For

Interconnection Customer: Delaware River Solar, LLC

Applicant: Rosario Giufre

5000 kW Solar Generator System

State Route 42, Forestburgh NY 12777

Interconnection to Orange & Rockland Utilities

NY Western Division

Mongaup Substation

13.2 kV Feeder 2-1-13

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1.0 INTRODUCTION

This report presents the analysis results of the Orange and Rockland Utilities ("Orange and Rockland" or the "Company") interconnection study based on the proposed interconnection and design submittal from the Interconnection Customer in accordance with the Company CESIR Study Requirements Rev. 1.9. 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 New York State Standardized Interconnection Requirements (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 **$494,297.**

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 study was performed between daylight hours of 08:00-20:00 hrs.

3.0 COMPANY EPS PARAMETERS

Substation	Mongaup
Transformer Name (list multiple where normally tied to common bus)	12
Transformer Peak Load (kW)	2970.62
Contingency Condition Load, N-1 Criteria (kW) (as applicable)	N/A
Daytime Light Load (kW)	311
Generation: Total, Connected, Queue (kW)	5315, 315, 5000
Contingency Condition Generation: Total, Connected, Queue (kW)	N/A
Supply Voltage (kV)	69
Transformer Maximum Nameplate Rating (kVA)	7500
Distribution Bus Voltage Regulation	LTC
Transmission GFOV Status	Not Installed
Bus Tie	None
Number of Feeders Served from this Bus	1

Connecting Feeder/Line	2-1-13
Peak Load on feeder (kW)	N/A
Daytime Light Load on Feeder (kW)	311
Feeder Primary Voltage at POI (kV)	13.2
Line Phasing at POI	3
Circuit distance from POI to substation	2.70 miles
Distance from POI to nearest 3-phase, (if applicable)	N/A
Line Regulation	N
Line/Source Grounding Configuration at POI	Effective
Other Generation: Total, Connected, Queue (kW)	5315, 315, 5000

System Fault Characteristics without Interconnection Customer DG at POI with System Upgrades described in Section 6	
Interconnection Customer POI Location (Pole X/Y)	38745/56909
I 3-phase (3LLL)	2167 Amps
I Line to Ground (3I0)	2026 Amps
Z1 (100 MVA base)	0.3631 + j2.1522 PU
Z0 (100 MVA base)	0.7114 + j2.4123 PU

4.0 INTERCONNECTION CUSTOMER SITE

The Interconnection Customer is proposing a new primary service connection at a new customer location. The service voltage is 13.2kV. The proposed point of interconnection (POI) is on Feeder 2-1-13 supplied from Transformer Bank #12 at the Mongaup substation. The POI is on a three-phase line section.

The proposed 5000kW generating system consists of:

- 11,520 PV modules each rated 585 Watts.
- 2 Inverters each rated 2500 kW at 600 Volts (SUNGROW, SG3425UD-MV)
- 2 Generator Step Up transformers, 3425 kVA, YG-Y winding configuration, 13200 primary volts, 600 secondary volts.

5.0 SYSTEM IMPACT ANALYSIS

The analysis was run at the rated project size in normal system configuration connected to the feeder 2-1-13. The following table shows the impact study results of 5000 kW at 1.0 power factor project interconnecting to the distribution system.

#	Category	Criteria	Limit	Result
1	Voltage	Overvoltage	< 105% (ANSI C84.1)	Fail
	With the addition of the subject generator the maximum voltage as modeled on the Feeder is 105% of nominal.			
2	Voltage	Undervoltage	> 95% (ANSI C84.1)	Pass
	With the addition of the subject generator the minimum voltage as modeled on the Feeder is 0.99% of nominal.			
3	Voltage	Substation Regulation for Reverse Power	<100% minimum load criteria	Fail
	The total generation on project Bank #12 is 5.32 MW. The total minimum load on the Bank is 0.31 MW. Therefore, the generation to load ratio is 1710.14%.			
4	Voltage	Feeder Regulation for Reverse Power	<100% Minimum load to generation ratio	Pass
	Not applicable (no feeder voltage regulators upstream of the subject project).			
5	Voltage	Fluctuation	<3% steady state from proposed generation on feeder	Pass
	The greatest voltage fluctuation on the feeder occurs at: POI The resulting fluctuation at the feeder location is 0.92% due to this project's generation output stepping from 0% to 100%.			
6	Voltage	Fluctuation	<5% steady state from aggregate DER on substation bus	Pass
	The maximum component voltage fluctuation on the system is 2.75% due to all generation output stepping from 0% to 100%.			
7	Voltage	Fluctuation	Regulator tap movement exceeds 1 position, generation change of 75% of nameplate rating does not result in voltage change > ½ the bandwidth of any feeder voltage regulating device.	Pass
	The greatest voltage fluctuation on the feeder occurs at Voltage regulator cmp 99980945. The resulting fluctuation at the feeder location is 0.45V due to the proposed generation while the limit is 2V.			

#	Category	Criteria	Limit	Result
8	Voltage	Flicker	Screen H Flicker	Pass
	The Pst for the location with the greatest voltage fluctuation is 0.29 and the emissions limit is 0.35.			
9	Equipment Ratings	Thermal (continuous current)	< 100% thermal limits assuming no load	Fail
	The subject generator's full output current is 218.69 A. The total full output current of all DER downstream of 3P Fuse cmp 1568019 is approx. 217 A. 3P Fuse cmp 1568019 thermal capabilities are 100A.			
10	Equipment Ratings	Withstand (fault current)	<90% withstand limits	Fail
	A detailed Effective Grounding, Protection, and Coordination study is required.			
11	Protection	Unintentional Islanding	Unintentional Islanding Document & Company Guidelines	Pass
	The subject generator is a 5 MW PV generation system. The study passes this screen.			
12	Protection	Protective device coordination	Company Guidelines	Fail
	A detailed Effective Grounding, Protection, and Coordination study is required.			
13	Protection	Fault Sensitivity	Rated capabilities of EPS equipment	Fail
	A detailed Effective Grounding, Protection, and Coordination study is required.			
14	Protection	Ground Fault Detection	Reduction of reach > 10% (by Utility)	Fail
	A detailed Effective Grounding, Protection, and Coordination study is required.			
15	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 protection mitigation methods are required.			
16	Protection	Overvoltage - Distribution System Fault	< 138% voltage rise	Fail
	A detailed Effective Grounding, Protection, and Coordination study is required.			
17	Protection	Effective Grounding	IEEE C62.92.6 Coefficient of Grounding <0.8	Fail
	A detailed Effective Grounding, Protection, and Coordination study will be conducted to verify effective grounding and recommend a grounding transformer accordingly.			
18	SCADA	Required EMS Visibility for Generation Sources	Monitoring & Control Requirements	Yes
	The 5 MW subject generator triggers the requirement for SCADA reporting to the Utility.			

#	Category	Criteria	Limit	Result
19	Auto-Loop or Other			Pass
	N/A			

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. This includes any required EPS equipment upgrades. 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	Failures Addressed
• 3V0 protection and reverse power capability are needed at substation.	Substation Regulation for Reverse Power;
• Change the Tap of Step Transformer UID 7234757 from 1.0 to 0.975.	Overvoltage Violations;
• Replace existing (3) – 100k fuse links at pole 38591/56499 with a new Recloser	Thermal Violations;
• Perform detailed grounding and protection study	Protective device coordination, Fault sensitivity, Ground fault detection, Effective grounding
• Install primary metering at PCC	Monitoring and control
• Install electronic recloser at PCC	Monitoring and control
• Power Quality Metering/SCADA communications and reporting for proposed DG site	Monitoring and control

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

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

- Install 3V0 protection.
- Reverse power flow capability needs to be addressed.
- Upgrade existing substation meter with bi-directional meter.

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

- Replace existing (3) – 100k fuse links at pole 38591/56499 with a new Recloser.
- Change the Tap Step Transformer UID 7234757 from 1.0 to 0.975.
- Install electronic recloser at the PCC

This study was conducted based upon this facility being served by the interconnecting circuit during normal utility operating conditions. The terms, conditions, notification requirements, and other obligations of both the Company and the facility pertaining to disconnection of the facility are set forth in the applicable section(s) of the NYSSIR and the Interconnection Agreement that will be executed for the project(s) that were studied in this CESIR. Any change in system size and/or design is subject to the requirements of the NYSSIR, as well as supplemental documents developed by the Interconnection Technical Working Group and Interconnection Policy Working Group.

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 NYSSIR.

Distribution Planning Grade Estimate

Description	Cost
Install new 477 Conductor (3-phase, 200ft)	$7,800
Install Recloser (2)	$160,000
Junction Pole, Corner Pole, Riser Poles, Fuses	$5,000
Install Primary Metering Cluster	$6,800
Commissioning Time Post Installation	$5,500
Submittal Review, Redbook development, Site Inspections	$5,000
Power Quality Meter/SCADA Monitoring	$40,000
Contingency (15%)	$34,515
Total Distribution Estimate	**$264,615**

Substation Costs: $3V_0$ installation

Description	Cost
Engineering	$24,000
Design/Drafting	$15,750
ECC	$10,400
Substation Operations - Electricians	$84,150
Substation Operations - Relay Techs	$66,500
Relay and/or Panels	$41,200
Connectors	$2,225
Control Wire & Misc - Stores	$8,500
Contingency (15%)	$37,909
Total Substation Estimate	**$290,634**

Market-Initiated Cost Sharing 2.0 is applicable to the 3V0 installation. The project will be responsible for a Pro-Rata Share of the Qualifying Upgrade Cost based on kW Capacity.

CDG-00525 3V0 Cost Share: (5000kW/7189kW Capacity) * $290,634 = **$202,138**

Substation Costs: Bidirectional Metering

Description	Cost
Engineering	$2,400
Design/Drafting	$3,360
ECC	$5,200
Substation Operations - Electricians	$2,496
Substation Operations - Relay Techs	$2,512
Bitronics Meters	$6,180
Connectors	$103
Control Wire & Misc - Stores	$1,700
Contingency (15%)	$3,593
Total Substation Estimate	**$27,544**

The total interconnection cost estimate: $264,615 + $202,138 + $27,544 = **$494,297.**

Notes:

1. 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.
2. 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 NYSSIR I.C step 11.
3. 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,
   - 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.

8.0 REVISION HISTORY

Revision	Date	Description of Revision
1.0	08/23/2023	Initial document