Caiazza Response to 24 September 2024 RGGI Request for Comments

Introduction

I have been involved in the RGGI program process since it was first proposed. I follow and write about the details of the RGGI program in my retirement because its implementation affects whether I will be able to continue to be able to afford to live in New York. I have extensive experience with air pollution control theory, implementation, and evaluation of results having worked on every cap-and-trade program affecting electric generating facilities in New York including the Acid Rain Program, Regional Greenhouse Gas Initiative (RGGI) and several nitrogen oxide programs. Ultimately I believe the ambitions for a zero-emissions economy envisioned by RGGI proponents outstrip available renewable technology on the trajectory proposed such that the net-zero transition will do more harm than good. The opinions expressed in these comments do not reflect the position of any of my previous employers or any other organization I have been associated with, these comments are mine alone.

I submitted initial comment recommendations and followed up with supplemental comments in October 2021. Those comments addressed my concerns about a "binding" allowance cap, a possible emissions trajectory to zero by 2035 and market monitoring. In April 2023 I submitted comments on the status of emissions and proposed allowance trajectories. In comments submitted in October 2023 I argued that the current three-year compliance period should stay in place and urged caution regarding the proposed allowance allocation trajectories.

Summary

In these comments I address problems I see with the IPM modeling that underpins the Third Program Review proposals. IPM estimates that CO2 emissions will be much lower across the RGGI region by 2028. I do not think that is reasonable. I estimated how many renewable resources would need to be deployed to displace RGGI-affected source emissions and this confirmed my concern.

I think the questionable results are related to the limitations of IPM. Reports addressing the New York biennial review of the observed progress of its GHG emission reduction goals has identified supply chain, higher interest rates, inflation, and workforce limitations that have delayed progress in the rollout of New York wind and solar resource deployment. All these issues add significantly to model input uncertainty that are not incorporated in the IPM modeling.

I have serious concerns with the modeling methodology. My comments note that the IPM modelling approach cannot reconcile the deployment uncertainties observed in New York. Furthermore, it is not clear how well IPM addresses issues related to wind and solar weather effects on dispatchability. These ambiguities compound the inherent challenges related to allowance price estimates. As a result, I believe that the limitations of the IPM projections must be addressed in the Program Design elements.

Fortunately, the RGGI proposals do address this need. I commend the RGGI proposal to add a second CCR tier It is a reasonable response to the intractable modeling uncertainties. It should be an effective response to my concerns if the parameters are chosen correctly.

Finally, I review the proposed solutions to address environmental ambition if other jurisdictions join RGGI. I do not believe that the additional complexity and logistical implementation issues associated with the proposals is warranted because the difference in ambition is more symbolic than real.

Modeling Approach

The basis of the RGGI state program review proposal is modeling done by ICF using the Integrated Planning Model (IPM). There is not much documentation for the IPM analysis. The Program Review Update is the only documentation and that consists of "informational slides". The "detailed modeling results" are presented in a spreadsheet that does not include a table with explanations of the data provided. Even though I have reviewed every previous iteration of RGGI IPM modeling results, I had to spend a lot of time trying to decipher what they were doing. I do not think this lack of documentation is appropriate and request more comprehensive descriptions in the future.

The presentation slides note that "The RGGI states have conducted modeling analysis of an additional exploratory policy scenario". In this type of analysis, the policy scenario results are compared to a base case or business as usual scenario. Two cap scenarios were modeled:

- Flat Cap Scenario consistent with current program design
- Exploratory Policy Scenario with an increased reserve price, declining cap to 2037 and a new two-tier CCR.

Results from two cases of the "Exploratory Policy Scenario" are presented in the spreadsheet. Case A includes "currently contracted renewables only" and Case B includes "on-the-books policies and mandates". The Flat Cap Scenario includes on-the-book policies and mandates and the exploratory scenario projects what would happen with the policy changes. The documentation also notes that renewable cost data has been updated to align with NREL's 2024 release of the Annual Technology Baseline dataset. I believe that the updated data were different enough that it was appropriate to do a new current program design base case, i.e., the Flat Cap Scenario. An explanation of the cases is an example of the type of detailed documentation that I believe that RGGI should provide.

I have reservations about the analysis because the IPM projected emissions in 2028 are not credible. Table 1 lists the observed EPA Clean Air Markets Division annual CO2 emissions for the last three years and the Integrated Planning Model (IPM) projected 2028 emissions for the three modeling scenarios from the results spreadsheet. IPM projects an overall reduction of more than 50% in four years. I believe that the analysis over-estimates potential CO2 reductions in the ten RGGI states. Reductions in this time frame must occur when wind and solar resources displace the RGGI source generation, and my first impression is that it is unlikely that enough wind and solar can be built in that time frame.

Table 1: Comparison of Observed RGGI CO2 Emissions and IPM Projected Emissions (million tons)

	Observed Emissions			2028 IPM Projected Emissions		
				Policy Scenarios		Flat Cap
	2022	2023	2024	Case A	Case B	Case B
NYISO	30.8	28.9	28.0	12.5	9.3	10.2
ISONE	26.2	25.5	23.3	15.6	16.3	17.7
RGGI PJM	30.6	26.6	24.3	7.3	15.3	21.7
Total	87.6	81.0	75.6	35.3	40.9	49.5

Modeling scenario Case A includes "currently contracted renewables only and Case B, used in the Flat case, includes "on-the-books policies and mandates". I do not believe that the modeling addresses the fact that renewable rollouts are not going according to contracted renewable plans. The New York Department of Public Service (DPS) Case Number: 15-E-0302,: Proceeding on Motion of the Commission to Implement a Large-Scale Renewable Program and a Clean Energy Standard recently asked for comments on the DPS staff and the New York State Energy Research and Development Authority's (NYSERDA) July 1, 2024, filing of the Draft Clean Energy Standard Biennial Review. Comments submitted by EDF Renewables noted that:

> Reflecting on Sections 4 and 5 of the Draft Review with a look at the current state of contracted renewables and the path to achieving the 70% Goal:
>
> - Out of 156 RES Tier 1 projects that have been awarded, approved, or are pending approval by NYSERDA since 2004, 30 are operational and 23 are still under development.
> - 11 of 25 land-based wind projects are operational and 9 of 116 solar projects are operational. Operational projects have added 1,016 MW of capacity, 821 MW of which are land based wind projects.
> - 11,000 MW of capacity has been cancelled or is still under development.

The Draft Clean Energy Standard Biennial Review itself acknowledged this problem. It concludes that New York's Climate Leadership & Community Protection Act 70% renewable energy by 2030 target will not be met until 2033. The Biennial Review notes:

> New York's progress has been and will continue to be affected by conditions in the larger global markets. The complex renewable energy supply chain is a global network of materials procurement, processing, production, materials recovery, infrastructure, and logistics operations. As the United States and other nations raise their goals for emission reductions, those supply chains are stressed. Geopolitical tensions and policies incentivizing domestic production of major energy generation equipment also impact the cost and availability of materials and components. High interest rates and inflation – which were prevalent from mid-2021 through mid-2023 across the renewable energy supply chain – also play a role in raising the baseline for renewable energy input prices. While such prices have recently stabilized, input prices are higher than what was forecasted prior to the 2021-2023 inflationary period.

The IPM modeling does not address this reality. I think that is why the modeled emissions in 2028 are so low. In the absence of documentation citing just how much solar PV, onshore wind, and offshore wind resources were assumed to be deployed in the RGGI IPM modeling analysis I made my own estimate.

My projection of necessary renewable energy is based on evaluation of historical emissions data. Table 2 lists the observed annual CO2 emissions from the ten-state RGGI region from the EPA Clean Air Markets Division (CAMD) database for all programs. Note that this means that New Jersey emissions are included for all years. There has been a significant drop in CO2 emissions in the RGGI region, but a large portion of those reductions were due to fuel switching from coal and oil to natural gas and retirements of fossil-fired units. Importantly, the opportunity for further fuel switching reductions is very small. As a result, most future emission reductions must come from reduced operations at existing fossil-fired power plants due to displacement by renewable deployments.

Table 2: 10-State EPA CAMD All Program Annual CO2 Emissions by Fuel Type

	CO2				
Year	**Total**	**Coal**	**Oil**	**Natural Gas**	**Other**
2009	124,850,390	63,951,579	8,308,293	51,282,306	1,308,212
2010	138,296,441	67,871,067	9,162,006	60,189,238	1,074,130
2011	122,411,853	49,735,532	5,777,737	65,883,010	1,015,574
2012	112,255,222	32,812,092	7,489,168	70,660,990	1,292,972
2013	105,448,782	35,731,962	5,410,162	62,963,976	1,342,682
2014	108,167,363	35,095,553	5,721,204	65,090,048	2,260,558
2015	106,338,885	26,182,377	5,646,283	72,043,803	2,466,422
2016	104,456,902	23,332,013	2,722,703	75,543,522	2,858,664
2017	86,430,752	15,460,996	1,410,219	67,059,759	2,499,778
2018	94,198,352	16,349,938	2,441,685	72,843,684	2,563,046
2019	82,793,022	10,100,785	1,076,072	69,162,628	2,453,537
2020	78,275,058	6,323,826	708,303	69,189,015	2,053,914
2021	84,912,659	9,498,270	657,955	72,545,550	2,210,884
2022	87,639,175	6,766,792	1,603,531	77,322,568	1,946,283
2023	81,038,525	2,498,349	677,929	76,373,349	1,488,898
2024	37,777,457	1,706,991	298,357	35,164,634	607,474

Details for the methodology I used to estimate how much renewable energy is needed to reach the emissions listed in the modeling results are attached in a summary and spreadsheet. In brief, I calculated the average annual emissions for each fuel type. The IPM modeling results set the target emissions. I assumed the coal, oil, and other fuel types would go to zero by 2028 and that natural gas emissions equal the emissions projected by IPM in 2028. (Note that this is a gross approximation because among other things, oil serves a reliability requirement in New York State and cannot be replaced in the foreseeable future.) The EPA database also includes load. Using the EPA load data and the emissions I calculated the load per ton of CO2 for each fuel type. I used those parameters to estimate the load associated with the projected emissions.

In Table 3 I list the estimated renewable displacement load (MWh) value for each scenario at the top of the tables, e.g. 88,630,916 MWh of renewable energy must displace fossil fired generation for the Case A, Exploratory Policy Scenario. I determined the relative contributions of solar PV, onshore wind, and offshore wind based on results in the IPM modeling spreadsheet. Those percentages were multiplied by the total load that renewables must displace to estimate how much each type would have to displace. I assumed some conservatively high capacity factors for the renewable resources and calculated the capacity (MW) of each resource. In my opinion, there is very little chance that these levels of solar PV, onshore wind and offshore wind can be deployed by 2028 because of the problems noted in the Biennial Review.

Table 3: Estimated Renewable Deployment Necessary to Achieve IPM RGGI 2028 Emissions

Projected Renewable Capacity (MW)
Case A Exploratory Policy Scenario

Renewables load needed to displace emissions
88,630,916

	Percent	MWh	C.F.	MW
Solar PV	32%	28,204,235	23%	13,999
Onshore wind	42%	37,010,947	35%	12,071
Offshore wind	26%	23,415,734	45%	5,940

Projected Renewable Capacity (MW)
CaseB Exploratory Policy Scenario

Renewables load needed to displace emissions
76,761,829

	Percent	MWh	C.F.	MW
Solar PV	32%	24,427,240	23%	12,124
Onshore wind	42%	32,054,594	35%	10,455
Offshore wind	26%	20,279,996	45%	5,145

Projected Renewable Capacity (MW)
Case B Flat Cap Scenario

Renewables load needed to displace emissions
58,579,242

	Percent	MWh	C.F.	MW
Solar PV	32%	18,641,156	23%	9,252
Onshore wind	42%	24,461,817	35%	7,978
Offshore wind	26%	15,476,270	45%	3,926

There are other potential problems that could have bigger ramifications. IPM integrates "wholesale power, system reliability, environmental constraints, fuel choice, transmission, capacity expansion, and all key operational elements of generators on the power grid in a linear optimization framework". I think that the optimization process presumes that wind and solar resources can be freely substituted for other dispatchable resources in its estimates of the future electric power system. However, wind and solar resources are not dispatchable. It is not clear whether the IPM approach is appropriate for an electric system that has a large renewable component.

Furthermore, I do not know how IPM handles weather dependency of wind and solar in its projections. My back-of-the-envelope projection for renewable generation necessary to displace fossil fueled resource generation assumes that the replacement is on a one for one MWh basis. Presently, wind and solar generation is dispatched first because there is no fuel cost. Fossil resources are being used more and more only as backup when wind and solar is unavailable. As a result, wind and solar resources displace less and less fossil, as more resources are added. For example, solar resources can never eliminate fossil resources at night. The same holds true for wind because there is a significant correlation of wind facilities across large areas. For example, on 9/13/2024 at hour 1200 the New York Independent System Operator (NYISO) real-time fuel mix generation from over 2,500 MW of wind capacity across the state, including an offshore wind facility, was zero.

To accurately project future fossil generation in an electric grid with increasing amounts of intermittent wind and solar, dispatchability and weather dependency must be incorporated. I understand that the NYISO resource planners use historical meteorological data and associated wind and solar output to account for weather dependency and their resource planning approach incorporates dispatchability concerns. If IPM does not address this issue similarly, then the results for the future projections have little value and should not be relied on to make future predictions of the RGGI electric system. It would be prudent to compare the IPM modeling results with the projections for future resources developed by regional transmission operators in the region.

Allowance Market Modeling

Another modeling component of IPM provides allowance prices. The following slide in the presentation describes how IPM and the market price allowances differently. It says that IPM "predicts allowance prices based on fundamental assumptions about energy generation, electric load growth, and the allowance supply trajectory", and that the market "determines allowance prices based on current dynamics, in particular the balance between supply and demand, and expectations for the future".

How IPM and the market price allowances differently

- **IPM** predicts allowance prices based on fundamental assumptions about energy generation, electric load growth, and the allowance supply trajectory
- The **market** determines allowance prices based on current dynamics, in particular the balance between supply and demand, and expectations for the future.

IPM Considerations include:	Market Considerations include:
Long-term Fundamentals	Supply and Demand of Allowances
Generation Assumptions & Costs	Short-Term Events
Economic Growth Forecast	Speculation
Government Policies, and more…	Annual Emissions Trends, and more…

I believe that there is a fundamental disconnect between allowance market theory and reality because economic value theory for an allowance market fails to account for the behavior of the affected sources. The slide addresses some but not all my concerns.

The RGGI slide description of market considerations correctly includes supply and demand of allowances and short-term events. However, speculation and annual emissions trends are not significant considerations because affected source compliance planning is on a shorter-term basis. The RGGI slide descriptions do not recognize that owners and operators of sources (i.e., the compliance entities) treat the allowances primarily as compliance instruments and not as financial assets. Academic economic theory presumes that the compliance entities are looking years down the road but, in reality, there is no such long-term time horizon for affected sources. Compliance entity allowance purchasing decisions are based on their expected operations in the period between quarterly auctions or, at most, the entire 3-year compliance period including a small margin for operational variations and regulatory compliance. Finally, contrary to economic market program theory, there is little attempt to make the allowances a profit center by compliance entities, so speculation is not a consideration.

The slide describes IPM considerations including: "long-term fundamentals, generation assumptions & costs, economic growth forecast, and government policies." These considerations address my biggest concern about the IPM model. It has perfect foresight. The model incorporates locks the assumptions in and generates a solution based on the best way to resolve the effects. This is a problem in the first place because the assumptions used for the considerations are subject to change. For example, cost predictions necessarily are affected by inflation, and no one predicted the recent large changes. Secondly, these considerations introduce significant uncertainties that affect the deployment of the renewable resources necessary to displace fossil generating units and reduce their emissions. This in turn affects the scarcity of allowances relative to emissions and that affects allowance prices. As shown earlier, there are limited remaining opportunities to switch fuels which has been the most effective emission reduction strategy to date. The IPM allowance modeling estimates cannot handle these uncertainties, so they are little more than educated guesses for future allowance costs.

Modeling Scenario Comment Conclusion

Given the enormous uncertainties of the transition to zero-emissions in the RGGI states it would be prudent to address this issue directly. I commend the states for proposing a solution that, depending on how it is implemented, could deal with the problem simply.

RGGI has already adopted the Cost Containment Reserve (CCR). The CCR established a "quantity of allowances in addition to the cap which are held in reserve." If allowance prices exceed predefined price levels, these allowances are sold. The CCR is replenished at the start of each calendar year.

Table 4 lists CCR and trigger prices over time. Note that the March 13, 2024 allowance auction clearing price was $16.00 so the CCR allocation was completely used up. In the most recent auction, the clearing price was $25.75 which exceeds the 2030 trigger price. I expect that the CCR will be triggered next year too.

Table 4: RGGI Cost Containment Reserve

Year	Base Cap	Bank Adjustment	Adjusted Cap	CCR Trigger Price ($)	CCR Size
2020	78,175,215	21,891,408	56,283,807	$10.77	10,000,000
2021	75,147,784	19,090,330	56,057,454	$13.00	7,514,778
2022	72,872,784	19,090,330	53,782,454	$13.91	7,287,278
2023	70,597,784	19,090,330	51,507,454	$14.88	7,059,778
2024	68,322,784	19,090,330	49,232,454	$15.92	6,832,278
2025	66,047,784	19,090,330	46,957,454	$17.03	6,604,778
2026	63,772,784	N/A	63,772,784	$18.22	6,377,278
2027	61,497,784	N/A	61,497,784	$19.50	6,149,778
2028	59,222,784	N/A	59,222,784	$20.87	5,922,278
2029	56,947,784	N/A	56,947,784	$22.33	5,694,778
2030	54,672,784	N/A	54,672,784	$23.89	5,467,278

The ultimate issue is how the allowances allocated for the annual caps compare and the bank of already allocated allowances held compare with actual emissions. Environmental activists demand that the allowance cap "bind" emissions to ensure that the reductions occur on their arbitrary trajectory. They don't accept that a binding cap will limit emissions even if the zero-emissions resources are not available to displace the existing emissions and that the ramifications of that situation are enormous. In the worst case, an electric generating unit needed to keep the lights on will refuse to operate because they have insufficient allowances. The two-tier CCR should resolve this danger.

Response to "Environmental Ambition" Questions

The second component in the request for comments notes that "The RGGI states are interested in exploring potential market solutions that could enable such states to link to the RGGI market in the future, including potentially at a cap trajectory which may not align with the RGGI cap trajectory resulting from the Third Program Review." In particular, the RGGI states seek stakeholder feedback on potential accommodation mechanisms such as:

- The potential application of allowance trading or compliance ratios between entities in states that have and have not adopted the cap trajectory resulting from the Third Program Review.
- The potential application of volume limits in trading or compliance between entities in states that have and have not adopted the cap trajectory resulting from the Third Program Review.
- The proper basis to determine such potential allowance trading/compliance ratios, or volume limits, including respective emissions cap levels, reduction trajectories, price levels, and/or other relevant factors.
- Other potential mechanisms that would allow for participation by states implementing a cap trajectory that is different than the cap trajectory resulting from the Third Program Review, such as a cap trajectory previously adopted in regulations to be consistent with the current RGGI program, while safeguarding any new environmental ambition achieved by the current RGGI participating states as a result of the Third Program Review.

These mechanisms all would introduce significant logistical tracking and reporting issues. In addition, the accommodation mechanisms create an incongruous compliance system. Consider two trading regions:

- Region 1 starting emissions are 1,000 and the region target is zero in ten years, so the allowance reduction trajectory is 100 allowances per year
- Region 2 starting emissions are 2,000 and the region target is zero in twenty years, so the allowance reduction trajectory is also 100 allowances per year

In the first year the sum of the allowance caps for the two regions is 2,800. If in the first year Region 1 emissions are 1,000 and the Region 2 emissions are 1,800 the sum of the emissions is 2,800 and the two regions are in overall compliance with the combined limit. However, within Region 1 the sources are out of compliance if they are treated differently. The desired environmental impact is achieved on a slightly delayedschedule but all the accommodation mechanisms proposed penalize the sources.

What is the point of all the additional complexity? The only rationale is that the ambition is different for timing in two different regions and that needs to be considered. However, the difference in a ton reduced now versus a ton reduced in 2050 is inconsequential to global climate change. Therefore, I do not think that any of the potential accommodation mechanisms are necessary.

Conclusion

In these comments I address problems I see with the IPM modeling that underpins the Third Program Review proposals. I detailed specific concerns and issues that I think make resolving IPM uncertainties intractable. I commend the RGGI proposal to incorporate a two-tier CCR. It is a reasonable response to the intractable uncertainties. It should be an effective response to my concerns if the parameters are chosen correctly.

Finally, I reviewed the proposed solutions to address environmental ambition if other jurisdictions join RGGI. I do not believe that the additional complexity and logistical implementation issues associated with the proposals is warranted because the difference in ambition is more symbolic than real.