Central-East Voltage Limit Study (CEVC-24)

A Report by Operations Engineering Staff
New York Independent System Operator

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Executive Summary

With the pending completion of the Segment A and Segment B transmission projects, the NYISO deemed it appropriate to conduct a study of area voltage performance, including the investigation of voltage collapse transfer limits, for the Central-East operating interface. This report presents the methodology, analysis and results of this study.

The voltage collapse limits currently in use for the Central-East interface were developed in spring of 2023 as part of on-going studies related to transmission network upgrades. This study re-evaluates these limits to maintain reliable operation of the bulk power system. New derates were developed to account for the two new Edic-Princetown, 351 and 352, 345 kV lines coming into service.

This study shows overall increases in voltage collapse limits as a result of new transmission strengthening the existing network. The study also shows that no adjustments to pre-contingency low voltage limits are necessary.

It is recommended that the Central East voltage collapse limits be updated as reported in this study.

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Introduction

The purpose of this study is to evaluate the Central-East Voltage Collapse Transfer Limits for all-lines-in-service and significant equipment outage conditions expected for the system configuration for the Winter 2023-24 season going forward. This analysis was conducted on the NYISO Summer 2022 Operating Study base case with all system changes resulting from the Segment A and Segment B projects included. Details of base case development are included in this report.

This report documents the results of the analysis and provides recommendations based on the simulation results for operating criteria contingencies. Tables of the recommended derates, the contingencies evaluated, examples of power-voltage (PV) plots and summaries of the transfer base case conditions are included.

The New York State Reliability Council (NYSRC) Reliability Rules for Planning and Operating the New York State Power System provide the documented methodology employed to develop System Operating Limits (SOLs) within the NYISO Reliability Coordinator Area. NYSRC Reliability Rules require compliance with all North American Electric Reliability Corporation (NERC) Standards and Northeast Power Coordinating Council (NPCC) Standards and Criteria. NYSRC Rule C.1, Establishing Operating Transfer Capabilities, addresses the contingencies to be evaluated and the performance requirements to be applied. Rule C.1 also references NYISO Bus Voltage Limits as found in Tables A.2 and A.3 of the "NYISO Emergency Operations Manual". The applicable process for establishing voltage collapse limits is established by the "Guideline for Voltage Analysis and Determination of Voltage-Based Transfer Limits" found in the NYISO "Transmission Expansion and Interconnection Manual" Attachment G.

Recommendations

It is recommended that the limits presented in this report be employed to secure the bulk power system for the applicable system conditions identified in this study. Figures 1 through 7 show the breakdown of the Central-East Voltage Collapse Transfer Limit components. Tables showing the changes in limits can be found in the Discussion section.

The results of the study also showed that no changes are needed for pre-contingency low voltage limits, given the recommended establishment of the Central-East interface voltage collapse limits.

Figure 1 – Oswego Generating Complex Limits

Oswego Generating Complex Limits						
	0 Oswego Cmplx I/S	1 Oswego Cmplx I/S	2 Oswego Cmplx I/S	3 Oswego Cmplx I/S	4 Oswego Cmplx I/S	5 Oswego Cmplx I/S
Base Limit	3460	3540	3640	3725	3805	3885

Figure 2 - Limit Derates for Independence Generating Station

Limit Derates for Independence Generating Station						
Independence Units I/S	0 Oswego Cmplx I/S	1 Oswego Cmplx I/S	2 Oswego Cmplx I/S	3 Oswego Cmplx I/S	4 Oswego Cmplx I/S	5 Oswego Cmplx I/S
0	645	485	335	240	150	95
1	515	395	265	195	115	75
2	380	300	195	145	80	55
3	245	205	125	95	45	35
4	165	140	85	65	30	25
5	85	70	45	35	15	15
6	0	0	0	0	0	0

Figure 3 - Limit Derates for Athens Generating Station

Limit Derates for Athens Generating Station						
Athens Units I/S	0 Oswego Cmplx I/S	1 Oswego Cmplx I/S	2 Oswego Cmplx I/S	3 Oswego Cmplx I/S	4 Oswego Cmplx I/S	5 Oswego Cmplx I/S
0	120	120	120	120	120	120
1	80	80	80	80	80	80
2	40	40	40	40	40	40

Figure 4 - Limit Derates for Transmission Facility Outages

Limit Derates for Transmission Facility Outages							
Transmission Facility Name	PTID	0 Oswego Cmplx I/S	1 Oswego Cmplx I/S	2 Oswego Cmplx I/S	3 Oswego Cmplx I/S	4 Oswego Cmplx I/S	5 Oswego Cmplx I/S
FITZPTRK-EDIC_____345_FE-1	25077	205	205	205	205	205	205
EDIC____-GORDONRD_345_14	327482	380	380	380	380	380	380
GORDONRD-ROTTRDAM_230_30	327485	35	35	35	35	35	35
GORDONRD-ROTTRDAM_230_31	327486	35	35	35	35	35	35
MASSENA_-MARCY____765_MSU1	25224	840	825	685	555	525	475
MARCY___-N.SCTLND_345_18	25276	485	485	485	485	485	485
VOLNEY__-MARCY____345_19	25345	200	200	200	200	200	200
INGHAM_C_115_115_PAR_2	25242	120	120	120	120	120	120
S HERO__-PLATSBRG_115_PV20	25027	100	100	100	100	100	100
PRINCTWN-N.SCTLND_345_55	327492	80	80	80	80	80	80
PRINCTWN-N.SCTLND_345_361	625031	85	85	85	85	85	85
PRINCTWN-N.SCTLND_345_362	625032	85	85	85	85	85	85
GORDONRD-PRINCTWN_345_371	625030	320	320	320	320	320	320
EDIC____-PRINCTWN_345_351		390	390	390	390	390	390
EDIC____-PRINCTWN_345_352		390	390	390	390	390	390

Figure 5 – Additional Limit Derate Adders for N-2 and N-3 Conditions

Additional Limit Derate Adders for N-2 and N-3 Transmission Facility Outages							
Transmission Facility Name	PTID	0 Oswego Cmplx I/S	1 Oswego Cmplx I/S	2 Oswego Cmplx I/S	3 Oswego Cmplx I/S	4 Oswego Cmplx I/S	5 Oswego Cmplx I/S
351 & 352		305	305	305	305	305	305
351 & 352 & 14		570	570	570	570	570	570
351 & 352 & 18		580	580	580	580	580	580
351 & 352 & 371		290	290	290	290	290	290
361 & 362		100	100	100	100	100	100
361 & 362 & 55		825	825	825	825	825	825

Figure 6 - Limit Derates for Capacitors, SVCs, STATCOM (out-of-service)

Limit Derates for Capacitors, SVCs, STATCOM (out-of-service)		
Reactive Device Name	PTID	Derate MWs
EDIC_PTR_345KV_CAP_CAP _1	31400	80
FRASER___345KV_CAP_CAP _1	31336	25
FRASER ___345KV_CAP_CAP _2	31345	25
GILBOA____345KV_CAP_CAP _1	31337	30
LEEDS ____345KV_CAP_CAP _1	31338	40
LEEDS____345KV_CAP_CAP _2	31346	40
MARCY____345KV_CAP_CAP _1	31339	75
MARCY____345KV_CAP_CAP _2	31353	75
N.SCTLND_345KV_CAP_CAP _1	31349	40
N.SCTLND_345KV_CAP_CAP _2	31342	40
N.SCTLND_345KV_CAP_CAP _3	31350	40
OAKDALE__ 345KV_CAP_CAP_1	31394	35
ROTTRDAM_230KV_CAP_CAP_3	31365	30
MARCY___345_STATCOM SVC	31395	75
FRASER__345_FRASER SVC	31328	70
LEEDS___345_LEEDS SVC	31327	50

Figure 7 - Limit Derates for Marcy-South Series Capacitors

Limit Derates for Marcy-South Series Capacitors (bypass breaker open)		
Bypass Breaker Name	PTID	Derate MWs
FRASER___345KV_3322_____________CB	315800	10
FRASER___345KV_3722_____________CB	315804	145
FRASER___345KV_3822_____________CB	315808	60

Loss-of-ISO-NE Source Impact on Central-East Voltage

The NYISO defines maximum Loss of ISO New England Source Contingency Limits on ISO New England's system operations to ensure that large capacity contingencies will not result in exceedance of voltage collapse limits on the New York Central East interface. New England sources do not contribute directly to Central East Voltage Collapse (CEVC) Transfer Limits, rather, they impact Central East flows post-contingency. The limits are defined in terms of a NE Source Contingency Limit and a Central East Post Contingency Offset.

From examination of post-contingency flows in this study it has been determined that the changes to the New York transmission system will support an increased limit. It is recommended that the minimum limit for the loss of ISO-NE source be increased to 1,500 MW from the present 1,320. The post-contingency distribution factor was found to be 0.33, which results in a new post-contingency offset of 495 MW. Details and supporting documentation will be presented in a separate report.

Discussion

System Representation and Base Study Assumptions

The study was conducted on the 2022 NYISO Summer Peak Operating Study Base Case with a NYISO forecasted summer coincident peak load of 31,765 MW. This base case was selected as a continuation of the previous study and was updated to account for all system changes expected in-service for Winter 2023-24 and beyond.

The initial base case is modeled as an all-lines-in-service representation with all generation in-service. A key level of conservatism in the development of voltage transfer limits developed for Operations is all analysis is conducted under peak load conditions. This is conservative for two reasons. First, it is the highest end user reactive load condition, and thereby consumes the greatest amount of inherent and controllable reactive resources at the point of delivery to the end user. Second, the delivery of power to the end user under peak load results in the highest level of reactive transmission losses across the system. Under anything less than peak load conditions, additional reactive resources are available to the system.

The initial base case dispatch real power transfers were adjusted to stress conditions through:

- Ontario generation set to attain an import of ~2500 MW across Frontier and Adirondack interfaces
- 7040 flow set to 1,500 MW import from Hydro-Québec
- 200 MW import on Cedars-Dennison
- Sandbar PAR set to achieve 100 MW flow on PV20
- Ontario-Michigan PARS set to maintain Lake Erie circulation near zero
- Interfaces at Dysinger-East interface and Moses-South stressed to 2,020 and 2,580 MW respectively.

To ensure utilization of available reactive resources, the following actions were taken:

- All capacitors in-service were switched in.
- All generator terminal voltages were set to local control, between .95 and 1.05.
- Assorted Generator and LTC control parameters were adjusted to maintain all bulk power buses within historic operating voltage ranges.
- Oswego area 345 kV stations modeled to typical voltages which can exceed 1.06 p.u.
- Marcy-South Series Capacitors were modeled out-of-service (bypassed).

Updates to the base case included additional transmission as part of the Segment A. This included the addition of the Edic-Princetown 345kV 351 and 352 lines. A change from the previous study is the modeling of the Knickerbocker Series Compensation as bypassed as a conservative assumption.

From the Segment B project, the Dover PAR, on the Pleasant Valley-Long Mtn 398 345 kV line between New York and New England, was bypassed as it is not expected to be in-service in the near future. A follow up study will be conducted to evaluate any impacts this device may have on Central-East performance.

Study Criteria

This analysis was conducted in accordance with the “NYSRC Reliability Rules, Standards for Planning and Operation the New York ISO Bulk Power System” and "NPCC Regional Reliability Reference Directory # 1 Design and Operation of the Bulk Power System".

The NYISO Transmission Expansion and Interconnection Manual, Attachment G: NYISO Transmission Planning Guideline #2-1 "Guideline for Voltage Analysis and Determination of Voltage-Based Transfer Limits" describes the methodology employed to determine voltage transfer limits.

A pre-contingency kV limit is determined when the post-contingency voltages fall below the post-contingency low voltage limit. In this analysis the pre-contingency low voltages were recorded at the highest transfer at which the post-contingency low solved voltage reached the defined post-contingency low limit. The NYISO post-contingency low voltages employed in the analysis are found in the NYSO Emergency Operations Manual, Attachment A, Table A-2 "NYISO Voltage Limits".

Study Methodology

The Voltage Contingency Analysis Procedure (VCAP) is used to evaluate the steady state voltage performance of the power system for a series of power transfer conditions. A transmission interface in the vicinity of the area of the system to be studied is tested by preparing a series of power flow base cases with increasing MW transfer levels across that interface. The pre-contingency cases are then subjected to the most severe voltage contingencies for the area involved. The post-contingency cases are then reviewed for voltage performance at each of the monitored buses to best determine reactive conditions and develop guidelines for the operation of the system.

The basic principle employed is to develop a set of power transfer vs. voltage (PV) curves through the VCAP application. These PV curves are developed by progressively increasing transfers across Central-East interface and recording the post contingency voltage for severe contingencies. Two potential limits are obtained through examination of the PV curves. A post-contingency voltage transfer limit is defined when the post contingency voltage crosses the predefined post contingency low voltage limit. A voltage collapse transfer limit is defined by identifying the highest transfer where post contingency power flow stopped increasing, also called the "knee" of the post contingent flow curve, and then applying a 5% margin. The voltage collapse transfer limit is then compared to that transfer level obtained by applying the applicable post-contingency low voltage limit. To ensure that a voltage-based transfer limit is determined with a safe margin, the lower of the two power transfer levels from the foregoing comparison is to be selected as the interface transfer limit.

A key level of conservatism in the development of voltage transfer limits developed for operations is all analysis is conducted under peak load conditions. This is conservative for two reasons. First, it is the highest end user reactive load condition, and thereby consumes the greatest amount of innate and controllable reactive resources at the point of delivery to the end user. Secondly, the delivery of power to the end user under peak load results in the highest level of reactive transmission losses across the system. Under anything less than peak load conditions, additional reactive resources are available to the system.

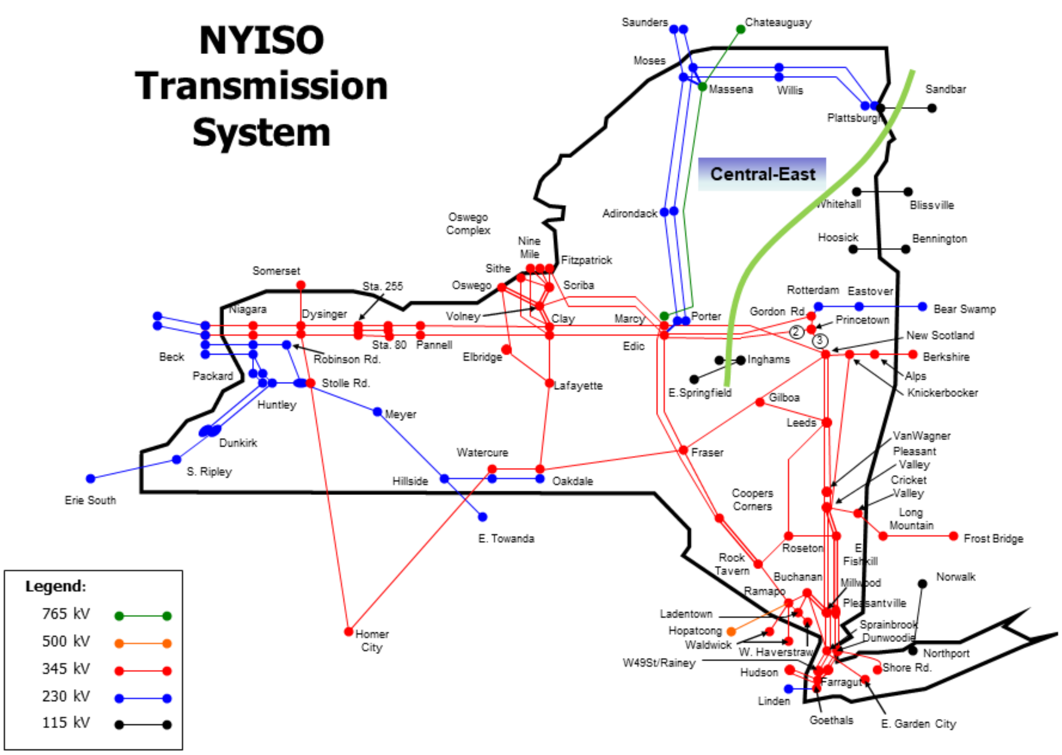
Central-East Interface Definition

The Central-East interface definition is given below in Figure 8 and illustrated in Figure 9. The Edic-Princetown 345kV 351 and 352 circuits are a new addition to the interface definition.

Figure 8 – Central-East Interface Definition

CENTRAL EAST			
Mohawk Valley (Zone E) – Capital (Zone F)			
	Name	**Line ID**	**Voltage (kV)**
	Edic-Gordon Road*	14	345
	Marcy-New Scotland*	18	345
	East Springfield-Inghams*	7-942	115
	Inghams PAR	PAR	115
	Inghams Bus Tie	R81	115
	Edic*-Princetown	351	345
	Edic*-Princetown	352	345
North (Zone D) – ISONE (Zone N)			
	*Plattsburgh-Sand Bar	PV20	115

Figure 9 - NYISO Transmission System (Central-East inset)



Transfer Case Development

Transfer cases were developed by sourcing generation in the Oswego Complex. Power was sinked to major generation on the 345 kV network in western Massachusetts. For some configurations it was necessary to adjust flows on the Ontario-New York, Dysinger-East and Moses-South interfaces. For base transfer conditions the bulk power system voltages were maintained in the .95-1.05 p.u. range.

To ensure full utilization of available reactive resources, the following actions were taken.

- All switched shunt capacitors were switched in so long as it did not cause excessively high voltage.
- Generator and LTC voltage control parameters were adjusted to maintain adequate voltages. In some cases, where generator step up transformer ratios warranted, plant voltage settings were set higher than 1.05 p.u.

Voltage Contingency Evaluation

Figure 10 below lists the contingencies that were evaluated for each configuration studied.

Figure 10 – Central-East Contingencies

ID	Name	Description
ce01	Edic-Gordon Rd. 345	CE01 L/O EDIC- GORDON RD. (14)
ce02	Marcy-N.Scot 345	CE02 L/O MARCY-NEW SCOTLAND (18)
ce03	N.Scot-Leeds 345	CE03 L/O NEW SCOTLAND-LEEDS (94)
ce07	Marcy South N.	CE07 TWR NORTHERN MARCY SOUTH DBL CKT
ce08	Marcy South S.	CE08 TWR SOUTHERN-MARCY SOUTH DBL CKT
ce09	Fitz-Edic-Princetown	CE09 STK EDIC R10 BRK FE-1/BKUP CLR#351
ce11	SBK Edic R945	CE11 STK EDIC R945 BKR 14&Edic 3/1 BK5
ce13	Volney-Marcy	CE13 L/O VOLNEY-MARCY (VU-19)
ce15	SBK Marcy R3108	CE15 STK MARCY R3108 BKR VU-19&UE1-7
ce20	SBK Edic R70	CE20 STK EDIC R70 BRKR
ce30	SBK Princetown 345	CE30 STK PRINCETOWN BRKR G220 (361&371)
ce31	Princetown-N.Scot 345	CE31 L/O PRINCETOWN-NEW SCOTLAND (55)
ce32	361-362 Dlb Ckt Twr 345	CE32 TWR PRNCETWN-N.SCTLAND 361/362 DBL CKT
ce33	351-352 Dlb Ckt Twr 345	CE33 TWR EDIC-PRINCETOWN 351/352 DBL CKT
ce34	SBK Edic R935	CE34 STK EDIC R935 BKR 14 & FE-1
ce35	351&UCC2-41 Dlb Ckt Twr	CE35 TWR 351 & UCC2-41 DBL CKT
ce36	352&EF24-40 Dlb Ckt Twr	CE36 TWR 352 & EF24-40 DBL CKT
log09	Ravenswood 3	LOG09 L/O RAVENSWOOD 3
log15	Ph2 DC 1500	LOG15 L/O SANDY POND HVDC @ 1500 MW

Configuration Modeling

Figure 11 below lists the equipment outages that were modeled and studied. The 351-352 double circuit tower contingency leaves the possibility that the system may be operated in a N-2 configuration that resembles the system at present and therefore additional derates are necessary. The studied N-2 and N-3 configurations are listed in Figure 12.

Figure 13 below lists the reactive devices modeled and studied. In this study there is only one shunt capacitor bank at Rotterdam as cap bank #4 has been retired. Although the VanWagner caps were studied, the impact to Central-East VC was small enough to not warrant implementing a derate.

Figure 11 – Central-East Line Outages

Equipment Status	ID	Voltage (kV)
0-5 Oswego Units IS	-	-
Fitz-Edic 1 O/S	FE-1	345
Edic-Gordon Rd 14 O/S	14	345
Gordon Rd-Rotterdam 30 O/S	30	345/230
Gordon Rd-Rotterdam 31 O/S	31	345/230
Massena-Marcy 1 O/S	MSU1	765
Marcy-New Scotland 18 O/S	18	345
Volney-Marcy 19 O/S	19	345
Princetown-New Scotland 55 O/S	55	345
Gordon Rd-Princetown 371 O/S	371	345
Princetown-New Scotland 361 O/S	361	345
Princetown-New Scotland 362 O/S	362	345
Edic-Princetown 351 O/S	351	345
Edic-Princetown 352 O/S	352	345

Figure 12 – Central-East N-2 and N-3 Line Outages

Equipment Status	IDs	Voltage (kV)
Princetown-New Scotland 361 & 362 O/S	361 & 362	345
Princetown-New Scotland 361 & 362 & 55 O/S	361 & 362 & 55	345
Edic-Princetown 351 & 352 O/S	351 & 352	345
Edic-Princetown 351 & 352 & Edic-Gordon Rd 14 O/S	351 & 352 & 14	345
Edic-Princetown 351 & 352 & Marcy-New Scotland 18 O/S	351 & 352 & 18	345
Edic-Princetown 351 & 352 & Gordon Rd-Princetown 371 O/S	351 & 352 & 371	345

Figure 13 - Central-East Reactive Devices Studied

Equipment Status	ID	Voltage (kV)
Marcy-Coopers Corners SR IS	3722	345
Edic-Fraser SR IS	3822	345
Fraser-Coopers Corners SR IS	3322	345
Edic Cap O/S		345
Fraser Caps O/S (2)		345
Gilboa Cap O/S		345
Leeds Caps O/S (2)		345
Marcy Caps O/S (2)		345
New Scotland Caps O/S (3)		345
Oakdale Cap O/S		345
Rotterdam Caps O/S (1)*		230
VanWagner Caps O/S (2)		345
Fraser SVC O/S		345
Leeds SVC O/S		345
Marcy STATCOM O/S		345

*Represents Rotterdam Cap Bank #3. Rotterdam Cap Bank #4 has been retired.

Monitored Buses

All buses in the Emergency Operations Manual A.2 Bus List were monitored for pre-contingency and post-contingency low voltage limits.

Results

The Appendices contain all the tabular results. Due to the volume of material, the Appendices are a separate document. As an example, the results of the 3 Oswego units all-lines-in-service base case analysis are presented here.

Figure 14 below shows the post-contingency flows for the most limiting contingencies for the 3 Oswego units in-service base case. From this graph the knees of the curves are identified. In this case the most limiting contingency is the loss of the Phase II DC tie at 1500 MW.

Figure 14 - Post-Contingency Flows for 3 Oswego Units IS Base Case

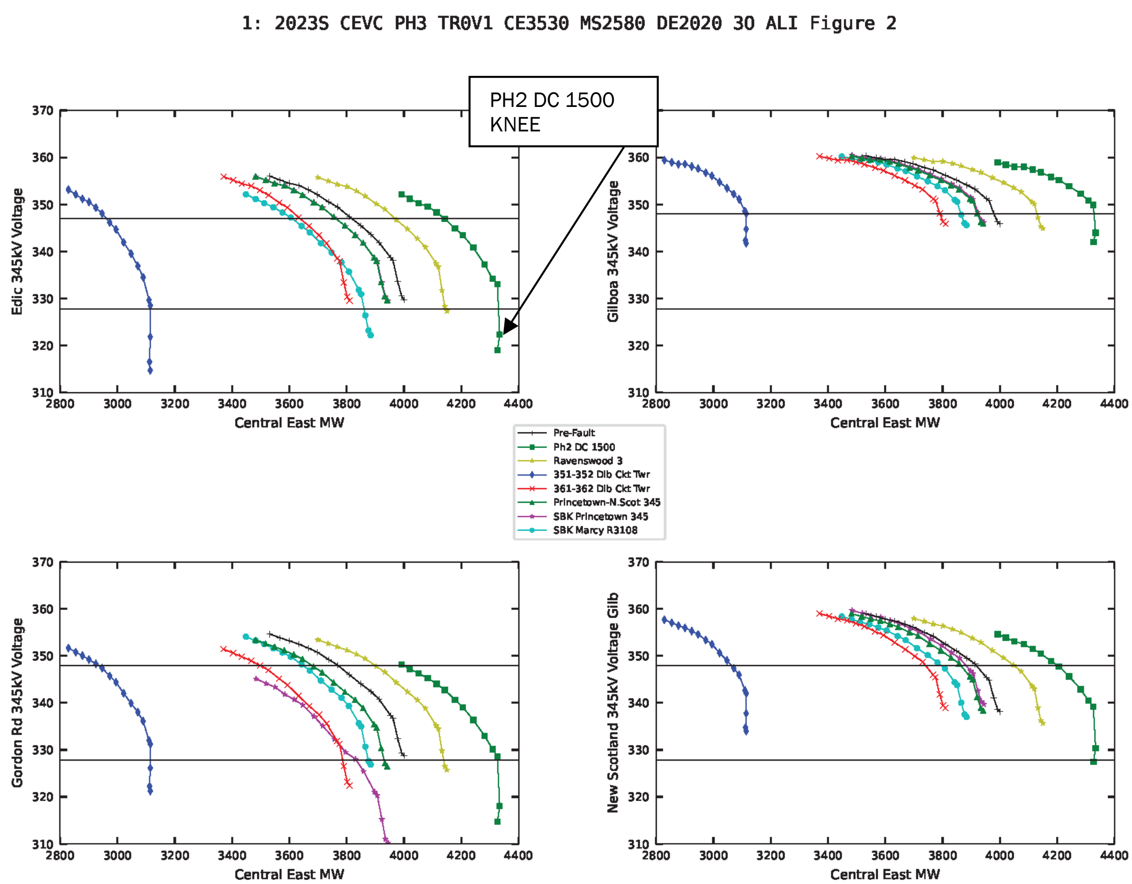


Figure 15 below shows the pre-contingency base flow with the respective post-contingency voltage for each of the most limiting contingencies. The graph is marked with the MW level corresponding to the knee of the curve from the post-contingency plot on the previous page. It is also marked at the MW level of the 5% margin from this knee. Furthermore, the limit for the post-contingency low voltage is identified, which happens to be at Gordon Rd 345kV station for a stuck breaker at Princetown 345kV station. From this it can be seen that the 5% margin is more limiting than the post-contingency low voltage limit.

Figure 15 - Pre-Contingency Flows for 3 Oswego Units IS Base Case

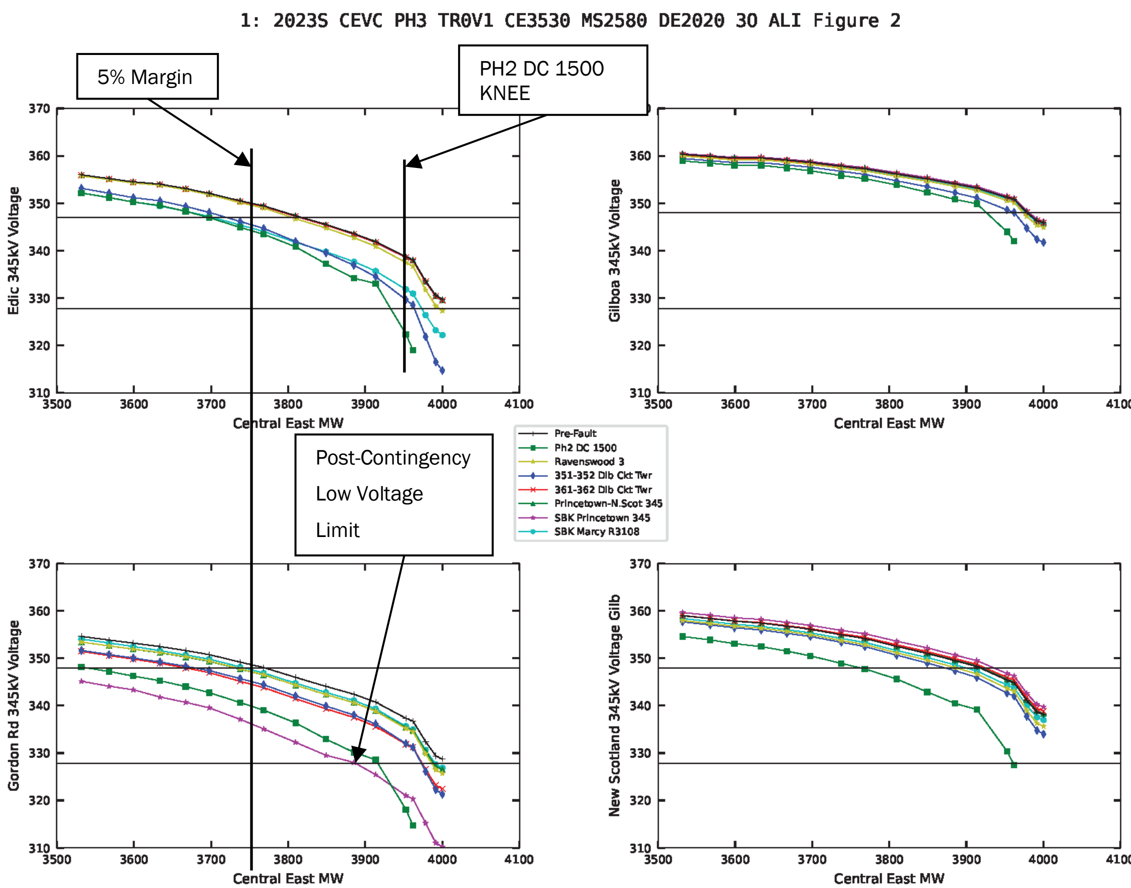


Figure 16 below shows the limits in tabular form, listing the limiting elements in increasing value.

Figure 16 - Tabular Limit Results for 3 Oswego Units IS Base Case

Limit	<------------FACILITY------------>	<---CONTINGENCY--->
3755	limit with 5% margin	Ph2 DC 1500
3757	Dunwoodie 345kV Voltage	Pre-Fault
3763	limit with 5% margin	Marcy South N.
3763	limit with 5% margin	351-352 Dlb Ckt Twr
3769	Gordon Rd 345kV Voltage	Pre-Fault
3777	Sprain Brook 345kV Voltage	Pre-Fault
3779	limit with 5% margin	Fitz-Edic-Princetown
3779	limit with 5% margin	352 & EF24-40 Dlb Ckt Twr
3799	Marcy 345kV Voltage	Pre-Fault
3800	limit with 5% margin	Edic-Gordon Rd. 345
3800	limit with 5% margin	Marcy-N.Scot99 345
3800	limit with 5% margin	N.Scot-Leeds 345
3800	limit with 5% margin	Marcy South S.
3800	limit with 5% margin	SBK Edic R945
3800	limit with 5% margin	Volney-Marcy
3800	limit with 5% margin	SBK Marcy R3108
3800	limit with 5% margin	SBK Edic R70
3800	limit with 5% margin	SBK Princetown 345
3800	limit with 5% margin	Princetown-N.Scot 345
3800	limit with 5% margin	361-362 Dlb Ckt Twr
3800	limit with 5% margin	SBK Edic R935
3800	limit with 5% margin	351 & UCC2-41 Dlb Ckt Twr
3800	limit with 5% margin	Ravenswood 3
3801	PRNC345	Pre-Fault
3817	Edic 345kV Voltage	Pre-Fault
3887	Gordon Rd 345kV Voltage	SBK Princetown 345

All-Lines-In-Service Base Limit Changes

Figure 17 below shows a comparison of the existing and new limits for the All-Lines-In-Service cases. The base limits include derates for Chateauguay 7040 imports at 1,500 MW.

Figure 17 - Base Limits for Oswego AVR Status with All-Lines-In-Service and 7040 Imports at 1500 MW

	Number of Oswego AVRs In-Service					
	0	1	2	3	4	5
New ALI Limit	3460	3540	3640	3725	3805	3885
Existing Limit	2390	2480	2595	2720	2800	2885
Change	+1070	+1060	+1045	+1005	+1005	+1000

Derates for Sithe Independence Changes

Figure 18 below shows a comparison of the existing and new derates for Sithe Independence.

Figure 18 - Derates for Sithe Independence

	New Derates						Existing Derates						Change					
# Sithe Units IS	# Oswego AVRs IS																	
	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
0	645	485	335	240	150	95	460	405	290	280	260	220	185	80	45	-40	-110	-125
1	515	395	265	195	115	75	375	330	245	235	210	180	140	65	20	-40	-95	-105
2	380	300	195	145	80	55	285	255	195	190	160	140	95	45	0	-45	-80	-85
3	245	205	125	95	45	35	195	175	145	145	105	95	50	30	-20	-50	-60	-60
4	165	140	85	65	30	25	130	120	100	100	70	65	35	20	-15	-35	-40	-40
5	85	70	45	35	15	15	65	60	50	50	35	35	20	10	-5	-15	-20	-20
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Derates for Athens

Figure 19 below shows a comparison of the existing and new derates for Athens.

Figure 19 - Derates for Athens

	New Derates							Existing Derates							Change					
# Athens Units IS	# Oswego AVRs IS																			
	0	1	2	3	4	5		0	1	2	3	4	5		0	1	2	3	4	5
0	120	120	120	120	120	120		10	20	30	80	75	130		110	100	90	40	45	-10
1	80	80	80	80	80	80		0	0	20	55	40	90		80	80	60	25	40	-10
2	40	40	40	40	40	40		0	0	10	20	25	75		40	40	30	20	15	-35
3	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0	0

Derates for Reactive Devices

Figure 20 below shows a comparison of the existing and new derates for reactive devices on the system.

Figure 20 - Derates for Reactive Devices

Devices	New Derates	Existing Derates	Change
Edic Cap O/S	80	85	-5
2 Fraser Caps O/S	50	40	+10
Gilboa Cap O/S	30	5	+25
2 Leeds Caps O/S	80	30	+50
2 Marcy Caps O/S	150	140	+10
3 New Scotland Caps O/S	120	120	0
Oakdale Cap O/S	35	35	0
1 Rotterdam Cap O/S*	30	55	-25
Marcy Statcom OON	75	70	+5
Fraser SVC OON	70	30	+40
Leeds SVC OON	50	20	+30
FCC33 SC Byp Open	10	45	-35
UCC2-41 SC Byp Open	145	135	+10
EF24-40 SC Byp Open	60	90	-30

*Represents Rotterdam Cap Bank #3. Rotterdam Cap Bank #4 has been retired.

Derates for Existing Line Outages

Figure 21 below shows a comparison of the existing and new derates for existing line outages.

Figure 21 - Derates for Existing Line Outages

	New Derates						Existing Derates						Change					
	# Oswego AVRs IS																	
Equipment O/S	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
FE-1	205	205	205	205	205	205	145	145	145	145	145	145	60	60	60	60	60	60
14	380	380	380	380	380	380	860	885	920	990	1020	1050	-480	-505	-540	-610	-640	-670
30 or 31	35	35	35	35	35	35	25	25	25	25	25	25	10	10	10	10	10	10
MSU1	840	825	685	555	525	475	650	660	575	660	560	570	190	165	110	-105	-35	-95
18	485	485	485	485	485	485	880	910	970	1035	1075	1160	-395	-425	-485	-550	-590	-675
19	200	200	200	200	200	200	145	145	145	145	145	145	55	55	55	55	55	55
ING_PAR	120	120	120	120	120	120	120	120	120	120	120	120	0	0	0	0	0	0
PV20	100	100	100	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0
55	80	80	80	80	80	80	25	25	25	25	25	25	55	55	55	55	55	55
361 or 362	85	85	85	85	85	85	30	30	30	30	30	30	55	55	55	55	55	55
371	320	320	320	320	320	320	285	310	310	425	485	565	35	10	10	-105	-165	-245

Derates for New Equipment

Figure 22 below shows derates that were developed as a result of new equipment coming into service.

Figure 22 - New Derates

	# Oswego AVRs In-Service					
	0	1	2	3	4	5
Edic-Princetown 351 or 352 O/S	390	390	390	390	390	390

New Derates for N-2 and N-3 Conditions

Figure 23 below shows new derates that were developed as a result of system configuration changes. These derates are added to the derates for the individual outages.

Figure 23 - New Derates for N-2 and N-3 Conditions

	Number of Oswego AVRs In-Service					
	0	1	2	3	4	5
Edic-Princetown 351 & 352 O/S	305	305	305	305	305	305
Edic-Princetown 351 & 352 & Edic-Gordon Rd 14 O/S	570	570	570	570	570	570
Edic-Princetown 351 & 352 & Marcy-New Scotland 18 O/S	580	580	580	580	580	580
Edic-Princetown 351 & 352 & Gordon Rd-Princetown 371 O/S	290	290	290	290	290	290
New Scotland-Princetown 361 & 362 O/S	100	100	100	100	100	100
New Scotland-Princetown 361 & 362 & 55 O/S	825	825	825	825	825	825