For

Interconnection Customer: Delaware River Solar, LLC

Applicant: Rosario Giufre

2,700 kW Solar Generation System

305 Oakland Valley Road, Deerpark NY 12729

Interconnection to Orange & Rockland Utilities

NY Western Division

Cuddebackville Substation

34.5 kV Feeder 5-3-34

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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. 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 **$1,707,119.**

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 0800-2000 hours.

3.0 COMPANY EPS PARAMETERS

3.1 Current System Configuration

Substation	Cuddebackville
Transformer Name (list multiple where normally tied to common bus)	Bank 15
Transformer Peak Load (kW)	20,250
Contingency Condition Load, N-1 Criteria (kW) (as applicable)	n/a
Daytime Light Load (kW)	8,190
Generation: Total, Connected, Queued Ahead (kW)	40,920; 2,918; 38,004
Contingency Condition Generation: Total, Connected, Queued Ahead (kW)	n/a
Supply Voltage (kV)	69
Transformer Maximum Nameplate Rating (kVA)	35,000
Distribution Bus Voltage Regulation	Yes
Transmission GFOV Status	Not installed
Bus Tie	Closed
Number of Feeders Served from this Bus	3

Connecting Feeder/Line	5-3-34
Peak Load on feeder (kW)	9,820
Daytime Light Load on Feeder (kW)	3,400
Feeder Primary Voltage at POI (kV)	34.5
Line Phasing at POI	3
Circuit distance from POI to substation	2.08 miles
Distance from POI to nearest 3-phase, (if applicable)	n/a
Line Regulation	No
Line/Source Grounding Configuration at POI	Effective
Other Generation: Total, Connected, Queued Ahead (kW)	24,554; 354; 24,200

System Fault Characteristics without Interconnection Customer DG at POI with System Upgrades described in Section 6	
Interconnection Customer POI Location (Pole X/Y)	Pole 42300/53742
I 3-phase (3LLL)	3,184 Amps
I Line to Ground (3I0)	3,173 Amps
Z1 (100 MVA base)	0.1325 + j0.5359[p.u.]
Z0 (100 MVA base)	0.1574 + j0.5264[p.u.]

4.0 INTERCONNECTION CUSTOMER SITE

The Interconnection Customer is proposing a new primary service connection at a new customer location. The service voltage is 34.5 kV. The applicant proposes installing one Solar Generation System with AC power rating of 2,700 kW. The proposed solar project is interfaced with one (1) inverter and one (1) medium voltage transformer.

The proposed point of interconnection (POI) is on Feeder 5-3-34 supplied from Transformer Bank #15 at the Cuddebackville substation. The POI is on a three-phase line section. Approximately 1.5 miles must be converted from 2.4 kV to 34.5 kV to interconnect the project.

The study was performed between the hours of 0800-2000 hours.

The proposed 2,700 kW solar generation system consists of:

- One (1) SUNGROW SG 3425 UD-MV Inverter (limited to 2,700 kW) at 600 Volts AC.
- One Generator Step Up transformer, 3,425 kVA, grounded wye primary and wye secondary winding configuration, 34,500 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 5-3-34. The following table shows the impact study results of 2,700 kW at 1.0 power factor project interconnecting to the distribution system.

#	Category	Criteria	Limit	Result
1	Voltage	Overvoltage	< 105% (ANSI C84.1)	Pass
	With the addition of the subject project the maximum voltage as modeled on the Feeder is 104.5% of nominal.			
2	Voltage	Undervoltage	> 95% (ANSI C84.1)	Fail
	With the addition of the subject project the minimum voltage as modeled on the Feeder is 85.5% of nominal. These low voltage violations are pre-existing.			
3	Voltage	Substation Regulation for Reverse Power	<100% minimum load criteria	Fail
	The total generation on Bank #15 is 40.92 MW. The minimum load on this substation bank is 8.19 MW. The generation to load ratio is 499.64%.			
4	Voltage	Feeder Regulation for Reverse Power	<100% Minimum load to generation ratio	n/a
	Not applicable (no feeder voltage regulation installed)			
5	Voltage	Fluctuation	<3% steady state from proposed generation on feeder	Pass
	The greatest voltage fluctuation on the feeder occurs at proposed project POI. The resulting fluctuation at the POI is 1.00% due to the proposed project.			
6	Voltage	Fluctuation	<5% steady state from aggregate DER on substation bus	Pass
	The maximum component voltage fluctuation on the system is 4.40% 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
	There are two voltage regulators on the study feeder. The maximum voltage fluctuation is 0.4V which is less than the 1/2 BW limit of 2 V of the respective voltage regulator.			
8	Voltage	Flicker	Screen H Flicker	Pass
	The Pst for the location with the greatest voltage fluctuation is 0.011 and the emissions limit is 0.35.			

#	Category	Criteria	Limit	Result
9	Equipment Ratings	Thermal (continuous current)	< 100% thermal limits assuming no load	Fail
	The subject generator's full output current is 45.18 A. The Fuse at cmp 2849715 (size: 25K) is overloaded with the proposed project online.			
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	Fail
	The rating of subject project is 2.7 MW. The total generation, including the proposed interconnection of 2.7 MW, exceeds the 2/3 of the minimum feeder loading and substation loading. The generation to minimum load ratio for a possible feeder island is 722.17% and a possible substation island is 499.64%. Also, no single inverter manufacturer makes up at least 2/3 of the total inverter capacity in the potential islands.			
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
	The proposed system interconnection transformers' winding configuration is Yg (primary) – Y (secondary). The utility will verify and evaluate the impact of proposed project on reduction of reach by conducting a detailed Effective Grounding, Protection, and Coordination study.			
15	Protection	Overvoltage - Transmission System Fault	Company 3V0 criteria	Pass
	The generation to load ratio on the serving distribution system has not satisfied the Company's planning threshold in which transmission ground fault overvoltage become an electrical hazard due to the distribution source contribution. Primary side of Bank #15 is Yg and will not require 3V0 protection. An evaluation of the existing EPS has been performed and it has been determined that protection mitigation methods are not 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
	With subject project interconnected the modeled R0/X1 is 0.29 PU and the X0/X1 is 0.98 PU; The proposed system interconnection transformers' winding configuration is Yg (primary) – Y (secondary). A detailed Effective Grounding, Protection, and Coordination study will be conducted to verify effective grounding and recommend a grounding transformer accordingly.			

#	Category	Criteria	Limit	Result
18	SCADA	Required EMS Visibility for Generation Sources	Monitoring & Control Requirements	Yes
	The 2.7 MW subject project triggers the requirement for SCADA reporting to the Utility.			
19	Auto-Loop			Fail
	The study feeder has an auto-loop connection to feeder 109-4-34. The Supplemental Screens fail when the proposed project connects to the alternate feeder 109-4-34.			

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
Relocate step down transformer at cmp 2873640 to line section right after cmp 1126395 (POI) to convert area to 34.5 kV	Construction to facilitate the interconnection
Upgrade station LTC controls	Reverse power flow at substation
Upgrade station metering	Reverse power flow at substation
Upgrade fuse cutout size at cmp 2849715 or replace with solid blades	Equipment thermal rating
Perform detailed grounding and protection study	Protective device coordination, Fault sensitivity, Ground fault detection, Effective grounding
Install electronic recloser	Monitoring & Control
Install primary metering cluster	Monitoring & Control
Design and Inspections	Monitoring & Control
Commissioning Time Post Installation & Monitoring	Monitoring & Control
Reclose delay	Risk of islanding
Disconnect the proposed project while operating in auto-loop configuration connected to feeder 109-4-34	Auto-Loop 3V0 screen

Additional details on the scope of mitigations can be found below:

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

- Upgrade station Bank #15 LTC controls to work properly with the reverse power flow.
- Upgrade the existing substation Bank #15 meter with a bi-directional meter.

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

- Relocate step transformer at cmp 2873640 to line section right after cmp 1126395 (POI) to convert area to 34.5 kV
- Install an electronic recloser at the POI.
- Upgrade fuse cutout size at cmp 2849715 or replace with solid blades.
- A detailed grounding and protection study is required to evaluate sensitivity, reduction of reach, protection coordination, and effective grounding.
- Implement reclose delay on upstream protective devices to avoid reclosing into live island.
- Disconnect the proposed project while operating in auto-loop configuration connected to feeder 109-4-34.

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

477 Conductor Upgrade (3-phase, 7600 feet)	$957,600
477 Conductor New Install (3-phase, 400 feet)	$15,600
Installing Junction Pole (2)	$20,000
Installing Sensing xFmrs (2)	$25,000
Installing Large Step xFmr (3)	$150,000
Installing Small xFmr (4)	$40,000
Installing Recloser (2)	$170,000
Installing GOAB Switch (1)	$25,000
Primary Metering Cluster Installation	$6,800
Commissioning Time Post Installation	$5,500
Design and Inspections	$5,000
SCADA Monitoring/Power Quality Meter	$40,000
Contingency (15%)	$219,075
Total Distribution Estimate	**$1,679,575**

Substation Metering Upgrade Estimate

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: $1,679,575 + $27,544 **= $1,707,119**

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	06/30/2023	Initial document