Roger Caiazza Personal Comments on the
Proposal to Incorporate Carbon Pricing into the Wholesale Energy Markets
Carbon Pricing Draft Recommendations Report

Via email to NYISO at IPP_feedback@nyiso.com
Response to DPS sent through Document and Matter Management System "Matter 17-01821"

Introduction

I am motivated to submit these comments so that there is at least one voice of the unaffiliated public whose primary interest is an evidence-based balance between environmental goals and costs to ratepayers. There are significant hurdles to implementing carbon pricing as proposed in the Carbon Pricing Draft Recommendations report prepared for the Integrating Public Policy Task Force (IPPTF) dated August 2, 2018. I do not believe that the draft recommendations make a persuasive case that carbon pricing for the New York wholesale electric market is a more efficient way to incentivize CO2 abatement than existing approaches already in use in New York.

These comments are submitted as a private retired citizen. They 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. The majority of New York State (NYS) ratepayers are unaware of the ramifications of this proceeding or have any idea of the consequences of incorporating the cost of carbon emissions into New York State (NYS) wholesale electricity markets. As a result this process has been flying under the radar without public understanding of the enormous potential costs and small environmental benefits of the concept.

The ultimate question that must be resolved is whether carbon pricing can work in the wholesale electric market sector in New York State. I agree that the theory of a carbon price on the whole economy and all energy sectors lets the market decide how best to reduce carbon is attractive. However, in this application it would only apply to one energy sector in one region of the economy. The following comments show that the proposal is not as economically efficient as existing carbon reduction approaches.

In addition, my comments address relevant issues raised by the draft recommendations. The draft recommendations propose market design concepts to incorporate the social cost of carbon in a manner that (1) is economically efficient, (2) avoids major cost shifts among New York customers, (3) is transparent, and (4) provides market and regulatory stability. Consideration should also be given to implementation constraints such as cost for agencies and affected sources to develop the carbon pricing information needed and the limitations of available information to be used. I believe it is also important that the final decision to implement this also consider the benefits of the program beyond helping to meet an arbitrary politically driven goal.

Economic Efficiency

My comments on the IPPTF meeting materials website on July 9, 2018 address the possibility that the carbon price will raise the energy market clearing price "whenever carbon-emitting resources are on the margin"[1]. In that analysis I assumed that the increase in cost due to the carbon price will put carbon-emitting resources on the margin all the time which given the cost of fuel and cost of carbon is reasonable. I estimated that if carbon pricing was in effect in 2015 the total cost to be $3.027 billion and in 2016 $2.985 billion which are both more than double the direct tax of Social Cost of Carbon (SCC) times the annual CO2 emissions ($1.321 billion in 2015 and $1.248 billion in 2016). While I am encouraged that the draft recommendations note the effect of the carbon price on energy market clearing prices I believe it is important that the NYISO prepare its own analysis of this effect to better estimate how often carbon-emitting resources will be on the margin and the effect on market clearing prices both historically and in the future.

This particular issue is very important with respect to economic efficiency. The carbon charge residuals will be returned to the LSEs but the increase in costs due to the change in market clearing price will not. In theory, the higher net revenues for lower emitting units will encourage renewable development but the practicality of this effect on the narrow segment of the wholesale electric market is questionable. In particular, there are limits to renewable deployment relative to system reliability and security that may limit development in response to this indirect stimulus.

The draft recommendations and the discussions to date have not addressed the impact of increases to energy costs as it relates to energy producers with costs lower than the clearing price. In particular, what portion of the increased LBMP goes to the existing renewables, nukes, and all the fossil gens with costs lower than the clearing price? The ultimate efficiency value to determine the efficacy of this program is the program cost divided by the new renewable MWHs estimated to be added. I have not seen any estimates of this.

Environmental Efficiency

In addition to economic efficiency the decision to institute this proposal should consider the environmental efficiency ($/ton) reduced or the program cost divided by the tons of CO2 that are estimated to be reduced. Since 1998 NYS CO2 emissions have dropped 56% from 57,228,699 tons to 25,301,757 tons (Table 1). This table also lists the primary fuel used and it is apparent that the reduction was due to fuel switching away from coal and residual oil to natural gas primarily driven by changes in the fuel cost differential between those fuels and not the Regional Greenhouse Gas Initiative (RGGI). With respect to the carbon pricing initiative there aren't much more in the way of fuel switching reductions available. The NYS Department of Environmental Conservation has proposed a regulation that will eliminate coal-firing. The only way residual oil firing can get much lower is if those units shutdown but they provide a valuable capacity backup capability so that may be difficult to implement. As a result, I don't think that the carbon pricing initiative will have much impact on future fuel switching to lower CO2 emitting sources.

The carbon pricing initiative theory is that increasing the cost of fossil-fired units will incentivize renewables so that fossil units will run less and renewables will run more. Table 2 lists NY generation by fuel type from all

[1] Page 3, Carbon Pricing Draft Recommendations

sources of energy. Unfortunately, these NYSERDA data only go to 2015 but it shows pretty much the same story. Petroleum and coal are down significantly and as a result CO2 emissions are also down (Table 3). Table 4 consolidates the fuel type categories. The 1998 and 2015 numbers suggest that further CO2 reductions will be difficult. Fossil emissions have gone down 21,775 GWh. Despite extensive energy efficiency and conservation efforts total electric generation has gone up 10,195 GWh. The change was made up by increases in imports 19,128 GWh, nuclear 13,307 GWh, other 274 GWh and renewables 2,290 GWh. (Note that I include all the non-fossil fuel types under my renewables category.) NYS does not want to encourage more imports unless they are lower CO2 emitting than existing sources and from an economic standpoint imports out of state generation does not provide in-state jobs. Even though CO2 is considered an existential threat by the state for this program Indian Point nuclear is scheduled to close which will most likely increase fossil emissions. Renewables have increased but will have to do so in a much larger way and will now be competing with a lower cost alternative – a new natural gas power plant. In order to meet the ambitious goals NYS investment has to be as efficient (lower $ per ton reduction) as possible.

The draft recommendations note[2] that the "New York Public Service Commission (PSC) would set the Gross Social Cost of Carbon (SCC) pursuant to the appropriate regulatory process. Such a process would be subject to the State Administrative Procedures Act (SAPA)." I have shown previously (here, here, and here) that the fundamental problem is that the Integrated Working Group SCC value that has been proposed does not accurately reflect the current state of the science relative to the probability of temperature being highly sensitive to CO2. As a result that value over-estimates the potential benefit of New York emission reductions.

Despite my misgivings I have no doubt that the PSC will set the SCC at the levels shown in Figure 1 of the draft recommendations. The SCC starts at $47.30 in 2020 and rises to $69.32 in 2030. In Table 1 the 2017 total CO2 mass from NYS was 25,301,757 tons. If we multiply the 2020 SCC value times the 2017 CO2 mass we get $1.961 billion in carbon price revenues. The average annual reduction from 2000 to 2017 was 1.9 million tons per year. If that rate could be continued and all that reduction were entirely due to the carbon price then the effective reduction cost would be $630 per ton. The actual cost will be higher because future reductions will be smaller because reductions from the most effective reduction strategy, fuel switching, are used up, and not all the reductions can be ascribed to carbon pricing because there are other reduction programs in place. I do not think that an estimate at least an order of magnitude greater than the supposed benefit of reducing a ton of carbon supports the use of carbon pricing in the NY wholesale electric market.

In October 2017 RGGI released The Investment of RGGI Proceeds in 2015 report that tracks the investment of the RGGI proceeds and the benefits of these investments throughout the region. The report claims states that over the period covered by the report, $1.37 billion in RGGI proceeds have been invested and that the investments are projected to avoid the release of 20.5 million short tons of CO2. This means that the RGGI investments have reduced CO2 at a rate of $66.61 per ton. These reductions are at least the same order of magnitude as the SCC and are approximately ten times more effective than the possible cost effectiveness of a carbon price on the wholesale electric market of New York.

[2] Page4, Carbon Pricing Draft Recommendations

Table 1: NYS Annual CO2 Emissions from EPA (Methodology details here)

Year	CO2 Mass (Short Tons)					
	Total	Coal	Other Solid	Residual Oil	Other Oil	Natural Gas
1998	57,228,699	27,584,834	0	25,135,867	0	4,507,998
1999	58,507,243	24,335,654	0	28,477,174	0	5,694,415
2000	57,114,439	25,546,641	0	25,550,253	0	6,017,545
2001	53,195,854	23,519,892	0	21,128,611	1,643,203	6,904,148
2002	51,546,524	24,073,494	0	18,160,724	1,516,906	7,795,400
2003	53,240,989	24,491,989	0	18,268,830	3,216,401	7,263,769
2004	55,125,941	23,673,988	0	19,041,636	2,651,675	9,758,643
2005	56,018,928	22,348,515	0	18,736,548	3,035,533	11,898,332
2006	47,912,271	22,183,541	0	9,948,566	1,649,917	14,130,247
2007	49,575,411	21,884,899	0	10,012,277	1,921,077	15,757,159
2008	42,844,448	18,679,355	444,472	7,414,414	1,686,932	14,619,275
2009	38,295,368	13,637,433	208,400	5,644,155	1,370,850	17,434,529
2010	42,563,848	14,950,792	88,666	6,936,901	576,286	20,011,203
2011	37,445,417	10,394,280	0	4,461,132	306,381	22,283,623
2012	35,800,053	5,030,164	186,615	4,609,976	437,716	25,535,582
2013	33,991,141	5,463,637	74,661	4,099,679	199,768	24,153,395
2014	34,692,213	4,667,127	657,883	4,495,060	124,538	24,747,605
2015	33,271,739	2,229,725	600,041	4,824,185	108,193	25,509,594
2016	31,440,502	1,588,950	615,717	3,029,375	125,402	26,081,058
2017	25,301,757	763,861	626,856	1,186,139	55,453	22,669,449

Table 2: NYS Electric Generation by Fuel Type (GWh), NYSERDA Patterns and Trends 2001-2015 Table 3-5.

Year	Coal	Natural Gas	Petroleum	Conv. Hydro	PS Hydro	Nuclear	Net Imports	Other	Waste	LFG	Wood	Wind	Solar	Total
1998	25,265	42,472	14,901	29,316	2,211	31,314	3,145	2,754	n/a	n/a	n/a	0	0	151,377
1999	23,366	45,999	13,304	24,752	2,058	37,019	6,904	2,950	n/a	n/a	n/a	0	0	156,352
2000	25,010	39,729	14,945	24,910	1,843	31,508	15,723	2,958	n/a	n/a	n/a	10	0	156,636
2001	23,432	38,697	16,512	21,486	1,666	40,395	10,628	2,404	1,837	284	283	21	0	155,241
2002	23,239	38,451	11,534	24,612	1,601	39,617	17,088	2,282	1,878	198	206	82	0	158,507
2003	23,581	28,156	19,292	24,207	1,591	40,679	18,163	2,302	1,905	205	192	41	0	158,012
2004	22,853	27,294	21,205	26,745	1,408	40,640	17,646	2,303	1,883	209	211	116	0	160,211
2005	20,598	31,873	24,013	26,204	1,379	42,443	18,115	2,481	1,899	329	253	103	0	167,208
2006	20,968	42,134	6,778	27,110	1,312	42,224	18,569	2,488	1,902	326	260	655	0	162,238
2007	21,406	45,634	8,195	24,184	1,373	42,453	20,708	2,555	1,902	397	256	833	0	167,341
2008	19,154	43,856	3,745	25,711	1,790	43,209	23,899	2,996	1,903	533	560	1,251	0	165,612
2009	12,759	41,780	2,648	26,420	1,525	43,485	25,009	2,888	1,900	648	340	2,266	0	158,780
2010	13,583	48,916	2,005	24,214	889	41,870	26,517	2,916	1,893	708	315	2,596	0	163,505
2011	9,426	50,805	1,189	27,634	721	42,695	25,201	2,823	1,878	735	210	2,828	7	163,329
2012	4,551	59,462	580	24,572	731	40,775	26,180	2,945	1,897	736	311	2,992	53	162,840
2013	4,697	54,354	1,007	25,631	766	44,756	25,694	3,003	1,799	828	377	3,539	67	163,514
2014	4,325	54,380	2,136	25,974	849	43,041	22,103	3,194	1,866	789	539	3,986	71	160,059
2015	2,046	56,923	1,892	25,879	825	44,620	22,273	3,028	1,862	745	422	3,984	101	161,572
% of Generation														
1998	16.7%	28.1%	9.8%	19.4%	1.5%	20.7%	2.1%	1.8%				0.0%	0.0%	100.0%
2001	15.1%	24.9%	10.6%	13.8%	1.1%	26.0%	6.8%	1.5%	1.2%	0.2%	0.2%	0.0%	0.0%	100.0%
2015	1.3%	35.2%	1.2%	16.0%	0.5%	27.6%	13.8%	1.9%	1.2%	0.5%	0.3%	2.5%	0.1%	100.0%

Table 3: NYS Estimated Greenhouse Gas Emissions from Fuel Combustion (tons) converted from NYSERDA Patterns and Trends 2001-2015 Table A-1.

Year	Residential	Commercial	Industrial	Transportation	Electric Generation	Net Imports of Electricity	Total
1998	35.8	30.7	23.8	79.1	61.7	1.3	232.3
1999	38.8	33.4	19.9	81.9	62.2	2.8	238.9
2000	44.4	35.5	19.3	83.4	61.3	6.3	250.2
2001	42.9	33.9	17.9	82.7	60.5	4.2	242.2
2002	40.5	34.3	16.3	85.0	55.8	6.8	238.8
2003	43.9	36.5	15.5	89.3	57.0	7.2	249.5
2004	42.9	38.4	15.5	90.4	57.3	7.0	251.5
2005	43.9	31.6	16.5	92.3	59.0	7.2	250.5
2006	36.4	28.0	16.1	93.5	50.6	7.4	232.1
2007	40.6	29.4	15.5	91.4	53.7	8.3	238.9
2008	39.3	28.5	15.2	88.5	46.8	9.5	227.8
2009	36.2	27.6	12.6	85.7	37.5	10.0	209.7
2010	34.9	26.6	11.3	82.6	41.1	10.6	207.1
2011	34.2	26.7	12.2	77.3	36.8	10.0	197.2
2012	33.5	23.1	11.8	79.6	35.5	10.4	193.9
2013	35.6	24.7	11.5	80.0	33.0	10.2	195.1
2014	39.1	24.3	12.2	81.6	33.5	8.8	199.5
2015	39.1	24.0	11.8	81.4	32.1	8.8	197.2

Table 4: Consolidated Fuel Type

Year	Fossil	Import	Nuclear	Other	Renewable
1998	54.6%	2.1%	20.7%	1.8%	20.8%
2001	50.7%	6.8%	26.0%	1.5%	16.5%
2015	37.7%	13.8%	27.6%	1.9%	20.9%

Key:

Fossil:	Coal, natural gas and petroleum
Import:	Import
Nuclear:	Nuclear
Other	Other
Renewable:	Conventional hydro, pumped storage hydro, waste, land-fill gas, wood, wind & solar

I believe that direct investment of CO2 reduction funding towards programs to reduce CO2 is more efficient than the indirect funding approach of a carbon price without targeted programs. The carbon pricing recommendation does not specify how much of the carbon price residual will flow back to the customer and how much will be appropriated for carbon reduction programs. While I agree that the theory of a carbon price on the whole economy that lets the market decide how best to reduce carbon is attractive it appears that this approach in the limited context of the New York wholesale electric market is not as efficient as direct investments. If New York insists on reducing carbon then I believe it should do so as cheaply as possible and this initiative is not the cheapest option.

Emission Reporting Issues

The section entitled Application of the Carbon Price to Internal Suppliers[3] addresses the logistics of how internal suppliers would incorporate the price of carbon into their participation in wholesale energy markets. I have extensive background in emissions reporting and believe that the proposed reporting scheme has significant problems related to implementation, consistency, and timing.

The draft recommendations state "All internal suppliers participating in the wholesale energy markets would self-report their carbon emissions or their estimated emissions to the NYISO through a new weekly emissions data submission process." I cannot emphasize enough that this new weekly emissions data submission process is not going to be simple or easy to implement. The time, effort, and cost needed to produce a system to analyze emissions data should be considered in the decision whether or not to proceed. Emissions reporting requirements vary depending upon the size and regulatory requirements of the unit. There are no current weekly reporting requirements so every internal supplier will have to develop their own approach. For the more sophisticated sources that have to report hourly emissions based on stack measurements this report won't require much additional logistical support. However, carbon pricing is supposed to cover smaller less sophisticated units that currently only report emissions on an annual basis using fuel data and emission factors. The logistical support to provide these estimates will be a burden. For example, smaller units may not have remote reading fuel meters so someone will have to manually read the data on a much more frequent basis than today. The fuel data has to be converted to emissions and for those sources that is another manual operation currently not required. The NYISO is going to have to develop a methodology for the emissions data submission process to handle the logistics to transfer the data and then will have to have a system to incorporate that data into their existing billing and settlement processes. This is not a simple system to implement. Also note that for those units that do not report hourly data to EPA that the methodology for calculating emissions in not necessarily going to be transparent.

In my review of the data requirements I am not sure how carbon pricing will be incorporated into the bidding process. In the discussion of the carbon charges and external transactions, there is an option for the NYISO to provide prices with and without carbon charges so that import pricing could be considered without the carbon charge. I guess that the NYISO is going to have to request multiple prices one of which will be the $/MWh for CO2 to meet that condition. That means that the internal suppliers are going to have to develop a procedure for estimating their carbon costs for their bids. I believe that this was the basis for the draft recommendation

[3] Page 5, Carbon Pricing Draft Recommendations

dismissing the idea that NYISO calculate the CO2 rates because "suppliers are better positioned to accurately estimate their emissions than the NYISO". The reason that suppliers are better positioned is because they will know which fuel will be burned and can use the appropriate emission factors. However, what happens if something requires the fuel to be changed unexpectedly after the bid is submitted? Because I believe that the carbon adder is going to be a primary driver of price most of the time that is important because it raises a transparency issue. If the fuel change affected the bid order was that because of gamesmanship or a regulatory requirement? If NYISO calculates the estimates the emissions it is transparent.

My biggest concern with the logistics of carbon reporting is timing. The draft recommendations state:

> Self-reported emissions and the applicable carbon price would determine the carbon charges assessed in the NYISO settlements process. Just like today's NYISO settlements process, these settlements would be subject to true-ups as part of the normal billing processes. Internal suppliers that provide updated data in time for the final bill closeout would have their final settlements adjusted. Self-reported emissions would be subject to verification; for example, with emissions data from the U.S. EPA's Clean Air Markets Division (CAMD) database.

The problem is the result of the quality assurance and quality control requirements for all hourly emissions data submitted to EPA by the majority of generators. Those emissions data are completely transparent and the values can be traced back to certifiable standards. However, that process requires independent testing. The results of those tests have to be analyzed and the results may require the hourly data to be adjusted, so the data may not be finalized for weeks after the test. Furthermore, EPA extensively reviews the data submittals and could also mandate data adjustments. As a result, the final verified data many not be available for the verification to the EPA CAMD for months, long after the normal NYISO settlement process true-up.

There is another true-up issue that has been glossed over. The draft recommendations state that "The applicable carbon price would be based on the PSC's Gross SCC with adjustments for RGGI allowance prices for those suppliers required to hold RGGI allowances." The draft recommendations do not explicitly state what RGGI allowance price would be used to calculate the residual price. Earlier I believe the suggestion was to use the quarterly allowance auction price. However, I do not believe that represents the true price of the allowances on a day to day basis. As I have commented before, I think it is more appropriate to use the price that a source would have had to pay on a daily basis, in other words some secondary market price. RGGI provides market monitoring reports including quarterly reports on the secondary market. which note that:

> The secondary market is important for several reasons. First, it gives firms an ability to obtain CO2 allowances at any time during the three months between the RGGI auctions. Second, it provides firms a way to protect themselves against the potential volatility of future auction clearing prices. Third, it provides price signals that assist firms in making investment decisions in markets affected by the cost of RGGI compliance.

There are at least two options for a daily price: the RGGI CO_2 Allowance Tracking System (RGGI COATS) has a public report for transaction prices and the RGGI quarterly secondary market reports define CO2 allowance prices as a function of futures prices. The final recommendations for the RGGI allowance price should address whether the quarterly auction price or a secondary market price is the more appropriate value to use for wholesale electric market carbon pricing and explain the rationale why the choice is the most equitable.

Double Payments

The double payment discussion[4] is important to consider relative to economic efficiency. The draft recommendations note that:

> Some stakeholders have expressed concern that if the NYISO implements carbon pricing in the wholesale energy markets, certain resources may receive compensation for the same carbon reduction benefits twice; once from State REC payments, and once from the NYISO's carbon charge. In response to these concerns, the NYISO is considering options to reduce the potential for double payments. The NYISO encourages further discussion, feedback, and consideration of approaches to reducing potential double payments for carbon emission reductions.

Before this proposal is finalized this issue has to be resolved. My primary concern is the cost to reduce CO2. None of the existing programs for CO2 reductions have provided dollars per ton reductions that are markedly better than the biased, out-of-date, and indefensible SCC values the PSC has been using. When compared to the current Federal SCC values there is no social benefit even when there is a single payment. Double payments exacerbate the problem markedly.

External Transactions

The Application of the Carbon Price to External Transactions[5] is another complication that could have profound effects. The draft recommendations state:

> Applying a carbon charge to only internal resources would make them less competitive compared to external resources. Imports would increase, potentially up to the transmission limits, and exports would decrease. Production would shift to resources outside of New York that would not otherwise generate—resources that are costlier and likely higher-emitting. Such distortions would undermine the State's energy, environmental and economic objectives.
>
> To avoid creating such distortions, the Straw Proposal proposes to apply carbon charges to external transactions such that they compete with internal resources (and each other) as if the NYISO was not applying a carbon charge to internal suppliers (*i.e.*, on a status quo basis). Imports would earn the LBMP without the carbon effect, at the relevant border; similarly, exports would buy energy at the LBMP without the carbon effect. This would apply to all external transactions, with no unit-specific or portfolio-specific exceptions for existing or new clean energy resources.

I agree that increasing imports would undermine the State's energy, environmental and economic objectives. Therefore it is important to prevent distortions that would cause that to happen. I am not at all comfortable that this can be prevented as simply as suggested in the draft recommendations. As noted earlier in order to address this it appears that in-state sources will have to include the carbon adder cost.

The draft recommendation statement that "In addition to charging internal generators, the NYISO would charge imports for emissions and credit exports for avoiding other emissions to prevent the carbon charges on internal

[4] Page 6, Carbon Pricing Draft Recommendations
[5] Page 7, Carbon Pricing Draft Recommendations

generation from causing emissions leakage and costly distortions" is troubling. In order to incorporate emissions into the energy market NYISO is going to have to calculate emissions. If they can do it for outside the state then I think it would be better to calculate in-state emissions using the same methodology for consistency.

LSE Allocations

I also am worried about the allocation of the carbon charge to the LSEs. The draft recommendations note that[6]

> Any allocation mechanism should be evaluated against at least two design objectives:
>
> - **Economic Efficiency**. LSEs in zones with higher carbon effects on LBMPs would still pay more on net than other LSEs, providing a stronger price signal to reduce consumption where marginal emissions rates are highest.
> - **Equity of Cost Burden**. More of the residuals would be allocated to the customers who bear a greater cost of carbon pricing, thus reducing (but not eliminating) differences among LSEs in the net cost they face from carbon pricing.

An important finding in my previous comments was that the hourly energy cost in each LBMP varied across the state. Clearly the basis for the allocation methodology should consider the hourly energy costs incurred as a result of the carbon price.

Potential Benefits

I do not believe that the benefits of a carbon price on wholesale electric markets out-weigh the costs. These comments show that because New York has already reduced its CO2 emissions so much that it is very unlikely that the cost per ton reduced will be lower than the SCC proposed. It should also be pointed out that there is an even weaker case for co-benefits of other emissions such as SO2 and NOx. Table 5 lists SO2, NOx and CO2 mass and rate from 1998 to 2017 for all units that reported data to EPA. SO2 mass is down 99% and SO2 rate is down 98%. NOx mass is down 88% and NOx rate is down 76%. If anyone is going to try claim benefits from those pollutants for further reductions then the most recent rates should be used for the calculation. The cost per ton reduced and the benefits will be impacted by the low existing levels so much that I doubt that there are any meaningful benefits.

The final aspect of the benefits of this program that should be considered is the actual impact on warming. In the absence of any official quantitative estimate of the impact on global warming from the overall New York State initiative related to climate change, Reforming the Energy Vision (REV), I did my own calculation. I simply adapted data for this emission reduction from the calculations in Analysis of US and State-By-State Carbon Dioxide Emissions and Potential "Savings" In Future Global Temperature and Global Sea Level Rise. This analysis of U.S. and state by state carbon dioxide 2010 emissions relative to global emissions quantifies the relative numbers and the potential "savings" in future global temperature. In order to estimate the impact of REV I simply pro-rated the emission values for the United States with the emission values for New York. The ultimate impact of the REV 80% reduction of 188.7 million metric tons on projected global temperature rise would be a reduction, or a "savings," of approximately 0.0028°C by the year 2050 and 0.0058°C by the year 2100. . In order to give you an idea of how small this temperature change is consider changes with elevation and latitude. Generally, temperature decreases three degrees Fahrenheit for every 1,000 foot increase in elevation above sea

[6] Page 7, Carbon Pricing Draft Recommendations

level. The projected temperature difference is the same as going down 42 inches. The general rule is that temperature changes three 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 1 mile. Clearly these benefits are immeasurable.

Ultimate Goal

The IPPTF Charter states:

> Incorporating the cost of carbon dioxide into the wholesale Energy markets is intended to provide the most efficient means to incentivize carbon abatement from a broad set of electric suppliers, supporting the state's clean energy policies to reduce electric sector carbon dioxide emissions while continuing to leverage market forces to provide affordable, reliable electricity.

Advocates for the state's clean energy policies often point to the German Energiewende or energy transition plan to move away from fossil fuels and nuclear to a low carbon energy supply as a policy for New York to emulate because it has been successful. However, a recent paper, Vernunftkraft, Bundesinitiative für vernünftige Energiepolitik or Compendium for a Sensible Energy Policy, produced by a group of German energy experts, engineers and technicians, eviscerates any claims for Energiewende success. Their full study is available to be downloaded in PDF here and should be required reading for NY energy policy decision makers. It describes issues that have come up in Germany and I see no reason why those problems would not happen here.

I am a numbers and history guy. If the State can produce numbers or show examples where a carbon abatement policy has worked elsewhere then I can determine whether I can support that policy. My fundamental problem with REV is I have not seen where any jurisdiction has been able to move away from fossil fuels without markedly increasing costs. Furthermore, there are very few places where the relative amount of renewable energy proposed for New York has been implemented and none on the scale of the New York electric system so it is not clear to me whether that much renewable energy can actually be implemented without threatening the reliability of the New York grid.

In the absence of any numerical or historical evidence that the state's clean energy policies will work as proposed the most I can hope for is to argue against specific programs that clearly increase costs with little benefits. Based on the analysis for these comments, incorporating the cost of carbon dioxide into wholesale electric markets is a less efficient means to incentivize carbon abatement than existing programs. Therefore it is inappropriate to implement as proposed by the NYISO draft recommendations document.

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Table 5: EPA Clean Air Markets Division Data New York State Air Pollution Emissions from All Program Units

Year	SO2 Mass (tons)	SO2 Mass Coal-only (tons)	NOx Mass (tons)	NOx Mass Coal-only (tons)	CO2 Mass (tons)	CO2 Mass Coal-only (tons)	SO2 Rate (lbs/mmBtu)	NOx Rate (lbs/mmBtu)	CO2 Rate (lbs/mmBtu)
1998	309,775	240,393	87,027	59,377	57,228,699	27,584,834	0.872	0.245	161.122
1999	276,333	210,668	97,376	53,969	58,507,243	24,335,654	0.616	0.217	130.454
2000	283,345	218,649	101,635	57,727	57,114,439	25,546,641	0.649	0.233	130.858
2001	250,928	187,677	92,733	50,789	53,195,854	23,519,892	0.592	0.219	125.483
2002	231,985	185,458	85,917	50,084	51,546,524	24,073,494	0.560	0.207	124.365
2003	253,803	179,836	88,186	50,826	53,240,989	24,491,989	0.628	0.218	131.722
2004	228,267	148,407	82,813	44,704	55,125,941	23,673,988	0.562	0.204	135.622
2005	177,349	109,248	78,788	39,442	56,018,928	22,348,515	0.426	0.189	134.534
2006	108,686	90,134	58,035	37,863	47,912,271	22,183,541	0.299	0.160	131.688
2007	107,210	84,107	58,569	37,149	49,575,411	21,884,899	0.286	0.156	132.160
2008	65,427	53,730	47,556	30,719	42,844,448	18,679,355	0.196	0.142	128.252
2009	46,344	38,186	35,675	22,758	38,295,368	13,637,433	0.164	0.126	135.487
2010	49,568	44,909	36,143	23,274	42,563,848	14,950,792	0.157	0.115	134.974
2011	40,756	37,729	31,062	20,262	37,445,417	10,394,280	0.142	0.108	130.109
2012	17,637	15,631	24,823	12,976	35,800,053	5,030,164	0.060	0.085	122.543
2013	16,878	14,391	24,082	12,090	33,991,141	5,463,637	0.061	0.087	123.427
2014	16,676	11,824	22,214	9,979	34,692,213	4,667,127	0.060	0.079	124.058
2015	8,777	4,892	20,990	8,876	33,271,739	2,229,725	0.032	0.076	119.991
2016	4,533	3,121	16,222	4,576	31,440,502	1,588,950	0.017	0.061	118.073
2017	2,561	1,429	11,253	2,770	25,301,757	763,861	0.012	0.052	116.677

% Reduction	-99.1%	-99.3%	-88.4%	-94.9%	-56.8%	-96.9%	-98.1%	-76.1%	-10.6%