NYISO Operating Study
Winter 2015-16

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New York Independent System Operator, Inc

Approved by the NYISO Operating Committee (OC)
December 10th, 2015

Executive Summary

This study is conducted as a seasonal review of the projected thermal transfer capability for the winter 2015-16 operating 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 winter 2014-2015 to winter 2015-2016 are shown on page 7. Internal interface limits are essentially unchanged from the winter 2014-2105. Differences in the evaluated external interface limits from winter 2014-2015 to winter 2015-2016 are shown on page 10. External interface limits are essentially unchanged from the winter of 2014-2015.

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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 winter 2015-16 capability period. This analysis indicates that, for the winter 2015-16 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

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4. SYSTEM REPRESENTATION AND BASE STUDY ASSUMPTIONS

4.1 System Representation

The representation was developed from the NYISO Data Bank and assumes the forecast winter coincident peak load of 24,515 MW. The other NPCC Balancing Areas and adjacent Regional representations were obtained from the RFC-NPCC winter 2015-16 Reliability Assessment power flow base case and has been updated to reflect the winter 2015-16 operating 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 winter 2014-15 capability period:

Retirements	
Dunkirk 2 (Mothballed)	-75 MW
Total Retirements	**-75 MW**
Additions	
Marsh Hill Wind (Nameplate)	16 MW
Astoria 20	167 MW
Total Additions	**183 MW**

B. Transmission Facilities Changes

Significant facility changes since the winter 2014-15 capability period include the following:

- Moses to Massena (MMS2) 230 kV line remains out-of-service
- Addition of the Mainesburg 345 kV substation
- Addition of the Eastover Road 230 kV substation
- Addition of the Five Mile Road 345 kV Substation

Moses to Massena (MMS2) 230 kV line will remain out-of-service for the winter 2015-16 operating period.

Mainesburg is a new 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 new 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.

Five Mile Road is a new 345 kV substation on the NYSEG 345 kV system between Stolle Road in western New York and Homer City in northern PJM. This substation modifies the existing NYISO to PJM tie line from Stolle Road to Homer City 345 kV to Homer City to Five Mile Road 345 kV. This station is expected to be in-service for the winter 2015-16 period.

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 winter 2015-16 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 winter 2015-16 base case, the schedule for the tie is 188 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 winter 2015-16, and the MMWG winter 2015-16 power flow base cases. The series reactors on the Dunwoodie – Mott Haven (71 and 72) and the Sprain Brook – W. 49th St. 345 kV cables (M51 and M52) are out of service in the base case. The series reactors on the Sprain Brook – East Garden City 345 kV (Y49), E. 179th St. – Hell Gate (15055) 138 kV feeder and Gowanus to Farragut (41 and 42) cables are in-service.

5. DISCUSSION

5.1 Resource Assessment

A. Load and Capacity Assessment

The forecast peak demand for the winter 2015-16 capability period is 24,515 MW. This forecast is approximately 222 MW (0.90%) lower than the forecast of 24,737 MW for the winter 2014-15 capability period, and 1,223 MW (4.75%) lower than the all-time New York Control Area (NYCA) seasonal peak of 25,738 MW, which occurred on January 7, 2014.

The Installed Capacity (ICAP) requirement for the winter period is 28,683 MW based on the NYSRC 17.0% Installed Reserve Margin (IRM) requirement for the 2015-2016 Capability Year. NYCA generation capacity for winter 2015-16 is 41,312 MW, and net external capacity purchases of 338 MW have been secured for the winter period. The combined capacity resources represent a 69.9% margin above the forecast peak demand of 24,515 MW. These values were taken from the 2015 Load & Capacity Data report produced by the NYISO, located at:

http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2015%20Load%20and%20Capacity%20Data%20Report.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 winter 2014-15, 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 winter 2015-16. 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". NYISO contingencies include stuck breakers, double tower contingencies, single element contingencies and loss of generation facilities. For this assessment period the most severe single generation contingency is Nine Mile Point 2 at 1,297 MW. 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 winter 2015-16 thermal transfer limits to winter 2014-15 transfer limits. Changes in these limits from the 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 winter 2015-16 and 2014-15, with limiting element/contingency descriptions. Significant differences in these thermal transfer limits are discussed below.

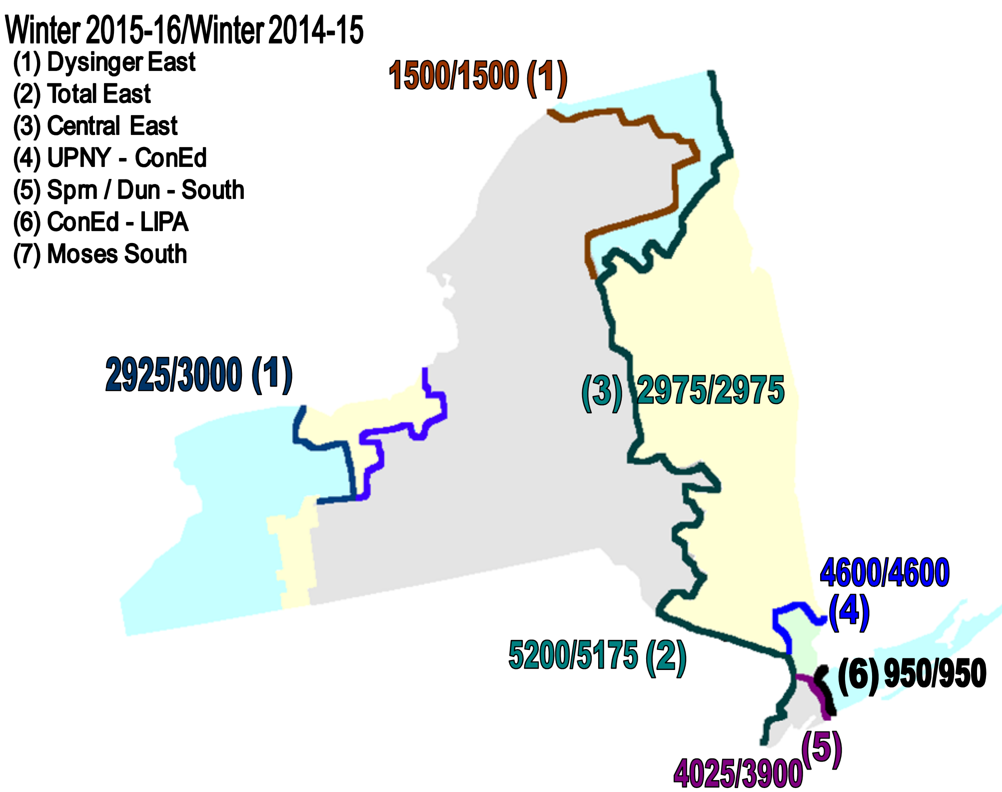

Figure 1 – Cross-State Thermal Transfer Limits

Dysinger East interface thermal transfer limit decreased 75 MW. This peak load limitation is due to higher 230 kV transmission power flows between Niagara and the Dunkirk stations, for the conditions studied. These limits are sensitive to load in Zone A and flow toward PJM on the Dunkirk-Erie 230 kV tie. Generation dispatch also affects the system constraints as it affects the flows on the 230 kV system.

Sprain Brook/Dunwoodie South interface thermal transfer limit increased 125 MW. This is due to the redistribution of New York City generation.

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. An over-current relay is installed at West Woodbourne 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:

ConEd – LIPA PAR Settings	Normal	Emergency
Jamaica – Lake Success 138 kV	-210 MW	105 MW
Jamaica – Valley Stream 138 kV	-108 MW	70 MW
Sprain Brook – E. Garden City 345 kV	635 MW	635 MW

ISO-NE – LIPA PAR Settings		
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 approximately 175 MW of emergency transfer from Con Edison to Long Island, if requested, via the ties.

LIPA to ConEd emergency assistance

LIPA anticipates being able to supply approximately 459 MW of emergency transfer from Long Island to Con Edison, if requested, via the ties.

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 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

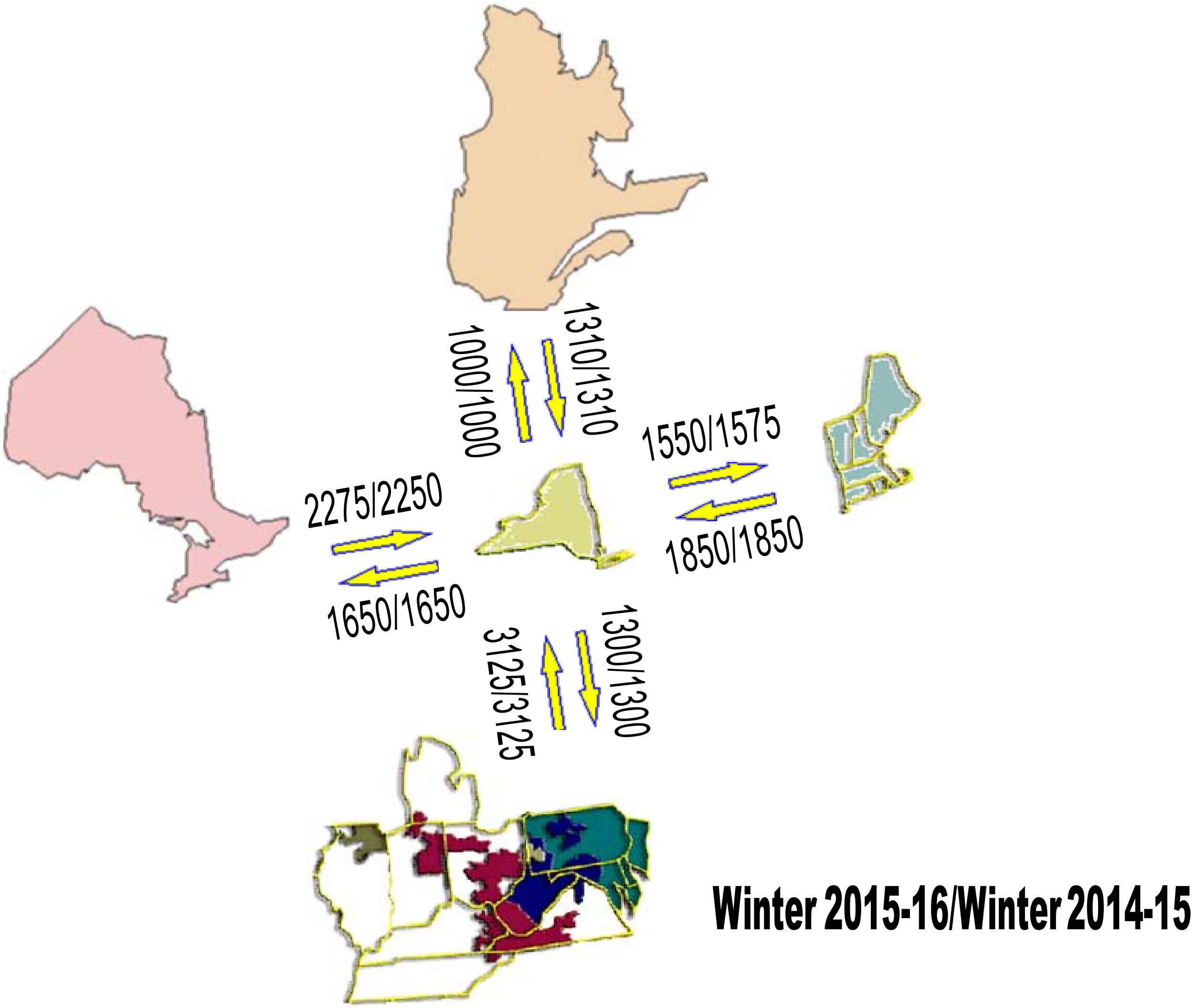

Figure 2 – Inter-Area Thermal Transfer Capabilities (1)

Thermal transfer limits between New York and adjacent Balancing Areas are also 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.

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

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). Two new 345 kV lines from Lake Road to West Farnum (341 line) and West Farnum to Millbury (366 line) are expected to be in-service by the end of December 2015. The Sherman Road 345 kV substation is also being rebuilt as a new breaker-and-a-half substation.

In addition to the IRP work, as of October 2015, the A127 and B128 lines are closed through all the way from Harriman to Millbury providing two new east-west through paths. Another new 115 kV line in western Massachusetts, the R170 line from West Hampden to Palmer, is expected to be in-service in November 2015.

Capacity

In the New England Control Area, from October 2015 through March 2016, a total of 190 MW of new wind generation is expected with the largest one being Oakfield Wind (135 MW). In addition, a new 10 MW PV generation (Harrington Street) is expected to be in-service by December 2015.

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

e. Northport – Norwalk Harbor Cable Flow

The Northport – Norwalk Harbor cable (1385 NNC 601, 602, and 603) are all in-service and the TTC (Total Transfer Capability) is unchanged from previously accepted values. This facility is not metered as part of NY-NE interface.

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 winter 2015-16 analyses, the pre□contingency schedule is 0 MW from Blissville (ISO-NE) to Whitehall (NYISO). The scheduled flow on the PAR may be adjusted to protect internal Vermont and New York 115 kV transmission for certain 345 kV contingency events in southern Vermont.

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

The phase shifting transformer (PST) on this circuit will control pre-contingency flow between the respective stations. VELCO, NYPA, ISO-NE and NYISO developed a joint operating procedure. For the winter 2014-15 analyses, the pre-contingency schedule is 100 MW from Plattsburgh (NYISO) to Sandbar (ISO-NE). The scheduled flow on the PST may be adjusted to protect internal Vermont and New York 115 kV transmission for certain transmission contingency events in northern New York, Vermont and New England.

h. Transient Stability Limitations

For certain system configurations, stability performance determines the transfer capability between the Areas. For those instances, the limits have been obtained from the report "1992-1996 NYPP-NEPOOL TRANSFER LIMIT STUDY - OCTOBER 1992." A new study of NYISO-ISO-NE transfer capability through 2009, including transient stability assessment, has been completed since the spring of 2007. The stability limits are expressed in terms of the transfer on the "Northern Ties", i.e., excluding flow on the Norwalk Harbor – Northport circuit. Stability limits for transfers from New England to New York are a function of the New England MW load level, and include the effect of Northfield and Bear Swamp in the generating and pumping mode.

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 New York. 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 winter 2015-16 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.

c. DC Ties

Neptune DC tie is expected to be available at full capability, 660 MW, for winter 2015-16. Neptune DC tie is a transmission facility connecting Raritan River 230 kV (First Energy East, PJM) to Duffy Avenue 345 kV (LIPA, NYISO). Back to Back AC-DC-AC Hudson Transmission Project (HTP) tie is expected to be available at full capability, 660 MW, for winter 2015-16. HTP is a transmission tie connecting Bergen 230 kV (PSEG, PJM) to the West 49th street station at (ConEd, NYISO). Transfer across HTP might be limited, based on the real-time system conditions, down to the Firm Transmission Withdrawal Rights of 320 MW, as specified in the Interconnection Service Agreement O66. Both DC links have only withdrawal rights from PJM region.

d. Variable Frequency Transformer (VFT) Tie

The Linden VFT tie is a transmission facility connecting the Linden 230 kV (PSEG, PJM) to Linden 345 kV (ConEd, NYISO). For the winter 2015-16 analysis, the pre-contingency schedule is 300 MW from PSEG to ConEd. Linden VFT has a bi-directional transfer capability / right of 330 MW.

e. New Coordinated Transaction Scheduling system (CTS)

On November 4th 2014 PJM Interconnection and the New York Independent System Operator launched a coordinated transaction scheduling system to streamline the flow of electricity across the two systems, cutting energy production costs.

The system incorporates projected price differences between the two markets into interregional scheduling decisions and is expected to reduce LMP price differential between two markets.

f. Opening of western PJM - New York 230/115 kV Ties as Required

In recognition of recent field experience that simultaneous high transfers in western New York with high transfers to PJM can result in potential cascade contingencies on NYISO 115 kV circuits a NYISO/PJM operating protocol was introduced in the summer of 2014. The Warren – Falconer 115 KV and the Erie – South Ripley 230 kV interconnections, between First Energy East and New York may be opened in accordance with NYISO and PJM operating protocol provided that this action does not cause unacceptable impact on local reliability in either system.

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 VI, Table 4. The thermal transfer limits between NY and Ontario were determined for two scheduled transfers in either direction on the phase angle regulating 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_2014jun.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 four of the PARs on the four major transmission lines interconnecting Ontario and Michigan are in service. 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 199 MW in winter, 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 - WINTER 2015-16
ALL LINES I/S

	Dysinger East	UPNY - ConEd$_1$	Sprain Brook Dunwoodie - So.	ConEd – LIPA Transfer Capability
NORMAL	2925 (1)	4600 (3)	4025 (5)	950 (7)
EMERGENCY	3250 (2)	5050 (4)	4125 (6)	1550 (8)

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	Huntley – Sawyer (80) 230 kV	@LTE	760 MW	L/O	Huntley – Sawyer (79) 230 kV
(2)	Packard – Sawyer (77) 230 kV	@STE	795 MW	L/O	Packard – Sawyer (78) 230 kV
(3)	Leeds – Pleasant Valley (92) 345 kV	@LTE	1783 MW	L/O	Athens – Pleasant Valley (91) 345 kV
(4)	Leeds – Pleasant Valley (92) 345 kV	@STE	1912 MW	L/O	Athens – Pleasant Valley (91) 345 kV
(5)	Dunwoodie – Mott Haven (71) 345 kV	@SCUC$_2$	1084 MW	L/O	Dunwoodie – Mott Haven (72) 345 kV
(6)	Dunwoodie – Mott Haven (71) 345 kV	@NORM	741 MW		Pre-Contingency Loading
(7)	Dunwoodie – Shore Rd. (Y50) 345 kV	@LTE	977 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	741 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 - WINTER 2015-16
ALL LINES I/S

	MSC-7040 FLOW HQ->NY 600 MW	MSC-7040 FLOW 0 MW	MSC-7040 FLOW NY->HQ 600 MW
CENTRAL EAST			
NORMAL	2975 (1)	2975 (1)	2975 (1)
EMERGENCY	3350 (2)	3350 (2)	3350 (2)
TOTAL EAST			
NORMAL	5200 (3)	5200 (3)	5200 (3)
EMERGENCY	6100 (2)	6100 (2)	6100 (2)
MOSES SOUTH			
NORMAL	2150 (4)	1500 (4)	775 (6)
EMERGENCY	2325 (5)	1600 (5)	875 (5)

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	New Scotland – Leeds (93) 345 kV	@LTE	1692 MW	L/O	New Scotland – Leeds (94) 345 kV
(2)	New Scotland – Leeds (93) 345 kV	@STE	1912 MW	L/O	New Scotland – Leeds (94) 345 kV
(3)	Rock Tavern – Ramapo (77) 345 kV	@LTE	2010 MW	L/O	Roseton – East Fishkill (RFK305) 345 kV East Fishkill 345/115 kV Transformer
(4)	Moses – Massena (MMS1) 230 kV	@LTE	1254 MW	L/O	Moses – Adirondack (MA1) 230 kV Moses – Adirondack (MA2) 230 kV Adirondack – Porter (12) 230 kV
(5)	Moses – Massena (MMS1) 230 kV	@NORM	1076 MW		Pre-Contingency Loading
(6)	Moses – Massena (MMS1) 230 kV	@LTE	1254 MW	L/O	Volney – Marcy (19) 345 kV Marcy – Edic (UE1-7) 345 kV

TABLE 2.a

NYISO to ISO-NE INTERFACE THERMAL TRANSFER LIMITS - WINTER 2015-16
ALL LINES I/S

New York to New England	DIRECT TIE	NYISO FACILITY	ISO-NE FACILITY
		Northport –Norwalk 100 MW	
NORMAL	1600 (1)	3375 (3)	2225 (5)
EMERGENCY	2650 (2)	3425 (4)	2225 (6)
		Northport –Norwalk 0 MW	
NORMAL	1550 (1)	3400 (3)	2200 (5)
EMERGENCY	2600 (2)	3500 (4)	2200 (6)

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	Long Mountain – Pleasant Valley (398) 345 kV	@LTE	1476 MW	L/O	SS:MILLST 345 Manchester – Millstone (310) 345 kV Beseck – Millstone (348) 345 kV Montville – Millstone (371) 345 kV Card Street – Millstone (383) 345 kV Montville 345/115 kV Transformer Millstone G2 24 kV Millstone G3 24 kV
(2)	Long Mountain – Pleasant Valley (398) 345 kV	@STE	1590 MW	L/O	Millstone G3 24.0 kV
(3)	New Scotland – Alps (2) 345 kV	@LTE	1410 MW	L/O	Long Mountain – Pleasant Valley (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
(5)	Berkshire – Northfield (312) 345 kV	@LTE	1793 MW	L/O	Long Mountain – Pleasant Valley (398) 345 kV
(6)	Berkshire – Northfield (312) 345 kV	@STE	1793 MW	L/O	Long Mountain – Pleasant Valley (398) 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 - WINTER 2015-16
ALL LINES I/S

New England to New York	DIRECT TIE	NYISO FACILITY	ISO-NE FACILITY
		Norwalk –Northport @ 0 MW	
NORMAL	1850 (1)		1475 (5)
EMERGENCY	2000 (2)		1475 (5)
		Norwalk –Northport @ 100 MW	
NORMAL	1900 (1)		1525 (5)
EMERGENCY	2100 (2)		1525 (5)
		Norwalk–Northport @ 200 MW	
NORMAL	1500 (3)		1600 (5)
EMERGENCY	1825 (4)		1600 (5)

	LIMITING ELEMENT	**RATING**			**LIMITING CONTINGENCY**
(1)	Long Mountain – Pleasant Valley (398) 345 kV	@LTE	1476 MW	L/O	Berkshire – Alps (393) 345 kV Berkshire – Northfield Mountain (312) 345 kV Smithfield – Salisbury (690) 69 kV Berkshire 345/115 kV Transformer
(2)	Long Mountain – Pleasant Valley (398) 345 kV	@NORM	1283 MW		Pre-Contingency Loading
(3)	Northport – Norwalk Harbor (NNC) 138 kV	@LTE	597 MW	L/O	Long Mountain – Pleasant Valley (398) 345 kV Smithfield – Salisbury (690) 69 kV
(4)	Northport – Norwalk Harbor (NNC) 138 kV	@STE	641 MW	L/O	Long Mountain – Pleasant Valley (398) 345 kV
(5)	Norwalk Junction – Archers Lane (3403D) 345 kV	@LTE	922 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 - WINTER 2015-16
ALL LINES I/S

NYISO to PJM	DIRECT TIE	NYISO FACILITY	PJM FACILITY
NORMAL	1175 (1)	1175 (3)	1575 (6)
3-115-O/S	1425 (2)	1300 (4)	1625 (7)
EMERGENCY	1175 (8)	1700 (5)	1575 (6)
3-115-O/S	1500 (9)	1350 (10)	1625 (7)

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	East Sayre – North Waverly (956) 115 kV	@LTE	139 MW	L/O	East Towanda – Hillside (70) 230 kV
(2)	East Towanda – Hillside (70) 230 kV	@LTE	564 MW	L/O	Fraser – Coopers Corners (33) 345 kV Marcy – Coopers Corners (UCC2-41) 345 kV
(3)	Gardenville – Cloverbank (142) 115 kV	@LTE	117 MW	L/O	Gardenville – Dunkirk (73) 230 kV Gardenville – Dunkirk (74) 230 kV
(4)	South Perry – Meyer (934) 115 kV	@LTE	116 MW	L/O	Stolle Rd. – High Sheldon (67) 230 kV Stolle Rd. – Five Mile Road (29) 345 kV
(5)	Border City – Guardian (969) 115 kV	@STE	179 MW	L/O	Lafayette – Clarks Corners (4-46) 345 kV
(6)	Towanda – East Sayre 115 kV	@EMER	131 MW	L/O	East Towanda – Hillside (70) 230 kV
(7)	Mainesburg – Mansfield 115 kV	@EMER	140 MW		Pre-Contingency Loading
(8)	East Sayre – North Waverly (956) 115 kV	@STE	139 MW	L/O	East Towanda – Hillside (70) 230 kV
(9)	East Towanda – Hillside (70) 230 kV	@NORM	512 MW		Pre-Contingency Loading
(10)	Border City – Guardian (969) 115 kV	@STE	179 MW	L/O	Wethersfield – Meyer (85/87) 230 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 3.b

PJM to NYISO INTERFACE THERMAL TRANSFER LIMITS - WINTER 2015-16
ALL LINES I/S

PJM to NYISO	DIRECT TIE	NYISO FACILITY	PJM FACILITY
NORMAL	2600 (1)	2750 (6)	2325 (3)
3-115-O/S	3125 (2)	3300 (7)	3200 (11)
EMERGENCY	2650 (4)	3250 (9)	2425 (8)
3-115-O/S	3200 (5)	3450 (10)	3200 (11)

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	Warren – Falconer (171) 115 kV	@LTE	136 MW	L/O	Five Mile Road – Homer City (37) 345 kV
(2)	East Towanda – Hillside (70) 230 kV	@LTE	564 MW	L/O	Mainesburg – Watercure (30) 345 kV
(3)	Towanda – East Sayre 115 kV	@EMER	131 MW	L/O	(Stuck Breaker Hillside 230 kV) Hillside – Watercure (69) 230 kV East Towanda – Hillside (70) 230 kV Hillside 230/34.5 kV Transformer Hillside 115/34.5 kV Transformer
(4)	Warren – Falconer (171) 115 kV	@STE	140 MW	L/O	Five Mile Road – Homer City (37) 345 kV
(5)	East Towanda – Hillside (70) 230 kV	@STE	598 MW	L/O	Mainesburg – Watercure (30) 345 kV
(6)	North Waverly – Lounsberry 115 kV	@LTE	157 MW	L/O	Watercure – Oakdale (31) 345 kV Clarks Corners – Oakdale (36) 345 kV
(7)	South Ripley – Dunkirk (68) 230 kV	@LTE	564 MW	L/O	Stolle Rd. – Five Mile Road (29) 345 kV Five Mile Road – Homer City (37) 345 kV Five mile Road 345/115 kV Transformer
(8)	Towanda – East Sayre 115 kV	@EMER	131 MW	L/O	East Towanda – Hillside (70) 230 kV
(9)	North Waverly – Lounsberry 115 kV	@STE	167 MW	L/O	Watercure – Oakdale (31) 345 kV
(10)	South Ripley – Dunkirk (68) 230 kV	@STE	607 MW	L/O	Five Mile Road – Homer City (37) 345 kV
(11)	Erie East – Four Mile 115 kV	@EMER	257 MW	L/O	Erie East – Four Mile 230 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 - WINTER 2015-16
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	2275 (1)	1700 (3)	3175 (5)	2575 (1)	2000 (3)	3475 (7)
EMERGENCY	2825 (2)	2050 (4)	3825 (6)	3125 (2)	2375 (4)	4150 (6)
New York to Ontario		**L33/34P 0 MW**			**L33/34P 300 MW**	
NORMAL	1650 (8)		950 (7,11)	1975 (8)		1250 (7,11)
EMERGENCY	2075 (9)		1350 (10,11)	2375 (9)		1650 (10,11)

	LIMITING ELEMENT	RATING			LIMITING CONTINGENCY
(1)	Beck – Niagara (PA27) 230 kV	@LTE	540 MW	L/O	Beck – Niagara (PA 301) 345 kV
(2)	Beck – Niagara (PA27) 230 kV	@STE	685 MW	L/O	Beck – Niagara (PA 301) 345 kV
(3)	Packard – Sawyer (77) 230 kV	@LTE	747 MW	L/O	Niagara – Packard (61) 230 kV Packard – Sawyer (78) 230 kV Sawyer – Huntley (78) 230 kV Packard 230/115 kV Transformer
(4)	Packard – Sawyer (77) 230 kV	@STE	795 MW	L/O	Packard – Sawyer (78) 230 kV
(5)	Q30M 220 kV	@LTE	450 MW	L/O	Q23BM + Q25BM 220 kV
(6)	Q30M 220 kV	@NORM	427 MW		Pre-Contingency Loading
(7)	Q30M 220 kV	@LTE	450 MW	L/O	Q24HM + Q29HM 220 kV
(8)	Beck – Niagara (PA27) 230 kV	@LTE	540 MW	L/O	Beck – Niagara (PA 302) 345 kV Q22P 220 kV Beck #2 unit 15
(9)	Beck – Niagara (PA27) 230 kV	@NORM	480 MW		Pre-Contingency Loading
(10)	Q30M 220 kV	@LTE	450 MW	L/O	Q29H 220 kV

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