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ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

# NYISO 2015/2016 ICAP Demand Curve Reset

## Review of Preliminary Recommendations and Overview of Draft Report

ICAPWG
June 27, 2016

# Today's Presentation

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- **Outline of process and next steps**
- **Review of changes from 6/15 ICAPWG meeting**
  - Net Energy and Ancillary Services (EAS) revenues model adjustments
- **Overview of Draft Report**
  - Review of preliminary recommendations and results

# Outline of Schedule

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- **Draft Report released for stakeholder review on June 23, 2016**
  - Provides a preliminary recommendation for the ICAP Demand Curve peaking unit technology and associated reference point prices (RPs) for the 2017/18 Capability Year
- **Analysis Group (AGI) seeks written stakeholder feedback on the Draft Report by July 8, 2016**
  - AGI to present at July 20, 2016 ICAPWG meeting
- **AGI and Lummus Consultants (LCI) will release a Final Report in August 2016, which will include:**
  - Consideration of additional stakeholder feedback and analysis as warranted;
  - Updated values that reflect the most current data available for locational based marginal prices (LBMPs), reserve prices, fuel prices, emission prices, and escalation factors; and
  - Net EAS revenues and RPs for combined cycle units, for informational purposes
- **NYISO and AGI will update the recommended ICAP Demand Curve parameters using finalized data for the filing with FERC on or before November 30, 2016**

# Draft Report is Preliminary

- **The Draft Report provides preliminary values for the ICAP Demand Curves for the 2017/18 Capability Year; however:**
  - All numerical results presented in the Draft Report will be updated for the Final Report to reflect:
    - Any changes that AGI and LCI deem appropriate in consideration of stakeholder comments and any further research/analysis AGI and LCI may undertake; and
    - The most current data available at such time as required for the estimation of net EAS revenues and escalation of capital costs

# Review of Changes since June 15 ICAPWG

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- **The Draft Report reflects the following changes to the net EAS revenue model compared to materials shared with stakeholders at the June 15 2016 ICAPWG meeting**
  - Load Zone F and G gas prices are indexed to the Iroquois Zone 2 gas hub
  - Inclusion of level of excess (LOE) adjustment factors (LOE-AF) to reflect tariff prescribed LOE conditions (see following slides for additional details regarding the LOE-AFs)
    - Average Annual LOE-AF range from 1.02 (NYCA) to 1.04 (NYC)
    - Model applies monthly values for on peak, high on peak, and off-peak
  - Model logic updated to include an opportunity cost of providing Operating Reserves, equal to the intraday fuel premium/discount (see Slide 7 for additional details regarding this cost)

# Level of Excess Adjustment Factors



- **GE developed a series of GE-MAPS modeling runs to estimate the hourly LBMPs for each Load Zone for the period 2017 – 2021**
  - Based on 2015 CARIS Phase I data and assumptions
  - Final report may reflect 2016 CARIS Phase II data, if available, or modifications to 2015 CARIS Phase I reflect CARIS Phase II resource assumptions

- **GE generated the following modeling runs:**
  - Tariff prescribed level of excess case ("At Criterion"): minimum Installed Capacity Requirement plus 200 MW (capacity of the peaking plant)
  - "As found" case: Reflects summer capacity + firm net imports + UDRs vs. load

- **System loads were adjusted for every hour in each Load Zone so that the resulting ratio of peak load to available resources equaled the reserve margin consistent with LOE conditions**

# Level of Excess Adjustment Factors



- **LOE-AFs were developed for the following periods in each month:**
  - On-peak: beginning 7 am and ending 11 pm inclusive, Monday through Friday excluding NERC Holidays
  - High on-peak: subset of peak hours as follows:
    - Summer: June, July, August from 2 pm to 5 pm inclusive
    - Winter: December, January, February from 4 pm to 7 pm inclusive
  - Off-peak: all hours not defined as included in on-peak
- **The LOE-AF by period, month, and Load Zone, is calculated as the ratio of average "at-criterion" and "as found" LBMPs:**

$$LOEAF_{P,M,Y,Z} = \frac{Average(At\ Criterion\ LBMP)_{P,M,Z}}{Average(As\ Found\ LBMP)_{P,M,Z}}$$

- **LOE-AFs are applied to both LBMPs (DAM and RTD) and reserve prices in the net EAS revenues model**

# LOE-AF by Load Zone and Energy Period

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| Load Zone | Month | Jan | Feb | March | April | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capital (Load Zone F) | Off-peak | 1.047 | 1.048 | 1.040 | 1.025 | 1.015 | 1.022 | 1.016 | 1.032 | 1.021 | 1.022 | 1.044 | 1.040 |
| | On-peak | 1.033 | 1.022 | 1.019 | 1.011 | 1.005 | 1.002 | 1.016 | 1.023 | 1.016 | 1.017 | 1.034 | 1.005 |
| | High On-peak | 1.064 | 1.064 | - | - | - | 0.997 | 1.002 | 1.022 | - | - | - | 1.022 |
| Central (Load Zone C) | Off-peak | 1.029 | 1.014 | 1.035 | 1.029 | 1.019 | 1.022 | 1.025 | 1.032 | 1.028 | 1.024 | 1.052 | 1.028 |
| | On-peak | 1.003 | 1.043 | 1.031 | 1.018 | 1.018 | 1.012 | 1.015 | 1.021 | 1.018 | 1.018 | 1.032 | 1.028 |
| | High On-peak | 1.002 | 1.052 | - | - | - | 1.006 | 1.004 | 1.013 | - | - | - | 1.027 |
| Hudson Valley (Load Zone G) | Off-peak | 1.042 | 1.037 | 1.036 | 1.027 | 1.018 | 1.024 | 1.027 | 1.032 | 1.024 | 1.023 | 1.046 | 1.035 |
| | On-peak | 1.023 | 1.025 | 1.022 | 1.017 | 1.013 | 1.014 | 1.025 | 1.026 | 1.019 | 1.017 | 1.032 | 1.012 |
| | High On-peak | 1.037 | 1.059 | - | - | - | 1.022 | 1.063 | 1.065 | - | - | - | 1.026 |
| New York City (Load Zone J) | Off-peak | 1.045 | 1.039 | 1.036 | 1.028 | 1.019 | 1.027 | 1.034 | 1.037 | 1.027 | 1.026 | 1.047 | 1.036 |
| | On-peak | 1.047 | 1.040 | 1.026 | 1.020 | 1.016 | 1.022 | 1.039 | 1.054 | 1.022 | 1.018 | 1.034 | 1.026 |
| | High On-peak | 1.045 | 1.062 | - | - | - | 1.038 | 1.129 | 1.159 | - | - | - | 1.028 |
| Long Island (Load Zone K) | Off-peak | 1.050 | 1.047 | 1.032 | 1.032 | 1.023 | 1.023 | 1.037 | 1.029 | 1.027 | 1.027 | 1.025 | 1.028 |
| | On-peak | 1.066 | 1.024 | 1.017 | 1.017 | 1.014 | 1.017 | 1.033 | 1.035 | 1.020 | 1.011 | 1.016 | 1.030 |
| | High On-peak | 1.065 | 1.025 | - | - | - | 1.023 | 1.131 | 1.108 | - | - | - | 1.010 |

# Net EAS revenues: Opportunity Cost of Providing Reserves

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- **Net EAS revenues model updated to include an opportunity cost of providing reserves**
  - Cost is equal to the cost to obtain (or sell) fuel necessary to provide reserves
    - Cost is based on the intraday premium (discount)
  - Dual fuel units do not face an opportunity cost to providing reserves when the cost of oil is less than the cost of gas

- **AGI and LCI provided the following preliminary recommendations in the Draft Report:**
  - The Siemens SGT6-5000F5 represents the highest variable, lowest fixed cost peaking plant that is economically viable in all locations
    - To be economically viable and practically constructible, the F Class Frame machine would be built with SCR emission control technology across all locations
    - Based on market expectations, the F Class Frame machine would more often than not be built with dual fuel capability in all locations
  - Derivation of ICAP Demand Curve parameters for the 2017/2018 Capability Year reflect the following inputs:
    - **Gas Hubs**: Load Zone C (TETCO M3), Load Zones F and G (Iroquois Zone 2), Load Zones J and K (Transco Zone 6)
    - **Cost of Capital**: After Tax Weighted Average Cost of Capital of 8.36% in NYC and 8.60% in all other locations
    - **Zero Crossing Point**: NYCA (112%), G-J Locality (115%), NYC and LI (118%)

# Preliminary Results: Reference Point Price

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| Preliminary Monthly Reference Point Price ($/kW-Month) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fuel type | Technology | C - Central | F - Capital | G - Hudson Valley (Rockland) | G - Hudson Valley (Dutchess) | J - New York City | K - Long Island |
| Dual Fuel | Wartsila 18V50DF | $20.53 | $19.10 | $25.13 | $24.80 | $31.58 | $24.35 |
| | LMS100 PA | $16.28 | $14.88 | $19.37 | $19.06 | $23.88 | $17.48 |
| | SGT6-PAC5000F(5) SC | $11.24 | $10.99 | $14.81 | $14.57 | $18.33 | $11.17 |
| | 1x0 GE 7HA.02 | $9.71 | $9.77 | $13.93 | $13.22 | - | $20.28 |
| Gas only with SCR | Wartsila 18V50DF | $18.99 | $17.58 | $23.39 | $23.11 | - | - |
| | LMS100 PA | $15.62 | $14.45 | $19.04 | $18.74 | - | - |
| | SGT6-PAC5000F(5) SC | $10.44 | $10.48 | $14.06 | $13.88 | - | - |
| | 1x0 GE 7HA.02 | $8.37 | $8.60 | $12.61 | $11.98 | - | - |

- **Notes: Values are expressed in $2016 and will be updated with finalized data prior to the November 2016 filing with FERC.**
- **Data for GE 7HA.02 is provided for informational purposes**

# Preliminary Results: Gross CONE

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| Preliminary Gross CONE ($/kW-Year) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Fuel type** | **Technology** | **C - Central** | **F - Capital** | **G - Hudson Valley (Rockland)** | **G - Hudson Valley (Dutchess)** | **J - New York City** | **K - Long Island** |
| Dual Fuel | Wartsila 18V50DF | $256.70 | $251.53 | $283.44 | $280.63 | $330.60 | $314.00 |
| | LMS100 PA | $224.07 | $215.27 | $239.58 | $237.36 | $276.94 | $261.32 |
| | SGT6-PAC5000F(5) SC | $160.25 | $152.56 | $173.89 | $172.07 | $205.85 | $191.92 |
| | 1x0 GE 7HA.02 | $147.77 | $142.76 | $158.82 | $157.26 | - | $238.15 |
| Gas only with SCR | Wartsila 18V50DF | $237.71 | $229.76 | $260.80 | $258.36 | - | - |
| | LMS100 PA | $213.63 | $204.81 | $229.03 | $226.89 | - | - |
| | SGT6-PAC5000F(5) SC | $148.20 | $140.69 | $160.14 | $158.85 | - | - |
| | 1x0 GE 7HA.02 | $130.80 | $125.65 | $141.29 | $139.89 | - | - |

- **Notes: Values are expressed in $2016 and will be updated with finalized data prior to the November 2016 filing with FERC.**
- **Data for GE 7HA.02 is provided for informational purposes**

# Preliminary Results: Net EAS Revenues

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| Preliminary Net EAS ($/kW-Year) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Fuel type** | **Technology** | **C - Central** | **F - Capital** | **G - Hudson Valley (Rockland)** | **G - Hudson Valley (Dutchess)** | **J - New York City** | **K - Long Island** |
| Dual Fuel | Wartsila 18V50DF | $60.25 | $68.81 | $62.99 | $63.06 | $76.49 | $140.15 |
| | LMS100 PA | $57.35 | $62.84 | $58.42 | $58.44 | $70.98 | $125.46 |
| | SGT6-PAC5000F(5) SC | $48.21 | $43.61 | $41.07 | $41.14 | $55.79 | $111.77 |
| | 1x0 GE 7HA.02 | $53.37 | $48.22 | $46.20 | $46.24 | - | $119.20 |
| Gas only with SCR | Wartsila 18V50DF | $56.05 | $61.54 | $55.55 | $55.62 | - | - |
| | LMS100 PA | $53.61 | $56.77 | $51.00 | $51.02 | - | - |
| | SGT6-PAC5000F(5) SC | $44.16 | $36.76 | $34.06 | $34.13 | - | - |
| | 1x0 GE 7HA.02 | $49.36 | $42.38 | $39.32 | $39.36 | - | - |

- **Notes: Values are expressed in $2016 and will be updated with finalized data prior to the November 2016 filing with FERC.**
- **Data for GE 7HA.02 is provided for informational purposes**

# F Class Frame Machine with SCR and Dual Fuel (all locations)

| | | Current Year (2017-2018) | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Source** | **C - Central** | **F - Capital** | **G - Hudson Valley (Dutchess)** | **G - Hudson Valley (Rockland)** | **J - New York City** | **K - Long Island** |
| Gross Cost of New Entry ($/kW-Year) | [1] | $160.25 | $152.56 | $172.07 | $173.89 | $205.85 | $191.92 |
| Net EAS Revenue ($/kW-Year) | [2] | $48.21 | $43.61 | $41.14 | $41.07 | $55.79 | $111.77 |
| Annual ICAP Reference Value ($/kW-Year) | [3] = [1] - [2] | $112.04 | $108.95 | $130.93 | $132.82 | $150.06 | $80.15 |
| ICAP DMNC (MW) | [4] | 215.8 | 217.0 | 218.0 | 218.0 | 217.6 | 219.1 |
| **Total Annual Reference Value** | [5] = [3] * [4] | **$24,179,975** | **$23,643,213** | **$28,537,263** | **$28,949,925** | **$32,648,900** | **$17,562,708** |
| Level of Excess (%) | [6] | 100.6% | 100.6% | 101.5% | 101.5% | 102.3% | 103.9% |
| Ratio of Summer to Winter DMNCs | [7] | 1.039 | 1.039 | 1.054 | 1.054 | 1.077 | 1.075 |
| Summer DMNC (MW) | [8] | 223.1 | 223.4 | 223.3 | 222.7 | 223.0 | 226.3 |
| Winter DMNC (MW) | [9] | 231.3 | 231.3 | 231.3 | 231.3 | 229.9 | 231.3 |
| **Assumed Capacity Prices at Tariff Prescribed Level of Excess Conditions** | | | | | | | |
| Summer ($/kW-Month) | [10] | $10.73 | $10.48 | $13.13 | $13.34 | $15.99 | $8.75 |
| Winter ($/kW-Month) | [11] | $7.07 | $6.91 | $7.88 | $8.01 | $8.15 | $4.09 |
| Monthly Revenue (Summer) | [12] = [10]*[8] | $2,393,484 | $2,341,718 | $2,932,141 | $2,971,557 | $3,566,866 | $1,979,885 |
| Monthly Revenue (Winter) | [13] = [11]*[9] | $1,636,511 | $1,598,825 | $1,824,063 | $1,853,420 | $1,874,615 | $947,219 |
| Seasonal Revenue (Summer) | [14] = 6 * [12] | $14,360,902 | $14,050,311 | $17,592,843 | $17,829,343 | $21,401,197 | $11,879,309 |
| Seasonal Revenue (Winter) | [15] = 6 * [13] | $9,819,068 | $9,592,952 | $10,944,377 | $11,120,523 | $11,247,690 | $5,683,314 |
| **Total Annual Reference Value** | [16] = [14]+[15] | **$24,179,971** | **$23,643,263** | **$28,537,220** | **$28,949,866** | **$32,648,887** | **$17,562,623** |
| **Demand Curve Parameters** | | | | | | | |
| | | **ICAP Monthly Reference Point Price ($/kw-Month)** | | | | | |
| | | **$11.24** | **$10.99** | **$14.57** | **$14.81** | **$18.33** | **$11.17** |
| ICAP Max Clearing Price ($/kW-Month) | | $19.29 | $18.68 | $24.15 | $24.50 | $30.90 | $24.55 |
| Demand Curve Length | | 12.0% | 12.0% | 15.0% | 15.0% | 18.0% | 18.0% |

# Appendix

# Derivation of Weighted Average Cost of Capital

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- **AGI estimated the Weighted Average Cost of Capital (WACC) and after tax WACC (ATWACC) using the following equations:**

$$(1)\ WACC = \ Debt\ Ratio * COD + (1 - Debt\ Ratio) * ROE$$

$$10.29\% = 55\% * 7.75\% + (1 - 55\%) * 13.4\%$$

$$(2)\ ATWACC = \ Debt\ Ratio * COD * (1 - composite\ tax\ rate) + (1 - Debt\ Ratio) * ROE$$

$$8.36\% = 55\% * 7.75\% * (1 - 45.37\%) + (1 - 55\%) * 13.4\% \text{ (NYC)}$$

$$8.60\% = 55\% * 7.75\% * (1 - 39.62\%) + (1 - 55\%) * 13.4\% \text{ (All other locations)}$$

# Overview of Preliminary Net EAS Revenue Estimates

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- **Further detail on preliminary net EAS revenue estimates are provided in a Draft Report Appendix with breakouts by commitment state, fuel, and year**

## F Class Frame Machine with Dual Fuel and SCR

| Run Hours May, 2013 - April, 2014 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Day-Ahead Commitment** | | Energy | | | | Reserve | | | | None | | | |
| **Real-Time Dispatch** | | Energy | Reserve | Buyout | Limited | Energy | Reserve | Buyout | Limited | Energy | Reserve | None | Limited |
| C | Central | 1,014 | 0 | 504 | 0 | 8 | 2 | 148 | 0 | 244 | 0 | 6,840 | 0 |
| F | Capital | 662 | 15 | 510 | 0 | 38 | 0 | 257 | 0 | 193 | 0 | 7,085 | 0 |
| G | Hudson Valley (Dutchess) | 962 | 0 | 424 | 0 | 42 | 1 | 275 | 0 | 188 | 0 | 6,868 | 0 |
| G | Hudson Valley (Rockland) | 962 | 0 | 413 | 0 | 42 | 1 | 275 | 0 | 187 | 0 | 6,880 | 0 |
| J | NYC | 2,401 | 0 | 428 | 0 | 31 | 1 | 171 | 0 | 112 | 0 | 5,616 | 0 |
| K | Long Island | 3,207 | 0 | 402 | 1,333 | 35 | 0 | 96 | 15 | 112 | 0 | 3,475 | 85 |
| **Net EAS Revenues May, 2013 - April, 2014** | | | | | | | | | | | | | |
| **Day-Ahead Commitment** | | Energy | | | | Reserve | | | | None | | | |
| **Real-Time Dispatch** | | Energy | Reserve | Buyout | Limited | Energy | Reserve | Buyout | Limited | Energy | Reserve | None | Limited |
| C | Central | $41.44 | $0.00 | $20.16 | $0.00 | $0.65 | $0.00 | $0.20 | $0.00 | $8.31 | $0.00 | $0.00 | $0.00 |
| F | Capital | $31.68 | $1.75 | $26.81 | $0.00 | $3.95 | $0.00 | $0.19 | $0.00 | $8.07 | $0.00 | $0.00 | $0.00 |
| G | Hudson Valley (Dutchess) | $34.85 | $0.00 | $21.47 | $0.00 | $3.90 | $0.00 | $0.20 | $0.00 | $7.40 | $0.00 | $0.00 | $0.00 |
| G | Hudson Valley (Rockland) | $34.81 | $0.00 | $21.44 | $0.00 | $3.89 | $0.00 | $0.20 | $0.00 | $7.38 | $0.00 | $0.00 | $0.00 |
| J | NYC | $69.94 | $0.00 | $18.64 | $0.00 | $3.35 | $0.00 | $0.21 | $0.00 | $3.60 | $0.00 | $0.00 | $0.00 |
| K | Long Island | $152.52 | $0.00 | $16.54 | $0.00 | $3.91 | $0.00 | $0.09 | $0.03 | $7.50 | $0.00 | $0.00 | $0.00 |

| May, 2013 - April, 2014 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Run-Time Hours** | | | **Net Energy Revenues ($/kW-year)** | | |
| **Load Zone** | | Gas | Oil | Total | Gas | Oil | Total |
| C | Central | 1,258 | 8 | 1,266 | $49.76 | $0.65 | $50.41 |
| F | Capital | 777 | 116 | 893 | $32.62 | $11.08 | $43.69 |
| G | Hudson Valley (Dutchess) | 1,084 | 108 | 1,192 | $35.96 | $10.18 | $46.14 |
| G | Hudson Valley (Rockland) | 1,083 | 108 | 1,191 | $35.92 | $10.17 | $46.08 |
| J | New York City | 2,449 | 95 | 2,544 | $64.23 | $12.66 | $76.89 |
| K | Long Island | 3,232 | 122 | 3,354 | $150.79 | $13.14 | $163.93 |

# NYCA ICAP Demand Curve Comparison

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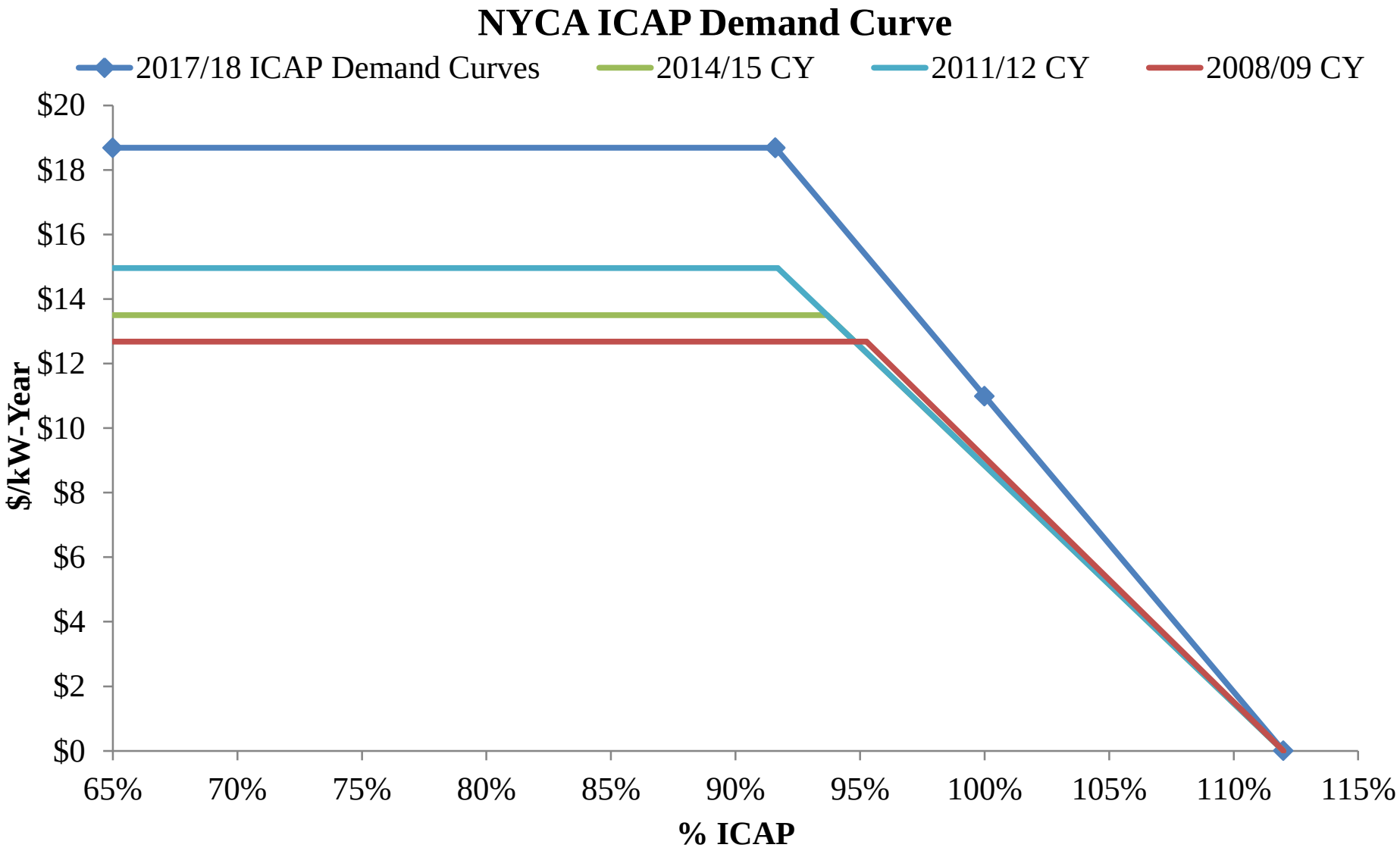

# G-J Locality ICAP Demand Curve Comparison

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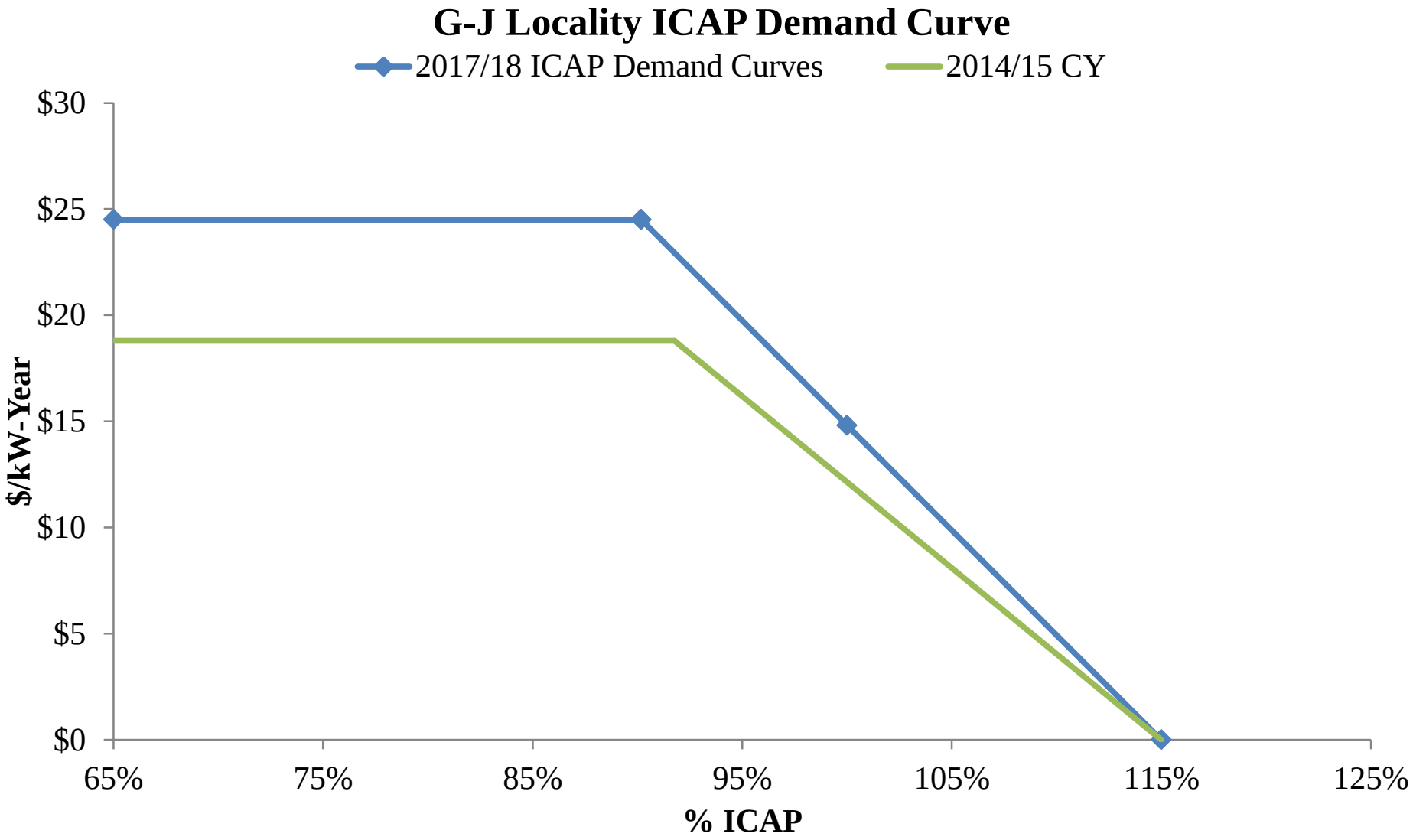
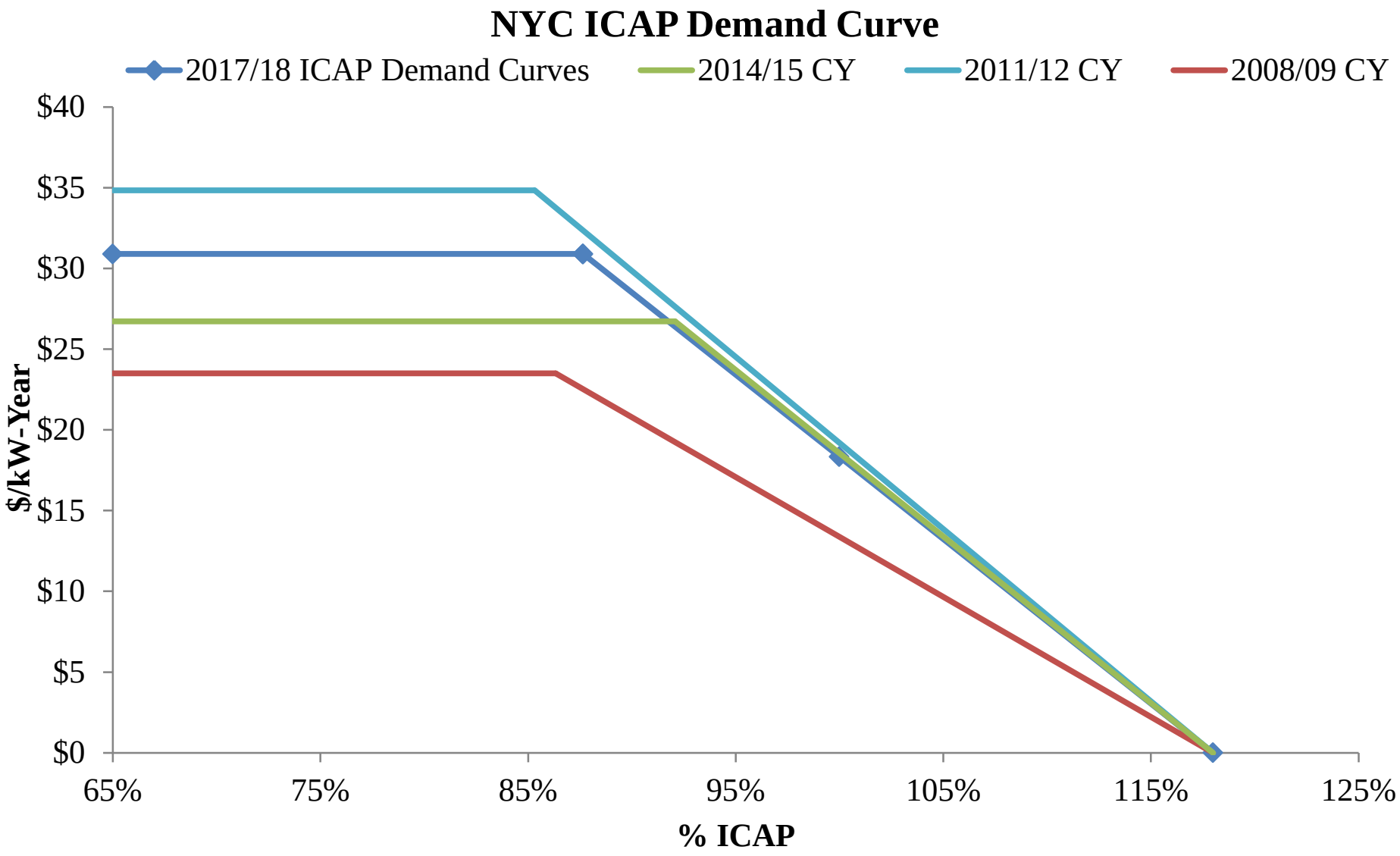


# NYC ICAP Demand Curve Comparison



# LI ICAP Demand Curve Comparison

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