of extreme low temperatures.) By 2017, Efficiency Maine had helped building owners install more than 25,000 high-efficiency ductless heat pumps.<sup>93</sup> Many of these installations were conversions from oil heating.



*The indoor unit for a ductless heat pump can be installed without significant construction. Photo: Sara Thompson via Flickr CC BY-SA 2.0.*

By expanding its offerings to include home heating, Efficiency Maine’s Home Energy Savings Program doubled the amount of energy its clients saved in 2014 compared to 2013.<sup>94</sup> These investments also save Mainers money. Efficiency Maine calculates Mainers will save \$19 million over the lifetime of efficiency measures installed in 2017.<sup>95</sup>



## Advance the Next Generation of Clean Energy Technologies

Existing energy efficiency and renewable energy technologies are capable of providing large energy savings and emission reductions. But to help reach the region's climate goals, we will also need to deploy new technologies and approaches that are currently either experimental or too expensive for widespread use. Research and development investments can help bring these new technologies to our homes and businesses faster. New York and Rhode Island both use revenue from the sale of carbon pollution allowances to fund developments that would help speed future emission reductions.

## New York: Funding More Efficient Heating and Cooling for Buildings

More than one-third of New York State's global warming pollution results from the energy used to heat, cool and ventilate buildings.<sup>96</sup> If New

York is to meet its global warming pollution reduction goals, it needs to find more efficient and less polluting ways to keep buildings warm in the winter and cool in the summer. Additionally, because heating, ventilation and air conditioning (HVAC) equipment is expensive and long-lived, building owners want to install tested and reliable equipment and are unwilling to take a chance on more efficient but unproven technologies.

To address these challenges, the New York State Energy Research and Development Authority (NYSERDA) uses some of its RGGI revenues to fund research into improved HVAC technologies. The Advanced Buildings Program's NextGen HVAC Innovation Challenges solicit proposals from companies and groups seeking funding to develop more efficient technologies or ways of ensuring widespread marketplace acceptance of those technologies.<sup>97</sup> NYSERDA is interested in technologies such as heat pumps, better HVAC controls, and coupling renewable energy and



*Efficiency Maine has used carbon auction revenues to help homeowners install heat pumps, which use an electric-powered motor to extract warmth from outdoor air and bring it inside, reducing home energy use by up to 40 percent. This Maine home has two separate ductless heat pumps. Photo: Courtesy Efficiency Maine.*



*New York has used carbon auction funds to spur advancement of clean energy technologies, such as a faster and less expensive method of drilling and installing pipes in the ground for geothermal heating systems. Photo: Dandelion Energy*

energy storage capacity with conventional heating and cooling equipment.<sup>98</sup>

For example, NYSERDA has helped fund work in Rhinebeck, New York, by energy company Dandelion to demonstrate a faster and less expensive method of drilling and installing pipes in the ground for geothermal heating systems.<sup>99</sup> Dandelion, a spinoff of Google parent company Alphabet, Inc., also has developed an innovative financing program that allows homeowners to install geothermal heating with no money down. NYSERDA has also supported a demonstration of the energy savings possible with a new fluid for ground source heat pumps. The new fluid, made by Kilfrost GEO, moves more easily in cold conditions than traditional fluids, reducing the amount of energy required to move it through pipes. It also is safer because it is not flammable. NYSERDA hopes to help demonstrate the feasibility and value of this new product and encourage geothermal system installers to begin using it.

### **Rhode Island: Planning for the Electricity Grid of the Future**

Rhode Island's energy sources are going to change dramatically in the years to come. The state plans to add tens of thousands of electric vehicles to its roads by 2025, which will increase electricity demand.<sup>100</sup> By 2035, the state will obtain 38.5 percent of its electricity from wind, solar and other sources of renewable energy, up from 13 percent today.<sup>101</sup> The state also has committed to reducing its total global warming pollution by 45 percent from 1990 levels by 2035, which will require changes in all aspects of energy use.<sup>102</sup>

To meet these goals, Rhode Island's electricity system will need to undergo significant changes. The electricity grid will need to be able to handle the multidirectional flow of electricity, as more power comes from small, distributed generation sources, such as rooftop solar facilities. Electricity grid operators will need more ability to manage electricity demand, not simply its supply, such



as by delaying some electric vehicle charging to periods of low demand or high renewable energy availability, instead of having every electric vehicle be charged in the early evening when commuters return home.

Anticipating these changes and what they might mean for the state's electricity grid, in 2015 Rhode Island used RGGI funds for an

initial analysis of the challenges to modernizing the grid.<sup>103</sup> A stakeholder group that included representatives from the state's Office of Energy Resources, the utility company that serves the state, the state's energy efficiency provider, and others considered various scenarios of future clean energy use. They evaluated the consequences for the state's electricity system of increased electricity demand for



*As more Rhode Islanders drive electric vehicles, operators of the electricity grid will need to be able to manage demand, such as by delaying some electric vehicle charging to periods of high renewable energy availability, instead of having every electric vehicle be charged in the early evening when commuters return home. Rhode Island has used revenue from its carbon auction funds to develop plans to upgrade the state's electricity grid. Photo: Misuzu Allen/U.S. Air Force*

charging vehicles and heating buildings. They also considered the greater need to centrally influence electricity demand.<sup>104</sup> They identified existing planning mechanisms that will help grid operators, power suppliers and customers prepare for Rhode Island's clean energy future. The Systems Integration Working Group also recommended next steps for the state, including:

- Preparing for and encouraging the adoption of electric vehicles, such as by adjusting electricity pricing to encourage vehicle charging during off-peak hours, clarifying policies so that companies that provide electric vehicle charging are not mistakenly regulated as utility companies, and improving tools that forecast electricity demand to help understand the impact of electric vehicles on the grid.
- Researching the potential costs and benefits of investing in advanced metering infrastructure that provides more information and control over electricity use.
- Evaluating the potential for changing how regulators evaluate the success of electric utilities and determine how to set rates. By changing incentives that utilities face, regulators could better reward utilities for investing in energy efficiency and meeting environmental goals.

Since publication of the Systems Integration Working Group's recommendations, Rhode Island has begun to redesign the regulatory framework governing its electricity grid and undertaken additional research and policy development to prepare for a clean energy future.<sup>105</sup>

# Short-Sighted Spending Decisions Slow the Clean Energy Transition

States have used carbon revenue from RGGI to cut pollution, save consumers money, and speed the transition to a clean energy future. But some states have spent carbon revenue in ways that don't forward the region's emission-reduction goals—reducing the effectiveness and benefits of the program.

## Diverting Funds from Clean Energy Purposes

New York, Connecticut, New Jersey and New Hampshire have all diverted RGGI funds to state general funds, making it harder for the region to achieve its long-term carbon emission reduction goals.

In 2009, New York transferred \$90 million in RGGI proceeds to its general fund as a deficit reduction measure.<sup>106</sup> New York has also used carbon auction revenue funds to pay for existing clean energy programs rather than to expand clean energy efforts, according to an analysis by Environmental Advocates of New York (EANY), which notes that this “deviated from the original intent of the [RGGI] program.” According to EANY's analysis:

- From 2015 to 2018, New York used \$92 million of RGGI funds to support energy tax credits, but some of that RGGI money replaced funding that had previously come from state operating funds.<sup>107</sup>
- From 2013 through September 2017, \$208 million in RGGI funds were budgeted for

efficiency and renewable incentive programs run by the Long Island Power Authority.<sup>108</sup> EANY found that over “a similar time period, LIPA cut its own program spending by 30 percent from 2013 levels,” resulting in RGGI funds “effectively subsidizing LIPA rates.”<sup>109</sup>

Connecticut's two-year budget ending in June 2019 diverts a total of \$20 million in carbon auction proceeds to state general funds.<sup>110</sup> The same budget also sharply reduces funding for programs that traditionally receive a portion of their funding from carbon revenue: the Energy Efficiency Fund and the Connecticut Green Bank.<sup>111</sup> According to Connecticut's Office of Consumer Counsel, overall cuts to clean energy spending (including, but not limited to, diversion of RGGI proceeds) will have impacts including:<sup>112</sup>

- A \$31 million cut to the Energy Efficiency Fund's commercial and industrial budget, resulting in fewer efficiency upgrades for Connecticut businesses.
- A nearly \$3 million cut to clean energy education and training.
- Nearly 13,000 fewer homes will receive weatherization upgrades.

In FY2010, New Jersey diverted \$65 million in RGGI proceeds to state general funds. The money was originally intended for New Jersey's Clean Energy Solutions Capital Investment Program, which provided loans and grants for a variety of

clean energy projects including renewable energy and energy efficiency.<sup>113</sup>

In the early years of the RGGI program, New Hampshire diverted \$3.1 million to its general fund.<sup>114</sup>

### Spending Funds on Polluting Fuels

Several states have spent carbon auction funds on new equipment that relies on polluting fuels. While the new purchases produce less global warming pollution than the equipment they replaced, they create more climate pollution than other options. And because this equipment will remain in service for decades, it will prolong the region's reliance on fossil fuels, as states face a choice of abandoning relatively new infrastructure that burns fossil fuels, or delaying the transition to cleaner fuels. A far better choice would be to spend carbon auction revenues on equipment that can start the region on a path to a clean energy future now.

Maryland's Freedom Fleet Voucher Program is an example of a program that funds polluting fuels, despite the availability of cleaner alternatives.

Though the new vehicles are more efficient and produce less local health-threatening air pollution than diesel vehicles, they are not as clean as electric-powered vehicles. Maryland provides funds for new or converted "alternative fueled vehicles" registered in Maryland for use in commercial, non-profit agency or public fleets.<sup>115</sup> The program funds the purchase of propane- and natural gas-powered vans and buses, as well as electric vehicles (though it excludes light-duty electric vehicles). To date, 79 percent of program funds have gone toward propane or natural gas vehicles, 20 percent have gone toward hybrid electric vehicles, and only 1 percent of funds have gone toward all-electric vehicles.<sup>116</sup>

Maine's Home Energy Savings Program helps fund the purchase of more efficient fossil-fuel burning boilers and furnaces, producing short-term emission savings but committing those homeowners to burning oil or propane for years to come. To support the region's transition to zero-emission energy sources, home heating programs should focus on energy efficiency improvements that deliver savings regardless of a home's heat source, and also fund electric-based heating options.



# Policy Recommendations

**T**he commitment of Northeastern and Mid-Atlantic states to reducing global warming pollution and making smart investments in clean energy has begun to move the region toward a clean energy future. As the region's carbon reduction program expands to include New Jersey and Virginia, all RGGI states should focus on how to improve the program's effectiveness by seeking strong limits on pollution from power plants and maximizing the benefits of investment in clean energy. New Jersey and Virginia are in an especially strong position to learn from other states and develop highly effective programs.

## Set Strong Caps on Pollution from Power Plants

New Jersey and Virginia should set strong state caps on carbon pollution from their power plants. The purpose of the regional climate plan is to curb emissions from electricity generation, and therefore ambitious pollution reduction goals are critical to its success. According to an analysis by the Natural Resources Defense Council (NRDC), for New Jersey a strong cap would be 12 to 13 million tons per year.<sup>117</sup> For Virginia, NRDC's analysis shows a strong cap would be 28 million tons.<sup>118</sup>

Seeking strong state limits on power plant pollution in New Jersey and Virginia as they join RGGI (or, in Virginia's case, potentially adopt a parallel program) is additionally important for setting a clear precedent. If RGGI is to expand to include other adjacent states or other sectors of

the economy, it will have to grapple with many of these same questions. What New Jersey and Virginia do may influence future negotiations to expand RGGI.

## Use Auction Revenues to Accelerate the Transition to Clean Energy

All states participating in the regional climate program should avoid the temptation to divert auction revenues from clean energy programs to other purposes, such as supporting a state's general budget. Furthermore, RGGI funds should not be used as a replacement for existing funding of energy efficiency and renewable energy efforts.

New Jersey and Virginia are in the position of developing plans from scratch for how to spend their auction revenue funds, with the benefit of understanding what has worked best in other states.

New Jersey law already provides broad guidelines for how carbon auction revenues should be spent. The state's Global Warming Solutions Fund Act stipulates that 60 percent of proceeds should be spent on commercial and industrial clean energy programs, 20 percent should be dedicated to low- and moderate-income residential programs, 10 percent should be distributed to local governments, and 10 percent should be used to support the ability of forests and marshes to hold carbon.<sup>119</sup> The law provides guidelines on how regulators should choose which projects to fund, prioritizing the amount of carbon pollution

reduced, the cost-effectiveness of reductions, and the secondary benefits provided.<sup>120</sup> This still leaves the state wide latitude in how to develop programs that will provide emission reductions and bill savings to energy customers.

To get the most benefit from these investments, New Jersey should adopt the following approach:

- New Jersey should use revenue from the sale of pollution allowances to expand its existing energy efficiency programs, as several other Northeastern and Mid-Atlantic states have done. New Jersey's current programs achieve one-fifth of the electricity savings obtained by programs in Vermont, Rhode Island or Massachusetts, the leading states in the region.<sup>121</sup>
- New Jersey should reduce emissions from sources other than electricity generation. For example, 10 percent of homes in New Jersey are heated with heating oil.<sup>122</sup> Using carbon auction revenue to improve the insulation and air-tightness of those homes and heat them with electricity could reduce global warming pollution in the state.
- New Jersey should emulate the examples set by Massachusetts' Green Communities program and New York's Clean Energy Communities program, which have leveraged funding dedicated to municipalities to encourage local governments to adopt and implement strong clean energy policies, magnifying the impact of RGGI funds.
- Auction funds can also be used to attract more revenue to improve energy efficiency, boost renewable energy use, and reduce climate pollution, as Connecticut's Green Bank has done.

Virginia should join RGGI via legislative action, which will give the state the ability to ensure auction revenues are spent as effectively as possible to reduce climate pollution and facilitate the state's transition to a clean energy future.

- Virginia has extensive clean energy opportunities. It has adopted fewer energy efficiency and renewable energy policies than many other states in the regional climate program, and spent less money supporting clean energy.<sup>123</sup> The state can look to its counterparts in the Northeast and Mid-Atlantic as it develops new clean energy programs.
- Virginia and its utilities can also leverage the experience of local governments with clean energy program deployment.<sup>124</sup> Cities, counties, and towns in Virginia have sponsored innovative clean energy programs. Localities work closely with residents and businesses, and have a proven track record of delivering success.



*Through the Massachusetts Green Communities Program, carbon auction revenues helped pay for a more efficient heating and cooling unit at Chelmsford High School. Photo: Massachusetts Department of Energy Resources.*

# Notes

1 The sum of benefits presented in RGGI, Inc., *The Investment of RGGI Proceeds through 2014*, September 2016, archived at [https://web.archive.org/web/20180807173355/https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI\\_Proceeds\\_Report\\_2014.pdf](https://web.archive.org/web/20180807173355/https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2014.pdf), plus RGGI, Inc., *The Investment of RGGI Proceeds in 2015*, October 2017, archived at [https://web.archive.org/web/20180925082929/https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI\\_Proceeds\\_Report\\_2015.pdf](https://web.archive.org/web/20180925082929/https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2015.pdf) and RGGI, Inc., *The Investment of RGGI Proceeds in 2016*, September 2018, archived at [https://web.archive.org/web/20181005040840/https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI\\_Proceeds\\_Report\\_2016.pdf](https://web.archive.org/web/20181005040840/https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2016.pdf).

2 Savings are over the lifetime of the clean energy upgrades and are based on the assumption that New Jersey achieves the same savings per dollar invested as the nine states currently in RGGI obtained in 2016. This estimate assumes New Jersey invests \$344 million from 2020 to 2030, based on an emissions cap of 12 million tons and a carbon price of \$2.88 to \$3.26 per ton, per Natural Resources Defense Council et al., Letter to New Jersey Department of Environmental Protection Commissioner Catherine McCabe and New Jersey Board of Public Utilities President Joseph Fiordaliso, *RE: Ensuring New Jersey's Re-Entry into RGGI Includes a 2020 Carbon Cap Level That Maintains the Program's Environmental Integrity*, 5 June 2018. Data on nine-state 2016 benefits and investments in energy efficiency, renewable

energy and greenhouse gas abatement from RGGI, Inc., *The Investment of RGGI Proceeds in 2016*, September 2018, archived at [https://web.archive.org/web/20181005040840/https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI\\_Proceeds\\_Report\\_2016.pdf](https://web.archive.org/web/20181005040840/https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2016.pdf). Mid-Atlantic households consumed an average of 8,465 kWh of electricity in 2015, per U.S. Energy Information Administration, *2015 Residential Energy Consumption Survey, Table CE2.2: Fuel Consumption in the Northeast – Totals and Averages*, May 2018.

3 See note 1.

4 Abt Associates, *Analysis of the Public Health Impacts of the Regional Greenhouse Gas Initiative, 2009-2014*, January 2017, archived at <https://web.archive.org/web/20170313222319/http://www.abtassociates.com/AbtAssociates/files/7e/7e38e795-aba2-4756-ab72-ba7ae7f53f16.pdf>.

5 Ibid.

6 U.S. Energy Information Administration, *Electricity Data Browser*, accessed at [www.eia.gov/electricity/data/browser/](http://www.eia.gov/electricity/data/browser/) on 15 May 2018.

7 Weston Berg et al., American Council for an Energy-Efficient Economy, *The 2018 State Energy Efficiency Scorecard*, October 2018.

8 Connecticut Green Bank, *2017 Annual Report*, no date, archived at <https://web.archive.org/web/20181005043743/https://www.ctgreenbank>.

com/wp-content/uploads/2018/07/AR-FY17-layout-final-for-web.pdf.

9 Maryland Energy Administration, *2016 LMI Program – Energy Savings Summary*, no date, archived at <https://web.archive.org/web/20180514194457/http://energy.maryland.gov/govt/Documents/FY16%20LMI%20Program%20Results.pdf>.

10 Massachusetts Department of Energy Resources, *Green Community Designations Reach Two Hundred and Ten*, 20 July 2018, archived at <https://web.archive.org/web/20180724061259/https://www.mass.gov/files/documents/2018/07/20/map-summary-green-communities-210.pdf>.

11 126th Maine Legislature, *An Act To Reduce Energy Costs, Increase Energy Efficiency, Promote Electric System Reliability and Protect the Environment*, L.D. 1559, 5 June 2013, archived at <https://web.archive.org/web/20181005165534/http://legislature.maine.gov/bills/getPDF.asp?paper=HP1128&item=1&snm=126>.

12 Efficiency Maine, *FY2017 Annual Report*, revised 2 January 2018, archived at <https://web.archive.org/web/20181005171414/https://www.energymaine.com/docs/FY2017-Annual-Report.pdf>, p. iii.

13 NYSERDA, “*NextGen HVAC Innovation Challenges*” Program Opportunity Notice (PON) 3519, accessed 16 August 2018, archived at <https://web.archive.org/web/20181005171956/https://portal.nyseda.ny.gov/servlet/servlet.FileDownload?file=00Pt0000007X4SBEA0>, and NYSERDA, *New York’s Regional Greenhouse Gas Initiative-Funded Programs Status Report, Quarter Ending December 31, 2017, Final Report*, June 2018, archived at <https://web.archive.org/web/20181005171907/https://www.nyseda.ny.gov/-/media/Files/Publications/Energy-Analysis/RGGI/2017-Q4-RGGI-status-report.pdf>.

14 Maria Gallucci, “Call for NJ Governor to Repay \$65 Million to Carbon Fund,” *Reuters*, 31 May 2011, archived at <https://web.archive.org/>

[web/20181005162724/https://www.reuters.com/article/idUS63172127920110531](https://www.reuters.com/article/idUS63172127920110531).

15 Mike Jones, Transportation Program Manager/Clean Cities Coordinator, Maryland Energy Administration, personal communication, 23 August 2018.

16 Natural Resources Defense Council et al., Letter to New Jersey Department of Environmental Protection Commissioner Catherine McCabe and New Jersey Board of Public Utilities President Joseph Fiordaliso, *RE: Ensuring New Jersey’s Re-Entry into RGGI Includes a 2020 Carbon Cap Level That Maintains the Program’s Environmental Integrity*, 5 June 2018.

17 Natural Resources Defense Council, *NRDC Comments on VA DEQ’s Proposed Regulations for Emissions Trading (9VAC5 Chapter 140, Rev. C17)*, 9 April 2018.

18 RGGI, Inc., *The Investment of RGGI Proceeds in 2016*, September 2018, archived at [https://web.archive.org/web/20181005040840/https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI\\_Proceeds\\_Report\\_2016.pdf](https://web.archive.org/web/20181005040840/https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2016.pdf).

19 RGGI, Inc., *CO2 Allowance Tracking System: Summary Level Emission Reports*, accessed 17 August 2018 at <https://rggi-coats.org/>.

20 Ibid.

21 RGGI, Inc., *Auction Results*, accessed 17 July 2018, archived at <https://web.archive.org/web/20180623232535/https://www.rggi.org/auctions/auction-results>.

22 See note 1.

23 See note 18.

24 See note 4.

25 Ibid.

26 See note 6.

27 Ibid.

28 Ibid.

29 The sum of 2008-2014 energy efficiency, clean energy and GHG abatement savings presented in *The Investment of RGGI Proceeds*. See note 1.

30 See note 18.

31 New Jersey Governor Philip Murphy, *Executive Order No. 7*, 29 January 2018.

32 RGGI, Inc., *RGGI States Announce Proposed Program Changes: Additional 30% Emissions Cap Decline by 2030* (press release), 23 August 2017, archived at [https://web.archive.org/web/20181005041853/https://www.rggi.org/sites/default/files/Uploads/Press-Releases/2017\\_08\\_23\\_Announcement\\_Proposed\\_Program\\_Changes.pdf](https://web.archive.org/web/20181005041853/https://www.rggi.org/sites/default/files/Uploads/Press-Releases/2017_08_23_Announcement_Proposed_Program_Changes.pdf).

33 Based on 9 participating states. Ibid and see note 19.

34 Calculated from estimated emissions and carbon prices from RGGI, Inc. See note 32.

35 See note 16.

36 Based on recommended cap and annual reductions from Natural Resources Defense Council et al. See note 16.

37 Based on recommended cap and annual reductions in Virginia State Air Pollution Control Board, *Carbon Dioxide Trading Program (Rev. C17) Re-Proposed Regulation* (powerpoint), 29 October 2018, archived at <https://web.archive.org/web/20181101173106/https://www.deq.virginia.gov/Portals/0/DEQ/Air/GHG/C17-reproposal.pptx>.

38 Calculated from carbon cap and estimated allowance prices by Natural Resources Defense Council et al. See note 16.

39 Calculated from recommended Virginia carbon cap in Virginia State Air Pollution Control Board, *Carbon Dioxide Trading Program (Rev. C17) Re-*

*Proposed Regulation* (powerpoint), 29 October 2018, archived at <https://web.archive.org/web/20181101173106/https://www.deq.virginia.gov/Portals/0/DEQ/Air/GHG/C17-reproposal.pptx>, and estimated allowance prices from Natural Resources Defense Council et al. See note 16.

40 Note that these savings may overlap with savings achieved from the cap on power plant emissions. Savings are over the lifetime of the clean energy upgrades. This estimate assumes New Jersey invests \$344 million from 2020 to 2030, based on an emissions cap of 12 million tons and a carbon price of \$2.88 to \$3.26 per ton, per Natural Resources Defense Council et al., in note 16. Data on nine-state 2016 benefits and investments in energy efficiency, renewable energy and greenhouse gas abatement from RGGI, Inc., in note 18. Mid-Atlantic households consumed an average of 8,465 kWh of electricity in 2015, per U.S. Energy Information Administration, *2015 Residential Energy Consumption Survey, Table CE2.2: Fuel Consumption in the Northeast – Totals and Averages*, May 2018.

41 Mid-Atlantic households consumed an average of 8,465 kWh of electricity in 2015, per U.S. Energy Information Administration, *2015 Residential Energy Consumption Survey, Table CE2.2: Fuel Consumption in the Northeast – Totals and Averages*, May 2018.

42 See note 18.

43 Pat Knight and Spencer Fields, Synapse Energy Economics, *New England Electricity Demand: How Low Can You Go? (2018)*, 2 May 2018, archived at <https://web.archive.org/web/20180817034053/http://www.synapse-energy.com/about-us/blog/new-england-electricity-demand-how-low-can-you-go-2018>.

44 See note 18.

45 Ibid.

46 Ibid.

- 47 See rankings in note 7, in Table 8.
- 48 See note 18 and Massachusetts Energy Efficiency Advisory Council, *2015 Annual Report with Data from the 2013-2015 Plan Term: Cost-Effective Energy Efficiency for Residents, Businesses and Institutions*, no date, <http://ma-eeac.org/wordpress/wp-content/uploads/EEAC-Year-2015-Annual-Report-the-the-Legislature.pdf>.
- 49 Massachusetts Energy Efficiency Advisory Council, *2015 Annual Report with Data from the 2013-2015 Plan Term: Cost-Effective Energy Efficiency for Residents, Businesses and Institutions*, no date, <http://ma-eeac.org/wordpress/wp-content/uploads/EEAC-Year-2015-Annual-Report-the-the-Legislature.pdf>.
- 50 Mass Save, *Home Energy Services Activity*, accessed 9 September 2018, archived at <https://web.archive.org/web/20181005042441/http://www.massavedata.com/Public/HESActivity>.
- 51 Mass Save, *Process and Manufacturing Equipment*, accessed 5 September 2018, archived at <https://web.archive.org/web/20181005042638/https://www.masssave.com/en/learn/business/process-and-manufacturing-equipment/>, and Mass Save, *Business*, accessed 5 September 2018, archived at <https://web.archive.org/web/20171030013522/https://www.masssave.com/en/learn/business/>.
- 52 See note 49.
- 53 See note 7.
- 54 See note 49.
- 55 John Rogers, Union of Concerned Scientists, *Massachusetts Clean Energy Bill 2018: Continuing the Journey* (blog), 9 August 2018, archived at <https://web.archive.org/web/20181005043113/https://blog.ucsusa.org/john-rogers/massachusetts-2018-clean-energy-bill>.
- 56 Massachusetts Department of Energy Resources, *Massachusetts Named Most Energy Efficient State in the Nation: Commonwealth Earns Top Ranking on American Council for an Energy-Efficient Economy Scorecard for 8<sup>th</sup> Consecutive Year* (press release), 4 October 2018, archived at <https://web.archive.org/web/20181005043518/https://www.mass.gov/news/massachusetts-named-most-energy-efficient-state-in-nation>.
- 57 Connecticut Green Bank, *Metal Finishing Technologies to Save \$1.9 Million in Energy Costs: Connecticut Green Bank's C-PACE Program Finances Significant Upgrades*, 8 November 2017, archived at <https://web.archive.org/web/20181005043605/https://www.ctgreenbank.com/metal-finishing-technologies-cpace/>, and Nicholas Zuba, Senior Manager, Commercial and Industrial Programs, Connecticut Green Bank, personal communication, 22 August 2018.
- 58 Nicholas Zuba, Senior Manager, Commercial and Industrial Programs, Connecticut Green Bank, personal communication, 22 August 2018, and Connecticut Green Bank, *Energy on the Line*, accessed 24 August 2018, at <http://www.energyontheline.com/>.
- 59 See note 57.
- 60 Ibid.
- 61 See note 8.
- 62 Direct Energy Solar/Centrica Business Solutions, *A Win-Win for Dollars and Learning* (factsheet), no date, accessed 15 August 2018 at <https://www.centricabusinesssolutions.com/us/case-study/win-win-dollars-and-learning>.
- 63 Ben Healey, President, Inclusive Prosperity Capital, personal communication, 22 August 2018.
- 64 See note 62.
- 65 Connecticut Green Bank, *Connecticut Green Bank and Onyx Renewable Partners Announce Commercial Solar Funding Agreement* (press release), 12 September 2017, archived at <https://web.archive.org/web/20180128172952/http://www.ctgreenbank.com:80/onyx-renewable-commercial-solar/>.



66 See note 63.

67 Ibid.

68 See note 8.

69 Rachel Cluett, Jennifer Amann, and Sodavy Ou, American Council for an Energy-Efficiency Economy, *Building Better Energy Efficiency Programs for Low-Income Households*, March 2016, archived at <https://web.archive.org/web/20170324201257/http://aceee.org/sites/default/files/publications/researchreports/a1601.pdf>.

70 RGGI, Inc., *The Investment of RGGI Proceeds in 2015*, October 2017, archived at [https://web.archive.org/web/20180925082929/https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI\\_Proceeds\\_Report\\_2015.pdf](https://web.archive.org/web/20180925082929/https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2015.pdf).

71 See note 9.

72 Maryland Energy Administration, *Maryland Strategic Energy Investment Fund, Report on Fund Activities FY17*, 24 January 2018, archived at <https://web.archive.org/web/20181005163754/http://news.maryland.gov/mea/wp-content/uploads/sites/15/2018/01/2017-Maryland-Strategic-Energy-Investment-Energy-Fund-Report-FINAL.pdf>.

73 Maryland Energy Administration, *Civic Works: Serving Communities through Energy Efficiency*, 9 December 2016, archived at <https://web.archive.org/web/20180514205157/http://news.maryland.gov/mea/2016/12/09/civic-works-serving-communities-through-energy-efficiency/>.

74 Ibid.

75 Maryland Energy Administration, *2015 Clean Energy Communities Low-to-Moderate Income Grant Program: ACDS Brings Comfort, Cost Savings to Annapolis Apartments*, no date, archived at [https://web.archive.org/web/20180514194513/http://energy.maryland.gov/govt/Documents/ACDS\\_CaseStudy\\_FY15.pdf](https://web.archive.org/web/20180514194513/http://energy.maryland.gov/govt/Documents/ACDS_CaseStudy_FY15.pdf).

76 Massachusetts Dept. of Energy Resources, *Green Communities Designation and Grant Program*, November 2014, archived at <https://web.archive.org/web/20171215233510/mass.gov/eea/docs/doer/green-communities/pubs-reports/gc-progress-report.pdf>.

77 Massachusetts Department of Energy Resources, *Guide: Becoming a Designated Green Community*, accessed 9 August 2018, archived at <https://web.archive.org/web/20180809181652/https://www.mass.gov/guides/becoming-a-designated-green-community>.

78 Ibid.

79 See note 10.

80 Synapse Energy Economics for Massachusetts Department of Energy Resources, *Massachusetts Green Communities Program 2016 Progress Report*, December 2017, archived at <https://web.archive.org/web/20180814232915/https://www.mass.gov/files/documents/2018/03/12/gc-2016-progress-report.pdf>.

81 Ibid.

82 Ibid.

83 NYSERDA, *New York State's Regional Greenhouse Gas Initiative Investment Plan, 2017 Operating Plan, Final Report*, December 2017, archived at <https://web.archive.org/web/20180613012414/https://www.nyserda.ny.gov/-/media/Files/EE/RGGI/2017-RGGI-Operating-Plan.pdf>.

84 NYSERDA, *Solarize: A High-Impact Action for the Clean Energy Communities Program*, no date, archived at <https://web.archive.org/web/20180612205642/https://www.nyserda.ny.gov/-/media/Files/Programs/Clean-Energy-Communities/CEC-Solarize-Step-by-Step-Guidance.pdf>.

85 Maine Governor's Energy Office, *Maine Comprehensive Energy Plan Update 2015*, February 2015, archived at <https://web>.

archive.org/web/20171209160039/  
[https://www.maine.gov/energy/pdf/  
2015%20Energy%20Plan%20Update%20Final.pdf](https://www.maine.gov/energy/pdf/2015%20Energy%20Plan%20Update%20Final.pdf),  
p. 10.

86 See note 11.

87 Efficiency Maine, *2014 Annual Report*,  
no date, archived at [https://web.archive.  
org/web/20181005171312/https://www.  
energymaine.com/docs/2014-Efficiency-Maine-  
Annual-Report.pdf](https://web.archive.org/web/20181005171312/https://www.energymaine.com/docs/2014-Efficiency-Maine-Annual-Report.pdf).

88 See note 12, p. 39, and U.S. Energy  
Information Administration, *Regional Greenhouse  
Gas Initiative Auction Prices Are the Lowest since  
2014*, 31 May 2017, archived at [https://web.  
archive.org/web/20180815174339/https://www.  
eia.gov/todayinenergy/detail.php?id=31432](https://web.archive.org/web/20180815174339/https://www.eia.gov/todayinenergy/detail.php?id=31432).

89 See note 12, p. 39.

90 Steve Dunn, U.S. Department of Energy, Office  
of Energy Efficiency and Renewable Energy, *Cold  
Climate Air-Source Heat Pumps: An Innovative  
Technology to Stay Warm in Winter and Cool in  
Summer*, 14 April 2017, archived at [https://web.  
archive.org/web/20170516151533/https://www.  
energy.gov/eere/buildings/articles/cold-climate-  
air-source-heat-pumps-innovative-technology-  
stay-warm-winter](https://web.archive.org/web/20170516151533/https://www.energy.gov/eere/buildings/articles/cold-climate-air-source-heat-pumps-innovative-technology-stay-warm-winter).

91 Efficiency Maine, *Ductless Heat Pump Case  
Study in Presque Isle, Maine* (video), 23 October  
2014, available at [https://www.youtube.com/watc  
h?v=IFG43SA9ajQ&feature=youtu.be&list=UUJIST  
dldRXiBomi6fZbWagQ](https://www.youtube.com/watch?v=IFG43SA9ajQ&feature=youtu.be&list=UUJISTdldRXiBomi6fZbWagQ).

92 Efficiency Maine, *High Efficiency Heat Pumps*,  
accessed 14 August 2018 at [https://www.  
energymaine.com/heat-pumps/](https://www.energymaine.com/heat-pumps/).

93 See note 12.

94 Lifetime MMBtu savings from all HESP  
programs for 2013 versus 2014. Efficiency Maine,  
*2013 Annual Report of the Efficiency Maine Trust*,  
corrected 11 February 2014, archived at [https://  
web.archive.org/web/20160412083947/https://](https://web.archive.org/web/20160412083947/https://)

[www.energymaine.com/docs/2013-Efficiency-  
Maine-Annual-Report.pdf](http://www.energymaine.com/docs/2013-Efficiency-Maine-Annual-Report.pdf), p. 25-26, and see note  
87, p. 23.

95 See note 12, p. 32.

96 NYSERDA, “*NextGen HVAC Innovation  
Challenges*” Program Opportunity Notice (PON)  
3519, accessed 16 August 2018, archived at  
[https://web.archive.org/web/20181005171956/  
https://portal.nyserdera.ny.gov/servlet/servlet.FileD  
ownload?file=00Pt0000007X4SBEA0](https://web.archive.org/web/20181005171956/https://portal.nyserdera.ny.gov/servlet/servlet.FileDownload?file=00Pt0000007X4SBEA0).

97 NYSERDA, *New York’s Regional Greenhouse  
Gas Initiative-Funded Programs Status Report,  
Quarter Ending December 31, 2017, Final Report*,  
June 2018, archived at [https://web.archive.org/  
web/20181005171907/https://www.nyserdera.  
ny.gov/-/media/Files/Publications/Energy-  
Analysis/RGGI/2017-Q4-RGGI-status-report.pdf](https://web.archive.org/web/20181005171907/https://www.nyserdera.ny.gov/-/media/Files/Publications/Energy-Analysis/RGGI/2017-Q4-RGGI-status-report.pdf).

98 See note 96.

99 Joseph Borowiec, Program Manager,  
Advanced Buildings Program, NYSERDA, personal  
communication, 19 September 2018.

100 Rhode Island Executive Climate Change  
Coordinating Council (EC4), *Rhode Island  
Greenhouse Gas Emissions Reduction Plan*,  
December 2016, archived at [https://web.archive.  
org/web/20181005172245/http://climatechange.  
ri.gov/documents/ec4-ghg-emissions-reduction-  
plan-final-draft-2016-12-29-clean.pdf](https://web.archive.org/web/20181005172245/http://climatechange.ri.gov/documents/ec4-ghg-emissions-reduction-plan-final-draft-2016-12-29-clean.pdf).

101 38.5 percent: see note 100; 13 percent:  
Tim Faulkner, “Report Knocks Rhode Island  
for Dirty Renewables,” *ecoRI News*, 26 July  
2018, archived at [https://web.archive.org/  
web/20180726175358/https://www.ecori.org/  
renewable-energy/2018/7/26/report-knocks-  
rhode-island-for-dirty-renewables](https://web.archive.org/web/20180726175358/https://www.ecori.org/renewable-energy/2018/7/26/report-knocks-rhode-island-for-dirty-renewables).

102 See note 100.

103 See note 70.

104 Rhode Island Office of Energy Resources,  
*Systems Integration Rhode Island Vision*

Document, January 2016, archived at <https://web.archive.org/web/20170906023320/http://www.energy.ri.gov/documents/siri/Systems%20Integration%20Rhode%20Island%20Vision%20Document%20January%202016%20FINAL.pdf>.

105 State of Rhode Island, Office of Energy Resources, *Power Sector Transformation*, accessed 21 August 2018, archived at <https://web.archive.org/web/20180213152647/http://www.energy.ri.gov/electric-gas/future-grid/>.

106 See note 70.

107 Conor Bambrick, Environmental Advocates of New York, *RGGI at a Crossroads*, May 2018, archived at [https://web.archive.org/web/20181002040854/http://eany.org/sites/default/files/documents/rggi\\_at\\_a\\_crossroads.pdf](https://web.archive.org/web/20181002040854/http://eany.org/sites/default/files/documents/rggi_at_a_crossroads.pdf).

108 Ibid.

109 Ibid.

110 Connecticut Office of Fiscal Analysis, *SB-1502: An Act Concerning the State Budget for the Biennium Ending June 30, 2019, Making Appropriations Therefor, Authorizing and Adjusting Bonds of the State and Implementing Provisions of the Budget, OFA Fiscal Note*, accessed 24 August 2018, archived at <https://web.archive.org/web/20171205091348/https://www.cga.ct.gov/2017/FN/2017SB-01502-R00-FN.htm>.

111 Keith Phaneuf, "Lawmakers Urge Reversing Clean-Energy Cuts, But Lack Budget Fix, *The CT Mirror*, 13 February 2018, archived at <https://web.archive.org/web/20180213230820/https://ctmirror.org/2018/02/13/lawmakers-urge-reversing-clean-energy-cuts-but-lack-budget-fix/>; Energy Efficiency Fund RGGI funding: Energize CT, *Energy Efficiency Board 2017 Programs and Operations Report*, 1 March 2018, archived at <https://web.archive.org/web/20181005172714/https://www.energizect.com/sites/default/files/Final-2017-Annual-Legislative-Report-WEB-2-20-18.pdf>; CT Green Bank RGGI funding: BlumShapiro for Connecticut Department of Finance and

Administration, *Connecticut Green Bank, Comprehensive Annual Financial Report, Fiscal Year Ended June 30, 2017*, archived at <https://web.archive.org/web/20181005172756/https://www.ctgreenbank.com/wp-content/uploads/2017/10/FY17-CT-Green-Bank-CAFR-10-31-2017.pdf>.

112 Connecticut Office of Consumer Counsel, *Impacts of Energy Efficiency Fund Raid Being Felt throughout Connecticut*, 16 January 2018, archived at [https://web.archive.org/web/20181005172836/http://www.ct.gov/occ/lib/occ/2018-0112\\_fundraidimpacts\\_to.pdf](https://web.archive.org/web/20181005172836/http://www.ct.gov/occ/lib/occ/2018-0112_fundraidimpacts_to.pdf).

113 See note 14, and Open EI, *Clean Energy Solutions Capital Investment Loan/Grant Program (New Jersey)*, accessed 24 August 2018, archived at [https://web.archive.org/web/20181005162901/https://openei.org/wiki/Clean\\_Energy\\_Solutions\\_Capital\\_Investment\\_Loan/Grant\\_Program\\_\(New\\_Jersey\)](https://web.archive.org/web/20181005162901/https://openei.org/wiki/Clean_Energy_Solutions_Capital_Investment_Loan/Grant_Program_(New_Jersey)).

114 See note 70, and Analysis Group, *Note on Methodology for Tracking State Expenditures of RGGI Auction Proceeds*, accessed 24 August 2018, at [http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/economic\\_impact\\_rggi\\_methodological\\_note.pdf](http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/economic_impact_rggi_methodological_note.pdf).

115 Maryland Energy Administration, *Maryland Freedom Fleet Voucher Program*, accessed 24 August 2018, archived at [https://web.archive.org/web/20180514193512/https://energy.maryland.gov/transportation/Pages/incentives\\_ffvp.aspx](https://web.archive.org/web/20180514193512/https://energy.maryland.gov/transportation/Pages/incentives_ffvp.aspx).

116 See note 15.

117 See note 16.

118 See note 17.

119 New Jersey Department of Environmental Protection, *Global Warming Solutions Fund Act Flowchart*, accessed 9 August 2018, archived at <https://web.archive.org/web/20181005163300/https://www.state.nj.us/dep/aqes/images/rggigwsfawflowchart2.jpg>.

120 *N.J.A.C. 7:27D, Global Warming Solutions*

*Fund Rules*, accessed 5 September 2018, archived at [https://web.archive.org/web/20170709190241/https://www.nj.gov/dep/rules/rules/njac7\\_27d.pdf](https://web.archive.org/web/20170709190241/https://www.nj.gov/dep/rules/rules/njac7_27d.pdf).

121 See note 7.

122 U.S. Energy Information Administration, *State Profile and Energy Estimates*, 19 July 2018, accessed at <https://www.eia.gov/state/?sid=NJ>.

123 See note 7.

124 John Morrill and Demetra McBride, Arlington County, *Arlington's Comments to Virginia Energy Plan*, 24 August 2018, archived at <https://web.archive.org/web/20181011000227/http://townhall.virginia.gov/L/viewcomments.cfm?commentid=66634>.

