# Attachment N. National Grid Coordinated Electric System Interconnection Review (CESIR) (Redacted)

# For
# Wildcat Renewables, LLC
# Mitchell Ave Solar
# 3,250 kW Solar Generator System
# 1683 Route 9, Stuyvesant, New York, 12173

# Interconnection to National Grid
# NY East
# Capital Region
# Hudson District
# Stuyvesant Substation
# 13.2 kV Feeder 03551

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## 1.0 INTRODUCTION

This report presents the analysis results of the 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 Company ESB No. 750 series. 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 [redacted]

The interconnection was found to be feasible at 3,250 kW 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.

## 3.0 COMPANY EPS PARAMETERS

| Substation | Stuyvesant |
|---|---|
| Transformer Name | TB3 |
| Transformer Peak Load (kW) | 4,071 |
| Contingency Condition Load, N-1 Criteria (kW) (as applicable) | 464 |
| Daytime Light Load (kW) | 1,156 |
| Generation: Total[1], Connected, Queued Ahead (kW) | 8,773; 1,481; 2,442 |
| Contingency Condition Generation: Total[1], Connected, Queued Ahead (kW) | 6,780; 1,123; 2,407 |
| Supply Voltage (kV) | 34.5 |
| Transformer Maximum Nameplate Rating (kVA) | 13,300 |
| Distribution Bus Voltage Regulation | Yes, via LTC |
| Transmission GFOV Status | Not Installed |
| Bus Tie | N/A |
| Number of Feeders Served from this Bus | 2 |

| Connecting Feeder/Line | 03551 |
|---|---|
| Peak Load on feeder (kW) | 1,669 |
| Daytime Light Load on Feeder (kW) | 464 |
| Feeder Primary Voltage at POI (kV) | 13.2 |
| Line Phasing at POI | 3 |
| Circuit Distance from POI to Substation | 0.71 miles |
| Distance to nearest 3-phase, (if applicable) | 0 miles |
| Line Regulation | No |
| Line/Source Grounding Configuration at POI | Effective |
| Generation: Total[1], Connected, Queued Ahead (kW) | 6,780; 1,123; 2,407 |

| System Fault Characteristics without Interconnection Customer DG at POI | |
|---|---|
| Interconnection Customer POI Location | Pole 812, US HWY 9 |
| I 3-phase (3LLL) | 3,399 Amps |
| I Line to Ground (3I0) | 3,398 Amps |
| Z1 (100 MVA base) | 0.3072 + j1.26022 PU |
| Z0 (100 MVA base) | 0.32724 + j1.2464 PU |

[1] The total value referenced here includes the subject generator, connected generation and generation that is queued ahead.

## 4.0 INTERCONNECTION CUSTOMER SITE

The Interconnection Customer is proposing a new primary service connection with Account No. 56623-78015.

This location is presently served by National Grid at 13.2 kV, thereby only requiring a 3-phase extension to the point of common coupling (PCC) from National Grid's radial 13.2 kV distribution feeder 03551 from the Stuyvesant substation.

The proposed generating system consists of:

- A PV system (DC) consisting of seven thousand twenty (7,020) VSUN VSUN575N-144BMH-DG solar modules (575 W).
- Twenty-six (26) customer owned Sungrow SG125HV PV inverters rated at 125 kW, with a generation total of 3,250 kW.
- One (1) 3,250 kVA / 600 $V_{AC,}$ wye-grounded primary / wye-grounded secondary, step-up transformer with Z% = 5.75% and X/R of 6.
- One (1) 450 kVA primary-connected, zig-zag grounding transformer with Z = 5% and X/R of 4.
- Customer owned pole #C1 with customer main disconnect 600A, 35kV, lockable, 3P gang-operated, Eaton M-Force switch.
- Customer owned pole #C2 with customer pole top NOVA 15.5kV, 630A, 12.5kVA recloser and control.
- Customer owned riser pole #C3 with National Grid utility-owned primary meter.
- Customer owned riser pole #C4 with customer main disconnect 600A, 35kV, lockable, 3P gang-operated, Eaton M-Force switch.

## 5.0 SYSTEM IMPACT ANALYSIS

| Category | Criteria | Limit | Result |
|---|---|---|---|
| Voltage | Overvoltage | < 105% (ANSI C84.1) | Pass |
| With the addition of the subject generator, the maximum voltage as modeled on the Feeder is 104.5% 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 100.5% of nominal. | | | |
| Voltage | Substation Regulation for Reverse Power | <100% minimum load criteria | Fail |
| The total generation on Feeders 03551 and 03552, including the subject generator, is 8.773 MW. The total minimum load on these Feeders is 1.156 MW. The generation to load ratio is 758.9%.<br><br>**As a result, Stuyvesant substation transformer TB3 LTC controls must be replaced with bi-directional controls.** | | | |
| Voltage | Feeder Regulation for Reverse Power | <100% Minimum load to generation ratio | Pass |
| There are no feeder regulators between the POI and 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 near Pole 19 Souther Rd. The resulting fluctuation at the feeder location is 2.83% due to the proposed generation and 0.89% 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 0.036 and the emissions limit is 0.35. | | | |
| Equipment Ratings | Thermal (continuous current) | < 100% thermal limits | Pass |
| The subject generator's full output current is 142 A. The total full output current of all DER downstream of the feeder breaker is 297 A. The thermal capability of the Company's limiting equipment getaway cable is 425A. | | | |
| 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 3,250 kW PV generation system. The proposed generation system exceeds the Company's criteria for islanding a distributed resource under light load conditions and will require the following upgrades:

- **National Grid Protection and Control Package (e.g., the PCC Recloser).**

| Protection | Protective device coordination | Company Guidelines | Fail |
|---|---|---|---|

The DG Interconnection Customer has proposed a Utility Grade Recloser for use as Primary Service Protection (PSP). This protective device is shown in the proper location on the submitted line diagrams. Preliminary recloser device settings **were not** provided in the initial submittals. ***Both ground and phase instantaneous and time curve overcurrent settings will need to be provided in this recloser along with ESB-756B Power Quality functions (27, 59, 81).***

*The DG Interconnection Customer will need ensure that this recloser will coordinate, with 0.25 second margin, to the following proposed device characteristics:*

**50/51P** = P/U – 600 A, Curve – U4, Time Dial = 1.3, Instantaneous P/U – N/A
**50/51N** = P/U – 480 A, Curve – U4, Time Dial = 1.4, Instantaneous P/U – N/A

The customer shall submit formal specifications for review and approval by National Grid to ensure proper coordination, correct function types, etc. if the project moves forward. These files will be required in their native format (SEL AcSELerator, Cooper Proview, etc.) when submitted.

| 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 | Fail |
|---|---|---|---|

The Interconnection Customer has proposed one (1) 3,250 kVA 13.2 kV wye -grounded primary / 0.6 kV wye-grounded secondary interconnecting transformer with an impedance of 5.75% (19.36Ω) and X/R ratio of 6. Additionally, to provide effective grounding at the location, the Customer has proposed one (1) 450 kVA 13.2kV primary connected zig-zag grounding transformer with an impedance of 5% and X/R ratio of 4.

To be within Company guidelines, the grounding transformer shall have an impedance of ***60.083*** **Ohms** on a 13.2kV base. With the primary connected grounding transformer in service, the Interconnection Customer will contribute approximately 69 Amps of 3I0 current to remote bolted line to ground faults and 125 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 will 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 ground fault overvoltage protection is not installed at the Stuyvesant substation. The

| | | | |
|---|---|---|---|
| interconnecting customer shall pay for 3V0 installation at Stuyvesant substation, associated 3V0 costs are subject to cost sharing. | | | |
| 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 109.2%. | | | |
| Protection | Effective Grounding | R0/X1 < 1 and X0/X1 < 3 | Pass |
| With subject generator interconnected, the maximum modeled R0/X1 is 0.46 PU and the maximum modeled X0/X1 is 1.51 PU. | | | |
| SCADA | Required EMS Visibility for Generation Sources | Monitoring & Control Requirements | Fail |
| The 3,250 kW subject generator triggers the requirement for SCADA reporting to the Utility. Therefore, the following system modifications are required:<br><br>- **National Grid protection and Control package (e.g., the PCC recloser).** | | | |
| Other | | | |
| None | | | |

## 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 | Failures Addressed |
|---|---|---|
| National Grid Protection and Control Package (Recloser, Switches, Poles, & SCADA Integration) | [redacted] | Unintentional Islanding, Required EMS Visibility for Generation Sources |
| *3V0 Substation Upgrade | [redacted] | Substation Regulation for Reverse Power, Overvoltage – Transmission System Fault |

** This project will be subject to cost sharing for major substation upgrades. Please contact your CEI job owner to discuss the potential impacts of cost sharing further.*

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

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

- 3V0 substation upgrade (EPC with CCVTs, protection relays and test switches, relay panel, bi-directional LTC controller, and supporting equipment). *

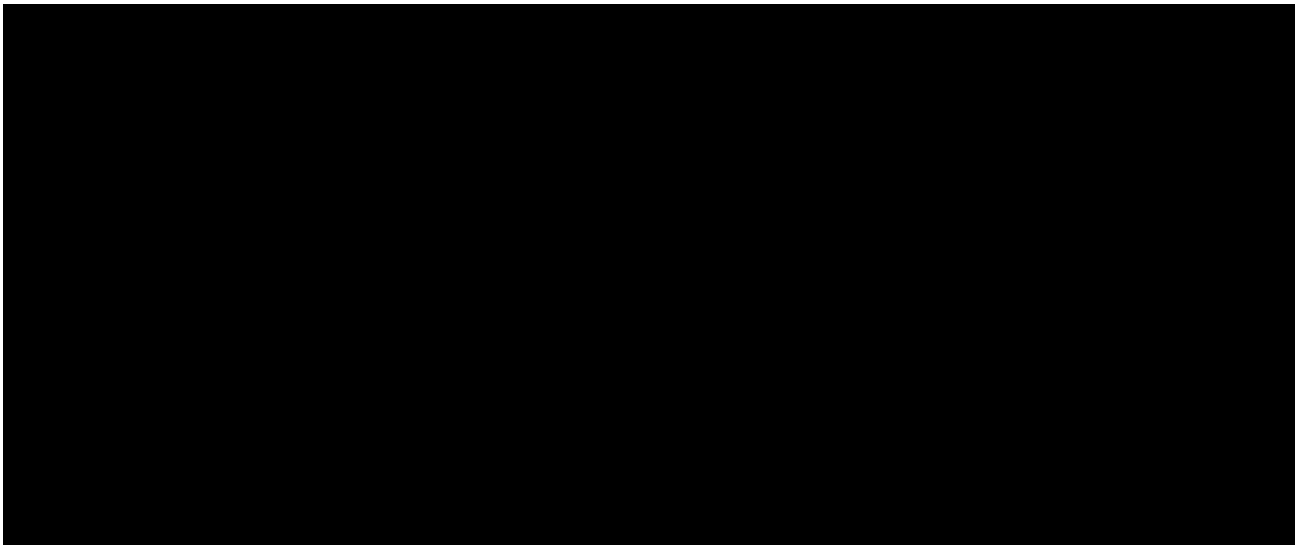
The distribution upgrades required to facilitate the proposed installation include the following:

- National Grid protection and control package (recloser, switches, poles, and SCADA integration).

## 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**



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 SIR 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.