ANALYSIS GROUP

The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States

Review of RGGI's Fourth Three-Year Compliance Period (2018-2020) and Options for RGGI States to Advance Key Equity Priorities

Authors:

Daniel Stuart, Ph.D.

Paul Hibbard

May 2023

Acknowledgments

This is an independent report on the economic impacts of RGGI program implementation, covering the fourth compliance period of the program (2018-2020), and a summary of options for RGGI states to advance key equity priorities moving forward. This Report complements three previous studies completed by Analysis Group in November 2011, July 2015, and April 2018 on RGGI's Compliance Periods 1, 2, and 3 (2009-2011, 2012-2014, and 2015-2017 respectively). The analytic methods of this Report follow closely upon those used in the prior reports to ensure methodological consistency.

This Report is part of the RGGI Project Series: a series of independent and nonpartisan research and analysis projects to inform and assist leaders and stakeholders in the Northeast and other states.

This Report was prepared by Analysis Group with funding from the Merck Family Fund, Environmental Defense Fund, and Daniel Hildreth. The authors wish to thank the foundations for their support of this independent analysis. We also express our thanks and appreciation to the Barr Foundation for their support of the TAG members' participation.

We also thank Laurie Burt, of Laurie Burt, LLC and the Project Coordinator for the RGGI Project Series, for her input and assistance throughout this project. The authors also wish to note their sincere appreciation to members of the Technical Advisory Group ("TAG") who reviewed and provided helpful comments on analytic methods, research, and results:

Erin Childs, Strategen
Meredith Cowart, Rocky Mountain Institute
Lila Greiner, GreenRoots
Sharon Lewis, CT Coalition for Economic & Environmental Justice
Devashree Saha, Ph.D., World Resources Institute
Ethan Story, Center for Coalfield Justice
Paola Tamayo, Acadia Center
Amy Tuininga, Ph.D., Montclair State University, PSEG Institute for Sustainability Studies

The Report, however, reflects the analysis and judgment of the authors alone and does not necessarily reflect the views of the foundations, Ms. Burt, or any advisory group member, nor the organizations they represent or of which they are a part. Finally, the authors recognize and thank their colleagues at Analysis Group (Hea Akau, Muath Ibaid, Ari Lerner, and Max Lutzius) for exceptional analytic support throughout the project and Pavel Darling for helpful feedback.

About Analysis Group

Analysis Group is one of the largest economic consulting firms globally, with more than 1,000 professionals in 14 offices in North America, Europe, and Asia. Analysis Group provides economic, financial, and business strategy consulting to leading law firms, corporations, and government agencies.

Analysis Group's energy and environment practice area is distinguished by expertise in economics, finance, market modeling and analysis, regulatory issues, and public policy, as well as significant experience in environmental economics and energy infrastructure development. Members of Analysis Group's practice have worked for a wide variety of clients including: energy producers, suppliers and consumers; utilities; state regulatory commissions and other public agencies; tribal governments; power system operators; foundations; financial institutions; start-up companies; and others. For more information, visit **www.analysisgroup.com**

Table of Contents

Index of Figures and Tables

Glossary of Terms

Abbreviation	Definition
AEO	Annual Energy Outlook
AG	Analysis Group, Inc.
BTM	Behind-the-meter
BTM PV	Behind-the-meter Photovoltaic
CO_2	Carbon Dioxide
DAC	Disadvantaged Community
EE	Energy Efficiency
EIA	Energy Information Administration
EJ	Environmental Justice
FERC	Federal Energy Regulatory Commission
GHG	Greenhouse Gases
ISO	Independent System Operator
ISO-NE	Independent System Operator of New England
LMP	Locational Marginal Price
M&V	Measurement and Verification Study
MOU	RGGI Memorandum of Understanding
N/A	Not Applicable
NPV	Net Present Value
NREL	National Renewable Energy Laboratory
NYISO	Independent System Operator of New York
VOM	Variable Operations and Maintenance
PCM	Production Cost Model
PJM	Independent System Operator for Territory Serving Parts or All of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia.
PV	Photovoltaic
RE	Renewable Energy
RGGI	Regional Greenhouse Gas Initiative

I. Executive Summary

A. Overview

In 2009, ten Northeastern and Mid-Atlantic states launched the Regional Greenhouse Gas Initiative ("RGGI"), the country's first market-based program to reduce emissions of carbon dioxide ("CO_2") from existing and new power plants.[1] The scope of RGGI is significant: the current set of RGGI states account for more than one-seventh of the population in the U.S. and more than one-sixth of the nation's gross domestic product. It is thus important to evaluate and understand the program's performance and outcomes. Insights and observations gleaned from an analysis of RGGI's net economic impacts on its member states is valuable not only to the RGGI states as they consider future policy approaches but also to other states and regions as they develop their own plans to reduce CO_2 emissions.

RGGI Continues to Deliver Economic Benefits for Member States, with $669 Million in Net Economic Benefits and 7,874 Job-Years Added Between 2018 to 2020

Although RGGI's original purpose was to reduce CO_2 emissions from power generation to help mitigate the economic, social, and environmental risks of climate change, RGGI impacts economic outcomes through changes in power sector operations and the spending of auction proceeds. As in our previous three reports, we track how RGGI-related dollars impact the economies of member states over a three-year compliance period. First, we track how RGGI dollars leave the pockets of fossil-fuel power generators to buy CO_2 allowances, make their way into state accounts, and then roll out into the economy through the expenditure of the allowance auction proceeds. Second, we track how fossil-fuel power generators pass on RGGI-related costs through changes in wholesale electricity prices. Third, we track how RGGI-related investments in energy efficiency and behind-the-meter PV ("BTM PV") reduce consumer payments through declines in load.

Although our study uses power sector and macroeconomic modeling to develop credible counterfactuals to observed outcomes, the analysis is empirically grounded by focusing on the actual economic activity that results from RGGI including:

- CO_2 allowance prices and CO_2 auction results
- Dollars distributed from the auction to the states
- Actual state-government decisions about how to spend the allowance proceeds
- Measurable reductions in energy use from energy-efficiency programs funded by RGGI dollars
- Traceable impacts of lower energy use on wholesale power prices
- Value added to the economy.

Consistent with our previous three reports, we find that RGGI has continued to deliver net economic benefits to member states, with $669 Million in economic value-added and 7,874 job-years added between 2018 to 2020.

[1] The ten original RGGI states were Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. New Jersey participated in the first three years of the RGGI program but withdrew its participation at the end of 2011. New Jersey rejoined RGGI and participated in its first auction after rejoining in 2020. Virginia joined RGGI in 2020 and participated in its first auction in 2021. Pennsylvania joined RGGI in 2022 but is yet to participate in an auction. Virginia and Pennsylvania are not included in our economic analysis but are included in our discussion of key equity issues as relevant member states for RGGI's current Third Program Review.

This Report analyzes the economic impacts of RGGI's most recent three-year compliance period, which spanned 2018 through 2020, for RGGI member states which participated in an auction during this time period (Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New York, Rhode Island, Vermont, and, for 2020, New Jersey). This analysis follows three previous studies completed by Analysis Group in November 2011, July 2015, and April 2018 on RGGI's Compliance Periods 1, 2, and 3 (2009-2011, 2012-2014, and 2015-2017 respectively).[2] The robust conclusion across all of our reports is that RGGI has delivered economic benefits to its member states while helping states make progress toward their greenhouse gas ("GHG") emission reduction targets.

RGGI States Are Taking New and Innovative Approaches to Advance Equity Priorities

Beyond RGGI's original purpose to abate CO_2 and its associated impact on aggregate economic activity, RGGI intersects with recently announced goals of RGGI states to monitor and address the disproportionate impact on overburdened communities of harmful air, water and solid waste hazards associated with energy production and use. RGGI impacts overburdened communities through changes in economic activity and changes in local air pollutants. However, unlike the aggregate impact of RGGI on economic activities, much less is known about the impact of RGGI on overburdened communities.

In this report we review the status of state and federal efforts to monitor and address disproportionate environmental impacts on overburdened communities, consider the intersection of these issues with RGGI program design and administration, and provide observations and recommendations for consideration by the RGGI states. In particular, there are opportunities for new studies of potential pollution hot spots impacting overburdened communities, increased spending of RGGI auction proceeds on ambient air pollution monitors, greater participation of members of overburdened communities in the review of permitting of polluting facilities, additional gathering of data on investments impacting overburdened communities, and minimum spending requirements for the investment of RGGI auction proceeds in overburdened communities.

In addition, we discuss how RGGI intersects with state goals to monitor and address the disproportionate impact on overburdened communities of energy production and use, and the associated harmful air, water and solid waste hazards.[3] The RGGI states have committed to consider these issues on a going-forward basis, both as part

[2] Paul J. Hibbard, Susan F. Tierney, Andrea M. Okie, and Pavel G. Darling, *The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States*, November 2011 (available at http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/economic_impact_rggi_report.pdf); and, Paul J. Hibbard, Andrea M. Okie, Susan F. Tierney, and Pavel G. Darling, *The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States*, July 2015 (available at http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_july_2015.pdf). "The Economic Impacts Of The Regional Greenhouse Gas Initiative On Nine Northeast And Mid-Atlantic States," Analysis Group, April 17, 2018, available at https://www.analysisgroup.com/globalassets/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_april_2018.pdf. The analytic method and structure of this Report were modeled closely on those of the prior reports. The analytic method employed in these reports has been peer-reviewed. See Hibbard, Paul and Susan Tierney. "Carbon Control and the Economy: Economic Impacts of RGGI's First Three Years." *The Electricity Journal*. Volume 24: 10, December 2011, pp. 30-40 and Hibbard, Paul, Susan Tierney, Pavel Darling, and Sarah Cullinan. "An expanding carbon cap-and-trade regime? A decade of experience with RGGI charts a path forward." *The Electricity Journal*. Volume 31: 5, June 2018, pp. 1-8.

[3] As documented in **Section III.B**, many different terms have been used by environmental justice and equity advocates, federal regulators, and state regulators to describe communities disproportionately impacted by environmental, health, and economic inequities including harmful air, water, and solid waste hazards. Such terms include "overburdened communities," "disadvantaged communities," "environmental justice communities," "frontline communities," and "distressed communities." For the purposes of simplicity, without assuming that this is the appropriate term to use in any given situation, we will refer to these communities as "overburdened communities" except when referring to the specific terminology employed by state or federal agencies.

of the RGGI program and more generally in the development and administration of economic, energy, and climate policies. In this report we review the current status of such efforts at state and federal levels, consider the intersection of these issues with RGGI program design and administration, and provide observations and recommendations related to this for consideration by the RGGI states. Additionally, we catalog the status of equity metrics under development for every RGGI state, select federal agencies, and select non-RGGI states.

B. Economic Results

Reflecting the original aim of the RGGI program, over the past twelve years, CO_2 emissions from power generation in the RGGI region have declined 46% from an average of 142 million short tons in the base period of 2006 to 2008 to 77 million short tons in 2020.[4] These emissions declines are partly driven by RGGI itself, along with other state energy and environmental policies and broader economic and industry factors.[5]

However, beyond these CO_2 reductions, owners of fossil-fueled power plants have spent $3.8 billion to purchase CO_2 emission allowances as part of a centralized regional auction over RGGI's history. In turn, fossil-fuel power plants have modified their bid offers in regional wholesale electricity markets to reflect these allowance purchases and grid operators in these regions have used these offer prices to dispatch power plants economically while maintaining system reliability.

Since 2009, the RGGI states have received virtually all of the $3.8 billion in auction proceeds and disbursed them back into the economy in various ways including: energy efficiency ("EE") measures and programs; renewable energy ("RE") projects; GHG-emission reduction measures; direct electricity consumer bill assistance, including for low-income households; education and job training programs; and beneficial electrification programs.

RGGI has delivered $669 million in net economic benefits to member states from 2018 to 2020

Consistent with our previous reports, we find that RGGI member states experienced net economic benefits over the last three years (2018-2020) after accounting for both direct program spending and the impacts of RGGI on the power sector. Overall, RGGI led to $669 million (net present value or "NPV") of total economic activity in the ten-state region over the 2018-2020 time period.[6] When spread across the region's population, these economic impacts amount to $15 in net positive value added per capita.[7] **Figure 1** shows the net economic value to the ten-state RGGI region as a whole, with results also broken out by power system region (with the six New England states participating in the ISO-NE electrical region, New York participating in the one-state NYISO system, and Maryland, Delaware, and New Jersey participating in the multi-state PJM power system).

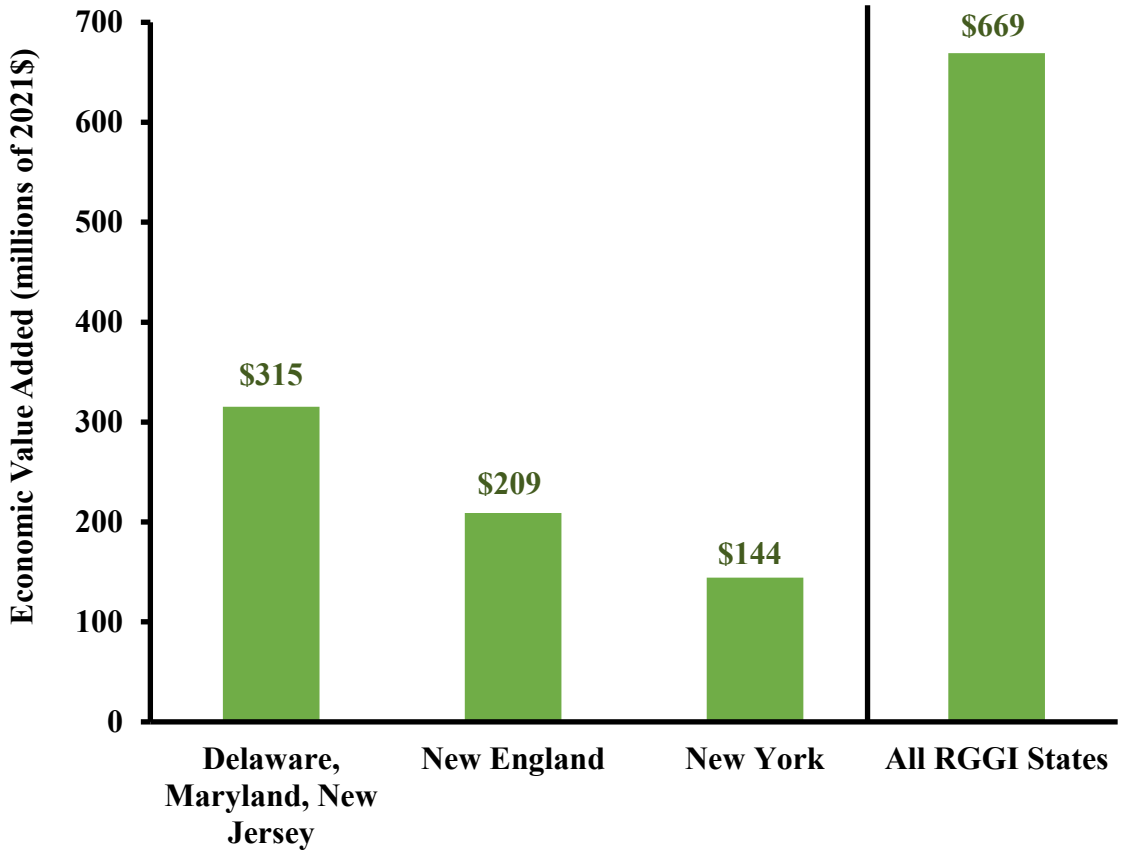
[4] "CO2 Emissions from Electricity Generation and Imports in the Regional Greenhouse Gas Initiative: 2019 Monitoring Report," The Regional Greenhouse Gas Initiative, June 15, 2022, available at: https://www.rggi.org/sites/default/files/Uploads/Electricity-Monitoring-Reports/2019_Elec_Monitoring_Report.pdf; https://www.rggi.org/allowance-tracking/rggi-coats

[5] Murray, Brian and Peter Maniloff. "Why have greenhouse emissions in RGGI states declined? An econometric attribution to economic, energy market, and policy factors," September 2015, available at: https://www.sciencedirect.com/science/article/pii/S0140988315002273

[6] All results for Compliance Period 4 are reported in 2021 dollars, with results reported using a 3-percent "public" discount rate.

[7] The relevant population is defined as the average population covering the nine continuous RGGI member states for 2018 and 2019, and the ten member states including New Jersey in 2020. Source: https://www.census.gov/programs-surveys/popest/technical-documentation/research/evaluation-estimates/2020-evaluation-estimates/2010s-state-total.html

Figure 1. Net Economic Impact of the Implementation of RGGI During the 2018-2020 Period



Notes: [1] Figures are reported in 2021 dollars (NPV), converted using a 3-percent public discount rate. [2] Total economic value added reflects the impacts of the direct spending of RGGI proceeds, net electric sector impacts to consumer payments, net impacts to power plant owner profits, changes in capacity payments, and consumer benefits from natural gas savings associated with energy efficiency investments funded with RGGI auction proceeds.

Moreover, Compliance Period 4 led to overall job increases amounting to thousands of new job-years over time. According to our analysis, the net effect is that RGGI activity during the 2018-2020 period led to over 7,874 new job-years, cumulative over the study period. Jobs that result from RGGI-related expenditures occur in many parts of the economy, with examples including workers who perform efficiency audits and who install energy efficiency measures in residences and commercial buildings, renewable resource installers, and staff performing training on energy issues.

Importantly, in our economic analysis of the RGGI program we do not attempt to quantify the potential long-term benefits of reducing the risks of climate change. The focus of our analysis is specific and narrow: to review the direct impacts of program implementation on the economies of the RGGI states to test the possibility that controlling emissions of CO_2 will lead to negative economic consequences for states that take action. Our results – which instead reveal positive economic impacts – should be viewed as additive to whatever other benefits to

human health and the environment flow from reducing economic, social, health and environmental risks associated with climate change, reduced health risks associated with ancillary reductions in other pollutants, or reduced health and environmental impacts associated with other effects of fossil-fuel generation.

These economic benefits reflect the complex ways that RGGI dollars interact within local economies.

These net economic benefit estimates capture the direct impacts of RGGI spending, along with producer-to-producer supply-chain linkages and changes in spending due to changes in household income. Together, these dollar flows have direct and indirect multiplier effects locally and regionally.[8] The size of RGGI's economic impacts varies by state, in large part because the states spent their RGGI auction proceeds in different ways, tailored to each state's economic, energy, and climate policy goals.[9] Different expenditures have different direct and indirect effects on their economies and on their electric systems. For example, a state's use of RGGI dollars to pay for EE measures or RE facilities will tend to lower electricity prices in wholesale power markets (as compared to a "without-RGGI" scenario). This in turn places downward pressure on consumers' electricity bills over time.

Local investment of RGGI dollars on energy efficiency and renewable energy help counter the impact on electricity prices resulting from CO_2 allowance costs.

On the one hand, the inclusion of the cost of CO_2 allowances in wholesale prices tends to increase wholesale electricity prices in the RGGI region in the 2018-2020 compliance period. But these near-term impacts are offset in subsequent years because states invest a substantial amount of the RGGI auction proceeds on EE and RE programs. EE and RE programs reduce net electricity consumption for program participants and lower wholesale electricity prices for everyone in the RGGI region by lowering regional electricity demand. Overall, despite an initial increase in wholesale electricity prices during the compliance period, consumers enjoy net economic gains through the combination of direct program spending and savings associated with EE and RE spending.

Over the previous twelve years, RGGI has contributed to a 46% reduction in carbon emissions, raised $3.8 billion in allowance revenues, generated net economic benefits of approximately $5.7 billion dollars, and added 48,000 incremental job-years

While RGGI contributed to a 46% reduction in carbon emissions, the AG Reports have consistently found that RGGI delivered net economic benefits to the RGGI states. In short, we have found that across all four compliance periods – the period 2009-2020 – RGGI has delivered $475 million in economic benefits and 4,000 incremental job-years per year to the RGGI states.

These findings have been consistent since RGGI's inception, creating substantial cumulative economy and job benefits to participating states.[10] Our modeling of the four compliance periods indicates that, over the past twelve years, RGGI's carbon cap-and-invest program has generated cumulative net positive economic value for the

[8] Our macroeconomic analysis captures all regional impacts of a single state's spending for the ten RGGI member states.
[9] Overall, the distribution of spending across the RGGI states for the 2018-2020 period was: 41% on EE; 17% on RE projects; 17% on direct bill assistance to consumers; 6% on program administration; 13% on GHG-emission reduction programs; and the remainder on other programs. Individual state expenditures varied significantly across these categories.
[10] Job benefits reflect "job-years," and do not identify what portion of these numbers are associated with permanent versus temporary jobs.

participating states' economies of approximately $5.7 billion dollars (2021$).[11] States' participation in RGGI has led to approximately 48,000 job-years while, at the same time, annual carbon-emissions have dropped nearly 46 percent.

The RGGI model has successfully achieved CO2 reductions through a cooperative multi-state framework that preserves state authority.

The states that comprise the RGGI region are highly diverse in many ways: their political settings and policy objectives vary widely across the states and, notably, have changed significantly *within* states over time. For example, their electric-generating portfolios differ substantially in size, technologies, fuel mix, and age; their economic bases vary; and the states have unique legal and regulatory structures that oversee energy, utility, and environmental policies.

Despite these differences, the RGGI states' experience confirms that states can work together, particularly when doing so is likely to lower compliance costs. The joint decision by the RGGI states to make their CO_2 allowances available to the market through a unified auction has generated $3.8 billion for public use. Had the allowances been given away for free, the states would not have had the benefit of the auction proceeds and instead would have transferred away significant public economic value to owners of power plants. Because of RGGI's "cap-and-invest" model, states' use of allowance proceeds has allowed for the support of diverse state energy/environmental policy and economic outcomes. For example, states have used RGGI auction proceeds to support a variety of state-specific social, fiscal, and environmental policy goals, such as assisting low-income customers, supporting advanced energy policy goals, and restoring wetlands, among other things.

C. RGGI States Are Implementing New and Innovative Policies to Advance Equity Priorities

RGGI states are actively implementing new policies to address the disproportionate impacts of energy supply and use on overburdened communities.

We summarize recent policy developments among RGGI states, which have increasingly recognized the disproportionate impacts of energy supply and use on overburdened communities. Moreover, RGGI states have committed to exploring environmental justice and equity issues in the context of RGGI's current Third Program Review process. This will be the first time environmental justice and equity issues are considered in the context of RGGI program design: the current RGGI Memorandum of Understanding (MOU), which outlines the framework of the Model Rule that may be considered by each participating state in developing their own RGGI implementation laws and regulations, does not mention justice or equity considerations.[12] Within the context of these policy

[11] As noted earlier, we have used the same foundational analytic methods, assumptions, and data sources across all four studies to ensure consistency in study results. However, caution must be exercised in directly adding results across study periods. We rely on our previous work for this calculation. *See*, Hibbard, Paul, Susan Tierney, Pavel Darling, and Sarah Cullinan. "An expanding carbon cap-and-trade regime? A decade of experience with RGGI charts a path forward." *The Electricity Journal*. Volume 31: 5, June 2018, pp. 1-8.

[12] The RGGI States' MOU has a preamble that recognizes the common objectives of the states' own policies "to conserve, improve, and protect their natural resources and environment in order to enhance the health, safety, and welfare of their residents consistent with continued overall economic growth and to maintain a safe and reliable electric power supply system." The MOU also declares a common goal of the states of "reducing our dependence on imported fossil fuels will enhance the region's economy by augmenting the

developments, we highlight several ways identified by federal and state agencies and stakeholders to address equity issues.

The RGGI states could specifically evaluate and address potential pollutant "hot spot" issues arising from RGGI implementation.

Although RGGI has reduced air pollution in aggregate as a co-benefit of reducing CO_2 emissions, the RGGI program could result in increases in emissions of harmful pollutants at times from one or more individual power plants. To assess this potential effect, we describe a hybrid methodological approach in **Section III.C** that combines actual emissions data from specific generators, pollution transport modeling, and economic supply curve analysis that could be used to estimate the impact of RGGI or other similar environmental policies on the emissions from a specific generator. This method could allow RGGI states to analytically assess the potential for adverse public health and environmental impacts in specific locations and, if found, seek ways to avoid or address them.

The RGGI states could use RGGI allowance revenues to improve the monitoring of air quality in specific communities.

Given the potential for local air quality impacts discussed in the previous bullet, states could consider increasing the installation of air quality monitoring stations in overburdened communities to monitor ambient air pollutant concentrations and assess the impact of RGGI, or other climate/environmental policies, on air quality and public health in these locations. To the extent funding is an issue, a state could consider using RGGI allowance proceeds for this purpose.

RGGI program reviews could actively support greater participation by affected members of the public in overburdened communities.

Many of the state programs we review have developed procedures to require opportunities for, and in some cases fund, the active participation of representatives from overburdened communities and environmental justice groups. The attention of RGGI program design to these equity issues could be significantly improved by ensuring active participation of members and/or representatives of these communities in (a) programs to monitor pollutant emissions from affected power plants and the monitoring of changes in the air quality at these locations, and (b) specific proceedings of state agencies related to the siting, development and/or permitting of power plants in or near these communities. RGGI auction proceeds could be used to support the participation of community members in relevant program reviews and other formal state proceedings.

RGGI states could track and report the use of RGGI allowance proceeds specifically with respect to the distribution of the benefits of RGGI-funded programs among residents, with a focus on overburdened communities.

Historically, the RGGI states have carefully tracked the use of auction proceeds. Studies like this have tracked the benefits that flow from RGGI revenue spending. The RGGI states could consider expanding the collection of data

---

region's energy security and by retaining energy spending and investments in the region…" Additionally, the original RGGI MOU states that delay in addressing GHG emissions will make later investments in mitigation and adaptation more difficult and costly, and that a market-based carbon allowance-trading program will create strong incentives for the development of lower-emitting energy sources and energy efficiency. *See* https://www.rggi.org/sites/default/files/Uploads/Design-Archive/MOU/MOU_12_20_05.pdf, pp. 1-2.

related to allowance proceeds spending with a focus on investments in overburdened communities and the distribution of benefits of RGGI program spending to different segments of the population.

RGGI states could consider establishing standards that set a minimum distribution of benefits to overburdened communities.

In line with recent minimum spending standards by state governments and the Justice 40 Executive Order by President Biden, RGGI states could use the data and analysis described in the previous bullet to ensure that a minimum proportion of RGGI investing – and associated benefits – flows to overburdened communities. As one example, this minimum could be set at the proportion of the population living in overburdened communities. If a state wishes to go beyond the minimum to alleviate inequities more rapidly, it could consider directing a much higher proportion of RGGI auction proceeds to be invested in overburdened communities.

II. Economic Impacts of RGGI, 2018-2020

A. Introduction

Since the last RGGI Program Review in December 2017 and our previous economic report in 2018, there have been dramatic changes to the electric power sector:

- Nationwide, the share of coal as a portion of generation has declined from 44.5% in 2009 to 19.3% in 2020.[13]
- Renewable technologies and storage have experienced a remarkable decline in capital costs: median installed prices for residential PV declined 60% from 2009 to 2020; the average installed cost of wind projects declined more than 43% between 2009 and 2020; and average battery energy storage capital costs declined by 72% between 2015 and 2019.[14]
- Twenty-two states, including several RGGI member states, have announced energy plans with goals of 100% clean energy or net power sector decarbonization within the next twenty or thirty years.[15]
- As discussed in detail in **Section III**, many states, including the majority of RGGI member states, have enacted statutory requirements and regulations to incorporate environmental justice priorities into energy and environmental policies.

[13] EIA, Electricity Data Browser, available at: https://www.eia.gov/electricity/data/browser/#/topic/0?agg=2,0,1&fuel=vtvv&geo=g&sec=g&linechart=ELEC.GEN.ALL-US-99.M~ELEC.GEN.COW-US-99.M~ELEC.GEN.NG-US-99.M~ELEC.GEN.NUC-US-99.M~ELEC.GEN.HYC-US-99.M~ELEC.GEN.WND-US-99.M~ELEC.GEN.TSN-US-99.M&columnchart=ELEC.GEN.ALL-US-99.M~ELEC.GEN.COW-US-99.M~ELEC.GEN.NG-US-99.M~ELEC.GEN.NUC-US-99.M~ELEC.GEN.HYC-US-99.M~ELEC.GEN.WND-US-99.M&map=ELEC.GEN.ALL-US-99.M&freq=M&start=200901&end=202301&chartindexed=0&ctype=linechart&ltype=pin&rtype=s&pin=&rse=0&maptype=0

[14] https://emp.lbl.gov/sites/default/files/2_tracking_the_sun_2022_report.pdf; https://emp.lbl.gov/wind-technologies-market-report; https://www.eia.gov/analysis/studies/electricity/batterystorage/pdf/battery_storage_2021.pdf

[15] https://www.cesa.org/projects/100-clean-energy-collaborative/guide/table-of-100-clean-energy-states/

- COVID-19 led to changes in electric load, supply chain disruptions, and a pause on program administration and disbursement of funds for many RGGI states who received RGGI allowance revenues in 2020.

In the midst of these changing economic and regulatory realities, RGGI is currently undertaking its Third Program Review, which requires RGGI states to examine RGGI's design and performance.[16] As part of this program review, RGGI states will:[17]

- "Conduct technical analyses, including electricity sector modeling, to inform decision-making related to core Program Review topics, such as the regional CO2 emission cap
- Solicit input from communities, affected groups, and the general public on the Program Review process and timeline, core topics and objectives, modeling assumptions and results, and other policy and design considerations.
- Convene independent learning sessions with experts and other interested parties on key design elements"

As such, we hope this report is a timely update on RGGI's recent economic impacts to its member states and the results of this assessment and lessons learned are useful not only to the RGGI states but also to others that have expressed interest in establishing carbon control programs.

B. RGGI Emissions and RGGI Allowance Auction Results

CO_2 emissions from power generation have declined 46% in the RGGI region from an average of 142 million short tons in the base period of 2006 to 2008 to 77 million short tons in 2020, as shown in **Figure 2**.[18] The RGGI states lowered the regional CO_2 emissions cap by 45 percent in 2014 and further tightened it by 2.5 percent per year thereafter, during the current study period. These emissions declines are partly driven by RGGI itself, along with other state energy and environmental policies and broader economic and industry factors.[19]

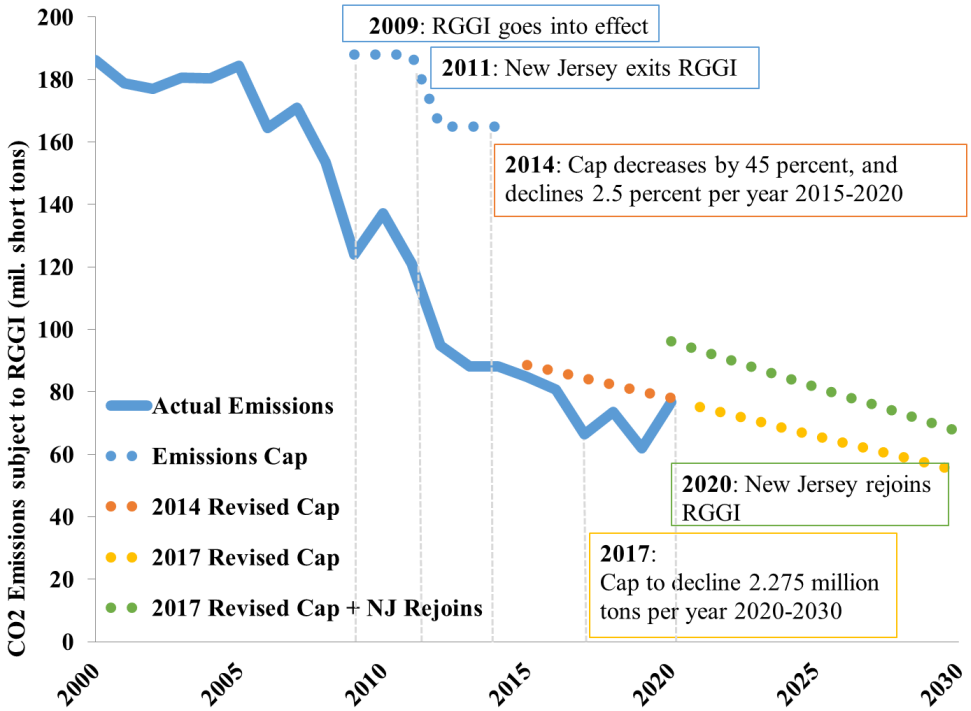
[16] https://www.rggi.org/program-overview-and-design/program-review

[17] https://www.rggi.org/sites/default/files/Uploads/Program-Review/9-13-2021/Third%20Program%20Review_Timeline_Public_2021-09-07.pdf

[18] https://www.rggi.org/allowance-tracking/rggi-coats; "CO2 Emissions from Electricity Generation and Imports in the Regional Greenhouse Gas Initiative: 2019 Monitoring Report," The Regional Greenhouse Gas Initiative, June 15, 2022, available at: https://www.rggi.org/sites/default/files/Uploads/Electricity-Monitoring-Reports/2019_Elec_Monitoring_Report.pdf

[19] Murray, Brian and Peter Maniloff. "Why have greenhouse emissions in RGGI states declined? An econometric attribution to economic, energy market, and policy factors," September 2015, available at: https://www.sciencedirect.com/science/article/pii/S0140988315002273

Figure 2. Actual CO_2 Emissions in the RGGI States and Evolution of the RGGI CO_2 Emissions Cap



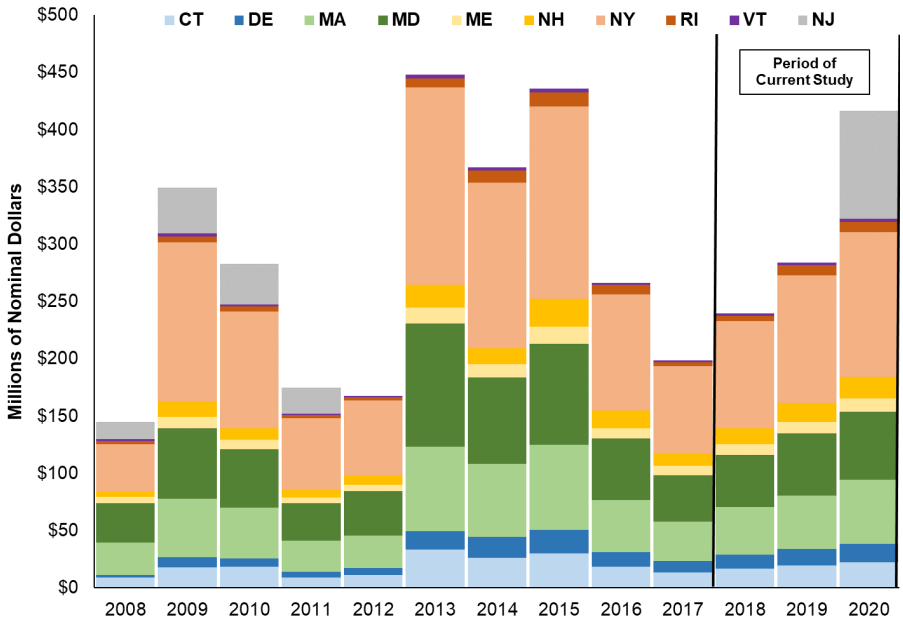
Source: RGGI, Inc. data from the RGGI CO_2 Allowance Tracking System (COATS), available at: https://www.rggi.org/allowance-tracking/rggi-coats

From 2018 through 2020, the auction of RGGI CO_2 emission allowances has resulted in the collection and disbursement to states of approximately $940 million (see **Figure 3**). This Compliance Period 4 revenue is slightly more than the amount collected in Compliance Period 3 - $901 million – and slightly less than the amounts collected in prior Compliance Periods - $952 million collected in Compliance Period 1 (2009-2011) and $983 million collected in Compliance Period 2 (2012-2014).[20] The final auction in the study period occurred in December 2020, with all of the approximately 16.2 million allowances offered for sale selling at an auction clearing price of $7.41 per allowance. **Figure 3** shows RGGI proceeds by state and region over the first four compliance periods.

Total auction proceeds in Compliance Period 4 ended up being slightly higher than in the previous period (by less than five percent), reflecting the offsetting impact of higher allowance prices and lower allowance volumes sold (as shown in **Figure 4**).

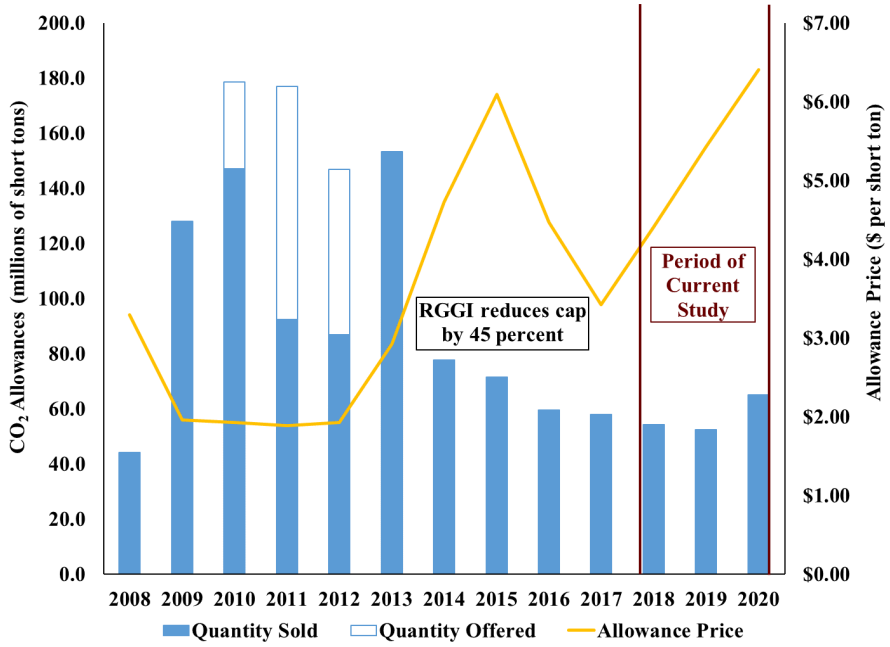
[20] The dollars reported here are in nominal dollars. For comparison purposes, we converted these amounts into real dollars (2021$), by inflating them based on the Consumer Price Index. With these conversions into real dollars (2021$), Compliance Period 1 proceeds amounted to $1.08 billion, Compliance Period 2 proceeds were $1.05 billion, Compliance Period 3 proceeds totaled $0.94 billion, and Compliance Period 4 proceeds totaled $0.94 billion.

Figure 3. RGGI CO_2-Allowance Auction Proceeds by State by Compliance Period



Notes: [1] Figures include Auctions 1-50. Auction proceeds from Auctions 1 and 2 (occurring in 2008) are included in 2009. All other values are expressed in nominal dollars in the year the auction proceeds were generated. [2] Figures do not include fixed-price sales proceeds. **Source**: RGGI, Inc.

Figure 4. RGGI Auction Allowances and Clearing Prices



Notes: Clearing prices are weighted averages, based on number of allowances sold. **Source**: RGGI, Inc.

C. Overview of Method for Assessing Economic Impacts

Consistent with how we conducted our assessments in the AG 2011, 2015 and 2018 Reports, our analysis of Compliance Period 4 tracks how allowance auction revenues are spent and identifies the associated economic impacts. There are four major elements of our review, each of which is discussed in more detail in the sections that follow:

1. We first established the **scope and overall framework of the analysis**, to create an integrated analytic framework that separates and highlights RGGI state impacts based on known historical program implementation data (*i.e.*, during Compliance Period 4), from other factors and impacts outside the region or associated with forecasts or projections. This scope of analysis included modeling of actual funds received and spent by the states, and actual impacts on electricity markets, as well as an assessment of the impacts of RGGI program expenditures on the larger economy.
2. Next, we conducted a thorough review of **data and information on each state's use of funds collected from the sale of RGGI allowances**. We initially received data from RGGI detailing each state's programs that received RGGI funding, and how much RGGI funding each program received in each year of Compliance Period 4. We supplemented this information by researching individual programs to understand the specific activities that were being funded, and by relying in some instances on the work done in our prior studies. The purpose of this step was to track how RGGI revenues were disbursed (from RGGI, Inc. to the states) because of auctions occurring during Compliance Period 4, how disbursed funds were used by the states, and what impacts resulted from associated program implementation. Part of this analysis resulted in information about the use of allowance proceeds that affected activity in the electric sector (*e.g.*, how expenditures on EE programs affected the level of energy use in various portions of the day and in different seasons of the year) and in other parts of the economy (*e.g.*, how different program expenditures provided job training, or purchases of equipment, as described further below).
3. Third, we modeled **electric sector outcomes** from both the incurrence of increased costs associated with affected facilities' compliance obligations (namely, the purchase of allowances and changes in the electric supply offers and wholesale market clearing prices consistent with those CO_2 allowance costs), and the effect of changes in electric generation and demand associated with the use of funds to spur investment in energy efficiency and renewable investments. Our electric sector analysis was conducted using the Enelytix model.[21]
4. Fourth, we modeled **macroeconomic outcomes**, combining electric sector outcomes – positive and negative – with expenditures in all sectors of the economy associated with the use of RGGI funds in the ten states. This produced an overall picture of how RGGI program implementation has affected the economy, including multiplier effects associated with the impacts on consumer electricity payments, power plant owners' costs and revenues, and the flow of RGGI-related dollars through other sectors of the economy. Our macroeconomic analysis was conducted using the IMPLAN model.

It is clear from our program research and results that different investment portfolios by states resulted in different impacts from both economic and non-economic perspectives.

[21] Note that Enelytix allowed for estimation of electric-energy market impacts while capacity-market impacts were calculated separately.

D. Scope of Economic Analysis

Overview

To carry out our analysis of economic impacts of RGGI, we ran power-system dispatch models and macroeconomic models under two scenarios: the "RGGI case," which is effectively the world as it actually occurred during Compliance Period 4; and the counterfactual "no-RGGI case," which involves changes to model inputs and assumptions to create conditions depicting a world in which the RGGI program had not been in place as of the beginning of 2018. The difference in economic impacts between the two cases reflects RGGI's incremental impacts during Compliance Period 4.

In constructing the scope of our analysis, we were guided by three key objectives. First, we wanted to focus on impacts only within the RGGI states (the geographic perspective). Second, we wanted to identify near-term and longer-term impacts associated only with RGGI's implementation during Compliance Period 4 (2018-2020) (the temporal perspective). Third, we wanted results that were grounded as much as feasible in actual, known expenditures, programs, and impacts (the empirical perspective).

From a geographic perspective, we focused our analyses on the activities and impacts exclusively within the RGGI states. While some money from RGGI spending that flows outside of the RGGI states affects the economies of states outside the RGGI region (for example, the manufacture of light bulbs or insulation used in energy efficiency programs, or flows of dollars to the federal government associated with changes in income), we did not try to report those out-of-region impacts in our analysis. Similarly, in the power-system modeling, our evaluation of impacts on power plant owners (also referred to as producers or generators here) and energy consumers was limited to those groups located within RGGI states.

From a temporal perspective, we focused our analysis on the fourth RGGI Compliance Period. This means that we included in power pricing the cost to power producers of obtaining RGGI allowances for 2018-2020, and we included in power and economic sectoral investments only RGGI auction revenues that were received during this time period.

Focusing on these three years of RGGI dollars, we tracked actual dollars collected from power producers during the twelve auctions that have occurred during Compliance Period 4, taking place from March 2018 through December 2020. The funds from these auctions flowed to the states spending them (or programming them for later expenditures, or spending previously collected dollars) during the 2018-2020 time period. Within the electric system, the impacts of these initial auctions also show up during the 2018-2020 period, as power plant owners priced the value of CO_2 allowances into prices they offer in regional wholesale markets. The macroeconomic impacts occur over the time period that allowance proceeds are collected and spent (2018-2020), but there are longer-term effects associated with the imprint of EE and RE project expenditures made during that period on energy use for the following decade (through 2030).[22] We thus track these direct effects of RGGI to date in the near term (*i.e.*, Compliance Period 4), and in the long term track secondary impacts from expenditure of RGGI

[22] As described in more detail later in this report, we assume a ten-year lifetime for installed EE measures and RE projects and conservatively truncate our modeling period after 10 years despite these resources having impacts (in the case of EE) and useful lives (in the case of RE) beyond then.

dollars by the states (for EE and RE-related expenditures from 2018-2020, and from the implications of those EE and RE measures on electricity use from 2018-2030).

From the perspective of modeling data and assumptions, we focus our analysis on known quantities associated with actual results from the fourth three years of the program. That is, we do not forecast allowance prices; we use actual allowance prices as they revealed themselves through the auctions. We do not estimate future program revenues, since we were focused on actual RGGI auction proceeds to date. We do not project how future revenues will be spent by states, since we rely entirely upon how the states have actually decided to spend allowance proceeds received to date. We make no assumptions about states' participation in RGGI going forward. Nor do we project impacts associated with programs funded through RGGI dollars collected in future years.

The goal of our analysis is thus to identify those incremental economic impacts associated with implementation of RGGI during Compliance Period 4: known allowance prices and revenues; known distribution of revenues to states; actual or committed expenditures associated with state proceeds; and observable impacts associated with RGGI-funded program implementation. In this sense, our analysis should be viewed as a snapshot of impacts associated with a finite period – Compliance Period 4 – of RGGI program administration, and not a projection or forecast of how RGGI may, could or should evolve.

To accomplish our goal, however, we had to establish what these programs meant from an economic perspective, to create the "no-RGGI" counterfactual case, against which we compare the actual economic outcomes during the 2018-2020 time period (which included RGGI).

E. Data Collection and Processing

Overview

Our analysis began with the collection and processing of data related to RGGI program implementation in each of the ten states (Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New York, Rhode Island, Vermont, and, for 2020, New Jersey). Identifying and tracking the use of RGGI proceeds is fundamental to our analysis, and has been facilitated by states' reporting of their expenditures to RGGI, Inc. on a quarterly basis. This process also involved the translating of expenditures on EE measures and new RE projects into impacts on power-system energy consumption and electricity peak loads into 8,760 hourly profiles for every year in the model period.

In the end, we were able to obtain most of the necessary data from the information reported to and by RGGI, Inc. Where information was missing or incomplete, we took successively deeper steps to fill in data gaps, sort out inconsistencies, establish proxy values, and/or arrive at a workably complete data set for use in the study.

Data Gathering

Approach

The first anchor point for our data analysis is the level of revenues collected through the quarterly auctions of allowances (approximately $940 million) during Compliance Period 4. We collected data on the sales of allowances into the market and on the allocation of those auction revenues to states. Total revenue allocations to states are shown in **Figure 3**.

Participating RGGI states report their spending of RGGI proceeds to RGGI, Inc. on a quarterly basis. RGGI, Inc. publishes these data and breaks expenditures down into the following seven investment categories: EE, clean and renewable energy, GHG abatement, direct bill assistance, administration, RGGI, Inc. administration, transfers to the general fund, and beneficial electrification.

Using these data, we traced and categorized in detail the actual use of RGGI auction proceeds for funding to various types of activities, and identified the effects of the funded activities, programs, and investments. By "effects" we mean the tangible results of the expenditures that are significant or important from the standpoint of measuring power system dispatch and economic impacts through the Enelytix and IMPLAN models. For example, what are the annual household electricity savings, on- and off-peak, associated with specific EE measures? How many MWh of generation will flow annually from an installed solar photovoltaic ("PV") system using RGGI dollars? Identifying such effects involved (1) collecting data and estimates by RGGI, Inc. on such effects, and (2) applying best-practice estimation methods where data across states were missing, incomplete or inconsistent.

Process

Based on our review of the data, the similarities in spending vehicles across RGGI states, and the levels of disaggregation needed for model inputs, we divided program spending into seven categories. These categories are described below, and expenditures by category for each electric market region (New England, New York, and PJM RGGI states), as well as for the entire RGGI footprint, are presented in Table 2 and Figure 3, below.

1) *Energy Efficiency and Other Utility Programs* – Because much of the RGGI funds were spent on EE measures, and because different measures lead to different impacts on consumers' demand for electricity, we grouped information on EE programs into residential retrofit/new construction and commercial retrofit/new construction categories.
2) *Renewable Investment* – This includes grants to programs and investments focused on the development, distribution, and installation of renewable or advanced energy technologies. Consistent with available information on auction proceeds spending from individual RGGI states, we assume that the vast majority of this investment supported behind-the-meter solar photovoltaic ("BTM PV") installations.
3) *Education and Job Training* – This includes monies used for programs (i) to educate business and residential consumers about energy consumption and the availability of programs to reduce consumption, and (ii) train workers with new skills and knowledge in industries and activities that contribute to lowering energy use (*e.g.*, installation of EE measures) or the production and distribution of renewable or other advanced energy technologies.
4) *Clean Technology Research/Development* – This includes grants and other funding to support research or other public/private groups focused on the furthering R&D related to GHG emissions (e.g., clean technologies, alternative transportation, carbon sequestration).
5) *Direct Energy Bill Assistance* – This includes use of RGGI funds to provide payment credits or other means to reduce bills paid by consumers for electricity and heating/cooling. In some cases, investments in this category are targeted to low-income households.[23]

[23] When RGGI funds target low-income households, we modify the assumed income distribution of program recipients when inputting the spending into IMPLAN to match the income eligibility cutoffs of the relevant program.

6) *GHG Reduction Programs* – The GHG reduction programs include a variety of expenditures aimed at reducing GHG emissions (*e.g.*, R&D grants for CO_2- emission abatement technologies, direct investment in "green" start-up companies, efforts to reduce vehicle miles traveled, climate change adaption measures, investments in existing fossil-fuel fired power plants to make them cleaner and/or more efficient).

7) *Program Administration* – RGGI Program Administration refers to RGGI auction proceeds used by each RGGI state to cover costs associated with the administration of the state's CO_2 Budget Trading Program and/or related consumer benefit programs.

The amounts of funds spent by program category (by RGGI state, by electrical region for the RGGI states and for the ten-state RGGI region as a whole) are show in **Table 3** and **Figure 5**, below.

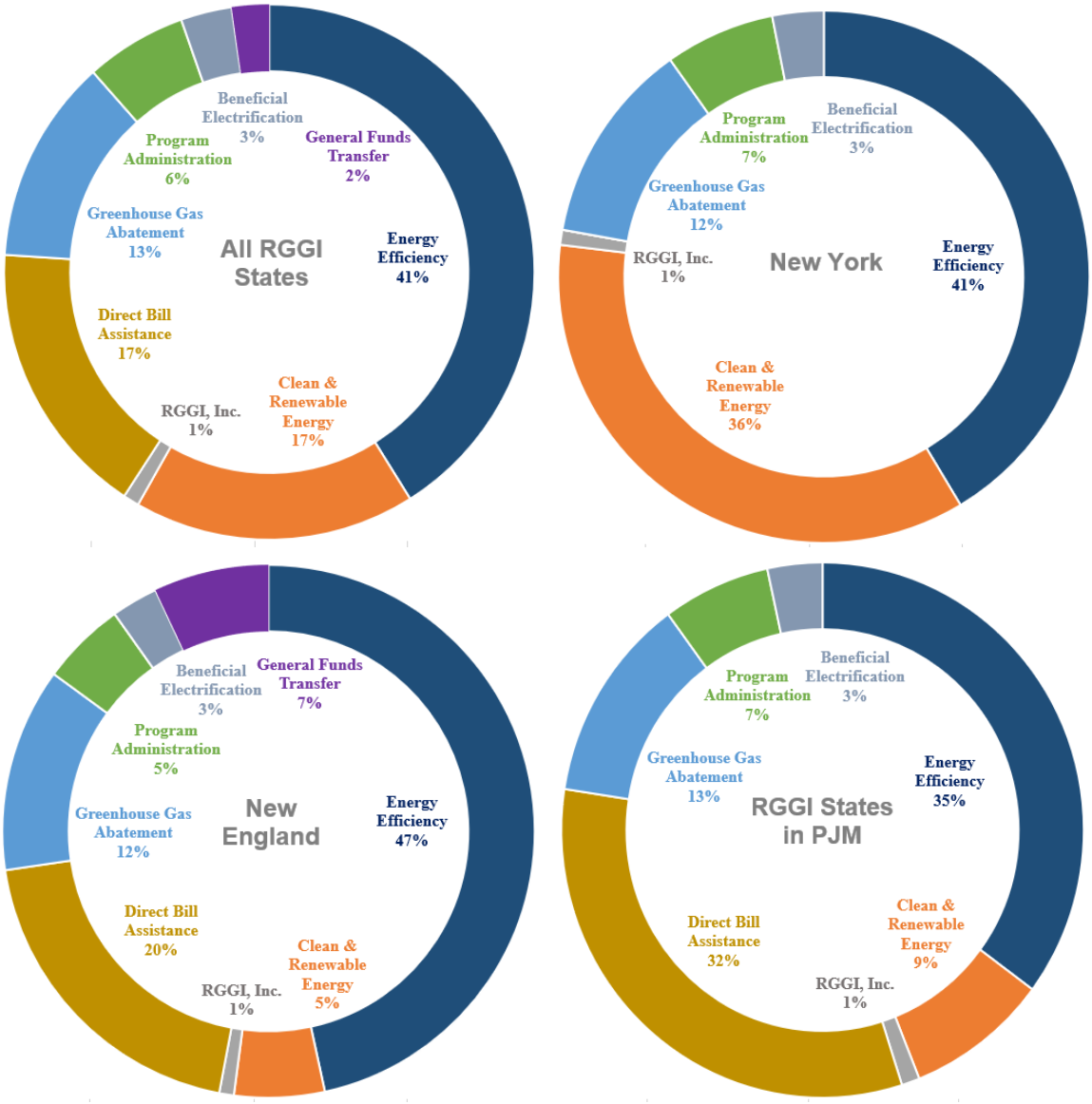
Table 1. Investment of RGGI Proceeds by Program Category (Millions of Nominal Dollars), By State and Region for 2018-2020

	Energy Efficiency	Clean & Renewable Energy	RGGI, Inc.	Direct Bill Assistance	GHG Programs	Program Administration	Beneficial Electrification	General Fund	Total
Connecticut	24.0	6.8	0.3	-	-	2.9	-	16.3	**50.3**
Maine	19.8	-	0.2	6.0	-	0.8	-	-	**26.8**
Massachusetts	46.6	0.0	1.1	-	28.1	6.1	6.6	-	**88.5**
New Hampshire	8.2	-	0.3	40.1	-	0.6	-	-	**49.2**
Rhode Island	4.8	6.0	0.1	-	0.9	1.5	-	-	**13.3**
Vermont	5.6	-	0.0	-	-	0.1	-	-	**5.7**
New England Subtotal	**109.0**	**12.8**	**2.1**	**46.1**	**29.0**	**12.0**	**6.6**	**16.3**	**233.8**
New York	105.0	90.1	2.3	-	31.3	17.0	7.9	-	**253.6**
New York Subtotal	**105.0**	**90.1**	**2.3**	**-**	**31.3**	**17.0**	**7.9**	**-**	**253.6**
Delaware	41.4	5.0	0.3	1.8	6.3	3.6	1.4	-	**59.6**
Maryland	39.7	15.4	1.8	72.9	22.5	11.8	6.0	-	**170.1**
New Jersey	0.0	-	0.5	-	-	-	0.5	-	**1.0**
RGGI States in PJM Subtotal	**81.1**	**20.3**	**2.6**	**74.7**	**28.8**	**15.4**	**7.8**	**-**	**230.7**
All RGGI States	**295.1**	**123.2**	**7.0**	**120.8**	**89.1**	**44.4**	**22.4**	**16.3**	**718.2**

Source: Analysis of state-level proceeds spending data reported to RGGI, Inc. All dollars are nominal. "Beneficial Electrification" was added by RGGI, Inc. in 2020 and principally refers to incentives for electric vehicle purchases or electric charging station investment. New Jersey re-entered RGGI in 2020, leading to limited initial investment in 2020. For the purposes of modeling, we assume New Jersey investment of RGGI allowance proceeds follows the RGGI Strategic Funding Plan.[24]

[24] https://nj.gov/rggi/docs/rggi-strategic-funding-plan.pdf

Figure 5. Summary of RGGI Proceeds Spending by Independent System Operator



Source: Analysis of state-level proceeds spending data reported to RGGI. "RGGI States in PJM" includes New Jersey, Maryland, and Delaware.

F. Modeling Approach

Overview

Since our goal was to track the incremental impact on the economy resulting from the purchase and use of RGGI allowances and from the states' use of those RGGI allowance proceeds during Compliance Period 4, we needed to (1) construct a counterfactual electric system that did not reflect RGGI impacts and (2) develop an analysis that followed the flow of RGGI dollars through the economy.

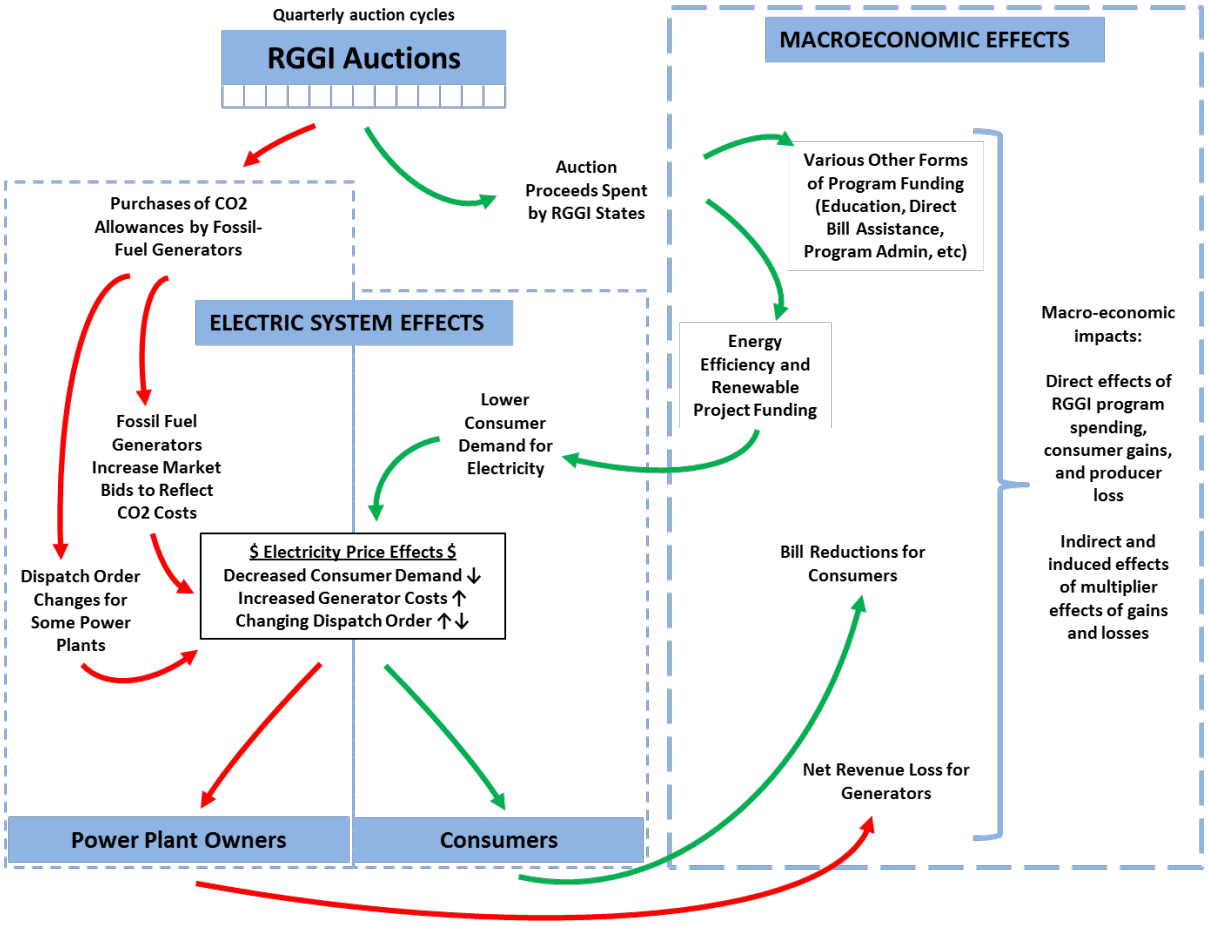
With respect to impacts on the general economy, RGGI allowance proceeds have two effects. First, when the states use RGGI proceeds to fund *any* activity, those monies have a direct impact in the form of purchases of goods and services in the economy. Second, in one way or another, many states programs expend allowance proceeds on investments that affect costs in the power sector (*e.g.*, to facilitate cost-effective reductions in power-sector emissions of CO_2, and/or to mitigate the impact of the RGGI program on consumers' electricity costs). Thus, both the compliance obligation and the use of RGGI proceeds create changes in the power sector, in the form of changes in power plant owners' costs, offer prices bid into wholesale electricity markets, and consumer spending on electricity bills. In aggregate, these changes in spending lead to revenue gains and losses (to power plant owners) and gains and losses (to consumers), which, in turn, affect economic flows in the economy.

To estimate these impacts on the economies of RGGI states, we model changes to the electric system and macroeconomic outcomes. The general flow of data and modeling outcomes is depicted in **Figure 6**.

Our modeling approach combines analysis of power sector effects (through modeling using Enelytix), and analysis of macroeconomic effects (through use of IMPLAN). The foundation of our modeling analysis is, in effect, a comparison between two scenarios run through the models. In the Enelytix model, we run a dispatch of the regional power systems "with" and "without" RGGI, and include in each run the same core conditions: power system infrastructure both in place and as it evolves over the modeling period (that is, transmission configurations and power plant additions and retirements); local and regional forecasts of electric energy and peak load by service territory over the modeling period; and projections of fuel prices and allowance prices for NO_x and SO_2; and so forth.[25] In the IMPLAN analysis, we start with economic relationships that exist among providers and users of goods and services in the RGGI states, and then we introduce the direct expenditures (RGGI proceeds) and the revenue gains and losses to electricity consumers and power producers (from the Enelytix model).

[25] Note that we do not model any capacity changes due to the presence of RGGI. Forecasts of load, fuel and other prices are needed for the post-2020 period to analyze the impact of the energy efficiency and renewable investments made during the 2018-2020 period.

Figure 6. Schematic of RGGI's Impacts on the Electric System and State Economies



The two cases in Enelytix can be described as follows:

- RGGI Scenario – In the RGGI scenario, the power system is modeled as it is. That is, the RGGI case represents the world as it has evolved with RGGI in place and operating as it did during Compliance Period 4. It includes all of the programs, measures, investments, and funding that are associated with the fourth RGGI compliance period, and all of the impacts on the power system and economy associated with the use of RGGI funds.
- No-RGGI Scenario – In order to create the counterfactual against which we compare and contrast the RGGI case, we create a scenario configured to represent the power system and economy as it would have progressed absent expenditure of RGGI-related dollars in Compliance Period 4. In order to do this, we relied on all of the data and representations of RGGI investments and associated effects described in the previous section, and removed those investments and effects from the RGGI scenario. But for these changes, all elements of the modeling process are identical across cases.

We then traced the dollar differences in these two Enelytix runs (with and without RGGI) through the macroeconomic IMPLAN model to capture the impacts of these electric sector outcomes; we also injected funds related to the states' direct expenditures of RGGI program dollars in IMPLAN.

In the following sections, we summarize the power system and macroeconomic models, and highlight a few key factors of the modeling approach that help to interpret the results.

Power Sector Analysis

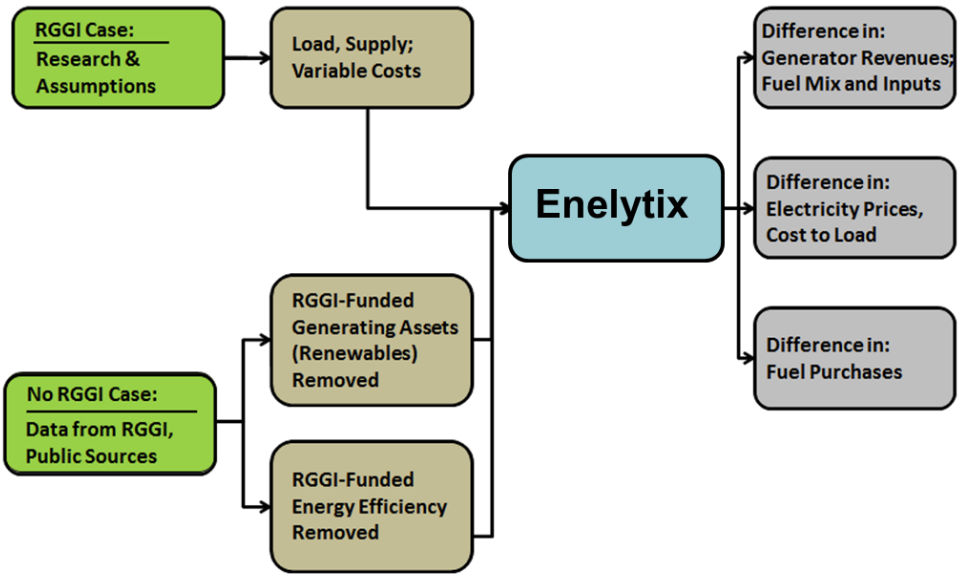
RGGI has two primary effects in wholesale power markets. First, during the 2018-2020 compliance period, power prices are increased during those hours when fossil-fired power generating facilities set the market price. These fossil-fired power generating facilities increase their offer bids to reflect the additional CO_2 allowance cost associated with RGGI. Second, during the entire 2018-2030 model period, demand and marginal prices are decreased due to changes in load associated with EE measures and RE projects installed as a result of spending RGGI allowance proceeds.

Using the Enelytix power system dispatch simulation model, we quantified these net impacts on regional and local electric-system loads, power prices, and revenues to power producers associated with implementation of the RGGI program in the third compliance period. These relationships are summarized in **Figure 7.** Using Enelytix, we created the "with RGGI" case (benchmarking the modeling results to the actual electric output that was observed in 2018-2020) and then constructed a counterfactual "no-RGGI" case. Comparing the results of the two cases provided information about the incremental effect of RGGI's Compliance Period 4 on power system users and producers.

The Enelytix power system model is configured to comprehensively simulate the dispatch of the power system on an hourly level based on power plant marginal costs, subject to various operational and transmission system constraints that can alter dispatch order (and thus prices) in real time. The Enelytix model simulates unit commitment and system dispatch based on, and reflecting: (1) the operational characteristics and marginal production costs of every generating facility in the power region being studied (in this case, New England, New York, and PJM); (2) the configuration of and limits on transfers of power across the transmission system, comprising every transmission line and other system components in place; and (3) algorithms designed to reflect the operational constraints of power plants, such as the time it takes to start units and to ramp them up to various power levels, the minimum time they must be on, and the minimum time they must be off. Given the level of detail in how Enelytix represents the power system – that is, down to very small power plants and specific transmission system components and limits – it is able to simulate and produce power prices, unit output, emissions, costs to loads (*e.g.*, wholesale supply to consumers), producer revenues, and other factors.

Given this level of detail, we are able to model investments in EE and the development of new generation using RGGI funds at the state-level. This allowed us to capture the impact of such investments on the wholesale prices that consumers pay – and that power producers are paid – on hourly and locational bases. As shown conceptually in **Figure 7**, we simulated the dispatch of the three regional power systems that contain the RGGI states for each hour of the modeling period (January 2018 through December 2030) for both the "with RGGI" and "no-RGGI" cases. Based on the output of those two cases, we calculate changes in (1) peak load, (2) unit dispatch, (3) wholesale electric prices, (4) payments to power producers, (5) payments by consumers, and (6) changes in transmission congestion costs.

Figure 7. Diagram of Enelytix Modeling Inputs and Outputs for RGGI Impacts on the Electric System



Armed with estimates of the net power sector impacts of RGGI on consumers and producers, we use the output data from Enelytix as inputs to the IMPLAN model. From a macroeconomic perspective, the end result of changes in power-system costs, revenues, and payments are (a) changes in economic conditions for power plant owners (affecting their ability to spend and save in the general economy), and (b) changes in the level of disposable income enjoyed by consumers as a result of RGGI's impact on wholesale electricity prices which affects their spending and saving in the general economy. Consequently, changes in these two factors serve as inputs to the general economic model (described below), along with other categories of RGGI program investment.

Macroeconomic Model

As previously noted, changes in power producer revenues and consumer incomes associated with electric-system impacts lead to these larger direct and indirect impacts in the economy as a whole. Other economic impacts also need to be taken into account: those related to the actual direct spending of RGGI auction proceeds by government agencies (and in turn, indirectly by the recipients of the RGGI-funded grants). All of these direct economic impacts will result in both indirect and induced effects due to multiplier effects of these changes in consumer income and producer revenues and from the purchases of goods and services in the economy by those who receive RGGI-related spending from the states.

Consequently, in order to model macroeconomic impacts, we combine the changed revenues and spending that come from the Enelytix model with all categories of the direct investment of RGGI allowance revenues in the macroeconomic model, IMPLAN. IMPLAN is a social accounting/input-output model that attempts to replicate the structure and functioning of a specific economy (*e.g.*, a state or a country), and is widely used in public and private sector economic impact analyses. It estimates the effects on a regional economy of a change in economic activity by using baseline information capturing the relationships among businesses and consumers in the economy based on historical economic survey data that track flows of money through the economy. IMPLAN tracks dollars spent in a region, including dollars that circulate within it (*e.g.*, transfers of dollars from consumers to producers), dollars

that flow into it (*e.g.*, purchases of goods and services from outside the local economy), and dollars that flow outside of it (*e.g.*, payments to the federal government). The model thus examines inflows, outflows, and interactions within the economy under study.

Specifically, IMPLAN captures various impacts, including:

- *Employment impacts* (the total number of jobs created or lost);
- *Income impacts* (the total change in income to employees that results from the economic activity); and
- *"Value-added" impacts* (the total economic value added to the economy, which reflects the gross economic output of the area less the cost of the inputs).

Both the employment and "valued added" impacts from IMPLAN reflect:

- *Direct effects:* the initial set of inputs that are being introduced into the economy. In our study, these include the direct effects of RGGI on owners of power plants as a whole, on energy consumers (end users of electricity, natural gas and heating oil), and use of RGGI proceeds to buy goods and services in the economy (*e.g.*, investment in EE, work training programs, bill payment assistance for low-income consumers).
- *Indirect effects:* the new demand for local goods, services and jobs that result from the new activity. Examples include the spending on labor to retrofit buildings with EE measures, or to train workers in these skills. Some RGGI auction proceeds lead to payments for things to suppliers located outside the local region (*e.g.*, the purchase of efficient lighting equipment or solar panels manufactured outside of the RGGI region); IMPLAN traces those dollars that do not stay within the local economy when dollars are spent on RGGI-related activities.
- *Induced effects:* the increased spending of workers resulting from income earned from direct and indirect economic activity.

Modeling Factors

To calculate the impacts of RGGI, we needed to make a number of assumptions about the systems and economies that we are studying. These assumptions relate to: (1) the relevant boundaries (*e.g.*, geographic, temporal) of the analysis, (2) the methods for putting dollar flows occurring during different time periods into a common economic framework; (3) key modeling parameters in the power system; and so forth. We highlight a few of these below.

Focus on Compliance Period 4

First, the analysis does not specifically control for any RGGI-funded investments in EE or supply before 2018 or after the program's fourth compliance period. For modeling purposes alone, and in order to isolate the incremental effects only of Compliance Period 4, we made no assumptions about RGGI continuing beyond 2020, nor did we attempt to isolate (and remove) the impacts of RGGI-related activity that occurred during the program's first nine years. Further, we do not assume that there is a price on carbon through other regional, state, or federal legislation at any point during the modeling period (through 2030). Neither assumption should be interpreted as a judgment or expectation about the likelihood one way or the other of continued RGGI program implementation, or the emergence of a national carbon-pricing regime. Constructing the analysis in this way is specifically intended to allow for focus on the specific incremental impacts of RGGI implementation during Compliance Period 4, holding all else equal.

Timing of Economic Impacts that Affect the Power Sector

The focus on actual expenditures and impacts in only the fourth three years of program implementation, in combination with the application of a discount rate, ends up highlighting the fact that RGGI benefits lag behind RGGI costs. The costs show up in electric system impacts to wholesale prices during the first three years of the modeling period (*i.e.*, Compliance Period 4), while the benefits flow to consumers over the entire modeling period (starting at the beginning of 2018 and then through 2030). Conversely, the benefits flow to owners of power plants early on (when marginal power prices are higher), with later year effects diminishing those net revenues received during the three years of the fourth compliance period.

Representation of Energy Efficiency Programs

The starting point for our energy efficiency analysis is the reported annual program expenditures of RGGI states from 2018-2020. As discussed above, we identify those program expenditures associated with energy efficiency for residential and commercial buildings. Then, we rely on detailed data on program-level energy efficiency expenditures, natural gas savings, and electricity savings to estimate the total MWh of avoided electricity consumption and total MMBtu of avoided natural gas consumption in each year.[26]

Given estimates of total electricity and natural gas savings associated with energy efficiency for every RGGI state and year of the compliance period, we distribute these savings across every hour of the modeling period using hourly energy efficiency savings profiles from NREL's ComStock and ResStock datasets.[27] These profiles vary by state, sector (commercial/residential), and specific energy efficiency measures (e.g. lighting, heating, cooling, refrigeration, etc.). We assume RGGI-funded energy efficiency programs support representative portfolios of energy efficiency measures. These portfolios are calibrated to match the distribution of actual electricity and natural gas savings associated with energy efficiency programs, as estimated in recent measurement and verification (M&V) studies.[28] In this way, we are able to translate annual electricity and natural gas savings into hourly savings profiles. The electricity savings profiles are then prepared for input into Enelytix, while the natural gas savings estimates are combined with natural gas futures prices to directly calculated the value of associated savings.[29]

---

[26] Specifically, we relied on data from the Northeast Energy Efficiency Partnership's (NEEP) Regional Energy Efficiency Database (REED). (See http://www.neep.org/initiatives/emv-forum/regional-energy-efficiency-database). This database contains 2011-2019 program level data for the RGGI states and contains information on Annual & Lifetime Energy Savings, Peak Demand Savings, Avoided Air Emissions, and Program Expenditures. Using this database, we estimate the cost per avoided MWh of electricity and cost per avoided MMBtu of natural gas consumption for commercial and residential buildings. We assume a measure lifetime of ten years, which is a conservative assumption consistent with the previous AG reports. For example, in the NEEP datasets, we found that the weighted average measure life across all RGGI states in 2018 and 2019 was approximately 11.5 years.

[27] https://comstock.nrel.gov/; https://resstock.nrel.gov/

[28] C1634 Energy Conscious Blueprint Impact Evaluation FINAL REPORT, Connecticut Energy Efficiency Board And Evaluation Administrator Team, October 18, 2020, available at: https://energizect.com/sites/default/files/documents/C1634%20ECB%20Evaluation%20Report%20-%20Final.pdf R1603; CT Home Energy Solutions and Home Energy Solutions Impact Evaluation - Final report, West Hill Energy and Computing, May 22, 2019, available at: https://energizect.com/sites/default/files/documents/R1603_Eversource%20Comments%20on%20CT%20HES%20Impact%20Evaluation%20Review%20Draft_6.19.19%20(embedded%20comments).pdf

[29] Unlike the electricity savings of energy efficiency, we do not explicitly model price impacts from changes in natural gas consumption associated with RGGI-funded energy efficiency projects.

G. Modeling Results

Net Economic Impacts

RGGI's fourth compliance period produced a net positive economic benefit of $669 million ($NPV). As previously mentioned, this includes net electric sector impacts to electric consumers and power plant owners, in addition to the non-electric benefits and program spending that result from state spending of RGGI proceeds.[30] These impacts include:

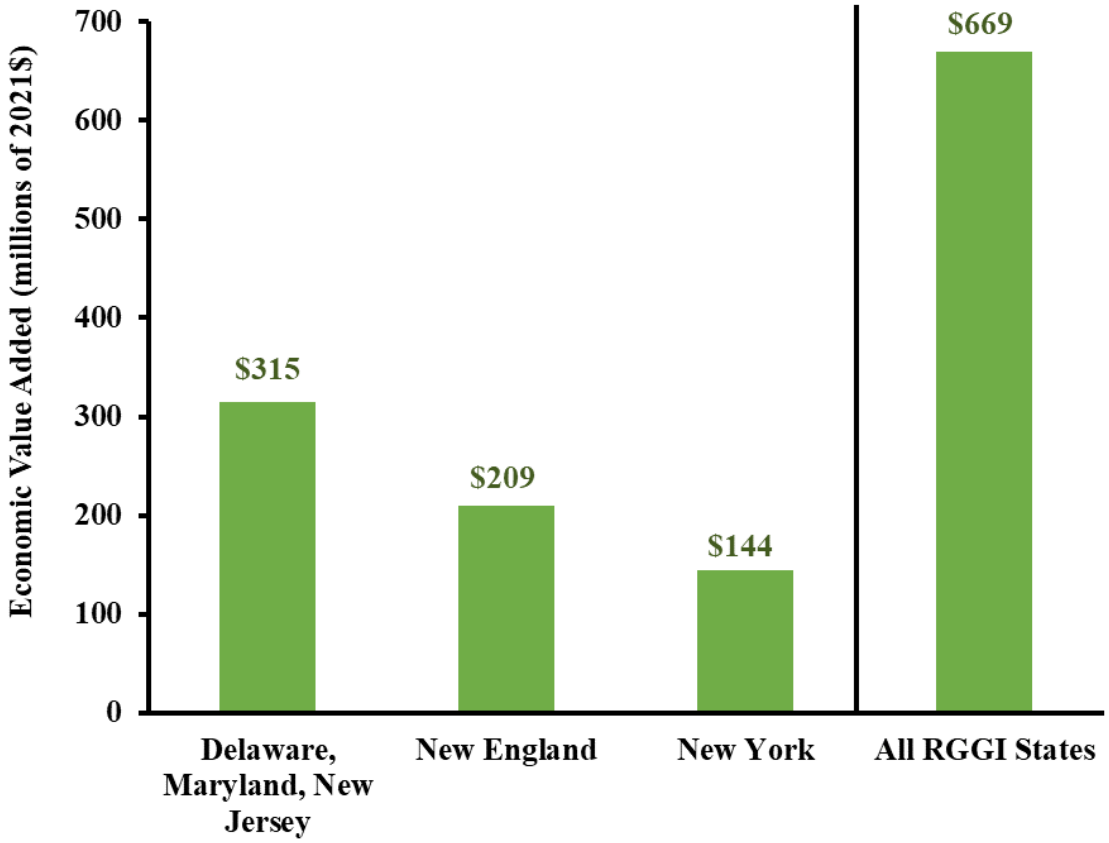
1. Program spending on programs without direct power sector impacts (e.g. rebates to all retail electric customers, climate and clean technology research, recycling grants, transfers to general funds, etc.)
2. Net changes in consumer payments reflecting the NPV of short-term bill increases from 2018-2020 and the long-run bill savings from 2021-2030 due to RGGI-funded EE and RE investments
3. Net changes in producer profits reflecting the NPV of short-term profit increases from 2018-2020 and long-run profit declines from 2021-2030 due to RGGI-funded EE and RE investments[31]
4. Consumer natural gas savings associated with RGGI-funded EE investments
5. Capacity savings associated with RGGI-funded EE and RE investments

As these individual impacts ripple through the economy, they have the net effect of producing positive economic value. This can be seen in **Figure 8** which shows the direct, indirect, and induced economic impacts to the ten-state region from the five individual components described above.

[30] Note that analyzing the economic value-added means that a dollar of direct spending does not translate into a direct effect of one dollar of value added. For example, if a dollar is spent in a state on light bulbs, the direct value added is only the net revenue and income of the retail store where the light bulb was purchased, thus excluding the manufacturing costs of the light bulb itself if it was manufactured outside the state. The same holds true for the direct revenue change to power plant owners. Direct electric consumer bill impacts are assumed to be equal to the value added to electric consumers given that any reduction in electric spending equates to a proportional increase in actual value to electric consumers.

[31] "Producer profits" refers to producer revenues minus all operating costs including fuel costs and variable operating and maintenance costs ("VOM"). We assume that the capacity mix between the RGGI and No RGGI scenarios are identical. As such, there are no changes in capital costs or fixed operations and maintenance costs ("FOM").

Figure 8. Net Economic Impact of the Implementation of RGGI During the 2018-2020 Period

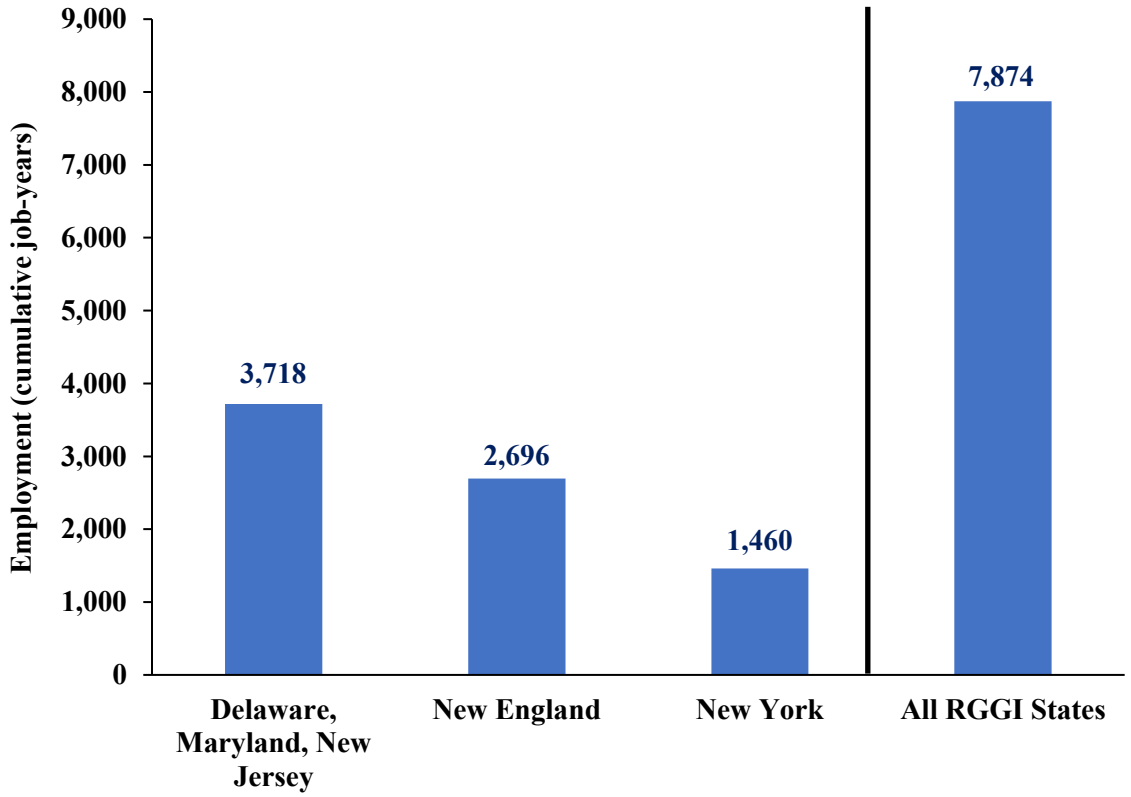


Notes: [1] Figures are reported in 2021 dollars (NPV), converted using a 3-percent public discount rate. [2] Total economic value added reflects the impacts of the direct spending of RGGI proceeds, net electric sector impacts to consumer payments, net impacts to power plant owner profits, changes in capacity payments, and consumer benefits from natural gas savings associated with energy efficiency investments funded with RGGI auction proceeds.

Employment Impacts

In addition to an economic benefit, the use of RGGI proceeds results in a positive employment impact through an increase of over 7,874 new job-years (see **Figure 9**).

Figure 9. Net Employment Impact to RGGI States as a Result of RGGI Implementation During the 2018-2020 Period



Note: [1] Figures represent employment in terms of cumulative job-years over the study period. [2] Total employment impacts reflect the impacts of the direct spending of RGGI proceeds, net electric sector impacts to consumer payments, net impacts to power plant owner profits, changes in capacity payments, and consumer benefits from natural gas savings associated with energy efficiency investments funded with RGGI auction proceeds.

III. Options for RGGI States to Advance Equity Priorities

A. Introduction

As discussed above, RGGI has delivered net economic benefits to RGGI states across the four previous compliance periods while simultaneously ensuring that carbon dioxide emissions have declined by 46 percent between the base period of 2006 to 2008 and 2020.[32] In this sense, RGGI is an economic "win-win": RGGI delivers cost-effective emissions reductions while simultaneously increasing net economic activity in the RGGI states.

However, despite the positive benefits of RGGI as a whole for the reduction of emissions of CO_2 and other harmful pollutants, and for the overall economy, much less is known about the impact of RGGI with respect to any relief of environmental, health, or economic inequities for overburdened communities. One might assume that if RGGI has contributed to reducing emissions overall, this is also likely to be the case in such communities; but this is not necessarily true, and cannot be assumed without monitoring of air pollutant concentrations in specific locations. Similarly, one might assume that the increase in spending on EE programs means there has been an increase in EE spending in overburdened communities. Yet it also cannot be assumed that spending in these communities has increased, or that it has increased in proportion to spending in other communities.

The RGGI states recognize that the equitable distribution of benefits is an important issue, and have committed to investigating environmental justice and equity issues in the context of the current, ongoing program review process for the first time.[33] The RGGI Memorandum of Understanding (MOU), which outlines the framework of the Model Rule that each participating state considers in developing their own RGGI implementation laws and regulations, does not mention justice or equity considerations.[34] Moreover, to date, RGGI has had limited visibility into how RGGI spending impacts overburdened communities. For example, the RGGI Proceeds report in 2020 identifies 13 percent of 2020 investments went to programs focused on low-income recipients.[35] However, this number does not measure the impact of general program investment on low-income recipients, nor the impact of RGGI investments on communities historically overburdened by environmental, economic, and health impacts associated with energy production and use.

Thus, we include an introductory review of current state and federal efforts to better understand and begin to address equity and environmental justice priorities in the context of energy and climate policy, and specifically consider these issues with respect to the future design and administration of the RGGI program. Based on our

[32] "CO2 Emissions from Electricity Generation and Imports in the Regional Greenhouse Gas Initiative: 2019 Monitoring Report," The Regional Greenhouse Gas Initiative, June 15, 2022, available at: https://www.rggi.org/sites/default/files/Uploads/Electricity-Monitoring-Reports/2019_Elec_Monitoring_Report.pdf

[33] "RGGI Third Program Review: Updated Timeline," RGGI, July 5, 2022, available at https://www.rggi.org/sites/default/files/Uploads/Press-Releases/Program_Review_Timeline_Update_2022-07-05.pdf.

[34] "Model Rule," RGGI, December 14, 2018, available at https://www.rggi.org/sites/default/files/Uploads/Design-Archive/Model-Rule/2017-Program-Review-Update/2017_Model_Rule_revised.pdf.

[35] *See* "The Investment of RGGI Proceeds in 2020," RGGI, May 2022, available at https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2020.pdf.

review, we highlight several observations for RGGI states regarding how they could prioritize, track and report RGGI investments in overburdened communities.

B. Evolving Environmental Justice and Equity Policies

States with decarbonization goals have focused on pathways that generally rely on electrification of building (primarily heating) and transportation sectors, and the simultaneous rapid decarbonization of the power sector.[36] Given historic inequities in the location of fossil fuel infrastructure, these decarbonization policies could have consequences for individuals living in overburdened communities disproportionately impacted by environmental, health, and economic inequities, including in RGGI states.[37] The remainder of this section documents recent policies related to environmental justice and equity for the federal government, certain non-RGGI states, and every RGGI state.

Federal Policies

Statutory/Regulatory requirements: By Executive Order 14008, President Biden set the goal that 40 percent of the overall benefits of certain federal investments flow to disadvantaged communities ("DACs") that are marginalized, underserved, and overburdened by pollution ("Justice40").[38] A "covered program" is a federal program that falls in the scope of the Justice40 initiative because it includes investments that can benefit disadvantaged communities across one or more of the following seven areas: climate change, clean energy and energy efficiency, clean transit, affordable and sustainable housing, training and workforce development, remediation and reduction of legacy pollution, and the development of critical clean water and wastewater infrastructure. Existing and new programs created by President Biden's Inflation Reduction Act, the Bipartisan Infrastructure Law, and the American Rescue Plan that make investments in any of these categories can also be considered Justice40 covered programs[39].

[36] See, e.g., "Accelerating Decarbonization of the U.S. Energy System," National Academies of Sciences, Engineering, and Medicine, 2021, available at: https://nap.nationalacademies.org/catalog/25932/accelerating-decarbonization-of-the-us-energy-system

[37] For example, "in RGGI states the percentage of people of color that live within 0–6.2 miles from power plants is up to 23.5 percent higher than the percent of the white population that lives within those same distance bands, and the percentage of people living in poverty that live within 0–5 miles from power plants is up to 15.3 percent higher than the percent of the population not living in poverty within those same distance bands." *See* "Environmental justice and power plant emissions in the Regional Greenhouse Gas Initiative states," Juan Declet-Barreto and Andrew A. Rosenberg, July 20, 2022, available at https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0271026. *See also*, "PM2.5 polluters disproportionately and systemically affect people of color in the United States," Christopher Tessum et al., April 28, 2021, available at https://www.science.org/doi/10.1126/sciadv.abf4491

[38] "Justice40," The White House, available at https://www.whitehouse.gov/environmentaljustice/justice40/.

[39] "Justice40," The White House, available at https://www.whitehouse.gov/environmentaljustice/justice40/.

Additionally, President Biden has required the head of every federal agency to conduct an equity review to assess whether underserved communities and their members face systemic barriers to accessing benefits and opportunities available pursuant to those policies and programs.[40] 90 agencies across the federal government have created Equity Action Plans documenting each agency's efforts to address the barriers and discrimination underserved communities face.[41]

Advisory council: Executive Order 14008 established two new councils on environmental justice. The White House Environmental Justice Interagency Council Executive Order was charged to develop: "a strategy to address current and historic environmental injustice by consulting with the White House Environmental Justice Advisory Council and with local environmental justice leaders; "clear performance metrics to ensure accountability"; and "an annual public performance scorecard on its implementation."[42] The White House Environmental Justice Advisory Council ("WHEJAC") was charged "to provide independent advice and recommendations to the Chair of the Council on Environmental Quality and to the White House Environmental Justice Interagency Council on how to increase the Federal Government's efforts to address current and historic environmental injustice" including on "broad cross-cutting issues related, but not limited, to issues of environmental justice and pollution reduction, energy, climate change mitigation and resiliency, environmental health, and racial inequity."[43]

The National Environmental Justice Advisory Council (NEJAC), an advisory council to EPA, was established in 1993 and "provides advice and recommendations about broad, cross-cutting issues related to environmental justice, from all stakeholders involved in the environmental justice dialogue."[44] In this role, the NEJAC provides independent advice and recommendations to the EPA Administrator. The Council's major objectives are to provide advice and recommendations about EPA efforts to:

- "Integrate environmental justice considerations into Agency programs, policies and activities.
- Improve the environment or public health in communities disproportionately burdened by environmental harms and risks.
- Address environmental justice by ensuring meaningful involvement in EPA decision-making, building capacity in disproportionately burdened communities, and promoting collaborative problem-solving for issues involving environmental justice.
- Strengthen its partnerships with other governmental agencies, such as other Federal agencies and State, Tribal, or local governments, regarding environmental justice issues.
- Enhance research and assessment approaches related to environmental justice."[45]

[40] https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-advancing-racial-equity-and-support-for-underserved-communities-through-the-federal-government/

[41] https://www.whitehouse.gov/equity/#equity-plan-snapshots

[42] https://www.whitehouse.gov/environmentaljustice/white-house-environmental-justice-interagency-council/

[43] https://www.epa.gov/system/files/documents/2023-03/2023%20White%20House%20Environmental%20Justice%20Advisory%20Council%20Charter.pdf

[44] https://www.epa.gov/environmentaljustice/national-environmental-justice-advisory-council

[45] "National Environmental Justice Advisory Council," EPA, available at https://www.epa.gov/environmentaljustice/national-environmental-justice-advisory-council.

Preferred metrics for identifying EJ concerns: As part of the Justice40 initiative, many federal agencies are developing methods for identifying disadvantaged communities, including DOE, EPA, CEQ, CDC, and DOT.[46] We highlight four federal agencies with publicly available methods for identifying disadvantaged communities:

- DOE: 36 distinct metrics. A Census tract is considered disadvantaged when it ranks in the 80th percentile of the cumulative sum of the 36 burden indicators and have at least 30% of households classified as low-income. The DOE only selects the top 20% of census tracts within each state.
- EPA: 28 distinct metrics. No single definition for disadvantaged communities. Any individual demographic factor may be combined with a single environmental indicator, to display areas with the highest intersection between these socioeconomic factors and the environmental indicator.
- CEQ: 33 distinct metrics. A Census tract is considered disadvantaged when it meets more than 1 burden threshold AND is low income OR if they are on land within the boundaries of Federally Recognized Tribes. Census tracts that are completely surrounded by disadvantaged communities are also considered disadvantaged if they meet an adjusted low income threshold (≥ 50th percentile).
- CDC: 40 distinct metrics. Environmental Justice Index is defined as the sum of (percentile ranked sum of environmental burden indicators) and (percentile ranked sum of social vulnerability indicators).

Appendix Table 1 presents the specific variables used by each of these agencies to identify DACs.

Non-RGGI State Policies

In this section, we discuss how the only other states in the United States with current cap-and-invest programs – California and Washington – have incorporated equity priorities into the design of their cap-and-invest programs.

California

Statutory requirements: Disadvantaged communities in California are specifically targeted for investment of proceeds from the state's economywide cap-and-invest Program. In 2012, Senate Bill 535 established initial requirements for minimum funding levels to disadvantaged communities ("DACs"). The legislation also requires CalEPA to identify those communities according to "geographic, socioeconomic, public health, and environmental hazard criteria". In 2016, Assembly Bill 1550 directed CalEPA to identify DACs and also established the currently applicable minimum funding levels:

- At least 25 percent of funds must be allocated toward DACs
- At least 5 percent must be allocated toward projects within low-income communities or benefiting low-income households
- At least 5 percent must be allocated toward projects within and benefiting low-income communities, or low-income households, that are outside of a CalEPA-defined DAC but within ½ mile of a disadvantaged community.[47]

[46] https://www.energy.gov/diversity/justice40-initiative; https://www.epa.gov/ejscreen/ej-and-supplemental-indexes-ejscreen; https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5; https://www.atsdr.cdc.gov/placeandhealth/svi/index.html; https://www.transportation.gov/priorities/equity/justice40/transportation-disadvantaged-census-tracts-historically-disadvantaged;
[47] "SB 535 Disadvantaged Communities," OEHHA, available at https://oehha.ca.gov/calenviroscreen/sb535.

Advisory council: The Environmental Justice Advisory Committee is chartered to advise the California Air Resources Board "in developing its Scoping Plan, and any other pertinent matter in implementing AB 32."[48] It requires that the Committee be comprised of representatives from communities in the State with the most significant exposure to air pollution, including, but not limited to, communities with minority populations or low-income populations, or both. Recommendations from the EJAC include just transition and energy policies that are designed to benefit low-income and pollution-burdened communities.[49]

Preferred metrics for identifying EJ concerns: The 25% highest scoring census tracts in CalEnviroScreen 4.0, census tracts previously identified in the top 25% in CalEnviroScreen 3.0, census tracts with high amounts of pollution and low populations, and federally recognized tribal areas as identified by the Census in the 2021 American Indian Areas Related National Geodatabase.[50]

Washington

Statutory requirements: At least 35% (with a goal of 40%) of emissions allowance auctions will be earmarked specifically for projects and programs designed to address air quality issues in overburdened communities and to advance health and environmental equity statewide. In addition, at least 10% of auction funds must be allocated to Tribal projects.[51]

Additionally, the Healthy Environment for All (HEAL) Act in 2021 requires seven state agencies (Department of Health; the state departments of Agriculture, Commerce, Ecology, Natural Resources and Transportation; and the Puget Sound Partnership) to:[52]

- Incorporate environmental justice as a part of agency work, including incorporating environmental justice into agency strategic plans, developing community engagement plans and tribal consultation frameworks, and conducting environmental justice assessments for certain significant actions.
- Promote the equitable sharing of environmental benefits and investing in communities that have experienced the greatest environmental and health burdens. Agencies must focus expenditures toward creating environmental benefits for overburdened communities and vulnerable populations. The law sets a minimum of 35%, and a goal of 40%, of expenditures to these communities.
- Provide a voice for disproportionately affected communities and centering environmental justice. The law creates an environmental justice council to advise the state and an interagency work group to coordinate among agencies.
- Support evaluation tools and processes. The law requires that the Department of Health must maintain and update the Environmental Health Disparities map for evaluating and tracking

[48] "Environmental Justice Advisory Committee," California Air Resources Board, available at https://ww2.arb.ca.gov/environmental-justice-advisory-committee.
[49] "Environmental Justice Advisory Committee," California Air Resources Board, available at https://ww2.arb.ca.gov/environmental-justice-advisory-committee.
[50] "SB 535 Disadvantaged Communities," OEHHA, available at https://oehha.ca.gov/calenviroscreen/sb535.
[51] https://ecology.wa.gov/Blog/Posts/February-2022/The-Climate-Commitment-Act-Washington-s-Path-to-Ca
[52] https://doh.wa.gov/community-and-environment/health-equity/environmental-justice; https://app.leg.wa.gov/RCW/default.aspx?cite=70A.65&full=true#70A.65.230

environmental health disparities. Agencies and the council must track, measure, and report on environmental justice implementation.

Moreover, the Washington State Department of Ecology is obligated to conduct environmental justice reviews to identify overburdened communities highly impacted by air pollution by deploying air monitoring networks. These monitors help determine which sources are the greatest contributors of criteria pollutants to develop a high priority list of significant emitters. Once the environmental justice review is complete, the department must establish air quality targets and achieve the reduction targets through adoption of emission control strategies or other methods.[53]

Advisory council: The Environmental Justice Council's purpose is to advise state agencies on incorporating environmental justice into agency activities. Specific council duties are to: "1) Provide recommendations to the state on implementing environmental justice requirements such as environmental justice assessments, community engagement plans, and strategic plans 2) Develop guidance on identifying overburdened communities and the use of the environmental health disparities map 3) Track progress toward increasing health equity and ensuring environmental justice throughout Washington 4) Provide recommendations on the development and implementation of climate programs, including programs funded from carbon revenues 5) Serve as a forum for environmental justice concerns and priorities 6) Provide recommendations to the governor and legislature on actions that advance environmental justice."[54]

Preferred metrics for identifying EJ concerns: Preferred EJ metrics are under development for the Department of Health; the state departments of Agriculture, Commerce, Ecology, Natural Resources and Transportation; and the Puget Sound Partnership.[55] The Washington Environmental Health Disparities Map tracks environmental health disparities across communities.[56] "Highly impacted communities" are defined as "a community designated by the department of health based on cumulative impact analyses or a community located in census tracts that are fully or partially on 'Indian country'," while "overburdened communities" are defined as "a geographic area where vulnerable populations face combined, multiple environmental harms and health impacts, and includes, but is not limited to, highly impacted communities."[57]

[53] https://app.leg.wa.gov/RCW/default.aspx?cite=70A.65.020&pdf=true

[54] https://waportal.org/partners/home/environmental-justice-council; https://app.leg.wa.gov/RCW/default.aspx?cite=70A.02.110&pdf=true

[55] https://doh.wa.gov/sites/default/files/2022-12/300023-EnvJusticeImplementationPlan.pdf?uid=63adf2603a15a

[56] https://fortress.wa.gov/doh/wtnibl/WTNIBL/

[57] https://app.leg.wa.gov/RCW/default.aspx?cite=70A.02.010&pdf=true; https://app.leg.wa.gov/RCW/default.aspx?cite=19.405.020

RGGI State Policies

In this section, we offer a snapshot of the status of RGGI state policies related to environmental justice and equity priorities. Our review is focused on the following types of policies: statutory or regulatory requirements for state agencies to evaluate their impacts on environmental justice or equity outcomes; advisory councils formed to advise and coordinate environmental justice and equity policies across state agencies; quantitative metrics designed to identify or track outcomes for overburdened communities; spending requirements requiring minimum levels of program funding go to overburdened communities; and permitting requirements requiring the consideration and review of a polluting facility's impacts on overburdened communities prior to permit approval or renewal.

Table 3 offers a high-level comparison of RGGI states' current policies and **Appendix Table 2** summarizes metrics related to environmental justice and equity employed by each RGGI member state.

Table 3. Summary of Environmental Justice and Equity Policies for RGGI Member States

	CT	DE	MA	MD	ME	NH
Statutory Requirements	Yes	No	Yes	Yes	Active Development	No
Advisory Council	Yes	Yes	Yes	Yes	Yes	Yes
EJ Metrics	Yes	Active Development	Yes	Yes	Active Development	No
Spending Requirements	No	No	No	Active Development	No	No
Permitting Requirements	Yes	No	Yes	Yes	No	No
	NJ	**NY**	**PA**	**RI**	**VA**	**VT**
Statutory Requirements	Yes	Yes	No	No	Yes	Yes
Advisory Council	Yes	Yes	Yes	Yes	Yes	Active Development
EJ Metrics	Yes	Yes	Yes	Yes	Active Development	Yes
Spending Requirements	No	Yes	No	No	No	Active Development
Permitting Requirements	Yes	Yes	No	No	No	No

Connecticut

Statutory requirements: Sec. 22a-20a of the Connecticut General Statutes requires any applicant seeking a new or expanded permit or siting approval in an EJ community to submit a meaningful public participation plan and evaluate the need for a community environmental benefit agreement., Moreover, this section of the Connecticut General Statutes defines "environmental justice communities", "affecting facilities", "meaningful public participation", and "community environmental benefit agreements:"[58]

- "Environmental justice community" means (A) a United States census block group, as determined in accordance with the most recent United States census, for which thirty per cent or more of the population consists of low income persons who are not institutionalized and have an income below two hundred per cent of the federal poverty level; or (B) a distressed municipality.
- "Affecting Facilities" means any facility that falls under at least one of the following categories: (A) electric generating facility with a capacity of more than 10 megawatts; (B) sludge or solid waste incinerator or combustor; (C) sewage treatment plant with a capacity of more than 50 million gallons per day; (D) intermediate processing center, volume reduction facility or multitown recycling facility with a combined monthly volume in excess of 25 tons; (E) new or expanded landfill, including, but not limited to, a landfill that contains ash, construction and demolition debris or solid waste; (F) medical waste incinerator; or (G) major source of air pollution, as defined by the federal Clean Air Act.
- "Meaningful public participation" means (A) residents of an environmental justice community have an appropriate opportunity to participate in decisions about a proposed facility or the expansion of an existing facility that may adversely affect such residents' environment or health; (B) the public's participation may influence the regulatory agency's decision; and (C) the applicant for a new or expanded permit, certificate or siting approval seeks out and facilitates the participation of those potentially affected during the regulatory process
- "Community environmental benefit agreement" means a written agreement entered into by the chief elected official or town manager of a municipality and an owner or developer of real property whereby the owner or developer agrees to develop real property that is to be used for any new or expanded affecting facility and to provide financial resources for the purpose of the mitigation, in whole or in part, of impacts reasonably related to the facility, including, but not limited to, impacts on the environment, including, but not limited to, air quality and watercourses, quality of life, asthma rates, traffic, parking and noise.

Advisory council: As established by Executive Order No. 21-3, the Department of Energy and Environmental Protection (DEEP) administers the CT Equity and Environmental Justice Advisory Council (EEJAC).[59] "The purpose and mission of the CEEJAC is to advise the Commissioner of DEEP on current and historic environmental injustice, pollution reduction, energy equity, climate change mitigation and resiliency, health disparities, and racial inequity, including but not limited to the following:

> A. Integrating environmental justice considerations into the programs, policies, and activities of DEEP to improve the health and environment of Environmental Justice Communities, in key areas including, but not limited to:

[58] "Sec. 22a-20a. Environmental justice community," Connecticut Department of Energy and Environmental Protection, available at https://www.cga.ct.gov/current/pub/chap_439.htm#sec_22a-20a.
[59] "Connecticut Equity and Environmental Justice Advisory Council (CEEJAC)," Connecticut DEEP, available at https://portal.ct.gov/DEEP-CEEJAC.

(1) rulemaking,
(2) permitting standards and processes,
(3) compliance and enforcement,
(4) science and data, and
(5) equitable program delivery; providing mechanisms for Environmental Justice Communities to have a meaningful opportunity to participate in any decision;

B. Providing mechanisms for Environmental Justice Communities to have a meaningful opportunity to participate in any decision to allow in such communities certain types of facilities which, by the nature of their activity, have the potential to increase environmental and public health stressors and where appropriate, to limit the further placement and expansion of such facilities in these communities;
C. Developing a model plan for community engagement and stakeholder outreach centered around meaningful participation; and
D. Strengthening DEEP's partnerships with other governmental agencies, other states, tribal, local governments, and community leaders and organizations regarding environmental justice issues."

Preferred metrics for identifying communities with environmental justice and equity concerns: As described above, environmental justice communities are defined by Sec. 22a-20a. Additionally, the CT Department of Economic and Community Development defines "distressed municipality" as "any municipality in the state which meets comparable thresholds of distress […] in the areas of high unemployment and poverty, aging housing stock and low or declining rates of growth in job creation, population and per capita income."[60] Finally, the CT DEEP also provides mapping information with the percent population minority (defined as the percent of the population in the given area that identifies their race as a race other than white alone and/or identifies their ethnicity as Hispanic or Latinx) and the percent households with limited English proficiency.[61]

Delaware

Statutory requirements: No current requirements.

[60] "C.G.S. Section 32-9p," https://www.cga.ct.gov/current/pub/chap_578.htm. The CT DECD applies the following methodology for identifying distressed communities: "DECD Methodology: Weighted components are summed to measure the rank of the 169 towns. For each component, every town is ranked from 1 to 169, with the best town scoring 1 and worst 169. The top 25 towns with highest total scores are designated distressed municipalities. Precise DECD's components and weights:

1. Per capita income for 2020, weight 1
2. % Of poverty in population for 2020, weight 1
3. Unemployment rate for 2021, weight 2
4. % Change in population from 2010 to 2020, weight 1
5. % Change in employment from 2011 to 2021, weight 1
6. % Change in per capita income from 2010 to 2020, weight 1
7. % Of house stock built before 1939 in 2020, weight 1/3
8. % Population with high school degree and higher in 2020, weight 1
9. Per Capita Adjusted Equalized Net Grand List in 2023-2024, weight 1

[61] https://ctdeep.maps.arcgis.com/apps/webappviewer/index.html?id=d04ec429d0a4477b9526689dc7809ffe

Advisory council: Department of Natural Resources and Environmental Control (DNREC) internal EJ Working Group[62] and the Justice Forty Oversight Committee[63] at the Delaware General Assembly.

Preferred metrics for identifying EJ concerns: The "Delaware Environmental Justice Discovery Tool" is under development by the DE DNREC: "to integrate environmental justice into its decision-making, DNREC is developing a map-based tool for agency staff that leverages data and information from DNREC programs and external partners to help staff identify communities disproportionately impacted by agency decisions and environmental issues. We are working on a version of this tool that would be useful to the public as well."[64] [65]

Maine

Statutory requirements: Public Law 2021, Chapter 279[66] required the Governor's Office of Policy Innovation and the Future (GOPIF) to submit a report to the Joint Standing Committee on Environment and Natural Resources and the Joint Standing Committee on Energy, Utilities and Technology that includes recommendations regarding methods of incorporating equity considerations into actions at the Department of Environmental Protection and the Maine Public Utilities Commission as well as any suggested legislation. Specifically, GOPIF, in consultation with other state offices and agencies, shall advance recommendations which:

> "1. Develop methods of incorporating equity considerations in decision making at the Department of Environmental Protection, the Public Utilities Commission and other state agencies; and
> 2. Develop definitions for "environmental justice," "environmental justice populations," "frontline communities" and any other terms determined by the office to be necessary for the incorporation of equity considerations in decision making at the department, the commission and other state agencies."[67]

Advisory council: The Equity Subcommittee of the Maine Climate Council, housed at the Governor's Office of Policy, Innovation, and the Future, works together with the Department of Environmental Protection, Public Utilities Commission, and other affected agencies to develop and implement policies and procedures that support implementation of the state's climate strategies in ways that ensure equitable sharing of benefits across diverse populations in Maine.[68] [69]

---

[62] "Environmental Justice at DNREC," DNREC, available at https://dnrec.alpha.delaware.gov/environmental-justice/.
[63] "Justice Forty Oversight Committee," Delaware General Assembly, available at https://legis.delaware.gov/TaskForceDetail?taskForceId=441.
[64] "Data and Information," DNREC, available at https://dnrec.alpha.delaware.gov/environmental-justice/data/.
[65] https://legis.delaware.gov/TaskForceDetail?taskForceId=441
[66] "An Act To Require Consideration of Climate Impacts by the Public Utilities Commission and To Incorporate Equity Considerations in Decision Making by State Agencies," State of Maine, June 17, 2021, available at https://legislature.maine.gov/legis/bills/getPDF.asp?paper=HP1251&item=3&snum=130
[67] "Report on Equity Considerations in Decision Making," Governor's Office of Policy Innovation and the Future, February 25, 2022, available at https://www.maine.gov/dep/publications/documents/GOPIF%20Report%20Pursuant%20to%20Public%20Law%202021%20Chapter%20279%20(LD%201682)_2-25-2022.pdf.
[68] https://www.maine.gov/future/initiatives/climate/climate-council/equity-subcommittee
[69] https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/MaineWontWait_OneYearProgressReport_SinglePgs.pdf

Preferred metrics for identifying EJ concerns: The Equity Subcommittee of the Maine Climate Council ("ESC") has identified "priority populations" as:[70]

- "Individuals and Households: Households with low-income individuals, older adults (age 65+), people with asthma or other health vulnerabilities, people with disabilities, people with limited access to transportation, Black, Indigenous and People of Color (BIPOC), people with limited English proficiency, low-income residents of rental housing (especially multifamily), mobile home residents, low-income homeowners, unhoused individuals, and families. Individual worker characteristics include employment and work authorization status, 7 students, people with limited English proficiency including New Mainers, 8 gender, 9 people transitioning from prison or in recovery, and/or migrant workers.
- Geographic Areas and Communities: Low-income communities, rural communities, small towns with limited staff capacity, 10 disadvantaged communities (discussed below), climate-frontline communities, 11 and/or Tribal and Indigenous communities.
- Businesses: Businesses in the natural resource industries like agriculture, forestry, and fishing, 12 clean energy industry (including energy efficiency), small businesses, minority- or women-owned business enterprises (MWBEs)."

However, the "ESC does not expect Maine to establish one overarching definition" for each of these communities, and Maine has not adopted a statewide definition for disadvantaged communities.[71]

Maryland

Statutory requirements: MD Env Code § 1-701 requires the Maryland Department of the Environment (MDE) to:

> "(1) Adopt a methodology for identifying communities disproportionately affected by climate impacts
>
> (2) Develop specific strategies to address geographical impact concerns, reduce emissions of greenhouse gases and co–pollutants, and build climate equity and resilience within communities disproportionately affected by climate impacts;
>
> (3) Set appropriate goals for the percentage of State funding for greenhouse gas emission reduction measures that should be used for the benefit of disproportionately affected communities;"[72]

Additionally, the MDE must identify "underserved communities", "overburdened communities", and "areas that are vulnerable to climate impacts, such as flooding, storm surges, and urban heat island effects, due to low levels of tree coverage, high levels of impervious surfaces, or other factors."

Finally, the MDE shall:

> "(1) Solicit input from all segments of the population that will be impacted by the policies developed under subsection (a) of this section, including individuals living in areas that may be identified as disproportionately affected communities under the proposed criteria;
>
> (2) Ensure that equity and geographical impact remedies are key principles; and

[70] https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/Maine%20Climate%20Council_Equity%20Subcommittee%20Final%20Report_March%202023.pdf

[71] https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/Maine%20Climate%20Council_Equity%20Subcommittee%20Final%20Report_March%202023.pdf

[72] "Statute 1-702," Maryland General Assembly, available at https://mgaleg.maryland.gov/mgawebsite/Laws/StatuteText?article=gen&section=1-702&enactments=False&archived=False.

(3) Incorporate geographical impact considerations into all recommendations, policies, programs, and funding priorities."[73]

Additionally, House Bill 1200 was signed into law on 05/29/2022 which requires "a person who is applying for a permit […] to include, as part of the permit application, the "EJ Score" from the "Maryland EJ tool" for the census tract where the applicant is seeking a permit, unless the permit requires the applicant to use a tool developed by the U.S. Environmental Protection Agency. In accordance with regulations adopted under the bill, the Maryland Department of the Environment (MDE) must review the EJ Score for the census tract where the applicant is seeking a permit using the Maryland EJ tool to verify the applicant's information. The bill requires MDE to implement regulations. The bill also modifies public notice provisions applicable to certain permit applications to incorporate EJ Scores, as specified."[74]

Finally, the 2023 Maryland Budget requires the MDE to "develop specific recommendations to identify and provide assistance to overburdened communities, including legislative and regulatory changes to achieve at least 40% of overall spending in the following programs, projects, and investments in coordination with the Department of Budget and Management (DBM): green infrastructure; climate change; clean energy and energy efficiency; clean transportation; affordable and sustainable housing; training and workforce development related to climate, natural disasters, the environment, clean energy, clean transportation, housing, water and wastewater infrastructure, and legal pollution reduction; remediation and reduction of legacy pollution; and critical clean water and waste infrastructure."[75]

Advisory councils: The Commission on Environmental Justice and Sustainable Communities (CEJSC) "analyzes and reviews what impact State laws, regulations, and policy have on the equitable treatment and protection of communities threatened by development or environmental pollution, and determines what areas in the State need immediate attention. Moreover, the Commission assesses the adequacy of statutes to ensure environmental justice, and develops criteria to pinpoint which communities need sustaining."[76] The CEJSC has issued 19 annual reports since its formation in 2001.[77]

Preferred metrics for identifying EJ concerns: As discussed above, MD Env Code § 1-701 defines "overburdened community" and "underserved community".[78]

An overburdened community means any census tract in which three or more of the following environmental health indicators are above the 75th percentile statewide: particulate matter (PM) 2.5; ozone; National Air Toxic Assessment (NATA) diesel PM; NATA cancer risk; NATA respiratory hazard index; traffic proximity; lead paint

[73] "Statute 1-702," Maryland General Assembly, available at https://mgaleg.maryland.gov/mgawebsite/Laws/StatuteText?article=gen&section=1-702&enactments=False&archived=False.
[74] "House Bill 1200," Maryland General Assembly, available at https://mgaleg.maryland.gov/2022RS/fnotes/bil_0000/hb1200.pdf.
[75] https://mgaleg.maryland.gov/Pubs/BudgetFiscal/2022rs-budget-docs-jcr.pdf
[76] https://msa.maryland.gov/msa/mdmanual/26excom/html/13envju.html
[77] "Annual Report 2022," Maryland Commission on Environmental Justice and Sustainable Communities, 2022, available at https://mde.maryland.gov/programs/crossmedia/EnvironmentalJustice/Documents/CEJSC%202022%20Annual%20Report%20DRAFT.pdf.
[78] "Statute 1-701," Maryland General Assembly, available at https://mgaleg.maryland.gov/mgawebsite/Laws/StatuteText?article=gen&section=1-701&enactments=false.

indicator; national priorities list superfund site proximity; risk management plan facility proximity; hazardous waste proximity; wastewater discharge indicator; proximity to a concentrated animal feeding operation (CAFO); percent of the population lacking broadband coverage; asthma emergency room discharges; myocardial infarction discharges; low-birth-weight infants; proximity to emitting power plants; proximity to a toxic release inventory (TRI) facility; proximity to a brownfields site; proximity to mining operations; and proximity to a hazardous waste landfill.

An underserved community means any census tract in which, according to the most recent U.S. census bureau survey:

(I) at least 25% of the residents qualify as low-income;
(II) at least 50% of the residents identify as nonwhite; or
(III) at least 15% of the residents have limited English proficiency.

Finally, in 2017, the MD EJScreen was developed to apply the CalEnviroScreen methodology to Maryland. The MDE is working to update the EJScreen in accordance with House Bill 1200.[79]

Massachusetts

Statutory requirements: "Environmental justice populations" were defined in Chapter 8 of the Acts of 2021, "An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy" (the "Climate Act of 2021") on 3/26/2021.[80] Additionally, environmental burden reviews for MassDEP environmental permits were modified to include climate change impacts. Previously, environmental justice policy was promulgated by the Executive Office of Energy and Environmental Affairs (EEA).[81]

Additionally, as of January 1, 2022, all new Massachusetts Environmental Policy Act (MEPA) projects required to file an Environmental Impact Report shall undertake measures to provide public involvement opportunities for such Environmental Justice Populations if one or more Environmental Justice Populations are located within the Designated Geographic Area around the project.[82]

Advisory council:[83] The Environmental Justice Council (EJC) is appointed by the Governor and chaired by the Secretary of the EEA. The EJC was created by the Climate Act of 2021 to advise and provide recommendations to the Secretary of EEA on relevant policies and standards to achieve environmental justice principles as defined in the Act. As part of this broad effort, every fifth year, the EJC conducts a comprehensive analysis to ensure the definition of environmental justice population achieves the objectives of the environmental justice principles. The EJC shall provide advice and make recommendations to the secretary on any necessary changes to the percentage thresholds included in the definition of EJ population and any related regulation.

[79] https://p1.cgis.umd.edu/mdejscreen/
[80] "AN ACT CREATING A NEXT-GENERATION ROADMAP FOR MASSACHUSETTS CLIMATE POLICY." Commonwealth of Massachusetts, available https://malegislature.gov/Laws/SessionLaws/Acts/2021/Chapter8.
[81] "Environmental Justice Policy Of The Executive Office Of Energy And Environmental Affairs," Executive Office of Energy and Environmental Affairs, June 24, 2021, available at https://www.mass.gov/doc/environmental-justice-policy6242021-update/download.
[82] https://www.mass.gov/regulations/301-CMR-1100-mepa-regulations
[83] "Environmental Justice Council," Commonwealth of Massachusetts, available at https://www.mass.gov/orgs/environmental-justice-council.

Preferred metrics for identifying EJ concerns: "Environmental justice" populations are defined as either "a neighborhood that meets 1 or more of the following criteria:

> "(i) the annual median household income is not more than 65 per cent of the statewide annual median household income;
> (ii) minorities comprise 40 per cent or more of the population;
> (iii) 25 per cent or more of households lack English language proficiency; or
> (iv) minorities comprise 25 per cent or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 per cent of the statewide annual median household income;"

or "a geographic portion of a neighborhood designated by the Secretary as an environmental justice population in accordance with law."[84] The EEA publishes a map of these environmental justice populations.[85]

New Hampshire

Statutory requirements: No current requirements.[86]

Advisory council: The New Hampshire Department of Environmental Services has adopted a Civil Rights and Nondiscrimination Implementation Plan to ensure proper nondiscrimination measures are implemented and monitored.[87] New Hampshire currently has an Energy Efficiency and Sustainable Energy Board established by statute.

Preferred metrics for identifying EJ concerns: None.

New Jersey

Statutory requirements: N.J.S C.13:1D-157 was signed into law on September 18, 2020, with final regulations adopted on April 17, 2023.[88] These regulations require the New Jersey Department of Environmental Protection (NJDEP) to evaluate the contributions of certain facilities to existing environmental and public health stressors in overburdened communities when reviewing certain permit applications: [89]

> "[T]he Department may not deem a permit application complete for review, unless the applicant completes the environmental justice impact statement (EJIS) process to assess the environmental and public health stressors in the overburdened community and the facility's potential contributions thereto, including conducting a public hearing in the affected overburdened community and responding to public comment on the application… [T]he Act further provides that, after review of the EJIS, response to public comment and any other relevant information, and upon a finding that approval of a permit or permit renewal, as proposed, would, together with other environmental or public health stressors affecting the overburdened

[84] https://malegislature.gov/Laws/SessionLaws/Acts/2021/Chapter8
[85] https://mass-eoeea.maps.arcgis.com/apps/MapSeries/index.html?appid=535e4419dc0545be980545a0eeaf9b53
[86] "Statement on Environmental Justice," New Hampshire Department of Environmental Services, October 25,2022, available at https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/environmental-justice-statement.pdf.
[87] https://www.des.nh.gov/about/civil-rights-and-environmental-justice; https://www.gencourt.state.nh.us/rsa/html/X/125-O/125-O-5-a.htm
[88] https://www.nj.gov/governor/news/news/562023/20230417a.shtml; https://dep.nj.gov/ej/communities/; https://dep.nj.gov/ej/law/.
[89] "AN ACT concerning the disproportionate environmental and public health impacts of pollution on overburdened communities, and supplementing Title 13 of the Revised Statutes." Senate and General Assembly of the State of New Jersey, available at https://www.nj.gov/dep/ej/docs/ej-law.pdf.

> community, cause or contribute to adverse cumulative environmental or public health stressors in the community that are higher than those borne by other communities in the State, county, or other geographic unit of analysis as determined by the Department, the Department: (1) shall deny a permit for a new facility, or approve a new facility permit with conditions upon the new facility's demonstration that it meets a compelling public interest; or (2) may apply conditions to a permit for the expansion of an existing facility or the renewal of an existing facility's major source permit."[90]

Additionally, Executive Order 7, which directed the NJDEP and Board of Public Utilities to return to RGGI, required the regulations administering New Jersey's participation in RGGI to "include specific guidelines for the allocation of funds realized by the State as a result of New Jersey's participation in RGGI...[and] [s]uch guidelines shall include, as a primary consideration of the State agencies charged with allocating said funds, factors that will ensure that funds are allocated to projects that will serve communities that are disproportionality impacted by the effects of environmental degradation and climate change, and which will alleviate the negative effects on human health and the environment resulting therefrom."[91]

In response to this directive, New Jersey state agencies have developed a RGGI Auction Proceeds Scoping Plan which defines funding priorities, potential funding initiatives, metrics to track spending outcomes, and a robust stakeholder process to solicit public feedback.[92] As part of this effort, New Jersey has developed the RGGI Strategic Investments Dashboard to track and report RGGI spending, include the proportion of funding flowing to overburdened communities.[93]

Advisory council: The Environmental Justice Advisory Council (EJAC) "shall serve as an advisory body to the Commissioner of the NJDEP on issues involving environmental justice and public health […] The EJAC will make recommendations to the Commissioner of NJDEP to ensure that NJDEP develops effective communication programs, implements and enforces environmental laws and empowers communities, consistent with the guidance document developed under EO-23, so that such actions do not unfairly burden any population within New Jersey with a disproportionate impact on the health, wellbeing, and quality of life of those residents […] The EJAC will coordinate with NJDEP's Office of Environmental Justice in providing advice and guidance to Executive Branch departments and agencies and will collaborate with the Environmental Justice Interagency Council (EJIC)to identify environmental justice community concerns, develop priorities and action plans, and facilitate interagency collaboration with environmental justice communities."[94]

The EJIC will provide "the forum for interagency collaboration to ensure regular and effective interagency communication, coordination and consistency; sharing of information and best practices; leveraging of resources and actions to advance the principles described above; and measuring our progress in individual and shared

[90] "Environmental Justice Rules," Office of the Commissioner, available at https://dep.nj.gov/wp-content/uploads/rules/rules/njac7_1c.pdf.
[91] https://nj.gov/infobank/eo/056murphy/pdf/EO-7.pdf
[92] https://nj.gov/rggi/docs/rggi-scoping-document.pdf
[93] https://njdep.maps.arcgis.com/apps/dashboards/71e62ee3de2d4a6585bf4766881406c6
[94] "Environmental Justice Advisory Council," NJDEP, available at https://dep.nj.gov/wp-content/uploads/ej/docs/ejac-bylaws-december-2020.pdf; https://nj.gov/infobank/eo/056murphy/pdf/EO-23.pdf

milestones to advance environmental justice via reduced environmental and public health stressors and increased environmental and public health benefits."[95]

Preferred metrics for identifying EJ concerns: N.J.S C.13:1D-157 defines an overburdened community as "any census block group, as determined in accordance with the most recent United States Census, in which:

- at least 35 percent of the households qualify as low-income households (at or below twice the poverty threshold as determined by the United States Census Bureau);
- at least 40 percent of the residents identify as minority or as members of a State recognized tribal community; or,
- at least 40 percent of the households have limited English proficiency (without an adult that speaks English "very well" according to the United States Census Bureau)."[96]

New York

Statutory requirements: The 2019 Climate Leadership and Community Protection Act (Climate Act) requires that Disadvantaged Communities receive a minimum of 35%, with a goal of 40%, of the benefits of spending on clean energy and energy efficiency programs, projects, or investments in the areas of housing, workforce development, pollution reduction, low-income energy assistance, energy, transportation, and economic development.[97] State agencies, in consultation with the CJWG and other relevant stakeholders, are developing a methodology for defining the benefits of State investments in Disadvantaged Communities. The definition of Disadvantaged Communities and the methodology for defining benefits will be provided to all State agencies to ensure a coordinated approach to directing benefits to Disadvantaged Communities as required by the Climate Act.

Additionally, Senate Bill S8830 was signed into law on Dec 30, 2022. The new law prevents the approval and re-issuing of permits for actions that would increase disproportionate and/or inequitable pollution burdens on disadvantaged communities:[98]

> "When issuing a permit for any project that is not a minor project […] and that may directly or indirectly affect a disadvantaged community, the department shall prepare or cause to be prepared an existing burden report and shall consider such report in determining whether such project may cause or contribute to, either directly or indirectly, a disproportionate or inequitable or both disproportionate and inequitable pollution burden on a disadvantaged community. No permit shall be approved or renewed by the department if it may cause or contribute to, either directly or indirectly, a disproportionate or inequitable or both disproportionate and inequitable pollution burden on a disadvantaged community."[99]

Advisory council: The Climate Justice Working Group, which has been tasked with: "the development of criteria to identify disadvantaged communities to ensure frontline and underserved communities benefit from our clean energy transition…The Working Group plans to consult with an Environmental Justice Advisory Group to ensure

[95] "Environmental Justice at New Jersey State Agencies," NJDEP, available at https://dep.nj.gov/ej/ej-state/.
[96] https://www.nj.gov/dep/ej/docs/ej-law.pdf
[97] "Scoping Plan 2022," New York State, December 2022, available at https://climate.ny.gov/-/media/project/climate/files/NYS-Climate-Action-Council-Final-Scoping-Plan-2022.pdf.
[98] "Senate Bill 8830," New York State Senate, April 22, 2022, available at https://legislation.nysenate.gov/pdf/bills/2021/S8830.
[99] https://legislation.nysenate.gov/pdf/bills/2021/S8830

that while we move the State toward a carbon neutral economy, all New Yorkers will reap the economic and environmental benefits of our nation-leading transition."[100] The first annual report was issued in December 2021.[101]

Preferred metrics for identifying EJ concerns: The CJWG used 45 indicators covering environmental burdens, climate change risk, population characteristics, and health vulnerabilities to identify 35 percent of tracts in New York as DACs.[102] See **Appendix Table 2** for the precise indicators. The CJWG scores each census tract in New York "based on relative burden, risk, vulnerability, or sensitivity" by combining the "percentile ranks of the indicators for each census tract to produce a value that measures a census tract's relative level of 'Environmental Burdens and Climate Change Risks,' as well as 'Population Characteristics and Health Vulnerabilities' relative to other tracts. Tracts with higher scores relative to (a) other tracts in the State; or (b) their region (New York City or Rest of State) were identified as DACs."

Additionally, "tracts where at least 5 percent of land is a federally recognized reservation or owned by an Indian Nation are automatically included as DACs and "DACs include households reporting annual total income at or below 60 percent of State Median Income, or are otherwise categorically eligible for low-income programs (i.e., Home Energy Assistance Program)."[103]

Pennsylvania

Statutory requirements: No current requirements. Governor Wolf issued Executive Order 2021-07, which established the Office of Environmental Justice, the Environmental Justice Advisory Board, and the Environmental Justice Interagency Council within the PA Department of Environmental Protection (DEP).[104]

Advisory council: The Environmental Justice Advisory Board, which shall make written recommendations to the Secretary of the DEP concerning policies, practices, and actions that DEP may implement to advance the goals of Environmental Justice.[105] The Environmental Justice Interagency Council "shall act in an advisory capacity and will:

> (1) Review and provide input and information to DEP related to the agency's development, implementation, and update of the EJ Plan, including specific mechanisms for monitoring and measuring the effects of implementing the Plan.
> (2) Identify and make recommendations to the Governor's Office to address potential disproportionate environmental impacts that state laws, regulations, policies, and activities may have on Pennsylvania residents in Environmental Justice Areas.

[100] "Climate Justice Working Group," New York State, available at https://climate.ny.gov/resources/climate-justice-working-group/.
[101] "Disadvantaged Communities Barriers and Opportunities Report," New York State, December 2021, available at https://climate.ny.gov/-/media/project/climate/files/21-35-NY-Disadvantaged-Communities-Barriers-and-Opportunities-Report-1.pdf.
[102] "New York State's Draft Disadvantaged Communities Criteria," New York State, available at https://climate.ny.gov/-/media/project/climate/files/LMI-dac-criteria-fact-sheet.pdf.
[103] "New York State's Draft Disadvantaged Communities Criteria," New York State, available at https://climate.ny.gov/-/media/project/climate/files/LMI-dac-criteria-fact-sheet.pdf.
[104] https://www.oa.pa.gov/Policies/eo/Documents/2021-07.pdf
[105] "History of the Office of Environmental Justice," PA DEP, available at https://www.dep.pa.gov/PublicParticipation/OfficeofEnvironmentalJustice/History/Pages/default.aspx.

(3) Recommend to executive agencies processes to incorporate Environmental Justice considerations into decision-making.
(4) Make recommendations to the Governor's Office to ensure consistency with federal Environmental Justice programs.
(5) Recommend a comprehensive Environmental Justice training plan for executive branch Commonwealth agencies."[106]

Preferred metrics for identifying EJ concerns: Within the context of the Environmental Justice Public Participation Policy (which provides guidelines for DEP's approach to public engagement for permit application reviews in Environmental Justice Areas), DEP defines an EJ Area as

- "any census tract where 20 percent or more individuals live at or below the federal poverty line
- and/or 30 percent or more of the population identifies as a non-white minority, based on data from the U.S. Census Bureau and the federal guidelines for poverty" [107]

However, there is not a Commonwealth-wide definition of Environmental Justice Areas, and the DEP recognizes a multitude of factors considered in EJ community engagement.[108]

Rhode Island

Statutory requirements: No current requirements. RI H7622, which would have established cumulative impact permits for new or expanded polluting facilities, did not pass on 06/23/2022.[109]

Advisory council: The RI Executive Climate Change Coordinating Council (RIE4C) is currently developing a Climate Justice Advisory Working Group.[110]

Preferred metrics for identifying EJ concerns: The Rhode Island Department of Environmental Management has developed the following definition for "environmental justice focus areas", defined as census tracts that meet one or more of the following criteria:

- "annual median household income is not more than sixty-five percent (65%) of the statewide annual median household income,
- minority population is equal to or greater than forty percent (40%) of the population,
- twenty-five percent (25%) or more of the households lack English language proficiency, or minorities comprise twenty-five percent (25%) or more of the population and the annual median household income

[106] https://www.oa.pa.gov/Policies/eo/Documents/2021-07.pdf
[107] "PA Environmental Justice Areas," PA DEP, available at https://www.dep.pa.gov/PublicParticipation/OfficeofEnvironmentalJustice/Pages/PA-Environmental-Justice-Areas.aspx.
[108] https://www.dep.pa.gov/PublicParticipation/OfficeofEnvironmentalJustice/Pages/PA-Environmental-Justice-Areas.aspx
[109] https://www.billtrack50.com/BillDetail/1465960
[110] "Governor McKee to Propose More Than $150 Million To Combat Climate Change in FY2023 Budget," State of Rhode Island, January 19, 2022 available at https://governor.ri.gov/press-releases/governor-mckee-propose-more-150-million-combat-climate-change-fy2023-budget.

> of the municipality in which the proposed area does not exceed one hundred fifty percent (150%) of the statewide annual median household income"[111]

The Rhode Island Department of Environmental Management has provided a public map with census tracts identified as environmental justice focus areas.[112]

Vermont

Statutory requirements: Act 154 set the goal of covered agencies to "direct investments proportionately to environmental justice focus populations."[113] Additionally, "the covered agencies shall either integrate the following information into existing annual spending reports or issue annual spending reports that include: (A) where investments were made and which geographic areas, at the municipal level and census block group, where practicable, received environmental benefits from those investments; and (B) the percentage of overall environmental benefits from those investments provided to environmental justice focus populations."[114]

Advisory council: Act 154 which requires establishment of an independent Advisory Council and a state government Interagency Committee focused on EJ issues. The Advisory Council is expected to be active beginning in the spring of 2023.[115]

Preferred metrics for identifying EJ concerns: "Environmental justice focus population" means any census block group in which:

> "(A) the annual median household income is not more than 80 percent of the State median household income;
> (B) Persons of Color and Indigenous Peoples comprise at least six percent or more of the population; or
> (C) at least one percent or more of households have limited English proficiency."[116]

Virginia

Statutory requirements: Under Article 12 § 2.2-234: "it is the policy of the Commonwealth to promote environmental justice and ensure that it is carried out throughout the Commonwealth, with a focus on

[111] "Environmental Justice Policy," RIDEM, available at https://dem.ri.gov/media/49366/download.
[112] https://ridemgis.maps.arcgis.com/apps/Embed/index.html?webmap=addba908b51046099ce095ea4d85e0b0&extent=-72.1464,41.2063,-70.5699,42.0378&zoom=true&scale=true&search=true&searchextent=true&basemap_gallery=true&disable_scroll=true&theme=light
[113] Covered state agencies, departments, and bodies consist of the Agencies of Natural Resources, of Transportation, of Commerce and Community Development, of Agriculture, Food and Markets, and of Education; the Public Utility Commission; the Natural Resources Board; and the Departments of Health, of Public Safety, and of Public Service.
[114] "Act 154 An act relating to environmental justice in Vermont," Vermont General Assembly, available at https://legislature.vermont.gov/Documents/2022/Docs/ACTS/ACT154/ACT154%20As%20Enacted.pdf.
[115] "Act 154 An act relating to environmental justice in Vermont," Vermont General Assembly, available at https://legislature.vermont.gov/Documents/2022/Docs/ACTS/ACT154/ACT154%20As%20Enacted.pdf.
[116] "Act 154 An act relating to environmental justice in Vermont," Vermont General Assembly, available at https://legislature.vermont.gov/Documents/2022/Docs/ACTS/ACT154/ACT154%20As%20Enacted.pdf.

environmental justice communities and fenceline communities"[117] However, this policy has not been operationalized into specific policies like permit review or spending requirements.

Advisory council: Interagency Environmental Justice Working Group, which was established in 2020 to "assess and provide recommendations regarding agency improvements to meaningfully engage environmental justice communities and fenceline communities in decision-making processes for agency activities that affect them." Specifically, the Working Group "shall conduct an assessment of the processes and resources required of state agencies to develop agency-specific environmental justice policies" to "(i) ensure environmental justice is meaningfully considered in the administration of agency regulations; (ii) consistently identify environmental justice communities and fence-line communities; (iii) identify how such communities are affected by agencies' regulatory activities; (iv) consider the economic development and infrastructure needs of environmental justice communities and fence-line communities in agency decision-making processes; and (v) contain robust public participation plans for residents of environmental justice communities and fenceline communities potentially affected by agency actions."[118]

Preferred metrics for identifying EJ concerns:[119] "Community of color" means any geographically distinct area where the population of color, expressed as a percentage of the total population of such area, is higher than the population of color in the Commonwealth expressed as a percentage of the total population of the Commonwealth. "Low-income community" means any census block group in which 30 percent or more of the population is composed of people with low income. "Environmental justice community" means any low-income community or community of color. "Fenceline community" means an area that contains all or part of a low-income community or community of color and that presents an increased health risk to its residents due to its proximity to a major source of pollution. Additionally, under the Virginia Clean Economy Act (VCEA), the Virginia Department of Energy, in consultation with the Council on Environmental Justice, is charged with determining whether implementation of the VCEA imposes a disproportionate burden on historically economically disadvantaged communities and reporting this determination on a triennial basis.[120] Virginia Department of Energy is currently in the beginning phases of establishing which metrics it will use in making this determination. The report is due to the General Assembly in 2023.

C. Key Policy Options for RGGI States to Advance Key Equity Priorities

Based on our review, we come to a number of observations and potential options for the RGGI states to consider related to environmental justice and equity priorities in program design and administration. Our initial observations are based on (1) our review of key issues arising in deliberations around federal and state efforts in this area, (2) emerging concepts for addressing equity and environmental justice issues through energy-related laws,

[117] "Article 12, Virginia Environmental Justice Act," State of Virginia, available at https://law.lis.virginia.gov/vacodefull/title2.2/chapter2/article12/.
[118] https://www.deq.virginia.gov/home/showpublisheddocument/15593/637932205092670000
[119] https://law.lis.virginia.gov/vacodefull/title2.2/chapter2/article12/
[120] "2021 Interagency Environmental Justice Working Group," Virginia DEQ, available at https://www.deq.virginia.gov/home/showpublisheddocument/15593/637932205092670000.

regulations and policies, and (3) a focus on those options that have a nexus to the administration of the RGGI program in each of the RGGI states.

It is important to note at the outset that the disproportionate health, environmental and economic impacts on overburdened communities associated with energy production and use extend well beyond power plant CO_2 emissions (the focus of the RGGI program). The transportation and building sectors are major sources of harmful air pollution in urban and rural areas while concentrations of industrial activity near urban areas and in other locations are a source of significant air, water, and solid waste pollution. And the total cost of energy use across all sectors – transport, heating, appliance use, and electricity – represents a major burden on low- and moderate-income consumers.

While there are several ways in which RGGI program design and administration can aid in addressing key equity/justice issues (discussed below), it is important to recognize that RGGI should not be the only focus of equity and justice efforts. This is because RGGI was designed as an emissions control program that has a relatively narrow focus on power plants, and a pollutant (CO_2) that affects human health through climate change rather than direct exposure to local ambient air pollution. We thus view the steps that RGGI states may take through RGGI program administration to monitor and address equity and environmental justice issues as important, but not on their own sufficient, to address existing health, environmental, and economic inequities for overburdened communities.

With these caveats, we find that there are several points of contact between RGGI and equity/environmental justice issues, including both impacts (from the power plants that are part of the RGGI program) and options related to the revenues accruing to states from the sale of emission allowances in quarterly RGGI auctions.

Although RGGI has reduced CO_2 emissions and associated local air pollutants overall, states could study the degree to which RGGI may result in increases in emissions of harmful pollutants from certain power plants.

RGGI is focused only on CO_2 emissions from a subset of fossil-fueled power plants in the Northeast and Mid-Atlantic. Yet the power plants affected by RGGI are also a major source of harmful air and water pollution above and beyond emissions of CO_2, including ozone precursors (like NO_x), particulate matter, sulfur dioxide, and mercury.[121] RGGI allowance costs result in lower overall emissions of CO_2 by reducing the total amount of coal, oil and natural gas burned at the affected power plants. This happens by (a) encouraging investments and operations that improve power plant efficiencies, (b) leading some fossil-fueled power plants to operate less than they otherwise would, and (c) changing the dispatch order of power plants to favor more efficient units (i.e., units that require less fuel to generate a given quantity of electricity). Because the overall effect of the RGGI program is to lower the total quantity of fossil fuels combusted at the affected power plants, it also leads to less total emissions of the other harmful pollutants that come from fossil power plant operations.

There are at least two ways, however, where emissions from a specific power plant could increase as a result of the program. First, the smallest power plants on the system – generally those smaller than 15-25 megawatts

[121] *See*, e.g., https://www.epa.gov/criteria-air-pollutants

("MW") in capacity – are not included in the program.[122] In competitive wholesale electricity markets, the additional cost of an allowance for a power plant that is included in RGGI could in theory make it more expensive than a power plant not in the program and result in an increase in electricity production at one of these smaller units. Second, increases in operating costs for fossil-fuel generators due to RGGI allowance costs could lead to a decrease in generation or even retirement of inefficient, higher polluting power plants. As a result of this decline in generation, another power plant or plants would need to operate more to make up the missing electricity. An example of this would be the lower generation or early retirement of a coal facility due to the cost of RGGI compliance leading to an increase in generation from a natural gas-fired combined cycle plant. Thus, in both cases, an individual power plant could increase output and emissions even if total emissions across the region are lower. If the natural gas-fired combined cycle plant was located near an overburdened community (and the coal plant was *not* located near an overburdened community), this outcome could result in a net increase in local emissions near overburdened communities.

The RGGI states could evaluate this possibility directly. However, new methods will be needed to reliably estimate the impact of RGGI on local air pollution in overburdened communities. Although production cost models can reliably estimate aggregate outcomes (e.g. prices, changes in generation, and associated changes in local air pollutants at the state-level), they are less well suited to identify the impact of RGGI on emissions from a specific generator.[123] As such, hybrid approaches that combine actual emissions data, pollution transport modeling, and economic supply curve analysis will likely be more reliable at teasing out the impact of RGGI or other similar environmental policies on outcomes for a specific generator that could potentially impact an overburdened community.[124] Here is an example of how such an analysis could be completed:

1. Public data on power plant emissions is available from EPA/CAMD's Power Sector Emissions Data, which generally collects hourly CO_2, NO_X, SO_2, and mercury emissions data for most electric generators with nameplate capacity greater than 25 MW. For those plants not covered by EPA/CAMD, EIA-860 and EIA-923 contain information on annual and monthly generation and annual CO_2, SO_2, and NO_x emissions. These datasets could allow researchers to identify generators with increased generation and associated

[122] All RGGI states require power plants with a nameplate capacity greater than 25 megawatts to participate in RGGI, except for New York which requires power plants with a nameplate capacity greater than 15 MW to participate in RGGI. *See*, https://www.rggi.org/sites/default/files/Uploads/Compliance-Materials/RGGI_2021InterimCompliance_Webinar_Final.pdf; https://govt.westlaw.com/nycrr/Document/Ibaff59a7ebf311dda772d657453a78af?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)

[123] Production cost models determine hourly generation by minimizing production costs (defined as the product of an individual facility's heat rate and fuel price plus variable operation and maintenance costs) subject to meeting load and a complicated set of detailed operational constraints including available transmission capacity. As an example of the potential difficulties of using a production cost model to estimate the impact of RGGI on overburdened communities, if two generators were located in the same load zone but one generator was located in a DAC and one generator was not, tiny differences in assumed/modeled production costs between the two generators might result in generation outcomes that do not align with actual generation outcomes, even if the total amount of generation in the load zone was equal to load (net of imports/exports) in every hour of the year. Such differences in generation outcomes could result in inaccurate estimates of RGGI's impact on local air pollutant concentrations.

[124] Hernandez-Cortes, Danae and Kyle Meng, "Do environmental markets cause environmental injustice? Evidence from California's carbon market," *Journal of Public Economics*, January 2023, Vol. 217, 104786; Pastor, Manuel et al. "Up in the Air: Revisiting Equity Dimensions of California's Cap-and-Trade System," White Paper, USC Dornsife Equity Research Institute, February 2022, available here: https://dornsife.usc.edu/assets/sites/1411/docs/CAP_and_TRADE_Updated_2020_v02152022_FINAL.pdf; Zeise, Lauren and Jared Blumenfeld, "Impacts of greenhouse gas emission limits within disadvantaged communities: progress toward reducing inequities," February 2022, available at: https://oehha.ca.gov/media/downloads/environmental-justice//impactsofghgpoliciesreport020322.pdf

emissions relative to a historical baseline. Alternatively, researchers could identify generators which have not reduced their generation and associated emissions relative to their peer generators.

2. EPA and NOAA offer public versions of detailed pollution transport modeling and pollution transport screens that can be employed to estimate the impact of changes in emissions from a given facility on local areas, including overburdened communities.[125] These models represent state-of-the-art science for modeling long-range atmospheric dispersal of pollutants based on the location and stack height of an electric generating facility and data on historic meteorological conditions. Using a combination of these models and actual changes in pollution concentrations as measured by ambient monitors, states could assess the significance of any given electric generating facility on pollution outcomes for local areas including overburdened communities. These models could also be used to monitor how differences in ambient air pollution between overburdened and non-overburdened communities evolve over time, and the extent to which these differences are being driven by the power sector.
3. In order to evaluate the potential for and likely significance of a hot spot problem associated with RGGI, an economic supply curve analysis can be employed to assess whether a given facility is likely to have changed generating behavior in response to RGGI allowance pricing. Such an approach recognizes that generation at any given facility will be affected by macroeconomic factors like fuel prices, along with local factors like load and transmission availability. This "economic case study" approach recognizes that (1) it is not possible to directly observe counterfactual outcomes for any given generator (i.e., comparing "with RGGI" and "without RGGI") and (2) statistical approaches that seek to estimate average treatment effects by carefully comparing "treated" and "control" facilities will generally not be able to recover facility-level treatment effects for every facility of interest.[126] A supply-curve analysis can assess whether any given facility is likely to produce more under RGGI than a No-RGGI counterfactual due to the existing capacity mix and each facility's respective marginal costs of generation.
4. Based on the results of the analyses described above, states may be able to identify generators with increases or comparatively modest declines in emissions, trace those generator emissions to pollutant concentrations in the relevant airshed, and assess whether the generator is unlikely to reduce emissions (either relative to historical emissions or relative to other regulated generators) due to the presence of RGGI alone.

Having identified the set of generators with a potential hot spot problem, it may be appropriate for state agencies to undertake stakeholder processes with active participation from impacted communities to assess whether action outside of RGGI should be taken to encourage incremental reductions in emissions at the relevant generators.[127] To the extent funding is an issue, a state could consider using RGGI allowance revenues to fund these types of studies.

[125] https://www.epa.gov/scram/air-quality-dispersion-modeling; https://www.ready.noaa.gov/HYSPLIT.php

[126] *See* e.g. Hernandez-Cortes, Danae and Kyle Meng, "Do environmental markets cause environmental injustice? Evidence from California's carbon market," *Journal of Public Economics*, January 2023, Vol. 217, 104786.

[127] For example, the state of Washington has an environmental justice review process enshrined in law: https://app.leg.wa.gov/RCW/default.aspx?cite=70A.65.020&pdf=true

States could use RGGI allowance auction revenues to improve the monitoring of air quality in specific communities.

From a public health perspective, the most important direct impact of a change in power plant operations is the potential increase in the concentration of harmful air pollutants. Whether this leads to a decrease in air quality depends on many factors – where the facility is located; when (what season, what time of day) it operates more than it otherwise would; whether or not its increase in emissions is offset by a decrease in emissions from other affected power plants near the community; and the weather and atmospheric conditions that determine pollutant dispersal, mixing in the airshed, chemical transformation (e.g., the transformation of NO_x into ground-level ozone in the presence of other pollutants and sunshine); and washout. To monitor progress in mitigating discrepancies in ambient air pollution for overburdened communities, states could consider increasing the installation of air quality monitoring stations, particularly in overburdened communities, to identify changes in air quality and public health in these locations. More air quality data could also help in identifying power plants that have increased generation, supplementing the analyses detailed above. This data should also be made available to the public in order to empower affected communities to make informed health decisions and take action when needed. To the extent funding is an issue, a state could consider using RGGI allowance revenues for this purpose.

RGGI states could include and actively support greater participation by affected members of the public in overburdened communities.

As discussed throughout this report, residents in overburdened communities are disproportionately impacted by economic, environmental and public health impacts from energy supply and use, and thus are strongly affected (positively and negatively) by energy and climate policies. Many of the state programs we review have developed programs and procedures to encourage – and in some cases fund – the active participation of representatives in overburdened communities. Active participation of members of overburdened communities in stakeholder processes could help improve regulatory decision-making regarding the permitting and emissions control of polluting facilities impacting overburdened communities.

For example, states could establish comprehensive obligations on the developers of new energy infrastructure related to ensuring full community engagement in the process of siting, permitting, and/or environmental review, as in Massachusetts.[128] Specifically, relevant provisions are included/proposed in state law governing pre-filing and filing obligations of energy infrastructure developers:

> "Prior to an applicant submitting a petition to construct a facility or generating facility […], a petitioner must develop a preliminary project statement about the facility that includes detailed information about the need, public health, environmental, and climate risks and burdens, environmental, energy, economic, and health benefits for communities within five miles of the facility. As part of this statement, the applicant must identify the location of all environmental justice populations within five miles of the facility […] Prior to filing a petition to the siting board, the preliminary project statement shall be shared with community-based organizations, elected

[128] As described in **Section III.B**, New Jersey also has requirements to ensure meaningful public participation in the NJDEP's process of reviewing environmental impacts on overburdened communities. *See*, https://dep.nj.gov/wp-content/uploads/rules/rules/njac7_1c.pdf.

> officials, and civic organizations who will potentially be impacted by the project located within five miles, posted to a public website, and translated into multiple languages, as relevant to the local populations. Within 30 days of submitting that statement, the project proponent shall invite community-based organizations, local elected officials, the director of environmental justice at the executive office of energy and environmental affairs, and director of the energy facilities siting board to a meeting to review the proposed project. An applicant shall make adjustments to the project that address environmental justice population concerns about safety, public health, location, or mitigation, or abandon plans to file its petition to the board. […] The Secretary of the Executive Office of Energy and Environmental Affairs, through a Massachusetts Environmental Policy Act Certificate shall determine whether an applicant made adjustments to the project that address environmental justice population concerns about safety, public health, location, or mitigation."[129]

Finally, states have taken concrete steps to ensure that financial hardship does not deter or prevent community participation in regulatory deliberations by ensuring sufficient funding is provided by the state, regulated entities, and/or developers for participation by members of affected communities. This funding makes community outreach efforts much more effective. One example of this type of mechanism is the provision of funding for intervention by the state's consumer advocate and in some cases other intervenors for proceedings related to electric company rates, planning, and infrastructure development proposals.[130] The revenues collected by RGGI states through allowance auctions could be used for this purpose, to encourage community participation in deliberations related to the design and administration of RGGI, or in state proceedings related to the economic, planning, or environmental review of new or existing energy infrastructure projects.[131]

Monitor the use of RGGI allowance proceeds specifically with respect to the distribution of the benefits of RGGI-funded programs among residents, with a focus on overburdened communities.

In this report we review the myriad ways that RGGI states use allowance auction revenues to support a wide variety of consumer, environmental, economic, and energy policy programs. Historically, the RGGI states have carefully tracked the use of auction proceeds and to some extent the benefits that flow from RGGI revenue spending. Benefits tracked include energy savings for electric and heating systems, reduced demand for capacity and energy, increase in the development of renewable resources, GHG reductions through other programs, and energy bill credits to low-income and other consumers.

The RGGI states could consider expanding the collection of data related to allowance revenue spending with a focus on investments and spending specifically to overburdened communities, and with a focus on the distribution

[129] https://malegislature.gov/Bills/193/HD4024

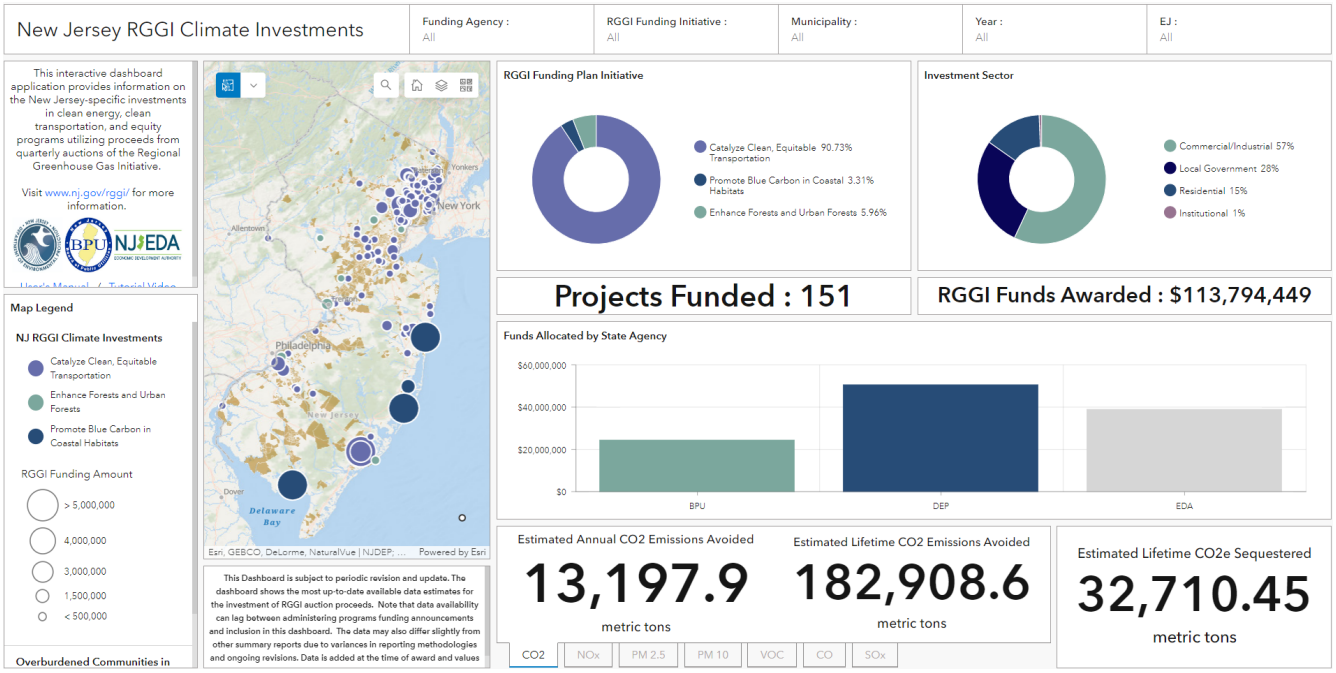
[130] https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter12/Section11E; https://www.cpuc.ca.gov/proceedings-and-rulemaking/intervenor-compensation

[131] For additional discussion of intervenor funding, see: https://rmi.org/five-steps-for-utilities-to-foster-authentic-community-engagement/; https://energynews.us/2021/09/24/commentary-intervenor-compensation-programs-can-level-the-regulatory-playing-field/; https://pubs.naruc.org/pub/B0D6B1D8-1866-DAAC-99FB-0923FA35ED1E#:~:text=Intervenor%20compensation%20is%20the%20practice,in%20state%20utility%20regulatory%20proceedings

of benefits of RGGI program spending to different segments of the population. Several states require a minimum proportion of investments flow to overburdened communities, and appropriate data collection is necessary to ensure that these standards are being met. For example, RGGI states could standardize collection of information on key determinants of benefit distribution such as geographic location, household income, and the nature of the spending. RGGI states could also conduct studies to quantify the direct spending and indirect/induced economic benefits realized in specific communities. This information could be used to track aggregate impacts of RGGI on overburdened communities in a consistent manner, even if individual states differ in EJ definitions.

For example, RGGI states currently track and report to RGGI, Inc. information on annual, statewide program spending. Although some of these programs are tailored to low-income households, it is not currently possible to identify the proportion of RGGI auctions accruing to overburdened communities. However, a limited amount of additional information could allow for the study of RGGI's impacts on overburdened communities in a uniform manner. Specifically, if states collect information on the location of specific program investments and, when relevant, household addresses and household income, it would be possible to study the proportion of RGGI funds accruing to overburdened communities applying *any* of the definitions listed in **Appendix Table 1** and **Appendix Table 2**. Geospatial analysis can easily map individual street addresses to census tracts. Then, having calculated the total amount of spending by census tract, publicly available data can be used to calculate the proportion of spending by investment type going to overburdened communities. For example, New Jersey has provided public information on the location and nature of investments funded by RGGI proceeds:[132]

Figure 10. Example of Public Website to Track RGGI Climate Investment Spending



Source: NJ DEP, New Jersey RGGI Climate Investments, available at: https://njdep.maps.arcgis.com/apps/dashboards/71e62ee3de2d4a6585bf4766881406c6, accessed on April 24, 2023.

[132] https://njdep.maps.arcgis.com/apps/dashboards/71e62ee3de2d4a6585bf4766881406c6

Then, applying the same procedure as described in **Section II.B,** IMPLAN could be employed to estimate the economic value-added and jobs impacts accruing to specific zip codes as a result of different types of investment spending and different types of program recipients. To capture the net economic impact of RGGI on the power sector, production cost models can be employed to calculate changes in consumer payments and producer profits. To assess economic impacts on geographic regions more granular than zip codes, zip-code estimates could be downscaled to the census tract-level using Census data on census tract shares of economic activity for select variables of interest (e.g. income, employment, etc.).

RGGI states could require that a minimum proportion of investments from RGGI auction proceeds flow to overburdened communities and low-income customers.

RGGI states could use the data and analysis described in the previous bullet to ensure that a minimum proportion of RGGI investing – and associated benefits – flow to overburdened communities. For example, many states already require minimum spending of utility energy efficient programs on low-income customers, in part to address the real financial, housing and resource barriers that such customers face in implementing EE to lower their energy costs.[133] Similarly, as a discussed above, Washington and New York require that overburdened communities receive a minimum of 35%, with a goal of 40%, of the benefits of spending on clean energy and energy efficiency programs.[134] In turn, RGGI states could require that a minimum proportion of RGGI allowance revenues are invested in overburdened communities. As one example, this minimum spending requirement could be set at the proportion of the population living in overburdened communities. If a state wishes to go beyond the minimum to more rapidly alleviate inequities, it could consider directing a much higher proportion of RGGI auction proceeds to be invested in overburdened communities.

IV. Conclusion

Prior to RGGI, U.S. market-based environmental policies tended to freely allocate allowances to regulated facilities.[135] RGGI was the first true "cap-and-invest" program that imposed a limit on carbon dioxide emissions while also returning allowance proceeds to state governments for re-investment in the local community.

Over the past twelve years, Analysis Group has found that this "cap-and-invest" model delivered both environmental and economic benefits. Since RGGI's inception, RGGI states have experienced a 46% reduction in carbon emissions, raised $3.8 billion in allowance revenues, produced $5.7 billion in net economic benefits, and added 48,000 job-years. We find that this trend continued from 2018 to 2020, with RGGI adding $669 million in net economic value ($15 in economic value added per capita) and 7,874 job-years to member states.

For the first time in a RGGI report, we have also documented how RGGI states have continued to pursue policy innovation by designing new regulations to identify and reduce inequities for communities overburdened by negative environmental, health, and economic impacts from energy production and use. After reviewing these

[133] *See*, e.g., https://database.aceee.org/state/guidelines-low-income-programs

[134] "Scoping Plan 2022," New York State, December 2022, available at https://climate.ny.gov/-/media/project/climate/files/NYS-Climate-Action-Council-Final-Scoping-Plan-2022.pdf; https://app.leg.wa.gov/RCW/default.aspx?cite=70A.65&full=true#70A.65.230

[135] Schmalensee, Richard, and Robert N. Stavins. 2013. "The SO2 Allowance Trading System: The Ironic History of a Grand Policy Experiment." *Journal of Economic Perspectives*, 27 (1): 103-22.

efforts, we highlighted key policy innovations that would help ensure RGGI advances equity priorities, while simultaneously delivering environmental and economic benefits. These policy options include:

- Conducting new studies of potential pollution hot spots affecting overburdened communities that combine emissions data, pollution transport modeling, and economic analysis
- Setting minimum spending requirements for RGGI investments in overburdened communities – for example, the minimum spending requirement could be set at the proportion of the population living in overburdened communities
- Expanding data collection to track and report RGGI investment spending and associated outcomes
- Using RGGI funds to monitor ambient air pollution in overburdened communities
- Providing opportunities and resources for active community participation in RGGI spending plans and environmental permitting

Appendix Table 1. Federal Agency Criteria for Identifying Overburdened Communities

Category	Variable	DOE	EPA	CEQ	CDC
Demographics	Low income	X	X	X	X
	Populations of color		X		X
	Federally recognized tribes			X	
	Historic underinvestment			X	
	Linguistic isolation	X	X	X	X
	Unemployed	X	X	X	X
	Less than high school education	X	X	X	X
	Age distribution	X	X		X
	Single parents	X			
	Renters	X			X
	Mobile homes	X			X
	Group quarters				X
	Sheltered and Unsheltered Population per sq. km	X			
	Drive time to employment ≥ 30 minutes	X		X	
	No vehicle(s) available	X		X	
	Jobs in the fossil fuel industry	X			
	Jobs in the coal industry	X			
Health Disparities	Disabilities (non-institutionalized)	X			X
	Low life expectancy		X	X	
	Heart disease prevalence		X	X	
	Asthma prevalence		X	X	X
	Diabetes prevalence			X	X
	Poor mental health prevalence				X
	High blood pressure prevalence				X
	Cancer prevalence				X
	% without health insurance	X			X

Appendix Table 1 (continued). Federal Agency Criteria for Identifying Overburdened Communities

Category	Variable	DOE	EPA	CEQ	CDC
Critical Service Gaps	Medically underserved		X		
	Broadband gaps	X	X		X
	Food desert	X	X		
	Lack of plumbing	X		X	
	High housing costs	X		X	X
	Lack of walkability				X
	Lack of green space	X		X	X
	Job access	X			
Energy Burden	High energy costs	X		X	
	Non-grid connected heating fuel	X			
	Power outage event duration	X			
	Power outage event frequency	X			
Transportation	High transportation costs	X		X	
	Near railway				X
	Near airport				X
	Traffic proximity and volume	X	X	X	X
Environmental Hazards	Diesel particulate matter	X	X	X	X
	Ozone concentration	X	X		X
	NATA Respiratory Hazard Index		X		
	Air toxics cancer risk	X	X		X
	Particulate matter	X	X	X	X
	Lead paint (house construction date is proxy)	X	X	X	X
	Proximity to RMP Sites	X	X	X	X
	Proximity to TSDFs	X	X	X	X
	Proximity to NPL Sites	X	X	X	X

Appendix Table 1 (continued). Federal Agency Criteria for Identifying Overburdened Communities

Category	Variable	DOE	EPA	CEQ	CDC
Environmental Hazards	Proximity to TRI Sites				X
	Wastewater discharge toxicity	X	X	X	
	Underground storage tanks		X	X	
	Impaired surface water				X
	Abandoned mine land present			X	X
Climate Hazards	Loss of life from climate hazards	X			
	Expected population loss rate			X	
	Expected building loss rate			X	
	Expected agriculture loss rate			X	
	Drought		X		
	Flood risk		X	X	
	Sea level rise		X		
	Wildfire		X	X	

Notes:

[1] DOE: The tract is considered disadvantaged when it ranks in the 80th percentile of the cumulative sum of the 36 burden indicators and have at least 30% of households classified as low-income. The DOE only selects the top 20% of census tracts in each state.

[2] EPA: The demographic index is combined with a single environmental indicator, to display areas with the highest intersection between these socioeconomic factors and the environmental indicator.

[3] CEQ: The tract is considered disadvantaged when it meets more than 1 burden threshold AND is low income (If the tract meets a burden in Workforce Development threshold, the socioeconomic threshold is High school education < 10%.) OR if they are on land within the boundaries of Federally Recognized Tribes. Census tracts that are completely surrounded by disadvantaged communities are also considered disadvantaged if they meet an adjusted low income threshold (≥ 50th percentile).

Sources:

[1] Council on Environmental Quality, "Climate and Economic Justice Screening Tool Technical Support Document," available at https://static-data-screeningtool.geoplatform.gov/data-versions/1.0/data/score/downloadable/1.0-cejst-technical-support-document.pdf.

[2] Department of Energy, "Energy Justice Mapping Tool - Disadvantaged Communities Reporter," available at https://energyjustice.egs.anl.gov/.

[3] Department of Energy, "J40 DAC Data Descriptions," available at https://energyjustice.egs.anl.gov/resources/serve/DAC/DAC%20Data%20Indicators%20(v2022c).pdf.

[4] Department of Toxic Substances Control, "Treatment, Storage, and Disposal Facilities," available at https://dtsc.ca.gov/treatment-storage-and-disposal-facilities/

[5] Environmental Protection Agency, "EJScreen: Environmental Justice Screening and Mapping Tool," available at https://www.epa.gov/ejscreen.

[7] Environmental Protection Agency, "List of Regulated Substances under the Risk Management Plan (RMP) Program," available at https://www.epa.gov/rmp/list-regulated-substances-under-risk-management-plan-rmp-program.

[8] Environmental Protection Agency, "Superfund: National Priorities List (NPL)," available at https://www.epa.gov/superfund/superfund-national-priorities-list-npl.

Appendix Table 2. RGGI State Criteria for Identifying Overburdened Communities

Category	Variable	CT	DE	ME	MD	MA	NH	NJ	NY	PA	RI	VT	VA
Demographics	Low income	X			X	X		X	X	X	X	X	X
	Populations of color				X	X		X	X	X	X	X	X
	Federally recognized tribes												
	Historic underinvestment								X				
	Linguistic isolation				X	X		X			X	X	
	Unemployed	X							X				
	Less than high school education	X							X				
	Age distribution								X				
	Single parents								X				
	Renters								X				
	Mobile homes								X				
	Group quarters												
	Housing vacancy rate								X				
	Age of home								X				
	Sheltered and Unsheltered Population per sq. km												
	Drive time to employment ≥ 30 minutes												
	No vehicle(s) available												
	Jobs in the fossil fuel industry												
	Jobs in the coal industry												
Health Disparities	Disabilities (non-institutionalized)								X				
	Low-birth-weight infants				X				X				
	Low life expectancy								X				
	Heart disease prevalence				X				X				
	Pulmonary disease prevalence								X				

Appendix Table 2 (continued). RGGI State Criteria for Identifying Overburdened Communities

Category	Variable	CT	DE	ME	MD	MA	NH	NJ	NY	PA	RI	VT	VA
Health Disparities	Asthma prevalence				X				X				
	Diabetes prevalence												
	Poor mental health prevalence												
	High blood pressure prevalence												
	Cancer prevalence												
	% without health insurance								X				
Critical Service Gaps	Medically underserved								X				
	Broadband gaps				X				X				
	Food desert												
	Lack of plumbing												
	Agricultural land								X				
	High housing costs								X				
	Lack of walkability												
	Lack of green space								X				
	Job access	X											
Energy Burden	High energy costs								X				
	Non-grid connected heating fuel												
	Power outage event duration												
	Power outage event frequency												
Transportation	High transportation costs												
	Near railway												
	Near airport												
	Traffic proximity and volume				X								

Appendix Table 2 (continued). RGGI State Criteria for Identifying Overburdened Communities

Category	Variable	CT	DE	ME	MD	MA	NH	NJ	NY	PA	RI	VT	VA
Environmental Hazards	Diesel particulate matter								X				
	Benzene concentration								X				
	Ozone concentration				X								
	NATA Respiratory Hazard Index				X								
	Air toxics cancer risk				X								
	Particulate matter				X				X				
	Lead paint (house construction date is proxy)				X								
	Proximity to remediation sites								X				
	Proximity to RMP Sites				X				X				
	Proximity to TSDFs				X								
	Proximity to NPL Sites				X								
	Proximity to TRI Sites				X								
	Proximity to emitting power plants				X								
	Proximity to scrap metal processors								X				
	Proximity to municipal waste combusters								X				
	Proximity to major oil storage facilities								X				
	Proximity to active landfills								X				
	Proximity to brownfield sites				X								
	Wastewater discharge toxicity				X				X				
	Underground storage tanks												
	Impaired surface water												
	Proximity to mine land				X				X				

Appendix Table 2 (continued). RGGI State Criteria for Identifying Overburdened Communities

Category	Variable	CT	DE	ME	MD	MA	NH	NJ	NY	PA	RI	VT	VA
Climate Hazards	Loss of life from climate hazards												
	Extreme heat projections								X				
	Expected population loss rate												
	Expected building loss rate												
	Expected agriculture loss rate												
	Drought												
	Flood risk								X				
	Sea level rise												
	Wildfire												

Notes:
[1] The Risk Management Plan (RMP) rule provides a List of Regulated Substances under section 112(r) of the Clean Air Act. An RMP site is a facility where a regulated substance is over the listed threshold.

[2] Treatment, Storage and Disposal Facilities are facilities that treat, store, and dispose of hazardous wastes.

[3] The National Priorities List (NPL) is the list of sites of national priority among the known releases or threatened releases of hazardous substances, pollutants, or contaminants.

[4] Formerly Used Defense Site (FUDS) are private sites not owned by the Federal Government and that are not included on the Superfund National Priorities List (NPL).

[5] Toxic Release Inventory Sites (TRI) are facilities that produce or use volumes of listed chemicals above an EPA set threshold.

Sources:

[1] "Environmental Justice Communities," Connecticut Department of Energy & Environmental Protection, available at https://portal.ct.gov/DEEP/Environmental-Justice/Environmental-Justice-Communities#DECD.

[2] “Data and Information,” Delaware Department of Natural Resources and Environmental Control, available at https://dnrec.alpha.delaware.gov/environmental-justice/data/.

[3] “Report on Equity Considerations in Decision Making,” Maine Governor’s Office of Policy Innovation and the Future, February 25, 2022, available at https://www.maine.gov/dep/publications/documents/GOPIF%20Report%20Pursuant%20to%20Public%20Law%202021%20Chapter%20279%20(LD%201682)_2-25-2022.pdf.
[4] “Statute 1-701,” Maryland General Assembly, available at https://mgaleg.maryland.gov/mgawebsite/Laws/StatuteText?article=gen&section=1-701&enactments=false.

[5] "Environmental Justice Populations in Massachusetts," Massachusetts Executive Office of Energy and Environmental Affirs, available at https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts.
[6] “Statement on Environmental Justice,” New Hampshire Department of Environmental Services, October 25,2022, available at https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/environmental-justice-statement.pdf.
[7] “New York State’s Draft Disadvantaged Communities Criteria,” New York State, available at https://climate.ny.gov/-/media/project/climate/files/LMI-dac-criteria-fact-sheet.pdf.

[8] “PA Environmental Justice Areas,” Pennsylvania Department of Environmental Protection, available at https://www.dep.pa.gov/PublicParticipation/OfficeofEnvironmentalJustice/Pages/PA-Environmental-Justice-Areas.aspx.
[9] “Environmental Justice Policy,” Rhode Island’s Department of Environmental Management, available at https://dem.ri.gov/media/49366/download.

[10] “Act 154 An act relating to environmental justice in Vermont,” Vermont General Assembly, available at https://legislature.vermont.gov/Documents/2022/Docs/ACTS/ACT154/ACT154%20As%20Enacted.pdf.
[11] “Article 12, Virginia Environmental Justice Act,” State of Virginia, available at https://law.lis.virginia.gov/vacodefull/title2.2/chapter2/article12/.