EVERSOURCE

Project Approval Form

Project Title: Community Power Group, [redacted] Ellington	**Project Number:** [redacted]
Date Prepared: 10/09/2025	**Company:** Eversource CT
Organization: Distributed Energy Resource Planning	**Project Category:** Distributed Generation
Project Initiator: [redacted]	**Project Type:** Specific
Initiating Organization: Distributed Energy Resources	**Capital Investment part of original Op Plan:** Yes
Project Manager: [redacted]	**Emergency Related Request?** No
Project Sponsor: [redacted]	**Facility Type** (check all that apply)**:** ☐ PTF ☐ non-PTF ☒ Distribution ☐ N/A (General Plant)
Required in service date: 12/31/2025	**NWS Excludable:** ☒ Yes ☐ No
Total Capital Request: $166.3K (100% Reimbursable)	**Authorization Type:** Full Funding

1. Executive Summary

A [redacted] photovoltaic (PV) array to be installed at [redacted], Ellington, CT. The project will interconnect to the [redacted].

The project will include:

- [redacted]
- [redacted]
- [redacted]

A load flow and Dynamic Temporary Over Voltage (TOV) and Risk of islanding (ROI) study were conducted and no issues were identified.

- Project Location
  - Division: Central
  - District: Tolland AWC
  - City/Town: Ellington

The partial funding estimate for this project was $220.9K capital and was approved at the 12/02/2021 CTPAC. The Full Funding request is $166.3K capital. The difference in cost equates to $54.6K, a decrease of 25% of the cost of the project. There was no change in scope to the project.

The reduced Full Funding estimate is due to:

- Partial Funding estimate called for Contractor Crews vs the Full Funding estimate calling for Eversource crews
- Partial Funding estimate called for [redacted] of line extension and the Full Funding estimate called for [redacted]
- Partial Estimate called for a Real Time Automation Controller (RTAC) but was removed in the Full Funding estimate

2. Project Cost Summary

Note: Dollar values are in thousands.

Capital Costs	2025	Total
Internal Labor and Construction Equipment	18.8	18.8
Outside Services	0.0	0.0
Materials	54.3	54.3
Removals	2.4	2.4
Risk and Contingency	11.6	11.6
Other	0.0	0.0
Subtotal	**87.1**	**87.1**

Indirect Capital Costs	2025	Total
Indirects/Overheads (including benefits)	79.2	79.2
Capitalized interest or AFUDC, if any	0.0	0.0
Subtotal	**79.2**	**79.2**
Total Capital Costs (Gross)	**166.3**	**166.3**
Less Total Customer Contribution	**-166.3**	**-166.3**
Project Costs (Net of Reimbursement)	**0**	**0**

3. Technical Justification

Background, Project Need/Justification, and Project Scope

a. Background

Community Power Group is proposing a [redacted] KW photovoltaic (PV) project, located at [redacted] Ellington, CT. The project will interconnect to the [redacted] feeder.

b. Project Need

The goal of this project is to provide service to the DER applicant to allow their generator to interconnect to the Eversource EPS. This project proposes the installation of a site-dedicated recloser and primary meter.

c. Project Scope

The new service will tap at pole [redacted] with a new junction pole and extend the three-phase west on to the customer property. The [redacted] pole will consist of a recloser. The [redacted] pole will consist of primary meter; this pole will mark the point in change in ownership from Eversource to the customer.

4. Alternatives Considered

NWS Exclusion Criteria (select all that apply)

☒ Project cost < $250k	☐ New Service
☐ CDOT Relocation	☒ Generator interconnection project
☐ Maintenance, Asset condition or safety related*	

Option Summary

There were no other options considered for this design.

5. Project Schedule

Milestone/Phase Name	Estimated Date
Partial Approval	December 2021
100% Detailed Engineering Completion	August 2025
Fully Funded	October 2025
Construction Start	November 2025
In Service Date	December 2025

6. Regulatory Decisions

N/A

7. Codes and Standards

N/A

8. Risk and Contingencies

Risk Event	Risk Horizon	Likelihood of Occurrence	Risk Mitigation
Actual cost higher than estimated due to scope changes.	2025	Low	Included contingency costs in the funding request. The project will also require a facility study to perform the detailed engineering.
Customer Permission / Siting Council / Municipal approvals	2025	Medium	New service requires limited easement with the existing customer.

Internal construction resources not available to perform the work.	2025	Low	Plan internal resources to perform the work. Use competitive bidding to ensure lowest outside labor cost.
Internal engineering resources not available to perform the work.	2025	Medium	Plan internal resources to perform the work. Use competitive bidding to ensure lowest outside labor cost.
Materials Shortage or long lead times	2025	Low	Pre-order long lead time material; minimize the use of non-standard and non-stocked material.
Storm delays	2025	Low	If storm activity delays work, we may be forced to use external resources.
System abnormal configuration	2025	Low	Schedule work to minimize system abnormal time. Install temporary bypasses/equipment if system will be abnormal for extended periods.
Technological risks involving integration of new technology	2025	Low	Before use of new technology ensure support of standards and manufacturer. Schedule project to accommodate for extra time or ensure new technology is not on the critical path.
Wetlands / Environmentally sensitive area	2025	Low	The new service poles/equipment will require a limited easement to the customer's site and is not anticipated to go in wetlands.

9. References

References
1. N/A

10. Attachments (One Line Diagrams, Images, etc.)

Attachment	Included in Submittal?
A. Partial Funding PAF	*YES*
B. Cost Estimate	*YES*
C. System and Station One-Lines	*YES*
D. Map	*YES*
E. Other : Impact Study	*YES*

Operations Project Authorization Form

Date Prepared: December 01, 2021	**Project Title:** Community Power Group, Middle Rd, Ellington, 1 of 1
Company/ies: Eversource CT	**Project ID Number:** [redacted]
Organization: Distribution Electric	**Class(es) of Plant:** Distribution
Project Initiator: [redacted]	**Project Category:** Distributed Generation
Project Manager: [redacted]	**Project Type:** Specific
Project Sponsor: [redacted]	**Project Purpose:** Distributed Generation New Service
Estimated in service date: April 01, 2024	**If Transmission Project: PTF?** N/A
Eng. /Constr. Resources Budgeted? No	**Capital Investment Part of Original Operating Plan?**
Authorization Type: Preliminary	**O&M Expenses Part of the Original Operating Plan?**
Total Request: $220,936 (100% Reimbursable)	

Financial Requirements:

Project Authorization
ERM: _____

FP&A: _____

Executive Summary

The purpose of this request is to authorize the expenditure of $220,936 which is 100% reimbursable to connect the Community Power Group [redacted] project located at [redacted] in Ellington, CT. The ENG estimate includes a 28% contingency and 11% CIAC tax for a projected 04/01/2024 in service date.

The proposed project will interconnect to the [redacted] circuit, via a new primary service. The scope of work includes: [redacted] new poles, a [redacted] recloser, and [redacted] primary meter. The study incorporated the [redacted] Cable Upgrades and Offloads.

The System Impact Study (SIS) and a dynamic study in PSCAD did not identify any other adverse effects that would require modifications to the Company's electric distribution system.

A transmission study is required by the ISO-NE for this project and has not been completed at this stage.

Project Costs Summary

	Prior Authorized	2024	2025	2026+	Totals
Capital Additions - Direct	$0	$133,248	$0	$0	$133,248
Less Customer Contribution	$0	($220,936)	$0	$0	($220,936)
Removals net of Salvage ____%	$0	$5,578	$0	$0	$5,578
Total - Direct Spending	$0	($82,110)	$0	$0	($82,110)
Capital Additions - Indirect	$0	$75,423	$0	$0	$75,423
Subtotal Request	$0	($6,687)	$0	$0	($6,687)
AFUDC	$0	$3,438	$0	$0	$3,438
Total Capital Request	$0	($3,249)	$0	$0	($3,249)
O&M	$0	$3,249	$0	$0	$3,249
Total Request	$0	($0)	$0	$0	($0)

Financial Evaluation

Direct Capital Costs	Year 1	Year 2	Year 3+	Total
Straight Time Labor	$3,180	$0	$0	$3,180
Overtime Labor	$2,156	$0	$0	$2,156
Outside Services	$121,865	$0	$0	$121,865
Materials	$11,742	$0	$0	$11,742
Other, including contingency amounts (describe)	($116)	$0	$0	($116)
Total Direct Costs	**$138,826**	**$0**	**$0**	**$138,826**

Indirect Capital Costs	Year 1	Year 2	Year 3+	Total
Indirects/Overheads (including benefits)	$75,423	$0	$0	$75,423
Capitalized interest or AFUDC, if any	$3,387	$0	$0	$3,387
Total Indirect Costs	**$78,810**	**$0**	**$0**	**$78,810**
Total Capital Costs	**$217,636**	**$0**	**$0**	**$217,636**
Less Total Customer Contribution	**($220,936)**	**$0**	**$0**	**($220,936)**
Total Capital Project Costs	**($3,300)**	**$0**	**$0**	**($3,300)**
Total O&M Project Costs	**$3,300**	**$0**	**$0**	**$3,300**
Total Project Cost	**$ (0)**	**$ -**	**$ -**	**$ (0)**

Note: Explain unique payment provisions, if applicable

Technical Justification:

Project Need Statement

The DER customer, Community Power Group, has requested Eversource to study the impact of its generator on the area Electric Power System [redacted] for primary configuration). A system impact study determined this project is okay to interconnect on circuit [redacted], without additional protection methods, such as direct transfer trip. A load flow was performed in Synergi and a dynamic study was performed in PSCAD to check the steady-state and transient voltage impact on the primary feed, alternate feed, and N-1 configuration at the substation, and no voltage rise or TOV issues were detected. No other thermal, back feed, or protection issues were identified as part of this SIS. The DER will be required to operate with a ramp rate limit to mitigate flicker concerns.

A new service drop is proposed for this DG project. [redacted] pole will be for new service, [redacted] pole will be for a site-dedicated recloser, and [redacted] pole will be a riser for [redacted] primary meter. The new service will only benefit the DER customer and will allow the customer access to the Eversource EPS.

Project Objectives

The goal of this project is to provide new service to the DER applicant to allow their generator to interconnect to the Eversource EPS. This project proposes the installation of three new poles for service, a site-dedicated recloser, and primary metering.

Project Scope

New Service

New service poles will be needed to provide electrical service from the Eversource [redacted], circuit to the proposed [redacted], Ellington, CT. The new service will be interconnected to pole [redacted] on [redacted]. The new service will also consist of [redacted] site-dedicated recloser and [redacted] primary meter. The change of point of ownership occurs on the load side of the Eversource owned primary meter.

Background / Justification

The DER applicant is proposing a new service at their inverter-based PV located at [redacted], Ellington, CT. There is currently no electrical service provided to the existing infrastructure.

Business Process and / or Technical Improvements:

This proposal will allow for the interconnection of the DER project to the Eversource EPS. There are currently no electrical services to the proposed solar farm.

Alternatives Considered with Cost Estimates

There are currently no alternate circuits that could interconnect the proposed DG at this location. Based on Eversource standards, the proposed new service design is typical of what Eversource field engineering would procure as this design was provided by the local circuit owner.

Project Schedule

Milestone/Phase Name	Estimated Completion Date
Preliminary Engineering	12/02/2021
Detailed Design	TBD
Construction	10/01/2023
Anticipated In Service Date	04/01/2024

Regulatory Approvals

N/A and not anticipated at this time.

Risks and Risk Mitigation Plans

Risk Event	Risk Horizon	Likelihood of Occurrence	Risk Mitigation
Actual cost higher than estimated due to scope changes.	2024	Low	Included contingency costs in the funding request. Included costs to conduct a facility study to get a construction grade estimate.
Customer Permission / Siting Council / Municipal approvals/ Wetlands Permitting	2024	Low	No line work needed.
Internal construction resources not available to perform the work.	2024	Low	Plan internal resources to perform the work. Use competitive bidding to ensure lowest outside labor cost. Construction is little over a year out, should be able to plan internal resources.
Internal engineering resources not available to perform the work.	2024	Low	Plan internal resources to perform the work. Use competitive bidding to ensure lowest outside labor cost.
Materials Shortage or long lead times	2024	Low	Pre-order long lead time material; minimize the use of non-standard and non-stocked material. Primary meter is longest lead time item and enough time exists to order.
Storm delays	2024	Medium	If storm activity delays work, we may be forced to use external resources.

System abnormal configuration	2024	Low	Schedule work to minimize system abnormal time. Install temporary bypasses/equipment if system will be abnormal for extended periods
Technological risks involving integration of new technology	2024	Low	Before use of new technology ensure support of standards and manufacture. Schedule project to accommodate for extra time or ensure new technology is not on the critical path. All equipment to be installed is approved by Standards.
Wetlands / Environmentally sensitive area	2024	Low	The line extension is down an existing street right of way. There should be no wetlands or environmentally sensitive areas along route. Customer service will also be along the road with limited easement onto the property.

Attachment B: Cost Estimate:

[redacted]



[redacted]

Project Approval Form

[redacted]

[redacted]

History of Revisions
Rev 0: 07/19/2021 MYP

Rev 1: 07/21/2021 DRM

Rev 2: 07/21/2021 RPA

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Abstract

This system impact study is to examine the [redacted] photovoltaic generator proposed on [redacted], Ellington, CT. A full circuit impact study is needed for this installation due to it failing the fast track screen. The study will cover impacts related to voltage, equipment, and protection.

The study found there to be no voltage issues during minimum and maximum loading at the full [redacted] output of the PV system operating at 100% power factor. The customer will need [redacted] new three phase service consisting of [redacted] new primary meter and recloser. The DG customer did not cause excess capacitor bank operations. The power quality was determined to be acceptable. The generator did not cause any of the LTC's at the Rockville or Scitico substations to operate on either the primary or alternate configurations. Reverse power flow at the Rockville [redacted] breaker was substantial during minimum load but did not back feed onto transmission. Fluctuations between states of the generator will be controlled by implementing a standard ramp rate. This will reduce the frequency of large swings in operation and prevent excess operation of voltage regulating equipment on the circuit. The Sandia Risk on Islanding Screen was performed and passed, therefore, this project does not create an islanding risk. The risk of islanding specification sheet indicates that the proposed inverters belong to Group 1 or 2A. A dynamic study in PSCAD was also performed to check Transient Over Voltage (TOV) and Ground Fault over Voltage (GFOV) and no concerns were found in the dynamic study.

Introduction

The purpose of this study is to determine the electrical system impacts of a [redacted] PV proposed on the [redacted] feeder. The electrical system impacts considered in this study are voltage, equipment, and protection concerns. Recommendations will be based on assurance that all the customers fed from this circuit, and adjacent alternate circuits, are within the established ratings for voltage and that fault protection is enough. The [redacted] was chosen for ease of interconnection at [redacted], Ellington, CT.

Project Location

[redacted]

Figure 1: Site plan for Community Power Group Ellington

System Configuration

The primary distribution voltage of the customer is 13.8 kV. The customer will fully export onto the Eversource distribution system. The [redacted] feeder has 260 kW of generation existing and queued ahead on the circuit with the majority of it comes from residential PV systems. The system was modeled using Synergi™ Electric, with a 98% power factor during maximum and minimum load for the 14W source circuits. The loads were allocated per circuit feeder head prior to analysis. The proposed system was modeled with a unity power factor. Simulations during minimum and maximum loading periods were studied, with the proposed system on and off. The existing generation always remained on due to no generation falling within one quarter of a mile from the [redacted], Ellington, CT. Day time peak and daytime minimum peak were the studied scenarios for this DG application. During each loading scenario, voltage flicker and rapid voltage change were analyzed in addition to steady state voltages because of this distribution system impact study. During those simulations, voltage and power factor were verified to ensure the circuit still meets regulatory standards after the proposed system is interconnected. A dynamic analysis was also completed due to greater than 100% of the minimum load being carried by the generator (i.e., back feed at the substation).

System Loading and Assumptions

The [redacted] substation is fed from [redacted] transmission lines and consists of [redacted] transformers, the [redacted] that steps the voltage down to [redacted] buses that feeds [redacted] circuits and [redacted] transformer [redacted] that steps the voltage down to [redacted] bus that feeds [redacted] circuit.

The loading information for the primary configuration is as follows. The [redacted] transformer, has a peak load of [redacted] and a daytime minimum load of [redacted].

[redacted]

Generation Characteristics:

Table 2: PV Generator Characteristics	
Generator Manufacturer:	Chint Power Systems America
Generator Model:	[redacted]
Phase:	Three
Max AC Power Output Total:	[redacted]
Nominal AC Output Voltage:	
Max Continuous Output Current:	
Power Factor:	
Frequency:	

Voltage Impact During Normal Operation | [redacted]

CT regulatory requirements require adherence to voltages at -5% to +5% PU. The modeling software uses a nominal voltage of 120 as the output, so the voltages from the model will need to stay between [redacted]. This portion of the study determines if the interconnection can maintain these requirements at peak and minimum loading conditions. The study looks at both peak and minimum loading during time in which the generator is in parallel with the Eversource system. All circuits fed from the [redacted] substation transformer were modeled for this analysis.

Peak Loading

At peak loading steady state conditions, with generation at unity power factor and the customer generation connected, the system can sustain voltage within the PURA limitations. The system does not cause any voltage or thermal issues throughout the model.

Table 3: Peak Load									
Circuit Point	Generation Off			95% Generation- Hold Taps			Generation 100% - Steady State		
[redacted]	120.8	120.2	119.3	124.9	123.8	122.4	124.9	123.8	122.4
	123.3	122	122	--	--	--	123.6	122.3	122.3
	1545	1514	1726	--	--	--	228	207	412
	322	323	366	--	--	--	321	331	361
	97.9	97.8	97.8	--	--	--	58	53.1	75.2
	7915	8039	8215	--	--	--	6618	6751	6922

Generation Off

During this simulation, the proposed PV was turned off while all existing PV remained at full output. As shown in Table 3, above, all voltages readings were within the PURA limitations.

Generation On

Under this simulation, all generators, including the proposed generator, were turned on. As shown in Table 3, all voltages were within the PURA limitations. Power factor does deteriorate

as the generation serves local load and increases the VAR flow on the system. The need for an additional capacitor bank to correct to power factor will be at the discretion of the circuit owner.

Generation at 95% - Flicker

Under this simulation, steady state system was locked into place with the proposed PV off. The capacitor banks and regulators in the model were then locked into place. The DG was then turned on to 95%, per Eversource standards. The voltage values were recorded, and the flicker was calculated. The flicker and voltages were acceptable remaining within the ANSI limits for voltage and within the 2% limit spelled out in the Eversource standards as shown in Table 4. It should be noted that the fluctuation in output only occurred with the proposed DG. Eversource typically considers DGs within [redacted] of the project. The nearest projects were greater than this distance and did not play a role in the system flicker calculation. Under normal circuit configurations and having all capacitor banks in service, the maximum flicker occurred at 3.39%. A ramp rate will be implemented to reduce the voltage flicker below 2%. Table 4 below illustrates the flicker on all three phases during peak load.

Table 4: Peak Load Flicker			
Phase	A	B	C
PCC	3.39%	3.00%	2.60%

Rapid Voltage Change

For flicker issues, Eversource can mitigate the issue by requiring the DG to install a ramp rate for the introduction of generation after the loss of generation due to a cloud or transient. However, this does not resolve the issue of the impacts to the Eversource distribution system when the DG is taken offline. IEEE 1547-2018 spells out that the rapid voltage change from a DER should not exceed 3%. As shown in Table 5, all rapid voltage change values are within the IEEE 1547-2018 limit of 3%., the maximum RVC occurred at 2.98%. Table 5 below illustrates the RVC on all three phases during peak load.

Table 5: Peak Load Rapid Voltage Change			
Phase	A	B	C
PCC	2.98%	2.91%	2.60%

<u>Minimum Loading</u>

At daytime minimum loading steady state conditions, with generation at unity power factor and the customer generation connected, the system can sustain voltage within PURA limitations on all circuits associated with the [redacted] configuration. For the minimum load

simulation all the voltage control cap banks were turned off. The system does not cause high voltage at the PCC; or elsewhere along the [redacted].

Table 6: Min Load 36%									
Circuit Point	Generation Off			95% Generation- Hold Taps			Generation 100% - Steady State		
[redacted]	121.8	121.5	121.3	125.6	124.9	124.2	125.6	124.9	124.2
	122.7	122.3	122.3	--	--	--	122.8	122.4	122.4
	531	513	596	--	--	--	-771	-788	-708
	239	249	251	--	--	--	276	288	289
	91.2	89.9	92.2	--	--	--	-94.1	-93.9	-92.6
	2665	2620	2896	--	--	--	1365	1322	1595

Generation Off

During this simulation, the proposed PV was turned off while all existing PV remained at full output. As shown in Table 6, above, all voltages readings were within the PURA limitations.

Generation On

Under this simulation, all generators, including the proposed generator, were turned on. As shown in Table 6, all voltages were within the PURA limitations.

Generation at 95% - Flicker

The same analysis for voltage flicker was studied during light load conditions. Table 7 below illustrates the voltage flicker. The voltage flicker does not stay within the 2% threshold with the worst-case scenario at 3.12%. A ramp rate will be implemented to reduce the voltage flicker below 2%.

Table 7: Min Load Flicker			
Phase	A	B	C
PCC	3.12%	2.80%	2.39%

Rapid Voltage Change

The same analysis for rapid voltage change was studied during light load conditions. Table 8 below illustrates the rapid voltage change. The rapid voltage change stays within the 3% threshold with the worst-case scenario at 2.96%.

Table 8: Min Load Rapid Voltage Change			
Phase	A	B	C
PCC	2.96%	2.80%	2.39%

Voltage Impact During Unplanned Alternate Operation [redacted]

This configuration simulates a power outage or fault that occurred upstream from the PV system location. Eversource has a scheme in place so that in this scenario the [redacted] will open and the [redacted] will close and the [redacted] will pick up the islanded zone of the [redacted] circuit. The alternate configuration load flow analysis on [redacted] feeder also includes [redacted] project.

Peak Loading

At peak loading steady state conditions, with generation at unity power factor and the customer generation connected, the system can sustain voltage within the PURA limitations. The system does not cause any voltage problems throughout the model as seen Table 9. The project did not cause a large amount of voltage flicker which will be mitigated with a ramp rate.

Table 9: Peak Load

Circuit Point	Generation Off			95% Generation- Hold Taps			Generation 100% - Steady		
[redacted]	117.9	119.3	118.8	122	123.3	122.7	122	123.3	122.7
	122.9	123.3	123.3	--	--	--	123.1	123.4	123.5
	1688	1055	707	--	--	--	421	-224	-572
	577	526	457	--	--	--	553	490	412
	94.6	89.5	84	--	--	--	60.6	-41.6	-81.2
	4920	4920	4920	--	--	--	3750	3750	3750

Generation Off

During this simulation, the proposed PV was turned off while all existing PV remained at full output. As shown in Table 9, above, all voltages readings were within the PURA limitations.

Generation On

Under this simulation, all generators, including the proposed generator, were turned on. As shown in Table 9, all voltages were within the PURA limitations.

Generation at 95% - Flicker

The same analysis for voltage flicker was studied during light load conditions. Table 10 below illustrates the voltage flicker. The voltage flicker did not stay within the 2% threshold with the worst-case scenario at 3.48%. This issue will be eliminated with a ramp rate.

Table 10: Peak Load Flicker

Phase	A	B	C
PCC	3.48%	3.35%	3.28%

Rapid Voltage Change

The same analysis for rapid voltage change was studied during light load conditions. Table 11 below illustrates the rapid voltage change. The rapid voltage change stays within the 3% threshold with the worst-case scenario at 2.98%.

Table 11: Peak Load Rapid Voltage Change			
Phase	A	B	C
PCC	2.98%	2.97%	2.98%

Minimum Loading

At daytime minimum loading steady state conditions, with generation at unity power factor and the customer generation connected, the system can sustain voltage within PURA limitations on all circuits associated with the [redacted]. The system does not cause high voltage at the PCC; or elsewhere on the [redacted] feeder.

Table 12: Min Load 32%									
Circuit Point	Generation Off			95% Generation- Hold Taps			Generation 100% - Steady		
[redacted]	118.9	118.8	123.1	122	121.7	125.8	122	121.7	125.8
	122.9	122.9	123.3	--	--	--	122.7	122.7	123
	-1103	-1251	-1542	--	--	--	-2361	-2509	-2827
	666	658	318	--	--	--	829	812	483
	-85.6	-88.5	-97.9	--	--	--	-94.4	-95.1	-98.6
	3770	3770	3770	--	--	--	5020	5020	5020

Generation Off

During this simulation, the proposed PV was turned off while all existing PV remained at full output. As shown in Table 12 above, all voltages readings were within the PURA limitations.

Generation On

Under this simulation, all generators, including the proposed generator, were turned on. As shown in Table 12, all voltages were within the PURA limitations.

Generation at 95% - Flicker

The same analysis for voltage flicker was studied during light load conditions. Table 13 below illustrates the voltage flicker. The voltage flicker does not stay within the 2% Eversource threshold with the worst-case scenario at 2.61%. Voltage flicker will be eliminated using a ramp rate. Implementing a ramp rate will further limit the impacts of this fluctuating resource.

Table 13: Min Load Flicker			
Phase	A	B	C
PCC	2.61%	2.44%	2.19%

Rapid Voltage Change

The same analysis for rapid voltage change was studied during light load conditions. Table 14 below illustrates the rapid voltage change. The rapid voltage change stays within the 3% PURA threshold with the worst-case scenario at 2.61%.

Table 14: Min Load Rapid Voltage Change			
Phase	A	B	C
PCC	2.61%	2.44%	2.19%

Voltage Impact During Planned Alternate Operation | [redacted]

[redacted]

Peak Loading

At peak loading steady state conditions, with generation at unity power factor and the customer generation connected, the system can sustain voltage within the PURA limitations. The system does not cause any voltage problems throughout the model from the two buses being fed from the [redacted] transformer. Power factor does deteriorate as the generation serves local load and increases the VAR flow on the system. The need for an additional capacitor bank to correct to power factor will be at the discretion of the circuit owner.

Table 15: Peak Load									
Circuit Point	Generation Off			95% Generation- Hold Taps			Generation 100% - Steady		
[redacted]	120.3	120.7	118.6	124.5	124.5	121.9	124.5	124.6	122.1
	122.7	122.4	121.3	--	--	--	123.2	123	121.9
	1534	1518	1703	--	--	--	240	223	416
	321	321	359	--	--	--	332	328	367
	97.9	97.8	97.9	--	--	--	58.7	56.3	75
	17137	16400	17282	--	--	--	15913	15123	15986

Generation Off

During this simulation, the proposed PV was turned off while all existing PV remained at full output. As shown in Table 15 above, all voltages readings were within the PURA limitations.

Generation On

Under this simulation, all generators, including the proposed generator, were turned on. As shown in Table 15, all voltages were within the PURA limitations.

Generation at 95% - Flicker

The same analysis for voltage flicker was studied during light load conditions. Table 16 below illustrates the voltage flicker. The voltage flicker does not stay within the 2% threshold with the worst-case scenario at 3.49%. Voltage flicker will be eliminated using a ramp rate. Implementing a ramp rate will further limit the impacts of this fluctuating resource.

Table 16: Max Load Flicker (N-1)			
Phase	A	B	C
PCC	3.49%	3.15%	2.78%

Minimum Loading

At daytime minimum loading steady state conditions, with generation at unity power factor and the customer generation connected, the system can sustain voltage within PURA limitations on all circuits associated with the [redacted]. The system does not cause high voltage at the PCC; or elsewhere on the [redacted] feeders.

Table 17: Min Load 37%									
Circuit Point	Generation Off			95% Generation- Hold Taps			Generation 100% - Steady		
[redacted]	121.8	121.8	121.3	125.6	125.2	124.2	125.6	125.2	124.2
	122.7	122.6	122.3	--	--	--	122.8	122.7	122.4
	546	530	615	--	--	--	-755	-772	-683
	246	257	259	--	--	--	285	293	300
	91.2	90	92.1	--	--	--	-93.5	-93.5	-91.5
	5933	5530	6143	--	--	--	4640	4236	4854

Generation Off

During this simulation, the proposed PV was turned off while all existing PV remained at full output. As shown in Table 17, above, all voltages readings were within the PURA limitations.

Generation On

Under this simulation, all generators, including the proposed generator, were turned on. As shown in Table 17, all voltages were within the PURA limitations.

Generation at 95% - Flicker

The same analysis for voltage flicker was studied during light load conditions. Table 18 below illustrates the voltage flicker. The voltage flicker does not stay within the 2% threshold with the worst-case scenario at 3.12%. Voltage flicker will be eliminated using a ramp rate. Implementing a ramp rate will further limit the impacts of this fluctuating resource.

Table 18: Min Load Flicker (N-1)			
Phase	A	B	C
PCC	3.12%	2.79%	2.39%

Regulators and Capacitors

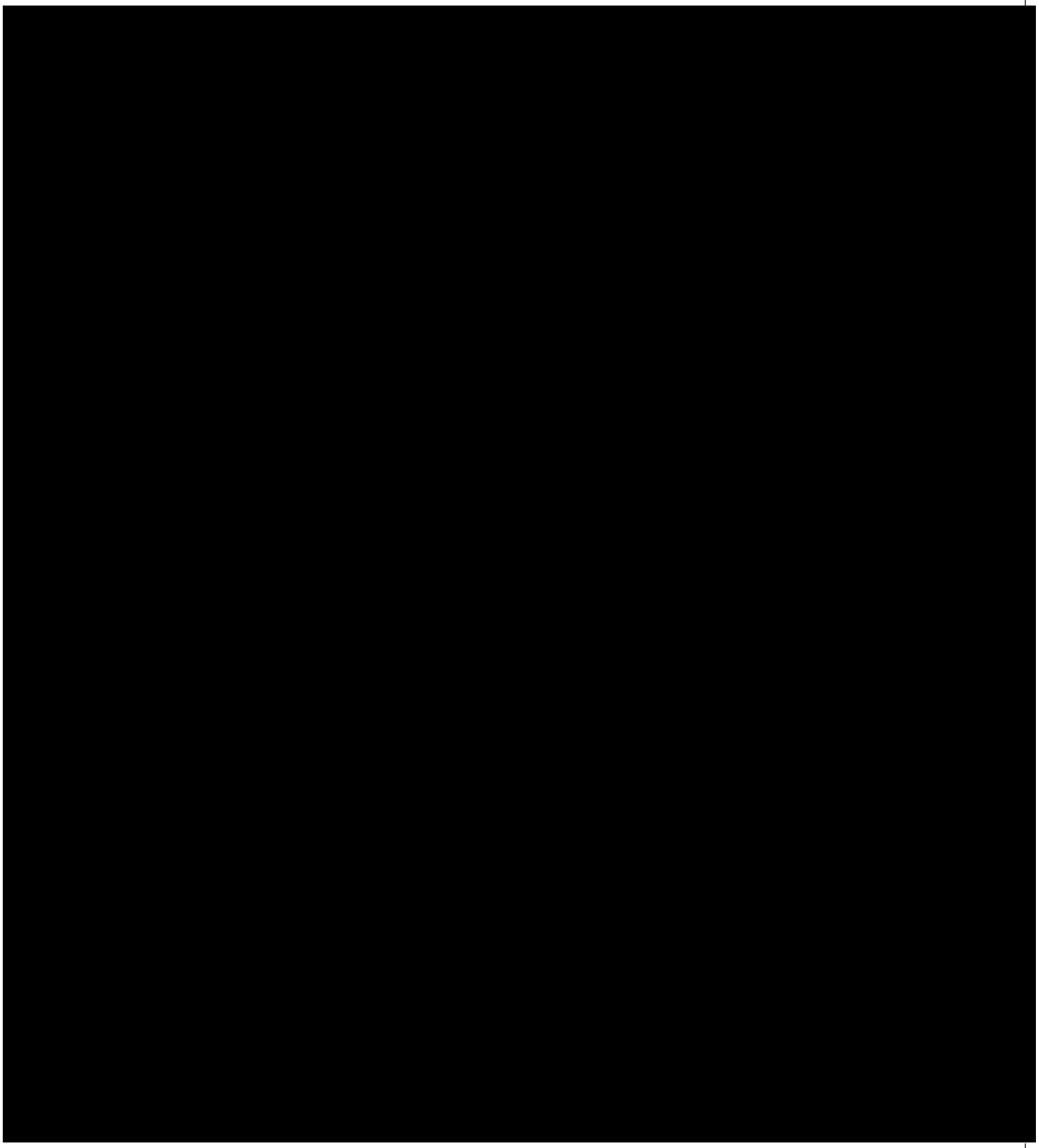
The [redacted] circuit has one [redacted] capacitor bank and three set of 150A voltage line regulators. The below tables illustrate the regulator and LTC operations that were experienced under the above load flow scenarios. During the minimum load when there was a reverse power flow through the feeder head all the voltage-controlled capacitors were turned off in the Synergi model. There were no capacitor bank operations as a result of the DG ramping on or ramping off due to fluctuation in output.

Primary Configuration: [redacted] Transformer

Table 19, below, illustrates the regulator tap positions and substation LTC positions before and after the PV system was put into the model. As you can see, there is no tap changes to the substation LTC with the addition of this project.

Project Approval Form





System Upgrades and Service

Primary Feed [redacted]

The customer will also need a new three phase service consisting of a recloser and one primary meters.

It was determined that system upgrades are necessary for the installation of this DG. The project will need the following:

[redacted]

Protection Study

P&C concluded that the system needs additional effective grounding measures. When the project goes to construction a coordination study will be conducted. The customer is expected to follow the Eversource inverter and relay settings. The typical settings mandated by ISO-NE are shown below in Figure 5.

One major aspect related to protecting the proposed system and electric grid, is whether the system is effectively grounded. Below describes the four (4) main criteria looked at to ensure the system is effectively grounded. All four (4) criteria must pass to be deemed effectively grounded.

1. Is the DG less than one (1) megawatt (MW)? *FAIL
2. Does the proposed system pass the anti-islanding concern or in other words, does it pass the generation to load ratio requirement? *YES
3. Does the fault current at the point of common coupling (PCC) stay below a value that's greater than 10% of the existing value? *YES
4. Is the proposed area unknown to excessive fault currents? *YES

Since the system failed One (1) of the four (4) effective grounding conditions, the customer will be responsible for providing additional effective grounding on the [redacted] installation.

[redacted]

Conclusion

Community Power Group has requested to interconnect an aggregate of [redacted] of inverter-based PV generation to the low side of the Rockville 14W substation on the [redacted] feeder at [redacted]. The system will be located approximately at [redacted] Ellington, CT which is located approximately [redacted] circuit miles from the [redacted] substation. The project did not cause any adverse impacts to customer voltages or power quality. The DG did not cause excess capacitor bank operations. The project did not cause any LTC operations. Their operation will be managed by implementing a ramp rate on the project, standard practice for Eversource to eliminate any voltage flicker. This project will be able to connect to the Eversource EPS with the installation of the required upgrades listed in the system upgrades and service section above. A dynamic study in PSCAD was also performed to check Transient Over Voltage (TOV) and Ground Fault over Voltage (GFOV) and no concerns were found in the dynamic study.

Appendices

