Caiazza Part 242 Comments

Introduction

These personal comments address two aspects of the proposed revisions to Part 242: changes to the rules themselves and the justification provided in the Regulatory Impact Statement (RIS) and the underlying premise of the regulations that the Regional Greenhouse Gas Initiative (RGGI) has been an unqualified success. I have no expectation that the Department of Environmental Conservation (DEC) will make any substantive response to the rules base on my comments because most of the proposed revisions are responses to the Regional Greenhouse Gas Initiative (RGGI) Model Rule so the opportunity for changes has passed. Nonetheless, there are differences of interpretation that need to be addressed between the intent of the Model Rule and what is proposed. In addition, the justification for these revisions provides New York citizens insufficient evidence to support the proposed changes and no quantification of the proposed benefits of the revisions proposed.

I am submitting these comments because I want my family to be able to afford to continue to live in New York State. The proposed rule is consistent with the Climate Leadership and Community Protection Act ("Climate Act") that will necessarily affect the price of energy in New York and based on results elsewhere I believe those costs will ultimately be unacceptable. I am a retired electric utility meteorologist with nearly 40 years of experience analyzing the effects of emissions on the environment. The opinions expressed in these comments do not reflect the position of any of my previous employers or any other company I have been associated with, these comments are mine alone.

There are three components of the following comments. I first address three underlying suppositions driving the proposed revisions: that RGGI has been a success and deserves to be revised, that expanding the applicability of the program to generating units greater than 15 MW but less than 25 MW is warranted, and that a binding cap is an appropriate goal. Next there is a section that specifically addresses the proposed revisions. Finally, I address the RIS justifications.

RGGI Success

The underlying premise of these proposed actions is that the Regional Greenhouse Gas Initiative has been an unqualified success and deserves to be expanded and revised. Sprinkled throughout the RIS are statements such as: "contributing to a 50% reduction in CO_2 from affected power plants in New York, it is estimated that the RGGI program provided $1.7 billion in avoided public health costs in New York by reducing associated air pollutants". These statements are based on a naïve comparison of emissions before and after RGGI program implementation. The reality is different as shown below.

I used data from the Environmental Protection Agency Clean Air Markets Division air markets program website. Emissions data from the electric generating unit (EGU) sector are available from before RGGI started to the present, so I downloaded all the EGU data for the nine states currently in RGGI from 2006 until 2018. In order to establish a baseline, I calculated the average of three years before the program started. As shown in Table 1 the total emissions have decreased from a baseline of over 127 million tons

prior to the program to just under 75 million tons in 2018. This represents a 40% decrease for the RGGI region as a whole as compared to the New York 50% reduction.

However, it is important to evaluate why the emissions decreased. When you evaluate emissions by the primary fuel type burned it is obvious that emissions reductions from coal and oil generating are the primary reason why the emissions decreased. Note that both coal and oil emissions have dropped over 80% since the baseline. Natural gas increased but not nearly as much. The fuel switch from coal and oil to natural gas occurred because it was economic to do so. I have always maintained that RGGI had very little to do with these fuel switches because fuel costs are the biggest driver for operational costs and the cost adder of the RGGI carbon price was too small to drive the use of natural gas over coal and oil. The fuel cost and RGGI adder cost differences also mean that affected sources did not do efficiency projects to reduce fuel use to comply because means those projects are constantly considered by generating plants and implemented when cost-effective and allowed by regulations.

Table 1: RGGI Nine-State EPA CAMD Annual CO2 Emissions Data by Primary Fuel Type

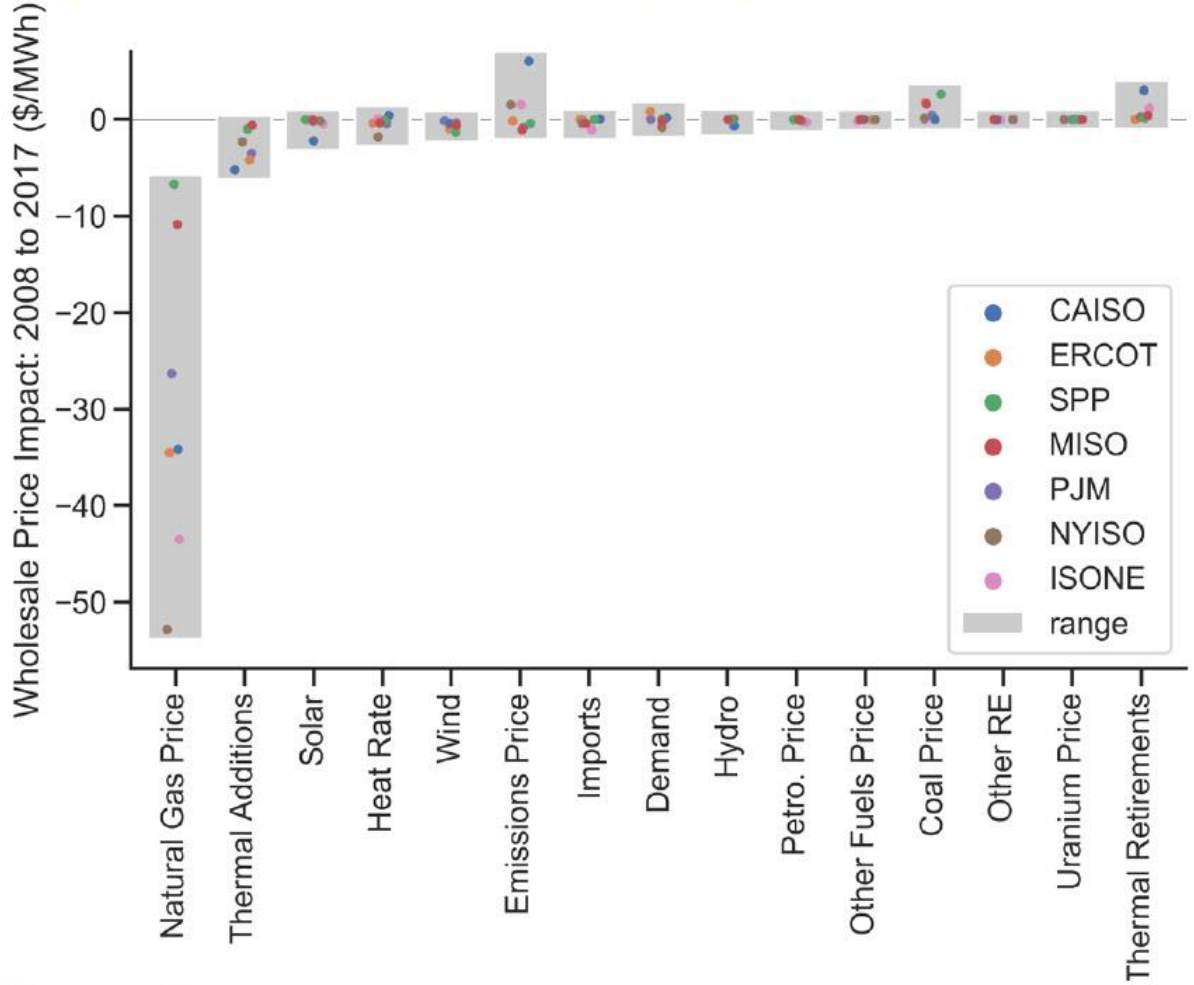
Year	Coal	Oil	Other Fuels	Natural Gas	Total
2006	74,482,225	14,216,973	2,429,844	37,048,932	128,177,974
2007	75,223,761	15,440,978	3,482,193	39,607,929	133,754,861
2008	67,977,062	10,472,201	3,509,366	37,452,817	119,411,446
Baseline	72,561,016	13,376,718	3,140,468	38,036,559	127,114,761
2009	57,324,247	7,419,112	2,998,324	40,602,093	108,343,776
2010	59,736,642	9,088,692	2,611,729	46,987,412	118,424,476
2011	43,871,136	5,755,660	3,256,356	51,801,174	104,684,325
2012	29,096,542	7,559,969	3,666,797	55,084,597	95,407,904
2013	31,759,050	5,441,067	2,770,525	48,973,865	88,944,508
2014	31,060,039	6,308,721	3,433,662	48,531,158	89,333,579
2015	23,279,018	6,271,650	3,615,647	52,983,907	86,150,223
2016	20,929,372	3,660,965	3,913,249	53,932,828	82,436,414
2017	13,522,351	1,568,617	3,415,221	49,092,154	67,598,342
2018	14,471,264	2,720,734	3,434,826	54,285,738	74,912,563

A recent report from the Department of Energy's Lawrence Berkeley National Laboratory, "The Impact of Wind, Solar, and Other Factors on Wholesale Power Prices: An Historical Analysis—2008 through 2017," confirms that emission prices have been a minor factor in wholesale electric price changes in the NYISO. The factors that affect wholesale electric prices determine the change in costs of production which in turn govern how much a particular unit operates. During the ten-year period of the study "falling natural gas prices were the dominant driver of overall market-wide average price drops, reducing average annual wholesale prices by $7–$53 per megawatt-hour (MWh) over the last decade". Note that in Figure ES-1 from that document that the $53 per MWh reduction was for the NYISO.

Figure ES-1 Impact of Wind, Solar, and Other Factors on Wholesale Power Prices, An Historical Analysis—2008 through 2017

An interactive version of data from the report is available online.

Figure ES-1. Average wholesale power energy price impact of various factors that changed between 2008 and 2017 across all ISO/RTO markets.



RE = renewable energy

As a result, the only reductions from RGGI that can be directly traced to the program are the reductions that result from direct investments of the RGGI auction proceeds. Information necessary to evaluate the performance of the RGGI investments is provided in the RGGI annual Investments of Proceeds update. In order to determine reduction efficiency, I had to sum the values in the previous reports because the most recent report only reported lifetime benefits. In order to account for future emission reductions against historical levels the annual reduction parameter must be used. Table 2 lists the sum of the annual avoided CO2 emissions generated by the RGGI investments from three previous reports. The total of the annual reductions is 2,818,775 tons while the difference between the baseline of 2006 to 2008 compared to 2017 emissions is 59,508,436 tons. The RGGI investments are only directly responsible for less than 5% of the total observed reductions!

Expanded Applicability

The proposed revisions expand applicability under Part 242 to capture certain units that serve an electricity generator with a nameplate capacity equal to or greater than 15 megawatts (MW). This proposal is not documented well and provides no convincing argument for adoption. The Regulatory Impact Statement does not list the units expected to be included by this revision or estimate how much CO2 is emitted by these units. The only rationale provided is that "New York stakeholders raised concerns during the extensive outreach efforts that the cost of complying with RGGI might result in increased operation at units not subject to the regulatory provisions of Part 242, particularly at smaller units below the existing 25 megawatt (MW) applicability threshold".

In the absence of an official list I developed my own by manually reviewing generating units in the NYISO Gold Book 2020 Table III-2: Existing Generating Facilities. Table 3 lists the units that I think are affected by this regulation. There are 69 units at fourteen facilities. Total nameplate capacity is 1,380.6 MW and in 2019 these units produced 101.5 GWh of electrical energy for an overall capacity factor of 0.8%. Clearly these units are used for peaking purposes, that is to say, they provide power when it is needed the most in the system to maintain reliability when consumers need power the most.

Table 2: Accumulated Annual Regional Greenhouse Gas Initiative Benefits

Time Period	RGGI Investments ($)	Avoided CO2 (Short tons)	Electric Energy Savings (MWhr)	Energy Savings (mmBtu)
Cumulative (2008-2014)	$ 1,365,479,614.73	1,700,000	2,400,000	5,300,000
2015	$ 410,158,329.31	298,410	505,761	1,500,000
2016	$ 436,397,470.69	382,266	409,630	1,600,000
2017	$ 315,600,000.00	438,099	699,019	1,424,199
Annual Totals	$ 2,527,635,414.73	2,818,775	4,014,410	9,824,199

Cost Efficiency	($/ton)	($/MWhr)	($/mmBtu)
Cumulative (2008-2014)	$ 803.22	$ 568.95	$ 257.64
2015	$ 1,374.48	$ 810.97	$ 273.44
2016	$ 1,141.61	$ 1,065.35	$ 272.75
2017	$ 720.39	$ 451.49	$ 221.60
Annual Total	$ 896.71	$ 629.64	$ 257.29

Time Period	Source
Cumulative (2008-2014)	https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2014.pdf
2015	https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2015.pdf
2016	https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2016.pdf
2017	https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2017.pdf

Table 3: Units Newly Affected by Proposed Revisions to Part 242

Station	Unit	In-Service Date	Name Plate Rating (MW)	Dual Fuel	Unit Type	Fuels		2019 Net Energy (GWh)	2019 Capacity Factor
						1	2		
74 St	GT-1	10/1/1968	18.5		GT	KER		0.1	0.1%
74 St	GT-2	10/1/1968	18.5		GT	KER		0.2	0.1%
Arthur Kill	GT-1	6/1/1970	20		GT	NG		0.4	0.2%
Astoria	GT01	7/1/1967	16		GT	NG		0.6	0.4%
Barrett	3	6/1/1970	18	YES	GT	NG	FO2	2.8	1.8%
Barrett	4	7/1/1970	18	YES	GT	NG	FO2	4.7	3.0%
Barrett	5	7/1/1970	18	YES	GT	NG	FO2	2.6	1.6%
Barrett	6	7/1/1970	18	YES	GT	NG	FO2	2.5	1.6%
Barrett	8	7/1/1970	18	YES	GT	NG	FO2	1.9	1.2%
Barrett	GT-1	6/1/1970	18	YES	GT	NG	FO2	3.9	2.5%
Barrett	GT-2	6/1/1970	18	YES	GT	NG	FO2	2.5	1.6%
Freeport	2-3	5/1/1973	18.1		GT	KER		0.2	0.1%
Glenwood	GT-1	4/1/1967	16		GT	FO2		0.1	0.1%
Gowanus	1-1	6/1/1971	20		GT	FO2		0.1	0.1%
Gowanus	1-2	6/1/1971	20		GT	FO2		0.1	0.1%
Gowanus	1-3	6/1/1971	20		GT	FO2		0.1	0.1%
Gowanus	1-4	6/1/1971	20		GT	FO2		0.1	0.1%
Gowanus	1-5	6/1/1971	20		GT	FO2		0.1	0.1%
Gowanus	1-6	6/1/1971	20		GT	FO2		0	0.0%
Gowanus	1-7	6/1/1971	20		GT	FO2		0	0.0%
Gowanus	1-8	6/1/1971	20		GT	FO2		0.1	0.1%
Gowanus	2-1	6/1/1971	20	YES	GT	FO2	NG	0.6	0.3%
Gowanus	2-2	6/1/1971	20	YES	GT	FO2	NG	0.5	0.3%
Gowanus	2-3	6/1/1971	20	YES	GT	FO2	NG	0.2	0.1%
Gowanus	2-4	6/1/1971	20	YES	GT	FO2	NG	0.5	0.3%
Gowanus	2-5	6/1/1971	20	YES	GT	FO2	NG	0.5	0.3%
Gowanus	2-6	6/1/1971	20	YES	GT	FO2	NG	0.5	0.3%
Gowanus	2-7	6/1/1971	20	YES	GT	FO2	NG	0.4	0.2%
Gowanus	2-8	6/1/1971	20	YES	GT	FO2	NG	0.2	0.1%
Gowanus	3-1	7/1/1971	20	YES	GT	FO2	NG	0.5	0.3%
Gowanus	3-2	7/1/1971	20	YES	GT	FO2	NG	0.4	0.2%
Gowanus	3-3	7/1/1971	20	YES	GT	FO2	NG	0.3	0.2%
Gowanus	3-4	7/1/1971	20	YES	GT	FO2	NG	0.2	0.1%
Gowanus	3-5	7/1/1971	20	YES	GT	FO2	NG	0.5	0.3%

Table 1: Units Newly Affected by Proposed Revisions to Part 242, continued

Station	Unit	In-Service Date	Name Plate Rating (MW)	Dual Fuel	Unit Type	Fuels		2019 Net Energy (GWh)	2019 Capacity Factor
						1	2		
Gowanus	3-6	7/1/1971	20	YES	GT	FO2	NG	0.2	0.1%
Gowanus	3-7	7/1/1971	20	YES	GT	FO2	NG	0.4	0.2%
Gowanus	3-8	7/1/1971	20	YES	GT	FO2	NG	0.4	0.2%
Gowanus	4-1	7/1/1971	20		GT	FO2		0.1	0.1%
Gowanus	4-2	7/1/1971	20		GT	FO2		0.1	0.1%
Gowanus	4-3	7/1/1971	20		GT	FO2		0	0.0%
Gowanus	4-4	7/1/1971	20		GT	FO2		0.1	0.1%
Gowanus	4-5	7/1/1971	20		GT	FO2		0.1	0.1%
Gowanus	4-6	7/1/1971	20		GT	FO2		0.1	0.1%
Gowanus	4-7	7/1/1971	20		GT	FO2		0.1	0.1%
Gowanus	4-8	7/1/1971	20		GT	FO2		0.1	0.1%
Hudson Ave	3	7/1/1970	16.3		GT	KER		0.1	0.1%
Hudson Ave	5	7/1/1970	16.3		GT	KER		0.6	0.4%
Jamestown	5	8/1/1951	28.7		ST	NG		7.5	3.0%
Jamestown	6	8/1/1968	25		ST	NG		25.4	11.6%
Narrows	1-1	5/1/1972	22	YES	GT	FO2	NG	2.3	1.2%
Narrows	1-2	5/1/1972	22	YES	GT	FO2	NG	1.5	0.8%
Narrows	1-3	5/1/1972	22	YES	GT	FO2	NG	3.4	1.8%
Narrows	1-4	5/1/1972	22	YES	GT	FO2	NG	2	1.0%
Narrows	1-5	5/1/1972	22	YES	GT	FO2	NG	3.1	1.6%
Narrows	1-6	5/1/1972	22	YES	GT	FO2	NG	2.2	1.1%
Narrows	1-7	5/1/1972	22	YES	GT	FO2	NG	2.3	1.2%
Narrows	1-8	5/1/1972	22	YES	GT	FO2	NG	1.6	0.8%
Narrows	2-1	6/1/1972	22	YES	GT	FO2	NG	2.6	1.3%
Narrows	2-2	6/1/1972	22	YES	GT	FO2	NG	1.5	0.8%
Narrows	2-3	6/1/1972	22	YES	GT	FO2	NG	3.1	1.6%
Narrows	2-4	6/1/1972	22	YES	GT	FO2	NG	3	1.6%
Narrows	2-5	6/1/1972	22	YES	GT	FO2	NG	1.6	0.8%
Narrows	2-6	6/1/1972	22	YES	GT	FO2	NG	1.3	0.7%
Narrows	2-7	6/1/1972	22	YES	GT	FO2	NG	3.6	1.9%
Narrows	2-8	6/1/1972	22	YES	GT	FO2	NG	2.1	1.1%
Northport	GT	3/1/1967	16		GT	FO2		0	0.0%
Port Jefferson	GT-1	12/1/1966	16		GT	FO2		0.1	0.1%
Ravenswood	1	7/1/1967	18.6		GT	NG		0.2	0.1%
Shoreham	2	4/1/1984	18.6		JE	FO2		0.3	0.2%

Part 242 is entitled the CO2 Budget Trading Program. As such I would expect that proposing to revise the applicability provisions of the rule would include an estimate of the CO2 emissions budget. Regrettably this was not the case. In order to determine if these facilities have any meaningful contribution to CO2 emissions in New York I did my own calculation (Table 4). I primarily relied on emissions data from the Energy Information Administration (EIA) available at https://www.eia.gov/electricity/data/emissions/ (Note that these data are only available through 2018) I also used Environmental Protection Agency (EPA) data at the Clean Air Markets Division at where the labeling of which units were in or out was confusing. In some instances, there were facilities where both EIA and EPA data were available and the difference represented the newly affected units. Finally, for the Ravenswood unit I simply pro-rated CO2 emissions by the Gold Book annual net generation because I could not extract appropriate data from EIA or EPA. For the five-year period 2014 to 2018 the highest annual total CO2 was 163,042 tons compared to the total from the state of 31,603,542 tons or only 0.5%. The fact that year-to-year variability is much larger than the emissions from these units means that the reductions from the addition of units between 15 MW and 25 MW are symbolic rather than meaningful.

Table 4: Estimated CO2 Emissions (tons) from Newly Affected Part 242 Sources

Plant Name	2014	2015	2016	2017	2018
Gowanus Gas Turbines Generating	5,789	13,168	15,329	5,217	15,489
Gowanus Gas Turbines Generating	6,808	3,522	2,314	3,038	4,030
Hudson Avenue	1,703	404	1,028	3,094	1,186
Narrows Gas Turbines Generating	18,792	61,513	79,055	24,518	67,790
Narrows Gas Turbines Generating	8,964	1,213	518	130	4,488
74th Street	770	638	580	536	374
Arthur Kill Generating Station	299	844	491	481	1,070
Northport	245	230	351	26,689	315
Astoria Generating Station	692	668	909	720	1,079
E F Barrett	19,198	32,752	41,289	24,814	37,944
Glenwood	135	608	241	192	143
Port Jefferson	155	153	430	105	151
Shoreham aka Wading River	423	512	1,659	370	864
Ravenswood	123	246	368	491	246
Plant No 2 Freeport	904	830	542	787	1,003
S A Carlson	18,456	17,636	17,937	17,604	7,825
Total	83,454	134,936	163,042	108,786	143,997
Total NYS CO2 Emissions	34,775,470	33,406,652	31,603,542	25,410,872	28,167,409
Newly Affected % of Total	0.2%	0.4%	0.5%	0.4%	0.5%

The only rationale provided to add these minor sources and their negligible emissions is that “New York stakeholders raised concerns during the extensive outreach efforts that the cost of complying with RGGI might result in increased operation at units not subject to the regulatory provisions of Part 242,

particularly at smaller units below the existing 25 megawatt (MW) applicability threshold". There are no quantified estimates of this change just a "feeling" that it might happen. In fact, the RIS Model Rule Policy Case Program Design Assumption description suggests that these units will run less because in the Reference Case New York is a net importer of 2,709 GWh in 2031 but New York imports more in the Model Rule Policy Case due to lower in-state generation **from gas units backing off",** my emphasis added in bold.

The previously mentions report, "The Impact of Wind, Solar, and Other Factors on Wholesale Power Prices: An Historical Analysis—2008 through 2017," finds that emission prices have been a minor factor in wholesale electric price changes. The factors that affect wholesale electric prices determine the change in costs of production which in turn govern how much a particular unit operates. During the ten-year period of the study "falling natural gas prices were the dominant driver of overall market-wide average price drops, reducing average annual wholesale prices by $7–$53 per megawatt-hour (MWh) over the last decade". Because the total compliance cost of RGGI has not been a significant factor affecting wholesale electric prices any incremental change in costs, it is not very likely that the cost of RGGI compliance will affect operations at the units affected by the proposed change in the applicability threshold.

Binding Cap

The RIS mentions a binding cap with respect to two aspects of the proposed rule. During the last program review the RGGI states decided to set the regional emissions cap in 2021 to 75,147,784 tons and then reduce it by 2.275 million tons per year thereafter, resulting in a total 30 percent reduction in the regional cap from 2020 to 2030. In addition, the RGGI states included a budget adjustment for banked allowances if the allowance bank exceeded the total quantity of 2018, 2019, and 2020 emissions at the end of the fourth control period. The RIS claims this will "help create a binding cap".

My interpretation of a cap and trade "binding cap" is that it requires emission reductions from affected sources as a result of the control program itself and not because of other factors. During the program review process, environmental stakeholders insisted that a "binding cap" was necessary despite significant reductions. In this instance I think there are considerations that make that a poor choice.

There is an important difference between cap and trade programs for SO2 and nitrogen oxides (NOx) emissions and cap and invest programs for GHG emissions. In particular, there are add-on control options for SO2 and NOx whereas there isn't any cost-effective option for CO2. As a result, affected sources could directly control their SO2 and NOx compliance and, more importantly, the cap limit can be set based on technologically available control performance. In RGGI and other GHG emissions programs, there are limited direct options for the affected sources and, going forward especially, compliance is going to have to rely on indirect reductions, i.e., someone will have to build a zero-emitting plant that displaces enough output from a fossil plant so that enough allowances are available to cover the affected source requirements. As a result, the ultimate control strategy for an emissions marketing CO2 control program is to run less and hope power is available from somebody else. The timing and magnitude of those reductions are not certain.

The RGGI Model Rule reduces the cap 2.275 million tons per year after 2021. Given the results to date, I believe that reduction rate is problematic because the primary source of observed reductions, fuel switching, is just about tapped out for "nine-state" RGGI. Adding New Jersey and Virginia to RGGI may add sources that can be converted to lower CO2 emission rates economically which would provide a source for more fuel switching reductions. At some point though, there will be no more cost-effective CO2 reduction opportunities at affected sources so future emission reductions can only occur by displacing more economic generation. That transition will rely on RGGI investments but, based on results to date, the cost per ton of reductions exceed the Social Cost of Carbon. If the abatement costs exceed the purported damages, then the value of the program is not cost-efficient. Therefore, despite the superficial appeal of a binding cap, it is prudent to not push this concept too hard.

The RGGI Model Rule also includes a budget adjustment for banked allowances if the allowance bank exceeded the total quantity of 2018, 2019, and 2020 emissions at the end of the fourth control period. The clear intent of that adjustment was that there should be a limit (fourth control period emissions) on the size of the allowance bank going forward in 2021 and it defies the imagination that anyone would construe that to mean that the comparison should occur before the surrender of the allowances necessary to reconcile fourth control period emissions. However, in the RGGI Compliance: CO_2 Budget Source Fact Sheet ("Fact Sheet") dated April 20, 2020 the "dates to remember" section states that the final true-up of allowance surrender for fourth control period emissions will occur on April 2, 2021. Using that schedule, the comparison of fourth control period emissions and the allowance bank occurs before reconciliation thus ensuring the third allowance bank adjustment.

The Fact Sheet provides the following timeline:

- January 30, 2021: Deadline to submit Q4-2020 CO_2 emissions data to the U.S. EPA
- March 1, 2021 (by 11:59 PM ET): Deadline to provide CO_2 allowances and to certify compliance for fourth control period compliance
- March 2, 2021:
    - CO_2 allowances (fourth control period allocation year and prior) in compliance accounts are frozen in COATS
    - Compliance data submitted by sources publicly available
- March 2, 2021 – April 1, 2021: States evaluate compliance for each CO_2 budget source
- April 2, 2021 (final true-up):
    - CO_2 allowances are automatically deducted from compliance accounts (not including any CO_2 allowances which have already been surrendered)
    - State compliance evaluations publicly available
    - Following final compliance true-up, CO_2 allowances in compliance accounts are unfrozen (if no allowance shortfall exists after compliance deductions are complete

The rationale for the timeline necessary to compare the fourth control period emissions to the allowance bank on April 2, 2021 ignores reality. According to the Fact Sheet the states need 31 days to

ensure compliance for each CO_2 budget source. The compliance test compares the certified number of allowances submitted by each affected source against the certified number of tons emitted for each CO_2 budget source. Given that the Potomac Economics Report on the Secondary Market for RGGI CO_2 Allowances for Q1 2020 released on March 13, 2020 included the allowances that were deducted for 2019 interim compliance based on the March 1, 2020 compliance certification submittals there is every reason to expect that there is a report that lists the emissions and allowances so that this comparison is a trivial effort. The Fact Sheet also notes that upon final true-up the CO_2 allowances are automatically deducted suggesting that the final step is no more than pushing a button.

There is another aspect of the "binding cap" that regulators, activists, and academics have so far ignored. In most market-based programs the allowance bank consists of allowance that the affected sources have earned by implementing control strategies that reduced their emissions below their capped emission rate. Those earned surplus allowances are then sold to other affected sources or investors. In RGGI the allowance bank consists of allowances that were, for the most part, purchased either in an auction or from the secondary market. Investors and other non-compliance entities could purchase allowances in the auctions that were not deemed surplus or earned by affected sources. In theory, if enough investors purchased enough allowances then they could exert market power and drive costs up if affected sources had to rely on purchasing allowances from the non-compliance entities for compliance purposes. RGGI has hired a market monitor, Potomac Economics, to prevent that from happening.

According to the RGGI website:

> Potomac Economics provides independent expert monitoring of the competitive performance and efficiency of the RGGI Allowance Market. This includes:
>
> - Evaluating the conduct of market participants in the RGGI auctions and secondary markets to identify potential anti-competitive conduct or significant barriers to market participation, including but not limited to the potential for market manipulation, collusion, and the exercise of market power;
> - Evaluating auction clearing prices, the quantity and value of allowances in the secondary market and the marginal cost of emission reductions in the long-term to determine whether the auction market is performing efficiently;
> - Assessing whether the auctions are administered in accordance with the noticed auction rules and procedures.
>
> Potomac Economics monitors the RGGI Allowance market in order to protect and foster competition, as well as to increase the confidence of participants and the public in the allowance market and the RGGI auctions.

Potomac Economics prepares annual reports, analysis of each quarterly auction, and a quarterly secondary market evaluation. Their description of firms participating in the RGGI market states:

- *Compliance-oriented entities* are compliance entities that appear to acquire and hold allowances primarily to satisfy their compliance obligations.

- *Investors with Compliance Obligations* are firms that have compliance obligations, but which hold a number of allowances that exceeds their estimated compliance obligations by a margin suggesting they also buy for re-sale or some other investment purpose. These firms often transfer significant quantities of allowances to unaffiliated firms.
- *Investors without Compliance Obligations* are firms without any compliance obligations.

These three categories form the basis for two overlapping groups.

- Compliance Entities – All firms with compliance obligations, and their affiliates. Combines the first and second of the above categories.
- Investors – All firms which are assessed to be purchasing primarily for investment rather than compliance purposes. Combines the second and third of the above categories.

Potomac Economics determines whether a compliance entity holds a number of allowances that exceeds its compliance obligations by a margin that suggests they are also buying for re-sale or some other investment purpose based on the entity's forecasted share of the total compliance obligations for the entire RGGI footprint through 2026, the total number of allowances in circulation, and consideration of the pattern of the entity's allowance transfers to unaffiliated firms versus affiliated firms. Because the input to those evaluations changes, the designation of a particular firm may change over time as more information becomes available.

The number of allowances that are believed to be held for compliance purposes includes 100 percent of the allowances held by compliance-oriented entities and a portion of allowances held by other compliance entities (i.e., entities with compliance obligations that are not included in the compliance-oriented category).

The point that has been ignored thus far is that although the non-compliance entities have not exerted control to date, the possibility exists they will as the allowance bank shrinks. The primary value of RGGI to the public is that the money invested from the auction proceeds has saved New York ratepayers $293 million. The money invested to provide those savings came from allowance sales. When compliance entities have to purchase allowances from the non-compliance entities prices will likely go up and inevitably ratepayers will have to pay more for power. There is no value to ratepayers for the cost differential between the price paid at auction by the non-compliance entities and the price paid by affected sources who need allowances for compliance.

In order to show that non-compliance entity "control" of the market is inevitable it is necessary to delve into the auction monitoring reports and the quarterly secondary market reports.

The Market Monitor Report for Auction 47 notes that:

> In Auction 47, Compliance Entities purchased 69 percent of the allowances sold. In the first 47 RGGI auctions, Compliance Entities purchased 74 percent of the allowances sold. In Auction 47, Compliance-Oriented Entities purchased 55 percent of the allowances sold.

After settlement of allowances sold in Auction 47:

- Forty-seven percent of the allowances in circulation will be held by Compliance-Oriented Entities.
- Fifty-three percent of the allowances in circulation are believed to be held for compliance purposes. The number of allowances that are believed to be held for compliance purposes includes 100 percent of the allowances held by Compliance-Oriented Entities and a portion of allowances held by Investors with Compliance Obligations.

The Market Monitor Report for Auction 48 notes that:

In Auction 48, Compliance Entities purchased 62 percent of the allowances sold. In the first 47 RGGI auctions, Compliance Entities purchased 74 percent of the allowances sold. In Auction 48, Compliance-Oriented Entities purchased 31 percent of the allowances sold.

After settlement of allowances sold in Auction 48:

- Forty-seven percent of the allowances in circulation will be held by Compliance-Oriented Entities.
- Fifty-three percent of the allowances in circulation are believed to be held for compliance purposes. The number of allowances that are believed to be held for compliance purposes includes 100 percent of the allowances held by Compliance-Oriented Entities and a portion of allowances held by Investors with Compliance Obligations.

There is a lag between the auction market reports and the secondary market monitoring reports so the most recent Report on the Secondary Market for RGGI CO_2 Allowances is for the first quarter of 2020. That report provides the number of allowances available:

At the end of the first quarter of 2020:

- There were 178 million CO2 allowances in circulation.
- Compliance-oriented entities held approximately 86 million of the allowances in circulation (48 percent).
- Approximately 99 million of the allowances in circulation (56 percent) are believed to be held for compliance purposes.

To sum up. At the end of the first quarter of 2020 there were 178 million allowances in circulation. Adding a conservative estimate for 2020 emissions of 40 million tons to the 2019 and 2018 total emissions of 136 million tons the fourth control period total would be 176 million tons. In 2019 and 2018 affected sources surrendered 66 million allowances so that means in the first quarter of 2021 the remaining compliance obligation has to be surrendered for the rest of 2018 and 2019 emissions as well as all of 2020 emissions so 110 million allowances will be needed for reconciliation. There are 99 million allowances currently held for compliance purposes and if compliance entities purchase all the remaining

2020 auction allowances (49 million) the compliance entities will own 148 million allowances and can cover the 110 million ton allowance obligation by surrendering allowances leaving them with 38 million allownces. After reconciliation of fourth control period emissions the allowance bank will total 117 million tons and 79 million tons of that will be owned by non-compliance entities. As a result, their share of the allowance bank will change from the current 44% to 68%. As the compliance entities surrender allowance for their compliance obligations their relative share of the allowance bank will shrink and, at some point the entities without compliance obligations will be able to demand windfall profits from their investments.

The lack of detailed publicly available data creates significant uncertainty about ownership of allowances and motives in the Potomac Economics classifications. "A portion of allowances held by Investors with Compliance Obligations" is believed to be held for compliance purposes. The secondary monitoring report notes that they evaluate if compliance entity holds a number of allowances that exceeds its compliance obligations by a margin that suggests they are also buying for re-sale or some other investment purpose partially based on the entity's forecasted share of the total compliance obligations for the entire RGGI footprint through 2026. It would be extremely beneficial if Potomac Monitoring would disclose their criteria for making these determinations. If a company with facilities throughout the region has a marketing department responsible for purchasing allowances then, based on my personal experience, the buffer necessary to assure compliance was always controversial and I am not comfortable that Potomac Economics is aware of the concerns of people responsible for compliance. That affects how many allowances are in which category.

Note that after settlement of allowances sold in Auction 47 that 47% of the allowances in circulation were held by Compliance-Oriented Entities and 53% are believed to be held for compliance purposes but that at the end of 2019 Compliance-oriented entities held 54% of the allowances in circulation and 57% were held for compliance purposes. It could be because in Auction 47 non-compliance entities purchased a lot of the available allowances but because Potomac Economics changes its classification of companies "as more information becomes available" it could simply be a re-classification of entities.

In conclusion, the rationale for a "binding cap" does not consider all aspects of such a market. The allowance ownership aspect of RGGI is unique and so far, as not played a role in the market. However, it appears that the market will be tested in this regard in the near future. The potential for future reductions from the primary mechanism for observed reductions is close to being exhausted. Therefore, it would be prudent to see how the market reacts to those factors before pushing for a binding cap by manipulating the timing of the fourth control period settlement to ensure a third allowance bank adjustment.

Recommendations on the Proposed Revisions to Part 242

This section lists the text from Express Terms Proposed Part 242 with my comments indented and italicized.

(75) 'Third adjustment for banked allowances'. An adjustment applied to the New York State CO_2 Budget Trading Program base budget for allocation years 2021 through 2025 to address allowances held in general and compliance accounts, including compliance accounts established pursuant to the CO_2 Budget Trading Program, but not including accounts opened by participating states, that are in addition to the aggregate quantity of emissions from all CO_2 budget sources in all of the participating states at the end of the fourth control period in 2020 and as reflected in the CO_2 Allowance Tracking System on March 17, 2021.

The RGGI model rule states that the third adjustment for banked allowances is determined on March 15, 2021 not March 17. That inconsistency should be resolved. As noted previously, the clear intent was that there should be a limit (fourth control period emissions) on the size of the allowance bank going forward in 2021. All the information necessary to base the third adjustment for banked allowances will be certified by the affected sources on March 15, 2021 and available to the RGGI states. In order to manipulate the system so that there will be a third adjustment RGGI conjured up a schedule, in the RGGI Compliance: CO_2 Budget Source Fact Sheet ("Fact Sheet") dated April 20, 2020, that states that the final true-up of allowance surrender for fourth control period emissions will occur on April 2, 2021. As noted in the binding cap discussion there are previously untested aspects of the market that make it prudent to see how the market reacts to those factors before pushing for a binding cap by manipulating the timing of the fourth control period settlement to ensure a third allowance bank adjustment.

(2) Any unit that, at any time on or after January 1, 2021, serves an electricity generator with a nameplate capacity equal to or greater than 15 MWe shall be a CO_2 budget unit if either: (i) that unit resides at a CO_2 budget source; or (ii) that unit resides at a source where there are two or more units with a nameplate capacity equal to or greater than 15 MWe. Any source that includes one or more such units shall be a CO_2 budget source, subject to the requirements of this Part.

I recommend deleting this proposed change. The rationale used in the Regulatory Impact Statement does not provide a convincing argument for adoption and these sources are a trivial source of CO2. The only rationale provided is that "New York stakeholders raised concerns during the extensive outreach efforts that the cost of complying with RGGI might result in increased operation at units not subject to the regulatory provisions of Part 242, particularly at smaller units below the existing 25 megawatt (MW) applicability threshold". However, the RIS Model Rule Policy Case Program Design Assumption description suggests that these units will run less because in the Reference Case New York is a net importer of 2,709 GWh in 2031 but New York imports more in the Model Rule Policy Case due to lower in-state generation from gas units backing off". I also showed above that because the total compliance cost of RGGI has not been a significant factor affecting wholesale electric prices, it is not very likely that the cost of RGGI compliance will affect operations at the units affected by the proposed change in the applicability threshold. The addition of these sources is not meaningful because in five years of historic data the CO2 emissions in the maximum year was only 160,000 tons from all the sources. Finally, most of these units are subject to other regulations that will force retirement soon.

Regulatory Impact Statement

In this section I reproduce portions of the Regulatory Impact Statement (RIS) text with my indented comments. I wish I could say that the RIS makes a compelling case for the proposed action but I can't. This is important because one of the purported benefits of New York's climate leadership is that New York will lead the way for others setting an example that they will emulate. However, absent compelling arguments, that benefit will not be realized.

Introduction

The burning of fossil fuels to generate electricity is a major contributor to climate change because fossil-fuel generators emit large amounts of CO_2, the principal greenhouse gas (GHG). Overwhelming scientific evidence confirms that a warming climate poses a serious threat to the environmental resources and public health of New York State - the very same resources and public health the Legislature has charged the Department to preserve and protect. The warming climate threatens the health and well-being of the State's residents and citizens, the State's property, and the natural resources held in trust by the State, including, but not limited to, the State's air quality, water quality, marine and freshwater fisheries, salt and freshwater wetlands, surface and subsurface drinking water supplies, river and stream impoundment infrastructure, and forest species and wildlife habitats. Not only will the proposed Program revisions help to further counter the threat of a warming climate, they will also produce significant environmental co-benefits in the form of improved local air quality, and a more robust, diverse and clean energy supply in the State.

> The biggest flaw in the RIS is the failure to quantify the impact of the proposed action on the alleged impacts of a warming climate. Instead there are vague allusions that the proposed revisions will "help to further counter the threat of a warming climate". In order to properly evaluate the benefits and costs of the proposed revisions the RIS should estimate the global warming potential impacts of the proposed action.
>
> In the absence of such an evaluation I calculated the effect of total elimination of New York's 1990 218.1[1] million metric ton greenhouse gas emissions on projected global temperature rise. I found there would be a reduction, or a "savings," of approximately 0.0032°C by the year 2050 and 0.0067°C by the year 2100. To give you an idea of how small this temperature change is consider changes with elevation and latitude. Generally, temperature decreases three (3) degrees Fahrenheit for every 1,000 foot increase in elevation above sea level. The projected temperature difference is the same as going down 27 inches. The general rule is that temperature changes three (3) degrees Fahrenheit for every 300 mile change in latitude at an elevation of sea level. The projected temperature change is the same as going south two thirds of a mile.
>
> Of course, the RIS should project what this particular action will do for global temperature. The RIS Model Rule Policy Case Program Design Assumption description states that CO_2 emissions in

[1] This was the total for 2015 NYS emissions in NYSERDA Greenhouse Gas Inventory 1990-2015. Subsequent editions have lowered the most recent total so this is a conservative value for impacts.

New York are projected to be 3.41 million tons lower in the Model Rule Policy Case than in the Reference Case in 2031. Using the same methodology as before I found there would be a reduction, or a "savings," of approximately 0.00005°C by the year 2050 and 0.00009°C by the year 2100. The projected temperature difference is the same as going down 3/8 of an inch and the projected temperature change is the same as going south 50 feet.

New York's actions also have to be considered relative to the rest of the world. According to the China Electricity Council, about 29.9 gigawatts of new coal power capacity was added in 2019 and a further 46 GW of coal-fired power plants are under construction. If you assume that the new coal plants are super-critical units with an efficiency of 44% and have a capacity factor of 80%, the reductions provided by this program will be replaced by the added 2019 Chinese capacity in 16 days or 6 days if the 2019 capacity and the units under construction are combined. Clearly, in the absence of worldwide commitments this proposal has no tangible value to the citizens of New York.

The RIS also claims that the emission reductions will also produce significant environmental co-benefits in the form of improved local air quality, and a more robust, diverse and clean energy supply in the State. I take issue with the environmental co-benefits arguments simply because I have never seen documentation that confirms those benefits relative to the observed air quality improvements in my lifetime (see for example my evaluation of PM 2.5 in New York City). Combining claimed benefits for robust and diverse energy supply with a clean energy supply is unsubstantiated rhetoric. In order for the power supply to be robust it has to be dispatchable whereas wind and solar clean energy is not. In order for the power supply to be diverse it cannot be shut down by a singular event and wind and solar can be shut down by a relatively common singular set of weather conditions at night.

The Greenhouse Effect and the Warming Climate

A naturally occurring greenhouse effect has regulated the earth's climate system for millions of years. Solar radiation that reaches the surface of the earth is radiated back out into the atmosphere as long wave or infrared radiation. CO_2 and other naturally occurring GHG emissions trap heat in our atmosphere, maintaining the average temperature of the planet approximately 60°F above what it would be otherwise. An enhanced greenhouse effect and associated climate change results as large quantities of anthropogenic GHGs, especially CO_2 from the burning of fossil fuels, are added to the atmosphere.

There is no question that the greenhouse effect regulates global temperatures, that additional greenhouse gases will enhance that effect, that anthropogenic GHG emissions have added to the observed trend in GHG atmospheric concentrations, that the climate is warming and that the anthropogenic GHG emissions likely contributed to the observed warming. However, given that there are many factors affecting climate change and that an enhanced greenhouse effect impacts not only temperature but also moisture which could have a negative feedback, it is naïve to assume that all the observed warming is caused solely by the greenhouse gas effect.

From 1983 until his retirement in 2013, Dr. Richard Lindzen was Alfred P. Sloan Professor of Meteorology at the Massachusetts Institute of Technology. He published over 200 papers and books and his research is still cited about 600 times per year. He recently published another scientific paper (Lindzen, 2020) that raises some important points relative to the greenhouse effect as it pertains to New York's energy policies:

- Doubling the atmospheric CO2 concentration from 280 ppm to 560 ppm results in just a 1-2% perturbation to the Earth's 240 W/m² energy budget. This doubled-CO2 effect has less than 1/5th of the impact that the net cloud effect has. And yet we are asked to accept the "implausible" claim that change in one variable, CO2, is predominantly responsible for altering global temperatures.

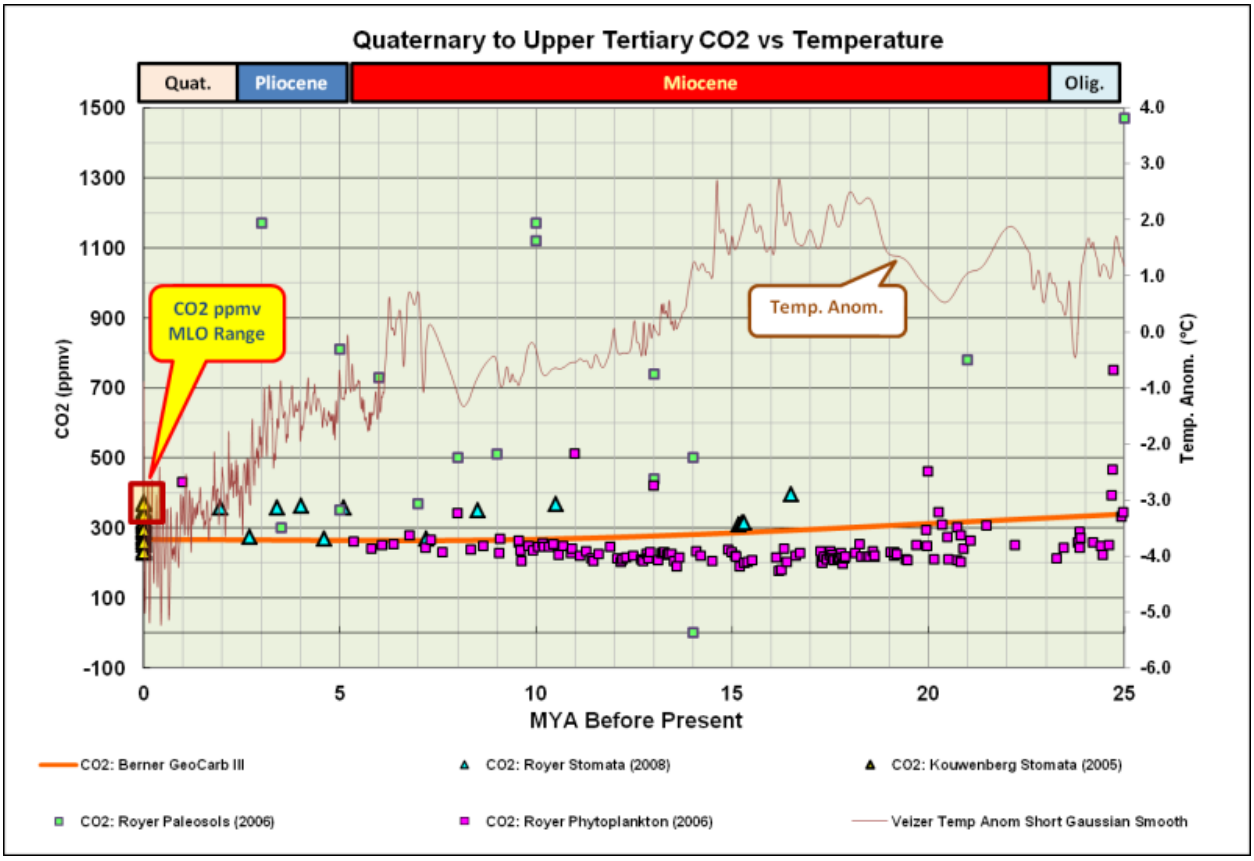
- A causal role for CO2 "cannot be claimed" for the glacial-to-interglacial warming events because CO2 variations follow rather than lead the temperature changes in paleoclimate records and the 100 ppm total increase over thousands of years produce "about 1 W/m²" of total radiative impact.

Since the mid-1700's, atmospheric concentrations of GHGs have increased substantially due to human activities such as fossil fuel use and land-use change. CO_2 has a very long residence time in the atmosphere and, thus, has a lasting effect on the climate. Average atmospheric CO_2 concentrations exceeded 407 parts per million in 2018, which according to ice core data, is higher than at any point in the past 800,000 years and the rate of increase is 100 times faster than previous natural increases at the end of the last ice age.

There are two aspects of these claims. If you look at the CO2 data going further back in geologic time, as shown in the following grapch, there is nothing particularly unusual about the record breaking CO2 levels of the past 800,000 years The thing that does stand out however is that we are cooler than in the past.

The second aspect is the rate of increase claim. The problem is that measurement resolution of proxy measurements of CO2 and temperature are not as finely resolved as today's instrumental data. The only way to directly compare the instrumental data to the pre-industrial proxy data is to filter the instrumental data down to the resolution of the proxy data. This leads to climate reconstructions with "enhanced variability during pre-industrial times" and "result in a redistribution of weight towards the role of natural factors in forcing temperature changes, thereby relatively devaluing the impact of anthropogenic emissions and affecting future predicted scenarios."[2]

[2] Esper, J., R.J.S. Wilson, D.C. Frank, A. Moberg, H. Wanner, & J. Luterbacher. 2005. "Climate: past ranges and future changes". *Quaternary Science Reviews* **24**: 2164-2166.



There is clear scientific consensus that anthropogenic emissions of CO_2 are contributing to the observed warming of the planet as presented in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.[8] The large and persuasive body of research demonstrates through unequivocal evidence that the Earth's lower atmosphere, oceans, and land surfaces are warming; sea level is rising; and snow cover, mountain glaciers, and Greenland and Antarctic ice sheets are shrinking. The Earth's climate is changing, with adverse consequences already well documented across the globe, in our nation and in the State. Extreme heat events are increasing and intense storms are occurring with greater frequency. Many of the observed climate changes are beyond what can be explained by natural variability of the climate.[9,10]

This description of the relationship between CO2 emissions and observed warming does not acknowledge that there is any scientific uncertainty about the greenhouse effect and climate change. The reality is that there is debate and New York State ignores the potential ramifications. Dr. Richard S. Lindzen, has summarized the scientific debate as follows:

> I will simply try to clarify what the debate over climate change is really about. It most certainly is not about whether climate is changing: it always is. It is not about whether CO2 is increasing: it clearly is. It is not about whether the increase in CO2, by itself, will lead to some warming: it should. The debate is simply over the matter of how much warming the increase in CO2 can lead to, and the connection of such warming to the innumerable claimed catastrophes. The evidence is that the increase in CO2 will lead to very little warming, and that the connection of this minimal warming (or even significant

warming) to the purported catastrophes is also minimal. The arguments on which the catastrophic claims are made are extremely weak –and commonly acknowledged as such.

In response to scientific projections of likely severe climate impacts of global average temperatures rise, the U.S. signed the1992 United Nations Convention on Climate Change. In 2016 the United States once again joined 197 countries in ratifying the Paris Climate Agreement, an enhancement to help the implementation of that Convention.

The claim that the United States ratified the Paris Climate Agreement is incorrect. The United States never properly joined the accord. It is a treaty that requires the advice and consent of the Senate. Instead, President Barack Obama chose to "adopt" it with an executive order. The Senate never voted on the treaty.

Impacts from Emissions Already Observed in New York's Climate

New York's climate has already begun to change, gradually taking on the characteristics of the climate formerly found in locations south of New York. The need for the reduction of CO_2 emissions, including through the reduced emissions cap, budget adjustment, and establishment of the ECR, is clearly supported by numerous direct impacts that have been observed in New York State and presented in the 2011 New York State ClimAID assessment and the 2014 update to ClimAID.

The title of this section exposes a significant error in the understanding of the ClimAID assessments. In particular, those assessments described observed climate trends but did not attempt to attribute how much of the observed trends were linked to GHG emissions, how much were caused by other anthropogenic effects such as land-use changes and the urban heat-island effect, and how much was caused by natural variability. For example, the observed monthly data source for average temperature and precipitation was the United State Historical Climatology Network and page 21 of the 2011 ClimAID document states that "this data product is not specifically adjusted for urbanization". One of the sites used to describe climate trends was at New York City's Central Park. Clearly the urban heat-island has a significant effect on temperature at that location. Therefore, the RIS presumption that the only cause of all the observed trends was GHG emissions over-estimates their role in observed climate change trends.

These include:

- Temperature. Temperatures in New York State have risen during the twentieth century, with the greatest warming coming in recent decades - temperatures have risen on average 0.25°F per decade over the past century. This warming includes an increase in the number of extreme hot days (days at or above 90ºF) and a decrease in the number of cold days (days at or below 32ºF).

  Because the effect of the urban heat-island is not considered these trends do not represent the trend due solely to the greenhouse effect.
- Sea level rise. Sea level in the coastal waters of New York State and up the Hudson River has been steadily rising over the twentieth century, chiefly as a result of thermal expansion of ocean waters, melting of land ice and local changes in the height of land relative to the height of the continental

land mass. Tide-gauge observations in New York indicate that rates of relative sea level rise were significantly greater than the global mean, ranging from 0.9 to 1.5 inches per decade.

The fact that New York tidal gauge rates of relative sea level rise are greater than the global mean shows that local changes in the height of land relative to the height of the continental land mass are a significant factor of sea-level rise that no amount of change to the greenhouse effect will affect.

Although the RIS purports to provide current information, consider an alternative assessment of current climate state based on data and not model speculation. Ole Humlum a former Professor of Physical Geography at the University Centre in Svalbard, Norway, and Emeritus Professor of Physical Geography, University of Oslo, reported "The State of the Climate 2019," that presents ten key facts in the Executive summary:

"1. According to the [surface] *instrumental temperature record (since about 1850), 2019 was a very warm year, but cooler than 2016.*

2. In 2019, the average global air temperature was affected by a moderate El Niño episode, interrupting a gradual global air temperature decrease following the strong 2015–16 El Niño.

3. Since 1979, lower troposphere temperatures have increased over both land and oceans, but more so over land areas. The possible explanations include insolation, cloud cover and land use. {Caiazza note: if the greenhouse effect were the only cause of the temperature increase then there should be no difference over land vs over water.}

4. The temperature variations recorded in the lowermost troposphere are generally reflected at higher altitudes too. In the stratosphere, however, a temperature 'pause' commenced in around 1995, 5–7 years before a similar temperature 'pause' began in the lower troposphere near the planet's surface. The stratospheric temperature 'pause' has now persisted for about 25 years.

5. The 2015–16 oceanographic El Niño was among the strongest since the beginning of the record in 1950. Considering the entire record, however, recent variations between El Niño and La Niña are not unusual.

6. Since 2004, when detailed recording of ocean temperatures began, the global oceans above 1900 m depth have, on average, warmed somewhat. The strongest warming (between the surface and 200 m depth) mainly affects the oceans near the Equator, where the incoming solar radiation is at its maximum. In contrast, for the North Atlantic, net cooling at the surface has been pronounced since 2004.

7. Data from tide gauges all over the world suggest an average global sea-level rise of 1–1.5 mm/year, while the satellite record suggests a rise of about 3.2 mm/year, or more. The noticeable difference in rate (a ratio of at least 1:2) between the two data sets still has no broadly accepted explanation.

8. Since 1979, Arctic and Antarctic sea-ice extents have had opposite trends, decreasing and increasing, respectively. Superimposed on these overall trends, however, variations of shorter duration are also important in understanding year-to-year variations. In the Arctic, a 5.3-year periodic variation is important, while for the Antarctic a variation of

about 4.5-years' duration is seen. Both these variations reached their minima simultaneously in 2016, which explains the simultaneous minimum in global sea-ice extent. This particularly affected Antarctic sea-ice extent in 2016.
9. Northern Hemisphere snow cover extent undergoes important local and regional variations from year to year. Since 1972, however, snow extent has been largely stable.
10. Tropical storms and hurricanes have displayed large annual variations in accumulated cyclone energy (ACE) since 1970, but there has been no overall trend towards either lower or higher activity. The same applies for the number of continental hurricane landfalls in the USA, in a record going back to 1851."

Future Impacts from Emissions Predicted for New York's Climate

Predictions of future impacts associated with emissions in New York further support the need for a substantial reduction in the CO_2 emissions cap as well as the budget adjustment and ECR, as outlined in the proposed revisions to the Program. The 2011 New York State ClimAid assessment and 2014 update also examined how sea level rise, changes in precipitation patterns, and more frequent severe weather conditions will affect New York's economy, environment, community life and human health. ClimAID used regionalized climate projections to develop adaptation recommendations and is a climate change preparedness resource for planners, policymakers, and the public.

The future impacts assessment in the RIS relies on the 2011 New York State ClimAid assessment and 2014 update that examined how sea level rise, changes in precipitation patterns, and more frequent severe weather conditions will affect New York's economy, environment, community life and human health. There are three problems with those assessments: reliance on global climate model simulations, the use of Representative Concentration Pathway 8.5, and the use of a regional climate model.

Climate sensitivity

Predictions of substantial global warming assume that the climate is very sensitive to an increase in GHG concentrations. The RIS does not recognize that this is an active debate because of climate feedback in various models and that estimates in peer reviewed studies range from 0.8°C warming to almost 6.0°C warming by 2100. Clearly such a wide range of uncertainty means climate model temperature projections remain dubious, at best. In my opinion climate sensitivity estimates based on measured data are more likely to be correct than GCM projected estimates and those estimates are invariably on the lower end of the range. The problem with the GCM estimates is cloud formation. For example, "Given current uncertainties in representing convective precipitation microphysics and the current inability to find a clear observational constraint that favors one version of the authors' model over the others, the implications of this ability to engineer climate sensitivity need to be considered when estimating the uncertainty in climate projections." To be clear, that means that modelers can conjure up whatever warming amount you want simply by tweaking how clouds form in response to the greenhouse effect.

Emissions RCP 8.5

In order to make a projection for the future it is necessary to not only project the effect of changing GHG concentrations but also project how emissions will change. The ClimAID assessment presents a range of possible projections but the worst-case impacts rely on a future emissions scenario that was not intended to be plausible. In short, the likelihood of the projected impacts that "make the case" for the proposed revisions are based on an unrealistic emissions scenario. While it does make for the scary story needed to justify the proposed action, the fact is that it is inappropriate for use as justification for it.

Regional Climate Model

One problem with a GCM is that in order to calculate the global climate a coarse horizontal grid is needed simply because of computational requirements. In order to account for New York-specific impacts using a finer grid resolution ClimAID developed a regional climate model. I believe they used a statistical technique to estimate regional climate impacts. If that assumption is correct then their results are flawed. In particular, the GCM gird resolution is so coarse that effects of the Great Lakes are not included. However, "These techniques assume that the relationship between large scale climate variables (e.g. grid box rainfall and pressure) and the actual rainfall measured at one particular rain gauge will always be the same." Given that precipitation downwind of the Great Lakes is strongly influenced by lake-effect snow and rain, the large-scale precipitation estimates that do not include the Great Lakes means that this is clearly not the case.

Future Impacts from Emissions for New York State's Resource Sectors

I am not going to respond to all the problematic statements in this section. As shown above there are serious concerns with the primary projections of temperature change. The secondary projections of impacts to resource sectors is even more speculative especially because the alleged impacts require specific uncertain climatic outcomes. I will highlight several issues that demonstrate a lack of nuanced understanding of potential climate change impacts.

In the section on Coastal Zones, the RIS states "Superstorm Sandy gained additional strength from unusually warm upper ocean temperatures in the North Atlantic". The RIS correctly does not attribute Superstorm Sandy to climate change. I do not disagree with the claim that the storm could have gained additional strength from unusually warm temperatures. I do want to point out that these claims point to the most likely long-term impact of anthropogenic climate change, i.e., impacts will be tweaks to the environment and not primary drivers of environmental change.

In the same section the RIS claims that New York's shoreline will be adversely affected by climate change: "The major contributor to sea level rise is thermal expansion and melting of glaciers and ice sheets." This section concerns Future Impacts from Emissions and therefore it is incompatible with the Impacts from Emissions Already Observed in New York's Climate discussion of sea level. As correctly noted in that section "Sea level in the coastal waters of New York State and up the Hudson River has been steadily rising over the twentieth century, chiefly as a result of thermal expansion of ocean waters,

melting of land ice and local changes in the height of land relative to the height of the continental land mass. Tide-gauge observations in New York indicate that rates of relative sea level rise were significantly greater than the global mean, ranging from 0.9 to 1.5 inches per decade". Because New York tidal gauge rates of relative sea level rise are greater than the global mean shows that local changes in the height of land relative to the height of the continental land mass are a significant factor of sea-level rise that no amount of change to emissions will affect.

In the section on agriculture the RIS notes that "increased summer heat stress will negatively affect cool-season crops and livestock unless farmers take adaptive measures such as shifting to more heat-tolerant crop varieties and improving cooling capacity of livestock facilities". Misleadingly, the section then goes on to say "A loss of milk production efficiency from heat effects could result in the loss of hundreds of millions of dollars annually for New York's dairy industry" based on the following:

> "Dairy farmers will also be impacted since milk production is maximized under cooler conditions ranging from 41°F to 68°F. New York is the third largest producer of milk in the United States, behind California and Wisconsin, with 14.9 billion pounds of milk produced in 2017. During the unusually hot summer in 2005, many New York dairy herds reported declines in milk production of five to 15 pounds of milk per cow per day (an eight to 20 percent decrease)."

The average July temperature in Syracuse is 71, Madison WI is 75, and Sacramento, CA is 77, so two states that produce more milk than New York have higher average temperatures. Additionally, the RIS mistakenly quotes a milk decrease from a weather event to support an alleged climate impact.

In the section on Air Quality and Public Health Benefits the RIS states:

> In addition to contributing to a 50% reduction in CO_2 from affected power plants in New York, it is estimated that the RGGI program provided $1.7 billion in avoided public health costs in New York by reducing associated air pollutants. Across the RGGI region, it is estimated that the RGGI program helped avoid 16,000 respiratory illnesses, up to 390 heart attacks, and 300 to 830 deaths. At a more local level, according to a 2002 study, the expected health benefits of urban air pollution reductions from climate change mitigation strategies in the New York City area (assuming that they produce an approximately 10 percent reduction in PM_{10} and ozone concentrations), would be to avoid approximately 9,400 premature deaths (including infant deaths), 680,000 asthma attacks, and 12 million restricted activity days.

Recall from the previous section on RGGI Success that the primary reason for the emission reductions was fuel switching from coal and residual oil to natural gas. That means that the RGGI contribution to those reductions was on the order of 5% and not 50%. That also means that the avoided health impacts were mostly due to fuel switching and not RGGI.

A couple of points about health impacts in general and the referenced 2002 study and the potential impacts of a 10% reduction in PM_{10} and ozone concentrations in particular. Between 2000 and 2019 Northeast air quality trends show more improvement than a 10% reduction: PM_{10} is down 39%, $PM_{2.5}$ is down 47%, ozone is down 24%, and SO2 is down 86%. Until such time that DEC can reference a study that shows the actual health benefits associated with the observed air quality improvements, I am not confident that their air quality health claim is accurate. Also note that future air quality impacts will be

much smaller because the higher polluting coal and residual oil sources have already been reduced. CO2 reductions from natural gas firing will not produce as many reductions in PM and Ozone levels and no change in SO2.

Components of the Proposed Program Revisions

One of the problems with New York's energy policy is demonstrated by this statement: "The reduction in the CO_2 emissions cap to approximately align with current levels represents a critical step to combat the significant challenges presented by climate change and to advance sound energy policies that foster energy efficiency, a reduction in reliance on fossil fuels, and energy independence". In particular, New York State has not done a holistic analysis of the energy and environmental alternatives proposed to replace fossil fuels. For example, this proposal is supposed to foster energy independence but in 2019 the United States was energy independent. New York's energy plan proposes to rely on renewable energy which will require battery energy storage. Both technologies rely on rare elements which are not produced in sufficient quantities domestically to cover the requirements of the New York energy transition so we will become less energy independent. Furthermore, the production of these rare elements is environmentally destructive so the State is merely leaking environmental impacts elsewhere.

Benefits from the Proposed Program Revisions

This section notes:

> The most recent version of the New York State Regional Greenhouse Gas Initiative-Funded Programs Status Report for the quarter ending December 31, 2018 estimates cumulative annual customer bill savings of $293 million.[42]

Unfortunately, Table 2 shows that as a GHG emission reduction mechanism, New York's RGGI investments fail to make investments that are less than the purported cost of the negative externalities for a ton of CO2 emitted today (the Social Cost of Carbon (SCC)). In fact, the cost per ton removed is an order of magnitude larger than the Obama-era SCC value. Therefore, New York's investments are woefully cost ineffective which suggests that our resources should be invested in adaptation because we will not be able to afford the costs of mitigation.

There is a paragraph in this section that describes the Climate Act:

> Most notably, as described above, the recently-enacted Climate Act establishes Statewide GHG emission reduction requirements and renewable and clean energy generation targets. In particular, ECL Section 75-0107, which was added by the Climate Act, requires a 40 percent reduction in Statewide GHG emissions from 1990 levels by 2030, and an 85 percent reduction from 1990 levels by 2050. Moreover, Public Service Law Section 66-p, which was also added by the Climate Act, establishes a target to generate 70 percent of the State's electricity from renewable energy sources by 2030, and to generate 100 percent of the State's electricity from carbon-free sources by 2040. The proposed revisions to the Program, including the additional reduction in the RGGI CO_2 emissions cap and the establishment of the ECR, further the objectives of the Climate Act. Finally, the Climate Act also includes multiple provisions that recognize that historically disadvantaged communities often suffer disproportionate and

inequitable impacts from climate change. The proposed revisions to the Program to expand its applicability to include certain smaller sources, many of which are located in such communities, are consistent with these provisions of the Climate Act.

Forgive me for going off-topic here but nowhere is there any suggestion that it would be appropriate to do a cumulative environmental impact analysis of the Climate Act. The pious claims of deep concerns by DEC for the environment when denying permits for natural gas pipelines are hypocritical in light of the lack of environmental oversight for the Climate Act. The number of wind mills will be in the thousands and the solar panels will cover square miles so there will be significant cumulative impacts.

This section concludes with claimed benefits of implementing the proposed revisions:

Climate change is a global problem and effective action at the national and international level is necessary in order to stabilize atmospheric GHG concentrations at acceptable levels. Notwithstanding this, particularly given the current federal Administration's recent actions to slow or rescind various regulatory and other efforts to reduce GHGs nationally, action now at the State and regional level to reduce GHG emissions and to implement the revisions to the Program will benefit and reduce the risk of injury to New York and its citizens and residents from climate change. The risks of injury from a warming climate increase with the rate and magnitude of the warming, and in turn, the rate and magnitude of warming is primarily dependent upon the level of CO_2 emissions. In addition, by implementing the proposed revisions to the Program now, New York and the Participating States can:

- Reduce the long-term costs of addressing climate change. By acting now, states can avoid the need for more disruptive measures later.
    - As noted previously there is no quantitative estimate of the potential reduction of climate change costs that will accrue due to the proposed action.
- Position the region ahead of competitors. Taking continued action to reduce the region's carbon-intensity will create a competitive advantage relative to other parts of the country when additional action is taken at the national and international level.
    - The German attempt to implement a similar but much less ambitious GHG emissions program led to massive price increases: "A German online site *Stromreport* writes that since the year 2000 the average electricity price for private households has risen from 13.94 to 30.43 euro cents per kilowatt hour (2019)". If the cost of electricity is so much higher than elsewhere it will be a competitive dis-advantage.
- Capture environmental co-benefits. Reducing power sector carbon emissions provides numerous environmental co-benefits, including reduced emissions of other pollutants associated with fossil-based electricity generation. Additionally, co-benefits will continue to be realized by allocating almost 100 percent of the CO_2 allowances to the EE&CET account to be auctioned by NYSERDA and have the resulting proceeds utilized for the account's purposes of furthering the GHG emission reduction objectives of the Program.
    - Future environmental co-benefits will be much smaller than in the past simply because future reductions will be displacing natural gas rather than coal and oil. As shown above, NYSERDA's investments are not cost-effective relative to the Social Cost of Carbon.

- Drive new technology. By attaching tangible financial value to avoided carbon emissions, the proposed Program revisions provide additional market incentive for developing and deploying new technologies that can increase fuel efficiency, utilize non-carbon resources (including renewable technologies such as wind and solar power), and reduce or eliminate carbon emissions from combustion sources. In addition, to the extent that the auctioning of allowances will spur additional investments in clean energy technologies, the auctions drive the deployment of new technologies in the State.
    - I believe the cost of avoiding carbon emissions is far greater than the cost of RGGI on operations so this will have little effect on new technology.
- Promote improved supply-side and demand-side efficiency. The proposed Program revisions create a direct incentive to reduce the fossil fuel inputs required to produce electricity through more efficient generating technologies. This is consistent with the Climate Act's target to obtain 100 percent of the State's electricity from carbon-free sources by 2040.
    - The NYSERDA investments in demand-side efficiency have provided tangible benefits. If DEC wants to claim supply-side efficiency gains then they should provide examples.
- Improve the region's energy security and reduce its exposure to higher energy prices. By creating a market incentive for low-carbon and non-carbon electricity technologies and by promoting increased supply-side and demand-side efficiency, the proposed Program revisions reduce the Northeast's long-term exposure to high fossil fuel energy prices. Efficiency improvements and advances in new energy technology fostered by the proposed Program revisions can help buffer the region from the considerable economic risks associated with continued dependence on these fuels.
    - If New York truly wants to reduce exposure to higher energy prices then they should embrace natural gas development which has proven to be the leading cause in decreased prices. In spite of New York's irrational war on natural gas fracking, that technology has been primarily responsible for the observed emission reductions and associated health benefits in the past decade.
- Stimulate economic development. The proposed Program revisions provide a positive stimulus for economic growth in the region by creating incentives for new technologies that could be developed in-region, promoting a more efficient and cleaner electricity generating sector, prompting other activities through its offsets program and improving efficiency. NYSERDA's investment of proceeds from the auctioning of allowances provides further economic benefits.
    - The broken window fallacy negates this claim. In the broken window fallacy - money spent on RGGI allowances, for example, is "money that cannot be spent on food, clothing, health care, or other industries. The stimulus felt in one sector of the economy comes at a direct - but hidden - cost to other sectors".

Allowance Apportionment

This section notes that "New York is one of five RGGI states (also DE, MA, MD and VT) that has agreed to an adjustment of their apportionment in order to provide more allowances to Rhode Island". There is

no explanation why this is necessary. Given all the alleged benefits of the investment proceeds it is not apparent why New York should forgo them to benefit Rhode Island.

Cost to State and Local Governments

One statement in the RIS in this section needs to be called out because it demonstrates another example of the DEC not understanding carbon pricing in general or the effect of RGGI on regulated sources. In particular, the RIS states "The JBPU and the Village of Freeport have a range of compliance options and can utilize the flexibility inherent under the Program to comply". A fundamental difference between any carbon cap control program and cap programs for other emissions at power plants is that there are no cost-effective add-on controls for CO2 whereas there are control technology options for SO2, NOx and most other pollutants. As a result, the affected sources have few options to comply with a CO2 price or cap. In reality the only affected source control strategy is to operate under the cap; if a source cannot purchase the allowances necessary to operate then they simply will stop running. In addition, because there are so few CO2 control options for the affected sources, this means that they will simply treat the costs of purchasing allowances as a tax.

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