January 12, 2022

Submitted via email to info@rggi.org

Re: Comments on RGGI Base Case Modeling

Environmental Defense Fund (EDF) strongly supports the continued leadership of the RGGI states in placing binding limits on carbon dioxide (CO_2) emissions from electricity generation. EDF is an international environmental advocacy organization with 2.5 million members nationwide, including nearly 750,000 members in the 11 RGGI member states, and we are dedicated to finding innovative approaches to solving our most difficult environmental challenges. EDF has extensive experience with carbon market design: we appreciate the challenges and benefits of a regional framework for reducing carbon pollution through a market-based program, and we respectfully offer the following comments and recommendations for consideration on RGGI's modeling approach.

Assumptions, Data Sources, and Model Outputs

1. **Natural gas price assumptions.** We recommend the RGGI states evaluate a range of natural gas prices in the model to explore the sensitivity of the results to different price projections. The generating resources selected by the model are highly sensitive to natural gas price assumptions, so it is important to understand how variation in prices might affect the economics of natural gas generating units going forward. In recent years, EIA's Annual Energy Outlook (AEO) projections have consistently over-estimated gas prices.[1] To account for uncertainty in future price assumptions, the analysis should evaluate sensitivity scenarios that assume a range forecasted prices – both higher prices and lower prices than those in the AEO Reference Case – such as those from the AEO High Oil and Gas Supply case and Low Oil and Gas Supply case to account for uncertainty in future prices.[2] The study should also seek to incorporate regional differentials in natural gas prices (e.g., differences in prices between New Jersey and Pennsylvania), as this too could impact investment decisions in the model. For example, bringing gas into ISO-NE is often constrained, which could impact prices compared to other RGGI states/regions.
2. **Estimating future renewable energy costs.** The analysis should utilize the NREL Annual Technology Baseline (ATB) for projected renewable energy cost data. These estimates better reflect the pace at which the costs of wind and solar have historically fallen than AEO

[1] See AEO retrospective review: https://www.eia.gov/outlooks/aeo/retrospective/.
[2] See https://www.eia.gov/outlooks/aeo/tables_side.php.

projections, and we expect them to fare better than AEO projections for future renewable energy costs.[3]

3. **Energy and peak demand**. ISO forecasts are developed for reliability planning and therefore may include "worst case" assumptions, which have been found to over-forecast demand. For each state/regional energy demand forecast used, it is important to understand and preferably align assumptions around behind-the-meter solar, energy efficiency, and beneficial electrification. Forecasts should account for current state energy efficiency resource standards and assume that the savings levels of the final year of a current policy continue into the future. The following projections/net-zero studies can provide guidance on how much additional growth should be modeled:
    - U.S. Pathways to Net-Zero Greenhouse Gas Emissions by 2050[4]
    - Princeton University Net-Zero America study[5]
    - E3 Net-Zero New England study[6]
    - E3 New York State Decarbonization Pathways Analysis[7]
    - Massachusetts Energy Pathways to Deep Decarbonization study[8]
4. **Evaluate a high-electrification scenario.** The analysis should include sensitivities on different load growth scenarios to assess how different levels of electricity demand impact the RGGI program. EDF recommends that the RGGI states model a high electrification scenario that reflects a large amount of electrification of the buildings and transportation sectors. This scenario should reflect levels of electrification that are consistent with what is needed to achieve the U.S. Nationally Determined Contribution[9] to reduce economy-wide GHG emissions

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[3] Bloomberg and Lazard LCOE analyses could provide additional points of comparison. See https://www.lazard.com/perspective/levelized-cost-of-energy-levelized-cost-of-storage-and-levelized-cost-of-hydrogen/.

[4] Available at: https://www.whitehouse.gov/wp-content/uploads/2021/10/US-Long-Term-Strategy.pdf.

[5] Available at: https://environmenthalfcentury.princeton.edu/sites/g/files/toruqf331/files/2020-12/Princeton_NZA_Interim_Report_15_Dec_2020_FINAL.pdf.

[6] Available at: https://www.ethree.com/new-study-evaluates-deep-decarbonization-pathways-in-new-england/.

[7] Available at: https://www.ethree.com/e3-evaluates-decarbonization-pathways-for-new-york-state/.

[8] Available at: https://www.mass.gov/doc/energy-pathways-for-deep-decarbonization-report/download.

[9] See https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/United%20States%20of%20America%20First/United%20States%20NDC%20April%2021%202021%20Final.pdf.

by 50-52% from 2005 levels by 2030.[10,11] To the extent feasible, the analysis should also account for regional variations in beneficial electrification. For example, the analysis might consider that electrification such as heat pumps may be more difficult in colder climates like New England, which could impact peak demand.

5. **Include all states with adopted regulations to participate in RGGI in the base case**. RGGI continues to expand with Pennsylvania recently adopting a regulation to participate beginning in 2022. The base case should include all states with adopted regulations, and the states should consider running scenarios with additional states, such as North Carolina which recently approved initiating a rulemaking that would end with joining RGGI, participating in the program to evaluate the benefits of expanding participation.
6. **State emission targets**. State targets with enforceable regulations should be included in the base case. If the RGGI states model any cases that assume policies that are not currently on the books, a sensitivity could reflect all states meeting their goals. It is important to note that when translating economy-wide targets to electric sector reductions, electric sector reductions could follow a steeper trajectory than assuming each sector achieves the same level of reductions.[12] State and/or federal policies finalized prior to RGGI modeling should be included. Additionally, EDF agrees with including state renewable portfolio standards and clean energy standards in the base case and modeling clean energy standards similarly to renewable portfolio standards.
7. **Storage capacity additions**. The analysis should include deployment of energy storage based on state clean energy mandates with market-driven build-out, as determined by the model to be

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[10] Multiple independent analyses conducted before President Biden's announcement of the U.S. emissions target for 2030 scoped a path to a bold U.S. Nationally Determined Contribution (NDC), from a range of groups including Environmental Defense Fund, Natural Resources Defense Council (NRDC), America is All In, the University of Maryland and others. See http://blogs.edf.org/climate411/2021/06/10/the-key-to-reaching-bidens-new-climate-goal-an-enforceable-clean-electricity-standard-that-slashes-pollution/.

[11] Analysis from EDF evaluating pathways to achieving the U.S. NDC assumed 100% zero-emission vehicle (ZEV) sales by 2035 for light-duty vehicles (LDVs) and 2040 for medium and heavy-duty vehicle sales. See https://www.edf.org/sites/default/files/documents/Recapturing%20U.S.%20Leadership%20on%20Climate.pdf. Analyses by University of Maryland and NRDC assumed 90% or greater ZEV sales for LDVs by 2035. NRDC's analysis assumed more than 95% of sales of space heating and nearly 100% of sales of water heating equipment to be electric by 2030. See https://cgs.umd.edu/sites/default/files/2021-03/Charting%20NDC%202030_Technical%20Appendix.pdf and https://www.nrdc.org/sites/default/files/2030-biden-climate-pollution-technical-appendix.pdf. Additionally, the Biden administration has set a target to make half of all new vehicles sold in the U.S. zero-emissions vehicles by 2030. See https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/.

[12] National-level projected outcomes or IEA World Energy Outlook modeling (see https://www.iea.org/reports/world-energy-outlook-2021) could be used to inform these assumptions. Also see Clean Energy Futures study on An 80x30 Clean Electricity Standard (available at: https://cleanenergyfutures.syr.edu/wp-content/uploads/2021/07/CEF-80x30-CES-Report_Final_July_9_21.pdf).

economic, included in addition to established state requirements. To support these estimates, the states should provide more information about IPM's deployment and cost assumptions for battery storage.

8. **Hydrogen and natural gas substitutes derived from captured methane from landfills, agricultural sources, or wastewater treatment**. The RGGI states should provide more information to improve understanding of modeling assumptions that will influence the deployment of hydrogen and natural gas substitutes captured from landfills, agricultural sources, or wastewater treatment. This information will likely include, among other things, the level of co-firing at electric generators that will be assumed, assumptions for converting existing gas pipelines to carry hydrogen, and whether blending to deliver fuel will be assumed. For hydrogen cost estimates, the states should consider reviewing Bloomberg forecasts. We expect prices for natural gas substitutes captured from landfills, agricultural sources, or wastewater treatment may follow natural gas prices, with an additional cost/premium. The states could consider using a constant dollar premium adder on top of AEO natural gas price curves for these estimates.[13] Additionally, the analysis should consider limitations on the available supply of natural gas substitutes.
9. **Provide criteria pollutant outputs from IPM**. Information about criteria pollutants is necessary to assess co-benefits and health impacts of different model rule scenarios. This information can serve as a baseline, but as discussed below, additional analysis beyond IPM modeling is needed to assess the impacts of RGGI at the local level, and especially impacts on communities disproportionately impacted by air pollution.
10. **Provide detailed results for non-RGGI states.** Detailed information about model outputs for non-RGGI states, particularly those that frequently act as electricity exporters into RGGI states, is necessary to assess the impacts of emissions leakage.
11. **Excess allowance pool**. One option for addressing excess allowances at the end of the analysis period is assessing model runs that make different assumptions around allowance availability and evaluating how this impacts allowance prices, especially as compared to the floor and ceiling prices. For example, if modeling assumptions around the allowance pool lead to lower allowance prices than the floor price, then the states should consider retiring residual allowances and not returning them to the market.

[13] The states should also consider data available from the Coalition for Renewable Natural Gas or Biofuel Association of America for price guidance.

Evaluating Local Pollution Impacts and Equity Implications

While studies to date have provided useful information about the health benefits of RGGI across the region,[14] more information is needed on the localized impacts of the program, especially in communities disproportionately impacted by air pollution**.** Environmental justice and equity-focused organizations as well as frontline communities most affected by pollution from electricity generation must be meaningfully involved in developing program analyses, have access to the necessary resources to participate, and have their input substantively shape the states' analysis plan. The RGGI states must engage directly with these groups and communities to understand what analysis and data is needed to assess RGGI's impacts and develop an analysis plan that reflects this input.

EDF supports recommendations from environmental justice groups and equity stakeholders to conduct additional analysis evaluating the impacts of RGGI at the community level. Comments submitted by the Climate Justice Alliance (CJA) in December[15] call on the RGGI states to commit to an ongoing, place-based equity analysis and report on the distribution of emissions reductions, including a cumulative burden analysis that considers the proximity of multiple power plants to overburdened communities, including facilities below the 25-Megawatt threshold. As a first and bare-minimum step, RGGI states should collect and make available all data identifying where local emission reductions have been achieved and where emissions have either remained unchanged or increased, so communities can assess the impacts RGGI is having on their local communities.

We also support comments submitted in November[16] by organizations representing frontline communities in Pennsylvania, which call for ongoing annual analysis of the economic and air quality impacts of RGGI on low-income communities, communities of color, and frontline communities. The analysis should include an assessment of the process for investing RGGI auction proceeds in these communities, the effectiveness of those investments, and whether investments are effectively remediating adverse impacts on these communities. We support the recommendation from these organizations that a minimum of 50% of auction proceeds be invested in disadvantaged communities. The analysis should also include an assessment of energy burdens for residential customers at different income levels and whether RGGI has impacted those energy burdens.

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[14] See https://www.abtassociates.com/insights/publications/report/analysis-of-the-public-health-impacts-of-the-regional-greenhouse-gas-0.

[15] See https://www.rggi.org/sites/default/files/Uploads/Program-Review/2021_Comments/Session2/CJA_Public_Comment_2021-12-03.pdf.

[16] See https://www.rggi.org/sites/default/files/Uploads/Program-Review/2021_Comments/Session2/PA_Frontline_Communities_Public_Comment_2021-11-29.pdf.

EDF recommends that the RGGI states provide outputs from the IPM model for criteria pollutants at the state- and, to the extent possible, local-levels. Information about local pollution is necessary to evaluate the relative impacts of different policy options on air quality and public health. This information is especially relevant in evaluating the impacts of RGGI and proposed design elements on communities that are overburdened by air pollution. Criteria pollutant reduction co-benefits and avoided health impact modeling should also be conducted and RGGI should explore mapping results to different jurisdictional levels to support decision-making by different policymakers, including but not limited to RGGI, on how to address local air pollution.

EDF notes that there is uncertainty in power sector modeling and localized results, especially when evaluating forecasted results at the plant-level. IPM provides information about plant-level operations, but these are aggregate "model plants" that do not individually represent actual facilities. As results depend on various assumptions and inputs that include some level of uncertainty, the way a model plant operates in IPM will be very different than how an actual facility operates. Translating the IPM model plant outputs into a co-pollutant model requires making further assumptions and further reduces the reliability of plant-level results. Given this level of uncertainty, the RGGI states must commit to equity-focused analysis in addition to the IPM model runs.

The results of these analyses, along with input from environmental justice and community advocates, should inform program design elements that can address pollution "hotspots," ensure program benefits – both economic and environmental – are directed to the communities that need them most, and prioritize accelerating pollution reductions in communities that are overburdened by air pollution.

We look forward to working with the states to improve the RGGI program and maximize its benefits through the Program Review process, and we appreciate your consideration of these comments.

Sincerely,

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