NYISO Operating Study
Summer 2015

Prepared by
Operations Engineering Staff
New York Independent System Operator, Inc

Approved by the NYISO Operating Committee
May 14, 2015

Executive Summary

This study is conducted as a seasonal review of the projected thermal transfer capability for the summer 2015 capability period. This study is performed to fulfill the NERC requirements R2 of FAC-013 and R11 of TOP-002-2a. The study evaluates the projected internal and external thermal transfer capabilities for the peak load and dispatch conditions studied.

The evaluated limits are shown in Tables 1 through 4. Differences in the evaluated internal interface limits from summer 2014 to summer 2015 are shown on page 7. Internal interface limits are essentially unchanged from the summer 2014, with the exception of Moses South which is limited to 2425 MW. Modeling the Moses to Massena (MMS2) 230 kV line in-service has altered both base and transfer patterns on the Moses South interface. Differences in the evaluated external interface limits from summer 2014 to summer 2015 are shown on page 10. External interface limits are essentially unchanged from the summer 2014, with the exception of NYISO-PJM and PJM-NYISO which are limited to 1300 MW and 2550 MW, respectively. Coal unit retirements in western New York and western PJM have altered both base and transfer patterns on the western NY system. In 2014, the real time limitations under NYISO-PJM transfers resulted in a new operating protocol associated with specific system transfer conditions. Adjustments have been made to the modeling assumption for the NYISO-PJM transfers in this analysis to more closely align with the observed real time system behavior. The rating increase on the limiting element, Dunkirk to South Ripley, is responsible for the increased PJM-NYISO transfers.

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1. INTRODUCTION

The following report, prepared by the Operating Studies Task Force (OSTF) at the direction and guidance of the System Operations Advisory Subcommittee (SOAS), highlights the thermal analysis evaluation for the summer 2015 capability period. This analysis indicates that, for the summer 2015 capability period, the New York interconnected bulk power system can be operated reliably in accordance with the "NYSRC Reliability Rules for Planning and Operating the New York State Power System" and the NYISO System Operating Procedures.

Transfer limits cited in this report are based on the forecast peak load and dispatch assumptions and are intended as a guide to system operation. Changes in generation dispatch or load patterns that significantly change pre-contingency line loadings may change limiting contingencies or limiting facilities, resulting in higher or lower interface transfer capabilities.

System Operators should monitor the critical facilities noted in the included tables along with other limiting conditions while maintaining bulk power system transfers within secure operating limits.

2. PURPOSE

The purpose of the study is to determine:

- The total transfer capabilities (TTC) between NYISO and adjacent areas including IESO, PJM and ISO-NE for normal conditions in the summer/winter periods. The TTC is calculated based on NERC TPL-002-0b Category B contingencies and a set of selected NERC TPL-003-0a Category C contingencies.
- The TTC between NYISO and adjacent areas including IESO, PJM and ISO-NE for emergency conditions in the summer/winter periods. The TTC is calculated based on NERC TPL-002-0b Category B contingencies.

This study is being performed to fulfill NERC requirements, which include Requirement R2 of FAC-013 and Requirement R11 of TOP-002-2a as quoted below.

"FAC-013-1—Establish and Communicate Transfer Capabilities Requirement R2:

The Reliability Coordinator and Planning Authority shall each provide its inter-regional and intra-regional Transfer Capabilities to those entities that have a reliability-related need for such Transfer Capabilities and make a written request that includes a schedule for delivery of such Transfer Capabilities as follows:

> R2.1. The Reliability Coordinator shall provide its Transfer Capabilities to its associated Regional Reliability Organization(s), to its adjacent Reliability Coordinators, and to the Transmission Operators, Transmission Service Providers and Planning Authorities that work in its Reliability Coordinator Area.
>
> R2.2. The Planning Authority shall provide its Transfer Capabilities to its associated Reliability Coordinator(s) and Regional Reliability Organization(s), and to the Transmission Planners and Transmission Service Provider(s) that work in its Planning Authority Area."

"TOP-002-2a—Normal Operations Planning Requirement R11:

The Transmission Operator shall perform seasonal, next-day, and current-day Bulk Electric System studies to determine System Operating Limits (SOLs). Neighboring Transmission Operators shall utilize identical SOLs for common facilities. The Transmission Operator shall update these Bulk Electric System studies as necessary to reflect current system conditions; and shall make the results of Bulk Electric System studies available to the Transmission Operators, Balancing Authorities (subject to confidentiality requirements), and to its Reliability Coordinator."

3. STUDY PARTICIPANTS

First Name	Last Name	Company Name	First Name	Last Name	Company Name
Anie	Philip	PSEG Long Island*	David	Mahlmann	NYISO
Michael	Del Casale	PSEG Long Island*	Robert	Golen	NYISO
Jalpa	Patel	PSEG Long Island*	De Dinh	Tran	NYISO
Robert	Eisenhuth	PSEG Long Island*	Kenneth	Wei	NYISO
Roy	Pfleiderer	National Grid	Roleto	Mangonon	O&R
Vicki	O'Leary	National Grid	Daniel	Head	ConEd
Diem	Ehret	National Grid	Ruby	Chan	Central Hudson
Michael	Spahiu	National Grid	Richard	Wright	Central Hudson
Brian	Gordon	NYSEG	Mohammed	Hossain	NYPA
Robert	King	NYSEG	Abhilash	Gari	NYPA
Jence	Mandizha	NYSEG	Larry	Hochberg	NYPA
Dean	LaForest	ISO-NE	Yuri	Smolanitsky	PJM
Bilgehan	Donmez	ISO-NE	Isen	Widjaja	IESO
Farzad	Farahmand	IESO	Ovidiu	Vasilachi	IESO
Jonathan	Mendoza	IESO	Edward	Davidian	IESO
Hardeep	Kandola	IESO			

*Agent for LIPA

4. SYSTEM REPRESENTATION AND BASE STUDY ASSUMPTIONS

4.1 System Representation

The representation was developed from the NYISO Data Bank and assumes the forecast summer coincident peak load of 33,567 MW. The other NPCC Balancing Areas and adjacent Regional representations were obtained from the RFC-NPCC summer 2015 Reliability Assessment power flow base case and has been updated to reflect the summer 2015 capability period.

A. Generation Resource Changes

The generator output levels for major units are summarized in Appendix B, and are consistent with typical operation for the period. The inter-Area schedules represented in the study base case are summarized in Appendix A. The following table shows generation retirements and additions since the summer 2014 capability period:

Retirements	
Ravenswood GT 3-3 (Mothballed)	-33 MW
Total Retirements	**-33 MW**
Additions	
Marsh Hill Wind (Nameplate)	16 MW
Ravenswood GT 3-4	33 MW
Binghamton Cogen	41 MW
Astoria 20	185 MW
Danskammer	495 MW
Total Additions	**770 MW**

B. Transmission Facilities Changes

Significant facility changes since the summer 2014 capability period include:

- Moses to Massena (MMS2) 230 kV line in-service.
- Mainesburg 345 kV substation

- Eastover Road 230 kV substation

Moses to Massena (MMS2) 230 kV line will be in-service for the summer 2015 capability period.

Mainesburg is a 345 kV substation on the NYSEG 345 kV system between Watercure in central New York and Homer City in northern PJM. This substation modifies the existing NYISO to PJM tie line from Watercure to Homer City 345 kV to Homer City to Mainesburg 345 kV and Mainesburg 345/115 kV bank.

Eastover Road is a 230 kV substation on the National Grid 230 kV system between Rotterdam in eastern New York and Bear Swamp in western ISO-NE. This substation modifies the existing NYISO to ISO-NE tie line from Rotterdam to Bear Swamp 230 kV to the new Eastover Road to Bear Swamp 230 kV tie line.

4.2 Base Study Assumptions

The Siemens PTI PSS™MUST and PSS™E software packages were used to calculate the thermal limits based on Normal and Emergency Transfer Criteria defined in the "NYSRC Reliability Rules for Planning and Operating the New York State Power System". The thermal transfer limits presented have been determined for all transmission facilities scheduled in service during the summer 2015 period.

The schedules used in the base case power flow for this analysis assumed a net flow of 1,000 MW from Public Service Electric & Gas (PSE&G) to Consolidated Edison via the PAR transformers controlling the Hudson – Farragut and Linden – Goethals interconnections, and 1,000 MW on the South Mahwah – Waldwick circuits from Consolidated Edison to PSE&G, controlled by the PARs at Waldwick. The Hopatcong – Ramapo 500 kV (5018) circuit is scheduled in accordance with the "Market-to-Market Coordination Process", August 14, 2013. For the summer 2015 base case, the schedule for the tie is 380 MW from PJM to New York. The four Ontario – Michigan PARs are modeled in-service and scheduled to a 0 MW transfer. These schedules are consistent with the scenarios developed in the RFC-NPCC Inter-Regional Reliability Assessment for summer 2015, and the MMWG summer 2015 power flow base cases. The series reactors on the Dunwoodie – Mott Haven (71 and 72), the Farragut – Gowanus (41 and 42) 345 kV and the Sprain Brook – W. 49th St. (M51 and M52) 345 kV cables, as well as the E. 179th St. – Hell Gate (15055) 138 kV feeder are in-service in the base case. The series reactors on the Sprain Brook – East Garden City (Y49) 345 kV cable are by-passed.

5. DISCUSSION

5.1 Resource Assessment

A. Load and Capacity Assessment

The forecast peak demand for the summer 2015 capability period is 33,567 MW[1]. This forecast is approximately 99 MW (0.30%) lower than the forecast of 33,666 MW for the summer 2014 capability period, and 389 MW (1.15%) lower than the all-time New York Control Area (NYCA) seasonal peak of 33,956 MW, which occurred on July 19, 2013.

The Installed Capacity (ICAP) requirement for the summer period is 39,273 MW based on the NYSRC 17.0% Installed Reserve Margin (IRM) requirement for the 2015 Capability Year. NYCA generation capacity for summer 2015 is 38,533 MW, and net external capacity purchases of 2,437 MW have been secured for the summer period. The combined capacity resources represent a 22.1% margin above the forecast peak demand of 33,567 MW. These values were taken from the 2014 Load & Capacity Data report produced by the NYISO, located at:

[1] Forecast Coincident Peak Demand (50th percentile baseline forecast)

http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2014_GoldBook_Final.pdf

The equivalent forced outage rate is 4.89%, and includes forced outages and de-ratings based on historical performance of all generation in the NYCA. For summer 2014, the equivalent forced outage rate assumed was 5.05%.

5.2 Cross-State Interfaces

A. Transfer Limit Analysis

This report summarizes the results of thermal transfer limit analyses performed on power system representation modeling the forecast peak load conditions for summer 2015. Normal and emergency thermal limits were calculated according to Normal and Emergency Transfer Criteria definitions in the "NYSRC Reliability Rules for Planning and Operating the New York State Power System". Facility ratings applied in the analysis were from the online MW ratings in the EMS, and are detailed in Appendix D. Generation shifts assumed for the thermal analysis are detailed in Appendix I.

Figure 1 presents a comparison of the summer 2015 thermal transfer limits to summer 2014 thermal transfer limits. Changes in these limits from previous years are due to changes in the base case load flow generation and load patterns that result in different pre-contingency line loadings, changes in limiting contingencies, or changes in circuit ratings, or line status. Appendix H presents a summary comparison of Cross-State thermal transfer limits between summer 2015 and 2014, with limiting element/contingency descriptions. Significant differences in these thermal transfer limits are discussed below.

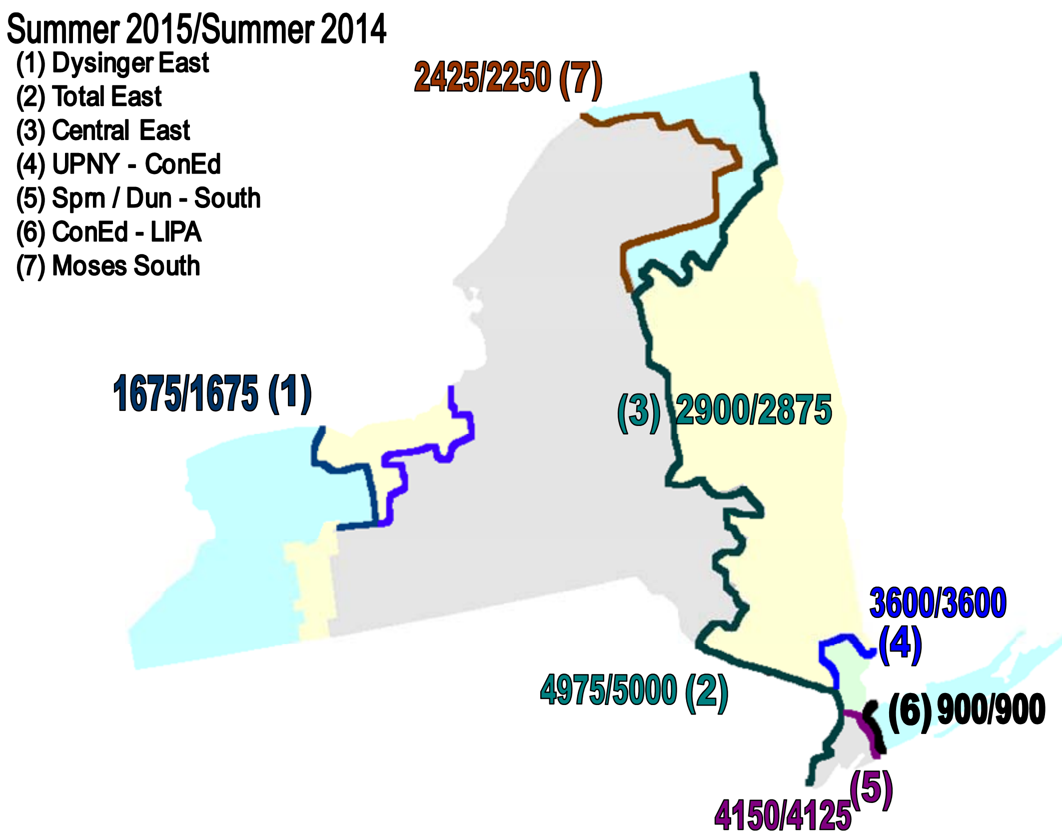

Figure 1 – Cross-State Thermal Transfer Limits

Moses South interface thermal transfer limit increased 175 MW. This is due to the Moses to Massena (MMS2) 230 kV line being modeled in-service and redistribution of initial flows.

B. Athens SPS

In 2008, a Special Protection System (SPS) went in-service impacting the thermal constraint on the Leeds to Pleasant Valley 345 kV transmission corridor. The SPS is designed to reject generation at the Athens combined-cycle plant if either the Leeds to Pleasant Valley 345 kV (92) circuit or the Athens to Pleasant Valley 345 kV (91) circuit are out-of-service and the flow on the remaining circuit is above the LTE rating. Generation at Athens will be tripped until the flow is below the LTE rating, the out-of-service circuit recloses, or the remaining circuit trips. This SPS is expected to be active when there is generation on-line at the Athens station, and will allow the NYCA transmission system to be secured to the STE rating of the 91 line for the loss of the 92 line, and vice-versa, for normal operating conditions. The SPS increases the normal thermal limit to match the emergency thermal limit across the UPNY-ConEd operating interface when the 91 or 92 is the limiting circuit. The Table 1 “Emergency” limit for the UPNY-ConEd interface can be interpreted as the “Normal” limit, when the Athens SPS is active.

C. Sensitivity Testing

The thermal limits presented in Section 6 were determined using the base conditions and schedules. The effects of various intra- and inter-Area transfers or generation patterns in the system are presented in Appendix G. Certain graphs indicate that there may not be a measurable sensitivity to the specific variable condition (winter peak load), or the sensitivity may occur at transfer levels above other transfer constraints (e.g., voltage or transient stability limitations). This analysis demonstrates how the particular constraint (thermal transfer limits) may respond to different conditions.

Phase angle regulator schedules may vary from day-to-day. A sensitivity analysis for selected interfaces has been included for the Ramapo and St. Lawrence interconnections. Graphs showing the sensitivity of the interface limit to the PAR schedule are included in Appendix G.

D. West Woodbourne Transformer

The Total-East interface may be limited at significantly lower transfer levels for certain contingencies that result in overloading of the West Woodbourne 115/69 kV transformer. Should the West Woodbourne tie be the limiting facility, it may be removed from service to allow higher Total-East transfers. Over-current relays are installed at West Woodbourne and Honk Falls to protect for contingency overloads.

E. ConEd – LIPA Transfer Analysis

Normal transfer capabilities were determined using the base case generation dispatch and PAR settings as described in Appendix B. Emergency limits are dispatch dependant, and can vary based on generation and load patterns in the LIPA system.

For emergency transfer capability analysis, the PARs controlling the LIPA import were adjusted to allow for maximum transfer capability into LIPA:

<u>ConEd – LIPA PAR Settings</u>

	Normal	Emergency
Jamaica – Lake Success 138 kV	-165 MW	85 MW
Jamaica – Valley Stream 138 kV	-123 MW	90 MW
Sprain Brook – E. Garden City 345 kV	637 MW	637 MW

<u>ISO-NE – LIPA PAR Settings</u>

Norwalk Harbor – Northport 138 kV	100 MW	286 MW

The PAR schedules referenced above and the ConEd - LIPA transfer assessment assume the following loss factors and oil circulation modes in determination of the facility ratings for the 345 kV cables:

- Y49 has a 70% loss factor in slow oil circulation mode.
- Y50 has a 70% loss factor in rapid circulation mode.

Emergency Transfer via the 138 kV PAR-controlled Jamaica ties between ConEdison and LIPA

Con Edison and LIPA have determined possible emergency transfer levels via the Jamaica - Valley Stream (901) 138 kV and Jamaica - Lake Success (903) 138 kV PAR-controlled ties that could be used to transfer emergency power between the two entities during peak conditions. The emergency transfer levels were calculated in both directions, for system peak load conditions with all transmission lines in service and all generation available for full capacity.

ConEd to LIPA emergency assistance

Based on analysis of historical conditions performed by LIPA and Con Edison, Con Edison anticipates being able to supply a total flow up to 175 MW of emergency transfer from Con Edison to Long Island, if requested, via the ties.

LIPA to ConEd emergency assistance

Historically, LIPA anticipated being able to supply a total flow up to 510 MW of emergency transfer from Long Island to Con Edison, if requested, via the ties. However, with rating changes to several 138kV circuits internal to the LIPA system, this emergency transfer capability will likely be reduced. Assessment of emergency transfer capability from Long island to Con Ed is under review.

F. Transfer Limits for Outage Conditions

Transfer limits for scheduled outage conditions are determined by the NYISO Scheduling and Market Operations groups. The NYISO Real-Time Dispatch system monitors the EHV transmission continuously to maintain the secure operation of the interconnected EHV system.

G. Transient Stability and Voltage transfer Limits

The interface transfer limits shown in Section 6 are the results of a thermal transfer limit analysis only. Transient stability and voltage interface transfer limits for all lines in-service and line outage conditions are summarized and available through the NYISO website located at:

http://www.nyiso.com/public/markets_operations/market_data/reports_info/index.jsp

5.3 Thermal Transfer Capabilities with Adjacent Balancing Areas

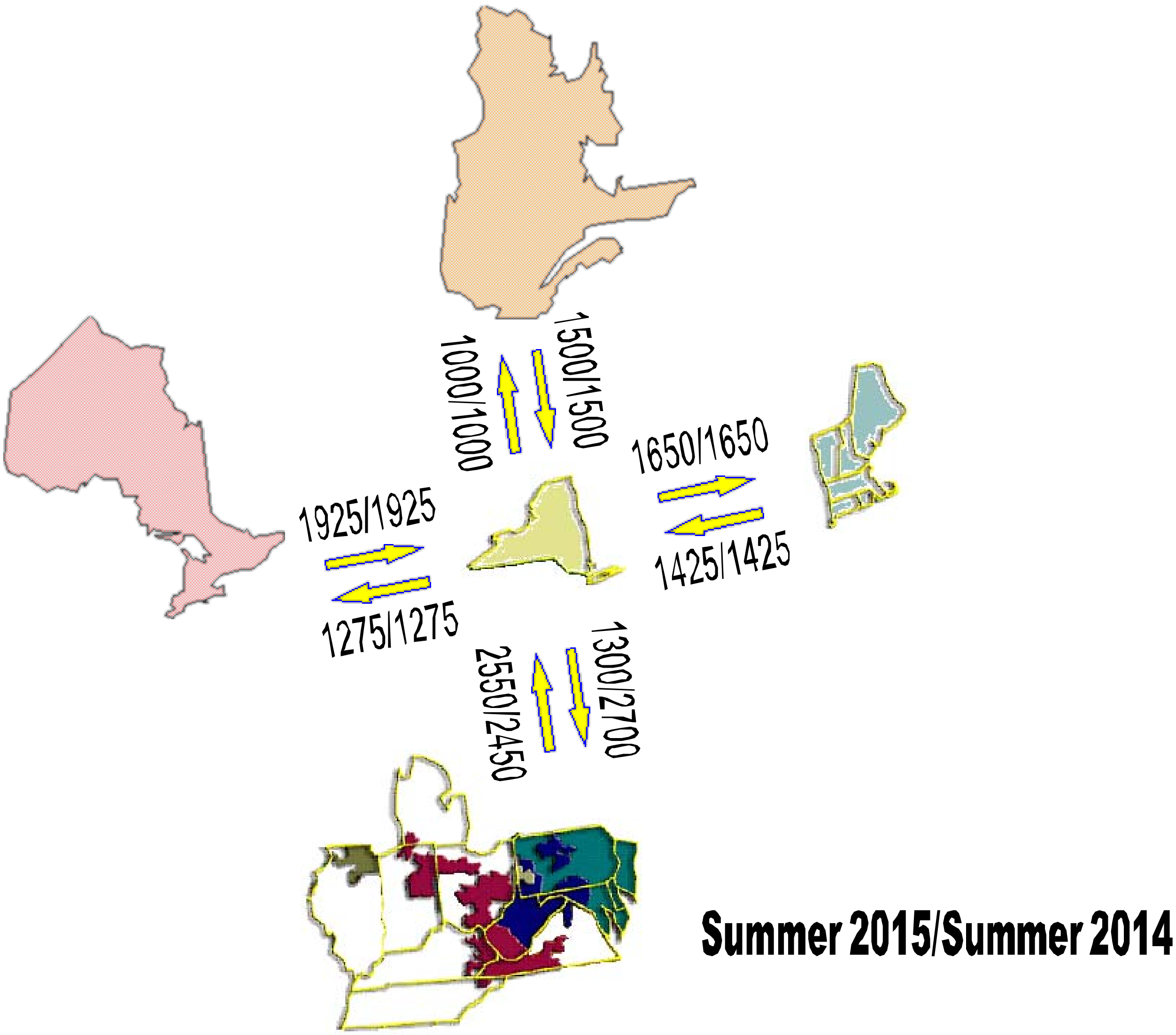

Figure 2 – Inter-Area Thermal Transfer Capabilities (2)

Thermal transfer limits between New York and adjacent Balancing Areas also are determined in this analysis. These transfer limits supplement, but do not change, existing internal operating limits. There may be facilities internal to each system that may reduce the transfer limits between Balancing Areas. Reductions due to these situations are considered to be the responsibility of the respective reliability authority. Some of these potential limitations are indicated in the summary tables by "[Reliability Coordinating] Facility" limits, which supplement the "Direct Tie" limits between the Balancing Areas. Transfer conditions within and between neighboring Balancing Areas can have a significant effect on inter- and intra-Area transfer limits. Coordination between Balancing Areas is necessary to provide optimal transfer while maintaining the reliability and security of the interconnected systems.

New York – PJM interface thermal transfer limit decreased 1400 MW. This is mainly due to generation redistribution in the western New York and PJM areas, which has modified traditional flow patterns. Also a new NYISO – PJM operating protocol has been implemented to secure the 115 kV western New York system for specific NYISO – PJM system conditions. The modeling

(1) TE-NY transfer capabilities shown in Figure 2 are not thermal transfer limits; for more information see Section 5.3.D.

assumptions were updated to reflect the field observation of the 115 kV limitation in transfer capability.

PJM – New York interface thermal transfer limit increased 100 MW. This is due to the increase in the line ratings of the limiting element, Dunkirk – South Ripley (68) 230 kV line.

A. New York – New England Analysis

a. New England Transmission/Capacity Additions

Transmission

The construction efforts continue on new 345 kV lines between eastern Connecticut, Rhode Island and Massachusetts as part of the Interstate Reliability Project (IRP). A new 345 kV line between Card and Lake Road is expected to be in-service in May 2015.

Concurrently, major transmission upgrades in northern New England will be completed. A new substation, Coopers Mills, in Maine will be fully in-service.

Capacity

Vermont Yankee nuclear generation (640 MW) is retired as of December 2014. No other major generation additions or retirements are scheduled before the summer 2015 capability period.

b. Thermal Transfer Limit Analysis

The transfer limits between the NYISO and ISO New England for normal and emergency transfer criteria are summarized in Section 6, Table 2.

c. Cross-Sound Cable

The Cross-Sound Cable is an HVdc merchant transmission facility connecting the New Haven Harbor 345 kV (United Illuminating, ISO-NE) station and Shoreham 138 kV (LIPA, NYISO) station. It has a design capacity of 330 MW. This facility is not metered as part of NYISO – ISO-NE interface, and HVdc transfers are independent of transfers between the NYISO and ISO-NE.

d. Smithfield – Salisbury 69 kV

CHG&E and Northeast Utilities will operate the Smithfield - Salisbury 69 kV (FV/690) line normally closed. The maximum allowable flow on this line is 31 MVA based on limitations in the Northeast Utilities 69 kV system. When the ISO-NE to NYISO transfer is greater than approximately 400 MW, however, the line will be opened, due to post contingency limits within the Northeast Utilities system. The FV/690 line has directional over-current protection that will trip the FV/690 Line in the event of an overload when the flow is into Northeast Utilities, no protection exists that will trip the FV/690 Line in the event of an overload when the flow is into NYISO.

e. Northport – Norwalk Harbor Cable Flow

Flow on the NNC Norwalk Harbor to Northport, facility is controlled by a phase angle-regulating (PAR) transformer at Northport. As system conditions vary the scheduled flow on the NNC may be used to optimize transfer capability between the Balancing Areas. The thermal transfer limits are presented in Table 2 for different PAR schedule assumptions on the Northport – Norwalk Harbor interconnection. Exhibits in Appendix G graphically demonstrate the optimization of transfer capability by regulating the flow on the Northport-Norwalk Harbor tie.

f. **Whitehall – Blissville 115 kV**

The phase angle regulator on this circuit will control pre-contingency flow between the respective stations. VELCO, National Grid, ISO-NE and NYISO developed a joint operating procedure. For the summer 2014 analyses, the pre-contingency schedule is 25 MW from Blissville (ISO-NE) to Whitehall (NYISO). The scheduled flow may be adjusted to protect the National Grid local 115 kV transmission south of Whitehall for 345 kV contingency events in southern Vermont.

g. **Plattsburgh – Sand Bar 115 kV (i.e. PV20)**

The phase angle regulating transformer at the VELCO Sand Bar substation was modeled holding a pre-contingency flow of approximately 100 MW on the PV20 tie. This modeling assumption was premised upon common operating understandings between ISO-NE and the NYISO given local operating practice on the Moses – Willis – Plattsburgh 230 kV transmission corridor. ISO-NE's analysis examined and considered New England system limitations given this modeling assumption and did not examine generation dispatch / system performance on the New York side of the PV20 tie for this analysis.

B. New York - PJM Analysis

a. **Thermal Transfer Limit Analysis**

The transfer limits for the New York - PJM interface are summarized in Section 6, Table 3. The phase angle regulating transformers controlling the Hopatcong – Ramapo 500 kV circuit are used to maintain flow at the normal rating of the Ramapo 500/345 kV transformer.

b. **Opening of PJM - New York 115 kV Ties as Required**

The normal criteria thermal transfer limits presented in Section 6 were determined for an all lines in-service condition. The 115 kV interconnections between First Energy East and New York (Warren - Falconer, North Waverly - East Sayre, and Laurel Lake - Westover) may be opened in accordance with NYISO and PJM Operating Procedures provided that this action does not cause unacceptable impact on local reliability in either system. Over-current protection is installed on the Warren - Falconer and the North Waverly - East Sayre 115 kV circuits; either of these circuits would trip by relay action for an actual overload condition. There is no overload protection on the Laurel Lake - Westover circuit, but it may be opened by operator action if there is an actual or post-contingency overload condition. However, opening the Laurel Lake – Westover tie could potentially cause local thermal and pre- and post-contingency voltage violations for the 34.5 kV distribution system within First Energy East (Penelec) transmission zone. Sensitivity analysis performed indicated that the thermal and voltage conditions were exacerbated for conditions that modeled high simultaneous interface flows from NY to PJM and NY to Ontario.

For the summer 2015 study the most limiting facility for the PJM to NYISO transfer was identified as an overload on the Everts Dive – South Troy 115 kV line (a segment on the Everts Drive – East Towanda 115 kV circuit) for a loss of Watercure – Mainesburg 345 kV line. This overload was observed due to a new 345/115 kV transformer being installed at the Mainesburg station. PJM has developed an Operating Procedure to manually open either the Mainesburg 345/115 kV transformer or the Mainesburg – Everts Drive 115 kV circuit pre-contingency, depending on the Armenia Mountain wind farm output and Seneca pump storage facility generation / pumping schedule.

Additionally, the Shawville plant deactivation is scheduled to occur in June 2015 and the plant is expected to return back in-service in spring of 2016 as a gas fired facility. Furthermore, Lackawanna – Hopatcong 500 kV line is expected to be in-service by June of 2015, this is the last portion of the Susquehanna-Roseland 500 kV project. Completion of the Susquehanna – Roseland project coupled with the generation deactivation at Shawville plant will impact flow on the PJM-NYSIO 115 kV tie-line facilities.

c. DC Ties

Neptune DC tie is expected to be available at full capability, 660 MW. Hudson Transmission Project (HTP) DC tie is expected to be to be available at full capability, 660 MW. For the summer 2015 HTP's firm withdrawals will be limited due to the Bergen – Athenia 230 kV project delay. HTP DC project was modeled as injecting 319 MW into NYSIO for the summer 2015 study.

d. Variable Frequency Transformer (VFT) Tie

The Variable Frequency Transformer Tie is a transmission facility connecting the Linden 230 kV (PSEG, PJM) to Linden 345 kV (ConEd, NYISO). For the summer 2015, Linden VFT will have 330 MW firm withdrawal right and 300 MW firm injection rights into PJM market. Linden VFT is modeled as injecting 315 MW into NYSIO for the summer 2015 study.

C. Ontario – New York Analysis

a. Thermal Transfer Limit Analysis

The thermal transfer limits between the NYISO and Ontario's Independent Electricity System Operator (IESO) Balancing Areas for normal and emergency transfer criteria are presented in Section 4, Table 4.3. The thermal transfer limits between NY and Ontario were determined for two scheduled transfers in either direction on the phase angle regulating (PAR) transformers controlling the L33P and L34P interconnections at St. Lawrence: One transfer at 0 MW and one at 300 MW.

The 300 MW transfer on L33P and L34P is the interconnection flow limit across these ties, as presented in Table 4.3 "Interconnection Total Transfer Capability (TTC) Limits" from the document "Ontario Transmission System" available at:

http://www.ieso.ca/Documents/marketReports/OntTxSystem_2014nov.pdf

b. Transient Stability Limitations

Transient stability limits for the NYISO - IESO interconnection are reported in "NYPP-OH TRANSIENT STABILITY TESTING REPORT on DIRECT TIE TRANSFER CAPABILITY - OCTOBER 1993" available at:

http://www.nyiso.com/public/webdocs/market_data/reports_info/operating_studies/NOH-1/NYPP-OH_1993.PDF

c. Ontario – Michigan PARs

All of the PARs on the four major transmission lines interconnecting Ontario and Michigan are in service and regulating. For this study, the PARs were scheduled to regulate at 0 MW.

d. Impact of the Queenston Flow West (QFW) Interface on the New York to Ontario Transfer Limit

The QFW interface is defined as the sum of the power flows into Ontario on the 230 kV circuits out of Beck. The QFW is primarily equal to the algebraic sum of the following:

- Total generation in the Niagara zone of Ontario including the units at the Beck #1, #2 & Pump Generating Stations, Thorold and Decew Falls GS
- The total load in the zone
- The import from New York

For a given limit for QFW, the import capability from New York will depend on the generation dispatch and the load in the Niagara zone. The import capability from New York can be increased by decreasing the generation in the Niagara zone. An increase in the load in this zone would also increase the import capability.

D. TransÉnergie–New York Interface

Thermal transfer limits between TransÉnergie (Hydro-Quebec) and New York are not analyzed as part of this study. Respecting the NYSRC and NYISO operating reserve requirements, the maximum allowable delivery into the NYCA from TransÉnergie on the Chateauguay – Massena (MSC-7040) 765 kV tie is limited to 1310 MW. However in real-time the total flow is limited to 1800 MW; the additional flow is a “wheel-through” transaction to another Balancing Authority Area. Maximum delivery from NYCA to Quebec on the 7040 line is 1000 MW.

The Dennison Scheduled Line represents a 115 kV dual-circuit transmission line that interconnects the New York Control Area to the Hydro-Quebec Control Area at the Dennison Substation, near Massena, NY. The Line has a nominal north to south capacity of 190 MW in summer, into New York, and a nominal south to north capacity of 100 MW into Quebec.

6. SUMMARY OF RESULTS – THERMAL TRANSFER LIMIT ANALYSIS

Table 1 – NYISO CROSS STATE INTERFACE THERMAL LIMITS

- Table 1.a
  - Dysinger East
  - UPNY – ConEd
  - Sprain Brook – Dunwoodie So.
  - ConEd – LIPA Transfer Capability
- Table 1.b – MSC-7040 Flow Sensitivity
  - Central East
  - Total East
  - Moses South

Table 2.a – NYISO to ISO-NE INTERFACE THERMAL TRANSFER LIMITS

- Northport-Norwalk Flow Sensitivity

Table 2.b – ISO-NE to NYISO INTERFACE THERMAL TRANSFER LIMITS

- Northport-Norwalk Flow Sensitivity

Table 3.a – NYISO to PJM INTERFACE THERMAL TRANSFER LIMITS

- 3-115 kV Ties I/S and O/S

Table 3.b – PJM to NYISO INTERFACE THERMAL TRANSFER LIMITS

- 3-115 kV Ties I/S and O/S

Table 4 – NYISO - IESO INTERFACE THERMAL TRANSFER LIMITS

- L33/34P Flow Sensitivity

TABLE 1.a

NYISO CROSS-STATE INTERFACE THERMAL TRANSFER LIMITS - SUMMER 2015
ALL LINES I/S

	Dysinger East	UPNY - ConEd$_1$	Sprain Brook Dunwoodie - So.	ConEd – LIPA Transfer Capability
NORMAL	1675 (1)	3600 (3)	4150 (5)	900 (7)
EMERGENCY	2350 (2)	4225 (4)	4150 (6)	1450 (8)

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	Huntley – Sawyer (80) 230 kV	@LTE	654 MW	L/O	Huntley – Sawyer (79) 230 kV
(2)	Huntley – Sawyer (80) 230 kV	@STE	755 MW	L/O	Huntley – Sawyer (79) 230 kV
(3)	Leeds – Pleasant Valley (92) 345 kV	@LTE	1538 MW	L/O	Athens – Pleasant Valley (91) 345 kV
(4)	Leeds – Pleasant Valley (92) 345 kV	@STE	1724 MW	L/O	Athens – Pleasant Valley (91) 345 kV
(5)	Dunwoodie – Mott Haven (71) 345 kV	@SCUC$_2$	1066 MW	L/O	(SB:RAIN345_7W) Mott Haven – Rainey (Q12) 345 kV Rainey 345/138 kV Transformer 7W Rainey – East 75 St. 138 kV East 75 St. – West 110 St. 138 kV
(6)	Dunwoodie – Mott Haven (71) 345 kV	@NORM	707 MW		Pre-Contingency Loading
(7)	Dunwoodie – Shore Rd. (Y50) 345 kV	@LTE	914 MW$_3$	L/O	(SB RNS2 @ Sprain Brook 345 kV) Sprain Brook – East Garden City (Y49) 345 kV Sprain Brook – Academy (M29) 345 kV
(8)	Dunwoodie – Shore Rd. (Y50) 345 kV	@NORM	653 MW$_3$		Pre-Contingency Loading

1: See Section 5.2.B for discussion on Athens SPS
2: The rating used for cable circuits during SCUC reliability analysis is the average of the LTE and STE rating (SCUC Rating).
3: LIPA rating for Y50 circuit is based on 70 % loss factor and rapid oil circulation.

TABLE 1.b

NYISO CROSS-STATE INTERFACE THERMAL TRANSFER LIMITS - SUMMER 2015
ALL LINES I/S

	MSC-7040 FLOW 800 MW	MSC-7040 FLOW 1310 MW	MSC-7040 FLOW 1600 MW
CENTRAL EAST			
NORMAL	2900 (1)	2900 (1)	2900 (1)
EMERGENCY	3200 (2)	3200 (2)	3200 (2)
TOTAL EAST			
NORMAL	4975 (1)	4975 (1)	4975 (1)
EMERGENCY	5625 (2)	5625 (2)	5625 (2)
MOSES SOUTH			
NORMAL	2050 (3)	2425 (3)	2650 (3)
EMERGENCY	2550 (4)	2675 (5)	2650 (5)

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	New Scotland – Leeds (94) 345 kV	@LTE	1538 MW	L/O	New Scotland – Leeds (93) 345 kV
(2)	New Scotland – Leeds (94) 345 kV	@STE	1724 MW	L/O	New Scotland – Leeds (93) 345 kV
(3)	Browns Falls – Taylorville (4) 115 kV	@LTE	114 MW	L/O	Chateauguay–Massena (MSC-7040) 765 kV Massena – Marcy (MSU1) 765 kV and TransÉnergie delivery
(4)	Browns Falls – Taylorville (4) 115 kV	@STE	126 MW	L/O	Browns Falls – Taylorville (3) 115 kV
(5)	Marcy 765/345 kV T2 Transformer	@STE	1971 MW	L/O	Marcy 765/345 kV T1 Transformer

TABLE 2.a

NYISO to ISO-NE INTERFACE THERMAL TRANSFER LIMITS - SUMMER 2015
ALL LINES I/S

New York to New England	DIRECT TIE	NYISO FACILITY	ISO-NE FACILITY
		Northport –Norwalk 100 MW	
NORMAL	1700 [1]	3000 [3]	
EMERGENCY	2325 [2]	3125 [4]	
		Northport –Norwalk 0 MW	
NORMAL	1650 [1]	3025 [3]	
EMERGENCY	2275 [2]	3150 [4]	

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	Pleasant Valley – Long Mountain (398) 345 kV	@LTE	1313 MW	L/O	SB:MILLST 3:14T Beseck – Millstone (348) 345 kV Millstone G3 24 kV
(2)	Pleasant Valley – Long Mountain (398) 345 kV	@STE	1596 MW	L/O	Millstone G3 24.0 kV
(3)	New Scotland – Alps (2) 345 kV	@LTE	1326 MW	L/O	Pleasant Valley – Long Mountain (398) 345 kV Smithfield – Salisbury (690) 69 kV
(4)	Reynolds Rd – Greenbush (9) 115 kV	@STE	398 MW	L/O	New Scotland – Alps (2) 345 kV

NOTE: The Northport – Norwalk Harbor (NNC) flow is positive in the direction of transfer
The Northport – Norwalk Harbor (NNC) line is no longer part of the New York – New England Interface Definition

TABLE 2.b

ISO-NE to NYISO INTERFACE THERMAL LIMITS - SUMMER 2015
ALL LINES I/S

New England to New York	DIRECT TIE	NYISO FACILITY	ISO-NE FACILITY
		Norwalk –Northport @ 0 MW	
NORMAL	1800 (1)		1350 (5)
EMERGENCY	2075 (2)		1400 (6)
		Norwalk –Northport @ 100 MW	
NORMAL	1825 (1)		1400 (5)
EMERGENCY	2100 (2)		1450 (6)
		Norwalk–Northport @ 200 MW	
NORMAL	1425 (3)		1450 (5)
EMERGENCY	2025 (4)		1500 (6)

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	Pleasant Valley – Long Mountain (398) 345 kV	@LTE	1313 MW	L/O	Alps – Berkshire (393) 345 kV Berkshire – Northfield Mount (312) 345 kV Berkshire 345/115 kV Transformer
(2)	Pleasant Valley – Long Mountain (398) 345 kV	@NORM	1135 MW		Pre-Contingency Loading
(3)	Northport – Norwalk Harbor (NNC) 138 kV	@LTE	513 MW	L/O	Pleasant Valley – Long Mountain (398) 345 kV Pleasant Valley – East Fishkill (F37) 345 kV
(4)	Northport – Norwalk Harbor (NNC) 138 kV	@STE	641 MW	L/O	Pleasant Valley – Long Mountain (398) 345 kV
(5)	Norwalk Junction – Archers Lane (3403D) 345 kV	@LTE	850 MW	L/O	Southington 5T Stuck Breaker
(6)	Norwalk Junction – Archers Lane (3403D) 345 kV	@LTE	850 MW	L/O	Long Mountain – Frost Bridge (352) 345 kV

NOTE: The Northport – Norwalk Harbor (NNC) flow is positive in the direction of transfer
The Northport – Norwalk Harbor (NNC) line is no longer part of the New England – New York Interface Definition

TABLE 3.a

NYISO to PJM INTERFACE THERMAL TRANSFER LIMITS - SUMMER 2015
ALL LINES I/S

NYISO to PJM	DIRECT TIE	NYISO FACILITY	PJM FACILITY
NORMAL	1775 (1)	1125 (3)	1625 (6)
3-115-O/S	1700 (2)	1300 (4)	1650 (7)
EMERGENCY	1925 (9)	1850 (5)	2350 (8)
3-115-O/S	1800 (10)	1500 (5)	1650 (7)

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	Goudey – Laurel Lake (952) 115 kV	@LTE	128 MW	L/O	East Towanda – Grover 230 kV Hillside – East Towanda (70) 230 kV East Towanda 230/115 kV Transformer North Waverly – East Sayre (956) 115 kV
(2)	Hillside – East Towanda (70) 230 kV	@LTE	531 MW	L/O	Marcy – Coopers Corners (UCC2-41) 345 kV Fraser – Coopers Corners (33) 345 kV
(3)	Gardenville – Long Road (180) 115 kV	@LTE	166 MW	L/O	(Tower 79 & 80) Huntley – Gardenville (79) 230 kV Huntley – Gardenville (80) 230 kV Suny (79) 230/34.5 kV Transformer Suny (80) 230/23.5 kV Transformer Sawyer 230/23.0 kV Transformer
(4)	Coddington Road – Etna (998) 115 kV	@LTE	101 MW	L/O	Watercure – Oakdale (31) 345 kV Oakdale – Clarks Corners (36) 345 kV
(5)	Border City – Guardian (969) 115 kV	@STE	179 MW	L/O	Lafayette – Clarks Corners (4-46) 345 kV
(6)	Evert Drive – South Troy 115 kV	@EMER	149 MW	L/O	East Towanda – Grover 230 kV Hillside – East Towanda (70) 230 kV East Towanda 230/115 kV Transformer North Waverly – East Sayre (956) 115 kV
(7)	Blairsville – Blairsville East 115 kV	@EMER	190 MW	L/O	Armstrong – Homer City 345 kV
(8)	East Sayre – Towanda 115 kV	@EMER	131 MW	L/O	Hillside – East Towanda (70) 230 kV
(9)	Falconer – Warren (171) 115 kV	@STE	119 MW	L/O	South Ripley – Dunkirk (68) 230 kV
(10)	Hillside – East Towanda (70) 230 kV	@NORM	483 MW		Pre-Contingency Loading

NOTE: Emergency Transfer Capability Limits may have required line outages as described in Section 5.3.B. PAR schedules have been adjusted in the direction of transfer.

TABLE 3.b

PJM to NYISO INTERFACE THERMAL TRANSFER LIMITS - SUMMER 2015
ALL LINES I/S

PJM to NYISO	DIRECT TIE	NYISO FACILITY	PJM FACILITY
NORMAL	1450 (1)	2200 (3)	725 (4)
3-115-O/S	2550 (2)	2300 (3)	2450 (9)
EMERGENCY	1550 (5)	2800 (8)	850 (7)
3-115-O/S	2550 (6)	2875 (10)	2450 (9)

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	Falconer – Warren (171) 115 kV	@LTE	116 MW	L/O	South Ripley – Dunkirk (68) 230 kV Gardenville – Dunkirk (73) 230 kV Gardenville – Dunkirk (74) 230 kV Dunkirk 230/115 kV Transformer Bank 31 Dunkirk 230/115 kV Transformer Bank 41
(2)	South Ripley – Dunkirk (68) 230 kV	@LTE	475 MW	L/O	Stolle Rd. – Homer City (37) 345 kV
(3)	North Waverly – Lounsberry 115 kV	@LTE	131 MW	L/O	Watercure – Oakdale (31) 345 kV Oakdale – Clarks Corners (36) 345 kV
(4)	Evert Drive – South Troy 115 kV	@EMER	149 MW	L/O	Watercure – Mainesburg (30) 345 kV Watercure – Oakdale (31) 345 kV
(5)	Falconer – Warren (171) 115 kV	@STE	119 MW	L/O	Glade – Forest 230 kV
(6)	South Ripley – Dunkirk (68) 230 kV	@STE	475 MW	L/O	Stolle Rd. – Homer City (37) 345 kV
(7)	Evert Drive – South Troy 115 kV	@EMER	149 MW	L/O	Watercure – Mainesburg (30) 345 kV
(8)	North Waverly – Lounsberry 115 kV	@STE	143 MW	L/O	Watercure – Oakdale (31) 345 kV
(9)	Four Mile – Erie Southeast 115 kV	@EMER	228 MW	L/O	Four Mile – Erie Southeast 230 kV
(10)	Watercure 345/230 kV Transformer	@STE	600 MW	L/O	Watercure – Oakdale (31) 345 kV

NOTE: Emergency Transfer Capability Limits may have required line outages as described in Section 5.3.B.
PAR schedules have been adjusted in the direction of transfer.

TABLE 4

NYISO - IESO INTERFACE THERMAL TRANSFER LIMITS - SUMMER 2015
ALL LINES I/S

	DIRECT TIE	NYISO FACILITY	IESO FACILITY	DIRECT TIE	NYISO FACILITY	IESO FACILITY
Ontario to New York		**L33/34P 0 MW**			**L33/34P 300 MW**	
NORMAL	1925 (1)	150 (2)	1725 (3)	2225 (1)	450 (2)	2025 (3)
EMERGENCY	2300 (4)	1050 (5)	2250 (6)	2600 (4)	1350 (5)	2550 (6)
New York to Ontario		**L33/34P 0 MW**			**L33/34P 300 MW**	
NORMAL	1275 (7)		1000 (3,10)	1575 (7)		1275 (3,10)
EMERGENCY	1750 (8)		1325 (9,10)	2050 (8)		1625 (9,10)

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	Beck – Niagara (PA27) 230 kV	@LTE	460 MW	L/O	Beck – Niagara (PA 301) 345 kV
(2)	Huntley – Sawyer (80) 230 kV	@LTE	654 MW	L/O	Huntley – Sawyer (79) 230 kV
(3)	Q30M 220 kV	@LTE	393 MW	L/O	Q24HM + Q29HM 220 kV
(4)	Beck – Niagara (PA27) 230 kV	@STE	558 MW	L/O	Beck – Niagara (PA 301) 345 kV
(5)	Packard – Sawyer (77) 230 kV	@STE	704 MW	L/O	Packard – Sawyer (78) 230 kV
(6)	Q30M 220 kV	@NORM	370 MW		Pre-Contingency Loading
(7)	Beck – Niagara (PA27) 230 kV	@LTE	460 MW	L/O	Beck – Niagara (PA 301) 345 kV Q28A 220 kV Beck #2 units 19 & 20 + Thorld GS
(8)	Beck – Niagara (PA27) 230 kV	@NORM	400 MW		Pre-Contingency Loading
(9)	Q29HM 220 kV	@NORM	415 MW		Pre-Contingency Loading

(10) This limit can be increased by reducing generation in the Niagara zone of Ontario. See Section 5.3.C.d. for discussion.