

nationalgrid	Coordinated Electric System Interconnect Review	Doc. #SP.NY-304035 Page 1 of 11
	Distributed Energy Resources - NYSSIR	Version 1.0 –3/15/2021

For
Nexamp
2,500 kW Photovoltaic Generator System
55 Farnan Road
South Glens Falls, NY 12803

Interconnection to National Grid
NY East
Northeast Region
Glens Falls District
Farnan Road Substation
13.2 kV Feeder 47651

THIS DOCUMENT AND ANY ATTACHMENTS HERETO ("DOCUMENT") IS MADE AVAILABLE BY NATIONAL GRID UPON AND SUBJECT TO THE EXPRESS UNDERSTANDING THAT: (A) NEITHER NATIONAL GRID NOR ANY OF ITS OFFICERS, DIRECTORS, AFFILIATES, AGENTS, OR EMPLOYEES MAKES ANY WARRANTY, ASSURANCE, GUARANTY, OR REPRESENTATION WITH RESPECT TO THE CONTENTS OF THE DOCUMENT OR THE ACCURACY OR COMPLETENESS OF THE INFORMATION CONTAINED OR REFERENCED IN THE DOCUMENT, AND (B) NATIONAL GRID, ITS OFFICERS, DIRECTORS, AFFILIATES, AGENTS, AND EMPLOYEES SHALL NOT HAVE ANY LIABILITY OR RESPONSIBILITY FOR INACCURACIES, ERRORS, OR OMISSIONS IN, OR ANY BUSINESS OR POLICY DECISIONS MADE BY ANY DIRECT OR INDIRECT RECIPIENT IN RELIANCE ON, THIS DOCUMENT OR THE INFORMATION CONTAINED OR REFERENCED THEREIN; ALL SUCH LIABILITY IS EXPRESSLY DISCLAIMED.

nationalgrid	Coordinated Electric System Interconnect Review	Doc. #SP.NY-304035 Page 2 of 11
	Distributed Energy Resources - NYSSIR	Version 1.0 –3/15/2021

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1.0 INTRODUCTION	3
2.0 EXECUTIVE SUMMARY	3
3.0 COMPANY EPS PARAMETERS	4
4.0 INTERCONNECTION CUSTOMER SITE	5
5.0 SYSTEM IMPACT ANALYSIS	6
6.0 MITIGATIONS FOR SYSTEM IMPACT ANALYSIS FAILURES	9
7.0 CONCEPTUAL COST ESTIMATE	10

nationalgrid	Coordinated Electric System Interconnect Review	Doc. #SP.NY-304035 Page 3 of 11
	Distributed Energy Resources - NYSSIR	Version 1.0 –3/15/2021

1.0 INTRODUCTION

This report presents the analysis results of the Niagara Mohawk Power Corporation d/b/a National Grid (“National Grid” or the “Company”) interconnection study based on the proposed interconnection and design submittal from the Interconnection Customer in accordance with the National Grid electric System Bulletin No. 756, Appendix B ‘Distributed Generation Connected To National Grid Distribution Facilities Per The New York State Standardized Interconnection Requirements’. The intent of this report is to assess this project’s feasibility, determine its impact to the existing electric power system (EPS), determine interconnection scope and installation requirements, and determine costs associated with interconnecting the Interconnection Customer’s generation to the Company’s Electric Power System (EPS). This Coordinated Electric System Impact Review (CESIR) study; according to the NYSSIR Section I.C Step 6; identifies the scope, schedule, and costs specific to this Interconnection Customer’s installation requirements.

2.0 EXECUTIVE SUMMARY

The total estimated planning grade cost of the work associated with the interconnection of the Interconnection Customer is **\$208,037**.

The interconnection was found to be feasible with modifications to the existing Company EPS and operating conditions, which are described in detail in the body of this Study.

The ability to generate is contingent on this facility being served by the interconnecting circuit during normal Utility operating conditions. Therefore, if the interconnecting circuit is out of service, or if abnormal Utility operating conditions of the area EPS are in effect National Grid reserves the right to disengage the facility.

No future increase in generation output beyond that which specified herein for this interconnection has been studied. Any increase in system size and/or design change is subject to a new study and costs associated shall be borne by the Interconnection Customer. An increase in system size may also forfeit the Interconnection Customer’s existing queue position.

nationalgrid	Coordinated Electric System Interconnect Review	Doc. #SP.NY-304035 Page 4 of 11
	Distributed Energy Resources - NYSSIR	Version 1.0 –3/15/2021

3.0 COMPANY EPS PARAMETERS

Substation	Farnan Road
Transformer Name	TB1
Transformer Peak Load (kW)	3,333
Contingency Condition Load, N-1 Criteria (kW) (as applicable)	N/A
Daytime Light Load (kW)	1,177
Generation: Total, Connected, Queued Ahead (kW)	5,083; 70; 2,513
Contingency Condition Generation: Total, Connected, Queued Ahead (kW)	N/A
Supply Voltage (kV)	34,500
Transformer Summer Normal Rating (kVA)	5,250
Distribution Bus Voltage Regulation	Yes
Transmission GFOV Status	Installed
Bus Tie	None
Number of Feeders Served from this Bus	1

Connecting Feeder/Line	47651
Peak Load on feeder (kW)	3,333
Daytime Light Load on Feeder (kW)	1,177
Feeder Primary Voltage at POI (kV)	13.2
Line Phasing at POI	3
Circuit Distance from POI to Substation	0.21 miles
Distance to nearest 3-phase	N/A
Line Regulation	No
Line/Source Grounding Configuration at POI	Effective
Other Generation: Total, Connected, Queued Ahead(kW)	5,083; 70; 2,513

System Fault Characteristics without Interconnection Customer DG at POI	
Interconnection Customer POI Location	Pole 5, Farnan Road
I 3-phase (3LLL)	2,692 Amps
I Line to Ground (3I0)	2,840 Amps
Z1 (100 MVA base)	0.25020 + j1.66509 PU
Z0 (100 MVA base)	0.10747 + j1.41938 PU

nationalgrid	Coordinated Electric System Interconnect Review	Doc. #SP.NY-304035 Page 5 of 11
	Distributed Energy Resources - NYSSIR	Version 1.0 –3/15/2021

4.0 INTERCONNECTION CUSTOMER SITE

The Interconnection Customer is proposing a new primary service connection with Account No. 29106-43035.

This location is presently served via National Grid's radial 13.2 kV feeder 47651 from the Farnan Road substation.

The proposed generating system consists of:

- A PV system (DC) consisting of seven-thousand eight-hundred and seventy-eight (7,878) JA Solar JAM72D09-385/BP PV modules (385W) – for a total DC system size of 3,033.33 kW_{DC}.
- One (1) SMA, SC4000-UP-US, central inverter (derated to 2,500 kW_{AC}, 600 V_{AC} output, UL 1741 listed, IEEE1547 certified) – for a total system size of 2,500 kW_{AC} connected to:
- One (1) 2,500 kVA, 13,200/600 V, Wye-G/Delta step-up transformer with Z = 5.75%, X/R = 6.8 with an associated 15 Ohm neutral grounding reactor.
- Customer-owned riser pole (Pole C1).
- Customer-owned pole (Pole C2) with customer-owned lightning arrestors, a group of 14.4 kV, 300 Amp, solid blade cutouts, and a customer-owned primary meter.
- Customer-owned pole (Pole C3) with pole-mounted utility-owned primary meter.
- Customer-owned pole (Pole C4) with customer-owned lightning arrestors and 14.4 kV rated 125 Amp, Type E fuses in cutouts.
- Customer-owned pole (Pole C5) with customer-owned lightning arrestors and gang operated, lockable, disconnect switch.

nationalgrid	Coordinated Electric System Interconnect Review	Doc. #SP.NY-304035 Page 6 of 11
	Distributed Energy Resources - NYSSIR	Version 1.0 –3/15/2021

5.0 SYSTEM IMPACT ANALYSIS

Category	Criteria	Limit	Result
Voltage	Overtoltage	< 105% (ANSI C84.1)	Pass
With the addition of the subject generator the maximum voltage as modeled on the feeder is 104.25% of nominal.			
Voltage	Undervoltage	> 95% (ANSI C84.1)	Pass
With the addition of the subject generator the minimum voltage as modeled on the feeder is 99.4% of nominal.			
Voltage	Substation Regulation for Reverse Power	<100% minimum load criteria	Fail
The total generation on Feeder 47651 is 5.083 MW. The total minimum load on this Feeder is 1.177 MW. Therefore, the generation to load ratio is 431.9%.			
Solution: Under a prior project in queue, the station regulator bank will need to be replaced with bi-directional, co-generation capabilities. If the prior project in queue does not proceed to construction, the subject generator will be responsible for the costs.			
Voltage	Feeder Regulation for Reverse Power	<100% Minimum load to generation ratio	Pass
There are no voltage regulators between the POI and the substation.			
Voltage	Fluctuation	<3% steady state from proposed generation on feeder, <5% steady state from aggregate DER on substation bus	Pass
The greatest voltage fluctuation on the feeder occurs at the pole 6 off of Henry Road. The resulting fluctuation at the feeder location is 1.82% due to the proposed generation and 0.001% on the substation bus due to the aggregate generation.			
Voltage	Flicker	Screen H Flicker	Pass
The Pst for the location with the greatest voltage fluctuation is 0.238 and the emissions limit is 0.350.			
Equipment Ratings	Thermal (continuous current)	< 100% thermal limits	Pass
The subject generator's full output current is 109 Amps.			
The total full output current of all DER downstream of the 336 MCM PE AL OH conductor is 113 Amps. The OH conductor between the station and POI is 336 MCM PE AL with a rating of 365 Amps.			
The total full output current of all DER downstream of the 5 MVA station transformer is 222 Amps. The 5 MVA station transformer thermal capabilities are 219 Amps.			
All equipment is within published thermal limits under minimum load conditions.			

nationalgrid	Coordinated Electric System Interconnect Review	Doc. #SP.NY-304035 Page 7 of 11
	Distributed Energy Resources - NYSSIR	Version 1.0 –3/15/2021

Category	Criteria	Limit	Result
Equipment Ratings	Withstand (fault current)	<90% withstand limits	Pass
The additional fault current contribution from the generation does not contribute to interrupting ratings in excess of existing EPS equipment.			
Protection	Unintentional Islanding	Unintentional Islanding Document & Company Guidelines	Fail
The subject generator is a 2.5 MW PV generation system. The subject generation exceeds the Company's criteria for islanding a distributed resource under light load conditions and will require a National Grid protection and control package.			
Protection	Protective device coordination	Company Guidelines	Pass
There are no protective devices between the subject generator's POI and the substation. The proposed Customer owned 125E fuses for site overcurrent protection provide adequate coordination with upstream devices on the Company's EPS.			
Protection	Fault Sensitivity	Rated capabilities of EPS equipment	Pass
Fault studies show that contribution from the subject generator for faults on the feeder will not have a significant increase in fault current seen by utility equipment. Aggregate source fault contribution with the addition of the subject generator is within the rated capabilities of EPS equipment.			
Protection	Ground Fault Detection	Reduction of reach > 0%	Fail
The Interconnection Customer has proposed one 2,500 kVA grounded wye primary – delta secondary interconnecting transformer with an impedance of 5.75% and X/R ratio of 6.8 equipped with a 15 Ohm neutral grounding reactor. To be within Company guidelines, the neutral grounding reactor shall have an impedance of 13 Ohms. With this neutral grounding reactor in service, the Interconnection Customer will contribute approximately 72 Amps of 310 current to remote bolted line to ground faults and 163 Amps to faults at the PCC.			
Protection	Overvoltage - Transmission System Fault	Company 3V0 criteria	Fail
The generation to load ratio on the serving distribution system has failed the Company's planning threshold in which transmission ground fault overvoltage become an electrical hazard due to the distribution source contribution. An evaluation of the existing EPS has been performed and it has been determined that setting changes are required to enable previously installed DTT at the Farnan Road station from the adjacent Mohican station which when enabled will provide adequate protection to the EPS. Solution: Under a prior project in queue, setting changes were required to enable previously installed DTT at the Farnan Road station from the adjacent Mohican station. If the prior project in queue does not proceed to construction, the subject generator will be responsible for the costs.			

nationalgrid	Coordinated Electric System Interconnect Review	Doc. #SP.NY-304035 Page 8 of 11
	Distributed Energy Resources - NYSSIR	Version 1.0 –3/15/2021

Category	Criteria	Limit	Result
Protection	Overvoltage - Distribution System Fault	< 125 % voltage rise	Pass
With subject generator interconnected the modeled voltage rise on the unfaulted phases of the system is 119.1%.			
Protection	Effective Grounding	$R0/X1 < 1$ and $X0/X1 < 3$	Pass
With subject generator interconnected the modeled $R0/X1$ is 0.59442 PU and the $X0/X1$ is 1.73699 PU.			
SCADA	Required EMS Visibility for Generation Sources	Monitoring & Control Requirements	Fail
The 2.5 MW subject generator triggers the requirement for SCADA reporting to the Utility.			
Other			
N/A			

nationalgrid	Coordinated Electric System Interconnect Review	Doc. #SP.NY-304035 Page 9 of 11
	Distributed Energy Resources - NYSSIR	Version 1.0 –3/15/2021

6.0 MITIGATIONS FOR SYSTEM IMPACT ANALYSIS FAILURES

Detail below is intended to provide sufficient information and clarity to give the Interconnection Customer an understanding to the relationship of costs and scope associated with the DER interconnection and the system modifications due to the DER impact. Where scope items are identified, associated labor, equipment rentals and indirect project support functions (such as engineering and project management) are intended and implied.

Upgrade Required	Option 1 – 2.5 MW	Failures Addressed
National Grid Protection and Control Package (Recloser, Switches, Poles, and SCADA Integration)	\$103,920	Unintentional Islanding
*Farnan Road Station Recloser Setting Changes	\$3,000	Enable DTT between Mohican and Farnan Rd. Stations for GFOV Protection
*Replace station voltage regulators with a like sized bank with bi-directional, co-generation capabilities.	\$83,117	Substation Regulation for Reverse Power

*These upgrades are required for a prior in-queue DG (Case #294530). The subject generator will only be responsible for these costs if the prior in-queue DG does not proceed to Construction.

Additional details on the scope of each option can be found below:

Option 1:

The substation upgrades required to facilitate the proposed installation include the following:

- *Replace the platform mounted bank of 3-167 kVA voltage regulators at the station with a new set of 3-167 kVA voltage regulators with bi-directional, co-generation capabilities.
- *Setting changes at the Farnan Road station to enable Direct Transfer Trip (DTT) to the Mohican station for Ground Fault Overvoltage (GFOV) protection.

The Distribution upgrades required to facilitate the proposed installation include the following:

- National Grid Protection and Control Package (Recloser, Switches, Poles, and SCADA Integration).

*These upgrades are required for a prior in-queue DG (Case #294530). The subject generator will only be responsible for these costs if the prior in-queue DG does not proceed to Construction.

nationalgrid	Coordinated Electric System Interconnect Review	Doc. #SP.NY-304035 Page 10 of 11
	Distributed Energy Resources - NYSSIR	Version 1.0 –3/15/2021

7.0 CONCEPTUAL COST ESTIMATE

The following items are a good faith estimate for the scope and work required to interconnect the project estimated under rates and schedules in effect at the time of this study in accordance with the most recent version of the New York State Standardized Interconnection Requirements (“SIR”).

Planning Grade Estimate

National Grid Work Segment	Planning Grade Cost Estimate not including Tax Liability					Capital portion for calculating tax liability	Tax Liability Applied to Capital	Customer Cost Total
Distribution Modifications	Material	Labor	Overheads	Pre-Tax	Total \$	Capital Costs	14.07%	Total \$
National Grid Protection and Control Package (Recloser, Switches, Poles, and SCADA Integration)	\$ 37,478	\$ 16,566	\$ 37,415	\$ 91,459	\$	88,816	\$ 12,461	\$ 103,920
Substation Modifications	Material	Labor	Overheads	Pre-Tax	Total \$	Capital Costs	14.14%	Total \$
*Replace and install a 3-167kVA regulator bank platform mounted at the station with bi-directional, co-generation capabilities	\$ 35,003	\$ 11,994	\$ 27,421	\$ 74,418	\$	61,999	\$ 8,699	\$ 83,117
*Farnan Rd Station Recloser Setting Changes	\$ -	\$ 3,000	\$ -	\$ 3,000	\$	-	\$ -	\$ 3,000
Non-System Costs	Material	Labor	Overheads	Pre-Tax	Total \$	Capital Costs	0.00%	Total \$
Customer Documentation Review, Field Verification and Witness Testing	\$ -	\$ 12,000	\$ 6,000	\$ 18,000	\$	-	\$ -	\$ 18,000
Total Project Costs:	\$ 72,481	\$ 43,560	\$ 70,836	\$ 186,877	\$	150,815	\$ 21,160	\$ 208,037
Dline Summary	\$ 37,478	\$ 28,566	\$ 43,415	\$ 109,459	\$	88,816	\$ 12,461	\$ 121,920
Station Summary	\$ 35,003	\$ 14,994	\$ 27,421	\$ 77,418	\$	61,999	\$ 8,699	\$ 86,117
Total	\$ 72,481	\$ 43,560	\$ 70,836	\$ 186,877	\$	150,815	\$ 21,160	\$ 208,037

*These upgrades are required for a prior in-queue DG (Case #294530). The subject generator will only be responsible for these costs if the prior in-queue DG does not proceed to Construction.

Notes:

- These estimated costs are based upon the results of this study and are subject to change. All costs anticipated to be incurred by the Company are listed.
- The Company will reconcile actual charges upon project completion and the Interconnection Customer will be responsible for all final charges, which may be higher or lower than estimated according to the SIR I.C step 11.
- This estimate does not include the following:
 - additional interconnection study costs, or study rework
 - additional application fees,
 - applicable surcharges,
 - property taxes,
 - overall project sales tax,

nationalgrid	Coordinated Electric System Interconnect Review	Doc. #SP.NY-304035 Page 11 of 11
	Distributed Energy Resources - NYSSIR	Version 1.0 –3/15/2021

- future operation and maintenance costs,
 - adverse field conditions such as weather and Interconnection Customer equipment obstructions,
 - extended construction hours to minimize outage time or Company's public duty to serve,
 - the cost of any temporary construction service, or
 - any required permits.
4. Cost adders estimated for overtime would be based on 1.5 and 2 times labor rates if required for work beyond normal business hours. Per Diems are also extra costs potentially incurred for overtime labor.