Pricing Carbon into NYISO's Wholesale Energy Market

Study Overview and Summary of Findings

PRESENTED TO

NYISO Business Issues Committee

PREPARED BY

Sam Newell
Roger Lueken
Tony Lee

September 12, 2017

THE Brattle GROUP

Agenda for Today's Presentation

- Study Purpose and Context
- Estimated Impacts of Carbon Pricing
  - Emissions
  - Economic Efficiency
  - Customer Costs
- Market Design Issues to Resolve

Study Purpose

NYISO commissioned The Brattle Group to explore whether and how New York State environmental policies could be pursued through the existing wholesale market structure.

- The study's purpose is two-fold:
  - Assess market design options for carbon pricing
  - Estimate how carbon pricing would affect market outcomes
- DPS and NYSERDA provided comments on methodology and accuracy of presentation
- This is the first step in a process involving NYISO, DPS, and stakeholders

New York has Goals, Mandates, and Mechanisms to Substantially Reduce CO_2 Emissions

State Energy Plan

- Reduce economy-wide greenhouse gas emissions 40% by 2030 and 80% by 2050, relative to 1990 levels
- 50% of electricity from renewables by 2030

Clean Energy Standard

- Renewable Energy Credits (RECs)
- Zero-Emission Credits (ZECs)

Numerous other policies

- Participation in the Regional Greenhouse Gas Initiative (RGGI)
- Reforming the Energy Vision
- Energy efficiency standards
- Governor’s proposal to eliminate coal-fired generation by 2020

Carbon Pricing Could Harmonize NYISO Markets and State Policies

NYISO wholesale markets provide electricity reliably and cost effectively

However, markets are not aligned with state decarbonization goals

Carbon pricing could internalize environmental costs and foster competition to meet energy and environmental goals cost effectively:

- Shift commitment and dispatch within the existing fleet
- Tilt investment in renewable resources toward those that displace the most carbon
- Push any investment in fossil generation toward the lowest-emitting technologies
- Reward storage and demand response that reduce emissions
- Incentivize energy efficiency and conservation
- Spur other innovations

Approaches to Implementing Carbon Price

Tighter RGGI caps

New York cap-and-trade

Carbon tax

Carbon charge (approach analyzed in this study)

- The Public Service Commission (NYPSC) sets the price
- NYISO adds a charge to resources' costs
- Collected charges returned to customers

Analysis Overview

How would a carbon charge affect carbon emissions, economic efficiency, and customer costs?

Analytical approach:

- 2025 snapshot
- Compare case with $40/ton carbon charge to case with CES and RGGI alone
- Spreadsheet model

Two analysis components:

- **Static Analysis:** Capture the direct effect of a carbon charge, assuming no change in operations or investment (affects energy prices, returned carbon charges, REC, ZEC, and TCC prices)
- **Dynamic Analysis:** Capture adjustments to operations and investment in response to the carbon charge

Extensive uncertainty analysis to test alternative assumptions

Environmental and Economic Efficiency Gains

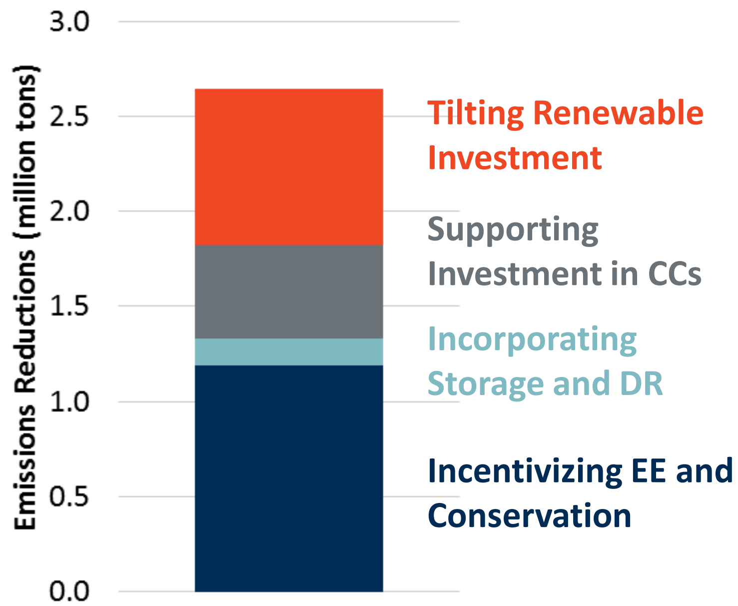
We evaluate four ways a carbon charge could reduce emissions

- Tilting investment in renewable resources toward those that displace the most carbon
- Pushing any new investment in traditional generation toward the lowest-emitting technologies
- Rewarding storage and demand response that reduce emissions
- Incentivizing energy efficiency and conservation

Note: we do <u>not</u> account for

- Dispatch switching in the existing fleet
- Innovative or idiosyncratic opportunities

Incremental Abatement Induced by $40/ton Carbon Charge



Environmental and Economic Efficiency Gains

We estimate a carbon charge could plausibly reduce annual CO_2 emissions by 2.6 million tons

These reductions could replace costlier measures to achieve the same CO_2 reductions

For example, these reductions could avoid 6.3 TWh of REC purchases, reducing total annual economic costs by $120 million

Impact on Customer Costs

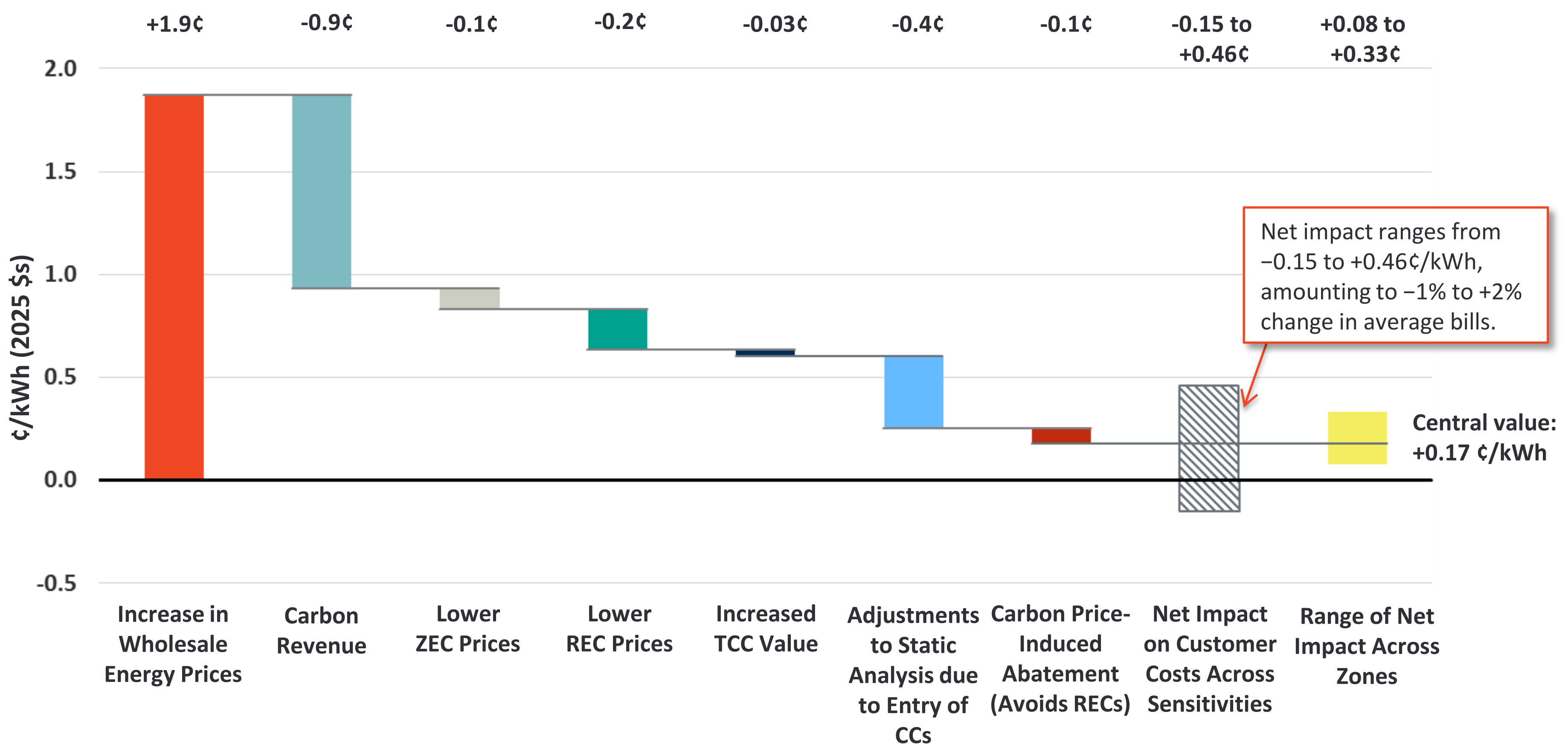
How much of the economic gains are enjoyed by consumers vs. clean energy producers?

Do higher energy prices cause a wealth transfer from consumer to producers?

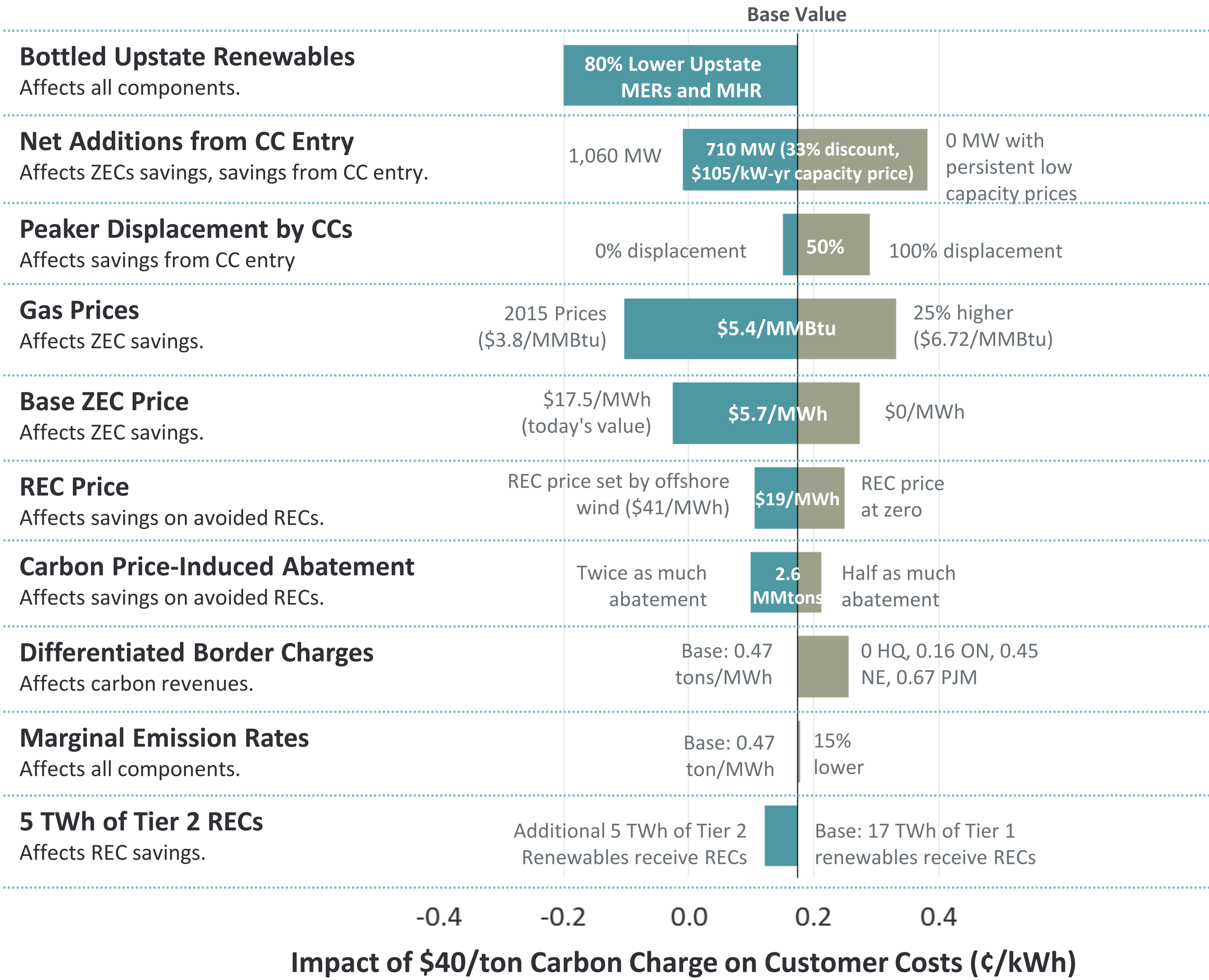
We estimate customer costs would not rise materially

- On net, average customer costs change between −$1.5/MWh to +$4.6/MWh around a central value of +$1.7/MWh
- This amounts to a −1% to +2% change in total customer electric bills
- Impacts could vary by zone, but the differences can largely be mitigated by targeted allocation of carbon revenues

Impact on Customer Costs



Effect of Major Sources of Uncertainty



Establishing the Appropriate Carbon Price

What should the price be, and how should it change over time?

NYPSC could set price trajectory in various ways, based on:

- The adopted Social Cost of Carbon (SCC), as assumed in our study
- The level needed to achieve New York's decarbonization goals

Returning Charges to Customers

NYPSC, DPS, NYISO and stakeholders will need to design a mechanism to return charges from NYISO to customers

Several design questions:

- How revenues flow from NYISO to LSEs, then from LSEs to customers
- Allocation of revenues across customers in different LSEs
- Whether revenues are distributed in volumetric or fixed rebates

Preventing Leakage with Border Adjustments

What is leakage?

- Import leakage
- Export leakage

Charging imports and crediting exports can prevent leakage

- Simple approach to eliminate the charge from traders' perspectives
- More granular approaches, accounting for neighbors' emission rates and carbon prices

Interactions with Other NY Policies and Processes

Distributed energy resources and REV

Renewable Energy Credits

Interactions with RGGI

Effect on decarbonization efforts in other sectors

Other NYISO processes

- Capacity market
- Transmission planning
- Flexibility incentives

Conclusions

Straightforward and economically efficient way to harmonize state goals with markets

Would improve the economic efficiency of meeting the state's energy and environmental goals

Customer costs would not rise materially, although more economic gains would flow to producers than consumers

Several market design areas for further discussion

Appendix

Assumptions on 2025 Market Conditions

Reasonable assumptions were made, mostly based on public sources (DPS, EIA, NYISO). Some of these assumptions on market conditions may be outdated.

Supply and Demand

- **Load:** Falls from 162 TWh in 2015 to 157 TWh.
- **Generation:** Fossil generation falls to 59 TWh, a 9% decrease from 2015.
  - Net imports, hydro, and other generation are unchanged from 2015, at 19, 26 , and 3 TWh.
  - Nuclear generation falls 16 TWh (to 28 TWh) due to Indian Point's planned retirement. This is more than offset by 18 TWh of new renewable generation (on top of about 5 TWh existing).
  - Remaining coal retires and 1,750 MW of planned CCs (CPV Valley and Cricket Valley) enter the market.

Wholesale Prices

- **Energy Prices:** We adjust 2015 prices for higher natural gas prices and RGGI prices.
  - The fuel component of offers rises by 84% due to higher upstate gas prices ($5.4/MMBtu in 2025).
  - RGGI prices rise from $6/ton in 2015 to $17.4/ton.
  - NYCA-wide load-weighted average LBMP rises from $38.4/MWh to $72.2/MWh.
- **Capacity Prices:** Adopt DPS's forecast: NYCA rises from $35/kW-yr in 2015 to $105/kW-yr by 2025.
- These increases reduce base ZEC prices to $5.7/MWh.

Carbon Emissions

- Internal emissions fall 14% to 29 million tons, due to replacing coal and some less efficient fossil with planned CCs and then scaling 2015 emissions by assumed change in total fossil generation.
- In addition, 11 million tons of imported emissions are charged and add to carbon fund. 4 million tons of exported emissions receive credits.

Estimating Marginal Emission Rates (MERs) for Calculating Wholesale Price Impacts

- The emission rate of the marginal, price-setting resource drives the effect of a carbon charge on customers and generators. Higher marginal emission rates (MERs) translate to higher energy prices.
- We used five-minute 2015 marginal unit data provided by NYISO and unit-level emission rates to estimate real-time MERs in each zone. When a zone does not contain any marginal units, we assign a marginal emissions rate from a neighboring zone, accounting for the locations of likely transmission constraints.
- The *implied MER* for the 20% of intervals when hydro w/storage is marginal:
  - Although hydro itself has no emissions, hydro with storage can time its generation to occur when prices and emission rates are high.
  - The price at which it offers and sells its output is a good guide for the value of what other resources are displaced in that hour and opportunity costs for selling in other hours.
  - We therefore assign a marginal emissions rate when hydro is marginal based on the average marginal emission rate of periods with similar LBMPs in which hydro is not on the margin.
  - Exception: we assume a zero MER when hydro is marginal in very low priced hours.
- We assume hourly MERs in 2025 are the same as in 2015, except coal (when marginal) is replaced by CCs.

Customer Cost Analysis Details

Increase in Wholesale Energy Prices

- A CO_2 charge increases energy prices.
- Adder = MER x $40/ton carbon charge.
- Across zones, wholesale energy prices increase by **$17 - $20/MWh**, with larger increases Downstate, where marginal emission rates are higher.

Zonal Variation in Wholesale Energy Price Increase Due to $40/ton Carbon Charge

Zone	Load-Weighted Average MER (tons/MWh)	Increase in Wholesale Energy Prices ($/MWh)
A	0.43	$17.4
B	0.44	$17.5
C	0.43	$17.2
D	0.42	$16.7
E	0.43	$17.3
F	0.48	$19.2
G	0.48	$19.3
H	0.48	$19.3
I	0.48	$19.2
J	0.48	$19.4
K	0.50	$20.1
NYCA	0.47	$18.8

Source: Marginal emission rates determined using 5-minute marginal fuel data provided by NYISO

Customer Cost Analysis Details

Refund of Carbon Revenues to Customers

- **NYISO collects carbon charges** from all internal fossil generation and imports (less credits for exports reducing external emissions), at each resource's emissions rate × the carbon price.
- We assume all **collected charges are refunded** to customers to offset the increase in energy prices.
- We evaluate **two approaches to allocating** refunds:
  - **By load ratio share:** All zones receive the same carbon refund per MWh of load.
  - **Targeted by zone** to minimize zonal variation in the carbon charge's net impact on customer costs.
- **Load ratio share allocation** results in a \$2.6/MWh range in net impacts in customer costs across zones
  - Largest impacts on Zone F, due to increase in wholesale prices similar to that of Downstate zones, and proportionately fewer capacity savings from CC entry (outside of the G-J locality).
- **Targeted allocation** can eliminate zonal variation, with all zones experiencing a \$1.7/MWh impact on customer costs

Returned Carbon Charges

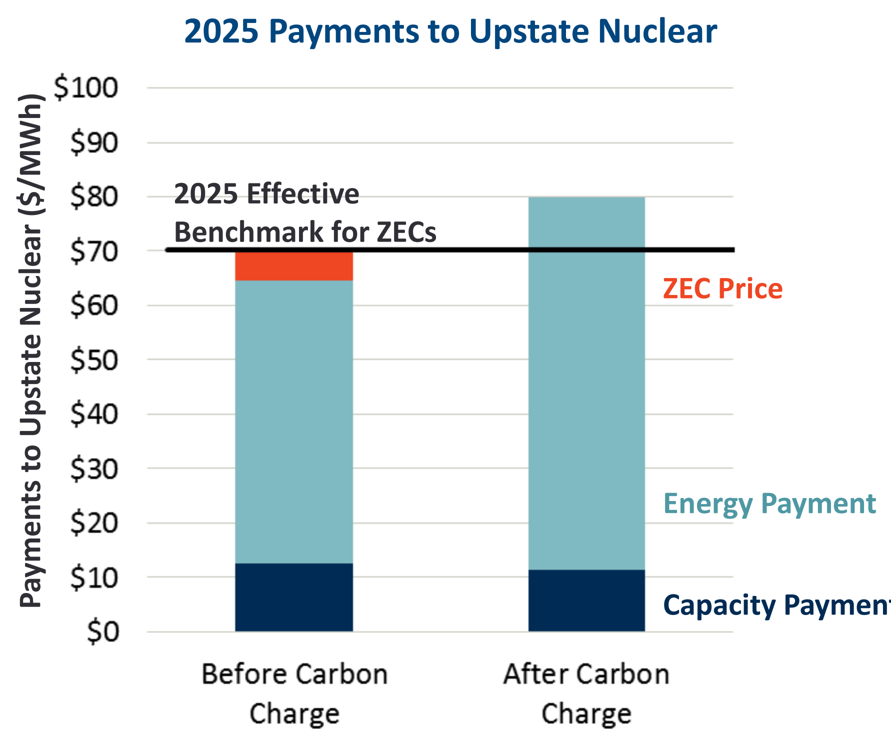
Load Ratio Share

Zone	Carbon Revenue Refunds (\$/MWh)	Estimated Change in Customer Costs (\$/MWh)
A	\$9.4	\$1.5
B	\$9.4	\$1.6
C	\$9.4	\$1.4
D	\$9.4	\$0.8
E	\$9.4	\$1.4
F	\$9.4	\$3.3
G	\$9.4	\$0.8
H	\$9.4	\$0.9
I	\$9.4	\$0.8
J	\$9.4	\$2.2
K	\$9.4	\$1.4
NYCA	\$9.4	\$1.7

Source & Notes: Carbon revenues from Brattle analysis. Zonal loads forecast from 2016 Goldbook.

Lower ZEC Prices

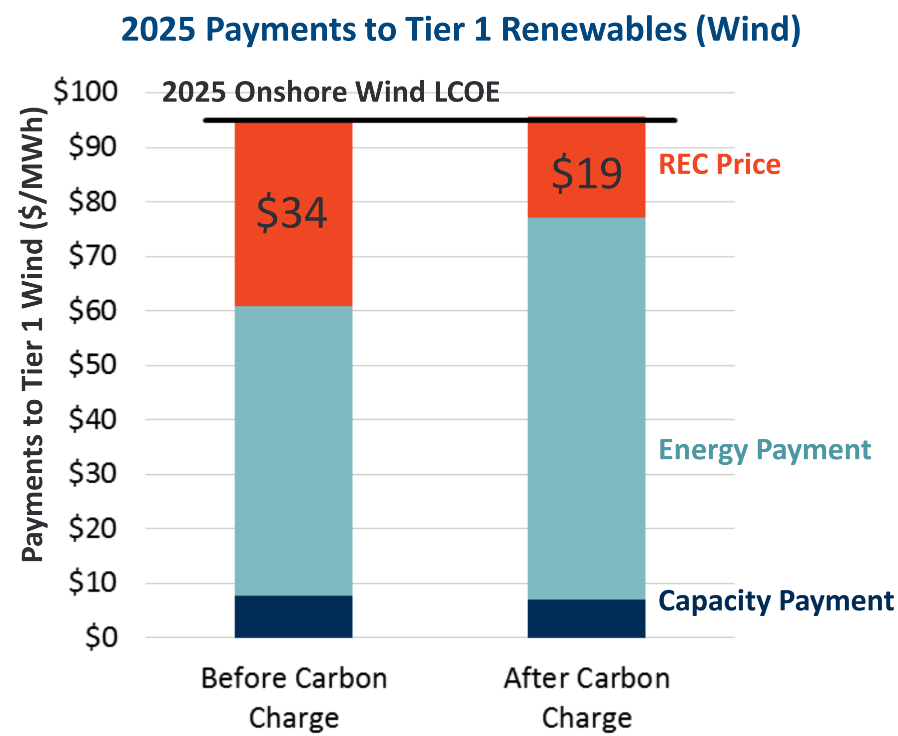
- Before a carbon charge, 28 TWh of upstate nuclear generation estimated to earn a ZEC price of $5.7/MWh in 2025 .
  - ZEC price is lower than 2015 price of $17/MWh due to rising energy prices (with rising gas prices) and capacity prices.
  - High wholesale prices do not drive the ZEC price to zero assuming the $39/MWh reference price rises with inflation to $49/MWh, and the SCC rises per the CES Order
  - Assume the 0.538 MER in the ZEC formula continues.
- With a carbon charge, enhanced Upstate energy prices will drive ZEC prices to zero.
- **Reduced ZEC payments of $161 million, or $1.0 per MWh of customer load in NY**



Customer Cost Analysis Details

Lower REC Prices

- A CO_2 charge will increase energy revenues to renewables, which will then enter the market at a lower REC price.
- Assume that each $1 increase in energy price (w/carbon charge) can reduce REC prices by $1.
- We calculate this effect for each renewable type based on the quantity of RECs, and the marginal emissions rates coincident with renewable production.
- Assume 18 TWh of Tier 1 RECs in 2025, based on DPS' CES Cost Study, with:
  - 9.1 TWh wind, 4.7 solar, 3.9 other
  - Assumes wind is added in zones A, C, D, E; solar is added in all zones but J; other is added in zones A – I
- **Reduced REC payments of $310 million, or $2.0/MWh of NY load**



Customer Cost Analysis Details

Increased TCC Value

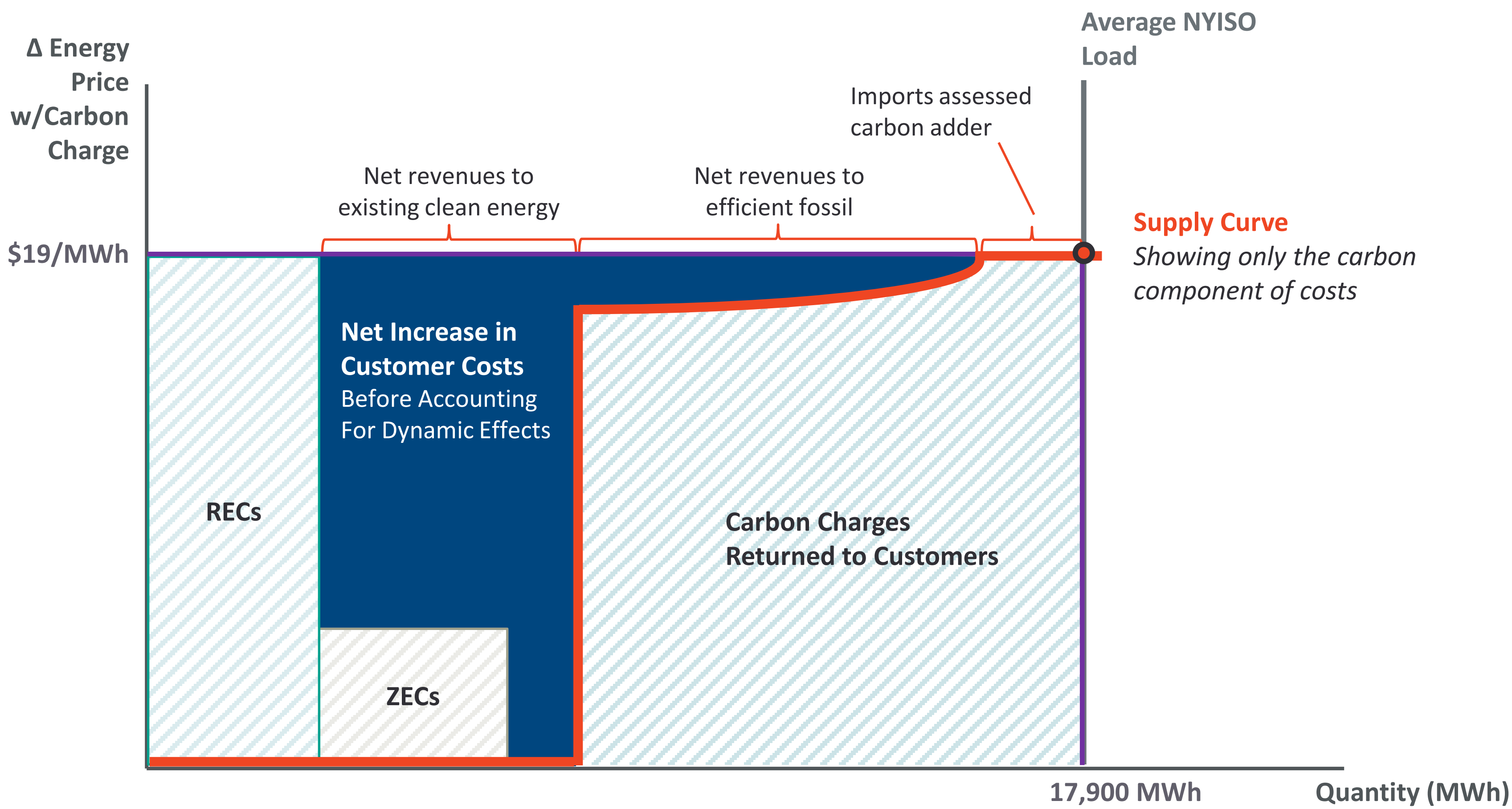
- A carbon charge may increase congestion costs by increasing price spreads across constraints.
- This represents a benefit to customers who have rights to TCC auction revenues.
- We approximate increased congestion costs across Central East (E to F).
  - Central East accounted for 50% of all NYISO congestion in 2015.
  - Increased congestion revenue = 0.05 ton/MWh spread across CE × \$40/ton × 2,500 MW × 8760 hours = \$44m/yr.
  - We conservatively do not count increased TCC value on any other constraints.
- We assume this effect is equal across zones on a \$/MWh basis, i.e. \$44m/yr divided by 157 TWh NYCA load = \$0.3/MWh.

Customer Cost Analysis Details

Energy Revenue Flow Schematic

Net Increase In Customer Costs is only 30% of ΔP x Q

before accounting for additional 23% savings from dynamic effects



Assumptions on Market Responses

We estimate the value of the four possible market responses, which are strongly driven by the following assumptions:

- **Tilting Renewable Energy Investment:** A carbon charge rewards renewables that offset more carbon and thus may tilt investment toward better-sited and better types of renewables for reducing carbon. We estimate how 2,000 MW of onshore wind generation investment (with a 31% capacity factor) shifts to types and locations that avoid 0.15 tons/MWh more CO_2 than absent a carbon charge.
- **Supporting Investment in CCs:** A carbon price could attract investment from relatively low-emitting combined cycles, offsetting generation from higher heat rate plants. We estimate 700 MW of new CCs would be attracted (further discussed in following slide), displacing 5.1 TWh of higher-emitting fossil generation.
- **Incorporating Storage and DR:** Carbon pricing accentuates price signals for storage and demand response to displace high-emitting fossil generation by arbitraging between hours with high and low emission rates. We estimate the abatement impact of 500 MW of storage in Zone J, if operated to discharge in the top 10% of highest-priced hours and charge in the bottom-10%- priced hours (w/ 20% roundtrip losses).
- **Incentivizing Energy Efficiency and Conservation:** A carbon charge may encourage large C&I customers (1/3 of load) to pursue increased energy efficiency and conservation if it raises their per-kWh rates, with carbon refunds and capacity savings lowering their non-volumetric rates . We estimate that a $40/ton carbon charges could raise C&I *energy* rates by 16%, reducing load by 5% (2.5 TWh), assuming a 0.3 elasticity of demand.

We do <u>not</u> account for

- Dispatch switching in the existing fleet or
- Innovative or idiosyncratic opportunities that the market might find

Impact of Dynamic Market Responses on Prices

- Carbon prices support investment and operation of any resource that reduces emissions; adding resources will lower wholesale prices. For simplicity, we estimate price impacts only for entry of CCs.
- Economic new resources (CCs in this case) should enter to capture the carbon bonus until energy and capacity prices fall and the market re-equilibrates, such that they earn no more than CONE overall.
  - **Lower capacity prices** as CC capacity enters. As prices decline, peaking capacity may exit or decide not to enter. We assume 0.5 MW peaking capacity is displaced for each 1 MW of CC entry.
  - **Lower energy prices** because CC entry shifts supply stack outwards. We estimate energy price reduction based on previous study result that adding 720 MW CC in Zone G would reduce energy prices by ~1%, all else equal.
  - We discount the amount of CC entry and resulting price effects by 1/3 since CCs could be uneconomic in a future with prolonged surplus and/or with a poor long-term outlook for fossil generation in a market aiming for 80% decarbonization by 2050.
- **Impacts on static analysis of customer costs *:*** re-equilibrated lower prices benefit customers but slightly reduce REC price savings associated with a carbon charge. ZEC prices unaffected, remaining zero after adjustments.
- This effect varies across zones depending on the static increase in energy revenues to a CC in a zone, the amount of CC entry affecting capacity and energy prices, and the load factor (for translating $/kW-yr to $/MWh).

Additional Abatement due to a Carbon Charge

We estimate the quantity of carbon price-induced abatement across four factors, which in total reduce CO_2 emissions by 2.6 million tons:

- **Tilting Renewable Energy Investment:** shift 2,000 MW of wind at 31% capacity factor, or 5.5 TWh of generation, to types and locations that avoid 0.15 tons/MWh more CO_2 emissions, reducing total CO_2 emissions by **0.8 million tons.**

- **Supporting Investment in CCs:** entry of 710 MW of new CCs would generate 5.1 TWh, reducing emissions by 0.1 tons/MWh when running (with 0.5 avg MER vs. a 0.4 emissions rate for CCs), reducing total CO_2 emissions by **0.5 million tons**.

- **Incorporating Storage and DR:** 500 MW of storage (with 20% roundtrip losses) in New York City shifts generation from the 10% lowest-cost hours to 10% highest-cost hours would reduce emissions by 0.4 tons/MWh across 0.4 TWh, reducing total CO_2 emissions by **0.1 million tons.**

- **Incentivizing Energy Efficiency and Conservation:** a carbon charge raises large C&I *per-kWh* rates by 16%, leading to a 5% reduction in load (assumes elasticity of demand of 0.3, reduces 52 TWh of large C&I load by 2.5 TWh). This load reduction avoids 0.47 tons/MWh on average, reducing total CO_2 emissions by **1.2 million tons.**

Economic and Customer Savings from Carbon-Price-Induced Abatement

- The 2.6 million tons of incremental emissions reductions induced by a carbon charge could be used to produce greater environmental benefit, or they could be used to meet a fixed emissions target at lower customer cost by replacing costlier measures.
- For example, if RECs were being procured beyond the CES targets in order to meet economy-wide carbon reduction goals, the carbon-charge-induced reductions could enable meeting
  - **2.6 million tons** of abatement could avoid buying **6.3 TWh** of RECs at $19/MWh, saving customers an additional **$120 million**
- We assume this effect is equal across zones on a $/MWh basis.

Net Impacts on Customer Costs Across Zones

Average NYCA net customer cost impact is +$1.7/MWh (0.9% change in bills).

- Zonal cost impacts range from **+$0.8 to +$3.3/MWh** (0.4% to 1.7% change in bills) when carbon revenues allocated by load share.
- Zonal variations can be eliminated by targeted allocation of carbon revenues.

Customer Cost Impact of $40/ton Carbon Charge By Zone and By Component ($/MWh)

	NYCA Average	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F	Zone G	Zone H	Zone I	Zone J	Zone K
STATIC ANALYSIS												
I. Increase in Wholesale Energy Prices	18.8	17.4	17.5	17.2	16.7	17.3	19.2	19.3	19.3	19.2	19.4	20.1
II. CO2 Revenue - **(A)** ***Allocate by Load Share***	-9.4	-9.4	-9.4	-9.4	-9.4	-9.4	-9.4	-9.4	-9.4	-9.4	-9.4	-9.4
II. CO2 Revenue - **(B)** ***Allocate to Equalize Zonal Impact***	-9.4	-9.2	-9.3	-9.0	-8.5	-9.1	-11.0	-8.5	-8.5	-8.5	-9.9	-9.1
III. Lower ZEC Prices	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
IV. Lower REC Prices	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
V. Increased TCC Value	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
Subtotal (A)	**6.0**	**4.7**	**4.8**	**4.5**	**4.0**	**4.6**	**6.5**	**6.6**	**6.6**	**6.5**	**6.7**	**7.4**
Subtotal (B)	**6.0**	**4.9**	**4.9**	**4.9**	**4.9**	**4.9**	**4.9**	**7.5**	**7.5**	**7.5**	**6.2**	**7.7**
DYNAMIC ANALYSIS												
VI. Adjustments to Static Analysis due to Entry of CCs	-3.5	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-5.0	-5.0	-5.0	-3.7	-5.2
VII. Carbon Price-Induced Abatement	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8
Total Net Change in Customer Costs (A)	**1.7**	**1.5**	**1.6**	**1.4**	**0.8**	**1.4**	**3.3**	**0.8**	**0.9**	**0.8**	**2.2**	**1.4**
Total Net Change in Customer Costs (B)	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**

Varies due to zonal differences in MERs

No change across zones (allocated on load-share)

Varies due to zonal differences in load factor and CC energy revenues

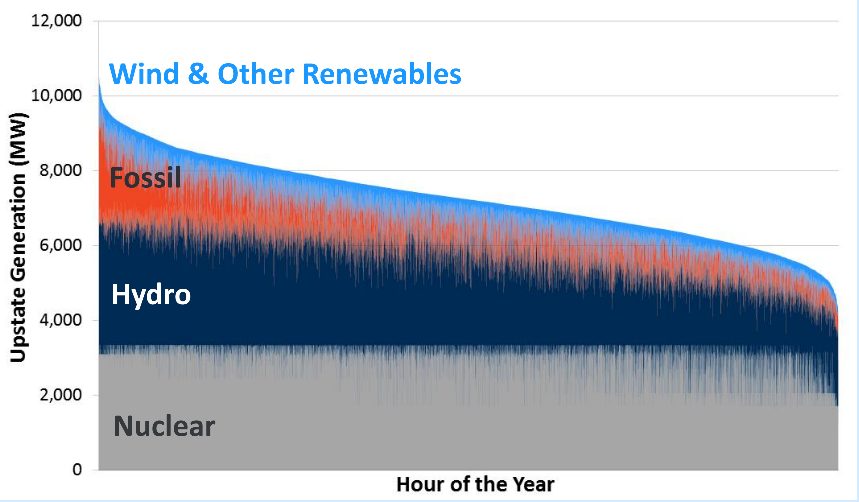
Upstate Average and Marginal Fuel Mix

Upstate generation is already mostly clean on average, but not necessarily on the margin.

- While fossil only accounts for **12%** of Upstate generation on *average*, fossil is the *marginal* fuel type for Upstate zones in **54%** of intervals (often from Downstate fossil plants).
- While hydro is zero-emitting, output can be traded off against fossil generation within an interval, while also storing more or less to displace more or less fossil in other hours. When marginal, hydro may set energy prices based on at its opportunity costs, which may include the effect of the carbon charge on competing fossil plants.

2016 Upstate Average Fuel Mix

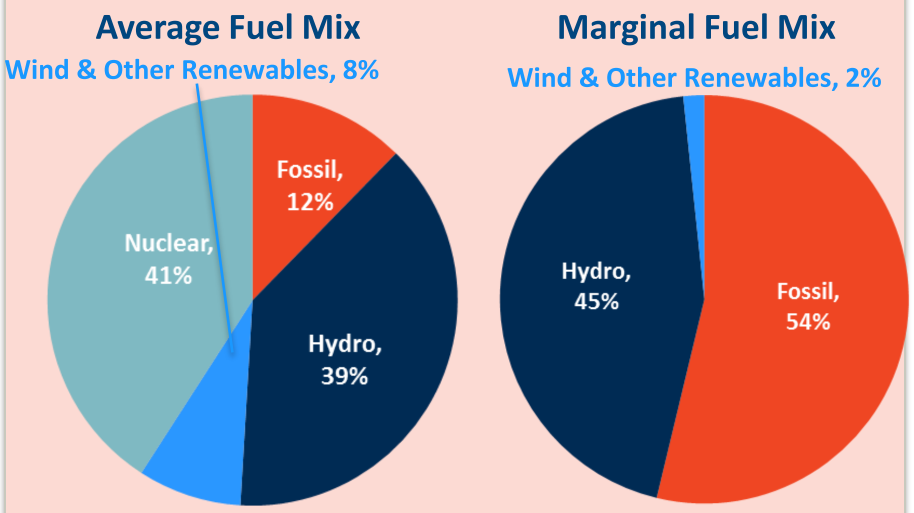
Fossil generation varies from **0% - 34%** (**12%** on average) of hourly *average* fuel mix.



Source: 5-minute generation mix data by zone, provided by NYISO.

2016 Upstate Average vs. Marginal Fuel Mix

Fossil makes up **12%** of *average* Upstate generation, but is the *marginal* fuel Upstate in **54%** of intervals.

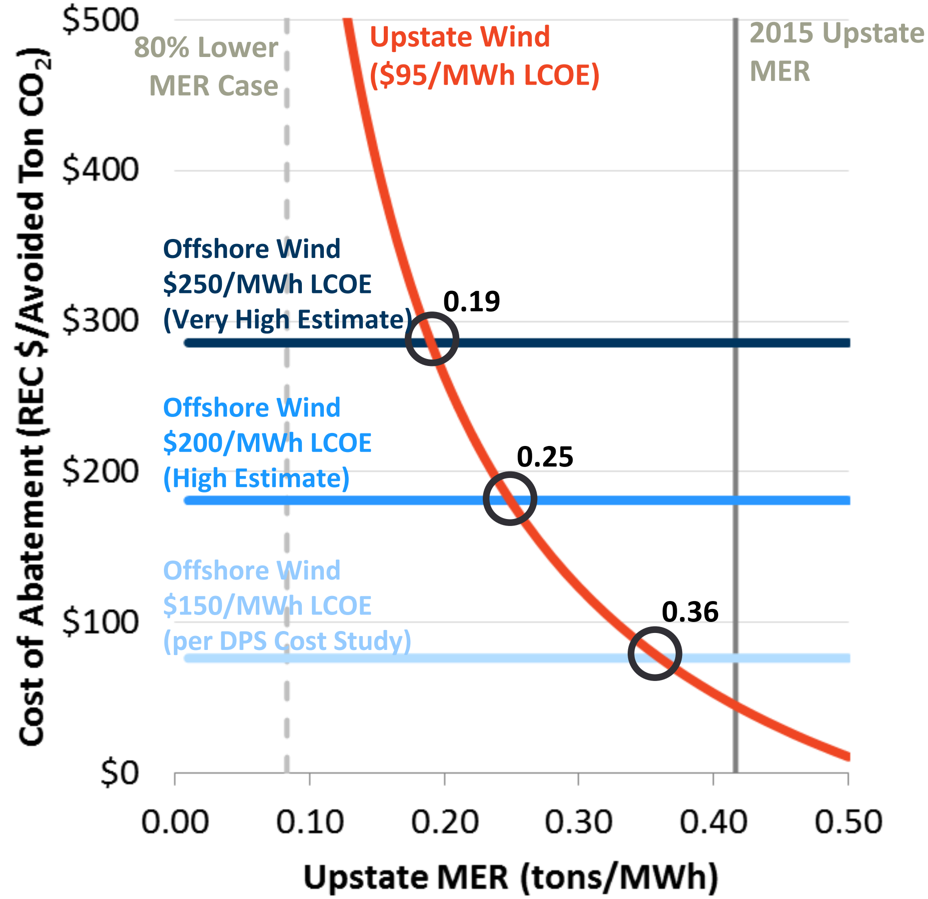


Source: 2017 Power Trends and 5-minute marginal fuel data provided by NYISO.

Upstate Wind vs. Downstate Wind Additions and Transmission

- At current Upstate MER (0.41 tons/MWh), Upstate wind is a more cost effective way to reduce CO_2 emissions than Downstate offshore wind.
- As the Upstate MER falls, Upstate wind will become less cost effective.
  - Analysis suggests Downstate offshore wind ($150/MWh LCOE) is more cost effective than Upstate wind if the Upstate MER falls below 0.36 (wind on the margin ~17% of hours).
  - Even with very high offshore wind LCOE of $250/MWh it is more cost effective than Upstate wind if Upstate MER falls below 0.19 (wind on the margin 45% of hours).
- Similarly, adding new transmission becomes increasingly cost effective as Upstate MERs and LBMPs fall; we estimate that new transmission is cost-effective when Upstate MERs fall below 0.35 tons/MWh.

Relative Cost of Reducing Emissions with Upstate and Downstate Wind



Notes: For Upstate Onshore Wind, we assume constant capacity revenues, and energy revenues decrease proportional to MER. For offshore wind, we assume in the case with decreasing downstate MERs that the MERs decrease at half the rate of upstate MERs.

Presenter Information

SAM NEWELL

Principal | The Brattle Group, Boston, MA

Sam.Newell@brattle.com

+1.617.864.7900

Dr. Samuel Newell, a Principal of The Brattle Group, is an economist and engineer with experience in electricity wholesale markets, the transmission system, and RTO/ISO rules. He supports clients throughout the U.S. in regulatory, litigation, and business strategy matters involving wholesale market design, generation asset valuation, transmission development, integrated resource planning, demand response programs, and contract disputes. He has provided testimony before the FERC, state regulatory commissions, and the American Arbitration Association.

Dr. Newell earned a Ph.D. in Technology Management and Policy from MIT, and a M.S. in Materials Science and Engineering from Stanford University. Prior to joining Brattle, Dr. Newell was Director of the Transmission Service at Cambridge Energy Research Associates.

About The Brattle Group

The Brattle Group provides consulting and expert testimony in economics, finance, and regulation to corporations, law firms, and governmental agencies worldwide.

We combine in-depth industry experience and rigorous analyses to help clients answer complex economic and financial questions in litigation and regulation, develop strategies for changing markets, and make critical business decisions.

Our services to the electric power industry include:

- Climate Change Policy and Planning
- Cost of Capital
- Demand Forecasting Methodology
- Demand Response and Energy Efficiency
- Electricity Market Modeling
- Energy Asset Valuation
- Energy Contract Litigation
- Environmental Compliance
- Fuel and Power Procurement
- Incentive Regulation
- Rate Design and Cost Allocation
- Regulatory Strategy and Litigation Support
- Renewables
- Resource Planning
- Retail Access and Restructuring
- Risk Management
- Market-Based Rates
- Market Design and Competitive Analysis
- Mergers and Acquisitions
- Transmission

Offices

BOSTON

NEW YORK

SAN FRANCISCO

WASHINGTON, DC

TORONTO

LONDON

MADRID

ROME

SYDNEY