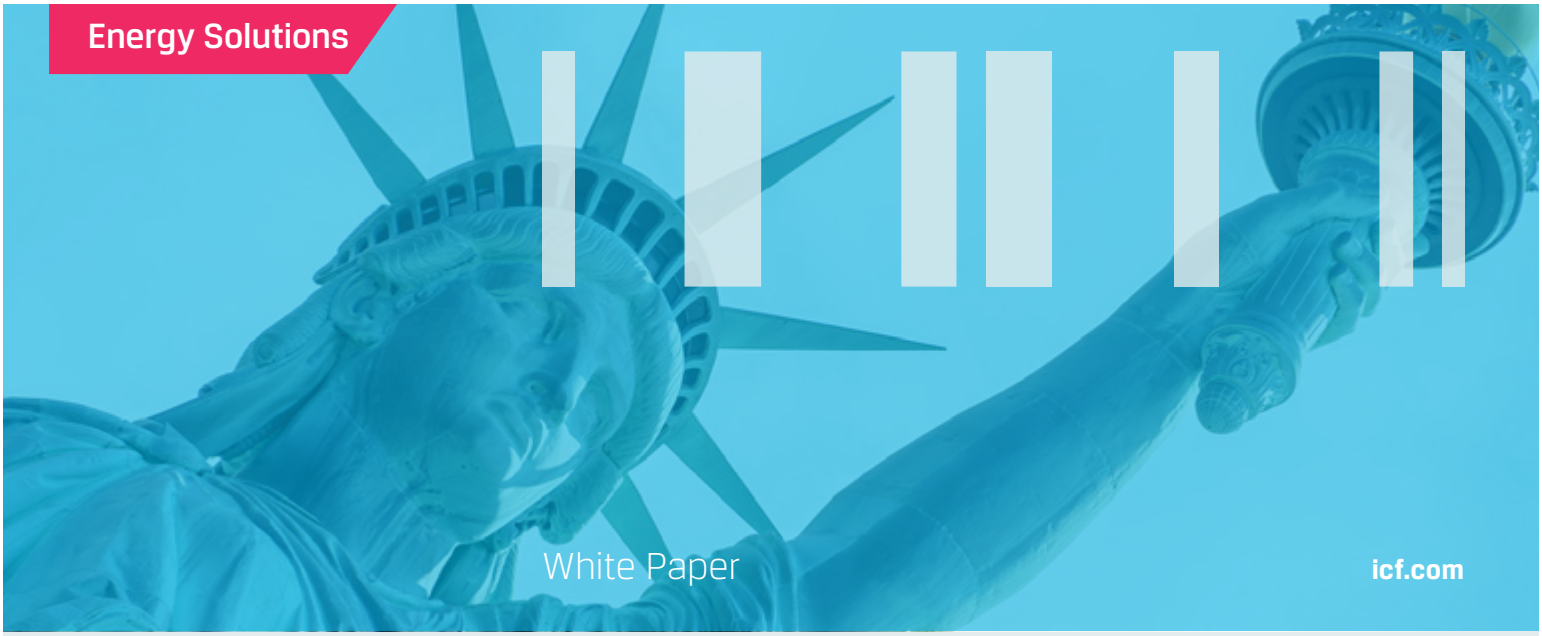


Carbon Premium: **Generator Impacts of New York's Carbon Pricing Proposal**

By Joseph Coscia, Dan Jerke, ICF

Shareables

- A Carbon Pricing Proposal for $50/ton could increase New York wholesale power prices by 50-75% in 2022.
- Projected prices would be above or near the levelized cost of electricity for wind and solar under the proposal prior to phaseout of the federal ITC and PTC.
- Energy margins of efficient gas generators could increase by up to $30/kW-year, potentially encouraging combined cycle repowerings and other low-carbon generation strategies.

Executive Summary

In April 2018, the joint task force of the New York ISO (NYISO) and NY Department of Public Service (DPS) released a straw 'Carbon Pricing Proposal' to incorporate the full social cost of carbon dioxide emissions into the wholesale markets administered by the NYISO.A final draft of the proposal was released by the NYISO on December 7, 2018. The Carbon Pricing Proposal intends to harmonize operation of the wholesale power market with the state's target of 50 percent of electricity generation from renewable sources by 2030. An initial carbon charge of $50/ton has been proposed—a value large enough to have a major impact on NYISO market dynamics. Renewables, nuclear, and efficient thermal generators would see significant upside from this proposal. As a result, the proposal would likely provide a boost to new investment in NYISO, including renewables as well as CCGTs.

New York's Carbon Pricing Proposal

Key elements of the proposal include an emissions-based carbon charge to be reflected in the energy market bids of all generators, the re-allocation of carbon fees collected from generators to load-serving entities, and charges on external transactions to avoid distorting imports and exports from NYISO. The proposed carbon charge is estimated at $50/ton less Regional Greenhouse Gas Initiative prices in 2022, based on the Social Cost of Carbon determined by the NYS Public Service Commission.[1]

1 NYISO, "IPPTF Carbon Pricing Draft Proposal," prepared for the Integrating Public Policy Task Force, December 7, 2018 available online.

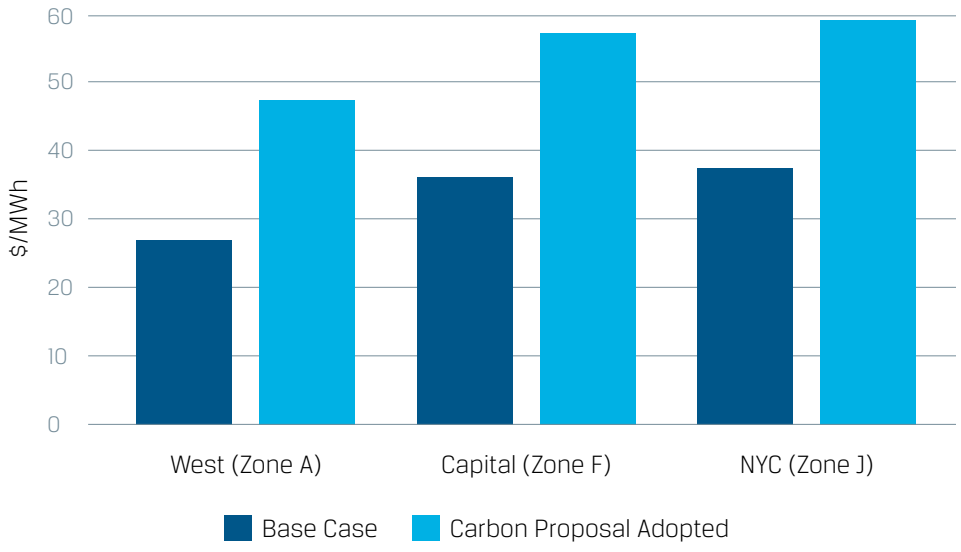
Compared to the existing RGGI allowance program, whose price has never exceeded $5-6/ton on an annual basis, this proposal represents a major change to the NYISO market and the largest explicit price on carbon dioxide emissions in any U.S. market. While the fate of the proposal remains unclear and it faces hurdles to adoption and implementation, the possibility of its realization has implications for the economics of each asset in the NYISO market.

Wholesale price impacts

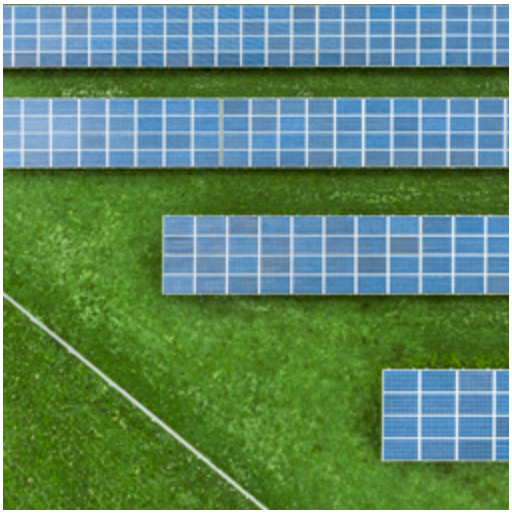
ICF used ABB PROMOD production cost modeling software to simulate security-constrained economic dispatch in the NYISO market for all hours of the year 2022 (the first full year that implementation of the proposal is possible) for a base case reflecting present trends without adoption of the carbon charge and an alternate case in which the full Social Cost of Carbon of $50/ton (before netting out RGGI allowance prices) was implemented. The energy margin, defined as energy market revenues minus variable costs, was calculated for each generator to examine the asset-specific impacts of the proposed carbon price.

Figure 1 shows annual average energy price results for a selection of NYISO zones in 2022 with and without adoption of the Carbon Pricing Proposal. The base case reflects existing trends including fuel prices based on traded forwards as of October 2018. Adoption of the carbon price increases average energy prices by approximately $21/MWh on average across all zones, representing an increase of 50% to 75%. This substantial increase would immediately transform NYISO into the highest-priced wholesale power market in the U.S. It is important to note that the resulting impact on retail prices is expected to be mitigated by the re-allocation of generators' carbon costs to load and the reduction of out-of-market payments linked to energy market prices.

FIGURE 1: ENERGY PRICE INCREASES IN NYISO ZONES A, F, AND J



Source: ICF

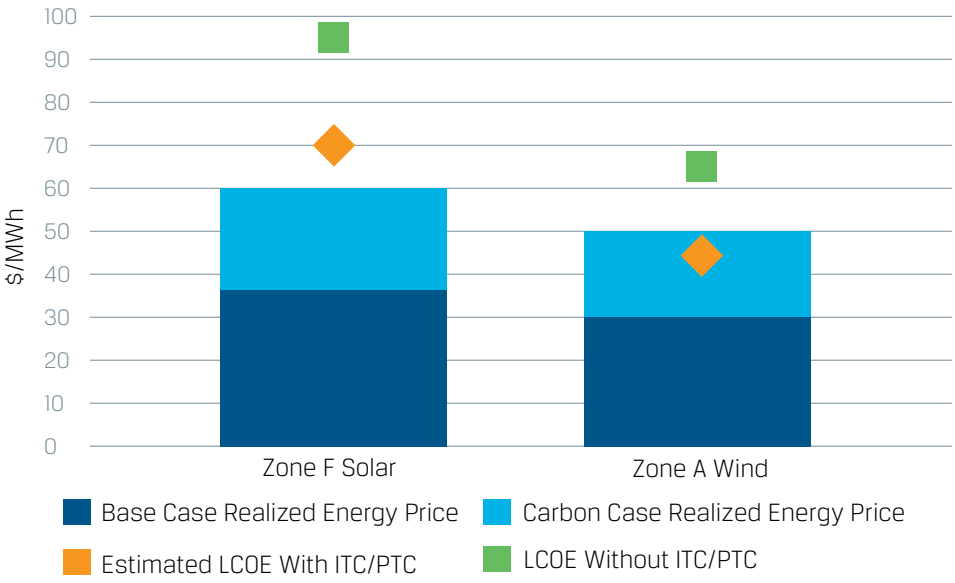


A brighter outlook for renewables

The proposal would directly increase the revenues of renewable generators by raising the market energy price. New York's existing hydropower facilities, which currently supply over 20% of NYISO generation, are the largest immediate beneficiaries and stand to realize the full value of the carbon pricing impact on a large volume of sales. Central to existing state goals and to the long-term market impact, however, is the extent to which the proposal promotes the development of new renewable resources.

Figure 2 shows the impact of the carbon charge on the projected annual realized energy prices in 2022 of two hypothetical utility-scale assets – a solar farm in the Capital (Zone F) region and a wind farm in the West (Zone A) region – alongside the estimated levelized cost of energy for each. For both wind and solar, the projected price is significantly below the resource's levelized cost without a carbon charge, but is near or above the levelized cost if the Carbon Pricing Proposal is adopted. The expected impact on realized price is higher for solar than for wind, due to the larger portion of solar generation that occurs during on-peak hours when the carbon impact is expected to be largest.

FIGURE 2: REALIZED PRICES VERSUS LEVELIZED COSTS



Source: ICF

In combination with capacity market payments, energy market revenues following implementation of the Carbon Pricing Proposal make investment in new wind and solar appear competitive prior to the final phaseout of the federal investment and production tax credits (ITC/PTC). However, new wind and solar in New York coming online following the phaseout of the ITC/PTC are likely to continue to rely on state support via Renewable Energy Credits (RECs) unless a comparable federal subsidy is extended. As a result, the pace of state-driven procurements is likely to continue to determine renewable deployment as the ITC/PTC expiration leaves renewable levelized costs in New York above market prices, even with explicit Social Cost of Carbon accounting in the market.

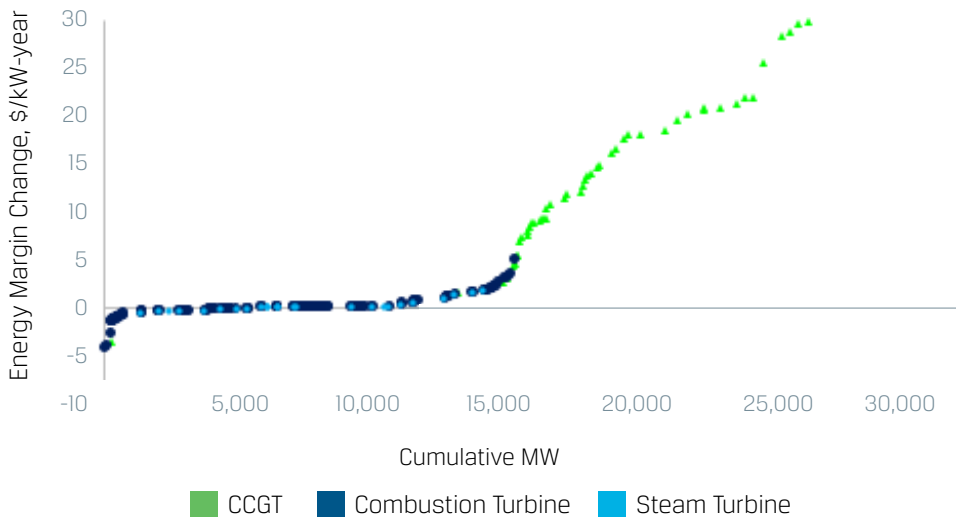
Implications for thermal plants

Among non-renewable generators, the chief beneficiaries of the Carbon Pricing Proposal are the state's existing nuclear power plants. While the additional proceeds to these resources will be offset by a decline in Zero Emissions Credit (ZEC) payments indexed to energy prices, the formula for calculating ZEC payments (in which only energy and capacity prices exceeding $39/MWh are subtracted) suggests that the gap between current prices and the $39 threshold will be realized as additional revenue by the plants. Moreover, the presence of a large carbon price after expiration of the ZEC contracts in 2029 could encourage some of the facilities to seek to extend their 60-year operating licenses and remain online.

Efficient fossil generators are also likely to benefit from the Carbon Pricing Proposal via an increase in the energy market price exceeding their own carbon costs. Because virtually all remaining fossil generation in NYISO is gas-fired, the energy margins of most generators stand to benefit from a carbon charge.

Figure 3 shows the projected change in energy margin for all fossil generating units in NYISO in 2022 with implementation of the Carbon Pricing Proposal relative to the base case. For nearly all gas generators in NYISO, the immediate expected impact of the carbon charge is a neutral or positive change in energy margin, ranging between $0 and $30/kW-year.

FIGURE 3: ENERGY MARGIN CHANGE FOR FOSSIL GENERATORS UNDER PROPOSAL



Source: ICF

The largest beneficiaries are combined cycle gas turbine (CCGT) plants with low heat rates and high utilization. The gap between market price and production costs widens the most for these assets. Plants which have low utilization today or are only marginally profitable when dispatched—including most steam turbine and combustion turbine units – are expected to earn a smaller or negligible surplus from the carbon charge. Inclusion of the Carbon Pricing Proposal had a small impact on the capacity factors of most generators, indicating that the merit order of gas-fired generators was largely preserved. Exceptions included

a reduction in utilization of plants with relatively more attractive fuel prices but higher heat rates (located primarily upstate) and an increase in capacity factor of plants with lower heat rates but relatively less competitive fuel prices (located primarily in the Capital zone).

The carbon premium – a positive signal for new investment

The sizeable potential increase in energy market margins of many assets across NYISO indicates that the immediate impact of the Carbon Pricing Proposal would be to embed a significant carbon premium into the market. The expected presence of a lucrative premium not just for renewable and nuclear facilities, but for a large portion of the thermal generating fleet as well, reflects the divide between the efficiency of the marginal price-setting unit and that of in-the-money generators in NYISO's existing fleet. The carbon premium therefore emerges from the efficiency gap associated with relatively high heat rates of the existing NYISO fleet, creating a market opportunity for the entry of more efficient resources if the proposal is adopted.

Multiple potential candidates for new entry may appear attractive. The direct price impact of the carbon charge would substantially improve the merchant revenues of wind and solar resources in New York, reducing (and perhaps, in some cases, eliminating) the RECs required to support investment. The reduced role of explicit subsidies in the revenues of new renewables could ease the state's procurement of large quantities to meet its public policy goals, as appears to be the intention of the Carbon Pricing Proposal. Furthermore, because the carbon premium will be highest during peak hours when the least efficient plants determine the energy price, carbon pricing is likely to improve the viability of battery energy storage systems paired with renewable generators, which could realize the full value of the peak hour carbon premium by acting as emissions-free generation in those hours.

In addition to renewables, and particularly if the state's highly ambitious renewable targets are delayed or not achieved, the carbon premium is likely to encourage turnover of the thermal generation fleet in the direction of increased efficiency. Repowering existing mothballed or inefficient assets—which cannot take advantage of the carbon premium due to their low utilization—with efficient combined cycle equipment may prove to be an attractive opportunity. Several generation owners in NYISO have existing queue positions to pursue such projects, which would be bolstered by the presence of a carbon premium. The Department of Environmental Conservation's imposition of more stringent NOx restrictions on downstate sources will catalyze the value proposition of repowering even further. The draft NOx rule from the DEC has yet to be finalized.

As the energy market effects of the Carbon Pricing Proposal are felt, the impact on prices in the NYISO capacity market is likely to be negative. If the carbon premium encourages investment in new generation, capacity prices for existing assets will decline to reflect an excess of supply. Additionally, higher energy margins will tend to reduce the net cost of new entry (net CONE) used by the NYISO in its demand curve reference point, resulting in slightly lower capacity prices at any level of supply. As a result, the Carbon Pricing Proposal could accelerate the retirement of older, inefficient combustion turbine and steam turbine generators in NYISO, due to these plants' dependency on capacity revenues.

Potential for major changes exists

At the time of writing, prospects for the adoption of the Carbon Pricing Proposal are unclear. NYISO stakeholders ranked carbon pricing as the second-highest priority for projects to undertake in 2019.

The NYISO is expected to finalize its proposal in early 2019, and it may proceed to a vote in the committee process. Stakeholder opposition to the proposal is expected, and if filed at FERC, challenges at FERC are foreseeable given the far-reaching market and asset impacts of the proposal. The complexity of implementing the proposal, including the re-allocation of carbon costs to load-serving entities and the determination of charges at external NYISO interfaces, also poses a major challenge. Nonetheless, the proposal process reflects the culmination of NYISO's efforts since 2016 to synchronize market mechanics with the state's Clean Energy Standard goals and a continuation of the trend in New York State commitments towards reducing energy sector carbon dioxide emissions. As a result, adoption of a form of the carbon pricing proposal is a possible outcome, although delays beyond the presently envisioned timeline and alteration of the proposal should be expected. The need for finality will mount in 2019 as there is a growing need to resolve the related market uncertainty and to clear the way for FERC to act on two critical mitigation dockets.

The implications of the policy—a short-term boost in energy margins for many resources and a long-term shakeup of the generation sector—should factor into the planning and outlook of any investor considering the NYISO market.

About the authors

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Prior to joining ICF, Mr. Jerke spent five years with the New York Independent System Operator, where he led the implementation of market power mitigation rules, presented market design proposals, and served as an expert witness before FERC. Mr. Jerke holds a B.S. degree with dual majors in Applied Economics and Natural Resources from Cornell University and an M.S. degree in Financial Engineering and Risk Analytics from the Rensselaer Polytechnic Institute.

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