

Effect of Carbon Pricing on ICAP Demand Curve Net EAS Revenues

Ryan Patterson

Associate, Capacity Market Design

IPPTF

October 11th, 2018



DRAFT – FOR DISCUSSION PURPOSES ONLY

©COPYRIGHT NYISO 2017. ALL RIGHTS RESERVED

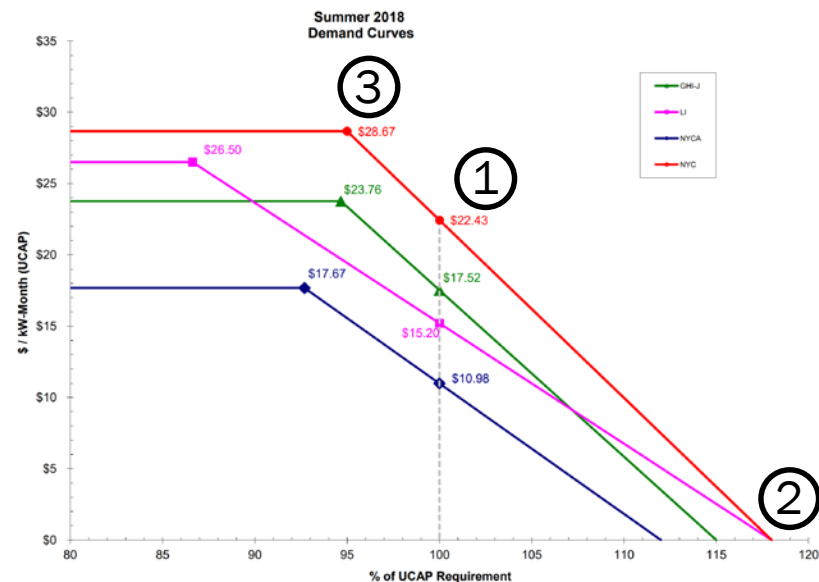
Agenda

- Background
- Overview & Study
- Recommended Treatment

Background

Background

- **The Energy market Carbon Pricing impacts the Capacity Market through the ICAP Demand Curves**
 - As currently applied, the ICAP Demand Curve is derived from:
 1. A reference point set to the minimum ICAP requirement based on the IRM set by the NYSRC, and
 2. A point at which the value of incremental capacity declines to zero (Zero Crossing Point)
 3. Maximum allowable price of capacity
- **The reference point is determined by evaluating (among other relevant variables):**
 - The cost of a hypothetical peaking plant (Gross CONE)
 - Less the amount of money it can expect to earn annually from the Energy and Ancillary Service markets, net of its cost to produce (Net EAS Revenue)
- **Charging generators carbon emissions the societal cost of carbon will impact the peaking plant's Net EAS Revenue**



Background

- **In the last ICAP Demand Curve reset process, the NYISO moved to a historic model that averages projected Net EAS Revenue over a three year period**
 - The study period runs from September 1st of Year 1 through August 31st of Year 3, using actual historic data such as LBMPs and fuel and emission costs
 - The three-year period precedes when the new ICAP Demand Curves will take effect
 - e.g., the 2017-2018 ICAP Demand Curves used Net EAS Revenue offset values measured from 9/1/2013 – 8/31/2016
- **In addition, the NYISO implemented an annual update process that allows for specific variables used in calculating the reference point to be recalculated each year between the quadrennial resets**
 - The annual update process allows for the ICAP Demand Curves to capture certain changes occurring between resets
 - The annual update is designed to capture changes to the inputs, such as fuel costs and emissions costs, as well as changes in market rules that impact Energy and Ancillary Services pricing outcomes
 - The Net EAS Revenue study period moves ahead one year with each annual update
 - e.g., the annual update for the 2018-2019 ICAP Demand Curves used Net EAS Revenue offset values measured from 9/1/2014 – 8/31/2017
 - This helps to capture market and operating cost changes over time

Overview & Study

Overview

- **The NYISO analyzed the impacts of Carbon Pricing on the ICAP Demand Curves to illustrate how the annual update process could effect future Capacity Market clearing prices**
- **Net EAS Revenue will be impacted by Carbon Pricing**
 - Both cost and revenue are impacted as emissions cost and LBMPs are expected to increase
 - Net EAS Revenue offset values and the reference point have an inverse relationship; as Net EAS Revenue increases, the reference point decreases, and vice versa

Study Methodology

- **In order to understand the potential impact of Carbon Pricing on the ICAP Demand Curves, several cases were run using the current Net EAS Model**
 - Two datasets were used to run several scenarios:
 - 2015 & 2016 Marginal Emissions Rates (MER) prepared by Brattle (see IPPTF meeting materials from 3/19/2018)
 - LBMP was increased by $\$50 * \text{MER}$ for the applicable hour and Load Zone in cases adjusted for carbon pricing
 - To account for the carbon price change, RGGI price was increased by \$50 for hours that LBMPs were adjusted for carbon pricing
 - Net EAS Revenue study period ran from 9/1/2013 – 8/31/2016 (applicable period for the 2017-2018 ICAP Demand Curves)
 - MAPS runs for 2020, 2025, 2030
 - LBMPs were output from the MAPS runs for carbon and no carbon (base) cases. These were then fed into the Net EAS Model along with projected fuel costs used in each respective MAPS run
 - To account for the carbon price change, RGGI price was increased by \$50 for the carbon cases
 - Estimates the impact to the 2017-2018 ICAP Demand Curves of potential Energy market outcomes once Carbon Pricing is fully implemented

Marginal Emissions Rate

At the NYISO's request, Brattle prepared a detail of Marginal Emissions Rates for every zone and hour of 2015 and 2016

- This data was used to calculate revised 2017-2018 ICAP Demand Curve reference point prices using revised Net EAS Revenue estimates
- Study period ran from 9/1/2013 – 8/31/2016 (no adjustments were made to 2013 or 2014 data)
- LBMP was adjusted by \$50 * MER for 2015 and 2016 data
- To account for the carbon price change, RGGI price was increased by \$50 for 2015 and 2016 data

Three scenarios using this data were run

- The 2015 & 2016 case adjusted LBMPs from 1/1/2015 – 8/31/2016 (2013 and 2014 data was retained and unadjusted)
- The 2016 Adder case adjusted LBMPs from 1/1/2016 – 8/31/2016 (2013 – 2015 data was retained and unadjusted)
- The Study Year 3 case adjusted LBMPs from 9/1/2015 – 8/31/2016 (Study Year 1 [9/1/2013 – 8/31/2014] and Study Year 2 [9/1/2014 – 8/31/2015] data was retained and unadjusted)

	MER Runs (2017-2018 ICAP Demand Curves)				
	Net EAS		Reference Point		
	Actual	2015 & 2016	Actual	2015 & 2016	Δ
F - Capital (Gas No SCR)	\$34.84	\$33.81	\$9.08	\$9.18	\$0.11
G - Lower Hudson Valley (DF)	\$39.42	\$39.24	\$14.84	\$14.86	\$0.02
J - New York City (DF)	\$53.94	\$51.55	\$18.61	\$18.91	\$0.30
K - Long Island (DF)	\$101.69	\$101.59	\$12.72	\$12.74	\$0.02
	Actual	2016 Only	Actual	2016 Only	Δ
F - Capital (Gas No SCR)	\$34.84	\$34.21	\$9.08	\$9.14	\$0.07
G - Lower Hudson Valley (DF)	\$39.42	\$40.06	\$14.84	\$14.77	(\$0.07)
J - New York City (DF)	\$53.94	\$53.79	\$18.61	\$18.63	\$0.02
K - Long Island (DF)	\$101.69	\$102.78	\$12.72	\$12.57	(\$0.16)
	Actual	Study Year 3	Actual	Study Year 3	Δ
F - Capital (Gas No SCR)	\$34.84	\$34.09	\$9.08	\$9.16	\$0.08
G - Lower Hudson Valley (DF)	\$39.42	\$39.98	\$14.84	\$14.78	(\$0.06)
J - New York City (DF)	\$53.94	\$53.19	\$18.61	\$18.70	\$0.09
K - Long Island (DF)	\$101.69	\$102.13	\$12.72	\$12.66	(\$0.06)

Marginal Emissions Rate

- Deeper dive into Zone J: why did the reference point price increase with carbon pricing?

- Average Zone J MER: 0.4788
- Peaking Plant CO₂ Emissions Rate: 0.5966
- For hours in which the peaking plant was dispatched for Energy in both the base case and carbon case, it earned more money in the carbon case
- However, the peaking plant ran for 996 fewer hours in the carbon case, due to having a higher CO₂ emissions rate than the marginal unit in Load Zone J for those hours
- LBMP Δ vs. Emissions Δ measures the difference in LBMP between the base case and carbon case against the difference in emissions cost between the base case and carbon case

	MER Runs (2017-2018 ICAP Demand Curves)				
	Net EAS		Reference Point		
	Actual	2015 & 2016	Actual	2015 & 2016	Δ
J - New York City (DF)	\$53.94	\$51.55	\$18.61	\$18.91	\$0.30

Dispatch Signal		Hour	Hour	LBMP Δ vs.	Zone MER
Base Case	Carbon Case	Count	Profit Δ	Emissions Δ	
Energy	Energy	6,247	1,338.19	-0.91	0.551422
Energy	No Dispatch	1,019	-5,191.79	-5.02	0.481137
No Dispatch	Energy	23	230.59	4.21	0.655692
No Dispatch	No Dispatch	14,639	-777.62	-6.43	0.455719
Ancillary		4,376	-2,756.87	-5.62	0.471418

Marginal Emissions Rate

- NYISO also ran a case calculating revised Net EAS Revenues and reference point prices for the 2018-2019 ICAP Demand Curves using the Marginal Emissions Rates in 2015 and 2016**
 - Study period for the 2018-2019 ICAP Demand Curves annual update is 9/1/2014 – 8/31/2017
 - LBMPs and RGGI costs were adjusted for 1/1/2015 – 12/31/2016 using the same methodology described on Slide 9 (2014 and 2017 data was retained and unadjusted)
 - Results with and without the collar (-8%/+12%) are shown, and are well within the normal variability expected for an annual update

	MER Runs (2018-2019 ICAP Demand Curves)				
	Net EAS		Reference Point		
	Annual Update	2015 & 2016	Annual Update	2015 & 2016	Δ
F - Capital (Gas No SCR)	\$28.13	\$26.90	\$10.04	\$10.17	\$0.13
G - Lower Hudson Valley (DF)	\$28.56	\$28.38	\$16.42	\$16.44	\$0.02
J - New York City (DF)	\$34.79	\$31.89	\$20.84	\$20.84	\$0.00
K - Long Island (DF)	\$71.30	\$70.45	\$14.25	\$14.25	\$0.00
			No Collar -	No Collar -	
	Annual Update	2015 & 2016	Annual Update	2015 & 2016	Δ
F - Capital (Gas No SCR)	\$28.13	\$26.90	\$10.04	\$10.17	\$0.13
G - Lower Hudson Valley (DF)	\$28.56	\$28.38	\$16.42	\$16.44	\$0.02
J - New York City (DF)	\$34.79	\$31.89	\$21.90	\$22.27	\$0.37
K - Long Island (DF)	\$71.30	\$70.45	\$17.89	\$18.01	\$0.12

MAPS Runs

- In addition to running the Net EAS Model with estimated Carbon Pricing adjustments for 2015 and 2016 data, Net EAS Revenues and reference point prices were also estimated using data from MAPS runs performed by Brattle and NYISO Planning for certain future years
 - Six total cases were run in MAPS – 2020, 2025, and 2030 cases, each with a base case and a carbon case
 - Outputs from MAPS for each case included one year's worth of LBMPs and projected fuel prices obtained from NYISO Planning. This data was duplicated for study years 2 and 3 for purposes of the three-year period utilized in estimating Net EAS Revenue.
 - Each Net EAS Revenue and reference point price outcome was calculated using 2017-2018 ICAP Demand Curve inputs and values, except for LBMPs and fuel prices obtained from NYISO Planning for each relevant case

	MAPS Runs (2017-2018 ICAP Demand Curves)				
	Net EAS		Reference Point		
	2020 - Base	2020 - Carbon	2020 - Base	2020 - Carbon	Δ
F - Capital (Gas No SCR)	\$10.31	\$8.42	\$11.58	\$11.78	\$0.19
G - Lower Hudson Valley (DF)	\$9.14	\$8.83	\$18.27	\$18.31	\$0.04
J - New York City (DF)	\$10.23	\$6.24	\$24.03	\$24.52	\$0.49
K - Long Island (DF)	\$12.67	\$7.00	\$25.51	\$26.32	\$0.81
	2025 - Base	2025 - Carbon	2025 - Base	2025 - Carbon	Δ
F - Capital (Gas No SCR)	\$8.32	\$6.43	\$11.79	\$11.98	\$0.19
G - Lower Hudson Valley (DF)	\$6.79	\$7.09	\$18.54	\$18.50	(\$0.03)
J - New York City (DF)	\$9.45	\$8.95	\$24.12	\$24.19	\$0.06
K - Long Island (DF)	\$14.80	\$12.47	\$25.20	\$25.53	\$0.33
	2030 - Base	2030 - Carbon	2030 - Base	2030 - Carbon	Δ
F - Capital (Gas No SCR)	\$15.38	\$10.35	\$11.07	\$11.58	\$0.51
G - Lower Hudson Valley (DF)	\$35.40	\$28.99	\$15.30	\$16.02	\$0.73
J - New York City (DF)	\$41.64	\$36.47	\$20.14	\$20.77	\$0.64
K - Long Island (DF)	\$52.90	\$44.97	\$19.73	\$20.87	\$1.14

Recommended Treatment

Recommended Treatment

- The changes to the reset process implemented in 2016 were intended to allow for the ICAP Demand Curves to capture changes in market conditions over time, including the impacts of changes to market rules
- As contemplated by the revised procedures, the resulting impacts of implementing Carbon Pricing in the wholesale market should be rolled into Net EAS Revenue estimates through the annual update process
 - Adjustments to the Net EAS Model to allow for incorporation of Carbon Pricing once implemented will be evaluated and discussed as part of the upcoming reset process

Feedback/Questions?

The Mission of the New York Independent System Operator, in collaboration with its stakeholders, is to serve the public interest and provide benefits to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policy makers, stakeholders and investors in the power system



www.nyiso.com

Appendix

Marginal Emissions Rate by Month

MER	F	G	J	K
2016	0.477350	0.477997	0.481291	0.513221
2015	0.472293	0.472817	0.476244	0.492306
Δ	0.005057	0.005180	0.005047	0.020915

MER by Month for Load Zones F, G, J, K

