



Building Clean Energy in New York:
The Case for Carbon Pricing at the NYISO

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Building Clean Energy In New York is series of Issue Briefs published by the Alliance for Clean Energy New York. Each Issue Brief aims to provide an in-depth look at a topic critical to the successful achievement of New York's legislative mandate of 70% renewable electricity by 2030.



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I. Executive Summary

New York State should support and pursue an initiative to account for carbon emissions in the State’s wholesale electricity markets. For two years, NY’s grid operator, the New York Independent System Operator (NYISO), has been studying and discussing this initiative with all stakeholders. Several analyses have been completed by different parties¹. The results of this work set the foundation for an innovative, first-in-the-nation policy to embed price signals that account for carbon emissions within New York’s wholesale electricity markets. This will support New York’s pursuit of aggressive and ambitious goals to reduce this pollution and transition New York to a 100% clean energy economy. This initiative will:

- Set an example for the Nation of how carbon policy can align with markets;
- Complement NY’s climate law and make it more likely that NY’s ambitious goals will be met;
- Lower the costs that would otherwise be paid by state agencies in achieving the State’s goals, lower the costs the State needs to invest in transmission, and lower the overall costs of achieving the climate law’s mandates; and
- Be able to be implemented quickly and cost-effectively, with NYS support.

II. Accounting for Carbon: Description of the Initiative

Presently the wholesale electricity markets in the United States do not capture the cost of carbon emissions to society. Hence, zero carbon resources, such as renewables, are not sufficiently compensated by the market for the value of their clean energy attribute. Wholesale electricity market rules need to be changed to fix this deficiency. The initiative to integrate a carbon price into New York’s electricity markets (hereinafter “Carbon Pricing”) is an example of how this deficiency can be efficiently fixed.

Carbon pricing is a program that would allow the NYISO to charge a fee to electric generators that emit carbon dioxide, with the fee set at the estimated cost to society of the damages caused by their carbon dioxide emissions. Economic experts in pollution control have long advocated charging emitters for the pollution they emit as the most effective way to reduce emissions by sending a clear price signal. The approach has been tried and shown to be highly successful, most notably for emissions of the sulfur dioxide that causes acid rain. For New York, because there are legal mandates in place to achieve renewable energy and climate goals, carbon pricing would not be the only instrument - or even the

¹ The NYISO hired the Brattle Group to perform a detailed analysis to estimate the impacts, costs, and benefits of this proposal. The Brattle Group’s analysis was then expanded and updated by Potomac Economics (the NYISO’s external Market Monitoring Unit) and by the Analysis Group. An additional analysis was developed by Resources for the Future. See complete list, with links, on the following page.



principal instrument - for achieving these goals but would be an essential complement to the law. It will support and assist in the achievement of New York's carbon reduction mandates by aligning market forces with policy goals.

Carbon Pricing will set an example for the nation and the world.

New York's electricity markets operate by power generators bidding in hourly to sell their electricity. The lower bids get selected first, and incrementally higher bids get selected until enough electricity has been purchased to meet the need at that time. The last (and highest) selected bid sets the market clearing price, that is, the price that all generators are paid.

By charging polluting generators a fee, the polluting generators will necessarily need to submit higher priced bids, causing the market clearing price to increase. Due to having higher bids, the polluting generators will run less often. Meanwhile, generators that do not emit carbon will not be charged the fee but will get paid more as the market clearing price increases. In this way, renewable generators, like hydro, wind, and solar facilities, as well as non-renewable zero-emitting generators like nuclear, will get more revenue from the NYISO electricity market. This will, in turn, allow the renewable generators to put in lower bids to NYSERDA for long-term renewable energy credit (REC) contracts, greatly reducing (by hundreds of millions of dollars per year) the costs that NYSERDA pays to implement the 70% by 2030 Clean Energy Standard program.

ANALYSES of the CARBON PRICING PROPOSAL

- The Brattle Group's initial published Carbon Pricing study: [Pricing Carbon Into NYISO's Wholesale Energy Market to Support New York's Decarbonization Goals](#) August 10, 2017, by the Brattle Group, authors include Samuel A. Newell.
- Brattle's final analysis of Carbon Pricing for the Integrating Public Policy Task Force (IPPTF): [Analysis of a New York Carbon Charge \(Updated\)](#) Presented to IPPTF, Nov 30, 2018 (Updated Dec 21, 2018), by the Brattle Group, Authors include Sam Newell.
- Potomac Economics analysis of Carbon Pricing: [MMU Evaluation of Carbon Pricing](#) by Pallas LeeVanSchaick, Potomac Economics, Market Monitoring Unit, May 9, 2019, Presentation to Market Issues/ICAP Working Groups
- Resources for the Future July 2019 report: [Benefits and Costs of Power Plant Carbon Emissions Pricing in New York: A Dynamic, Simulation-Based Analysis](#) by Resources for the Future, Final Report July 18, 2019, authors include Daniel Shawhan.
- Analysis Group's final report: [Clean Energy in New York State: The Role and Economic Impacts of a Carbon Price in NYISO's Wholesale Electricity Markets](#) by Analysis Group, Oct 3, 2019, by Susan F. Tierney and Paul J. Hibbard.
- The final NYISO Carbon Pricing proposal: [IPPTF Carbon Pricing Proposal](#) by the NYISO, Prepared for the Integrated Public Policy Task Force, December 7, 2018.



III. The Benefits of Carbon Pricing

a. CARBON PRICING WILL SET AN EXAMPLE FOR THE NATION AND WORLD

New York should be the first state to take this cutting-edge action. Our state has historically been a leader in energy and environmental policy among U.S. states. The recently enacted *Climate Leadership and Community Protection Act* is just the latest example, but it is one that underscores the imperative to act creatively on climate change. The evolution of environmental policy has repeatedly demonstrated a shifting pendulum between market approaches and so-called “command-and-control” approaches, and each approach has its proponents and detractors. In fact, a combination of market mechanisms and mandates is the best approach to protect the environment; ensure communities overburdened with pollution realize environmental improvement; harness the market; and allow the economy to thrive. This is the approach that New York should pursue now.

New York now has the most aggressive climate law in the United States. Adding Carbon Pricing to the portfolio of programs to implement this law will demonstrate an innovative approach to harmonizing aggressive environmental goals with a competitive market structure. It would be the first U.S. state and first grid operator to take this innovative action. It will strengthen New York’s competitive electricity markets at a critical juncture, allowing New York State, the NYISO, and all stakeholders the time to deliberately design and transition to the electricity market of the future, one that is designed not for fossil fuel power plants, but for a 100% carbon-neutral electricity system.

b) CARBON PRICING WILL COMPLEMENT THE CLIMATE LAW AND INCREASE THE LIKELIHOOD THAT NY’S AMBITIOUS GOALS WILL BE MET.

In contrast to previous renewable energy programs in New York, the current 70% by 2030 mandate is set in law. This is good news. Yet, it is important to note that previous New York State goals (25% by 2012; 30% by 2015) were not successfully achieved. Remembering this history, we would be wise to take all opportunities to adopt a “belt and suspenders” approach to New York’s drive to 70% by 2030, including implementing Carbon Pricing. Carbon Pricing will align and harmonize New York’s wholesale electricity markets with New York’s clean energy goals. This will harness market forces to help New York State meet its goals.

One goal is to get renewables built. As discussed above, Carbon Pricing will integrate the value of clean energy into the market and will dramatically reduce the cost of the separate REC-contracting program that NYSERDA implements² to get new renewable projects built. In this way,

Previous State goals (25% by 2012; 30% by 2015) were not successfully achieved.

² To achieve the full savings in the REC contract prices, New York’s PSC should provide NYSERDA the authority to use an Indexed REC contract approach for Tier 1 procurement, as requested by the [petition](#) submitted by ACE NY and AWEA (Petition of the American Wind Energy Association and the Alliance for Clean Energy New York for an Order



the cost of the NYSERDA program will decrease, and will be a better reflection of the cost premium required by renewable energy in NYS. In theory, when the energy market revenues increase enough, New York could see development of wind and solar power without REC contracts.³ If this happens, the resulting clean energy that emerges organically from the marketplace would save consumers the cost of funding the State programs that would otherwise be needed. We believe it will be more likely that because the grid is rapidly decarbonizing, the carbon increment to the energy market revenue will remain modest, and renewable development will continue to be supported by NYSERDA's Clean Energy Standard procurement, but at a lower cost.

New York State also has an energy storage goal. Carbon Pricing can support this goal by producing better and more lucrative price signals for investors in energy storage. For example, because the polluting generators are charged for their emissions, the carbon increment to energy prices will be larger when more polluting generators are contributing electricity to the grid. This will send a price signal to storage facilities to charge when the price is low (and the power is cleaner) and discharge with the price is higher (and less clean). The improved market economics for storage will yield savings to consumers in the form of reduced payments by State programs to stimulate storage, in pursuit of New York's aggressive 3,000 MW storage goal. The tools used by the Brattle Group to model the State's bulk power system were not capable of modeling storage, so no estimate of this consumer benefit was produced.

Carbon Pricing will also help support pre-2015 renewables and reinvestment in these existing hydropower and wind power projects. Because our goals are so ambitious, New York should be acting to support and maintain the existing generators we have⁴, and Carbon Pricing is one way to do that. New York's significant number of small hydropower generators are aging and face decisions about repairs, reinvestment, and life extension. With Carbon Pricing, the market provides these clean generators the boosted revenues they need to stay in operation. The same effect occurs for existing wind facilities as their REC contracts with NYSERDA end. These facilities face a decision – should they sell their RECs in New England, because New York has no program to procure them? Should they reinvest in increasing clean electricity production by replacing turbines or making other improvements? Right now, New York has no program in place to maximize the production from these existing resources or encourage these resources to keep their RECs in New York State. This is a serious gap in the Clean Energy Standard program. We note that because it is exceedingly difficult to make defensible assumptions about the future aging of generators or future exports of their RECs, no estimate of this consumer benefit was produced in any of the Carbon Pricing analyses.

The climate law's greenhouse gas goals are also supported. Carbon Pricing can help New York achieve its greenhouse gas (GHG) mandate to reduce economy-wide emissions 40% by 2030. Carbon Pricing enhances the economics of investing in efficiency improvements at existing gas-fired generators. This

Modifying the Clean Energy Standard Tier 1 Procurement Process, submitted in NYSPSC Case 15-E-0302 on March 13, 2019).

³ The Resources for the Future study, [Benefits and Costs of Power Plant Carbon Emissions Pricing in New York – A Dynamic, Simulation-Based Analysis](#), concludes that NY REC prices will drop to \$0 by 2025 in both the low & high cost of renewables scenarios, page 27. The study assumed a 2025 social cost of carbon of \$51 per short ton in 2013 dollars, page 7.

⁴The SAVE Renewables bill, also referred to as the "Tier 2 bill", was passed by both houses of the NYS Legislature in the 2019 session. This bill, S.23/A.4294, would, if signed into law by the Governor, provide an alternative mechanism for supporting the continued operation of existing renewable generators. In this case, Carbon Pricing will substantially reduce the cost to consumers of the Tier 2 procurement that that bill requires.



yields CO₂ emissions reductions that may not occur otherwise or would have occurred later in time. This benefit was also not quantified in any of the analyses. In addition to producing carbon dioxide reductions, more efficient generation reduces other pollution, potentially in densely populated areas, bringing a positive impact on public health. These more efficient power plants yield savings for consumers and these emission reductions from fossil-fuel units help accelerate the pace at which the State moves toward its GHG goals of 40% by 2030 and 85% by 2050.

Carbon Pricing is projected to decrease CO₂ emissions for the electric system of the entire eastern United States in addition to New York State. This is a finding of the Resources for the Future analysis in which the borders between New York and other States were modeled in detail.⁵ It is critical that Carbon Pricing is designed and implemented in a way that does not increase GHG emissions in locations outside of New York; this study confirms that it will decrease emissions elsewhere as designed.

Finally, there will be unknowable changes in innovations and behavior that will reduce emissions. These are made more likely by the higher rewards carbon pricing gives to those who will make them. This is sometimes called the power of the marketplace.

c) CARBON PRICING WILL LOWER THE COST TO THE STATE OF THE CLEAN ENERGY STANDARD

Adding Carbon Pricing to NYS's portfolio of clean energy programs will lower the price paid by New York's electricity consumers to fund the State program. This beneficial effect of Carbon Pricing works in several ways. Perhaps the simplest example is the program run by NYSERDA to stimulate the development of new large-scale renewable generation facilities. NYSERDA uses a competitive bidding process to award 20-year Renewable Energy Credit contracts ("REC contracts") which pay renewable developers a stream of payments that close the gap between the amount of revenues they can expect to get from the wholesale market and the amount of revenues they need to cover the cost of constructing and operating a wind or solar generator. For example, a renewable generator that forecasts that it can get \$50/MWh from the market but needs a total of \$70/MWh to cover its costs, will seek to obtain a REC contract for the difference, \$20/MWh. Now add carbon pricing to the equation. Carbon Pricing boosts the forecast of the wholesale market price to \$65/MWh. The same generator now needs only \$5/MWh in its REC Contract. In this example, Carbon Pricing causes the cost to consumers of funding NYSERDA's REC Contract program to fall from \$20/MWh to \$5/MWh.

Studies of Carbon Pricing have estimated its effect on the future costs incurred by the State's REC contract programs in procuring new renewable generation and on the State's costs for its distributed photovoltaic (PV) programs (e.g. NY-Sun). Three years were studied⁶: 2022, 2025, and 2030. The cost reduction estimates for these programs created by carbon pricing are as follows.

⁵ Resources for the Future, July 2019. [Benefits and Costs of Power Plant Carbon Emissions Pricing in New York – A Dynamic, Simulation-Based Analysis](#), Page 8.

⁶ The Brattle Group, November 30, 2018 (Updated December 21, 2018), [Analysis of a New York Carbon Charge](#), at page 30. In this analysis, annual customer savings are calculated by multiplying the quantity (TWh) by the increased energy revenues (\$/MWh). The second row of the table is used for the REC contract program, the third row of the table is used for the distributed PV program. Calculation method confirmed by communication with the Brattle Group.



Cost Reduction to NYSERDA from Carbon Pricing

	2022	2025	2030
REC Contract Program	\$149 million	\$216 million	\$349 million
Solar PV Program	\$65 million	\$72 million	\$71 million

Similarly, the costs to the State of its ZEC program (payments to keep several nuclear plants running and producing emissions-free power) will go down as the State reduces the ZEC price that it pays to Exelon, the operator of the upstate nuclear plants. Estimates of these savings were more difficult to project and vary more from year to year than do the REC and distributed PV savings. In summary, the direct costs to NYS agencies for implementing the Clean Energy Standard will be significantly reduced as a result of Carbon Pricing. Carbon Pricing will increase the energy market revenues realized by zero-emitting technologies. Thus, internalizing the cost of carbon means the cost of NY-Sun and the Clean Energy Standard to NYSERDA will be reduced.

d) CARBON PRICING WILL ENHANCE THE ECONOMICS OF NEW TRANSMISSION THAT IS ESSENTIAL FOR THE STATE TO MEET ITS RENEWABLE GOALS

New York's success in reaching its renewable goals is seriously jeopardized by the slow pace at which needed transmission additions are getting acknowledged, planned and implemented.⁷ Here too, Carbon Pricing can help. Quantitative analyses of potential transmission expansions tend to ignore the benefit of the reduced emissions and other environmental benefits that a transmission expansion can create. By putting the cost to society of CO₂ emissions right into the wholesale market price, this shortcoming in transmission cost/benefit analysis will be reduced. It is the wholesale prices that are used by the NYISO in quantifying the benefit of transmission additions. For example, a transmission addition that can move an additional 1 million MWh from Upstate (assuming a wholesale price of \$30/MWh) to Downstate (assuming a wholesale price is \$40/MWh) is calculated to have a benefit of \$10 million. Now, consider that with Carbon Pricing, the Upstate wholesale price becomes \$40/MWh and the Downstate price becomes \$55/MWh. Now, the benefit calculation shows that moving the same 1 million MWh from Upstate to Downstate has a benefit of \$15 million. In this way, more transmission proposals will be deemed economic, increasing the likelihood that they will get built, and built in the most cost-effective locations. As is stated in the October 3 report of the Analysis Group, "A carbon price will send price signals to investors, entrepreneurs, and project developers to invest in additional transmission capacity to open up Downstate New Yorkers' access to plentiful and relatively cheap zero carbon/renewable resources in Upstate New York."⁸

IV. Implementing Carbon Pricing: Quick and Cost-Effective

The potential drawback to charging emitters for their emissions is the risk that there would be an increase

⁷ For additional information on this topic, please see [Building Clean Energy in New York: The Case for Transmission Investments](#), Alliance for Clean Energy New York, September 2019.

⁸ Analysis Group, October 3, 2019. [Clean Energy in New York State: The Role and Economic Impacts of a Carbon Price in NYISO's Wholesale Electric Markets](#), Page 3.



in consumer prices. Fortunately, in this case, Carbon Pricing does not yield higher consumer prices of electricity on average. Estimates of the price impacts caused by Carbon Pricing for each of the first ten years of implementation, 2022 to 2031, can be derived from the Brattle Group’s results, as improved by Potomac Economics⁹.

Retail Rate Impact by Year in Dollars per MWh

2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
1.86	1.00	0.14	-0.72	-0.72	-0.72	-0.72	-0.72	-2.64	-2.64

In seven of the ten years, Carbon Pricing lowers retail prices. In three of the ten years, Carbon Pricing raises retail prices. The average effect over the 10-year period is to lower retail prices. All of the numbers, whether positive or negative, are small. This result is obtained despite failing to consider any of the benefits that were very difficult to quantify and were therefore left in an unquantified state. The unquantified benefits can be thought of as a cushion that reinforces the result that consumers will likely benefit.

The most important factor in achieving this negligible impact on consumer prices is that the NYISO’s Carbon Pricing proposal uses 100% of the funds collected from emitting generators to lower consumer prices. As described above, the pollution fees that the NYISO collects will be provided to NY’s wholesale electricity buyers to offset/reduce what they would otherwise pay the NYISO for buying electricity for their customers. This is a design choice in the proposal. The initiative could, for example, use the collected funds for other purposes, such as environmental programs or revenue for general government services. The Regional Greenhouse Gas Initiative (RGGI), an important cap-and-invest program in place in the Northeast and Mid-Atlantic states, collects funds when it sells emission allowances. Many of the member states, including New York, generally spend the funds on relevant and valuable programs, although each year a portion has gone to New York’s General Fund. This means that none of the funds that are collected get used directly for lowering consumer electricity prices, although programs supported by RGGI, like efficiency programs and NY-Sun, do lower consumer electricity bills. As currently envisioned, a central principal in the NYISO’s Carbon Pricing proposal is that the collected funds are returned to consumers¹⁰.

⁹ Using the results from the May 9, 2019 Market Monitoring Unit (MMU) presentation, the annual retail customer rate impacts can be estimated for the first ten years of carbon pricing (all stated in \$ per MWh): Values for the years 2022, 2025, and 2030 are an average of the values labelled “MMU Base” and “MMU Repo” taken from pages 26-28 of the May 9, 2019 MMU presentation. The years between 2022 and 2025 are estimated by interpolation. The estimates for years 2026-2029 were assumed to simply equal the 2025 result. The estimate for 2031 was assumed to equal the 2030 result. The purpose of the calculation was not to obtain precise annual values, but to get a ten-year stream of numbers that could then be summarized on a ten-year average basis. Using a discounted present value approach at a discount rate of 7.5%, the ten-year levelized annual value for the customer retail price effect is a price reduction of \$0.33/MWh. This equals 3.3 hundredths of a cent per KWh.

¹⁰ Another option would be to invest the funds in other initiatives to support NY’s carbon reduction goals, such as renewable energy deployment or energy efficiency. As a related matter, the CLCPA requires that funds expended to implement the law are invested so as to accrue 35-40% of the benefits to disadvantaged communities.



As a mostly clean generator, the New York Power Authority (NYPA) will receive substantial additional revenues under Carbon Pricing. This is a benefit to the State which could become a benefit to consumers if NYPA uses some of the funds to support renewable generation or energy efficiency programs. The Analysis Group estimates the benefit to NYPA for just a single year (2025) in the range of \$326 to \$400 million (in 2019 dollars¹¹). We note that if NYPA chooses to invest these funds in clean energy initiatives, the CLCPA requires that expenditures related to implementing the law are invested so as to accrue 35-40% of the benefits in disadvantaged areas.

One counterintuitive predicted result of Carbon Pricing deserves an explanation. The Brattle study projects that Carbon Pricing will result in only modest reductions in carbon emissions. The fact that the carbon reductions are modest is a direct result of how the analysis was done. Since New York's clean energy goals are now mandates, the Brattle study, and all the other analyses, assume that the State will exactly meet its very ambitious renewable generation goals in every year of the forecast period. This does *not* reflect what has historically happened in New York. Further, for each instance in which the analysis found that Carbon Pricing led to *more* renewable generation being built, the analysis decreased by an exactly offsetting amount the renewable generation that the State would procure by its program. In this way, it shows that Carbon Pricing would reduce the costs to the State for meeting the Clean Energy Standard, rather than that more renewable energy and less carbon emissions would result. Put another way, the analysis assumed that all of the State's renewable energy goals would be achieved without Carbon Pricing and did not attribute any of that achievement to Carbon Pricing.

Another area in which Carbon Pricing may save consumers significant dollars is related to the complicated and uncertain issue of whether the Federal Energy Regulatory Commission (FERC) will apply buyer-side mitigation more broadly to the NYISO capacity market. If FERC took this approach, which is increasingly possible, renewable energy generators would potentially be required to bid into the capacity market under a so-called Minimum Offer Price Rule, or "MOPR." Application of MOPR to projects that sell their RECs to NYSERDA will end up costing New York consumers. A recent report by the NorthBridge Group¹² has estimated that a future decision by the FERC to expand the application of buyer-side mitigation, such as to cover any generator in Upstate New York that sells their RECs to NYSERDA, could raise consumer costs dramatically, but that the implementation of Carbon Pricing would significantly reduce this cost. The NorthBridge analysis estimates that in such a scenario, Carbon Pricing would save consumers \$1.3 billion for the single year 2021. Savings in other years vary, however, approximate aggregate savings between 2021 and 2025 are \$4.4 billion. This potential benefit to consumers was not analyzed by prior studies (Brattle, Potomac, etc.) and is therefore in addition to the estimates of retail rate benefits discussed above. Importantly, the NorthBridge analysis does not presume that Carbon Pricing will change the FERC's future decisions about whether to apply buyers-side mitigation in New York. Rather, it estimates the cost to consumers of a future FERC decision both with and without Carbon Pricing. Consistent with the NorthBridge Group's analysis, the

¹¹ Analysis Group, October 3, 2019. [Clean Energy in New York State: The Role and Economic Impacts of a Carbon Price in NYISO's Wholesale Electric Markets](#), page 56.

¹² The NorthBridge Group, prepared by Aaron T. Paterson, November 2019. [Impact of Carbon Pricing on Potential Expanded Buyer-Side Mitigation in the NYISO Markets](#), Page 7. (This report can be found attached to the [comments of Exelon Corporation](#) in the New York Public Service Commission Case 19-E-0530: Proceeding on Motion of the Commission to Consider Resource Adequacy Matters, Nov 8, 2019).



Analysis Group's report¹³ did not quantify the effects of expanded buyer-side mitigation, but did acknowledge consumer cost impacts "too large to ignore" associated with expanded mitigation measures and Carbon Pricing's ability to stem those corresponding consumer costs.

V. Conclusion & Recommendations

New York State knows from experience how hard it is to achieve aggressive renewable generation goals. Prior goals of 25% by 2012 and 30% by 2015 have not been met. To greatly enhance the chances of achieving the even more aggressive, recently-enacted 70% by 2030 renewable electricity mandate, as well as goals for storage, distributed solar, and transmission investments, New York should employ the help of market price signals that reflect the full social cost of carbon. This innovative approach would set an example for the nation and the world. It would also complement the *Climate Leadership and Community Protection Act* and increase the chances that NY's ambitious goals will be met by harnessing market forces. Taking this approach is more efficient than relying solely on State programs to counteract the flawed price signals of a wholesale market that fails to reflect the cost to society of carbon pollution, and it will significantly lower the costs otherwise paid by state agencies to achieve these goals.

Were the implementation of Carbon Pricing to come at a large cost to consumers, there may be justification for pause in such a decision. But in this case, due to the circumstances of New York, and the powerful effect of flowing 100% of the carbon charge receipts back to consumers, there is estimated to be a benefit to consumers over the study period. It is time for New York to continue its excellent record of innovative leadership in energy and environmental policy by supporting Carbon Pricing for New York's wholesale electricity market.

¹³ Analysis Group, Susan F. Tierney and Paul J. Hibbard, October 3, 2019. [Clean Energy in New York State: The Role and Economic Impacts of a Carbon Price in NYISO's Wholesale Electricity Markets](#), Page 43.