	Coordinated Electric System Interconnected Review	IPP #14470
	Distributed Energy Resources - NYSSIR	Version 1 7/2/2019

For
Interconnection Customer: Lodestar Energy 260 Hunt Creek Rd
Applicant: Lodestar Energy
4000 kVA PV Generator System
260 Hunt Creek Rd

Interconnection to NYSEG
Binghamton Division
Substation Circuit
12.47kV Feeder

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1.0 INTRODUCTION

This report presents the analysis results of the NYSEG interconnection study based on the proposed interconnection and design submittal from the Interconnection Customer in accordance with the Company Bulletin 86-01. 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 \$525,817.

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, NYSEG 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 the requirements of the NYSSIR.

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3.0 COMPANY EPS PARAMETERS

Substation	0
Transformer Name	1
Transformer Peak Load (kVA)	9,670
Contingency Condition Load, N-1 Criteria (kW)	N/A
Minimum Daytime Load (kVA)	1,207
Generation: Total, Connected, Queued (kVA)	655.5, 140.3, 515.2
Contingency Condition Generation: T,C,Q (kVA)	N/A
Supply Voltage (kV)	12.47
Transformer Maximum Nameplate Rating (kVA)	8,625
Distribution Bus Voltage Regulation	Yes
Transmission GFOV Status	na
Bus Tie	closed
Number of Feeders Served from this Bus	2
Connecting Feeder/Line	8102802
Peak Load on Feeder (kVA)	4,200
Minimum Daytime Load on Feeder (kVA)	630
Feeder Primary Voltage at POI (kV)	12.47
Line Phasing at POI	Three-Phase
Circuit distance from POI to substation	2.32556 miles
Distance to nearest 3-Phase (if applicable)	N/A
Line Regulation	Yes
Line/Source Grounding Configuration at POI	Effective
Other Generation: Total, Connected, Queued (kVA)	309.5, 59.5, 250
System Fault Characteristics without Interconnection Customer DG at POI with System Upgrades described in Section 6	
Interconnection Customer POI Location	L-3622, P-208B
I 3-Phase (3LLL)	2280 Amps
I Line to Ground (3I0)	1856 Amps
Z1 (100 MVA Base)	0.614 + j1.936 PU
Z0 (100 MVA Base)	1.239 + j3.196 PU


4.0 INTERCONNECTION CUSTOMER SITE

The Interconnection Customer is proposing a new Primary Metered Service connection.

This location is presently served via Three-Phase 12.47kV.


The proposed generating system consists of :

The 4MVA of photovoltaic generation met the old flicker criteria but about 450' of existing 1/0 wire on the three phase line will have to be reconducted with 477AL to meet the capacity criteria. This study will be based on 4MVA of generation and assumes the 477AL reinforcement.

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5.0 SYSTEM IMPACT ANALYSIS

Category	Criteria	Limit	Result
Voltage	Overvoltage	<105% (ANSI C84.1)	FAIL
With the addition of the subject generator, the maximum voltage as modeled on the Feeder is 0% of nominal.			
Voltage	Undervoltage	>95% (ANSI C84.1)	FAIL
With the addition of the subject generator, the minimum voltage as modeled on the Feeder is 103.3% of nominal.			
Voltage	Substation Regulation for Reverse Power	<15% minimum load criteria	FAIL
The total generation downstream of the source regulation is 4.6555MVA. The total minimum load on this source is 1.2069 MVA. Therefore, the generation to load ratio is 385.7%.			
Voltage	Feeder Regulation for Reverse Power	<15% minimum load to generation criteria	FAIL
The total generation downstream of the circuit regulation is 4.3095 MVA. The minimum load on the circuit feeder is 0.63 MVA. Therefore, the generation to load ratio is 684%.			
Voltage	Fluctuation	<3% steady state from proposed generation on feeder	PASS
The greatest steady-state voltage fluctuation on the circuit is 2.89% due to the proposed generation and 0.58% on the substation bus due to the aggregate generation.			
Voltage	Fluctuation	<5% steady state from aggregate DER on substation bus	PASS
The greatest steady-state voltage fluctuation on the substation bus due to aggregate generation is 0.58%.			
Voltage	Fluctuation	Regulator tap movement >1 position	PASS
The greatest voltage fluctuation seen at the voltage regulation is 1.5V.			
Voltage	Flicker	Screen H Flicker	FAIL
The Pst for the location with the greatest voltage fluctuation is 0.635 and the emissions limit is 0.350			
Equipment Ratings	Thermal (Cont. Current)	Thermal limits (assuming no load)	FAIL
The proposed generation exceeds an existing equipment thermal capability. (see failed equipment chart below)			
Equipment Ratings	Withstand (Fault Current)	<90% withstand limits (Distribution Equip.)	PASS
No distribution issues.			
Equipment Ratings	Withstand (Fault Current)	<90% withstand limits (Substation Equip.)	PASS
The additional fault current contribution from the generation does not contribute to interrupting ratings in excess of existing EPS equipment.			

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Protection	Unintentional Islanding	Unintentional Islanding Document & Company Guidelines	PASS
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NO significant risk of unintentional islanding exists, no further study or investigation required. Provided that the customer uses the same manufacturer of inverters as stated in their application, if the manufacturer is changed it must be reviewed to ensure that the new manufacturer complies with the anti-islanding standards.

Protection	Protective Device Coordination	Company Guidelines (Dist. Line Fusing)	FAIL
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There are 2 existing protective devices between the Source and PCC. Distribution line Protection and Coordination must be reviewed, any changes or upgrades will be included in the Mitigation section below.

Protection	Protective Device Coordination	Company Guidelines (Reclosers and Breakers)	0
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0

Protection	Fault Sensitivity	Rated capabilities of EPS equipment	PASS
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The additional fault current contribution from the generation does not contribute to interrupting ratings in excess of existing EPS equipment.

Protection	Ground Fault Detection	Reduction of reach >100%	FAIL
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The Interconnection Customer has proposed a Neutral Reactor with an impedance of 14.1 ohms and X/R ratio of 7. To be within Company guidelines the Neutral Reactor shall have an impedance of 14.1 ohms. The Interconnection Customer will contribute approximately 4620 A of 310 current to remote bolted line to ground faults and 4618 A to faults at the PCC.

Protection	Overvoltage - Transmission System Fault	Company 3V0 criteria	PASS
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Due to the configuration of the substation, there is no issue in islanding the DG.

Protection	Overvoltage - Distribution System Fault	<125% voltage rise	PASS
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With subject generator interconnected the modeled voltage rise on the unfaulted phases of the system is 92%

Protection	Effective Grounding	[individual utility specifications]	FAIL
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With the subject generator interconnected the modeled R0/X1 is 0.25484 PU and the X0/X1 is 3.38141 PU


SCADA	Required EMS Visibility for Generation Sources	Monitoring & Control Requirements	Needed
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The 4 MVA subject generator triggers the requirement for a Sandia Screening

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Existing Equipment Rating Analysis Table:

EQUIPMENT	VOLTAGE (kV)	LINE	POLE	PASS/FAIL
3P_1/OAA (PHASES)	12.5	263	208	FAIL
3P_140K_FUSES	12.5	263	208	FAIL
3P_100K_FUSES	12.5	3622	14	FAIL

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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 included 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.

1. Each individual PCC location must have the ability to trip offline within 2.0 seconds for the loss of voltage on any one individual phase in order to electrically isolate the IPP from the utility at the generator interconnection and must be verified at checkout.
2. Any circuit tap, substation, or distribution line regulators, and substation LTC/regulator controls must be either already equipped with or changed out to retrofitted microprocessor controls that will handle reverse power flow and co-generation functionality. Based preliminary studies, the substation regulators should be set to 'co-generation' mode if it is a Siemen MJXL or MJ4A control. If it is an older M-2001C Beckwith control, it should be upgraded to an M-2001D unit and the 'DG' or 'auto determination' mode set. These include:
 - a. The feeder 179 regulators at Lounsberry substation
 - b. The new 3-328amp line regulators at L-260 P-51A
3. Transmission Planning will need to review the proposed installation
 - The proposed installation is equal to, or exceeds 1MVA of generation.
 - The possibility of reverse power flow through the distribution circuit source exists.
4. If the IPP cannot comply with the voltage regulation threshold criteria, install new line regulators on the utility-side of the PCC location. The new line circuit regulators shall be equipped with reverse power flow & co-generation functionality (Beckwith M2001-D).
5. Install a new microprocessor-controlled line recloser equipped with directionality on the utility-side of the primary metered service at the PCC.


** Recloser settings will be determined by Corporate Protection & Control**

6. Any potential manual or automatic switching schemes with other distribution circuits will require the customer to disconnect from the distribution circuit at the customer's PCC.
7. Protection & coordination is based on only the system-normal circuit configuration, and is not applicable for switching scenarios and ties with other distribution circuits.
8. The existing transmission circuit relaying will need to reviewed and verified by System Engineering in order to properly coordinate with the proposed downstream distribution protective devices.
9. About 450' of existing 1/0 wire on the three phase line will have to be reconducted to 477AL from L-263 P-208 to the PCC at L-3622 P-208B.
10. Load Drop Compensation (LDC) settings on the substation regulators can no longer be utilized to boost and buck the voltage according to the load. High Voltages were found during off peak periods. A new set of line regulators is needed.
11. A new set of 3-328amp line regulators is recommended at L-260 P-51A.

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12. The existing recloser at L-3430 P-2 outside the Lounsberry substation will require directionality. A microprocessor control with PT sensing on all three phases will be needed. The directionality function will need to be enabled.
13. The customer's inverter will be set to generate power in the power factor mode (not voltage regulation mode) at 100% power factor (unity).
14. At the substation feeder regulators, the recommended settings for the forward and reverse settings are R=0, X=0, Balance (set) voltage = 124V, bandwidth = 3V, and time delay = 30sec.
15. At the new set of 3-328amp regulator at L-260 P-51A, the recommended settings for the forward and reverse settings are R=0, X=0, Balance (set) voltage = 123V, bandwidth = 3V, and time delay = 45sec.
16. At the existing line regulator at L-3047 P-14, change the bandwidth and time delay to 3V and 60sec respectively.
17. Replace the existing 140K fuses at L-263 P-28 with a group op switch. Install 140K fuses at L-1263 P-207A and L-263 P-208B looking south.
18. Per Appendix K, the combined ESS and PV is limited to a total output of 4MVA. Per the PST=0.35 flicker chart in Section 9 and based on a discharge of 4MVA, the system is limited to 0.1 change per minute or a ramp rate of 4MVA every 10 minutes.
19. Per the PST=0.35 flicker chart in Section 9 and based on a maximum ESS charge of 3.5MVA, the ESS is limited to 0.1 change per minute or a ramp rate of 3.5MVA every 10 minutes.
20. Primary Distribution Interconnection/Transfer Connection:

Primary Distribution Line Configuration	Interconnection to Primary Distribution Line
Three-phase, three-wire	If a three-phase or single-phase generator, interconnection must be phase-to-phase
Three-phase, four-wire	If a three-phase (effectively grounded) or single-phase generator, interconnection must be line-to-neutral


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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


Project #14470			
Scope:			
A. Install Interconnection PCC Recloser with SCADA capability			
B. Feeder 179 regulators at Lounsberry substation			
C. Re-conductor about 450' of existing 1/0 wire to 477AL from L-263 P-208 to the PCC at L-3622 P-208B.			
D. Install 3-328 amp line regulators at L-260 P-51A			
E. Replace the existing recloser at L-3430 P-2 outside the Lounsberry substation			
F. Replace the existing 140K fuses at L-263 P-28 with a group op switch.			
G. Install 140K fuses at L-263 P-207A and L-3622 P-208B			
H. Primary metering installation			
I. Engineering support			
J. Project Administration			
Estimate Detail	cost/unit	unit	total
Install Interconnection PCC Recloser			
Labor	\$53,310	1	\$53,310
Materials	\$52,635	1	\$52,635
Overheads	\$24,350	1	\$24,350
Feeder 179 regulators at Lounsberry substation			
Labor	\$23,790	1	\$23,790
Materials	\$21,950	1	\$21,950
Overheads	\$11,578	1	\$11,578
Recon 450' of 1/0 wire to 477AL, L-263 P-208 to L-3622 P-208B			
Labor	\$26,940	1	\$26,940
Materials	\$6,640	1	\$6,640
Overheads	\$11,340	1	\$11,340
Install 3-328 amp line regulators at L-260 P-51A			
Labor	\$49,770	1	\$49,770
Materials	\$13,760	1	\$13,760
Overheads	\$25,205	1	\$25,205
Replace the existing recloser at L-3430 P-2			
Labor	\$30,555	1	\$30,555
Materials	\$49,135	1	\$49,135
Overheads	\$20,730	1	\$20,730

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Replace fuses with switch @ L-263 P-28			
Labor	\$11,670	1	\$11,670
Materials	\$7,560	1	\$7,560
Overheads	\$5,800	1	\$5,800
Install 140K fuses at L-263 P-207A and L-3622 P-208B			
Labor	\$1,710	2	\$3,420
Materials	\$415	2	\$830
Overheads	\$385	2	\$770
Install new primary meter service			
Labor	\$1,600	1	\$1,600
Materials	\$27,500	1	\$27,500
Overheads	\$1,400	1	\$1,400
Engineering support	\$5,000	1	\$5,000
Project Administration	\$10,000	1	\$10,000
Sub total			\$487,238
Taxes			\$38,579
Total			\$525,817
Notes to Developer: Cost estimates are +- 25%			
Developer is required to pay all actual costs for system upgrades and interconnection facilities.			

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 work
 - additional application fees,
 - applicable surcharges,
 - property taxes,
 - 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.

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8.0 REVISION HISTORY

<u>Version</u>	<u>Date</u>	<u>Description</u>
1.0	7/2/2019	Original

9.0 FLICKER TABLE

Flicker Pst = 0.35
(Short Term Flicker
Severity).

Chg/Min	% Flicker	Chg/Min	% Flicker	Chg/Min	% Flicker
0.1	2.8707	5	0.66465	13	0.48807
0.2	1.8312	6	0.616	14	0.47777
0.4	1.4217	7	0.59325	20	0.42819
0.6	1.27575	8	0.567	30	0.38669
1	1.1081	9	0.5425	40	0.36202
2	0.8988	10	0.52465	50	0.34752
3	0.7875	11	0.51129	60	0.336
4	0.7175	12	0.4992		