2017-2018 NYCA IRM Requirement Study

IRM Base Case Model Assumptions

Assumption Matrix

~~July 27~~August 23, 2016

Draft V06t~~5~~

't' signifies temporary, ICS has not yet reviewed

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Load Parameters

#	Parameter	2016 Model Assumptions	2017 Model Assumptions	Basis for Recommendation	Model Change	IRM Impact*
1	Peak Load Forecast (Preliminary Base Case – Parametric & Sensitivities)	2015 Gold Book NYCA: 33,636 MW NYC: 12,013 MW LI: 5,506 MW G-J: 16,441 MW	2016 Gold Book NYCA: 33,363 MW NYC: 11,795 MW LI: 5,422 MW G-J: 16,313 MW	Gold Book Forecast is used for Preliminary Base Case parametric study and sensitivity cases	N	Low(-)
2	Peak Load Forecast (Final Base Case)	October 2015 NYCA: 33377.6 MW NYC: 11777 MW LI: 5457 MW G-J: 16375 MW	TBD in Oct 2016 NYCA: xxxxxx MW NYC: yyyyy MW LI: zzzz MW G-J: uuuuu MW	Forecast based on examination of 2016 weather normalized peaks. Top three external Area peak days aligned with NYCA	N	N/A
3	Load Shape (Multiple Load Shape)	Bin 1: 2006 Bin 2: 2002 Bins 3-7: 2007	Bin 1: 2006 Bin 2: 2002 Bins 3-7: 2007	ICS Recommendation. Potential Sensitivity replacing 2002 shape	N	None
4	Load Forecast Uncertainty	Zonal Model to reflect current data with input from Con Ed and LIPA. (Attachment A)	Zonal Model to reflect current data with input from Con Ed and LIPA. (Attachment A)	Due to cool summer weather in 2014 and 2015, the LFU models do not need to be updated because there is no new information to model extreme weather conditions.	N	None

*(-) indicates a reduction in IRM while (+) indicates an increase. Range: Low < 0.5%, Medium 0.5% - 1%, High > 1%

Generation Parameters

#	Parameter	2016 Model Assumptions	2017 Model Assumptions	Basis for Recommendation	Model Change	IRM Impact
1	Existing Generating Unit Capacities	2015 Gold Book values. Use min (DMNC vs. CRIS) capacity value	2016 Gold Book values. Use min (DMNC vs. CRIS) capacity value	2016 Gold Book publication	N	None
2	Proposed New Units (Non-Renewable) and re-ratings	374.4 MW of new or returning non- wind resources (Attachment B1)	0 MW of new non- wind resources. 67.5 MW of project related re-ratings. (Attachment B1)	2016 Gold Book publication and generator notifications	N	None
3	Retirements and Mothballed units	0 MW retirements or mothballs reported (Attachment B2)	~~1619.7~~185.4 MW retirements or mothballs reported or Units in IIFO and IR[1] (Attachment B2)	Updated Policy 5 guidelines on retirement or mothball disposition in IRM studies. A sensitivity will be performed with Ginna and Fitzpatrick retired.	N	Low(+)
4	Forced and Partial Outage Rates	Five-year (2010-2014) GADS data for each unit represented. Those units with less than five years – use representative data. (Attachments C and C1)	Five-year (2011-2015) GADS data for each unit represented. Those units with less than five years – use representative data. (Attachments C and C1)	Transition Rates representing the Equivalent Forced Outage Rates (EFORd) during demand periods over the most recent five-year period (2011-2015)	N	Low(+)
5	Planned Outages	Based on schedules received by the NYISO and adjusted for history	Based on schedules received by the NYISO and adjusted for history	Updated schedules	N	None
6	Summer Maintenance	Nominal 50 MWs – divided equally between upstate and downstate	Nominal 50 MWs – divided equally between zones J and K	Review of most recent data	N	Low (+)

[1] ICAP Ineligible Forced Outage (IIFO) and inactive Reserve (IR)

#	Parameter	2016 Model Assumptions	2017 Model Assumptions	Basis for Recommendation	Model Change	IRM Impact
7	Combustion Turbine Derates	Derate based on temperature correction curves provided	Derate based on temperature correction curves provided	Operational history indicates the derates are in-line with manufacturer's curves	N	None
8	Existing and Proposed New Wind Units	1455.1 MW of qualifying wind for study year (Attachment B3)	221.1 MW of Wind Capacity additions totaling 1676.2 MW of qualifying wind (Attachment B3)	Renewable units based on RPS agreements, interconnection Queue, and ICS input.	N	Med(+)
9	Wind Shape	Actual hourly plant output of the 2013 calendar year. Summer Peak Hour availability of 14%	Actual hourly plant output over the period 2011-2015. New units will use zonal hourly averages or nearby units.	See White paper on new functionality of the GE MARS program to randomly select a wind shape from multiple years of production data	Y	Low(-)
10	Solar Resources (Grid connected)	31.5 MW Solar Capacity per 2014 production data summer availability factor of 38.8 % (Attachment B4)	31.5 MW Solar Capacity. Model chooses from 4 years of production data covering the period 2012-2015.	Concepts referenced in wind paper apply to solar modeling. GE MARS program will randomly select a solar shape from multiple years of production data.	Y	None
11	Small Hydro Resources	Derate by 46%	Derate by ~~yy~~46%	Review of five years of unit production data over the years 2011 to 2015	N	None
12	Large Hydro	Probabilistic Model based on 5 years of GADS data	Probabilistic Model based on 5 years of GADS data	Transition Rates representing the Equivalent Forced Outage Rates (EFORd) during demand periods over the most recent five-year period (2011-2015)	N	None

Transactions – Imports and Exports

#	Parameter	2016 Model Assumptions	2017 Model Assumptions	Basis for Recommendation	Model Change	IRM Impact
1	Capacity Purchases	Existing Rights: PJM – 1080 MW HQ – 1090 MW +20 MW if awarded through Class Year 2015. Total HQ 1110 MW All contracts model as equivalent contracts	Grandfathered amounts: PJM – 1080 MW HQ – 1090 MW HQ TO 1110 MW assuming awarded CRIS rights All contracts model as equivalent contracts	Grandfathered Rights, ETCNL, and other awarded long-term rights including 20 MW CRIS potentially awarded to HQUS	N	None
2	Capacity Sales	Long Term firm sales Summer 286.6 MW	Long Term firm sales Summer 284.9 MW	These are long term federal contracts	N	None
3	FCM Sales	No Sales within study period	No Sales within study period	Sensitivity based on Examination of Neighbor's FCM auction results	N	N/A
4	New UDRs	No new UDR projects	No new UDR projects	Existing UDR elections are made by August 1st and will be incorporated into the model	N	None

Topology

#	Parameter	2016 Model Assumptions	2017 Model Assumptions	Basis for Recommendation	Model Change	IRM Impact
1	Interface Limits	All changes reviewed and commented on by TPAS (Attachment E)	All changes reviewed and commented on by TPAS See (Attachment E)	Based on 2016: Operating Study, Operations Engineering Voltage Studies, Comprehensive Planning Process, and additional analysis including interregional planning initiatives (see white paper on Emergency Assistance)	Y	Low(-)
2	New Transmission	Transmission Owner Transmission Solutions (TOTS)	None Identified	Based on TO provided models and NYISO review.	N	None
3	Cable Forced Outage Rates	All existing Cable EFORs will be updated for NYC and LI to reflect most recent five-year history	All existing Cable EFORs updated for NYC and LI to reflect most recent five-year history	Based on TO analysis	N	Low (+)
4	PJM Representation of Internal Zones	Four bubble (Zones) Model	Five bubble (Zones) Model	See White Paper on four versus five bubble PJM representation	Y	Low(-)

Emergency Operating Procedures

#	Parameter	2016 Model Assumptions	2017 Model Assumptions	Basis for Recommendation	Model Change	IRM Impact
1	Special Case Resources	July 2015 –1254 MW based on registrations and modeled as 961 MW of effective capacity. Monthly variation based on historical experience *	July 2016 –1192MW based on registrations and modeled as 841 MW of effective capacity. Monthly variation based on historical experience *	Those sold for the program discounted to historic availability. Summer values calculated from July 2016 registrations. Performance calculation updated per ICS presentations on SCR performance. (Attachment F)	N	Low(+)
2	EDRP Resources	July 2015 75 MW registered modeled as 12 MW in July and proportional to monthly peak load in other months. Limit to five calls per month	July 2016 75 MW registered model as 13 MW in July and proportional to monthly peak load in other months. Limit to five calls per month	Those sold for the program discounted to historic availability. Summer values calculated from July 2016 registrations and forecast growth.	N	None
3	Other EOPs	671 MW of non-SCR/non-EDRP resources (Attachment D)	665 MW of non-SCR/non-EDRP resources	Based on TO information, measured data, and NYISO forecasts	N	Low(+)

* The number of SCR calls is limited to 5/month when calculating LOLE based on all 8760 hours.

External Control Areas

#	Parameter	2016 Model Assumptions	2017 Model Assumptions	Basis for Recommendation	Model Change	IRM Impact
1	PJM	Load and Capacity data provided by PJM/NPCC CP-8. Data may be adjusted per NYSRC Policy 5 Acceptable DR of 1890 available but not needed per Policy 5. 4 zone model. See (Attachment E)	Load and Capacity data provided by PJM/NPCC CP-8 Data may be adjusted per NYSRC Policy 5 See (Attachment E)	Initial review performed by the NPCC CP-8 WG prior to Policy 5 changes. White paper on external EOPs	See topology section above	None
2	ISONE	Load and Capacity data provided by ISONE/NPCC CP-8 Data may be adjusted per NYSRC Policy 5 (See Attachment E)	Load and Capacity data provided by ISONE/NPCC CP-8 Data may be adjusted per NYSRC Policy 5 See (Attachment E)	Initial review performed by the NPCC CP-8 WG prior to Policy 5 changes.	N	?
3	HQ	Load and Capacity data provided by HQ/NPCC CP-8 Data may be adjusted per NYSRC Policy 5 (Attachment E)	Load and Capacity data provided by HQ/NPCC CP-8 Data may be adjusted per NYSRC Policy 5 See (Attachment E)	Initial review performed by the NPCC CP-8 WG prior to Policy 5 changes.	N	None

#	Parameter	2016 Model Assumptions	2017 Model Assumptions	Basis for Recommendation	Model Change	IRM Impact
4	IESO	Load and Capacity data provided by IESO/NPCC CP-8 data may be adjusted per NYSRC Policy 5 See (Attachment E)	Load and Capacity data provided by IESO/NPCC CP-8 data may be adjusted per NYSRC Policy 5 See (Attachment E)	Initial review performed by the NPCC CP-8 WG prior to Policy 5 changes.	N	None
5	Reserve Sharing	All NPCC Control Areas and PJM interconnection indicate that they will share reserves equally among all members	All NPCC Control Areas indicate that they will initially share reserves equally among all members and then among non-members	Per NPCC CP-8 WG	N	None

Miscellaneous

#	Parameter	2016 Model Assumptions	2017 Model Assumptions	Basis for Recommendation	Model Change	IRM Impact
1	MARS Model Version	Version 3.18	Version 3.20	Per benchmark testing and ICS recommendation	N	None
2	Environmental Initiatives	No estimated impacts based on review of existing rules and retirement trends	No estimated impacts based on review of existing rules and retirement trends	Review of existing regulations and rules.	N	None

Attachment A

NYCA Load Forecast Uncertainty Model

2016 and 2017 LFU Models

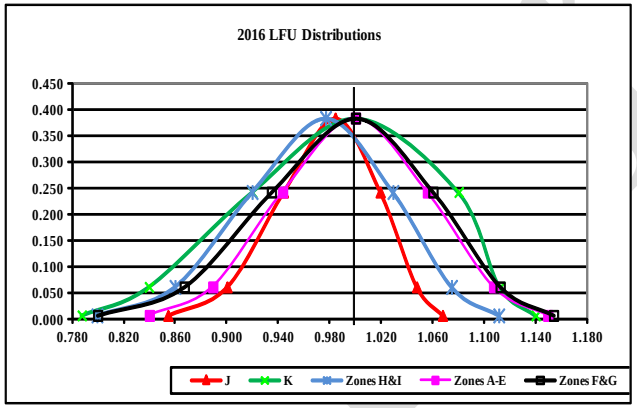
2016 Load Forecast Uncertainty Models

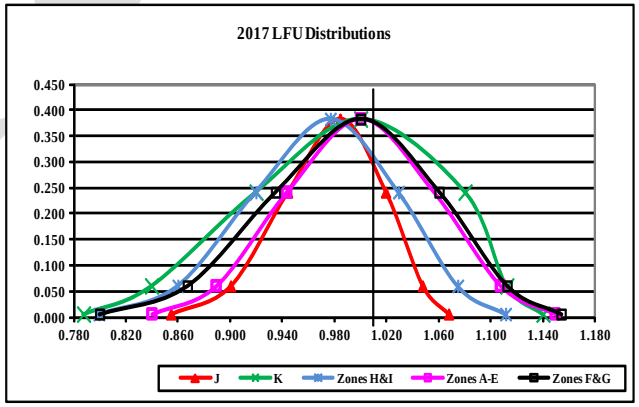
Multiplier	Zones A-E	Zones F&G	Zones H&I	Con Ed (J)	LIPA (K)
0.0062	0.8399	0.7997	0.7992	0.8543	0.7874
0.0606	0.8892	0.8670	0.8598	0.9002	0.8396
0.2417	0.9434	0.9347	0.9197	0.9440	0.9198
0.3830	1.0000	1.0000	0.9768	0.9842	1.0000
0.2417	1.0559	1.0602	1.0291	1.0192	1.0802
0.0606	1.1073	1.1124	1.0746	1.0475	1.1123
0.0062	1.1494	1.1539	1.1113	1.0676	1.1400

2017 Load Forecast Uncertainty Models

Multiplier	Zones A-E	Zones F&G	Zones H&I	Con Ed (J)	LIPA (K)
0.0062	0.8399	0.7997	0.7992	0.8543	0.7874
0.0606	0.8892	0.8670	0.8598	0.9002	0.8396
0.2417	0.9434	0.9347	0.9197	0.9440	0.9198
0.3830	1.0000	1.0000	0.9768	0.9842	1.0000
0.2417	1.0559	1.0602	1.0291	1.0192	1.0802
0.0606	1.1073	1.1124	1.0746	1.0475	1.1123
0.0062	1.1494	1.1539	1.1113	1.0676	1.1400

2017 LFU remains unchanged from the 2016 LFU forecast





Attachment B1

New Non-Wind Units and Unit Re-ratings[2]

B1 - Proposed Non-wind Units and Unit Re-ratings				
Project or Generator Name	**Zone**	**2016 MARS Model (MW)**	**New or Incremental (MW)**	**2017 MARS Model (MW)**
MARS				
New Non-wind Units				0.00
Re-ratings				
Bowline 2 rerate	G	557.4	10.0	567.4
East River 1	J	144.6	6.3	150.9
East River 2	J	144.8	7.6	152.4
Sithe Independence	C	910.8	43.6	954.4
Total New Units + Re-rates			67.5	

[2] Unit re-ratings are for generation facilities that have undergone uprate projects.

Attachment B2

Retiring and Ineligible Generating Units

Attachment B2 -Announced Unit Retirements and ICAP Ineligible Forced Outage (IIFO)					
Project or Generator Name	**Zone**	**Retirement Date**	**Existing CRIS (MW)**	**Summer Capability-DMNC (MW)**	**MARS Model(lesser of DMNC or CRIS (MW)**
Niagara Bio-Gen	A	1/1/2016	50.5	39.7	39.7
Astoria GT 05	J	1/1/2016	16	12.3	12.3
Astoria GT 07	J	1/1/2016	15.5	11.5	11.5
Astoria GT 12	J	1/1/2016	22.7	17.7	17.7
Astoria GT 13	J	1/1/2016	24	16.9	16.9
Fitzpatrick 1	C	1/1/2017	858.9	~~852.9~~0	~~852.9~~0
Ginna	B	4/1/2017	582	~~581.4~~0	~~581.4~~0
Astoria GT 08	J	7/1/2016	15.3	11.4	11.4
Astoria GT 10	J	7/1/2016	24.9	18.4	18.4
Astoria GT 11	J	7/1/2016	23.6	16.5	16.5
Ravenswood 04	J	1/5/2016	15.2	12.9	12.9
Ravenswood 05	J	1/5/2016	15.7	15.5	15.5
Ravenswood 06	J	1/5/2016	16.7	12.6	12.6
Total Retirements & IIFO				~~1619.7~~185.4	185.4

Attachment B3

Existing and New Wind Resources

B3 - Wind Resources					
Wind Resouce	**Zone**	**In Service Date**	**CRIS (MW)**	**Summer Capability (MW)**	**MARS Model**
ICAP Participating Wind Units					
Altona Wind Power	D	09/23/2008	97.5	97.5	97.5
Bliss Wind Power	A	03/20/2008	100.5	100.5	100.5
Canandaigua Wind Power	C	12/05/2008	125.0	125.0	125.0
Chateaugay Wind Power	D	10/07/2008	106.5	106.5	106.5
Clinton Wind Power	D	04/09/2008	100.5	100.5	100.5
Ellenburg Wind Power	D	03/31/2008	81.0	81.0	81.0
Hardscrabble Wind	E	02/01/2011	74.0	74.0	74.0
High Sheldon Wind Farm	C	02/01/2009	112.5	112.5	112.5
Howard Wind	C	12/01/2011	57.4	55.4	55.4
Madison Wind Power	E	09/01/2000	11.5	11.6	11.5
Maple Ridge Wind 1	E	01/01/2006	231.0	231.0	231.0
Maple Ridge Wind 2	E	12/01/2007	90.7	90.8	90.7
Munnsville Wind Power	E	08/20/2007	34.5	34.5	34.5
Orangeville Wind Farm	C	12/01/2013	88.5	93.9	88.5
Steel Wind	A	01/23/2007	20.0	20.0	20.0
Wethersfield Wind Power	C	12/11/2008	126.0	126.0	126.0
		Totals	**1457.1**	**1460.7**	**1455.1**
Non - ICAP Participating Wind Units					
Erie Wind		02/01/2012	0.0	15.0	0.0
Fenner Wind Farm		12/01/2001	0.0	30.0	0.0
Western NY Wind Power		10/01/2000	0.0	6.6	0.0
		Totals	0.0	51.6	0.0
Proposed IRM Study Wind Units					
Marble River	D	7/1/2012*	215.2	215.2	215.2
Orangeville re-rate	C	6/1/2017*	94.4	94.4	5.9
		Totals	215.2	215.2	221.1
Total Wind Resources		**Totals**	1672.3	1727.5	**1676.2**

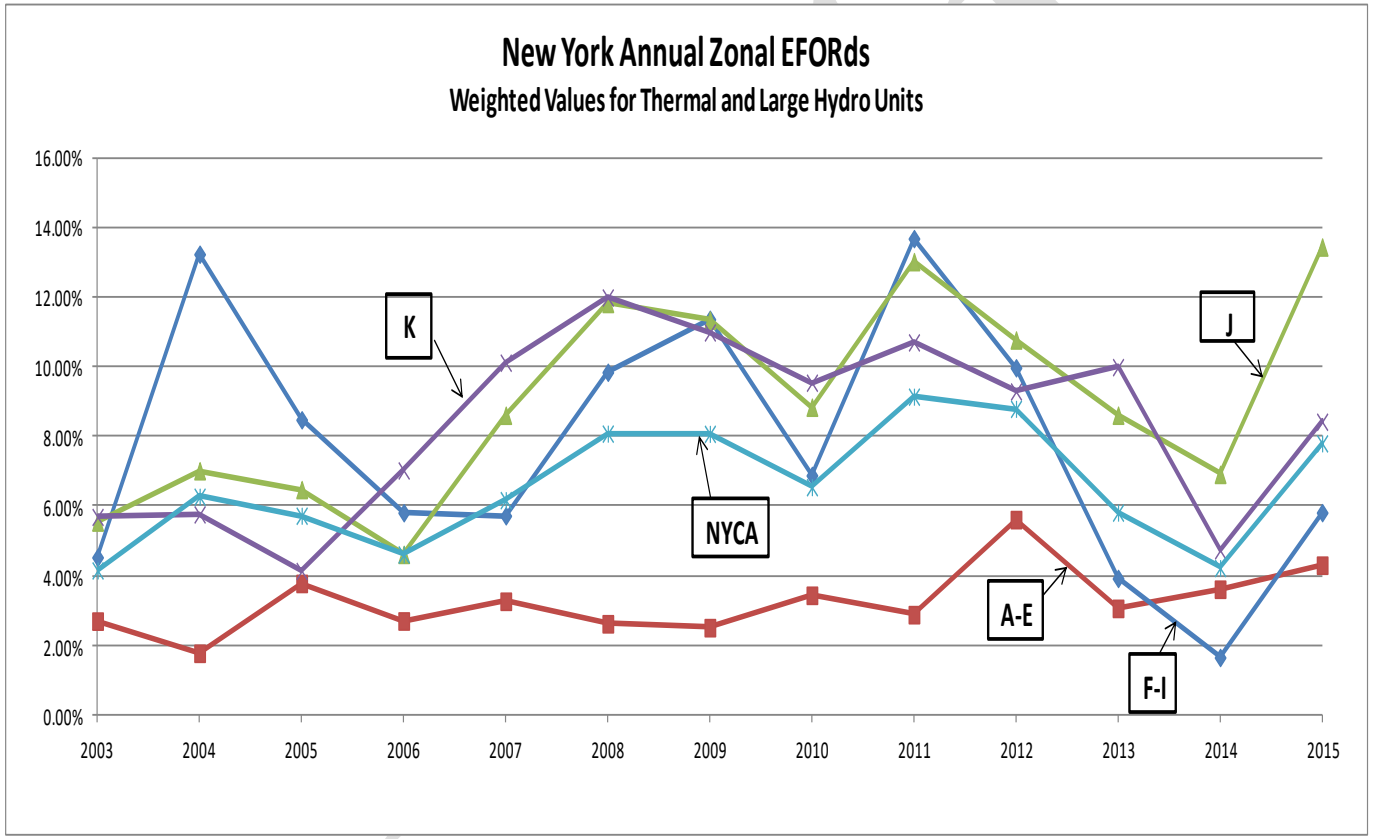
* Study assumes 2015 Class Year will be complete in 2016, awarding Marble River Wind 215 MW and Orangeville Wind 5.9 MW of additional CRIS rights

Attachment B4

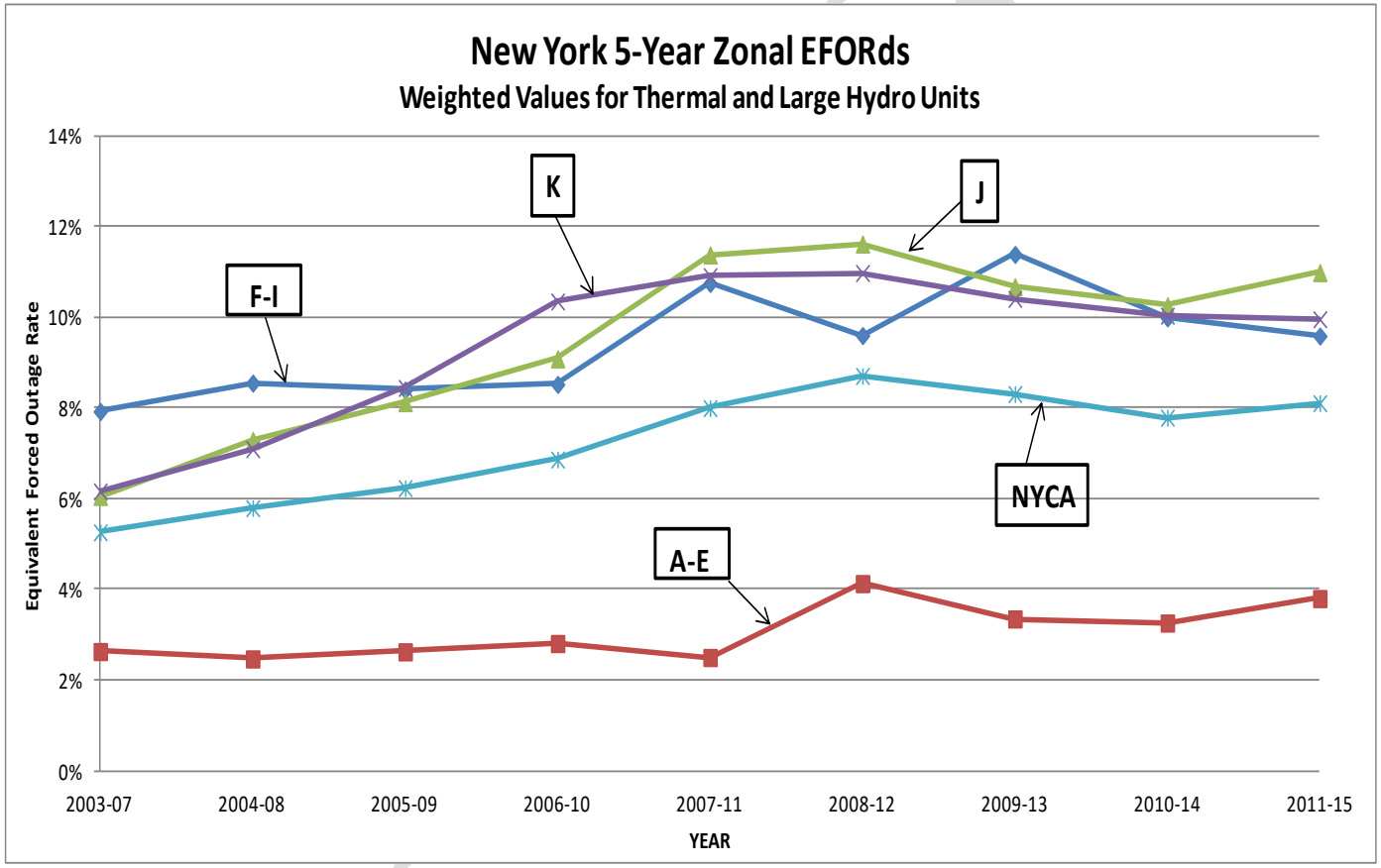
Existing and New Solar Resources

B4 - Solar Resources					
Wind Resouce	**Zone**	**In Service Date**	**CRIS (MW)**	**Summer Capability (MW)**	**MARS Model (MW)**
ICAP Participating Solar Units					
Long Island Solar	K	11/01/2011	31.50	31.50	31.50
		Totals	31.50	31.50	31.50
Proposed IRM Study Solar Units					
		Totals	0.00	0.00	0.00
Total Solar Resources		**Totals**	31.50	31.50	**31.50**

Attachment C



Attachment C1



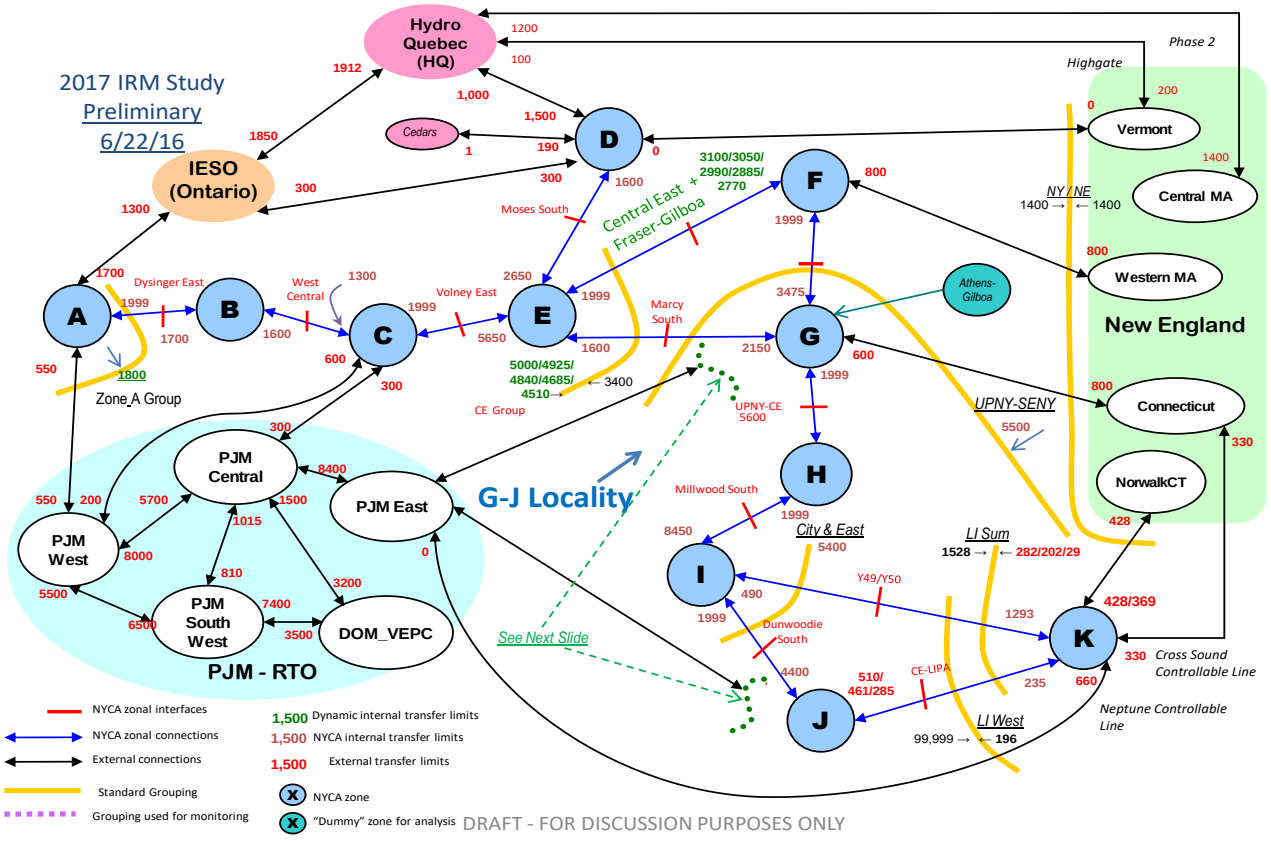
Attachment D

Emergency Operating Procedures

Step	Procedure	Effect	2015 MW Value	2017 MW Value
1	Special Case Resources	Load relief	1254 MW Enrolled/ 961 MW modeled	1192 MW Enrolled/ 841 MW modeled
/ 2	Emergency Demand Response Program	Load relief	75 MW Enrolled/12 MW Modeled	75 MW Enrolled/13 MW Modeled
3	5% manual voltage Reduction	Load relief	65 MW	66 MW
4	Thirty-minute reserve to zero	Allow operating reserve to decrease to largest unit capacity (10-minute reserve)	655 MW	655 MW
5	5% remote voltage reduction	Load relief	376 MW	386 MW
6	Voluntary industrial curtailment	Load relief	142 MW	125.5 MW
7	General public appeals	Load relief	88 MW	88 MW
8	Emergency Purchases	Increase capacity	Varies	Varies
9	Ten-minute reserve to zero	Allow 10-minute reserve to decrease to zero	1310 MW	1310 MW
10	Customer disconnections	Load relief	As needed	As needed

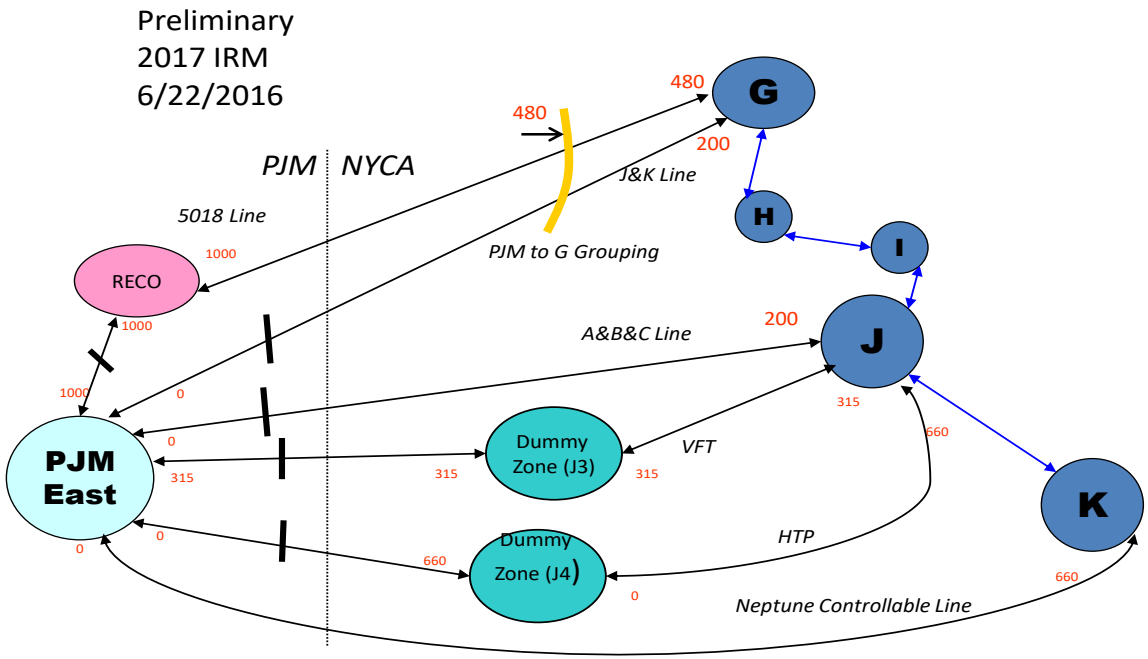
Attachment E

2017 IRM: RA Updated Topology Year 1 - NYCA



Attachment E1

PJM-SENY MARS Model



(PJM East to RECO) + (PJM East to J) + (PJM East to J3) + (PJM East to J4) + (PJM East to G) Limited to 2,000 MW

Attachment F
SCR Determinations

SCR Performance

	A	B	C	D	E	F
		=A*(100%)		=B*C		=D*E
C	July 2015 Registrations	2016 Forecast[1]	Performance Factor[2]	2016 UCAP	Translation Factor[3]	In Model Value
A-F	683.4	683.4	0.8443	577.0	0.900	519.3
G-I	86.2	86.2	0.7277	62.7	0.900	56.4
J	372.0	372.0	0.699	259.9	0.900	233.9
K	50.3	50.3	0.704	35.4	0.900	31.8
Total	1191.8	**1191.8**		934.9		841.4

1. These values represent no growth from July 2016 ICAP based registrations.
2. Based on ACL
3. This SCR Derate factor captures two different performance derates. These are; 1) the translation factor between ACL and CBL values (=0.90), and the fatique factor (=1.00).

Assumption Matrix History

Date	Ver	Preliminary Base Case	Ver	Final Base Case
2/3/16	V0.1	Preliminary assumptions without attachments.		
2/5/16	V01	Added "Draft" watermark. Editorial Changes as discussed at the 2/3 ICS meeting.		
2/22/16	V02	Load Shape, LFU and LFU graph added. Solar 5 year assumption added		
4/22/16	V03	Added attachments B1-B4, C, and C1; clarified solar modeling based on production years 2012-2015. 2016 Gold Book forecast added.		
6/22/16	V04	Added column to show potential impacts. Added topology maps (Attachment E and E1). Highlighted in yellow the missing information fields.		
7/27/16	V05	Page 6 blanks filled in. Attachments D and F added. EC corrections – table B2, C1.		
8/23/16	V06	Table B2 updated to reflect that ~~not retire~~ Ginna and Fitzpatrick nuclear units are not retired.		