NYISO
CENTRAL EAST AND UPNY-CONED VOLTAGE ANALYSIS FOR ATHENS GENERATING STATION

Central East and UPNY-ConEd Voltage Analysis for Athens Generating Station In-Service

1. INTRODUCTION

The Athens Generating Station (NEG, 1080MW) is expected to commence commercial operation in the spring of 2004. This combined-cycle plant consists of three natural gas fired combustion turbine generators (265MW each) and three heat-recovery steam powered turbine generators (95MW each), a plant total of 1080MW. The plant is connected to the NYISO 345kV system using three generator step-up transformers at the Athens 345kV switchyard. The Athens 345kV switchyard connects to Leeds via the #95 circuit, and to Pleasant Valley via the #91 circuit.

This study examines the Central East and UPNY-ConEd voltage constraints for the forecast 2004 system and determines limits for multiple levels of Athens generation.

2. OBSERVATIONS AND CONCLUSIONS

The analysis has indicated that Athens generation improves the voltage support and regulation in the New Scotland and Pleasant Valley vicinities. The result of this reactive support increases the voltage stability limited transfer capability across the Central East and UPNY-ConEd interfaces, but at the same time decreases thermally limited transfer capability across the UPNY-ConEd interface by loading directly on the existing thermal constraint of Athens to Pleasant Valley.

Based on the analysis, it is recommended that the Central East Maximum Transfer Levels be adjusted as summarized in Table 1 when Athens generation is in service. Taking the difference in Central East MTL with Athens at full dispatch (1080 MW) and Athens not dispatched and dividing by three, establishes the incremental change in MTL for each combined-cycle pair of CT/ST. The result is an increase of approximately 50 MW in the MTL per combined-cycle pair of Athens generators for the Marcy South North tower and New Scotland 99 bus fault contingencies.

TABLE 1

Determination of Central East Capability Based on Adjusted Maximum Transfer Levels				
	Central East Adjusted MTL(MW) (post-contingency transfer)		Change in Central East MTL	
	Marcy South North	New Scotland 99	Marcy South North	New Scotland 99
0 sets of Athens (0 MW)	3400	1950	--	--
3 sets of Athens (1080 MW)	3560	2105	160	155

In the voltage constrained transfer analysis for UPNY-ConEd, the thermal limits for UPNY-ConEd in each Athens dispatch are more limiting than the UPNY-ConEd Pre-Contingency Maximum Transfer Levels as shown below in Table 2.

TABLE 2

Sets of Athens Generation	Number of Roseton Units	Number of Bowline Units	UPNY-ConEd Thermal Limit (MW)	UPNY-ConEd Pre-Contingency MTL (MW)
0	0	0	2121	2370
0	0	2	3202	3380
0	2	2	4196	4305
3	0	0	1628	3055
3	2	0	2580	3935
3	2	2	3716	4780

2.1 Voltage Limits

Tables B1 through B5 in Appendix B summarize the recommended Central East Maximum Transfer Level (MTL) and Adjusted-MTL pre and post-contingency. This analysis evaluated five limiting Central East voltage contingencies with Athens generation sensitivity.

Tables D1 through D14 in Appendix D summarize the recommended UPNY-ConEd Maximum Transfer Level (MTL) and Adjusted-MTL pre and post-contingency. This analysis evaluated fourteen UPNY-ConEd voltage contingencies with Athens, Roseton, and Bowline generation sensitivities.

3. STUDY ASSUMPTIONS AND METHODOLOGY FOR CENTRAL EAST

3.1 Central East Base Case Development and Analysis

A. Base Case Load Flow

The New York portion of the study base case was developed from the NYISO Databank and reviewed by Operating Studies Task Force for the Summer 2003 Operating Study. Areas outside the New York Control Area (NYCA) were obtained from the VEM/MEN 2003 Summer Operating Case.

The voltage analysis for the addition of Athens generating station is a continuation of the review of the Central East voltage collapse transfer limit analysis first reported in "NYPP Central East Voltage Analysis – 1995" (August 1995).

B. Central East Definition

Central East Interface

Name	Circuit #	Voltage (kV)
Edic - New Scotland	14	345
Marcy - New Scotland	18	345
Porter - Rotterdam	30	230
Porter - Rotterdam	31	230
Plattsburgh – Sandbar (VT)	PV20	115
East Springfield – Inghams ED	942	115
Inghams CD – Inghams ED	PAR	115

C. SVC/FACTS Operating Modes

The Leeds SVC, Fraser SVC, and the Marcy CSC are set to zero reactive output in the base cases (pre-contingency). The Marcy CSC is modeled in the STATCOM mode, which provides the maximum benefit when considering voltage constrained transfer analyses.

4.2 UPNY-ConEd Methodology

A. Voltage Collapse Transfer Limits

The analysis was performed using steady state load flow techniques. The NYISO Operations Engineering Voltage Guideline (Method #3, Voltage Collapse Transfer Limits) is used to determine post-contingency maximum and critical transfer levels. This guideline is included as Appendix A. Generation in the IMO and ISO-NE Control Areas were dispatched to NYC to drive the transfer across the UPNY-ConEd interface.

4.3 UPNY-ConEd Discussion

A. Voltage Collapse Limit Transfer Analysis

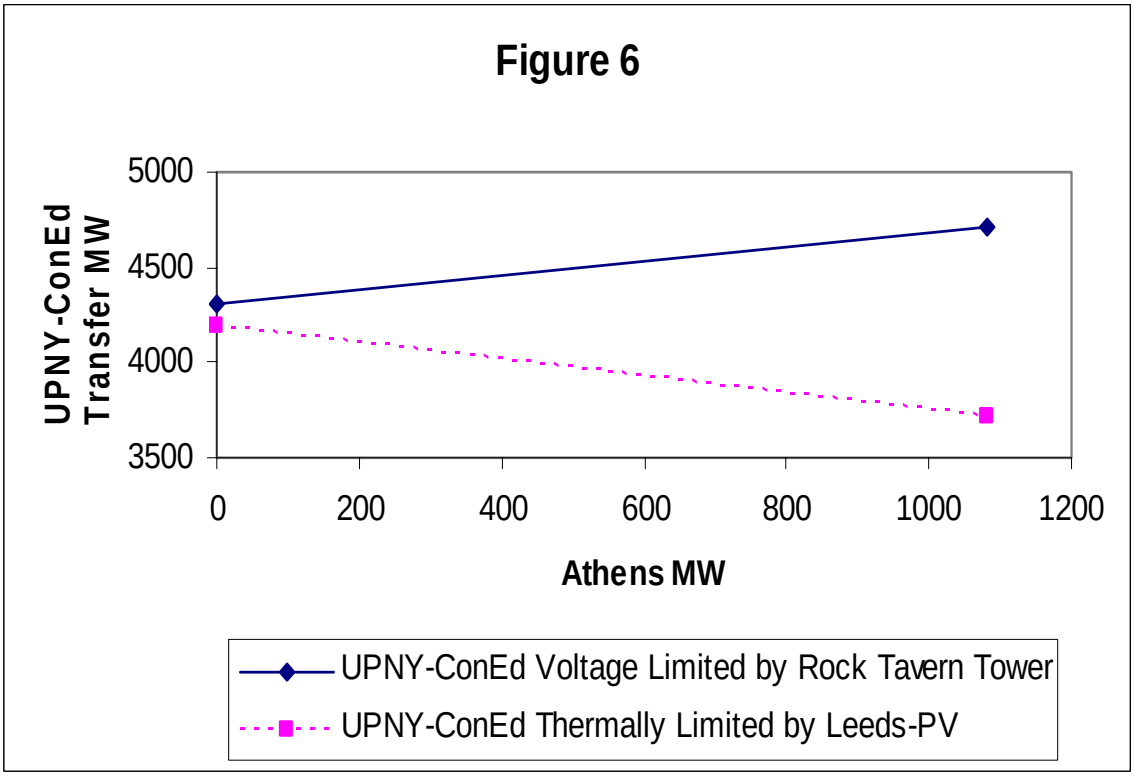
The following UPNY-ConEd voltage contingencies were evaluated:

- Three Phase at Athens (3PH @ Athens, L/O Athens-Pleasant Valley)
- Three Phase at Fishkill (3PH @ Fishkill, L/O Fishkill-Roseton)
- Three Phase at Leeds (3PH @ Leeds, L/O Leeds-Pleasant Valley)
- Buchanan Tower (LLG @ Buchanan, L/O Buchanan-Ramapo, L/O Buchanan Ladentown, and L/O Buchanan 345/115 Bank)
- Fishkill Tower (LLG @ Fishkill, L/O Fishkill-Pleasantville, L/O Fishkill-Wood St, and L/O Wood St-Pleasantville)
- Pleasant Valley Tower (LLG @ Pleasant Valley, L/O Pleasant Valley-Millwood, L/O Pleasant Valley-Wood St, and L/O Wood St-Millwood)
- Rock Tavern Tower (LLG @ Rock Tavern, L/O Rock Tavern-Coopers Corners, L/O Rock Tavern-Shoemakers Tap, L/O Shoemakers Tap-Coopers Corners, L/O Rock Tavern 345/115 Bank, and L/O Rock Tavern Cap Bank)
- Sprainbrook Tower (LLG @ Sprainbrook, L/O Sprainbrook-East View, L/O East View-Buchanan, L/O Sprainbrook-East View, and L/O East View-Millwood)
- Leeds Stuck Breaker 9293 (SLG-STK @ Leeds, L/O New Scotland-Leeds, and Leeds-Pleasant Valley)
- Leeds Stuck Breaker R395 (SLG-STK @ Leeds, L/O Leeds-Gilboa and Leeds Athens)
- Leeds Stuck Breaker R94301 (SLG-STK @ Leeds, L/O Leeds-New Scotland and Leeds-Hurley)
- Ramapo Stuck Breaker W72-2 (SLG-STK @ Ramapo, L/O Ramapo-Branchburg and Ramapo-Ladentown)

- Rock Tavern Stuck Breaker 31153 (SLG-STK @ Rock Tavern, L/O Rock Tavern-Roseton, L/O Rock Tavern-Shoemaker Tap, and L/O Shoemaker Tap-Coopers Corners)
- Rock Tavern Stuck Breaker 37751 (SLG-STK @ Rock Tavern, L/O Rock Tavern-Coopers Corners and Rock Tavern-Ramapo)

Tables in Appendix D summarize the MTL, calculation of the Adjusted MTL and Critical Transfer Level (UPNY-ConEd Pre and Post-contingency Operating Limit) for the different dispatches of Athens, Roseton, and Bowline generating stations. There is a separate table for each of the UPNY-ConEd voltage contingencies. The following are noted at the bottom of each of these tables. ***Corresponding Pre-Cont MW*** is the pre-contingency UPNY-ConEd transfer that corresponds to the post-contingency MTL UPNY-ConEd transfer. ***Pre-Cont Low Limit Bus*** is the station that violates its pre-contingency low voltage limit before the MTL. ***Pre-Cont Low Limit MW*** is the pre-contingency UPNY-ConEd transfer at which the station violates its pre-contingency low voltage limit. ***Post-Cont Low Limit Bus*** is the station that violates its post-contingency low voltage limit before the MTL. ***Post-Cont Low Limit MW*** is the post-contingency UPNY-ConEd transfer at which the station violates its post-contingency low voltage limit. These notes are calculated from the plots in Appendix D.

Rock Tavern Tower contingency is the most limiting voltage contingency in all the generation configurations studied for the UPNY-ConEd interface. This contingency is limited at Pleasant Valley, which is determined from the Pre-Contingency Adjusted MTL tables found in Appendix D. Figure 6 shows how Athens generation improves the voltage support at Pleasant Valley, but at the same time increases congestion on the UPNY-ConEd interface due to the thermal limits of Leeds/Athens – Pleasant Valley circuits.



For the "as found system" or 0 sets of Athens generation, current pre-contingency voltage limits at Pleasant Valley and Sprainbrook are more constraining than the UPNY-ConEd Critical Transfer as shown in figures 7 and 8. Comparing Figures 9 and 10 to figures 7 and 8 shows how Athens generation improves the voltage support at Pleasant Valley and Sprainbrook.

FIGURE 7
PRE AND POST FAULT VOLTAGE VS PRE-FAULT UPNY-CONED MW
0 ATHENS, 2 ROSETONS, 2 BOWLINES
LLG AT ROCK TAVERN

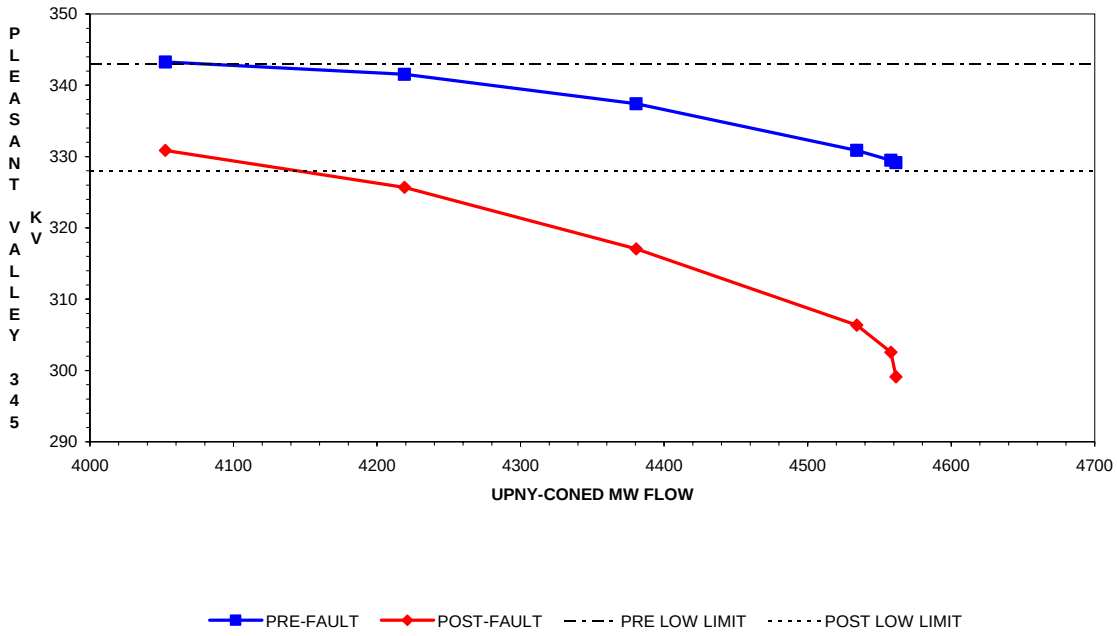


FIGURE 8
PRE AND POST FAULT VOLTAGE VS PRE-FAULT UPNY-CONED EAST MW
0 ATHENS, 2 ROSETONS, 2 BOWLINES
LLG AT ROCK TAVERN

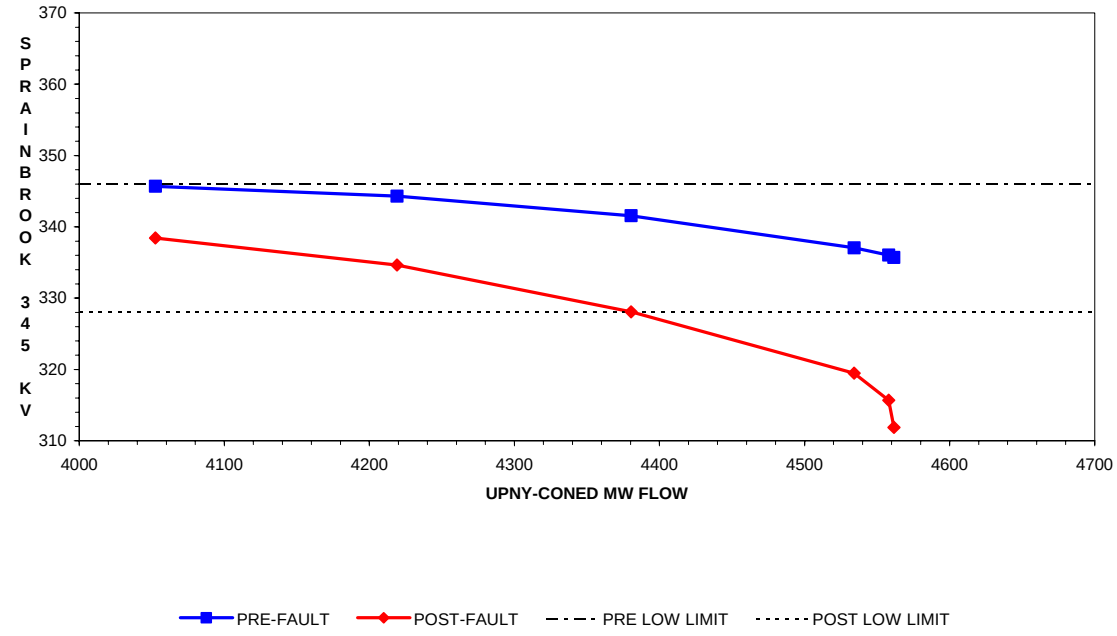


FIGURE 9
PRE AND POST FAULT VOLTAGE VS PRE-FAULT UPNY-CONED MW
3 SETS OF ATHENS, 2 ROSETONS, 2 BOWLINES
LLG AT ROCK TAVERN

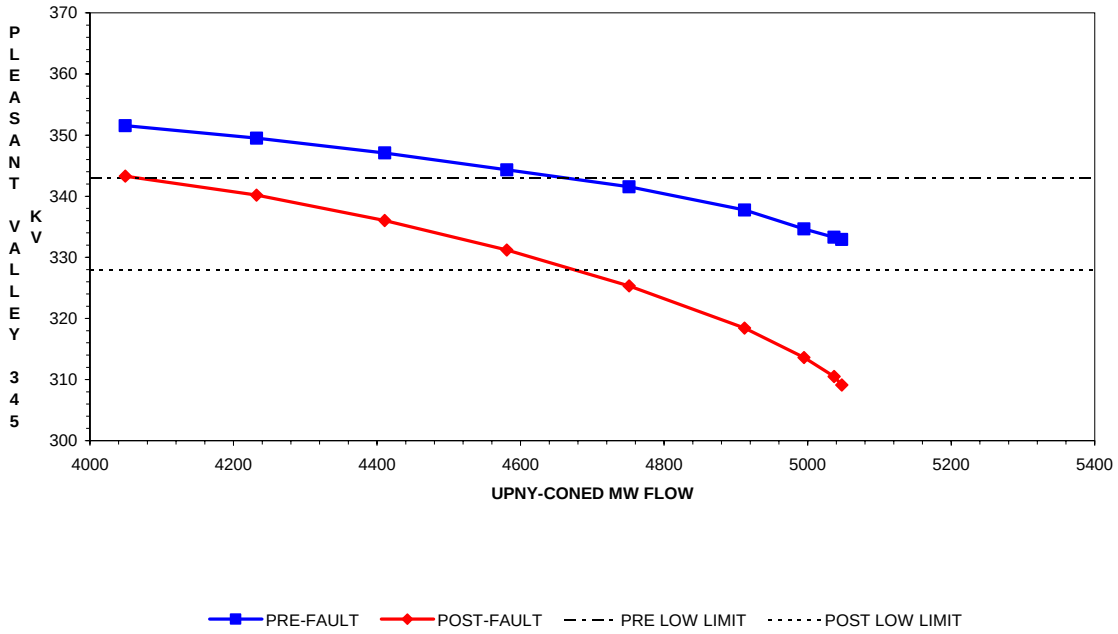


FIGURE 10
PRE AND POST FAULT VOLTAGE VS PRE-FAULT UPNY-CONED MW
3 SETS OF ATHENS, 2 ROSETONS, 2 BOWLINES
LLG AT ROCK TAVERN