

# Intra-Zonal Deliverability Evaluation PRELIMINARY RESULTS

NYISO IITF  
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# Deliverability Testing Scope

- To Be Performed on a Current System (“operating case”) and Future Year Horizon (“planning case”)
- Use DC Power Flow Method to Identify Possible Intra-Zonal Transmission Constraints to Delivering Capacity
- Evaluate 4+ Methods for Determining Deliverability with Operating and Planning Cases
- Provide Other Information as Specified by Work Scope



# 11/15/05: Objectives

- Present operating case results
- Present planning case results

## Results are for:

- Short Term Emergency contingency and line rating criteria
- PAR settings as provided in cases (PARs regulate in base case, fixed angle for contingencies)



# Changes to Operating Case

- Update of Pmax for several plants to reflect Gold Book (e.g., reductions of Pmax at Athens, Independence, Moses, etc.)



# Changes to Planning Case

- Update of Pmax for several plants to reflect Gold Book (e.g., reductions of Pmax at Athens, Independence, Moses, etc.)
- Increase of LI load (by 250 MW) to 5500 MW
- Remove two new NewBridge 138 kV lines added for PJM-LI HVDC. The HVDC is not included in the analysis (discussed later).
- Queue generation added for dispatch to approximate load growth + 20% for ROS, LI, NYC
- $P_{\max, \text{plan}} = P_{\max, \text{op}} + 1.2 * \text{Load}$



# Case Loads

<b>2005 Operating Case (OP-4)</b>				
	Case Load **	Case Losses	Gold Book *	(Load+Loss) - G.B.
J	11,090	145	11,315	-81
K	5,085	83	5,230	-62
ROS	15,673	782	15,552	903
NYCA	31,848	1,010	32,097	761
<b>2009 Planning Case (PL-4)</b>				
	Case Load **	Case Losses	Gold Book *	(Load+Loss) - G.B.
J	11,800	133	11,965	-32
K	5,500	87	5,580	7
ROS	16,309	687	16,243	753
NYCA	33,609	907	33,788	728
* from 2005 Gold Book Table I-2 (p.5), top table				
** loads scaled up from 2004 to match 2005 operating case data at right				



These projects are candidates for deliverability testing in the planning case, depending on whether capacity is needed as defined in Scope of Work.

Note: Bethlehem and Poletti Expansion are included in Operating case and are thus automatically included in the Planning case.

Planning Case: Class Year Units		
Queue	Project	Zone
20	Spagnoli Road	LI
32	ANP Brookhaven	LI
94	Neptune DC PJM -LI	LI
18	Poletti Expansion	NYC
19	NYC Energy (Kent)	NYC
24	Astoria Repowering - Phase 1	NYC
31	SCS Astoria	NYC
70	Astoria Repowering - Phase 2	NYC
90	Fortistar VP	NYC
91	Fortistar VAN	NYC
93	Cross Hudson	NYC
96	Calpine JFK	NYC
106	TransGas	NYC
110	PG&E Liberty	NYC
3	Bethlehem	ROS
22	Wawayanda	ROS
29	Bowline 3	ROS
33	Glenville	ROS
69	Empire-Besicorp	ROS
141	Flat Rock	ROS



## Planning Case Total Generation (MW) to Include

	2009 Planning (case PL4)	2005 Operating (case OP4)		Plan-Oper Load Change	2009 Planning: Calculation for Generation Inclusion					
	Load	Pmax	Load		Target Pmax (1)	Non-Queue Gen	Queue Gen Needed	Queue Positions Needed (3)	Total Queue Pmax (2)	Total Pmax
<b>NYC</b>	11,787	9,529	11,090	697	10,365	8,003	2,362	19, 24, 31, 70, 90, 91,93	2,862	10,865
<b>LI</b>	5,500	5,182	5,085	415	5,680	5,190	490	20, 32	830	6,020
<b>ROS</b>	16,309	25,159	15,673	636	25,922	24,834	1,088	22, 29	1,250	26,084
<b>Total</b>	33,596	39,870	31,848	1,748	41,968	38,027	3,941		4,942	42,969

(1) Target Planning Pmax = Pmax of 2005OpsCase+ 1.2 \* (load change)

(2) Actual may exceed needed because projects are lumpy

(3) Bethlehem and Poletti Expansion are included in both operating and planning cases

### Queue generation

#	Project	Zone	Case MW	Queue MW	Difference	Difference Explanation
19	NYC Energy Kent Ave	NYC	80	80	0	
20	KeySpan Spagnoli	LI	270	250	20	Revised PMAX to match queue MW
22	Calpine Wawayanda	ROS	546	500	46	Revised PMAX to match queue MW
24	Astoria Repowering Phase 1	NYC	714.4	367	347.4	Modeled as case MW
29	Bowline 3	ROS	806	750	56	Revised PMAX to match queue MW
31	SCS Astoria	NYC	1000	1000	0	
32	ANP Brookhaven	LI	280	290	-10	Revised PMAX to match queue MW
70	Astoria Repowering Phase 2	NYC	357.2	173	184.2	Modeled as case MW
90	Foristar VP	NYC	80	80	0	
91	Foristar VAN	NYC	80	80	0	
93	PSEG Cross Hudson	NYC	509	550	-41	Revised PMAX to match queue MW





# Operating Case: Base PAR Flows

PAR NAME	FROM-BUS	TO-BUS	CKT	ANGMAX	ANGMIN	ANGLE	FLOW	RATE	ANG-LIMIT
BARRETT	75032 BARRETT2	138 75033 BRRT PH	138 1	10.0	-10.0	-1.2	75.1	235.	NO
CORONA NORTH	74413 CORONA	138 74414 CORONA1R	138 1	25.0	-25.0	-16.3	-50.0	181.	NO
CORONA SOUTH	74413 CORONA	138 74415 CORONA2R	138 1	25.0	-25.0	-16.3	-50.0	181.	NO
DUNWOODIE-SHERMAN 1	74418 DUN NO	138 74420 DUN NO1R	138 1	20.0	-20.0	3.5	120.2	161.	NO
DUNWOODIE-SHERMAN 2	74418 DUN NO	138 74421 DUN NO2R	138 1	20.0	-20.0	3.6	120.2	161.	NO
DUNWOODIE SOUTH 1	74422 DUN SO	138 74424 DUN SO1R	138 1	25.0	-25.0	2.5	105.1	112.	NO
DUNWOODIE SOUTH 2	74422 DUN SO	138 74424 DUN SO1R	138 2	25.0	-25.0	2.5	105.1	112.	NO
EGCITY 1	75001 EGC PAR	345 75002 E.G.C.-1	345 1	25.0	-25.0	4.6	316.2	468.	NO
EGCITY 2	75001 EGC PAR	345 75003 E.G.C.-2	345 1	25.0	-25.0	4.6	316.2	468.	NO
FARRAGUT TR1 B-LINE	74327 FARRAGUT	345 74328 FARRGUT1	345 1	30.0	-30.0	6.7	-398.7	503.	NO
FARRAGUT TR2 C-LINE	74327 FARRAGUT	345 74329 FARRGUT2	345 1	30.0	-30.0	6.8	-398.8	497.	NO
FRESH KILLS R2	74468 FR-KILLS	138 74469 FRKILLR2	138 1	25.0	-25.0	4.2	-174.7	275.	NO
FRESH KILLS R1	74468 FR-KILLS	138 74470 FRKILLSR	138 1	25.0	-25.0	3.6	-174.8	272.	NO
GOETHALS A-LINE	74333 GOTHLS N	345 74334 GOTHLS R	345 1	25.0	-25.0	-8.1	-200.0	499.	NO
GOWANUS 1	74476 GOWNUS1R	138 74477 GOWNUS1T	138 1	25.0	-25.0	3.2	-139.8	226.	NO
GOWANUS 2	74478 GOWNUS2R	138 74479 GOWNUS2T	138 1	25.0	-25.0	2.7	-159.7	226.	NO
INGHAMS	78478 INGMS-CD	115 79136 INGHAM-E	115 1	20.0	-20.0	5.1	119.9	167.	NO
LAKE SUCCESS	75046 L SUCS	138 75047 L SUCSPH	138 1	25.0	-25.0	-10.7	147.7	321.	NO
NORTHPORT	75051 NRTHPRT1	138 75052 NRTHPRT2	138 1	15.0	-15.0	-0.7	-92.4	428.	NO
NORTH-NRWALK	75053 NRTHPT P	138 75075 NRTHPT1	138 1	50.0	-50.0	1.7	100.2	450.	NO
PARK 1	74512 PARK TR1	138 74516 PARK1REG	138 1	25.0	-25.0	3.3	198.1	240.	NO
PARK 2	74513 PARK TR2	138 74517 PARK2REG	138 1	25.0	-25.0	2.6	206.2	240.	NO
PILGRIM	75054 PILGRM P	138 75056 PILGRIM	138 1	25.0	-25.0	-0.9	-137.5	321.	NO
RAMAPO 1	74346 RAM PAR	345 74347 RAMAPO	345 1	40.0	-40.0	11.4	121.2	545.	NO
RAMAPO 2	74346 RAM PAR	345 74347 RAMAPO	345 2	40.0	-40.0	11.4	121.2	545.	NO
VALLEY STREAM	75066 VLY STRM	138 75067 V STRM P	138 1	25.0	-25.0	-10.3	104.7	321.	NO
ST LAWRENCE PS34	81255 STLAWL34	230 81259 STLAWR34	230 34	40.0	-40.0	14.0	0.0	300.	NO
ST LAWRENCE PS33	81256 STLAWL33	230 81257 STLAWR33	220 33	40.0	-40.0	14.0	0.3	240.	NO



# Planning Case: Base PAR Flows

PAR NAME	FROM-BUS	TO-BUS	CKT	ANGMAX	ANGMIN	ANGLE	FLOW	RATE	ANG-LIMIT
BARRETT	75032 BARRETT2	138 75033 BRRT PH	138 1	10.0	-10.0	-2.3	100.0	235.	NO
NORTHPORT	75051 NRTHPRT1	138 75052 NRTHPRT2	138 1	15.0	-15.0	3.3	-102.5	428.	NO
NORTH-NRWALK	75053 NRTHPT P	138 75075 NRTHPT1	138 1	50.0	-50.0	7.6	100.3	450.	NO
PILGRIM	75054 PILGRM P	138 75056 PILGRIM	138 1	25.0	-25.0	1.7	-102.5	321.	NO
LAKE SUCCESS	75046 L SUCS	138 75047 L SUCSPH	138 1	25.0	-25.0	1.6	164.2	321.	NO
VALLEY STREAM	75066 VLY STRM	138 75067 V STRM P	138 1	25.0	-25.0	3.7	122.1	321.	NO
EGCITY 1	75001 EGC PAR	345 75002 E.G.C.-1	345 1	25.0	-25.0	3.1	150.0	468.	NO
EGCITY 2	75001 EGC PAR	345 75003 E.G.C.-2	345 1	25.0	-25.0	3.2	150.0	468.	NO
ASTORIA RING	74402 ASTE-WRG	138 74498 ASTE-PAR	138 1	25.0	-25.0	7.3	180.0	0.	NO
CORONA NORTH	74465 CORONA-N	138 74415 CORONA2R	138 1	25.0	-25.0	18.2	-25.0	181.	NO
CORONA SOUTH	74413 CORONA-S	138 74414 CORONA1R	138 1	25.0	-25.0	18.5	-25.0	181.	NO
DUNWOODIE-SHERMAN 1	74418 DUN NO	138 74420 DUN NO1R	138 1	20.0	-20.0	-10.7	85.0	161.	NO
DUNWOODIE-SHERMAN 2	74418 DUN NO	138 74421 DUN NO2R	138 1	20.0	-20.0	-10.6	85.0	161.	NO
DUNWOODIE SOUTH 1	74422 DUN SO	138 74424 DUN SO1R	138 1	25.0	-25.0	-12.5	85.0	112.	NO
DUNWOODIE SOUTH 2	74422 DUN SO	138 74424 DUN SO1R	138 2	25.0	-25.0	-12.5	85.0	112.	NO
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ST LAWRENCE PS33	81256 STLAWL33	230 81257 STLAWR33	220 33	40.0	-40.0	-0.4	0.2	300.	NO
ST LAWRENCE PS34	81255 STLAWL34	230 81259 STLAWR34	230 34	40.0	-40.0	-0.4	0.1	300.	NO



# Deliverability Test Methods

## (From Work Scope)

**Recognize the probabilistic nature of forced outage rates and the impact on capacity requirements**

**Alternate 1: Resource Accounting Screen with intra-zonal power flow**

**Alternate 2: Power Flow Methodology with screening step (similar to PJM deliverability test)**

**Alternate 3: IRM and Locational Capacity Studies related to power flow analysis**

**Alternate 4: Combined Generation and Load Approach**



# Method Comparison

Method	Harmer (Upstream) Side Adjustments	Shift Used To Counter Increased Harmer Gen	Helper (Downstream) Side Adjustments	Shift Used To Counter Increased Helper Gen	Comments
1 Derated Unit Outputs	Reduction by Zonal Average EFORd	Zonal Available Generation (Pmax-Pgen) to Zonal Load	Reduction by Zonal Average EFORd	Zonal Available Generation (Pmax-Pgen) to Zonal Load	<ul style="list-style-type: none"> <li>•Simplest in Concept</li> <li>•Little Probabilistic Treatment</li> </ul>
2 PJM-like Method	100% of largest impact generator MW above cumulative 20% unavailability. 85% of impact thereafter	Zonal Available Generation (Pmax-Pgen) to Zonal Load	None	Zonal Available Generation (Pmax-Pgen) to Zonal Load	<ul style="list-style-type: none"> <li>•Complex formulation</li> <li>•Indirect Probabilistic Treatment</li> <li>•Several Subjective factors</li> </ul>
3 Load Adjustment	Load increased 15.9% to represent gen and load uncertainties	Zonal Available Generation (Pmax-Pgen) to Zonal Load	None	Zonal Available Generation (Pmax-Pgen) to Zonal Load	<ul style="list-style-type: none"> <li>•Some probabilistic treatment</li> <li>•Static shift factors</li> </ul>
4 Gen-Load Matching	Load increased 15.9% to represent gen and load uncertainties	Upstream Gen to Upstream Load. Excess Upstream Gen to Downstream Gen	Load increased 15.9% to represent gen and load uncertainties	Downstream Gen to Downstream Load	<ul style="list-style-type: none"> <li>•Varying shift factors</li> <li>•More direct probability treatment</li> </ul>
4A Needed Transfer Only	Load increased 15.9% to represent gen and load uncertainties	Upstream Gen to Upstream Load. Needed Upstream Gen to Downstream Load	Load increased 15.9% to represent gen and load uncertainties	Downstream Gen to Downstream Load	<ul style="list-style-type: none"> <li>•Separates gen pocket and transfer needs concepts</li> </ul>



# Results Analysis

If

- A Deliverability Question (Headroom  $<0$  for any of the 5 methods) is Found for the Zonal Gen to Load Shift Assumption,
- But Not for a NYCA Gen to NYCA Load Test

Then

- The Question is Classified as a possible modeling artifact



PAR settings are expected to have major impact on NYC results, and require further evaluation.

# Operating Case Results NYC

“No excess” indicates that “upstream” load exceeds “upstream generation”, thus no upstream generation for export

Negative value indicates overload

345 kV facilities						
Monitored Element	Contingency	M1	M2	M3	M4	M4_Need
74333 GOTHLS N 345 74336 GOWANUSN 345 1	_BaseCase	-34	-67	-67	-67	544
74335 GOTHLS S 345 74337 GOWANUSS 345 1	_BaseCase	-67	-101	-101	-101	531
138 kV facilities						
Monitored Element	Contingency	M1	M2	M3	M4	M4_Need
74380 GOWNUSR2 138 74484 GREWOOD 138 2	_BaseCase	-1	-14	-14	-14	227
74385 GOWNUSR1 138 74484 GREWOOD 138 2	_BaseCase	0	-13	-13	-13	227
Astoria pocket						
Monitored Element	Contingency	M1	M2	M3	M4	M4_Need
74403 ASTORIAW 138 74496 HG 5 138 1	_BaseCase	-119	-130	1	No excess	No excess
74403 ASTORIAW 138 74497 HG 6 138 1	_BaseCase	-111	-122	8	No excess	No excess
74435 E179 ST 138 74497 HG 6 138 1	_BaseCase	-5	-16	231	No excess	No excess
74468 FR-KILLS 138 74571 WILOWBK2 138 1	_BaseCase	4	-5	20	No excess	No excess



# Planning Case Results: NYC

- Analysis is still in progress.
- In particular, PAR settings given additional Astoria area generation need examination/adjustment.
- Will coordinate with NYISO and ConEdison on this and provide results.



# Operating Case Results

## LI

Negative value indicates overload

Monitored Element	Contingency	M1	M2	M3	M4	M4_Need
75265 RIV 1 69.0 75058 RVRHD 138 1	_BaseCase	7	8	155	15	<b>-21</b>

All Problems Appear to  
Be the Result of Load  
Escalation





# Planning Case Results

## LI

Negative value indicates overload

138 kV facilities						
Monitored Element	Contingency	M1	M2	M3	M4	M4_Need
75026 BRKHVEN2 138 75058 RVRHD 138 1	75049 WILDWOOD 138 75062 SHOREHAM 138 1	-8	-24	21	21	-38
69 kV facilities						
Monitored Element	Contingency	M1	M2	M3	M4	M4_Need
75044 HOLBROOK 138 75127 HOLBRK1 69.0 1	43HOL-RUL 2C	2	-7	7	-28	-11
75057 PT JEFF1 138 75208 PT.JEFF269.0 1	BaseCase	23	22	34	-8	3
75064 STERLING 138 75221 STERLING69.0 1	42:RUL-NB 2C	11	-2	19	-1	13
75176 JERICHO 69.0 75192 NEWBRGE269.0 1	BaseCase	21	22	76	-5	11
75190 MT.SINAI69.0 75207 PT.JEFF169.0 1	51:SHM1360	18	19	77	-9	7
75257 W.FLOYD169.0 75259 WYPNK1 69.0 1	43HOL-RUL 2C	3	1	11	-3	4



# Operating Case Results ROS

345 kV and 230 kV facilities						
Monitored Element	Contingency	M1	M2	M3	M4	M4_Need
78701 LEEDS 3 345 74344 PLTVLLEY 345 2	Athens PV	-108	-119	-9	-1422	290
78705 ATHENS 345 74344 PLTVLLEY 345 1	Leeds PV	-71	-81	26	-1349	321
115 kV and 138 kV facilities						
Monitored Element	Contingency	M1	M2	M3	M4	M4_Need
74018 SUGARLF 115 74046 ROCK TV1 115 1	Rck Tv Rmapo	14	15	113	-435	35
76701 HUNTLEY1 115 76723 S129-39 115 1	BaseCase	13	9	-100	-63	21
77431 CLAY 115 77460 HPKNS-11 115 1	77401 DEWITT 3 345 77439 DEWITT 1 115 1	6	8	191	-604	40
77441 ELBRIDGE 115 75505 STATE115 115 1	Quak Sleigh	38	42	28	-404	71
77450 GERES LK 115 77454 HARRIS 115 1	77401 DEWITT 3 345 77439 DEWITT 1 115 1	19	19	-202	-362	57
78000 ALCOA-NM 115 78017 DENNISON 115 1	BaseCase	-10	-24	-9	No excess	No excess
78000 ALCOA-NM 115 79597 ALCOA N 115 1	BaseCase	-73	-94	-72	No excess	No excess
78009 BRNS FLS 115 78021 FLAT RCK 115 1	Mass Marcy	-16	-23	-10	-46	48
78009 BRNS FLS 115 78025 HIGLEY 115 1	Mass Marcy	-14	-21	-8	-44	49
78009 BRNS FLS 115 78057 TAYLORVL 115 2	Mass Marcy	-19	-26	-13	-48	53
78011 BU+LY+MO 115 78471 BOONVL 115 1	Mass Marcy	6	-1	12	-23	35
78014 COLTON 115 78021 FLAT RCK 115 1	Mass Marcy	-6	-13	0	-36	56
78014 COLTON 115 78025 HIGLEY 115 1	Mass Marcy	3	-3	9	-26	23
78028 LOWVILLE 115 78057 TAYLORVL 115 1	Mass Marcy	7	1	13	-17	24
79313 MONSEY 138 79319 RAMP138 138 1	BaseCase	36	40	171	-1244	-37
79600 NIAG115E 115 76706 MTNS-120 115 1	Niag Robnsn	42	34	162	-209	121
79824 GINNA115 115 79825 PANNELLI 115 1	GEN:GINNA	128	139	470	-822	169
79826 QUAKER 115 79828 S204 908 115 98	GEN:GINNA	85	98	469	-929	129
Possible Modeling Artifacts (relieved by NYCA shift)						
Monitored Element	Contingency	M1	M2	M3	M4	M4_Need
78769 OW CRN E 115 78798 UNVL 7TP 115 1	BaseCase	60	63	1634	-113	79



# Planning Case Results ROS

Negative value indicates overload

115 kV and 138 kV facilities						
Monitored Element	Contingency	M1	M2	M3	M4	M4_Need
74020 DANSKAMA 115 74021 DC CBLTP 115 1	BaseCase	4	-3	-460	-129	58
75465 HINMN115 115 76261 HARIS115 115 1	BaseCase	-2	-11	-55	-267	85
75465 HINMN115 115 76702 LOCKPORT 115 1	BaseCase	32	23	0	-78	91
75505 STATE115 115 77441 ELBRIDGE 115 1	BaseCase	31	35	-13	-261	94
75505 STATE115 115 77441 ELBRIDGE 115 1	75405 OAKDL345 345 77403 LAFAYTTE 345 1	49	52	2	-243	116
75664 BINCO115 115 75669 NSIDE115 115 1	BaseCase	-4	-7	-7	-7	52
76261 HARIS115 115 76263 LEA34115 115 1	BaseCase	7	-1	-1	-1	157
76665 PACKARD2 230 76711 PACK(S)W 115 2	79592 NIAGAR2W 230 79601 NIAG115W 115 1	178	188	293	-754	250
77450 GERES LK 115 77454 HARRIS 115 1	77401 DEWITT 3 345 77439 DEWITT 1 115 1	25	25	-209	-387	58
77477 PALOMA 115 77485 S OSWEGO 115 1	BaseCase	68	71	275	-374	89
78000 ALCOA-NM 115 78017 DENNISON 115 1	BaseCase	-25	-40	-24	No excess	No excess
78000 ALCOA-NM 115 79597 ALCOA N 115 1	BaseCase	-93	-115	-92	No excess	No excess
78009 BRNS FLS 115 78025 HIGLEY 115 1	BaseCase	15	10	-43	-61	48
78712 GLENVILL 115 79157 SWAGRT E 115 1	BaseCase	70	78	596	-836	105
78712 GLENVILL 115 79158 SWAGRT W 115 1	BaseCase	52	58	607	-1038	87
79111 BAL TP E 115 79116 BROOK E 115 1	BaseCase	113	119	692	-613	139
79111 BAL TP E 115 79157 SWAGRT E 115 1	BaseCase	108	116	633	-729	141
79112 BAL TP W 115 79163 W.MILTON 115 1	BaseCase	82	88	637	-883	113
79117 BROOK W 115 79163 W.MILTON 115 1	BaseCase	92	99	623	-805	122
79313 MONSEY 138 79319 RAMP138 138 1	BaseCase	-26	-27	-111	-580	-26
79801 PANNELL3 345 79802 3T@S122 115 3T	GEN:GINNA	60	64	227	-409	94
79814 S418 115 115 79816 S67-1115 115 2	BaseCase	1	1	182	-752	20
78014 COLTON 115 78025 HIGLEY 115 1	79577 MARCY765 765 79578 MASS 765 765 1	-49	-61	-40	No excess	No excess

**No 345 kV or 230 kV facilities are indicated as limiting**



# Future Efforts

- Finalize Cases (as necessary) and Primary Results. Perform PAR Adjustments
- Draft Report focusing on:
  - Methods
  - Data Assumptions
  - Results
  - Results Interpretation
- Perform the Sensitivity Cases
- Fold Sensitivity Case Results into Final Report and Primary Results Interpretation
- Other Activities as Requested by IITF

