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Potential New Carbon Pricing in NYISO Markets: Supplemental Analysis of Future Economic Impacts

Update for NYISO Stakeholders – Partial Preliminary Results

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Analysis Group

June 24, 2019

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Agenda for today's update for stakeholders

- **Update on the revised scope of the study and report outline**
- **Partial preliminary results**
- **Next steps**

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Revised study scope and outline of the report

Analysis Group's review of potential economic impacts of NYISO's carbon-pricing proposal

Recap of process

- **NYISO engaged Analysis Group to examine potential economic impacts of the proposed carbon-pricing mechanism for NY's wholesale power markets**
  - Building off of and augmenting information in the December 2018 Brattle Group ("Brattle") analyses
  - Examining other impacts not addressed in the Brattle analyses
- **Tierney and Hibbard met with Market Issues Working Group on March 28th and April 23rd, 2019**
  - Overview of the initial scope of work for the supplemental study
  - Questions and feedback from stakeholders (including after the meeting)
- **Subsequent Analysis Group review of data, issues, feedback**
  - NYISO extension of the timeline for Analysis Group's work, to accommodate information from the new Potomac Economics ("Potomac") study re: technical enhancements of the Brattle report and repowering estimates
  - Further revision of the Analysis Group study scope, based on deeper dive into the data and feedback from stakeholders

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The revised scope of the Analysis Group study

Reflecting feedback from stakeholders and deeper dive into the data and issues

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Currently anticipated premises of the Analysis Group report

REFLECTING DEEPER UNDERSTANDING OF THE AVAILABLE INFORMATION

- **Design of a carbon pricing mechanism:**
  - The analysis assumes the design of the carbon pricing mechanism as described in NYISO's 12-7-2018 discussion draft
- **New York's public policies:**
  - The analysis attempts to take into account NY's public policies and goals for clean energy and wholesale power markets, as well as recent power-sector goals of other key stakeholders (e.g., NYC)
  - The report will not advocate for any particular changes that might occur in NY's electricity markets, system, economy, policies; rather it will take a "what if" type of approach
- **Quantification of retail customer bill impacts from a carbon price:**
  - The report will reflect various modeling results performed by Brattle and Potomac
  - The report will not attempt to quantify the trajectory of customers' retail rates, nor the impact on customers' overall electricity bills
- **Quantification of macroeconomic impacts of a carbon price:**
  - The report will not systematically quantify such impacts, due to limited availability of balanced information about relevant variables

✓ Preliminary results discussed today

Revised outline of the Analysis Group report

WHAT OUR REPORT IS ABOUT

- **Background**: Origins and design of the NYISO carbon-pricing proposal
- **Context**: NYS's public policies, structure and regulation of the wholesale market, electric-system topology
- **Role of a carbon price** (with other key NY policies) in support of the state's efficient clean-energy transition ✓
- **Potential implications for**:
  - Reducing the risk of buyer-side mitigation in NYISO markets
  - Improving power-production efficiencies, lowering fossil fuel use, air emissions, and public health costs ✓
  - Electricity costs in New York state
- **Summary of impacts**

Technical appendix (data, sources, assumptions, and methods)

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Partial preliminary results

Overview

Key points in today's presentation

PARTIAL RESULTS AND OBSERVATIONS

- **Even with progress toward its clean-energy goals, NY's power system will need to see entry of significant quantities of renewable and zero-carbon resources over the next two decades.**
  - New York is on the eve of enacting the New York Climate and Clean Communities Act, with aggressive carbon-reduction requirements in the power sector and beyond.
  - In recent years, the state's preference has been to accomplish these goals through RPS and CES competitive procurements of and contracts for RPS and CES resources.
  - Pursuing all new entry of such resources would substantially increase reliance on out-of-market contracts.
  - A carbon pricing mechanism could stimulate entry based on wholesale price signals and reduce risks associated with increasing quantities of supply under long-term contracts in FERC-regulated wholesale markets.
  - Assuming that under the new economy-wide carbon reduction requirements New York will need to rely more on the power sector to lower carbon emissions from the entire economy, then the state will need to adopt even more clean-energy resources in the power system—and a carbon price in the NYISO market will help accomplish these more-aggressive targets in ways as efficiently as possible.

Key points in today's presentation

PARTIAL RESULTS AND OBSERVATIONS

- **The Brattle and Potomac analyses indicate a range of carbon-pricing impacts: with greater operations and potential entry of more efficient, lower-emitting generation.**
  - Even with both analyses having included all of NY's new clean-energy resources needed to meet the state's goals (as they existed as of 2017, these analyses point to power-production efficiency improvements, lower emissions (in environmental justice communities in particular), public health improvements, and reduction in overall use of natural gas.
- **Not presented today:**
  - Impacts on reducing the risk of buyer-side mitigation in NYISO markets or on electricity costs in New York state.

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Potential role of a carbon price in NY's clean-energy transition

Interactions with the NY's preferred policy instruments to date

Context for considering a carbon price in NYISO markets

A ROLE IN SUPPORTING THE STATE'S CLEAN-ENERGY TRANSITION AS EFFICIENTLY AS POSSIBLE

- **Demonstrated policy preferences for the efficient performance and clean-energy transition of NY's electric system**
  - NY PSC's support for competition—where possible—in the state's retail and wholesale markets (e.g., REV, choice)
  - NY PSC's CES with NYSERDA competitive procurements of RECs and ZECs from targeted technologies
  - FERC support for competition in the NYISO's wholesale markets, and to accommodate state policies where possible
- **Aspirational policy transitions for the state's electric system**
  - REV goals for customer choice, diverse distributed energy resources, markets, affordable power supply
  - "Beneficial electrification" (e.g., transitioning to electric vehicles, electrification of building energy use)
  - Overall goals for the power sector as reflected in the upcoming New York Climate and Community Protection Act
    - 70% reliance on renewables by 2030, 100% reliance on zero-emitting resources by 2040
    - Technology-specific targets (e.g., storage, offshore wind)

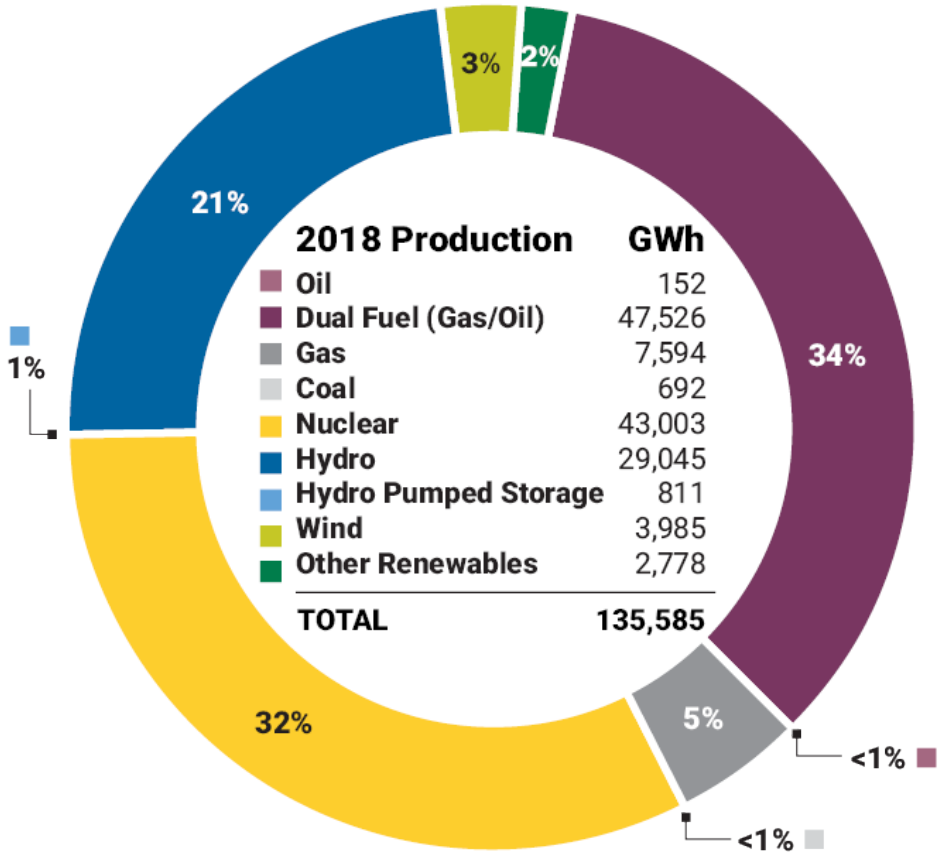
The status quo: Benchmarking NYISO's current renewables portfolio

UTILITY-SCALE RENEWABLES

- **2018 renewables generation: 26%**
  - Hydro = 21%
  - Wind = 3%
  - Other renewables = 2%

To meet its 2030 goal of 70% renewables, NYS will have just over a decade to add new renewable resources sufficient to produce 3 times the amount produced by hydro, wind, solar, and other resources in 2018. (Most of 2018 renewable output was from large hydro).* This is based on the Gold Book's Baseline forecast.

A high electrification scenario would mean an even-higher increase in renewables generation by 2030.



NYISO, Power Trends 2019

Entry of renewable resources to meet the Climate & Community Protection Act

SCALING UP OF UTILITY-SCALE RENEWABLES OVER THE NEXT DECADE

- **If NYS needs to triple the output from renewables over the next decade, how does that compare to what NYS has experienced over the last decade, and how could a carbon price support entry of renewables into NYS's markets?**

	% of NYISO Resources (Share of Business-as-Usual generation)		
	2009	2018	2030
Hydro	19% (4,236 MW)	21% (4,252 MW)	Will add the 2017, 2018, 2019 CES and 2018 offshore wind contracts (together totaling approximately 5,000 MW). GND Targets would double wind and solar, and ramp up offshore wind to 9,000 MW by 2035
Wind	1% (77 MW)	3% (1,739 MW)	
Other (incl. utility-scale solar)	2% (408 MW)	2% (382 MW)	
Total	22% (4,721 MW)	26% (6,373 MW)	70%

The 2030 renewables target will require substantially more incremental resources beyond those already under contract, or anticipated by upcoming solicitations.

A price on carbon in NYISO markets, based on the Social Cost of Carbon, could provide a relatively stable price signal for investors in clean energy resources, supporting an efficient transition, and reducing NYS's need to rely on out-of-market contracts to facilitate entry of renewables.

NYSERDA procurements of renewable attributes to date:

- **Over 11 RPS "Main Tier" solicitations, NYSERDA contracted with 2,241 MW of new renewable capacity (1/2005 - 5/2016).**
- **Over 2 CES solicitations in 2017 and 2018, NYSERDA contracted for an additional 2,748 MW of onshore wind (1,040 MW), utility-scale solar (1,687 MW), and hydro (3 MW), to be operational by 2023. A third CES solicitation (2019) is underway. A 2018 solicitation for 800 MW of offshore wind is awaiting final awards and contracts.**

NYISO, Power Trends 2010 and 2019; NYISO Gold Book, 2009 and 2010; NYSERDA, https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Standard/Renewable-Portfolio-Standard;

The status quo: Benchmarking NYISO's current non-emitting resources

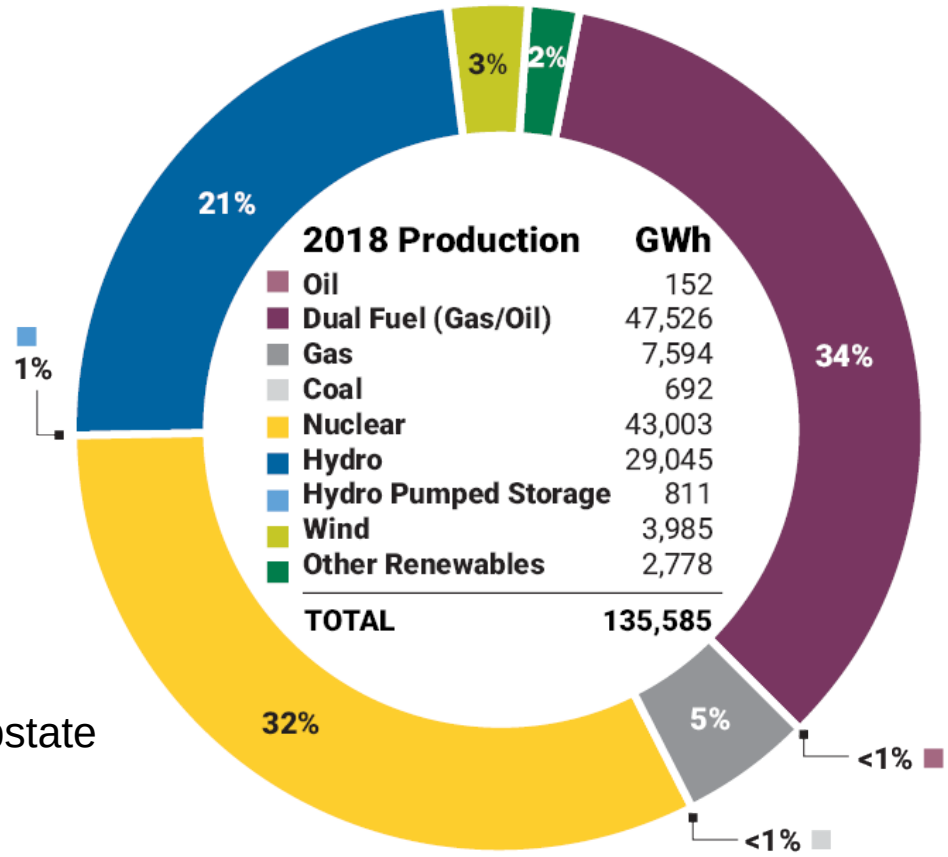
ZERO-CARBON RESOURCES

- **2018 clean (zero-carbon) generation: 58%**
  - Nuclear = 32%
  - Hydro = 21%
  - Wind = 3%
  - Other renewables = 2%

To meet its goal of 100% power-sector clean energy by 2040, NYS will need to take significant steps to add and/or retain zero-carbon resources over the next two decades.

This is the case with a Gold Book (a "business as usual" forecast of demand), and is even more so with a high electrification scenario.

Post-2029 zero-carbon supply will be particularly challenging if/when upstate nuclear units close.



NYISO, Power Trends 2019

Entry and retention of zero carbon-emitting resources

SCALING UP OF CLEAN-ENERGY RESOURCES BEYOND 2030

- **If NYS needs to triple the output from renewables over the next decade and fully decarbonize the power sector by 2040, how could a carbon price support entry of renewables into NYS's markets?**

	% of NYISO Resources (Share of Business-as-Usual generation)			
	2009	**2018**	**2030**	**2040**
Nuclear	**32% (5,264 MW)**	**27% (5,402 MW)**	**11% (2,133 MW)**	**6% (1,288 MW)**
Hydro	**19% (4,236 MW)**	**21% (4,252 MW)**	**70% (assumed)**	**94% (implied)**
Wind	**1% (77 MW)**	**3% (1,739 MW)**		
Other (incl. utility-scale solar)	**2% (408 MW)**	**2% (382 MW)**		
Total	**54% (9,985 MW)**	**53% (11,775 MW)**	**81%**	**100%**

Replacing zero-carbon output of NY's nuclear units will require substantially more incremental resources beyond those already under contract, or anticipated by upcoming solicitations.

A price on carbon in NYISO markets, based on the Social Cost of Carbon, could provide a relatively stable price signal for investors in clean energy resources, supporting an efficient transition with through location-specific price signals, encouraging retention of zero-carbon resources through market-based mechanisms, and reducing NYS's need to rely on out-of-market contracts to facilitate entry of renewables.

- **Only Fitz and NMP2 have operating licenses beyond 2029; only NMP2 is licensed beyond 2040.**

NYISO, Power Trends 2010 and 2019; NYISO Gold Book, 2009 and 2010; NYSERDA, https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Standard/Renewable-Portfolio-Standard;

Potential impacts of a carbon price in NYISO electric markets

POTENTIAL ROLE OF A CARBON PRICE IN SUPPORTING AN EFFICIENT CLEAN-ENERGY TRANSITION

- **In a scenario in which there were no NYISO carbon price and NYS were to rely solely on a procurement-and-contracting model in order to meet all of its clean-energy goals, an increasing—and arguably unsustainable—portion of the NYISO market would be under NYSERDA contracts:**
  - Currently, REC+ZEC contracts make up approximately 20% of generation.
  - By 2030, if all new renewables entered the market with long-term REC contracts (in addition to those already under contract) and if ZEC contracts were extended for Fitz and NMP2 beyond 2029, roughly 50%-60% of supply would be under contract.
- **By contrast, a NYISO carbon price could provide forward wholesale-market revenue visibility for investing in clean-energy resources.**
  - A carbon price could provide incentives for owners of upstate nuclear units to make investments to keep those units operating for as long as possible, postponing the need to replace their high-capacity-factor output with resources requiring some combination of clean energy resources with high capital investments.
  - Given lenders' focus on electric-market revenue streams and their reticence to finance the value of renewable projects' REC attributes without a long-term REC contract, electric-market revenues reflecting a price on carbon would enable more large-scale renewables to gain financing and enter the market without a REC contract.

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Impacts on power-production efficiency and related outcomes

Emissions, public health, and natural-gas usage

Potential impacts on a NYISO carbon price on local air pollution

CHANGES IN NO_X EMISSIONS BY ZONE (BASED ON BRATTLE AND POTOMAC ANALYSES)

Brattle (12/2018)

NOx emissions by zone…

		NO_x 2022 (Tons)	2025 (Tons)	2030 (Tons)
WEST	A	108	-31	-39
GENESEE	B	44	12	0
CENTRAL	C	84	-6	-43
NORTH	D	-2	-2	-2
MOHAWKVA	E	1	0	0
CAPITAL	F	26	-7	-14
HUDSONVA	G	-131	-121	8
MILLWOOD	H	0	0	-4
DUNWOODI	I	0	0	0
NYCITY	J	-518	-333	-335
LONGISLA	K	-52	10	18
	Total	**-439**	**-479**	**-410**

…with lower emissions occurring in NYC Environmental Justice Communities:

		2022 (Tons)	2025 (Tons)	2030 (Tons)
WEST	A	58	0	-1
GENESEE	B	0	0	0
CENTRAL	C	0	-8	-4
NORTH	D	0	0	0
MOHAWKVA	E	0	0	0
CAPITAL	F	0	0	0
HUDSONVA	G	0	0	0
MILLWOOD	H	0	0	0
DUNWOODI	I	0	0	0
NYCITY	J	-266	-137	-179
LONGISLA	K	-14	-18	-2
Total Zone J Adjacent [2]		-124	-85	-163
	Total	**-346**	**-248**	**-349**

Potomac (5/2019)

With repowering, NOx emissions by zone…

		NO_x 2022 (Tons)	2025 (Tons)	2030 (Tons)
WEST	A	107	-42	-80
GENESEE	B	43	8	-11
CENTRAL	C	53	-12	-85
NORTH	D	-1	-1	-8
MOHAWKVA	E	0	-3	-4
CAPITAL	F	16	-9	-22
HUDSONVA	G	-138	-93	-10
MILLWOOD	H	0	3	4
DUNWOODI	I	0	0	0
NYCITY	J	-615	-364	-334
LONGISLA	K	-85	-11	20
	Total	**-620**	**-525**	**-530**

…with lower emissions occurring in NYC Environmental Justice Communities)

		2022 (Tons)	2025 (Tons)	2030 (Tons)
WEST	A	61	0	0
GENESEE	B	0	0	0
CENTRAL	C	0	0	0
NORTH	D	0	0	0
MOHAWKVA	E	0	0	0
CAPITAL	F	0	0	0
HUDSONVA	G	0	0	0
MILLWOOD	H	0	0	0
DUNWOODI	I	0	0	0
NYCITY	J	-234	-156	-188
LONGISLA	K	-14	-13	-3
Total Zone J Adjacent [1]		-135	-101	-160
Repowered Generics [3]		70	67	58
	Total	**-252**	**-203**	**-293**

Potential impacts on a carbon price on local air pollution

CHANGES IN NO_X EMISSIONS IN OZONE NON-ATTAINMENT MONTHS (BASED ON BRATTLE ANALYSES)

Brattle (12/2018)

Statewide, NOx emissions are lower during the months when non-attainment days tend to occur.

Month	Nonattainment Days Occur in the Month?	NO_x 2022 Delta (Tons)	NO_x 2025 Delta (Tons)	NO_x 2030 Delta (Tons)
1		-1.72	-3.02	-91.22
2		-28.16	-13.67	15.53
3		-23.79	-6.33	66.33
4		-26.82	-32.96	55.40
5	Yes	-24.40	-75.30	-25.19
6	Yes	-39.58	-72.97	-54.93
7	Yes	-82.68	-53.42	-80.56
8	Yes	-90.08	-53.08	-61.08
9	Yes	-70.99	-69.32	-65.87
10		-57.71	-68.37	-145.07
11		15.09	-8.77	14.76
12		-8.11	-21.87	-37.80
Total		**-439**	**-479**	**-410**

Potential impacts on a carbon price on local air pollution

PUBLIC HEALTH IMPACTS RESULT FROM LOWER NO_X & SO_X EMISSIONS, AND RELATED PM2.5 (BASED ON BRATTLE ANALYSIS)

Brattle (12/2018)

Statewide impacts

Results for 2022 reflect changes in emissions between the simple baseline case and the simple carbon case.
Results for 2025 reflect changes between the simple baseline case (D2) and simple carbon case (D3).
Results for 2030 reflect changes between the simple baseline case (D5) and a carbon case, including all dynamic adjustments.

	2022		2025		2030	
	Incidence	Valuation	Incidence	Valuation	Incidence	Valuation
Hospital Admits, Asthma	0.000	-$1	0.001	$20	0.000	$6
Hospital Admits, All Respiratory	-0.001	-$22	0.011	$336	0.004	$119
Hospital Admits, Chronic Lung Disease	0.000	-$4	0.003	$61	0.001	$18
Hospital Admits, All Cardiovascular	-0.001	-$38	0.015	$561	0.005	$189
Acute Bronchitis	-0.004	-$2	0.076	$36	0.025	$12
ER Visits, Asthma	-0.001	$0	0.032	$13	0.010	$4
Mortality (low estimate)	-0.006	-$53,437	0.070	$649,217	0.024	$226,398
Mortality (high estimate)	-0.013	-$120,862	0.158	$1,468,633	0.055	$511,722
Infant Mortality	0.000	-$237	0.000	$2,827	0.000	$874
Asthma Exacerbation	-0.111	-$6	1.912	$109	0.619	$35
Work Loss Days	-0.428	-$56	6.977	$1,149	2.139	$356
Minor Restricted Activity Days	-2.572	-$174	41.329	$2,796	12.643	$855
Upper Respiratory Symptoms	-0.079	-$3	1.370	$45	0.453	$15
Lower Respiratory Symptoms	-0.056	-$1	0.963	$20	0.317	$7
Acute Myocardial Infarction, Nonfatal (low estimate)	-0.001	-$70	0.006	$746	0.002	$244
Acute Myocardial Infarction, Nonfatal (high estimate)	-0.005	-$654	0.057	$6,936	0.019	$2,264
Total (low estimate)	**-3.260**	**-$54,051**	**52.764**	**$657,938**	**16.242**	**$229,132**
Total (high estimate)	**-3.272**	**-$122,060**	**52.903**	**$1,483,544**	**16.290**	**$516,476**

Potential impacts on a carbon price on local air pollution

CHANGES IN CO_2 EMISSIONS (2030), REFLECTING BRATTLE AND POTOMAC ANALYSES

Brattle (12/2018)

Compared to the simple base case (which assumes that all clean-energy commitments as of 2017 are already in place in future years), the carbon price results in 7% lower CO_2 emissions in 2030 (a statewide reduction of 1.5 million tons reduction), after taking into account the effect of the combined dynamic changes.

Potomac Study (Repowering) (5/2019)

Compared to Potomac's base case, adding a carbon price results in 8% lower CO_2 emissions in 2030 (a statewide reduction of over 1.5 million tons reduction).

Potential impacts on use of fossil fuels in New York's power sector

CHANGING CONSUMPTION OF CARBON-INTENSIVE FOSSIL FUELS

- The Brattle analyses indicate that a carbon price would help to lower use of natural gas in the state's power system, especially in Downstate zones.

Impact of Carbon Price on Natural Gas Consumption in the Power Sector				
		2022	**2025**	**2030**
Brattle Study*	Statewide	-2.8%	-2.5%	-7.6%
	Zone J	*-7.0%*	*-4.3%*	*-9.7%*

The Brattle figures reflect changes in natural gas use in the following cases:
- 2022: simple baseline case and the simple carbon case.
- 2025: simple baseline case (D2) and simple carbon case (D3)
- 2030: simple baseline case (D5) and a carbon case, including all dynamic adjustments.

Next steps

- Analysis Group to consider today's feedback and complete final analysis
- Following
  - Review final results with NYISO staff
  - Review final results with Market Participants and Stakeholders
  - NYISO posting of Analysis Group's Technical Report
  - NYISO posting of Analysis Group's Summary for Policy Makers

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