CARIS UPDATED DRAFT CONGESTION RESULTS

Tom Gentile/Peter Simaan
New York Independent System Operator

ESPWG
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Agenda

- Summary of Results and Remaining Items
- Input Assumptions
- Action Items from previous meeting
- Congestion Results
- Discussion

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Summary of Results and Remaining Items

- Results of projected congestion and additional metrics – very good results; nearly complete
- Remaining tuning is focused on Generation levels downstate and major NYCA interfaces
- Comparison of Historic vs. CARIS
  - *Interfaces: Central East, Ramapo 5018 etc..*
  - *Shadow Prices – frequency and magnitude: top congested elements*

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Input Assumptions

- ***Based on 2009 CRP/RNA and CARIS Assumption Matrix***
- ***Highlights of year on year model changes***
  - *Caithness 4/2009*
  - *Trail Line (PJM 2010)*
  - *BesiCorp 2/2010*
  - *Polleti Retirement 2/2010*
  - *M29 in-service date 2011*
  - *Susqehanna-Roseland 500kV (PJM 2013)*

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Input Assumptions Con't

- Hurdle Rates
  - *Commitment*
    - 50 $/MWh (2009-2018)
  - *Dispatch*
    - 8 $/MWh (2009)
    - 15 $/MWh (2010-2018)
- Controllable Facilities
  - *Ramapo PARs +/- 500MW each*
  - *Hudson Valley-PSEG-ConEd 1000 MW Wheel*
  - *CSC +/- 300 MW and Neptune 0-660 MW into Long Island*
  - *Linden VFT 250-300MW into ConEd (2010)*
- Maintain Constant Reserve Margin in External Pools
- Uniform Global Emission Allowance Prices

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Input Assumptions Con't

- Fuel Switching
  - *Primary and Secondary Fuel Types Modeled*
  - *Fuel Switching Disabled for Primary Oil units in NYISO*
- LOGMOB
  - *Forced-Oil Operation for Northport 4 during Summer*
  - *Tuning continues on in-city MOB*

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Action Items from previous meeting

- Modeling Forced Outages
- Generation Maintenance Schedules
- Generation by Fuel Type Historical & Projected
- Loop Flows Issue
- Interchange: Historical & Projected
- Implied Heat Rates

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Forced Outages

- Each unit was assigned two types of outage schedules
  - *Planned maintenance outage schedule*
  - *Unplanned Outage Schedule*
    - Based on unit's EFORd
- Forced Outage duration determined as 8760x(EFORd)
- Forced Outage treated as a single occurrence event
  - *As opposed to splitting the duration into an average number of occurrences*

Generation Maintenance

Month	2007		2008		CARIS Database	
	Planned Outage	Unplanned Outage	Planned Outage	Unplanned Outage	Planned Outage	Unplanned Outage
Jan	2,894	673	2,319	1,045	1,737	889
Feb	3,406	181	4,899	476	963	1,255
Mar	6,106	399	5,503	478	3,150	3,948
Apr	7,698	1,831	8,911	1,617	3,055	2,510
May	2,668	2,444	4,024	556	3,499	3,275
Jun	734	168	1,707	80	1,793	1,575
Jul	1,228	362	1,798	602	1,695	878
Aug	320	290	1,344	193	557	510
Sep	2,067	655	1,572	2,294	2,017	823
Oct	7,222	398	5,660	1,681	1,558	1,768
Nov	6,069	358	5,160	951	5,155	2,257
Dec	2,693	1,156	4,042	951	5,664	1,733

Unplanned values are based on units' actual EFORd rates (average outage rates over a number of years).
CARIS Database Unplanned outage values may look higher because an Unplanned outage period is scheduled for every unit.
Historical Unplanned values are based on actual units being unavailable. Not every unit could experience an unplanned outage every year.

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Generation Maintenance Con't

- Historical (Planned) maintenance outages may experience longer duration than planned
  - *Highly dependent on inspection results*
- Historical (unplanned or forced) outages will vary from year to year
  - *Highly dependent on number of operating hours since last inspection/planned maintenance*

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Historical Generation by Fuel Type
2008 vs. 2009 Generation GWh

2008 GWh	Coal	FO2	FO6	Hydro	KER	NG	OTHER	UR	WND	Grand Total
West	11,485	-	-	13,704	-	339	665	-	161	26,354
Genessee	258	-	-	73	-	38	63	4,743	11	5,187
Central	3,635	-	92	529	-	1,516	495	21,079	81	27,427
North	-	-	-	7,359	-	2,123	137	-	169	9,788
Capital	-	-	-	2,931	-	11,620	131	-	-	14,682
Mohawk Valley	460	-	-	2,604	-	20	143	-	859	4,087
Hudson Valley	2,952	-	459	298	-	209	44	-	-	3,962
Millwood	-	-	-	-	-	-	400	17,382	-	17,782
Dunwoodie	-	-	-	3	-	-	-	-	-	3
NYCity	-	58	6,961	-	272	16,815	-	-	-	24,105
Long Island	-	195	907	-	-	9,222	917	-	-	11,241
Grand Total	**18,790**	**252**	**8,419**	**27,501**	**272**	**41,902**	**2,996**	**43,203**	**1,282**	**144,618**

2009 GWh	Coal	FO2	FO6	Hydro	KER	NG	OTHER	UR	WND	Grand Total
West	11,925	-	0	12,005	-	1,871	292	-	277	26,370
Genessee	-	-	-	181	-	549	-	4,468	16	5,214
Central	4,512	-	859	349	-	8,401	215	20,806	82	35,224
North	-	-	-	3,550	-	2,381	3	-	434	6,368
Mohawk Valley	416	-	-	1,824	-	659	1	-	996	3,897
Capital	-	-	-	1,830	-	15,063	0	-	-	16,893
Hudson Valley	2,852	-	109	363	9	1,182	24	-	1	4,539
Millwood	-	-	-	1	-	0	408	16,738	-	17,146
Dunwoodie	-	-	-	6	-	-	-	-	-	6
NYCity	-	335	2,880	-	987	21,209	-	-	-	25,411
Long Island	-	43	411	-	-	10,661	937	-	-	12,052
Grand Total	**19,704**	**378**	**4,259**	**20,110**	**996**	**61,975**	**1,879**	**42,012**	**1,807**	**153,120**

Observations from Generation by Fuel Type

- Hydro Generation
  - *7,400 GWh lower in 2009-2018 CARIS*
  - *Database updated*
- Combined Cycle Unit
  - *5,000 GWh higher in 2009-2018 CARIS*
  - *Driven by low Natural Gas Price Forecast*
- Higher generation from Gas-fired units
- Lower generation from Oil-fired units

LOOP FLOWS

- Inadvertent flows caused by:
  - *Neighboring Control Areas' generation serving their own load*
    - Captured by using the full representation of PJM, IESO and ISONE in the simulation
  - *Power Exchanges between Neighboring Systems*
    - Michigan PARs (4x125MW) Schedule +/- 500MW
    - IESO-MISO interface limited to +/-300MW

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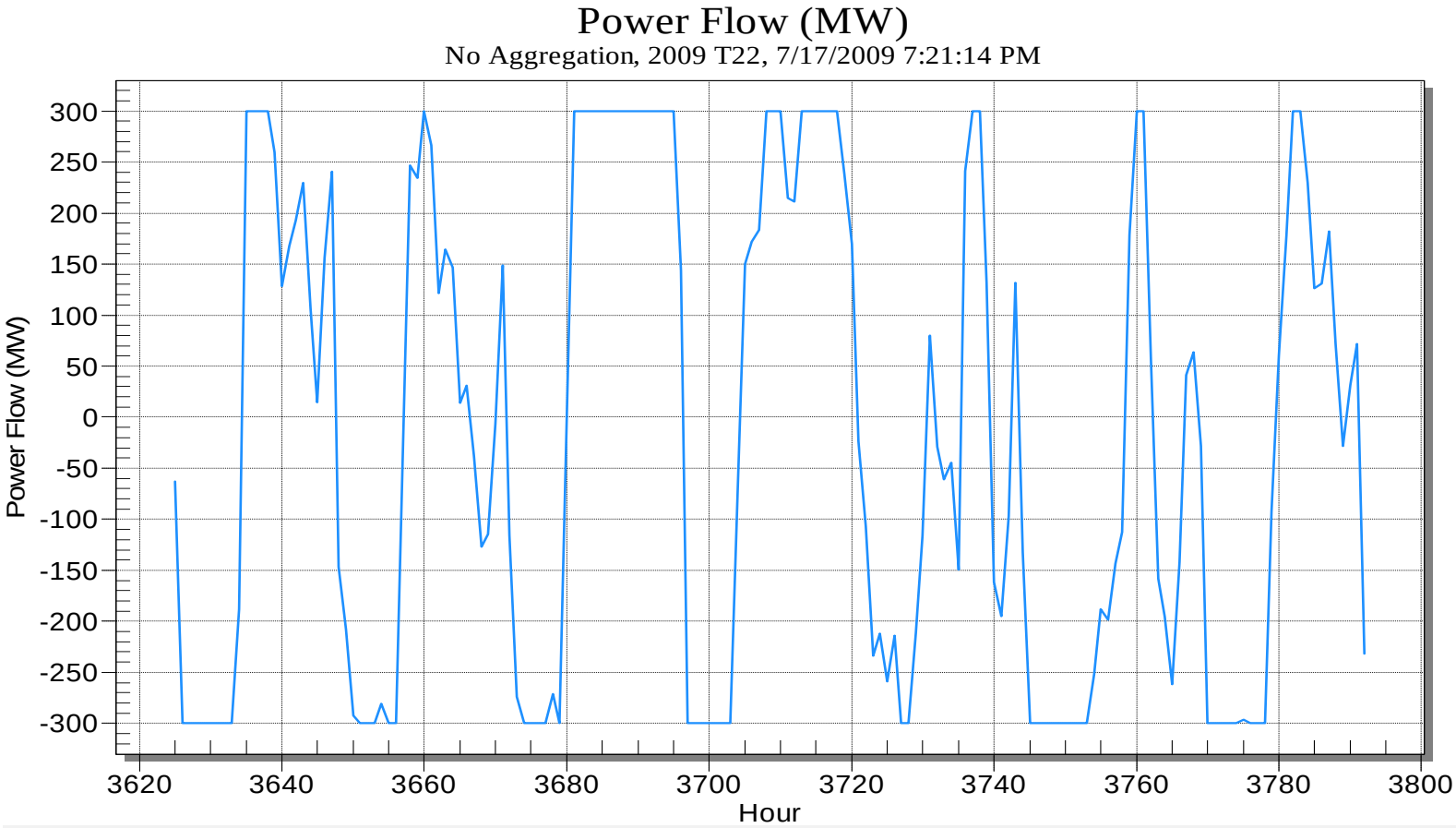
LOOP FLOWS IESO-MISO interface flow



Positive is counter-clockwise flow around Lake Erie
On-Peak Hours: Counter-Clockwise flow around Lake Erie
Off-Peak Hours: Clockwise flow around like Erie

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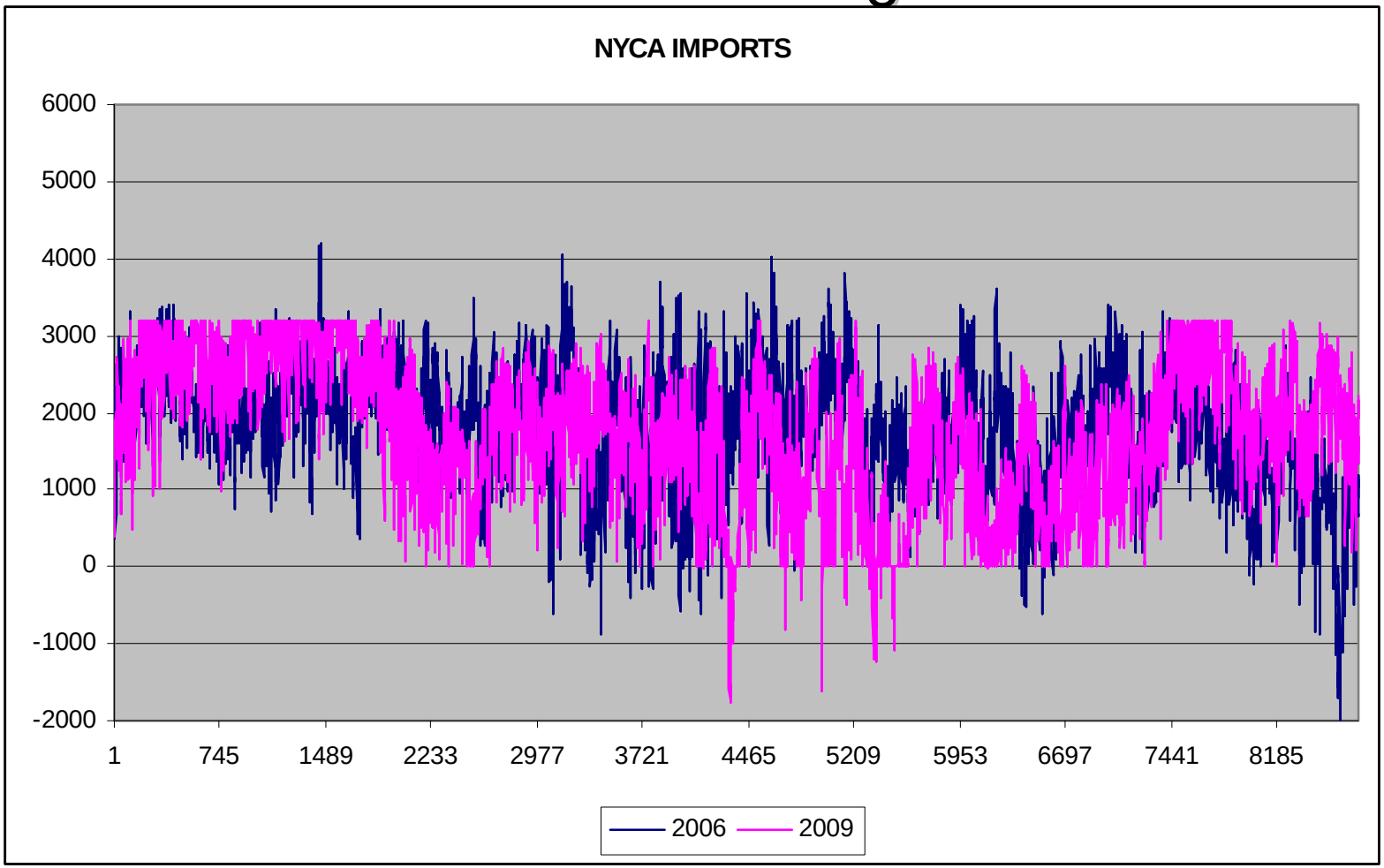
2006 vs. 2009 Interchanges



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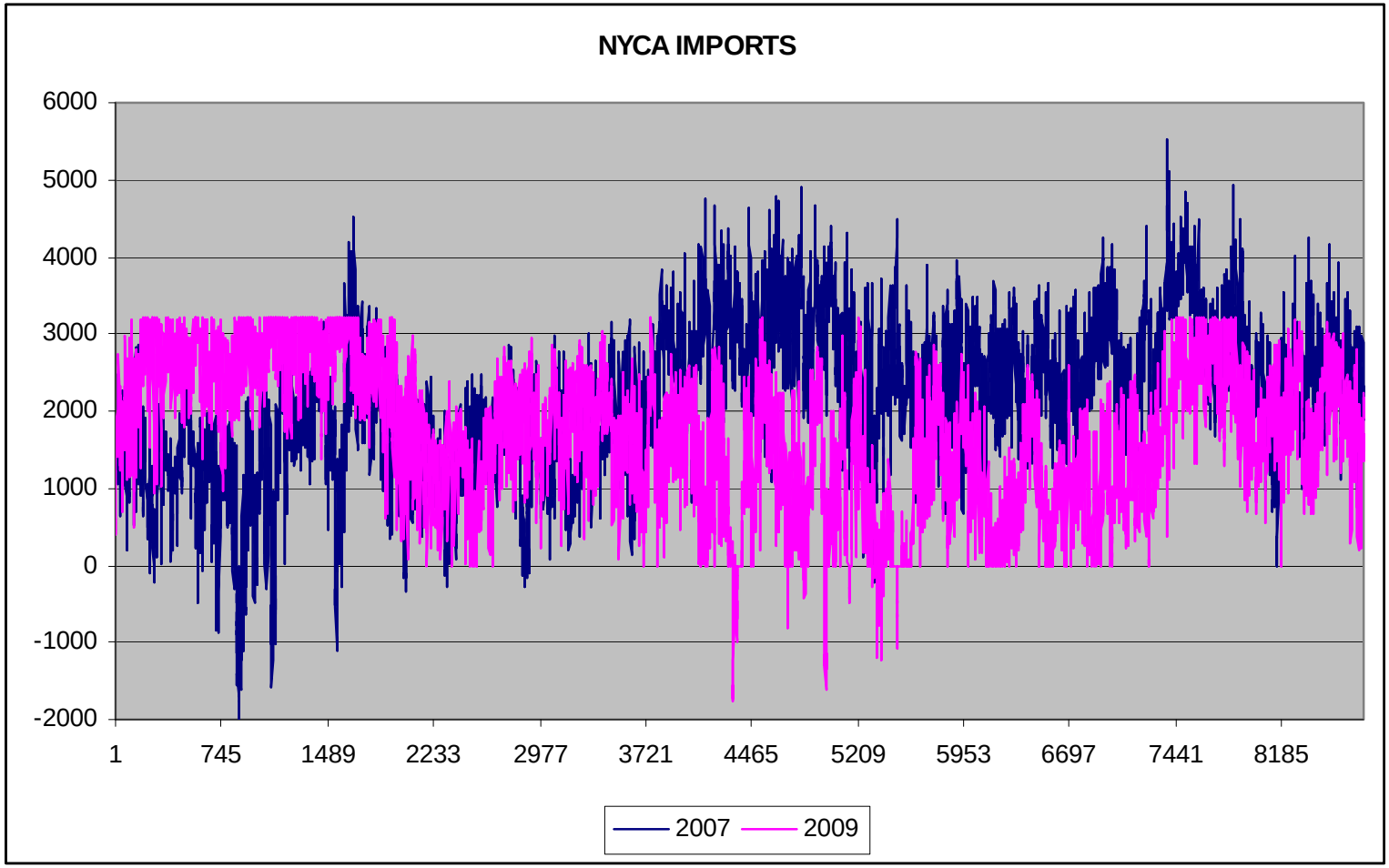
2007 vs. 2009 Interchanges



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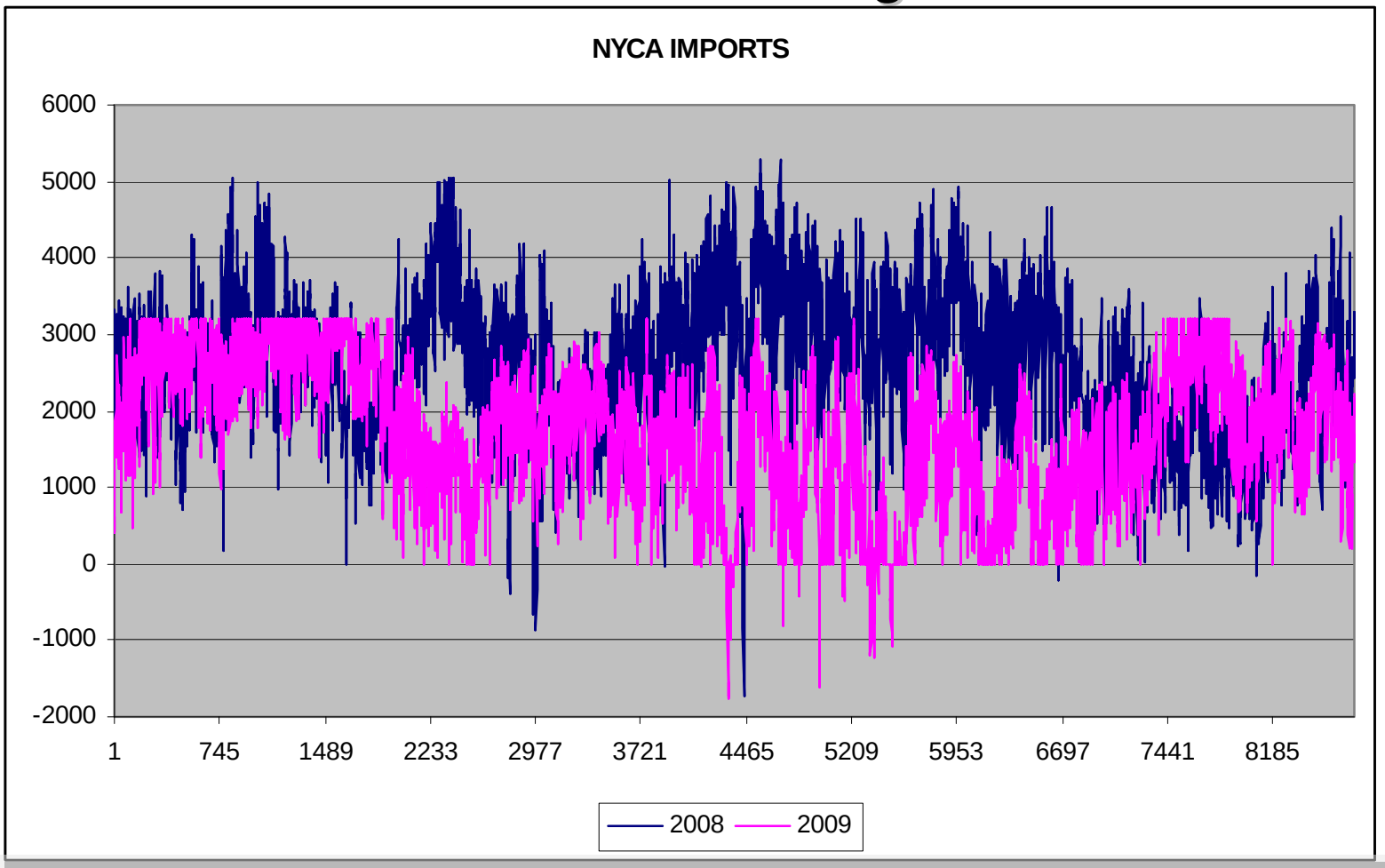
2008 vs. 2009 Interchanges



A period of higher fuel prices in 1st half of 2008 may caused higher NYCA imports

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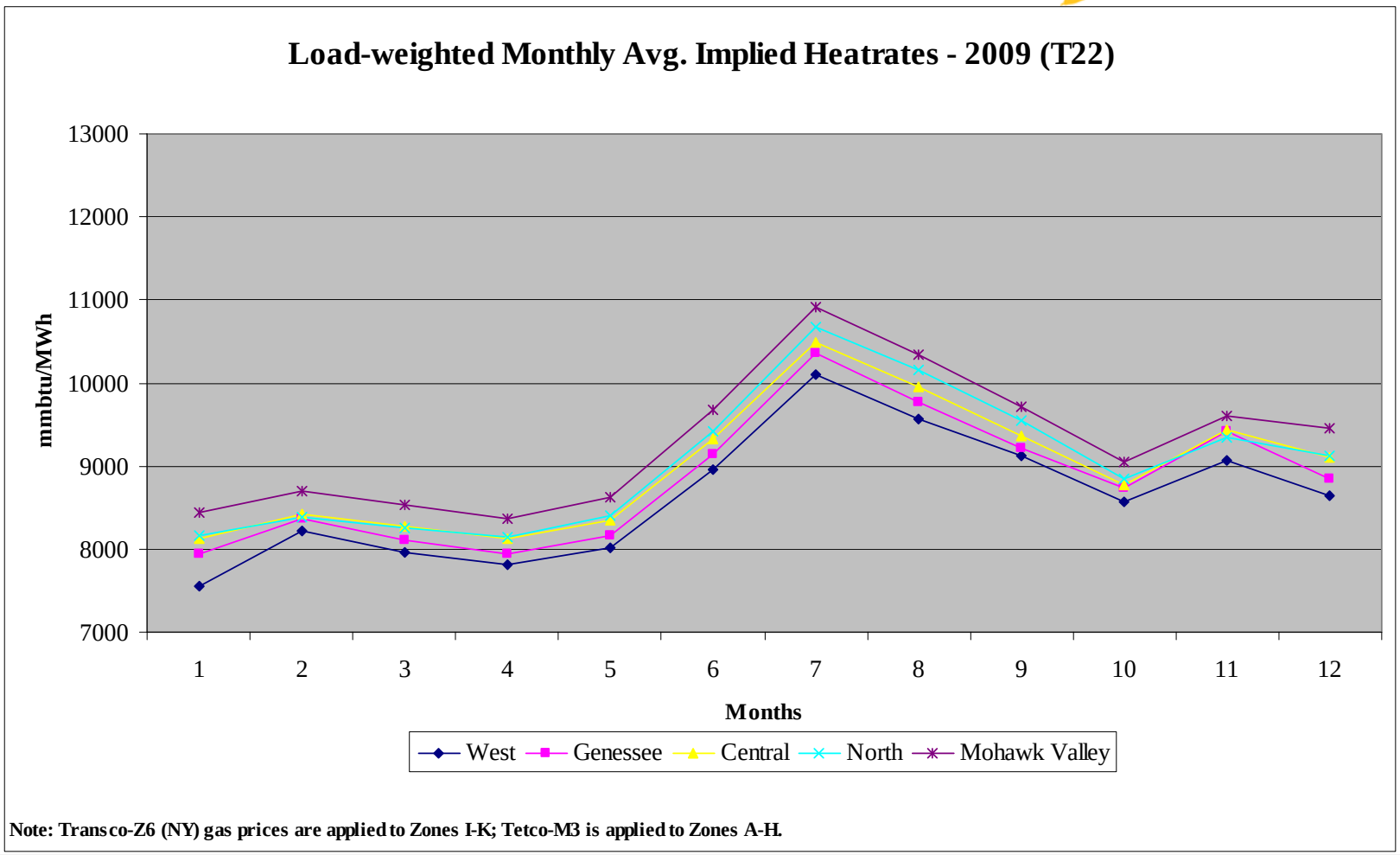

Heat Rates of marginal units are increasing from Zone A through Zone E

Across Zones A – E, the implied heat rates display the expected seasonal patterns with Summer months being the highest. The relative magnitudes are consistent with the differences in the generation fuel-mixes.

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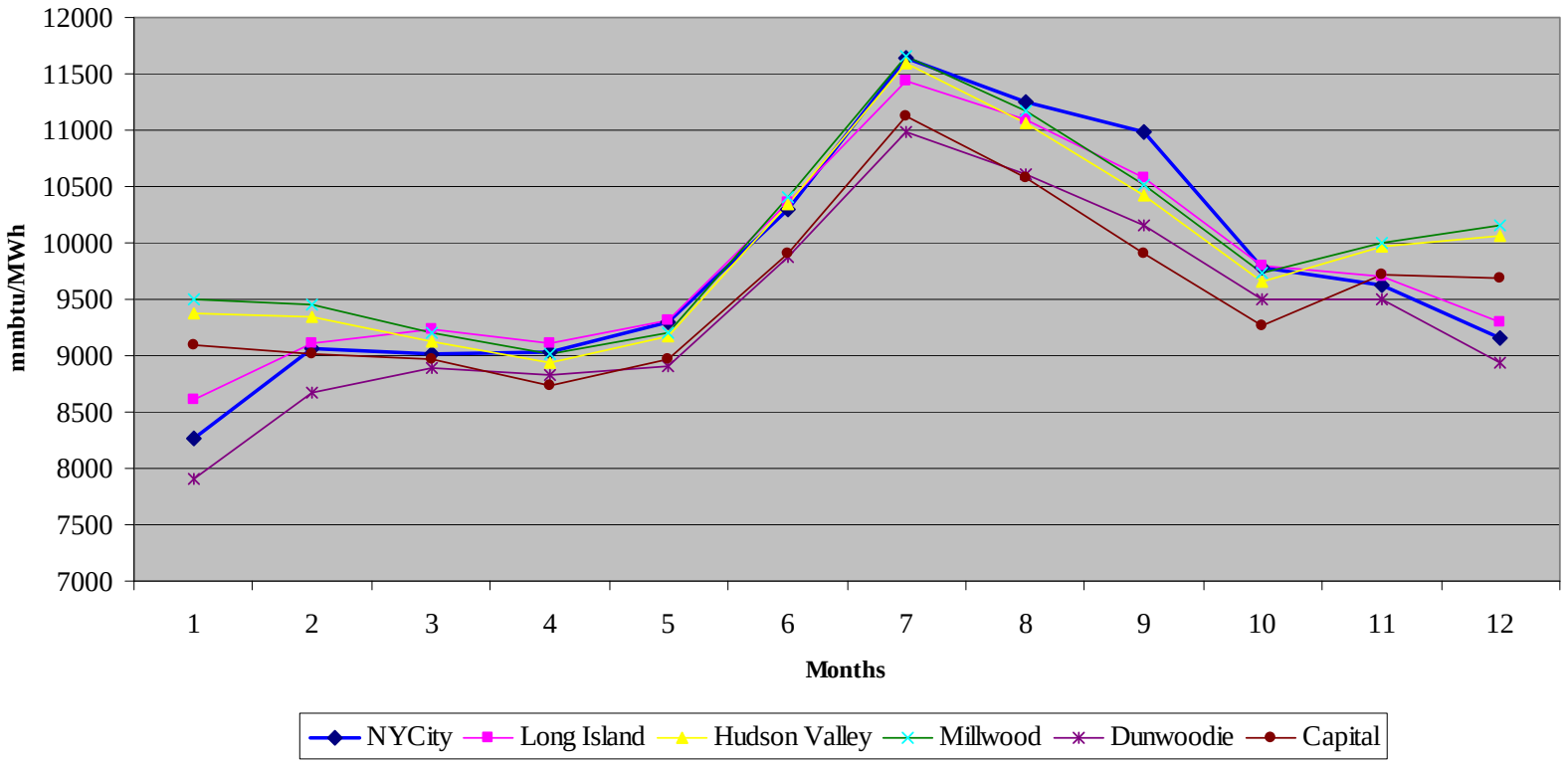
Load-weighted Monthly Avg. Implied Heatrates - 2009 (T22)



Note: Transco-Z6 (NY) gas prices are applied to Zones I-K; Tetco-M3 is applied to Zones A-H.

Heat rates of Marginal units are highest for Millwood, Hudson Valley, NYC and Long Island

In all zones, the implied heat rates display the expected seasonal patterns. With respect to Zones G and J, the difference in the assumed gas-prices explain the parity during non-winter months and the divergence during winter.

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Congestion Results

- Central East Interface Limit
  - *Utilizing multiple limits*
  - *Voltage limit is 2800MW*
  - *CARIS Database limit is 2600MW*
    - Applies penalty factor to further reduce limit depending on Oswego Complex Unit Commitment
  - *DAM limit is considerably lower 1100-2400MW*
    - Reserve Margin Reduction of 100MW
    - Certain Transmission Maintenance Schedule severely reduces the interface limit
- Cable Ratings NYC & LI
  - *Utilizing single limits*
  - *Operating conditions may cause lower cable ratings*

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Annual Metrics

- Projected Congestion does not include:
  - *Virtual Supply and Demand Bidding*
    - Virtual Bidding Patterns show net Virtual Supply in Upstate and net Virtual Load Downstate
  - *Transmission Maintenance Schedules*
    - Impact on the Central East limits (as low as 1200MW)
    - De-rates on the cable ratings (Zones J & K)
- NYISO evaluated the impact of Virtual and Transmission maintenance on total congestion value for 2009 Q1
  - *Other Factors*
    - Import / Export Schedules
    - PARs schedules

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Additional Metrics

Projected Emissions and Emission Costs

	Emissions			Cost		
	NOx	SO2	CO2	NOx	SO2	CO2
	Tons	Tons	KTons	K$	K$	K$
	Projected			Projected		
2009	47,353	76,642	58,329	59,191	5,058	204,153
2010	48,037	77,900	58,309	54,714	3,755	225,072
2011	48,718	77,366	58,708	22,180	3,073	251,270
2012	49,149	77,447	58,951	13,236	3,078	272,352
2013	49,563	77,307	59,493	23,069	3,092	291,513
2014	50,721	78,108	60,423	12,334	2,531	312,989
2015	51,130	77,825	60,772	17,475	1,550	331,814
2016	52,107	77,800	61,513	17,360	1,391	350,623
2017	52,594	77,514	61,918	16,141	1,353	366,988
2018	51,525	77,218	60,561	15,473	1,325	374,270

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Additional Metrics

Estimated Losses

Estimated Losses (GWh)										
Area	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
West	398	485	485	484	485	489	491	495	499	386
Genessee	208	250	250	249	250	254	257	260	264	306
Central	735	706	706	706	707	714	719	725	728	713
North	200	206	206	206	207	207	206	207	206	196
Mohawk Valley	896	757	758	753	757	763	767	769	772	909
Capital	649	560	565	563	565	571	577	585	595	663
Hudson Valley	381	339	339	338	339	344	346	350	354	388
Millwood	127	128	127	128	129	129	130	132	133	148
Dunwoodie	148	142	143	141	140	140	140	140	141	157
NYCity	351	439	453	455	457	468	477	490	496	540
Long Island	424	557	556	554	555	555	555	560	562	682
NYISO Total	**4,516**	**4,568**	**4,589**	**4,579**	**4,589**	**4,632**	**4,666**	**4,713**	**4,750**	**5,090**
IESO Total	**4,842**	**4,186**	**4,185**	**4,197**	**4,183**	**4,416**	**4,442**	**4,422**	**4,410**	**4,344**
PJM Total	**17,734**	**18,348**	**18,346**	**18,402**	**18,585**	**18,581**	**18,419**	**18,465**	**18,427**	**18,972**
ISO-NE Total	**2,541**	**2,702**	**2,701**	**2,709**	**2,701**	**2,710**	**2,699**	**2,688**	**2,680**	**2,753**
Total	**29,641**	**29,812**	**29,831**	**29,897**	**30,068**	**30,348**	**30,234**	**30,298**	**30,277**	**31,167**

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Historical Congestion (million $)

Monitored Facility	Contingency	2004	2005	2006	2007	2008
CENTRAL EAST - VC	Base Case	52	102	187	571	1,199
PLSNTVLY 345 LEEDS 345 1	ATHENS__-PLSNTVLY_345_91	24	164	441	410	642
DUNWODIE 345 SHORE_RD 345 1	SPRNBRK-EGRDNCTR-Y49	141	269	444	182	99
DUNWODIE 345 SHORE_RD 345 1	Base Case	11	56	37	77	80
RAINEY 138 VERNON 138 1	Base Case	5	84	21	19	81
MOTTHAVN 345 RAINEY 345 2	MOTTHAVN-RAINEY___345_Q11	-	-	-	33	137
RAINEY__345 DUNWODIE 345 1	W49TH_ST345_E13THSTA345AM54_	165	-	-	1	-
RAINEY__138 VERNON__138 1	TWR: 22 21 A2253	145	-	-	-	-
MOTTHAVN 345 RAINEY 345 1	MOTTHAVN-RAINEY___345_Q12	-	-	-	10	120
GREENWD 138 VERNON 138 1	Base Case	-	-	-	49	62
GREENWD 138 KENTAVE 138 1	Base Case	-	-	31	19	27
UPNY CONED	Base Case	25	11	16	1	24
LEEDS 345 N.SCTLND 345 1	N.SCTLND-LEEDS____345_94-LN	-	-	4	7	48
LEEDS 345 N.SCTLND 345 1	TWR:UCC2-41 FCC-33	-	-	5	-	36
SPRNBRK 345 EGRDNCTR 345 1	TWR:W73 W74 W89 W90 Y50 BK2	-	0	1	2	27
TOTAL EAST	Base Case	-	1	1	0	23
MOTTHAVN 345 DUNWODIE 345 2	DUNWODIE-MOTTHAVN_345_71	-	-	-	0	13

Historical Congestion Source: PROBE DAM quarterly reports; DAM data include Virtual bidding & Transmission planned outages

Projected Congestion (million $)

Type	Long Name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Contingency	ATHENS_PLTVLLEY_345_PLTVLLEY_LEEDS 3_2	65.47	83.30	131.47	149.90	127.80	122.31	121.20	123.78	130.09	167.32	1,222.66
Interface	CENTRAL EAST	26.58	47.50	51.45	68.44	35.37	42.36	46.40	59.43	78.23	93.22	548.98
Interface	NYCLP Greenwood	34.83	39.83	42.04	48.62	47.83	56.74	61.80	69.11	80.27	4.73	485.79
Interface	ABCJK PAR IMBALANCE	19.98	23.88	26.32	32.31	46.03	49.52	58.80	65.97	74.27	79.82	476.91
Interface	PAR-BAL FARAGUT	2.33	21.79	17.08	27.04	35.22	47.36	54.35	62.81	67.56	81.03	416.56
Contingency	NY MTHAVN-RAINY Q12_RAINEY_MOTT HAVEN_3		20.66	6.29	14.70	22.24	34.73	41.16	51.07	56.72	65.59	313.16
Contingency	QUENBRG_VERNE_138_E179 ST_15055 SR_1		9.38	14.85	15.55	16.09	21.34	24.56	25.15	27.51	30.35	184.79
Interface	Dunwoodie (I) to Long Island (K)	7.27	21.73	17.16	16.65	13.05	11.12	10.17	9.95	8.86	8.87	124.83
Interface	LIPA Cable	1.26	15.19	14.29	14.96	13.18	12.93	12.90	13.27	13.46	12.72	124.16
Contingency	FRKILLS_WILOWBK1_138_FRESH KILLS_WILOWBK2_1		5.39	5.69	7.22	9.20	12.15	13.84	16.23	17.50	16.58	103.80
Interface	IMO-MISO	4.91	8.31	9.29	11.26	13.78	10.72	9.38	11.30	11.48	7.84	98.28
Branch	E179 ST_15055 SR_1		0.22	4.40	5.29	7.26	10.76	12.72	15.37	17.17	15.73	88.92
Contingency	GOTHLSN_GOWANUSN_345_GOTHLS S_GOWANUSS_1	0.19	4.00	3.23	5.16	6.03	7.98	8.67	10.48	11.69	16.05	73.48
Interface	PJM East - NYISO	0.00	11.11	14.40	18.04	2.04	2.61	4.83	5.79	6.88	0.00	65.69
Branch	LINVFT2_LINVFT3_1		1.91	2.15	2.57	4.25	4.41	5.52	6.32	7.45	9.91	44.49
Contingency	GOTHLSS_GOWANUSS_345_GOTHLS S_GOWANUSS_1	(0.04)	0.98	0.70	1.07	2.06	3.13	4.26	4.66	4.88	9.21	30.92
Contingency	HUDSON1_FARRGUT_345_RAM PAR_RAMAPO_1	0.63	0.37	0.50	0.63	2.07	2.19	2.57	2.83	3.18	4.56	19.53
Contingency	GOTHN_GOWANN_345_GOTHLS N_GOWANUSN_1	0.27	1.41	1.32	1.99	2.31	2.57	2.91	3.15	3.15	0.01	19.11
Contingency	SBK:NIAG2W_NIAGW_230_PACKARD2_PACK(N)E_1	0.01	1.01	1.18	1.13	1.64	1.30	1.67	3.12	3.16	3.09	17.31
Contingency	RAINY8W138_VERNW_138_RAINEY_8E DUM_8	0.00	0.02	1.59	1.51	1.69	2.51	2.87	3.31	3.42	0.19	17.11
Branch	RAM PAR_RAMAPO_2	0.41	0.27	0.36	0.46	1.33	1.40	1.64	1.79	2.01	2.61	12.27
Contingency	TWR:FRSHK_GOTLSN_345_1_GOWANUSS_GOWNUS2T_1	0.14	0.24	1.01	0.97	0.92	1.30	1.91	2.50	2.59	0.11	11.69
Contingency	WALDWICK_SMAHWAH_345_WALDWICK_SMAHWAH2_1	2.37	2.05	0.95	1.07	0.77	0.85	1.06	1.03	1.02	0.19	11.36
Contingency	TWR:FRSHK_GOTLSN_345_GOWANUSN_GOWNUS1T_1	0.14	0.24	0.99	0.96	0.88	1.26	1.81	2.43	2.50	0.12	11.33
Contingency	SBK:SCRIBA_VOLNY_345_EDIC_MARCY T1_1	(0.90)	(1.10)	(0.81)	(0.95)	(1.11)	(1.29)	(1.29)	(1.51)	(1.26)	(1.57)	(11.78)
Branch	L SUCS_L SUCSPH_1	0.10	(0.22)	(2.30)	(2.26)	(1.76)	(1.53)	(1.38)	(1.30)	(1.20)	(1.05)	(12.90)
Branch	05HOWARD_02BRKSID_1	(0.19)	(1.40)	(1.19)	(1.44)	(1.45)	(1.54)	(1.57)	(1.58)	(1.58)	(1.29)	(13.13)
Interface	DYSINGER EAST-OP	(2.20)	(5.60)	(6.33)	(8.54)	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.00)	(22.71)
Interface	PAR JK 1000MW Wheel	(0.04)	(0.64)	(1.09)	(1.49)	(2.32)	(2.53)	(3.13)	(3.22)	(3.50)	(13.68)	(31.62)
Branch	STLAWR33_STLAWL33_33	(1.82)	(3.89)	(4.57)	(6.81)	(8.50)	(7.51)	(8.31)	(10.31)	(11.70)	(13.90)	(76.31)
Interface	FARRAGUT 1000MW WHEEL	(0.16)	(10.34)	(10.00)	(13.21)	(12.12)	(14.49)	(13.15)	(13.17)	(11.32)	7.40	(90.63)
Branch	STLAWR34_STLAWL34_34	(2.74)	(6.10)	(7.25)	(9.20)	(12.92)	(11.25)	(12.48)	(15.61)	(17.86)	(21.21)	(116.61)
Interface	WEST CENTRAL-OP	(0.00)	(0.01)	(0.79)	(1.00)	(35.96)	(32.24)	(31.06)	(39.52)	(45.06)	(58.00)	(244.25)

Projected Congestion Data Source: NYISO CARIS Base Cases (does not include Virtuals and Transmission outages)

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CARIS Projected Congestion 2009-2018

- Historical Pattern and trend to continue into 2018
  - *Central East Interface & Leeds-PV contingency*
- Lower NG prices in 2009 drove congestion down as gas-fired units generation downstate increased
- Commissioning of Caithness reduces congestion in 2009
- Susquehanna-Roseland (Hudson) 500kV line to pose operational challenges of PAR controlled interfaces
- Remaining tuning is focused on major NYCA interfaces will increase congestion levels and improve results

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Zonal Congestion in million $ Historical

Area	Historical				
	2004	2005	2006	2007	2008
West	(1)	(5)	1	(14)	(25)
Genessee	1	(1)	2	(14)	(9)
Central	0	(1)	3	9	18
North	(0)	(1)	(0)	(0)	(2)
Mohawk Valley	0	(0)	2	5	10
Capital	7	19	27	74	143
Hudson Valley	5	20	54	87	175
Millwood	3	12	27	31	78
Dunwoodie	4	24	44	56	124
NYCity	582	809	673	700	1,403
Long Island	229	508	708	518	624
Total	**831**	**1,382**	**1,541**	**1,451**	**2,540**

Historical Congestion Source: PROBE DAM quarterly reports; DAM data include Virtual bidding & Transmission planned outages

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Zonal Congestion Projected Results

Congestion Demand m$										
Area	2,009	2,010	2,011	2,012	2,013	2,014	2,015	2,016	2,017	2,018
West	(3)	(9)	(10)	(13)	(24)	(23)	(27)	(31)	(36)	(46)
Genessee	(1)	(2)	(2)	(2)	(16)	(15)	(16)	(19)	(22)	(28)
Central	0	(1)	(1)	(1)	(4)	(4)	(5)	(6)	(6)	(8)
North	0	0	0	1	0	0	0	0	1	1
Mohawk Valley	1	1	1	1	0	0	0	0	1	1
Capital	5	8	9	12	8	9	10	12	15	19
Hudson Valley	10	15	21	25	20	21	23	25	28	35
Millwood	3	5	7	8	7	7	7	8	9	11
Dunwoodie	8	12	16	19	16	16	17	18	20	25
NYCity	130	213	222	272	266	317	357	406	455	430
Long Island	37	69	79	88	72	69	72	76	82	96
NYISO Total	**188**	**311**	**341**	**408**	**345**	**396**	**439**	**489**	**546**	**536**

Values are consistent with Historical patterns

Congestion values are determined based on Marcy 345kV as a reference bus

Projected Congestion Data Source: NYISO CARIS Base Cases simulation Results (does not include Virtuals and Transmission outages)

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CARIS Metrics
Historical & Projected (Constrained Cases)

YEAR	CARIS Metrics - DAM bid based[1] million$			
	Load Payment	Generator Payment	Production Cost[2]	Congestion
2004	10,059	8,615	N/A	831
2005	15,314	13,153	N/A	1,382
2006	11,969	10,241	N/A	1,541
2007	12,831	10,840	N/A	1,451
2008	15,485	12,178	N/A	2,540
	PROJECTED			
2009	7,637	6,707	4,280	188
2010	10,288	8,904	5,374	311
2011	10,569	9,109	5,580	341
2012	11,120	9,521	5,907	408
2013	11,420	9,761	6,113	345
2014	12,071	10,306	6,542	396
2015	12,646	10,731	6,865	439
2016	13,400	11,303	7,240	489
2017	14,052	11,822	7,578	546
2018	14,540	11,970	7,698	536

(1) Source: Annual Congestion Report

(2) Market Reports reports Bid Production Cost values, which are negative numbers caused by a high number of negative market bids (Nuclear Units and other Bilaterals)

Historical Data Source: PROBE DAM quarterly reports; DAM data include Virtual bidding & Transmission planned outages

Projected Data Source: NYISO CARIS Base Cases (does not include Virtuals and Transmission outages)

Lower LBMPs (caused by lower fuel prices) drove down projected LBMP payments; also historic DAM bid load values may be higher compared to CARIS forecast

CARIS Metrics
Historical & Projected (Constrained Cases)

YEAR	NYCA Actual GWh		
	Demand	Generation	Interchange
2004	160,211	147,171	13,040
2005	167,208	153,265	13,943
2006	162,237	148,359	13,878
2007	167,341	150,407	16,934
2008	165,613	144,619	20,994
	PROJECTED		
2009	168,128	152,755	15,373
2010	169,747	152,587	17,160
2011	170,954	153,060	17,894
2012	171,927	153,353	18,574
2013	173,156	154,019	19,137
2014	174,800	155,382	19,418
2015	176,177	155,782	20,395
2016	178,250	156,924	21,326
2017	179,283	157,456	21,827
2018	180,427	154,654	25,773

NYCA Actual Data Source: NYISO archived hourly metered generation and load

Projected Data Source: NYISO CARIS Base Cases (does not include Virtuals and Transmission outages)

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Projected – Zonal Demand (GWh)

Demand GWh										
Area	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
West	16,011	16,143	16,189	16,211	16,287	16,375	16,436	16,532	16,615	16,689
Genessee	10,067	10,162	10,154	10,157	10,210	10,323	10,410	10,519	10,615	10,703
Central	16,881	16,975	17,039	17,035	17,102	17,219	17,311	17,418	17,464	17,507
North	7,014	7,102	7,147	7,153	7,178	7,192	7,176	7,185	7,171	7,187
Mohawk Valley	8,020	8,066	8,109	8,117	8,127	8,171	8,202	8,228	8,238	8,244
Capital	11,907	11,919	11,988	12,074	12,160	12,257	12,355	12,487	12,621	12,757
Hudson Valley	11,007	11,146	11,263	11,302	11,382	11,496	11,566	11,656	11,757	11,827
Millwood	2,748	2,786	2,817	2,830	2,871	2,884	2,903	2,928	2,954	2,985
Dunwoodie	6,478	6,541	6,572	6,564	6,593	6,586	6,595	6,607	6,638	6,680
NYCity	54,987	55,905	56,661	57,503	58,358	59,430	60,353	61,628	62,083	62,569
Long Island	23,008	23,002	23,015	22,981	22,888	22,866	22,870	23,062	23,127	23,278
NYISO Total	**168,128**	**169,747**	**170,954**	**171,927**	**173,156**	**174,800**	**176,177**	**178,250**	**179,283**	**180,427**
IESO Total	**163,142**	**163,078**	**163,068**	**163,529**	**163,009**	**169,607**	**170,225**	**169,815**	**169,350**	**169,925**
PJM Total	**743,597**	**744,155**	**744,091**	**746,288**	**744,484**	**744,382**	**737,442**	**739,349**	**737,664**	**737,785**
ISO-NE Total	**139,980**	**139,998**	**139,963**	**140,354**	**139,953**	**140,594**	**139,705**	**138,751**	**138,360**	**139,261**
Total	**1,214,856**	**1,216,987**	**1,218,085**	**1,222,107**	**1,220,611**	**1,229,391**	**1,223,559**	**1,226,174**	**1,224,666**	**1,227,406**

PJM includes PJM Classic, AP, AEP, CE, DAY, DLCO and DVP

Projected Zonal Demand Data Source: NYISO CARIS Base Cases (does not include Virtual Bidding and Transmission outages)

Projected - Zonal Generation (GWh)

Generator GWh										
Area	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
West	26,298	26,547	26,560	26,567	26,557	26,601	26,554	26,590	26,555	26,544
Genessee	5,214	5,241	5,236	5,248	5,215	5,220	5,208	5,223	5,179	5,239
Central	35,224	34,613	34,498	34,506	34,570	34,735	34,716	34,749	34,737	34,564
North	6,368	6,580	6,592	6,601	6,626	6,660	6,671	6,707	6,721	6,439
Mohawk Valley	3,925	3,984	3,998	4,014	4,015	4,022	4,028	4,046	4,041	4,029
Capital	16,572	18,430	18,449	18,432	18,576	18,692	18,771	18,845	18,781	18,474
Hudson Valley	4,539	4,616	4,749	4,781	4,778	4,895	4,864	4,920	5,045	4,706
Millwood	17,146	17,146	17,147	17,197	17,147	17,147	17,147	17,197	17,147	17,147
Dunwoodie	6	6	6	6	6	6	6	6	6	6
NYCity	25,411	23,743	23,930	24,126	24,569	25,191	25,595	26,259	26,555	26,225
Long Island	12,052	11,681	11,895	11,875	11,961	12,214	12,222	12,382	12,689	11,283
NYISO Total	**152,755**	**152,587**	**153,060**	**153,353**	**154,019**	**155,382**	**155,782**	**156,924**	**157,456**	**154,654**
IESO Total	**163,822**	**166,696**	**167,109**	**167,875**	**167,114**	**172,885**	**173,287**	**173,487**	**173,234**	**174,014**
PJM Total	**758,719**	**758,124**	**758,437**	**761,347**	**759,345**	**759,943**	**753,980**	**756,146**	**754,853**	**761,263**
HQ Total	**4,446**	**4,455**	**4,454**	**4,455**	**4,445**	**4,445**	**4,446**	**4,455**	**4,445**	**4,464**
ISO-NE Total	**139,028**	**136,550**	**136,533**	**136,735**	**136,549**	**137,521**	**136,624**	**135,734**	**135,223**	**136,097**
Total	**1,218,769**	**1,218,413**	**1,219,592**	**1,223,764**	**1,221,472**	**1,230,175**	**1,224,119**	**1,226,746**	**1,225,211**	**1,230,493**

PJM includes PJM Classic, AP, AEP, CE, DAY, DLCO and DVP

Projected Zonal Generation Data Source: NYISO CARIS Base Cases Simulation Results (does not include Virtual Bidding and Transmission outages)

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Projected Production Cost

Generator Production Cost m$										
Area	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
West	381	427	438	452	462	482	492	503	540	530
Genessee	78	89	89	92	92	95	99	102	108	112
Central	769	871	874	909	936	989	1,026	1,045	1,076	1,119
North	89	121	124	130	133	139	144	151	158	162
Mohawk Valley	56	77	82	89	93	98	100	104	105	107
Capital	547	830	847	885	903	941	978	1,023	1,059	1,093
Hudson Valley	147	180	194	202	209	227	232	245	261	242
Millwood	205	201	199	205	210	214	229	236	241	249
Dunwoodie	0	0	0	0	0	0	0	0	0	0
NYCity	1,439	1,807	1,931	2,101	2,211	2,438	2,609	2,821	2,953	3,103
Long Island	570	771	804	843	865	919	955	1,009	1,077	981
NYISO Total	**4,280**	**5,374**	**5,580**	**5,907**	**6,113**	**6,542**	**6,865**	**7,240**	**7,578**	**7,698**

Values are in nominal dollars

Increasing production cost reflect higher values for fuel prices, start-up cost, and emission allowance; also inflation rate escalation

Projected Production Cost Source: NYISO CARIS Base Cases Simulation Results (does not include Virtuals and Transmission outages)

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Zonal Load Payment Projected Results

Load LBMP Payment m$										
Area	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
West	638	836	851	884	908	956	996	1,043	1,088	1,125
Genessee	414	551	560	582	589	626	656	690	723	745
Central	688	916	937	974	1,005	1,057	1,102	1,159	1,209	1,254
North	290	388	397	414	427	447	463	484	503	524
Mohawk Valley	314	426	436	455	467	491	512	536	559	567
Capital	513	688	705	743	763	804	842	891	939	981
Hudson Valley	503	680	705	740	759	799	835	880	925	965
Millwood	127	171	178	187	193	202	211	223	234	245
Dunwoodie	306	412	425	445	454	473	491	515	539	563
NYCity	2,726	3,713	3,832	4,086	4,232	4,530	4,791	5,138	5,411	5,582
Long Island	1,118	1,507	1,542	1,609	1,623	1,686	1,747	1,842	1,920	1,989
NYISO Total	**7,637**	**10,288**	**10,569**	**11,120**	**11,420**	**12,071**	**12,646**	**13,400**	**14,052**	**14,540**

Values are in nominal dollars

Increasing LBMP payments reflect higher values for fuel prices, a slightly increasing trend of zonal forecasted demand (GWh) and the increase of projected zonal congestion payments (downstate)

Projected Load Payment Data Source: NYISO CARIS Base Cases Simulation Results (does not include Virtuals and Transmission outages)

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Zonal Generator Payment (million $) Projected Results

Generator LBMP Payment m$										
Area	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
West	1,041	1,375	1,397	1,446	1,472	1,548	1,605	1,669	1,728	1,766
Genessee	210	278	283	294	294	309	321	334	345	340
Central	1,437	1,871	1,900	1,978	2,035	2,136	2,215	2,314	2,410	2,477
North	265	362	370	385	398	418	435	456	476	473
Mohawk Valley	162	218	223	233	240	251	261	274	285	294
Capital	742	1,095	1,115	1,164	1,198	1,260	1,313	1,379	1,436	1,463
Hudson Valley	219	296	313	330	335	359	370	392	419	406
Millwood	792	1,051	1,077	1,130	1,146	1,195	1,240	1,300	1,352	1,406
Dunwoodie	0	0	0	0	0	0	0	0	0	1
NYCity	1,248	1,574	1,613	1,706	1,771	1,903	2,011	2,167	2,289	2,340
Long Island	592	784	818	855	872	925	960	1,017	1,083	1,005
NYISO Total	**6,707**	**8,904**	**9,109**	**9,521**	**9,761**	**10,306**	**10,731**	**11,303**	**11,822**	**11,970**

Values are in nominal dollars

Increasing LBMP payments reflect higher values for fuel prices, a slightly increasing trend of zonal forecasted demand (GWh) and the increase of projected zonal congestion payments (downstate)

Projected Generator Payment Source: NYISO CARIS Base Cases (does not include Virtuals and Transmission outages)

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Zonal LBMPs $ per MWh
Projected Results

Area	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
West	40.62	52.98	53.81	55.79	56.99	59.68	61.93	64.38	66.88	68.38
Genessee	41.52	54.87	55.81	57.99	58.45	61.33	63.72	66.24	68.90	70.66
Central	42.15	55.67	56.69	58.95	60.53	63.22	65.56	68.40	71.25	73.67
North	42.44	56.10	57.15	59.45	61.07	63.85	66.28	69.12	72.01	74.84
Mohawk Valley	43.54	57.42	58.49	60.87	62.46	65.25	67.70	70.64	73.61	76.13
Capital	45.00	59.68	60.85	63.56	64.78	67.65	70.23	73.45	76.77	79.73
Hudson Valley	46.47	61.62	63.12	65.95	67.13	70.00	72.63	75.93	79.25	82.29
Millwood	46.88	62.29	63.88	66.78	67.93	70.81	73.47	76.81	80.17	83.39
Dunwoodie	47.19	62.71	64.27	67.18	68.34	71.23	73.92	77.28	80.66	83.81
NYCity	48.50	64.86	66.12	69.33	70.74	74.28	77.37	81.21	85.00	87.11
Long Island	48.42	65.44	66.83	69.75	70.64	73.43	76.10	79.50	82.83	85.58
NYISO Total	**44.79**	**59.42**	**60.64**	**63.24**	**64.46**	**67.34**	**69.90**	**73.00**	**76.12**	**78.69**

Projected Zonal LBMPs Data Source: NYISO CARIS Base Cases Simulation Results (do not include Virtuals and Transmission outages)

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Discussion

- Next Step
  - *Finalize the base case & congestion forecast model – 8/7/09 ESPWG meeting*
  - *CARIS 3-Studies Selection (the grouped elements)*
  - *Application of Generic Solutions*
  - *Scenario Selection*
- Discussion

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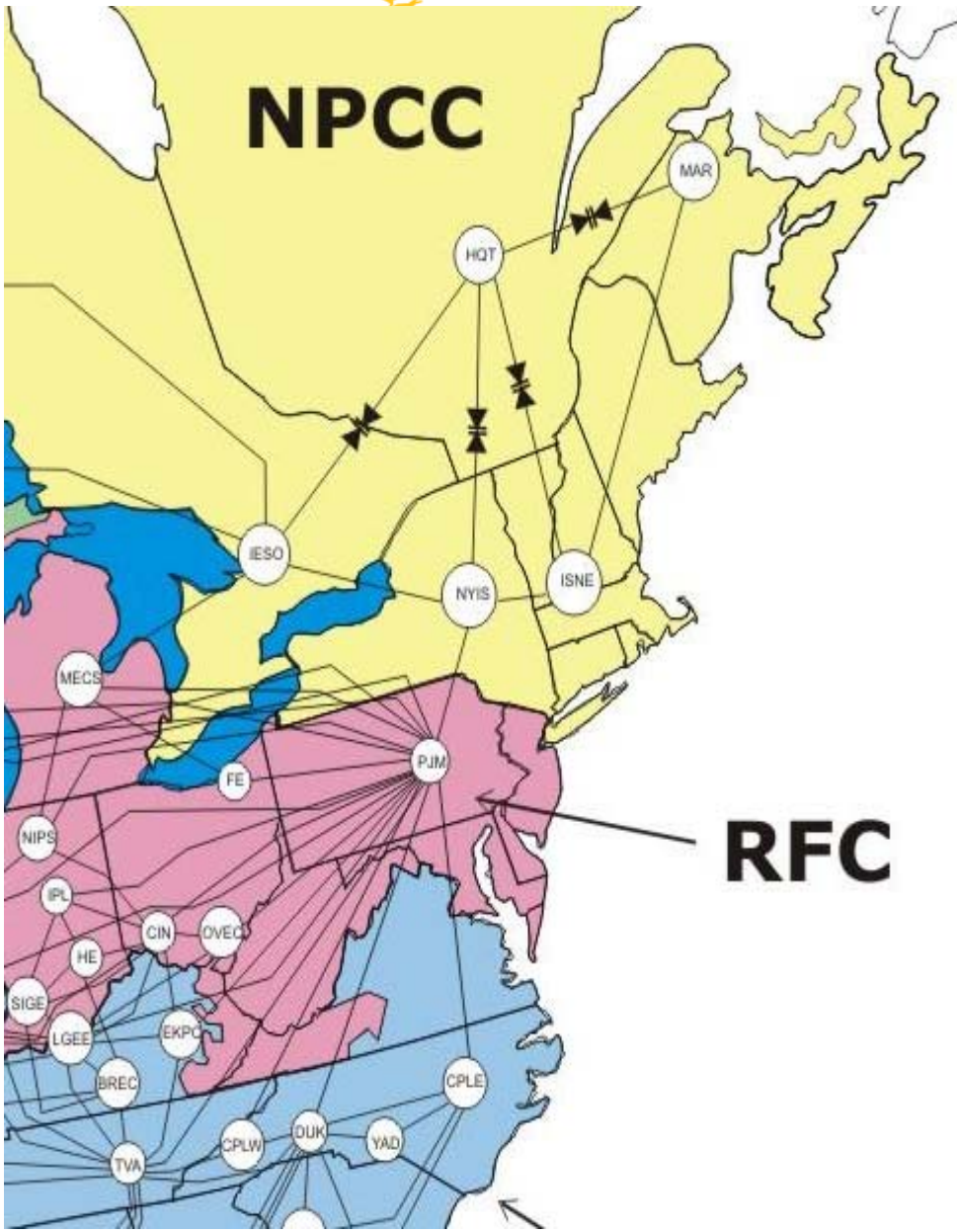
  - *PJM*
    - PJM Classic
    - AP, AEP, CE, DLCO, DAY and VP
- Proxy Bus
  - *HQ to NYISO & ISONE*
- Transmission Only
  - *MECS, FE, SPP, MAR, NIPS, OVEC, TVA*
  - *FRCC, SERC, ERCOT, WECC*



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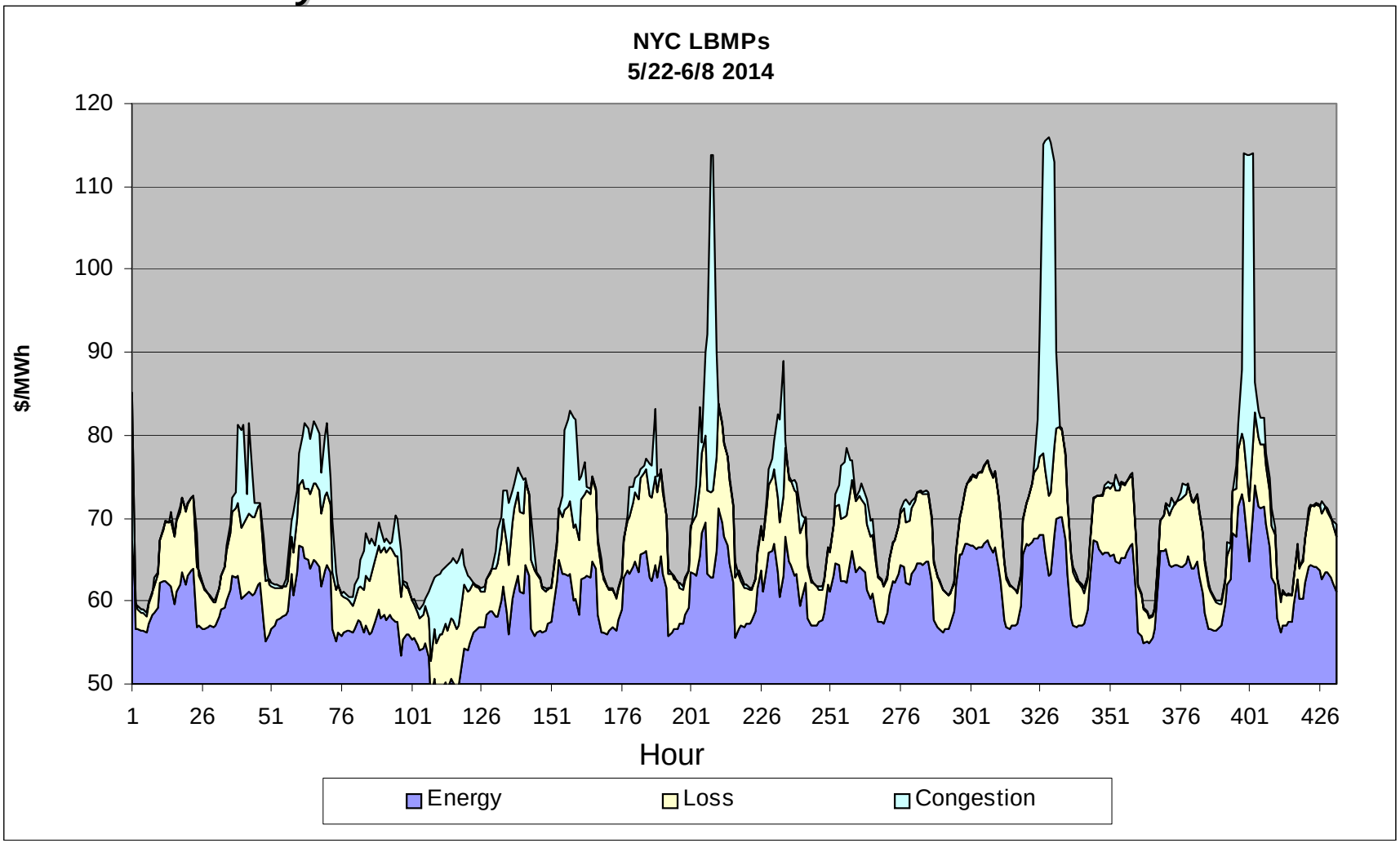
NYC Hourly LBMP



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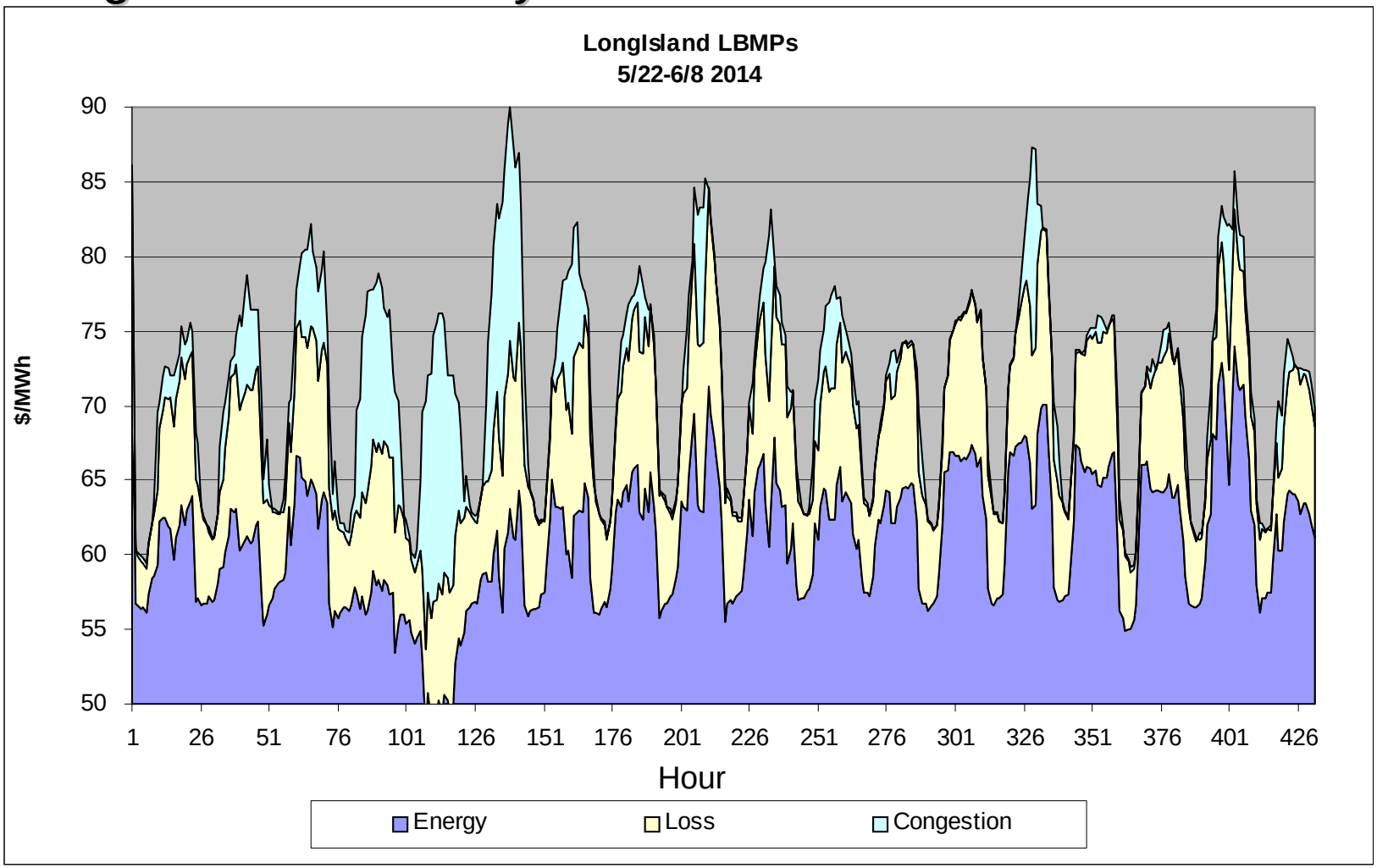
Long Island Hourly LBMP



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