

NYISO 2015/2016 ICAP Demand Curve Reset

Review of Stakeholder Comments and Anticipated
Updates to Final Report

ICAPWG
August 10, 2016

- **Stakeholder comments**
 - Issues covered in Draft Report
 - Net Energy and Ancillary Services (EAS) revenues model
 - Capital costs and gross cost of new entry (CONE)
 - Escalation factors
 - Other
- **Review of level of excess adjustment factors (LOE-AF)**
- **Appendix: Additional numerical results for informational purposes**
 - Gas only F-Class Frame unit without SCR in Load Zones C, F, and G (Dutchess County)
 - Review of net EAS revenues for informational combined cycle units

- **At this time, Analysis Group (AGI) does not recommend a change to the following issues, and is reviewing whether additional detail is needed in the Final Report in response to stakeholder comments:**
 - Selection of natural gas hubs
 - Financial parameters for cost of capital, including return on equity, cost of debt, and amortization period
 - Rationale for dual fuel and SCR capability in all Load Zones

- **Lummus Consultants (LCI) notes that sufficient detail is not available in the 2013 DCR Consultants Report to develop a full comparison of assumptions used to develop capital costs**
 - LCI estimates reflect an additional four years of data, LCI's professional judgement, and LCI's estimation methodologies and models

- **AGI will include the following updates in the Final Report**
 - Updated data:
 - All costs (gross CONE, net EAS revenues, and reference point prices) will be expressed in \$2017, using current escalation factors
 - Locational based marginal prices (LBMPs), ancillary service prices and cost data updated to reflect the period *July 1, 2013 through June 30, 2016*
 - *Data will be further updated in conjunction with NYISO Staff's Final Recommendations to reflect final values based on the period from September 1, 2013 through August 31, 2016*
 - Winter-to-summer ratio (WSR) values updated through August 2016 (reflecting final WSR values for period from September 1, 2013 through August 31, 2016)
 - LOE-AF developed using 2016 CARIS Phase 2 database
 - Include additional numerical sensitivities for F-Class Frame Unit in gas only without SCR configuration in Load Zones C, F, and G (Dutchess County)

- **Stakeholders requested that additional sensitivities be provided with the Final Report**

- **As noted on the prior slide, the Final Report will include gas only without SCR sensitivities for F-Class Frame Machine in Load Zones C, F, and G (Dutchess County)**
 - Values using the June 2016 Draft Report demand curve model are included in the appendix to this presentation

- **Final Report will not include additional sensitivities for technologies that do not meet applicable technology limits and/or requirements**
 - H Machine in NYC (due to 45 second autoswap requirement)
 - LMS without SCR (due to NSPS NOx requirement)
 - Gas only NYC or LI
 - Alternative natural gas hubs
 - Net EAS revenues model provides stakeholders with flexibility to test alternative gas prices

■ Stakeholder comments

- Issues covered in Draft Report
- Net Energy and Ancillary Services (EAS) revenues model
 - Environmental run-time limitations
 - Equivalent demand forced outage rate (EFORd)
 - Fuel parameters and assumptions
 - Comparison with MMU model
 - Intraday fuel premium
- Capital costs and gross cost of new entry (CONE)
- Escalation factors
- Other
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- **Stakeholders requested that the net EAS revenue estimates should be modified to account for increased revenues from NYISO's recent shortage pricing enhancements (i.e., Comprehensive Shortage Pricing)**

- **Response: The current net EAS revenues model appropriately captures potential net EAS revenue, including:**
 - Annual updates, which will continue to add market data with LBMPs reflecting actual shortage price events as they occur over time
 - LOE conditions, reflecting the 2016 CARIS Phase 2 database and GE MAPS modeling runs, include parameters for both on-peak and high on-peak periods in which shortage pricing would be in effect

- **Net EAS revenues model includes environmental run-time limitations for either the CO₂ New Source Performance Standard (NSPS) or NO_x Minor Source (when operating without SCR)**
 - NSPS for CO₂ requires that units limit their capacity factors over a 12-operating month or three year rolling average to the following values to remain non-base load
 - GE LMS100 PA (42.4%); Siemens 5000F5 (38.4%), and GE 7HA.02 (40.9%)
- **Net EAS revenues model evaluates environmental limits on an annual basis; when limit becomes binding, net EAS revenues model:**
 - Removes the least profitable energy (Day-Ahead Market [DAM] or real-time market [RTM]) run-time block; and
 - Allows the unit to earn DAM reserve revenues at prevailing DAM reserve prices (as adjusted by the applicable LOE-AF values), which may be \$0/MWh
 - *Rationale:* three year rolling average allows for generator flexibility in meeting targets; application of limit on annual basis in the net EAS revenues model is more restrictive than actual requirement

- **Stakeholders requested a review of the current 2.2% assumed EFORd rate**
 - Stakeholders noted that the NERC GADS 7.25% average EFORd for simple cycle gas turbines
- **Recommendation: Maintain the current 2.2% EFORd rate**
- **Rationale:**
 - Current recommendation reflects LCI's best professional judgement and experience with respect to reference technologies
 - GADS data relied upon by stakeholder comments reflects experience of 517 units and reports distribution of results by age and EFORd
 - More than 50% of units in-service prior to 1994; older units may not be directly comparable to a new peaking plant
 - 72 percent of units report an EFORd below 1.9% and 77 percent of units report an EFORd below 2.9%

- **Stakeholders requested a review of natural gas fuel transportation adders**
 - Current model assumes the following gas transportation costs for each Load Zone

Capacity Region	Gas Transportation (\$/MMBtu)	Intraday Gas Premium/Discount	Tax (Gas; ULSD)	Oil Transportation (\$/MMBtu)
NYCA	\$0.27	10%	-	\$2.00
G-J	\$0.27	10%	-	\$1.50
NYC	\$0.20	20%	6.9% (Gas); 4.5% (ULSD)	\$1.50
LI	\$0.25	30%	1.0% (Gas)	\$1.50

- **Recommendation: Maintain current gas transportations costs**
 - Accounts for cost to transport natural gas from producing regions to delivery points along interstate pipelines
 - Transportation costs are the same as both the 2013 DCR and Market Monitoring Unit (MMU) analysis

- **AGI provided monthly net EAS revenues results for the July 20, 2016 ICAPWG meeting**
- **Potomac Economics (MMU) has released monthly net EAS revenues from its model to stakeholders**
 - Potomac's model results reflect AGI's recommended gas hubs and unit specifications (e.g., capacity, heat rate, and variable costs)
 - Covers the period May 2013 through December 2015
 - Results reported by commitment state
- **The models use similar approaches (see similarities and differences on next slide)**

- **Key similarities and differences between the AGI and Potomac models include:**
 - Day-Ahead Commitment
 - Both models allow units to settle at the greater of DAM or RTM LBMPs (given opportunity cost of buyouts)
 - Potomac’s model reflects both Day Ahead Margin Assurance Payments (DAMAP) and financial buyouts; AGI model ensures day ahead revenues through financial buyouts
 - Real-Time Commitment
 - Potomac uses hourly integrated RTC price for commitment (using 1st indicative price) and RTD for settlement, with one hour look ahead and Bid Production Cost Guarantee (BPCG)
 - Potomac limits units to 1 start per day
 - Potomac allows units to run on oil during operational flow orders (OFOs)
 - AGI uses a two hour look ahead with RTD price
 - Potomac model does not include an opportunity cost or bid cost to provide reserves; AGI does, which limits reserve revenues
 - Both models use an average annual intraday fuel premium
 - AGI model uses Zonal LBMP prices; Potomac model uses nodal prices (LI)

- **AGI presented monthly net EAS revenues to stakeholders on July 20, 2016**
 - Stakeholders requested clarification for net EAS revenues earned in February 2016

- **In February 2016, the F-Class unit with dual fuel capability and SCR shows a negative net EAS revenue of $-\$0.05/\text{kW-mo}$ for a DAM reserve commitment and RTM energy dispatch in Load Zone K**
 - The result occurs due to the amortization of start-up costs in RTM
 - The unit was committed for DAM reserves from 6 pm to 7 pm for the February 19, 2016 market day;
 - On February 19, 2016, the unit runs in RTM from 6 pm to 11 pm
 - The full RTM block is more profitable than the single reserve hour
 - RTM hours for 7 pm to 11 pm are categorized in the “DA-None” to “RT-Energy” data cell

- **Stakeholder comments**
 - Issues covered in Draft Report
 - Net Energy and Ancillary Services (EAS) revenues model
 - Capital costs and gross cost of new entry (CONE)
 - Site selection
 - Property taxes
 - Productivity factors and labor rates
 - Escalation factors
 - Other
- **Review of updated level of excess adjustment factors (LOE-AF)**
- **Appendix: Additional numerical results for informational purposes**
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- **Stakeholders provided feedback on several site selection issues, including gas interconnection costs, site elevation costs, System Deliverability Upgrade (SDU) costs and the use of Orange County for Load Zone G**

- **Broadly, LCI notes that the study is based on generic sites within each Load Zone and is not site specific.**
 - Cost estimates reflect LCI's best professional judgement, considering hypothetical construction
 - All cost estimates reflect project specific uncertainty; LCI developed estimates consistent with Class 4 standards

- **Recommendation: LCI does not recommend a change to gas interconnection costs**
 - Confidential data for gas interconnection costs is consistent with LCI's total cost estimate but reflects site specific distances and engineering considerations
 - NYC estimates reflect a shorter distance and higher cost per diameter-mile

- **Recommendation: LCI does not recommend a change to site elevation costs for Load Zone J**
 - Load Zone J sites would likely not need to raise the site more than the 3.5 feet assumed in the estimate
 - Potential site elevations along the waterfront range from 10 feet to over 16 feet NAVD88
 - The Federal Emergency Management Agency (FEMA) minimum site elevation requirement is 14 feet NAVD88
 - 500 year flood elevation is 18 feet NAVD88, but that would be a developer's economic decision to design to that site elevation (i.e., not mandated by building code requirements)

- **Stakeholders requested that LCI and AGI evaluate locating a peaking plant in Orange County rather than Rockland County as an alternative to Dutchess County for Load Zone G**

- **Recommendation: The location west of Hudson should continue to reflect Rockland County**
 - Both Rockland and Orange County would require SCR technology for NO_x compliance
 - NYS DEC continues to classify lower Orange County metropolitan area as non-attainment
 - LCI evaluated construction labor costs in Orange County;
 - Union craft labor rates for the majority of power plant crafts (e.g., boilermaker, insulator, electrician, pipefitter, operating engineer, and ironworker) are the same as Rockland County
 - Craft rates for millwrights, carpenters, and laborers are lower than Rockland County
 - LCI believes the change in construction labor costs (and therefore total capital costs) for using Orange County instead of Rockland County is within current accuracy of cost estimates

- **Stakeholders requested a review of productivity factors and labor rates**
- **LCI developed its productivity based on its EPC experience in New York**
 - Productivity factors are impacted by general plant location (e.g., weather, traffic, union rules) and project construction schedule
 - Review of other data made available to LCI supports the consistency of LCI's productivity factors with factors used by other estimators for New York projects
- **LCI used New York Department of Labor (NYDOL) estimates for union construction labor rates**
 - LCI chose not to use NYDOL estimates for other occupations, including power plant operators and maintenance, which form the basis of the fixed operations and maintenance (FOM) costs
 - In contrast to union contract data (e.g., construction labor), occupational values are submitted by companies, which may be skewed by individual employers (e.g., nuclear power plants) in each Load Zone
 - LCI believes prior FOM estimates from the 2013 DCR were reasonable and escalated these values accordingly

- Stakeholders requested a review of payment in lieu of taxes (PILOT) rates outside of NYC and recommended the use of a 0.5% tax rate
- Recommendation: No change in recommended rate of 0.75%
 - PILOT agreements are typically project specific and depend on unique regional economic conditions, with rates increasing over time (1992 to 2004)
 - May include brownfield developments, repowering, or combined cycle units (which may provide greater total payments and employment opportunities)
 - Review of Industrial Development Agency (IDA) data identified 11 natural gas plants, with fiscal year 2014 effective tax rates ranging from 0.2% to 2.01%
 - Median value of 0.83%; weighted average by PILOT payment 0.80%

PILOT Payments (\$2014)

Project Name	Operating Capacity (MW)	Fuel Type	Technology Type	Total Project Amount (\$million)	Total PILOT Payments Due	Effective Tax Rate	Year
WPS Beaver Falls Generation	89	Gas	Combined Cycle	\$9.0	\$81,999	0.91%	1998
WPS Syracuse Generation	98	Gas	Combined Cycle	\$8.0	\$66,123	0.83%	1998
Brooklyn Navy Yard	296	Gas	Combined Cycle	\$370.0	\$748,526	0.20%	1995
Carthage Energy LLC	66	Gas	Combined Cycle	\$6.0	\$102,370	1.71%	1999
Bethellemn Energy Center	870	Gas	Combined Cycle	\$400.0	\$3,546,496	0.89%	2001
Freeport Generating Station	98	Gas	Gas Turbine	\$59.5	\$1,197,293	2.01%	2003
Empire Generating Project	676	Gas	Combined Cycle	\$358.0	\$1,000,000	0.28%	2009
Saranac Facility	270	Gas	Combined Cycle	\$166.5	\$420,000	0.25%	1989
Athens Generating Station	1,244	Gas	Combined Cycle	\$750.0	\$4,896,986	0.65%	2001
Independence Station	1,144	Gas	Combined Cycle	\$800.0	\$6,013,333	0.75%	1992
Pinelawn Power, LLC	77	Gas	Combined Cycle	\$92.0	\$998,500	1.09%	2004

- **Stakeholders requested a review of back-up fuel requirements, including total fuel use and limitations within net EAS revenue estimates calculation**

- **Recommendation: Current assumption (96 hours) reflects a balance of multiple considerations and appropriately balances ability to supply with costs of refueling**
 - Total backup fuel requirement is consistent with Con Edison requirement of 5 day supply (96 hours reflects 6 days of 16 hours or 4 days full load)
 - Total backup fuel requirement is consistent with LCI's experience with dual fuel plants
 - Total backup fuel inventory is consistent (but not exceeded) with observed oil burn within the current net EAS revenues model
 - Maximum consecutive oil burn is 69 hours over 4 days in LI and 56 hours over 4 days in NYC
 - The shortest period over which 96 hours of fuel oil is burned is 5 days in LI; all other regions are greater than 2 weeks

May, 2013 - April, 2014							
Load Zone		Run-Time Hours			Net Energy Revenues (\$/kW-year)		
		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

May, 2014 - April, 2015							
Load Zone		Run-Time Hours			Net Energy Revenues (\$/kW-year)		
		Gas	Oil	Total	Gas	Oil	Total
C	Central	1,875	10	1,885	\$19.60	\$0.31	\$19.91
F	Capital	717	24	741	\$16.15	\$0.82	\$16.98
G	Hudson Valley (Dutchess)	741	23	764	\$15.42	\$0.87	\$16.30
G	Hudson Valley (Rockland)	741	23	764	\$15.38	\$0.87	\$16.25
J	New York City	2,394	38	2,432	\$24.81	\$1.73	\$26.54
K	Long Island	3,314	39	3,353	\$67.15	\$1.51	\$68.66

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- **All values will be expressed in \$2017 for the Final Report, reflecting recently released data for each escalation component**
 - Final values are expected by September 29, 2016 for GDP Q2
 - Report uses national GDP deflator as a measure of historical general inflation and is not state or location specific
- **Stakeholders asked for clarification on the following issues:**
 - GDP Deflator is assigned a 15% weight for all technologies; this reflects the contribution of non-EPC costs to overall capital costs
 - Non-EPC costs are a percentage of EPC costs and do not vary by technology
 - Historical net EAS revenues are expressed in \$2017, consistent with gross CONE costs; net EAS revenues are escalated using GDP deflator
 - Draft Report also escalated net EAS revenues into current dollars
- **Note: Both the Draft Report and Final Report rely on the BLS Producer Price Index – Intermediate Demand by Commodity Type as the index for the “Materials Component” of the composite escalation factor**
 - Replaces BLS Producer Price Index for Stage of Processing, presented in February 19, 2016 presentation to the ICAPWG meeting

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- **AGI will update the LOE-AF's to reflect the 2016 CARIS Phase 2 database presented at the BIC on July 13, 2016**
- **2016 CARIS Phase 2 database reflects current changes to system conditions and updated parameters, including:**
 - Updated generator additions and retirements
 - 2016 Gold Book peak load and energy forecast
 - Updated fuel and emission price forecasts

(See the July 5, 2016 ESPWG presentation for additional information)

- **LOE-AF are estimated as the ratio of average LBMPs between the “as-found” and an “at-criterion” scenarios, for three periods (on-peak, high on-peak, and off-peak), consistent with Draft Report**
 - “At-criterion” is approximated through increases in load, consistent with the 2013 DCR and the 2016 Draft Report
 - AGI has evaluated two methods to approximate “at-criterion” cases, with different regional loads [see following slides]

- **Adjust load – consistent with preliminary LOE-AF using 2015 CARIS Phase 1, as presented in the Draft Report – to meet LCR and IRM for each Locality and NYCA: (1) Load Zone K, (2) Load Zone J, (3) G-J Locality, and (4) Load Zones A-F**
 - When applying the 2016 CARIS Phase 2 database, this method requires a reduction in load in Load Zones A-F to reach IRM

Load Zone	Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Capital (Load Zone F)	Off-peak	1.033	1.024	1.011	1.004	1.004	1.004	1.000	1.007	1.006	1.011	1.013	1.005
	On-peak	1.026	1.028	1.024	1.009	0.995	0.992	0.990	0.996	0.991	0.998	1.017	1.005
	High On-peak	1.019	1.036	-	-	-	0.977	0.971	0.977	-	-	-	1.018
Central (Load Zone C)	Off-peak	0.979	0.985	0.982	0.992	0.994	1.001	0.998	1.003	1.004	1.008	0.983	0.993
	On-peak	0.970	0.985	0.975	0.992	0.988	0.987	0.985	0.993	0.988	0.995	0.990	0.994
	High On-peak	0.972	0.960	-	-	-	0.969	0.965	0.972	-	-	-	0.970
Hudson Valley (Load Zone G)	Off-peak	1.029	1.023	1.010	1.010	1.009	1.016	1.016	1.022	1.016	1.022	1.013	1.013
	On-peak	1.027	1.032	1.024	1.018	1.008	1.015	1.018	1.019	1.012	1.013	1.024	1.023
	High On-peak	1.046	1.043	-	-	-	1.030	1.033	1.043	-	-	-	1.040
New York City (Load Zone J)	Off-peak	1.030	1.019	1.010	1.010	1.017	1.025	1.031	1.029	1.022	1.026	1.013	1.014
	On-peak	1.052	1.056	1.029	1.019	1.012	1.030	1.047	1.047	1.023	1.023	1.028	1.039
	High On-peak	1.057	1.054	-	-	-	1.035	1.162	1.129	-	-	-	1.037
Long Island (Load Zone K)	Off-peak	1.042	1.022	1.010	1.005	1.017	1.017	1.033	1.024	1.023	1.026	1.028	1.014
	On-peak	1.045	1.033	1.012	1.002	1.013	1.025	1.033	1.023	1.025	1.027	1.061	1.047
	High On-peak	1.028	1.021	-	-	-	1.033	1.129	1.070	-	-	-	1.024

- Meet IRM by raising load in each Load Zone an equal proportional amount

Load Zone	Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Capital (Load Zone F)	Off-peak	0.988	0.992	0.990	0.998	1.022	1.020	1.026	1.030	1.023	1.034	1.011	1.008
	On-peak	0.988	1.005	0.987	1.017	1.044	1.045	1.035	1.037	1.038	1.038	0.997	1.006
	High On-peak	0.987	1.006	-	-	-	1.057	1.045	1.048	-	-	-	0.996
Central (Load Zone C)	Off-peak	1.068	1.036	1.024	1.023	1.025	1.026	1.029	1.031	1.030	1.039	1.035	1.019
	On-peak	1.061	1.032	1.048	1.043	1.055	1.054	1.038	1.041	1.052	1.059	1.037	1.021
	High On-peak	1.062	1.044	-	-	-	1.058	1.043	1.049	-	-	-	1.038
Hudson Valley (Load Zone G)	Off-peak	1.014	1.010	1.001	1.004	1.023	1.028	1.029	1.033	1.025	1.035	1.013	1.011
	On-peak	1.016	1.020	0.999	1.024	1.050	1.057	1.040	1.036	1.039	1.034	1.008	1.009
	High On-peak	1.025	1.032	-	-	-	1.085	1.052	1.052	-	-	-	1.005
New York City (Load Zone J)	Off-peak	1.007	1.004	0.997	0.993	1.001	1.003	1.006	1.006	1.005	1.020	1.007	1.006
	On-peak	0.989	1.010	0.990	0.993	0.995	0.999	1.008	1.014	1.006	1.009	1.000	1.003
	High On-peak	0.996	1.014	-	-	-	1.007	1.009	1.020	-	-	-	1.003
Long Island (Load Zone K)	Off-peak	1.009	1.006	1.003	0.997	1.013	1.010	1.015	1.012	1.010	1.018	1.011	1.008
	On-peak	1.012	1.014	0.995	0.993	1.015	1.005	1.010	1.009	1.009	0.998	1.009	1.013
	High On-peak	1.003	1.008	-	-	-	1.010	1.015	1.021	-	-	-	1.000

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- **Detailed information for the F-Class Frame unit without SCR was provided with the Draft Report, in Append B**
 - Capital costs, FOM costs, and variable operations and maintenance costs

- **Aggregate net EAS revenues, gross CONE, and reference point prices are provided in the following slides**
 - All values reflect parameters used in the June 20, 2016 Draft Report, including LBMPs, reserve prices, cost data and LOE-AF
 - Updated values will be presented with the Final Report

- **Other technologies do not meet applicable NSPS NO_x standards without an SCR**

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	-	-
Gas only without SCR	SGT6-PAC5000F(5) SC	\$132.86	\$124.81	-	\$142.46	-	-

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	-	-
Gas only without SCR	SGT6-PAC5000F(5) SC	\$45.39	\$37.30	-	\$34.73	-	-

Preliminary Monthly Reference Point Price (\$/k W-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	-	-
Gas only without SCR	SGT6-PAC5000F(5) SC	\$8.78	\$8.83	-	\$11.99	-	-

- **Net EAS revenue estimates for the informational combined cycle units were developed**
 - The model uses simplified commitment and dispatch logic
 - Includes DAM energy commitment, RTM energy dispatch and the ability to buyout of a DAM energy commitment
 - Plant may operate at minimum load between starts, if net losses are lower than start up costs
 - Include a flat annual adder (\$3.70/kW-year) for ancillary service revenues, based on settlement data provided by NYISO for the period from 2013 to 2015
 - Reflects average of annual total ancillary services revenues, from 13 comparable units (capacity > 200 MW; net AS revenues > \$100,000)
 - Average \$/kW-year values based on summer and winter DMNC
 - Includes an incremental flat adder for voltage support services (VSS) of \$1.43/kW-yr

Informational Combined Cycle Results (Net EAS Revenues)



Net EAS (\$/kW-Year)								
Sensitivity	Fuel type	Technology	C - Central	F - Capital	G - Hudson Valley (Rockland)	G - Hudson Valley (Dutchess)	J - New York City	K - Long Island
Informational Combined cycle - Dual fuel		5000F CC	\$91.71	\$88.76	\$86.76	\$86.75	\$128.47	\$198.07
		8000H CC	\$97.10	\$92.71	\$90.34	\$90.38	\$133.30	\$203.55
Informational Combined cycle - Gas only		5000F CC	\$86.99	\$78.55	\$77.27	\$77.26	-	-
		8000H CC	\$92.04	\$81.23	\$80.77	\$80.81	-	-

Note:

All values in \$2017. Includes LBMPs, reserve prices and cost data for the three year period through June 30, 2016 and level of excess (LOE) adjustment factors (LOE-AF) based on 2015 CARIS Phase 1 database.

Informational Combined Cycle Results (Gross CONE)

Gross CONE (\$/k W-Year)									
Sensitivity	Fuel type	Technology	C - Central	F - Capital	G - Hudson Valley (Rockland)	G - Hudson Valley (Dutchess)	J - New York City		K - Long Island
							Including Property Tax Abatement	Excluding Property Tax Abatement	
Informational Combined cycle - Dual fuel	5000F CC		\$244.91	\$258.30	\$291.01	\$287.40	\$367.33	\$461.96	\$403.00
	8000H CC		\$219.72	\$233.25	\$262.47	\$258.88	\$330.37	\$415.78	\$359.09
Informational Combined cycle - Gas only	5000F CC		\$233.87	\$247.10	\$279.52	\$275.94	-	-	-
	8000H CC		\$209.68	\$223.02	\$252.02	\$248.42	-	-	-

Note:

Informational combined cycle units would not be expected to meet the average run time per start limitation to qualify for property tax abatement in NYC.

Informational Combined Cycle Results (Reference Point Prices)

Monthly Reference Point Price (\$/k W-Month)									
Sensitivity	Fuel type	Technology	C - Central	F - Capital	G - Hudson Valley (Rockland)	G - Hudson Valley (Dutchess)	J - New York City		K - Long Island
							Including Property Tax Abatement	Excluding Property Tax Abatement	
Informational Combined cycle - Dual fuel		5000F CC	\$16.24	\$18.05	\$24.89	\$24.48	\$33.02	\$46.10	\$36.22
		8000H CC	\$12.46	\$14.38	\$20.70	\$20.27	\$27.47	\$39.37	\$30.00
Informational Combined cycle - Gas only		5000F CC	\$15.57	\$17.94	\$24.65	\$24.24	-	-	-
		8000H CC	\$11.95	\$14.51	\$20.59	\$20.16	-	-	-

Notes:

All values in \$2017. Includes LBMPs, reserve prices and cost data for the three year period through June 30, 2016 and level of excess (LOE) adjustment factors (LOE-AF) based on 2015 CARIS Phase 1 database.

Informational combined cycle units would not be expected to meet the average run time per start limitation to qualify for property tax abatement in NYC.