Additional Reliability Study for Exelon Corporation

Evaluation of the Impact of the Retirement of the Ginna Nuclear Generation Station On the New York State Transmission System

FINAL REPORT

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Executive Summary

The New York Independent System Operator (NYISO), jointly with Rochester Gas and Electric Corporation (RG&E) at the request of Exelon Corporation, conducted an Additional Reliability Study to evaluate the impact of the retirement of the Ginna generation station (Ginna) on the reliability of the New York State Transmission System for the years 2015 and 2018. Ginna has a nameplate capacity rating of 614 MW with a summer and winter capability rating of 581.5 and 582.1 MW, respectively.

The system representation for this Additional Reliability Study is developed based on the NYISO 2013 FERC 715 filing, including existing and planned facilities reported in the NYISO 2013 Load and Capacity Data report to reflect the planned conditions for summer 2015 and summer 2018.

To evaluate the impact of the retirement of Ginna on the system performance of the Bulk Power Transmission Facilities (BPTF) in Zones A-F, power flow analyses were conducted to evaluate the thermal, voltage, and N-1-1 for normal (or design) contingencies as defined in the Northeast Power Coordinating Council (NPCC) and New York State Reliability Council (NYSRC) reliability criteria and rules. Statewide resource adequacy is also evaluated.

The 2015 thermal and voltage transfer limit analysis finds that the retirement may cause transfer limit changes ranging from +225 to -325 MW for the Dysinger East and West Central interfaces, respectively. For the 2015 N-1 analysis, the removal of Ginna results in pre-contingency overloads on the 345/115 kV transformers at Pannell Road and high overloads (150%) on those transformers for area contingencies. It also caused increased contingency overloading (110%) on BPTF lines connected to Clay 115 kV. For N-1-1, the Pannell transformers were highly overloaded (>150%) for various N-1-1 conditions. Regarding voltage, voltage transfer limits decreased, but were still higher than the thermal limits.

The 2018 thermal and voltage transfer limit analysis finds that the retirement may cause transfer limit changes ranging from +225 to -375 for the Dysinger East and West Central interfaces, respectively. For the 2018 N-1 analysis, the removal of Ginna results in a pre-contingency overload only on the Pannell Road 345/115 kV transformer #3; however, there are high overloads (approximately 133%) on the Pannell Road 345/115 kV transformers #1 and #2 for contingency conditions. For N-1-1, the Pannell Road 345/115 kV transformers and other 115 kV elements are significantly overloaded for various conditions. Regarding voltage, voltage transfer limits decreased, but were still higher than the thermal limits.

As modeled for this study, there is not a resource adequacy violation without Ginna in 2015 or 2018. The New York Control Area (NYCA) as modeled is at the loss of load expectation (LOLE) criteria of 0.1 in 2018 without Ginna; therefore, with expected load growth and no other changes to the system, there would be an LOLE violation in 2019.

The RG&E analysis also found violations on the local non-BPTF system. Starting with the summer 2015 and summer 2018 cases provided by the NYISO, RG&E adjusted the Rochester area load to RG&E's forecast levels (1857 MW for 2015 and 1955 MW for 2018). RG&E made no changes to other zonal loads or generation dispatch levels; 115 kV PAR settings are as noted in Appendix B. RG&E then conducted a load flow analysis of the non-BPTF for pre-contingency and N-1 contingency conditions with Ginna modeled in-service and out-of-service.

RG&E's results corroborate the NYISO findings with respect to both pre-contingency and N-1 overloads of the Pannell Road 345/115 kV transformers and other 115 kV elements with Ginna out-of-service in both the 2015 and 2018 cases. RG&E also noted voltage violations in the base case and under contingency in its 34.5 kV and lower voltage systems for both study year cases. The detailed results of the RG&E analysis are provided in Appendix B.

The study results indicate that, for the system as modeled, the retirement of Ginna would result in bulk and non-bulk reliability criteria violations in years 2015 and 2018. A mitigation solution equivalent to the impact of the full output of the Ginna plant would be necessary to maintain reliability in the Rochester area.

1. Introduction

The purpose of this Additional Reliability Study is to evaluate the impact of the retirement of the R.E. Ginna Nuclear Power Plant, LLC nuclear generation station (Ginna) on the reliability of the New York State (NYS) Transmission System. Ginna has a nameplate rating of 614 MW with a summer capability of 581.5 MW.

The NYISO assessment of the retirement of Ginna is performed in accordance with applicable North American Electric Reliability Corporation (NERC) Reliability Standards, Northeast Power Coordinating Council (NPCC) Design Criteria, New York State Reliability Council (NYSRC) Reliability Rules and Procedures, and NYISO planning and operation practices.

1.1. Study Period and Study Area

The NYCA representation for this study is derived from the NYISO 2013 FERC 715 filing with the transmission system and load changes made to reflect the NYCA system conditions, including existing and planned facilities, reported in the NYISO 2013 Load and Capacity Data report [8] for summer 2015 and summer 2018.

The study evaluates the impact of the retirement on the NYS Bulk Power Transmission Facilities (BPTF) in Zones A-F. Statewide resource adequacy is also evaluated. The applicable transmission interfaces are Dysinger East and West Central.

1.2. Criteria

This study is conducted in accordance with applicable NERC Transmission Planning (TPL) Reliability Standards [1], NPCC Design Criteria (Directory #1) [2], NYSRC Reliability Rules and Procedures [3], and NYISO planning and operation practices [4]-[7]. The NYSRC Reliability Rules are consistent with and in certain cases are more specific or stringent than the NPCC Directory #1 and the NERC TPL reliability Standards. This assessment respects all known planning horizon System Operating Limits (SOLs).

1.3. Base Case Conditions and Modeling Assumptions

The impact of the retirement of Ginna is evaluated for summer 2015 and summer 2018 peak load conditions. Base cases are developed with Ginna in-service and out-of-service to determine the incremental impact on the normal and emergency transfer limits for the applicable transmission interfaces.

The system representation is derived from the NYISO 2013 FERC 715 filing, including existing and planned facilities reported in the NYISO 2013 Load and Capacity Data report [8] to reflect the planned conditions for summer 2015 and summer 2018. With the generation at Ginna retired, the plant load of 5 MW is served from Station 13A 115 kV substation.

The power flow analysis of the BPTF models the non-coincident summer peak loads for Zones A-F as provided in the NYISO 2013 Load & Capacity Data report. The power flow analysis performed by RG&E on the local system uses the same model as is used for the BPTF, with the exception of modeling RG&E summer peak load as forecasted by RG&E. The resource adequacy analysis modeled the statewide coincident summer peak load. Table 1.3 provides a summary of the zonal load plus losses for 2015 and 2018.

Table 1.3 Zonal Load Plus Losses

Year	Forecast	Zonal Load plus Losses (MW)					
		A	B	C	D	E	F
2015	Gold Book Coincident	2667	2093	2932	807	1437	2386
	Gold Book Non-Coincident (NYISO case)	2716	2139	2969	897	1501	2431
	RG&E		2397				
2018	Gold Book Coincident	2693	2139	2993	815	1458	2456
	Gold Book Non-Coincident (NYISO case)	2749	2187	3032	910	1523	2502
	RG&E		2517				

The Rochester Area Reliability Project is not included in the 2015 case and is included in the 2018 case. All Dunkirk generation units are modeled out-of-service in the 2015 case and Dunkirk units 2, 3, and 4 (445 MW total) are modeled in-service in the 2018 case; associated local transmission upgrades are modeled in-service in both cases. The Cayuga generation plant (300 MW) is modeled in-service in the 2015 case and out-of-service in the 2018 case with associated local transmission upgrades in-service.

Additional modeling assumptions are as follows:

- Phase Angle Regulators (PARs), switched shunts, LTC transformers are modeled as regulating pre-contingency and non-regulating post-contingency. The study uses external PAR schedules established by the NYISO in coordination with the neighboring ISOs through NERC and NPCC base case development processes, as modeled in the NYISO FERC 715 power flow base cases filed in 2013.
- SVC and FACTS devices are set to zero pre-contingency and are allowed to operate to full range post-contingency.
- For the determination of transfer limits, the analysis simulates generation re-dispatch following the standard proportions used in NYISO transmission planning and operating studies, in accordance with the established standards and practices.

2. Assessment Results

2.1. Thermal Analysis

2.1.1. Methodology

In accordance with the NYISO methodology for Assessment of Transfer Capability in the Near-Term Transmission Planning Horizon, thermal transfer limit analysis is performed using the Siemens PTI PSS® MUST program utilizing the linear First Contingency Incremental Transfer Capability (FCITC) Calculation activity by shifting generation across the given interface under evaluation. The results are based on a deterministic summer peak power flow analysis and may not be applicable for use in probabilistic resource adequacy analysis.

Approximately 900 contingencies are evaluated including single element, common structure, stuck breaker, generator, multiple element, and DC contingencies. All contingencies studied are consistent with the applicable NERC Category A, B, and C contingencies and NPCC and NYSRC Design Criteria contingencies. The monitored elements include the BPTF elements. PARs maintain their scheduled power flow pre-contingency but are fixed at their corresponding pre-contingency angle in the post-contingency solution. In both 2015 and 2018, the 115 kV PARs in the Rochester area are modeled with the schedules provided in Table 2.1.1. In 2015, the PAR schedule for Ginna out-of-service is the same as the Ginna in-service case.

Table 2.1.1 RG&E PAR Schedule Assumptions

From Bus	To Bus	Ginna In-Service 2015 & 2018		Ginna Out-of-Service 2015		Ginna Out-of-Service 2018	
		Max MW	Min MW	Max MW	Min MW	Max MW	Min MW
S42 115	PS S23	10	-10	10	-10	110	90
S124C913	PS1	-130	-140	-130	-140	-30	-40
S124C913	PS2	-130	-140	-130	-140	-30	-40

To determine the transfer capability, the source and sink generation resources are adjusted uniformly based on the ratio of reserve generation to maximum generation. Wind, nuclear, and run-of-river hydro units are excluded from generation shifts. The general southerly direction of generation shifts is the result of increasing generation in the north and west and reducing generation in southeastern New York.

2.1.2. Analysis Results

Tables 2.1.2 and 2.1.3 provide a summary of the incremental impact of the retirement of Ginna on the 2015 and 2018 normal and emergency thermal transfer criteria limits for Dysigner East and West Central interfaces. Dysinger East measures transfer capability from western New York towards Rochester, while West Central measures from Rochester to the east.

In both 2015 and 2018, the Dysinger East interface normal and emergency thermal transfer limits increased with Ginna out-of-service. Similarly, the West Central interface normal and emergency thermal transfer limits decreased with Ginna out-of-service. The total change in transfer capability of these interfaces due to the retirement of Ginna is roughly equal to the capability of Ginna. The 2018 transfer capability increased compared to 2015 due to modeling Dunkirk generation in-service, although the incremental impacts to the transfer limits due to the retirement of Ginna remained approximately the same as what is shown in 2015.

Table 2.1.2 2015 Normal and Emergency Thermal Transfer Limits

	Normal		Emergency	
Interface	**Ginna In-Service**	**Ginna Out-of-Service**	**Ginna In-Service**	**Ginna Out-of-Service**
Dysinger East	1250 (1)(A)	1475 (1)(A)	1925 (2)	2150 (2)
West Central	-200 (1)(A)	-525 (1)(A)	475 (2)	150 (2)

Notes:

1. **Sawyer – Huntley 230** (Line 80) at 654 MW LTE rating for L/O Sawyer-Huntley 230 (Line 79)
2. **Sawyer – Huntley 230** (Line 80) at 755 MW STE rating for L/O Huntley-Gardenville 230 (Line 79)

A. Used Reliability Rules Exception Reference No. 13 – Post Contingency Flows on Niagara Project Facilities

Table 2.1.3 2018 Normal and Emergency Thermal Transfer Limits

	Normal		Emergency	
Interface	**Ginna In-Service**	**Ginna Out-of-Service**	**Ginna In-Service**	**Ginna Out-of-Service**
Dysinger East	2100 (1)(A)	2325 (1)(A)	2725 (2)	2950 (3)
West Central	600 (1)(A)	250 (1)(A)	1250 (2)	875 (3)

Notes:

1. **Huntley-Sawyer 230** (Line 80) at 654 MW LTE rating for L/O Huntley-Gardenville 230 (Line 79)
2. **Packard-Sawyer 230** (Line 77) at 704 MW STE rating for L/O Packard-Sawyer 230 (Line 78) and Niagara-Packard 230 (Line 61)
3. **Stolle Rd-High Sheldon 230** at 430 MW normal rating for pre-contingency loading

A. Used Reliability Rules Exception Reference No. 13 – Post Contingency Flows on Niagara Project Facilities

2.2. Voltage Analysis

2.2.1. Methodology

Voltage-constrained transfer limit analysis is performed using the Siemens PTI PSS®E (Rev. 32) software package in conjunction with the NYISO Voltage Contingency Analysis Procedure (VCAP) and with consideration of the voltage limit criteria. The voltage limit criterion specifies minimum and maximum voltage limits at key NYCA buses. The required post-contingency voltage is typically within 5% of nominal.

A set of power flow cases with increasing transfer levels is created for the Dysinger East and West Central interface from the base case by applying generation shifts similar to those used for the thermal analysis. For each interface, the VCAP program evaluates the system response to the set of most severe contingencies which are applicable to Table 1 for NERC Category B and C contingencies and NPCC transmission design criteria. Selection of these severe contingencies is based on an assessment of cumulative historical power system analysis, actual system events, and analysis of planned changes to the system.

For the voltage-constrained transfer analysis, load is modeled as constant power in all NYCA zones except the Con Edison service territory in both the pre-contingency and post-contingency power flows. The Con Edison voltage-varying load model is used to model the Con Edison load in all cases. The Con Edison load model does not significantly impact the analysis performed for the Dysinger East and West Central interface.

All reactive power adjustments modeled by generators, PARs, autotransformers, SVC and FACTS devices are regulated or adjusted within their respective capabilities. The reactive power of generators is regulated to a scheduled voltage in both the pre-contingency and post-contingency power flows. Tap settings of PARs and autotransformers regulate power flow and voltage, respectively, in the pre-contingency power flows, but are fixed at their corresponding pre-contingency settings in the post-contingency power flows. Similarly, switched shunt capacitors and reactors are switched at pre-determined voltage levels in the pre-contingency power flows, but are held at their corresponding pre-contingency position in the post-contingency power flows. In accordance with NYISO normal (pre-contingency) operating practice, SVC and FACTS devices are held at or near zero reactive power output in the pre-contingency power flows, but are allowed to regulate in the post-contingency power flows.

Voltage-constrained transfer analysis is performed to evaluate the adequacy of the system post-contingency voltage and to find the region of voltage instability. As the transfer across an interface is increased, the voltage-constrained transfer limit is determined to be the lower of: (1) the pre-contingency power flow at which the post-contingency voltage falls below the voltage limit criteria; or (2) 95% of the pre-contingency power flow at the “nose” of the post-contingency PV curve. The “nose” is the point at which the slope of the PV curve becomes infinite (vertical) reaching the point of voltage collapse and occurs when reactive capability supporting power transfer is exhausted. The region near the “nose” of the curve is generally referred to as the region of voltage instability.

The NYISO uses the above methodology to model a worst case steady-state voltage response based on the examination of actual system events. For the New York system, this represents a time frame of approximately 30-60 seconds after the contingency occurs, which recognizes some automatic response of the system following the contingency but before system operator actions are initiated.

Voltage-constrained transfer analysis is sensitive to the base case load and generation conditions, generation selection utilized to create the transfers, PAR schedules, key generator commitment, SVC, switched shunt availability, and inter-area power transfers. As no attempts are made to optimize voltage-constrained transfer limits, these sensitivities are not considered during voltage-constrained transfer analysis.

2.2.2. Analysis Results

Tables 2.2.1 and 2.2.2 provide the voltage-constrained transfer limit for the Dysinger East and West Central interface with Ginna in-service and out-of-service for 2015 and 2018. The voltage-constrained interface transfer limit with Ginna out-of-service for Dysinger East and West Central is approximately 600 MW higher than the emergency thermal transfer criteria (Tables 2.1.2 and 2.1.3).

Table 2.2.1 2015 Voltage Transfer Limits

Interface	Ginna In-Service	Ginna Out-of-Service
Dysinger East	2825 (1)	2750 (1)
West Central	1350 (2)	2800 (2)

Notes:

1. 95% of PV nose occurs for L/O Huntley – Gardenville #79 & #80 230 kV (Towers 79 and 80)
2. Gardenville 230 kV bus voltage post-contingency low limit for L/O Huntley-Gardenville #79 & #80 230kV (Towers 79 and 80)

Table 2.2.2 2018 Voltage Transfer Limits

Interface	Ginna In-Service	Ginna Out-of-Service
Dysinger East	3050 (1)	2975 (1)
West Central	1500 (1)	850 (1)

Notes:

1. **Station 80** 345 kV pre-contingency low limit

2.3. N-1-1

2.3.1. Methodology

N-1 analysis is performed using Siemens PTI PSS® MUST program and the TARA program. N-1-1 analysis is performed using the TARA program utilizing its N-1-1 capability. A cut-off was used to report all BPTF elements loaded above 90% of the applicable rating.

Approximately 900 contingencies are evaluated including single element, common structure, stuck breaker, generator, multiple elements, and DC contingencies are evaluated as the second contingency with single contingencies being evaluated as the first contingency. All contingencies studied are consistent with the applicable NERC Category A, B, and C contingencies and NPCC and NYSRC Design Criteria contingencies. The monitored elements include the BPTF elements. PARs maintain their scheduled power flow pre-contingency but are fixed at their corresponding pre-contingency angle in the post-contingency solution.

2.3.2. Analysis Results

For the 2015 N-1 analysis, the removal of Ginna results in pre-contingency overloads on the 345/115 kV transformers at Pannell Road and high overloads (150%) on those transformers for area contingencies. It also caused increased contingency overloading (110%) on BPTF lines connected to Clay 115 kV. The detailed results are provided in Table 2.3.1. Table 2.3.1 only shows the contingency that results in the highest overload on the monitored element.

For the 2018 N-1 analysis, the removal of Ginna results in pre-contingency overloads only on Pannell 345/115 kV transformer #3; however, the remaining Pannell 345/115kV transformers are overloaded following contingencies (>130%). The detailed results are provided in Table 2.3.2. Table 2.3.2 only shows the contingency that results in the highest overload on the monitored element.

For the 2015 N-1-1 analysis, the Pannell transformers are highly overloaded (>150%) for various N-1-1 conditions. Two 345/115 kV transformers at Station 80 also are significantly overloaded for N-1-1 conditions. The BPTF elements in the Rochester area have no voltage violations with Ginna out-of-service; however, the existing reactive compensation on all 115 kV and higher facilities in the Rochester area is needed to maintain voltage post contingency. The detailed results of the 2015 N-1-1 analysis are provided in Table 2.3.3. The results in the table are only showing the first and second contingency that provides the highest overload on the monitored element or instances where the system cannot be returned to within normal ratings following the first contingency (N-1-0, i.e. base case is the second contingency).

For the 2018 N-1-1 analysis, although Station 255 is modeled in-service, the Pannell transformers are highly overloaded (>130%) for various N-1-1 conditions. Similar to the 2015 N-1-1 analysis, the existing reactive compensation on all 115 kV and higher facilities in the Rochester area is needed to maintain voltage post contingency. The detailed results for the 2018 N-1-1 analysis are provided in Table 2.3.4. The results in the table are only showing the first and second contingency that provides the highest overload on the monitored element or instances where the system cannot be returned to within normal ratings following the first contingency (N-1-0, i.e. base case is the second contingency).

The ratings for this study are those in the 2013 FERC-715 filing cases, consistent with the scope of work; however, RG&E noted that the Pannell 345/115 kV transformer #3 has higher ratings of approximately 16% for normal rating and 20% for the LTE rating. With these rating increases, Pannell 345/115 kV transformer #3 is not overloaded with Ginna out-of-service for 2018; however, the transformer is overloaded by approximately 6% in 2015 under N-1-1 conditions.

The RG&E analysis also found violations on the local non-BPTF system. The detailed results of the RG&E analysis are provided in Appendix B.

Table 2.3.1 2015 N-1 Overloads

Monitored Facility (kV)	Contingency (kV)		% Loading		Delta % Impact
	Ginna In-Service	Ginna Out-of-Service	Ginna In-Service	Ginna Out-of-Service	
Clay-Lockheed Martin (#14) 115	SB:OSWE_R985	SB:OSWE_R985	111.2	123.3	12.1
Euclid-Woodard (#17) 115	SB:LAFA_ELB	SB:LAFA_ELB	97.9	108.4	10.5
Porter-Kelsey (#3) 115	SB:OSWE_R985	SB:OSWE_R985	100.1	103.7	3.6
Pannell 345/115 1TR	-	BASE CASE	-	111.1	>21.1
Pannell 345/115 1TR	-	SB:PANN345_1X12282	-	152.5	>62.5
Pannell 345/115 2TR	-	BASE CASE	-	111.1	>21.1
Pannell 345/115 2TR	-	SB:PANN345_3T12282	-	152.5	>62.5
Pannell 345/115 3TR	-	BASE CASE	-	118.8	>28.8
Pannell 345/115 3TR	-	SB:ROCH_2T8082	-	122.2	>32.2
Pannell – Quaker (#914) 115	-	Pannell 345/115 3T@S122	-	126.3	>36.3

Table 2.3.2 2018 N-1 Overloads

Monitored Facility (kV)	Contingency (kV)		% Loading		Delta % Impact
	Ginna In-Service	Ginna Out-of-Service	Ginna In-Service	Ginna Out-of-Service	
Euclid-Woodard (#17) 115	SB:LAFA_ELB	SB:LAFA_ELB	93.2	102.5	9.3
Porter-Kelsey (#3) 115	S:PTR115_ONDA	SB:OSWE_R985	99.4	102.7	3.3
Pannell 345/115 1TR	-	SB:PANN345_1X12282	-	133.4	>43.4
Pannell 345/115 2TR	-	SB:PANN345_3T12282	-	133.4	>43.4
Pannell 345/115 3TR	-	BASE CASE	-	107.4	>17.4
Pannell – Quaker (#914) 115	-	Pannell 345/115 3TR	-	121.6	>31.6

Table 2.3.3 2015 N-1-1 Overloads

Monitored Facility (kV)	Ginna In-Service		Ginna Out-of-Service		% Loading		Delta (%)
	First Contingency	Second Contingency	First Contingency	Second Contingency	Ginna In-Service	Ginna Out-of-Service	
Oakdale 345/115 2TR	Fraser 345/115 2TR	SB:OAKD345_31-B322	Fraser 345/115 2TR	SB:OAKD345_31-B322	100.0.	101.7	1.7
Oakdale 345/115 3TR	Watercure 345/230 1TR	SB:OAKD345_32-B222	Oakdale 345/115 2TR	Base Case	98.0	100.2	2.2
Watercure 345/230	Oakdale 345/115 2TR	SB:OAKD345_B3_3222	Oakdale 345/115 2TR	SB:OAKD345_B3_3222	104.1	106.8	2.7
Huntley-Sawyer (#80) 230	Hillside 230/115 4TR	S:HNT_GRD79	Huntley-Gardenville (#79) 230	SB:ROBI230	100.0	101.5	1.5
Clay-Lockheed Martin (#14) 115	Clay-Wood 17 115	SB:LAFA_ELB	Clay-Wood 17 115	SB:LAFA_ELB	131.1	149.6	18.5
Euclid-Woodard (#17) 115	CLAY – LM 14 115	SB:LAFA_ELB	CLAY – LM 14 115	SB:LAFA_ELB	106.2	119.2	13.0
Porter-Kelsey (#3) 115	OS-EL-LFYTE 17 345	SB:CLAY345_R130	OS-EL-LFYTE 17 345	SB:CLAY345_R130	115.8	117.2	1.3
Porter-W. Utica (#3) 115	OS-EL-LFYTE 17 345	SB:CLAY345_R130	Clay-Dewitt 345	SB:OSWE_R985	99.4	100.9	1.5
Pannell 345/115 1TR	L/O Ginna	SB:PANN345_1X12282	Rochester 345/115 5TR	SB:PANN345_1X12282	121.8	154.3	32.5
Pannell 345/115 1TR	L/O Ginna	Base Case	Pannell 345/115 2TR	Base Case	91.3	126.6	35.3
Pannell 345/115 2TR	L/O Ginna	SB:PANN345_3T12282	Rochester 345/115 5TR	SB:PANN345_3T12282	121.8	154.3	32.5
Pannell 345/115 2TR	L/O Ginna	Base Case	Pannell 345/115 1TR	Base Case	91.3	126.6	35.3
Pannell 345/115 3TR	L/O Ginna	Pannell 345/115 2TR	Pannell 345/115 1TR	SB:ROCH_2T8082	90.3	129.8	39.5
Pannell 345/115 3TR	L/O Ginna	Base Case	Pannell 345/115 1TR	Base Case	91.9	115.3	23.4
Rochester 345/115 2TR	Rochester 345/115 5TR	SB:ROCH_3T80-82	Rochester 345/115 5TR	SB:ROCH_3T80-82	107.3	117.1	9.8
Rochester 345/115 5TR	Rochester 345/115 2TR	SB:ROCH_3T80-82	Rochester 345/115 2TR	SB:ROCH_3T80-82	112.6	122.8	10.2
Pannell – Quaker (#914) 115	L/O Ginna	Pannell 345/115 3TR	Pannell 345/115 3TR	SB:ROCH_2T8082	93.6	125.4	31.8
Pannell – Quaker (#914) 115			Pannell 345/115 3TR	Base Case	-	118.5	>28.5

Table 2.3.4 2018 N-1-1 Overloads

Monitored Facility (kV)	Ginna In-Service		Ginna Out-of-Service		% Loading		Delta (%)
	First Contingency	Second Contingency	First Contingency	Second Contingency	Ginna In-Service	Ginna Out-of-Service	
Gardenville 230/115 TB3	Gardenville 230/115 2TR	SB:GARD230_R833	Gardenville 230/115 2TR	SB:GARD230_R833	101.4	106.0	4.6
Clay-Lockheed Martin (#14) 115	Clay-Wood 17 115	SB:LAFA_ELB	Clay-Wood 17 115	SB:LAFA_ELB	108.2	122.0	13.8
Clay-Euclid (#17) 115	Clay-LM 14 115	SB:LAFA_ELB	Clay-LM 14 115	SB:LAFA_ELB	98.6	105.4	6.8
Euclid-Woodard (#17) 115	Clay-LM 14 115	SB:LAFA_ELB	Clay-LM 14 115	SB:LAFA_ELB	107.9	116.5	8.6
Porter-Kelsey (#3) 115	PTR TRMNL 115	S:PTR115_SCHLR	OS-EL-LFYTE 17 345	SB:CLAY345_R925	112.9	114.0	1.1
Pannell 345/115 1TR	L/O Ginna	SB:PANN345_1X12282	Roch 345/115 5TR	SB:PANN345_1X12282	101.3	133.6	32.3
Pannell 345/115 1TR	-	-	Pannell 345/115 2TR	BASE CASE	-	116.6	>26.6
Pannell 345/115 2TR	L/O Ginna	SB:PANN345_3T12282	Roch 345/115 5TR	SB:PANN345_3T12282	101.3	133.6	32.3
Pannell 345/115 2TR	-	-	Pannell 345/115 1TR	BASE CASE	-	116.6	>26.6
Pannell 345/115 3TR	-	-	Pannell 345/115 2TR	SB:PANN345_3902	-	118.3	>28.3
Pannell 345/115 3TR	-	-	Pannell 345/115 2TR	BASE CASE	-	108.2	>18.2
Pannell – Quaker (#914) 115	-	-	Pannell 345/115 3TR	SB:ROCH_2T8082	-	110.6	>20.6
Pannell – Quaker (#914) 115	-	-	Pannell 345/115 3TR	BASE CASE	-	115.0	>25.0
Mortimer – S82 115	-	-	Pannell 345/115 1TR	SB:PANN345_1X12282	-	101.0	>91.0

3. Resource Adequacy

The statewide resource adequacy was evaluated for the years 2015 and 2018. The MARS study model is updated from the base case utilized in the 2012 Comprehensive Reliability Plan (CRP).

The resource adequacy results for 2015 show that with Ginna out-of-service, NYCA Loss of Load Expectation (LOLE) increases from 0.035 to 0.043. The maximum acceptable LOLE according to NPCC and NYSRC criteria is one-day-in-ten-years (0.1 per year); therefore, no resource adequacy violation would exist under the studied conditions. For the 2015 sensitivity where Ginna is out-of-service, but Dunkirk units 2, 3, and 4 are in-service, the NYCA LOLE was improved by the additional resources, and decreased from 0.043 to 0.032.

Table 3.1 summarizes the resource adequacy assessment results for 2015. The NYCA LOLE is well within NYCA resource adequacy requirements for all three study conditions.

Table 3.1 2015 Resource Adequacy Assessment Results

	Ginna In-Service	Ginna Out-of-Service	Dunkirk Sensitivity
NYCA LOLE	**0.035**	**0.043**	**0.032**

NYCA resource adequacy was next studied for the year 2018[1]. With Ginna in-service, study results indicate a NYCA LOLE of 0.074. With Ginna out-of-service, we find the NYCA LOLE increased to 0.100. While this result is considered marginal, it is not a violation. With expected load growth and no other changes to the system as modeled, there would be an LOLE violation in 2019. For the 2018 sensitivity where both Ginna and Huntley are out-of-service, the NYCA LOLE violation is more pronounced, at 0.188 (0.100 vs. 0.188). Final 2018 results are summarized in Table 3.2 below.

Table 3.2 2018 Resource Adequacy Assessment Results

	Ginna In-Service	Ginna Out-of-Service	Huntley Out Sensitivity
NYCA LOLE	**0.074**	**0.100**	**0.188**

[1] Selkirk is modeled out-of-service per the Letter of Intent to Mothball issued on Feb. 28, 2014

4. Conclusion

This Additional Reliability Study evaluates the impact of the retirement of Ginna on the reliability of the New York State Bulk Power Transmission Facilities (BPTF) for the years 2015 and 2018. The thermal and voltage transfer limit analysis finds that the retirement changes the transfer capability by +225 to -325 MW depending on the interface. For N-1 and N-1-1 analysis, the retirement of Ginna results in significant base case and contingency overloads on the BPTF. The BPTF elements in the Rochester area have no voltage violations with Ginna out-of-service; however, the existing reactive compensation on all 115 kV and higher facilities in the Rochester area is needed to maintain voltage post contingency. The RG&E analysis found violations on the local non-BPTF system. The detailed results of the RG&E analysis are provided in Appendix B. The resource adequacy results for 2015 and 2018 show no resource adequacy violations with Ginna out-of-service.

The study results indicate that, for the system as modeled, the retirement of Ginna would result in bulk and non-bulk reliability criteria violations in years 2015 and 2018. A mitigation solution equivalent to the impact of the full output of the Ginna plant would be necessary to maintain reliability in the Rochester area.

5. References

1. North American Electric Reliability Corporation, “Transmission Planning (TPL) Reliability Standards for the Bulk Electric Systems of North America”, TPL-001-0.1 (dated May 13,2009), TPL-002-0b (dated October 24, 2011), TPL-003-0b (dated April 23, 2010), and TPL-004-0a (dated April 1, 2005).
2. Northeast Power Coordinating Council, “NPCC Regional Reliability Reference Directory #1, Design and Operation of the Bulk Power System”, Version 1, dated April 20, 2012.
3. New York State Reliability Council, “NYSRC Reliability Rules for Planning and Operating the New York State Power System”, Version 32, dated January 11, 2013.
4. New York Independent System Operator, “Transmission Expansion and Interconnection Manual”, Attachment F: NYISO Transmission Planning Guideline #1-1 – Guideline for System Reliability Impact Studies Section 2.4.2 Impact on System Performance and Transfer Limits, Version 2.0, dated November 18, 2012.
5. New York Independent System Operator, “Transmission Expansion and Interconnection Manual”, Attachment G: NYISO Transmission Planning Guideline #2-1 – Guideline for Voltage Analysis and Determination of Voltage-Based Transfer Limits, Version 2.0, dated November 18, 2012.
6. New York Independent System Operator, “Transmission Expansion and Interconnection Manual”, Attachment H: NYISO Transmission Planning Guideline #3-1 – Guideline for Stability Analysis and Determination of Stability-Based Transfer Limits, Version 2.0, dated November 18, 2012.
7. New York Independent System Operator, “Emergency Operations Manual”, Section 4.1.3 Procedure for Relief of Potential Overloads on Non-Secured Facilities, Version 6.16, dated September 4, 2013.
8. New York Independent System Operator, “Load and Capacity Data”, Revision Final, dated April 2013.

APPENDIX A

SCOPE

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ATTACHMENT A

SCOPE OF WORK

Additional Reliability Study

1. Purpose

The purpose of this Additional Reliability Study is to evaluate the impact of the retirement of the Ginna nuclear generation station on the reliability of the New York State Transmission System and the local transmission system. This study is being jointly performed by Rochester Gas and Electric Corporation ("RG&E") and the New York Independent System Operator ("NYISO") at the request of Exelon Corporation (the "Requestor") pursuant to Section 31.2 of Attachment Y to the NYISO Open Access Transmission Tariff ("OATT") and in accordance with ISO Procedures.

The Requestor has requested that the NYISO and RG&E conduct an additional reliability study that models the potential retirement of the plant prior to summer 2014.

The study will assess the impact on the base case power system and be conducted in accordance with the applicable NERC, NPCC, NYSRC, RG&E and Affected System(s) reliability and design standards; and in accordance with applicable NYISO and local TOs study guidelines, procedures and practices.

2. Study Period

The study will be based on the system represented in the Summer 2015 and Summer 2018 power flow base cases derived from the NYISO 2013 FERC 715 filing. The generation at Ginna will be retired and the plant load of about 5 MW will be served from Station 13A. The study will be conducted using applicable power flow, stability, and MARS databases provided by the NYISO, and will include the representation of facilities expected to be in-service during the Study Period. RG&E will review the power flow base cases to verify the accuracy of the system topology and local load distribution.

3. Study Area

The study will evaluate the impact of the retirement on the New York State Bulk Power Transmission Facilities and 115 kV transmission facilities in the Zones A-F which are most likely to be affected and on the local transmission system. Statewide resource adequacy will also be evaluated.

4. Base Case Conditions

The case will include the baseline system with the Ginna unit out of service, and generation will be re-dispatched in the power flow case in accordance with NYISO practices. The impact of the retirement will be evaluated for summer peak load for years 2015 and 2018. The NYISO and RG&E will conduct the analysis as outlined in section 5 for each of these two years sequentially and will report the preliminary results from the analysis conducted for the 2015 year via a conference call or in person meeting discussion with the Requestor prior to commencing work for the 2018 year.

The power flow analysis of the bulk power system will model the non-coincident summer peak loads for Zones A-F as provided in the NYISO 2013 Load & Capacity Data report. The power flow analysis of the non-bulk system will use the same model as will be used for the bulk power system, with the exception of modeling RG&E summer peak load as forecasted by RG&E. The resource adequacy analysis will model the statewide coincident summer peak load.

The Rochester Area Reliability Project will not be included in the 2015 case and will be included in the 2018 case. All Dunkirk generation units will be modeled out-of-service in the 2015 case and Dunkirk units 2, 3, and 4 will be modeled in-service in the 2018 case; associated local transmission upgrades will be modeled in-service in both cases. The Cayuga generation plant will be modeled in-service in the 2015 case and will be modeled out-of-service in the 2018 case with associated local transmission upgrades in-service.

5. Review and Analysis

Power flow and resource adequacy analyses will be conducted to assess the system performance under the Base System Conditions in accordance with Applicable Reliability Standards, Guidelines and study practices. Stability analysis may be conducted if deemed necessary by the three parties.

The analyses will also determine the incremental impact of the retirement on the normal and emergency transfer limits of the Dysinger-East and West-Central interfaces in accordance with Applicable Reliability Standards, Guidelines and study practices. NYISO transfer limits will be evaluated in the predominant west-to-east/north-to-south direction. Sufficient analyses will be conducted to determine the most limiting of the thermal or voltage limits under summer peak load conditions.

Modifications to Base Cases, during analyses, will be documented in the Study Report.

5.1 Power Flow Analyses

Thermal and voltage analyses will be performed for the Base Case Conditions in the Study Area. A study of contingencies mainly in Zones A-F will be performed, including N-1-1 non-simultaneous double contingencies.

5.2 Resource Adequacy Analysis

Resource adequacy analysis will be performed for the Base Case Conditions to determine the impact of the retirement on the New York Control Area ("NYCA") loss of load expectation ("LOLE").

5.2.1 Resource Adequacy Sensitivities

Resource adequacy analysis will also be performed for two sensitivities: (1) the 2015 case with Dunkirk units 2, 3, and 4 in-service; (2) the 2018 case with Huntley units out-of-service.

5.3 Stability Analysis

Stability analysis may be performed for the Base Case Conditions to determine the impact of the retirement on system performance. This analysis would evaluate the impact of the retirement on the dynamic stability transfer limits on Dysinger-East and West-Central interfaces.

6. Modeling Assumptions

6.1 Phase angle regulators ("PARs"), switched shunts, and LTC transformers will be modeled as regulating pre-contingency and non-regulating post-contingency. The study will use PAR schedules established by the NYISO in coordination with the neighboring ISOs through the NERC and NPCC base case development processes, and were modeled in the NYISO FERC 715 power flow base cases filed in 2013.

6.2 SVC and FACTS devices will be set to zero pre-contingency and allowed to operate to full range post-contingency.

6.3 In order to determine transfer limits, the analysis will simulate generation re-dispatches according to the standard proportions used in NYISO transmission planning and operating studies, for NYISO interfaces. Where applicable, for local (Transmission Owner) interfaces, generation re-dispatching will be done in accordance with Transmission Owner standards and practices.

7. Report

After completing the analyses described in section 5 of this Scope of Work, RG&E and the NYISO will review the analyses and the NYISO will prepare a study report that presents the results of this Additional Reliability Study while protecting from disclosure any and all Confidential Information as defined under Attachment F of the OATT. The Study Report will be prepared, following the report outline (as applicable) specified in the NYISO Transmission Planning Guideline #1.0. A final version of the Additional Reliability Study Report will be issued by the NYISO.

APPENDIX B

RG&E ANALYSIS

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2015 CASE

The non-BPS 2015 case analysis conducted at RG&E load level of 1857 MW yields the following:

RG&E PAR Setting

From Bus	To Bus	Ginna In-Service RG&E PARs Locked Base Case Values	Ginna Out-of-Service RG&E PARs Locked Base Case Values	Ginna Out-of-Service RG&E PARs Locked Adjusted Case Values
		MW	MW	MW
S42 115	PS S23	[redacted]	[redacted]	[redacted]
S124C913	PS1	[redacted]	[redacted]	[redacted]
S124C913	PS2	[redacted]	[redacted]	[redacted]

THERMAL VIOLATIONS

2015 Base Overloads

FACILITY	%NORMAL RATING		
	Ginna In-Service RG&E PARs Locked at Base Case Values	Ginna Out-of-Service RG&E PARs Locked at Base Case Values	Ginna Out-of-Service RG&E PARs Locked at Adjusted Case Values
[redacted]		[redacted]	[redacted]
[redacted]		[redacted]	[redacted]
[redacted]		[redacted]	

2015 N-1 Overloads

MONITORED FACILITY	CONTINGENCY	%LTE RATING		
		Ginna In-Service RG&E PARs Locked at Base Case Values	Ginna Out-of-Service RG&E PARs Locked at Base Case Values	Ginna Out-of-Service RG&E PARs Locked at Adjusted Case Values
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VOLTAGE VIOLATIONS

There are voltage violations both in the base case and under contingency in the 34.5 kV and lower voltage systems.

2018 CASE

The non-BPS 2018 case analysis conducted at RG&E load level of 1955 MW yields the following:

RG&E PAR Setting

From Bus	To Bus	Ginna In-Service RG&E PARs Locked Base Case Values	Ginna Out-of-Service RG&E PARs Locked Base Case Values	Ginna Out-of-Service RG&E PARs Locked Adjusted Case Values
		MW	MW	MW
S42 115	PS S23	[redacted]	[redacted]	[redacted]
S124C913	PS1	[redacted]	[redacted]	[redacted]
S124C913	PS2	[redacted]	[redacted]	[redacted]

THERMAL VIOLATIONS

2018 Base Overloads

FACILITY	%NORMAL RATING		
	Ginna In-Service RG&E PARs Locked at Base Case Values	Ginna Out-of-Service RG&E PARs Locked at Base Case Values	Ginna Out-of-Service RG&E PARs Locked at Adjusted Case Values
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[redacted]		[redacted]	
[redacted]			[redacted]

2018 N-1 Overloads

MONITORED FACILITY	CONTINGENCY	%LTE RATING		
		Ginna In-Service RG&E PARs Locked at Base Case Values	Ginna Out-of-Service RG&E PARs Locked at Base Case Values	Ginna Out-of-Service RG&E PARs Locked at Adjusted Case Values
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2018 N-1-1 Overloads

1st contingency	2nd contingency	Monitored Element	%LTE Contingency Loading
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
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VOLTAGE VIOLATIONS

N-1 analysis

There are voltage violations both in the base case and under contingency in the 34.5 kV and lower voltage systems.

N-1-1 analysis

Bus Name	Base kV	Pre-contingency voltage (pu)	Contingency voltage (pu)	1st Contingency	2nd Contingency
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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