For
Interconnection Customer: OYA Pine Grove Road
Applicant: OYA Solar NY L.P.
2,100 kW Solar Generation System
194 Pine Grove Road, Middletown NY 10940
Interconnection to Orange & Rockland Utilities
NY West Division
Washington Heights Substation
13.2 kV Feeder 109-2-13

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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. 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 **$242,765***.

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 day hours of 0800-2000 hours.

3.0 COMPANY EPS PARAMETERS

Substation	Washington Heights
Transformer Name (list multiple where normally tied to common bus)	Bank 2109
Transformer Peak Load (kW)	16210
Contingency Condition Load, N-1 Criteria (kW) (as applicable)	N/A
Daytime Light Load (kW)	4440
Generation: Total, Connected, Queued Ahead (kW)	9316 , 1316 , 8000
Contingency Condition Generation: Total, Connected, Queued Ahead (kW)	N/A
Supply Voltage (kV)	69
Transformer Maximum Nameplate Rating (kVA)	25000
Distribution Bus Voltage Regulation	yes
Transmission GFOV Status	not installed
Bus Tie	open
Number of Feeders Served from this Bus	3

Connecting Feeder/Line	109-2-13
Peak Load on feeder (kW)	4140
Daytime Light Load on Feeder (kW)	1370
Feeder Primary Voltage at POI (kV)	13.2
Line Phasing at POI	3
Circuit distance from POI to substation	5.02 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, Queued Ahead (kW)	8475 , 475 , 8000

System Fault Characteristics without Interconnection Customer DG at POI with System Upgrades described in Section 6	
Interconnection Customer POI Location (Pole X/Y)	46515/54578
I 3-phase (3LLL)	1846 Amps
I Line to Ground (3I0)	1422 Amps
Z1	1.1078 + j4.2586 Ohms
Z0	2.7466 + j7.9002 Ohms

4.0 INTERCONNECTION CUSTOMER SITE

The Interconnection Customer is proposing a new primary service connection at a new customer location. The service voltage is 13.2 kV. The applicant proposes installing one Solar Generation System with AC power rating of 2,100 kW. The proposed solar project is interfaced with one inverter and one (1) medium voltage transformer.

The proposed POI is on Feeder 109-2-13 supplied from Transformer Bank #2109 at the Washington Heights substation. The POI is on a three-phase line section.

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

The proposed 2,100 kW PV system consists of:

- 1 Power Electronics HEMK FS2865K Inverter derated to 2,865 kVA at 600 Volts AC.
- 1 Generator Step Up transformer, 2,100 kVA, grounded wye primary and delta secondary winding configuration, 13,200 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 109-2-13. The following table shows the impact study results of 2,100 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 generator the maximum voltage as modeled on the Feeder is 104.3% 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 99.9% of nominal.			

3	Voltage	Substation Regulation for Reverse Power	<100% minimum load criteria	Fail
	The total generation on Feeders [109-1-13, 109-2-13, 109-3-13] is 9.316 MW. The total minimum load on these Feeders is 4.44 MW. Therefore, the generation to load ratio is 209%.			
4	Voltage	Feeder Regulation for Reverse Power	<100% Minimum load to generation ratio	n/a
	No Voltage Regulators located on Feeder 109-2-13			
5	Voltage	Fluctuation	<3% steady state from proposed generation on feeder	Pass
	The greatest voltage fluctuation on the feeder occurs at the POI. The resulting fluctuation at the feeder location is 2.0% due to this project's generation output stepping from 100% to 0%.			
6	Voltage	Fluctuation	<5% steady state from aggregate DER on substation bus	Pass
	The maximum component voltage fluctuation on the system is 2.7% 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
	Feeder 109-2-13 does not contain any voltage regulators. Interconnecting the project at 2.1 MW and Unity PF caused no change in LTC tap position or switched capacitor state.			
8	Voltage	Flicker	Screen H Flicker	Pass
	The Pst for the location with the greatest voltage fluctuation is 0.19 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 A per phase. Interconnection of the 2.1 MWac Application resulted in the following overloads: Fuse 9078319 -- 100K fuse with 5098 kW PV downstream (including application), needs to be upgraded to handle at least 215 A per phase.			
10	Equipment Ratings	Withstand (fault current)	<90% withstand limits	Pass
	Pending EGPC study			
11	Protection	Unintentional Islanding	Unintentional Islanding Document & Company Guidelines	Fail

	The subject generator is a 2.1 MW PV system. It failed JU Islanding guidelines for SANDIA step 4. Reclose delay is required.			
12	Protection	Protective device coordination	Company Guidelines	Pass/Fail
	Pending EGPC study			
13	Protection	Fault Sensitivity	Rated capabilities of EPS equipment	Pass/Fail
	Pending EGPC study			
14	Protection	Ground Fault Detection	Reduction of reach > 10% (by Utility)	Pass/Fail
	Pending EGPC study			
15	Protection	Overvoltage - Transmission System Fault	Company 3V0 criteria	Fail
	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. 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	Pass/Fail
	Pending EGPC study			
17	Protection	Effective Grounding	IEEE C62.92.6 Coefficient of Grounding <0.8	Pass/Fail
	Pending EGPC study			
18	SCADA	Required EMS Visibility for Generation Sources	Monitoring & Control Requirements	Yes
	The 2.1 MW subject project triggers the requirement for SCADA reporting to the Utility.			
19	Auto-Loop			N/A
	The study feeder 109-2-13 has no auto-loop connection.			

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
Upgrade Fuse 9078319 to handle at least 215 A per phase continuous	Thermal (continuous current)
Install 3V0 control for substation components	Company 3V0 criteria
Supplemental protection study, Install NGR	Withstand (fault current)
Perform Effective Grounding & Protection Coordination (EGPC) study	Protective device coordination, Fault sensitivity, Ground fault detection, Effective grounding
Install SCADA monitoring and control for application DG site	Monitoring & Control Requirements
Install Smart Capacitors	Monitoring & Control Requirements
Commissioning Time Post Installation & Monitoring	Monitoring & Control Requirements =
Reclose delay	Risk of islanding
Install 3V0 protection	Overvoltage - Transmission System Fault

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

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

- Install 3V0 protection. – **Cost covered by CDG-00401**
- Upgrade LTC controller for bi-directional operation – **Cost covered by CDG-00401**
- Upgrade substation meter with bi-directional meter – **Cost covered by CDG-00401**

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

- Install Motor Operated Air Brake switch (MOAB)
- Install smart capacitors (4) – **Cost covered by CDG-00401**
- Upgrade Fuse UID 9078319 – **Cost covered by CDG-00401**
- Install Power Quality monitoring at the PCC
- Install Primary Metering Cluster
- Install Secondary Metering for BESS Aux Load
- Install electronic recloser at the PCC
- Implement reclose delay

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.

Planning Grade Estimate

Description	Cost
Primary Metering Cluster Installation	$6,800
Install 477 ACSR	$7,800
Install MOAB switch	$50,000
Recloser Installation	$76,000
2 Junction Poles	$20,000
Commissioning Time Post Installation	$5,500
Design and Inspections	$5,000
Monitoring	$40,000
Contingency (15%)	$31,665
Total Distribution Estimate	**$242,765.00**

The total interconnection cost estimate: **$242,765***

*- If CDG-00401 drops out of the interconnection queue or is sold to a different developer than the developer owning CDG-00423, CDG-00423 shall receive the remaining cost upgrades covered by CDG-00401:

Distribution Upgrades Covered by CDG-00401:

Description	Cost
Smart Capacitor Installation (4)	$162,800
Cutout/Fuse	$10,000
Contingency (15%)	$25,920
Total Distribution Estimate	**$198,720.00**

Substation Upgrades Covered by CDG-00401:

Description	Cost
Engineering, Design, Drafting, Admin	$48,590
ECC	$6,500
OH Line	$29,400
SS Ops – Electricians	$117,810
SS Ops – Relay Techs	$96,900
Crane and Rigging	$2,060
Conduits	$10,300
Steel	$1,030
PTs	$35,700
Relays and Panels	$41,200
Connectors, Wire, Misc.	$8,190
Contingency (25%)	$99,420
Total Substation Estimate	**$497,100**

Notes:

1. CDG-00401 was initially studied at 5,000 kW which covers the capacity amount for CDG-00401 and CDG-00423.
2. 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.
3. 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.
4. 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.

5. 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	6/18/2021	Initial document
2.0	8/25/2022	Revised per Screen H results
3.0	5/8/2024	Moved PoI to the 109-2-13, updated results to reflect CDG-00401 impact and updated cost estimate.