Exhibit M
System Impact Study

Distribution Generation Interconnection Impact Study

PLH Vineyard Sky LLC
Maple Rd, North Branford, CT

April 15, 2024

Prepared For:
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1. Executive Summary

This distribution system impact study evaluates the effect of a proposed Distributed Generation (DG) interconnection, located at 121 W Pond Rd, North Branford, CT, 06471, on the operation and performance of the electric distribution system.

A system model was developed to simulate the DG interconnection under various operating conditions. The simulations results have shown that proposed DG interconnection of 4,000 kW of PV generation would result in no adverse impacts on the Electric Distribution Company (EDC) distribution system, nor to customers supplied from the same distribution feeder to which the Project would interconnect, if mitigations identified in this report are implemented prior to operation, based on the United Illuminating criteria.

The proposal cannot be implemented as requested without the system upgrades identified below. United Illuminating still needs to confirm protection and control impacts, as well as resulting impacts from proposed voltage regulation changes.

A summary of results is shown below in Table 1.

Analysis	Criteria	Results	Upgrades	Notes
Voltage Change	97.5% - 105%	Pass	None	Change one cap bank to Fixed ON operation
Voltage Fluctuations (Transient)	ΔV<3% at POI	Pass	Change existing regulator control settings	Operate proposed project at 97% var-absorbing power factor
Interconnection Transformer	Meets UI standards for utility grade	Pass	None	
Harmonics	< 5% THD, Individual Hamonic Requirements	Pass	None	
System Imbalance	Voltage Imbalance <3% Current Imbalance <15% Difference between phases <50 Amps	Pass	None	
Potential Ferroresonance	Wye connected primary	Pass	None	
Risk of Islanding	LROV & Sandia Screen	Fail	None	Further assessment needed
Distribution Thermal Loading	No distribution facilities loaded >90%	Pass	Remove/upgrade fuses	Remove or replace in-line fuses with 3-phase device
Feeder Thermal/Load Flow	Reverse power flow No Substation facilities >90% loaded	Pass	None	

Table 1 Results Summary

2. INTRODUCTION AND EVALUATION DESCRIPTION.

PLH Vineyard Sky LLC has requested the interconnection of two adjacent projects of 2,000 kW each of photovoltaic generation at 121 W Pond Rd, North Branford, CT, 06471. The projects have requested approval for the full output of 4,000 kW of PV generation through two 2,000 KVA GSU transformers, 13,800V G-Wye / 600V G-Wye, Z=5.75%, X/R=5.19. **For the remainder of this report, these two adjacent projects, totaling 4,000 kW, will be referred to as "the project".**

The purpose of this study is to evaluate the proposed DG interconnection through the Quinnipiac Substation, Feeder 1548 and its impact on the UI distribution system.

It is assumed that the customer, PLH Vineyard Sky LLC, will follow good engineering practice to conduct appropriate studies and evaluation of their facilities to ensure adequacy of all customer-owned equipment to be able to perform at the operating level detailed in their application.

The following items have been identified as the main areas of concerns for the DG interconnection to the UI system and will be included as part of this system impact study:

a. Voltage change Analysis - evaluation of the steady-state distribution voltage level on the feeder to ensure that voltage levels stay within acceptable limits.

b. Voltage Fluctuation Analysis – evaluation of the rapid change in voltage caused by changes in output at the generating station. This study is being performed to ensure that transient voltage during on to off generating transitions do not cause excessive voltage swings.

c. Interconnection Transformer – evaluation of compatibility of customer owned interconnection transformers with the EDC.

d. Harmonics – evaluation of harmonics injection from the generator and inverter to ensure compliance with total harmonic distortion (THD).

e. System Imbalance Impacts - evaluation of potential for voltage and current imbalance outside of criteria due to the interconnection of the DG installation.

f. Potential Ferroresonance – evaluation of the potential for the occurrence of ferro resonance upon switching at the service entrance.

g. Unintentional Islanding Screening – evaluation for an unintentional islanding condition in which the generator continues to supply power to a location even though electrical grid power from the local Electric Power System (EPS) is no longer present.

h. Distribution Thermal Loading – evaluation of thermal loading on distribution system equipment because of the DG installation.

i. Substation Thermal /Load Flow – evaluation of reverse power flow through the substation transformer, and into the transmission grid because of the DG installation and any thermal issues caused in the substation.

3. STUDY MODELS AND ASSUMPTIONS

Characteristics of the proposed DG interconnection and UI system are summarized below. The full one-line diagram of this interconnection is available in Appendix A and Feeder layouts are available in Appendix B.

- The proposed DG Interconnection Request was signed on 3/28/2022 and a revised single line drawing dated 6/9/2021 will be used in the study.
- The generating facility will be connected to the UI 13.8 kV distribution system at 121 W Pond Rd, North Branford, CT, 06471 on Feeder # 1548 out of the Quinnipiac Substation.
- The proposed DG unit will be connected to the UI 13.8 kV distribution system through two (2) 2,000 KVA GSU transformers, 13,800V G-Wye / 600V G-Wye, Z=5.75%, X/R=5.19.
- The transformers are assumed to be utility-grade and has a Basic Insulation Level (BIL) of #95 kV.
- The photovoltaic generating system will consist of 32 KACO 125 TL3 125kW inverters.
- The study assumes the proposed PV system will operate at a full output of 4,000 KW at unity power factor.

A system model has been developed in the CYMDIST version 9.2r1 power system simulation software. A diagram showing the circuit configuration is available in Appendix B. This model represents the photovoltaic generator, the GSU transformer, and the interconnecting distribution feeder with protection equipment.

Below is a list of assumptions made as part of the modeling and analysis:

- The system model considered both peak and minimum load conditions on the supply feeder, using 2021-2023 load information for maximum and minimum load data respectively, for the total demand of the feeder. This study uses the worst case scenarios of the last 3 years to determine possible mitigation techniques for observed adverse impacts
- All other customers' existing parallel generators and all generation on the feeders prior to the proposed project are assumed to be in service. Other existing DG generation on these feeders are not explicitly modeled during evaluation
- Loads are modeled as constant power type.
- The Load Flow analysis was conducted to determine the project impact on steady-state circuit voltage. To ensure adequate voltage to customers, 114 to 126 volts, the circuit voltage must remain within the range of 117 to 126 volts (120 volt base) during normal operations. In general, the circuit voltage at the substation must remain in the range of

120 to 126 volts to maintain an adequate voltage on circuit under all anticipated load conditions regardless of generation operation.

- The voltage at the source node of the feeders is operated at 1.03 per unit (14.2 kV) during peak load periods.
- The voltage at the source node of the feeders is operated at 1.00 per unit (13.8 kV) during minimum load periods.
- For peak load scenarios all the capacitors in the circuit are considered connected. For light load, the radio-controlled capacitor banks are considered disconnected, and the fixed ones connected.
- All voltages shown in the report refers to the Medium Voltage side (13.8 kV) converted to a 120 V nominal basis.

4. INTERCONNECTION EVALUATION

The system models developed were used to complete the required analyses and simulations to meet the screening criteria identified in Section 2 of this report. The subsequent sections provide the detailed performance of the DG interconnection against this criterion under multiple operating Scenarios. The Scenarios evaluated are summarized in Table 2 below.

DG Output	Load Model	Circuit kVA	Circuit kW
4,000 kW, 1.0 PF	Peak	10,750	10,635
4,000 kW, 1.0 PF	Off-Peak	2,500	2,475

Table 2 Evaluation Scenarios

4.1. Voltage Change Analysis

Voltage impact is a key screening criterion when interconnecting DG to the utility system. At a baseline, the impact of the DG under steady state conditions needs to meet standards to ensure that it can operate in normal conditions without causing issues to the system or other UI customers. The steady state voltage with and without the DG interconnected are shown in the table below.

Scenario	Feeder Vmin before DG	Feeder Vmax before DG	Feeder Vmin after DG	Feeder Vmax after DG	Results
Peak	118.1	124.7	118.3	124.9	Pass
Off-Peak	116.4	121.2	116.7	121.2	Fail
Criteria	Voltage between 117V – 126V				Fail

Table 3: Steady State Voltage

A voltage profile graph of each scenario, with DG off and at full output, is shown in the Figures 1-4 below.

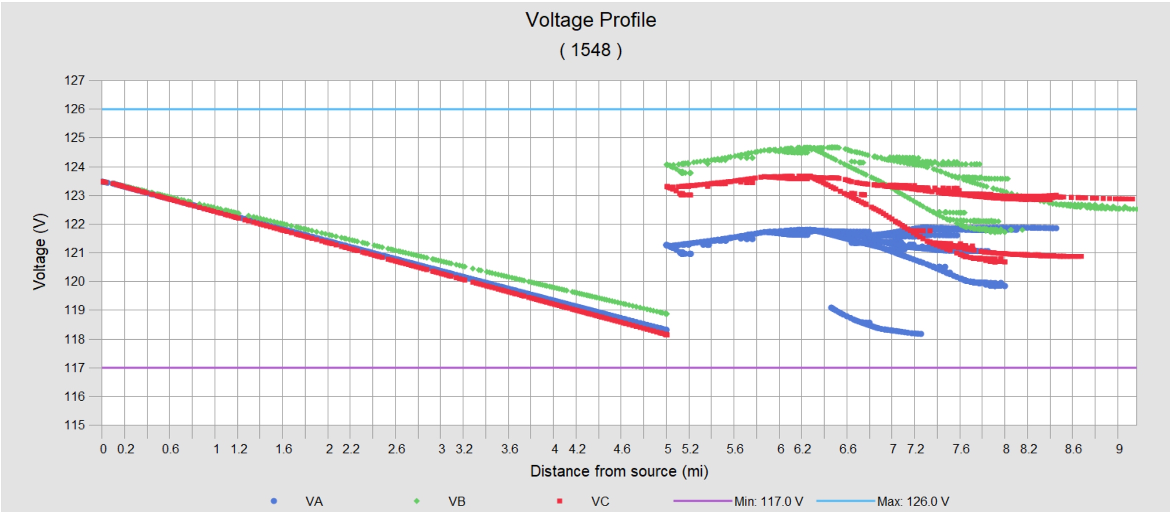


Figure 1: Feeder 1548, Peak Load, Trace of Feeder, Generation Off

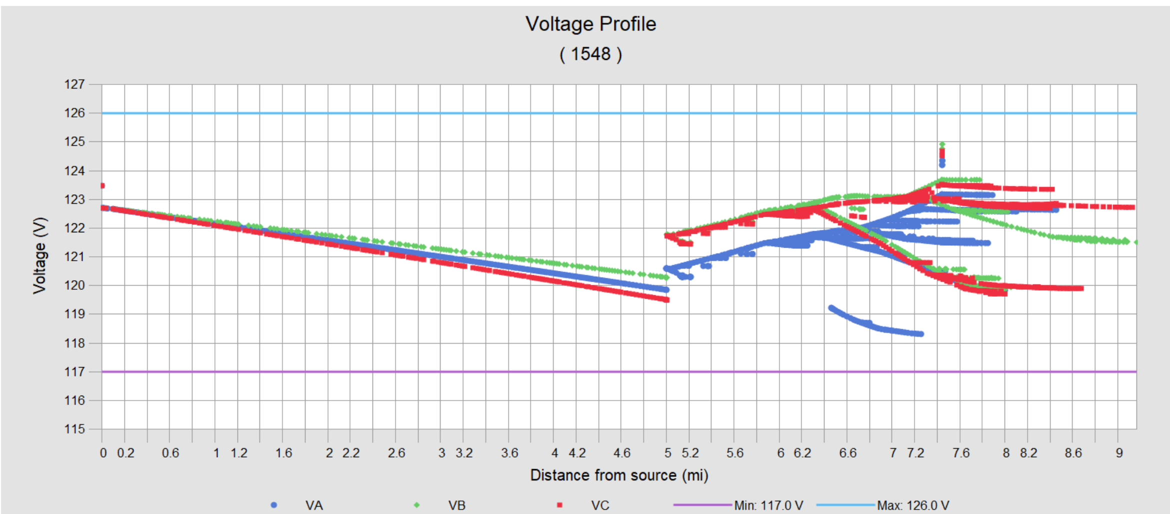


Figure 2: Feeder 1548, Peak Load, Trace of Feeder, Generation On

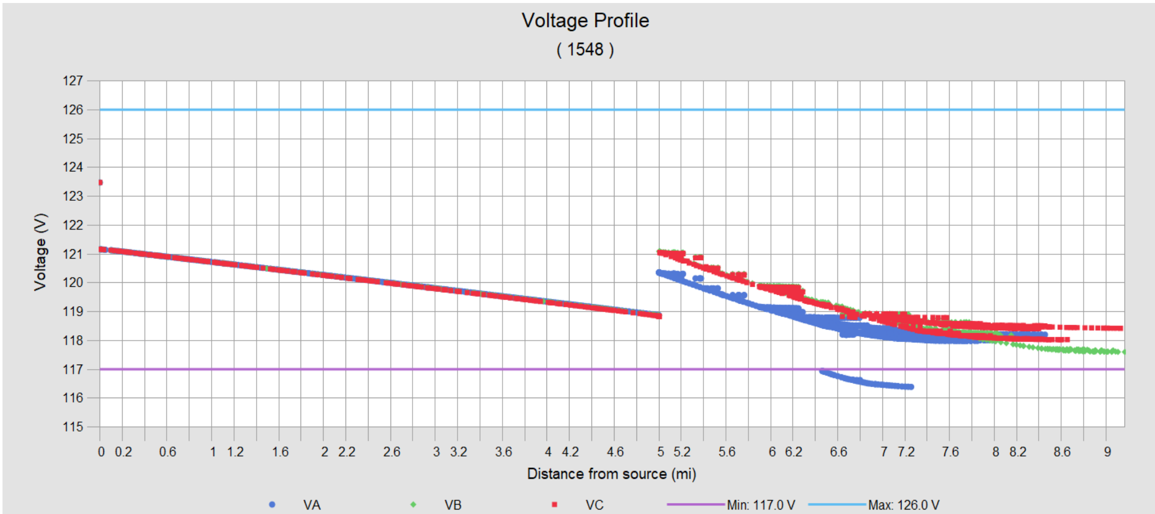


Figure 3: Feeder 1548, Off-Peak Load, Trace of Feeder, Generation Off

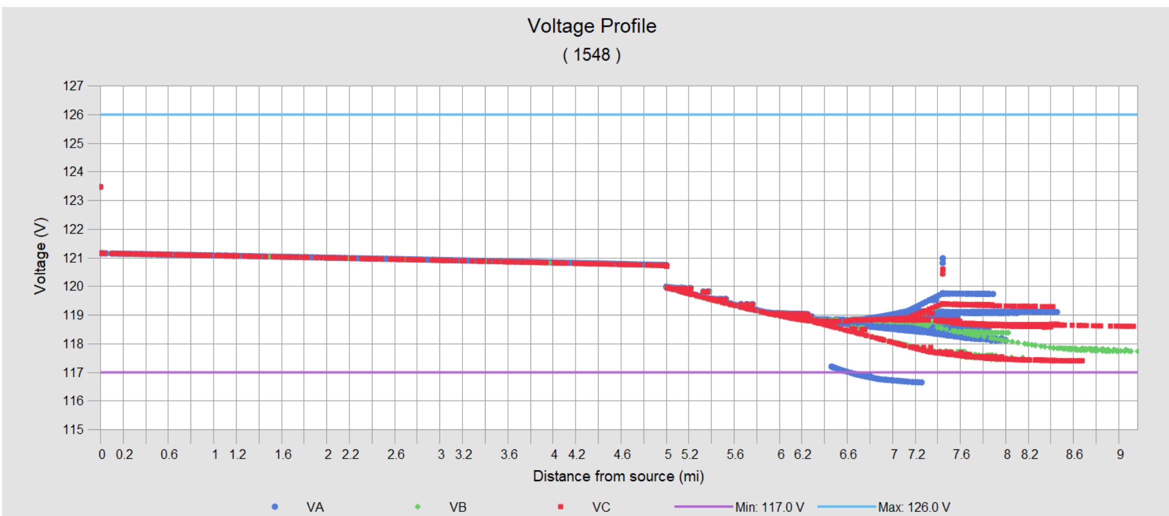


Figure 4: Feeder 1548, Off-Peak Load, Trace of Feeder, Generation On

Based on the criteria, there are steady state voltage violations which exist before and after the proposed DG interconnection. This issue can be mitigated with the following changes:

- Modify operating mode of 900 KVAR capacitor bank on Foxon Rd (RT 80), near Library Pl (Cyme section OH_PRI_1514177) from radio control to Fixed ON.

The following Table 4 and Figures 5 and 6 summarize the impact of this mitigation for the steady state voltage change off-peak scenario. **The remainder of the analyses in this report will assume this mitigation is in place:**

Scenario	Feeder Vmin before DG	Feeder Vmax before DG	Feeder Vmin after DG	Feeder Vmax after DG	Results
Peak	118.1	124.7	118.3	124.9	Pass
Off-Peak	117.5	121.3	117.7	122.1	Pass
Criteria	Voltage between 117V – 126V				Pass

Table 4: Steady State Voltage with Proposed Mitigation

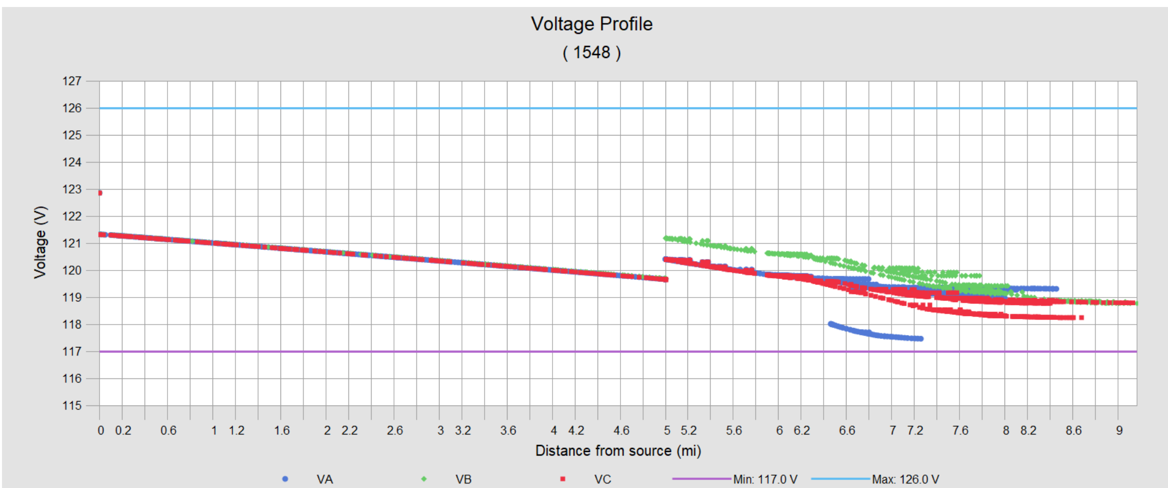


Figure 5: Feeder 1548, Off-Peak Load, Trace of Feeder, Generation Off (Mitigated)

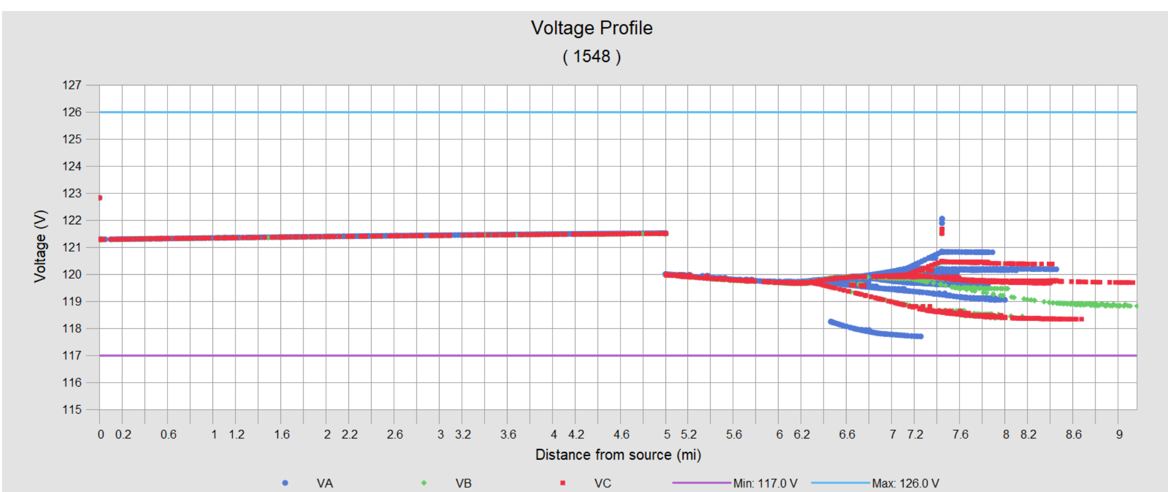


Figure 6: Feeder 1548, Off-Peak Load, Trace of Feeder, Generation On (Mitigated)

4.2. Voltage Fluctuation Analysis

One of the most significant limiting factors of interconnecting a new generating source is how much the voltage changes when the full capacity of the DG is suddenly disconnected from the system. These voltage changes may impact the safety, power quality, and reliability of supply to other customers which are served by the same feeder that the proposed DG will be interconnected to.

For these reasons it is recommended that voltage changes of more than 3% will trigger closer scrutiny. Standard utility voltage regulating equipment, including substation transformer load tap changers (LTC) and pole type voltage regulators may not be able to compensate for larger changes in voltage in a timely manner.

Table 5 below shows a summary of each Scenario when the photovoltaic system goes from full output (4,000 kW) to no output (0 kW).

Scenario	Voltage @ Full Output	Voltage @ No Output	ΔV/% change	Resulting tap change operations	Results
Peak					
Station Bus	122.5	122.1	0.4V/0.3%	0	Pass
Line Regulators	121.5	118.5	3.0V/2.5%	5	Fail
Project POI	123.3	117.9	5.4V/4.4%	N/A	Fail
Off-Peak					
Station Bus	121.3	121.3	0.0V/0.0%	0	Pass
Line Regulators	120.0	118.1	1.9V/1.6%	4	Fail
Project POI	120.4	116.6	3.8V/3.2%	N/A	Fail
Criteria	ΔV<3% at POI, No Excessive Tap Operation				Fail

Table 5: Voltage Fluctuation Summary

A dynamic voltage profile graph of each scenario, with the proposed DG transitioning from full output to no output, is shown in the Figures 7-12 below.

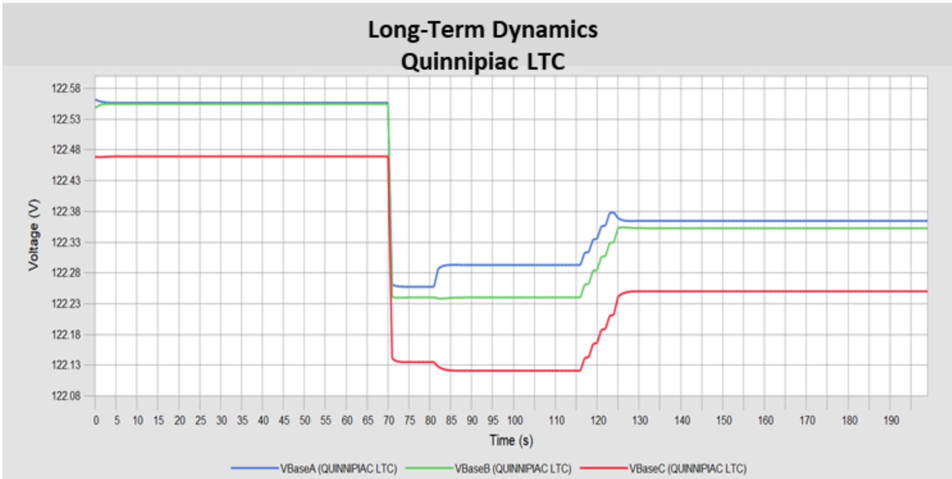


Figure 7: Peak Load, Quinnipiac Station Bus, Generation Shutoff at 70sec

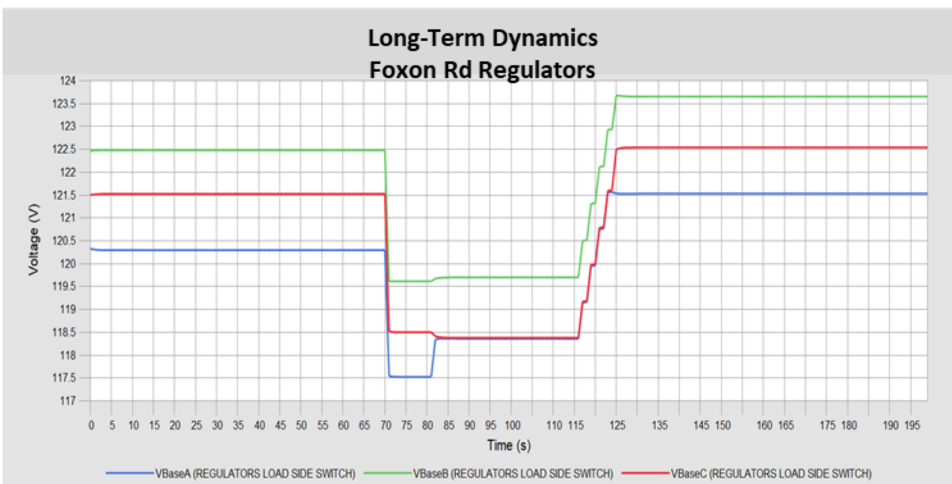


Figure 8: Peak Load, Foxon Rd Regulators, Generation Shutoff at 70sec

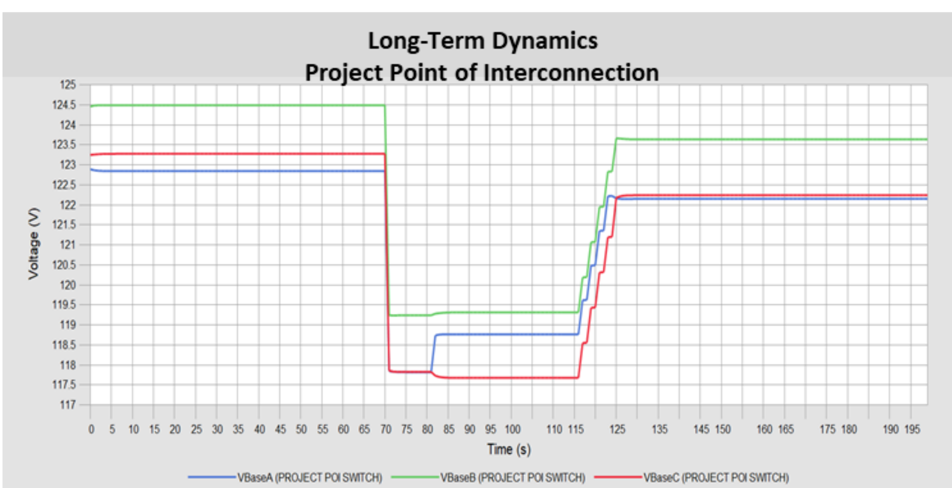


Figure 9: Peak Load, Project POI, Generation Shutoff at 70sec

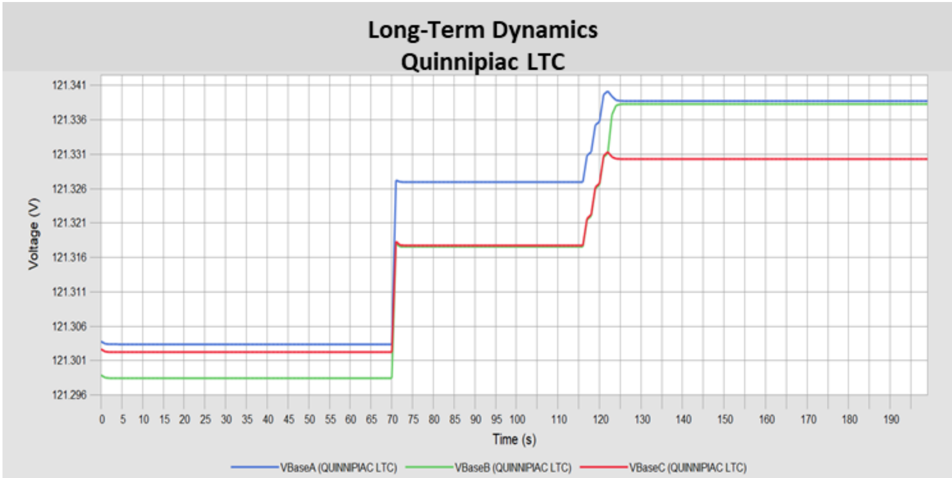


Figure 10: Off-Peak Load, Quinnipiac Station Bus, Generation Shutoff at 70sec

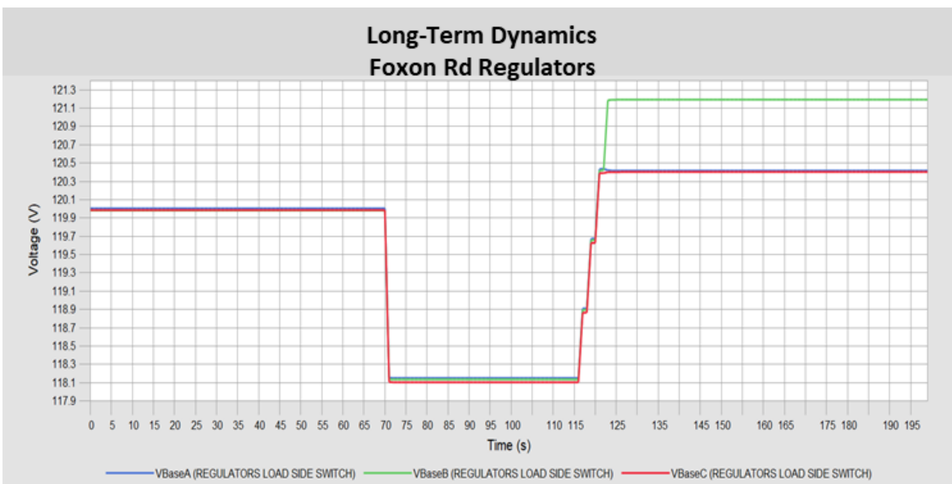


Figure 11: Off-Peak Load, Foxon Rd Regulators, Generation Shutoff at 70sec

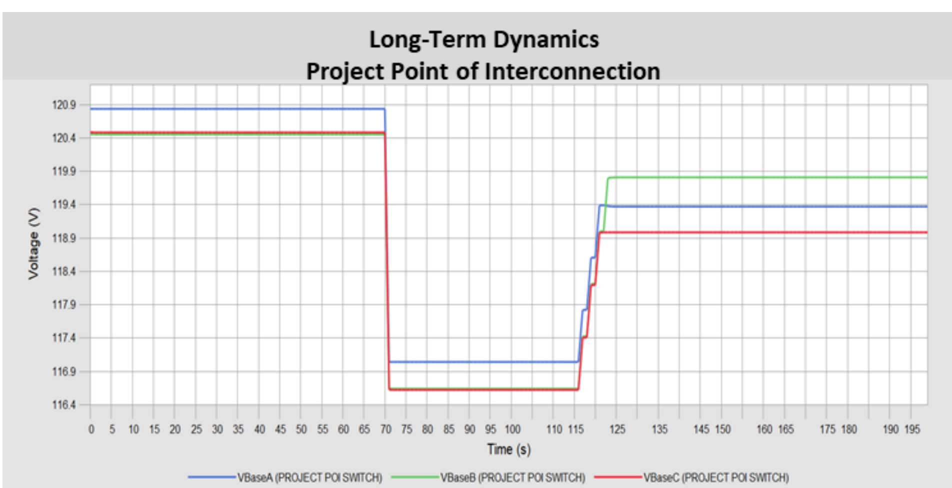


Figure 12: Off-Peak Load, Project POI, Generation Shutoff at 70sec

Based on the established criteria, the interconnected DG will cause excessive transient voltage on the interconnection Feeder, as well as excessive tap operations on the Foxon Rd regulators. These violations can be at least partially mitigated by making the following changes:

- Operate the PV project at a 97% var-absorbing PF.
- Change the Foxon Rd regulator control settings to "Cogeneration" mode, Voltage Setpoint = 122V, Bandwidth = 2V, and remove the Line Drop Compensation (LDC) settings (R=0, X=0). These will also be the settings for reverse power flow.

The following Table 6 and Figures 13-16 summarize the impact of this mitigation for steady state voltage change scenarios. **The remainder of the analyses in this report will assume these additional mitigations are in place:**

Scenario	Feeder Vmin before DG	Feeder Vmax before DG	Feeder Vmin after DG	Feeder Vmax after DG	Results
Peak	117.2	123.2	118.1	123.1	Pass
Off-Peak	118.3	121.3	117.7	121.2	Pass
Criteria	Voltage between 117V – 126V				Pass

Table 6: Steady State Voltage with Proposed Mitigation

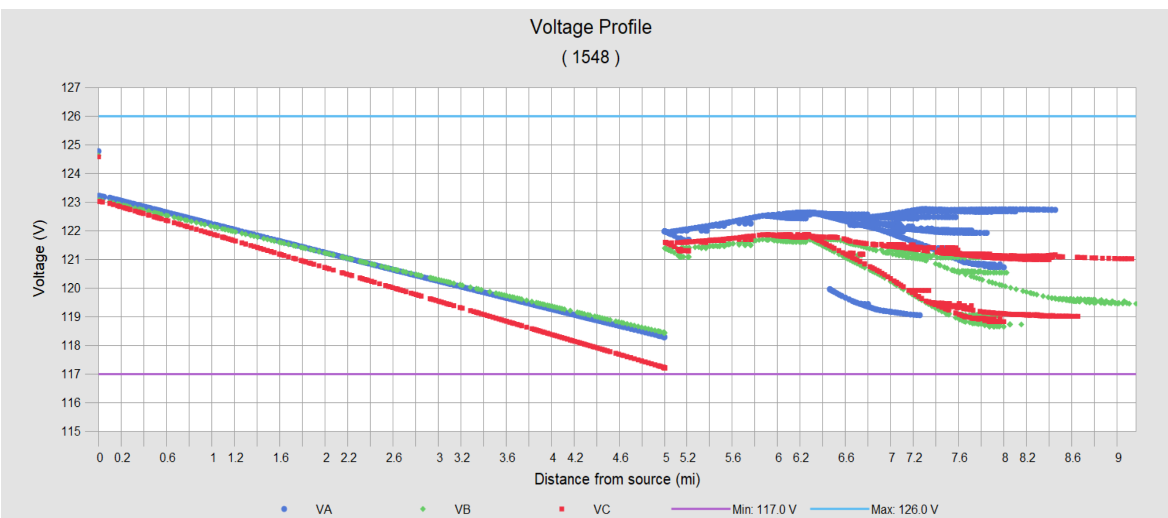


Figure 13: Feeder 1548, Peak Load, Trace of Feeder, Generation Off (Mitigated)

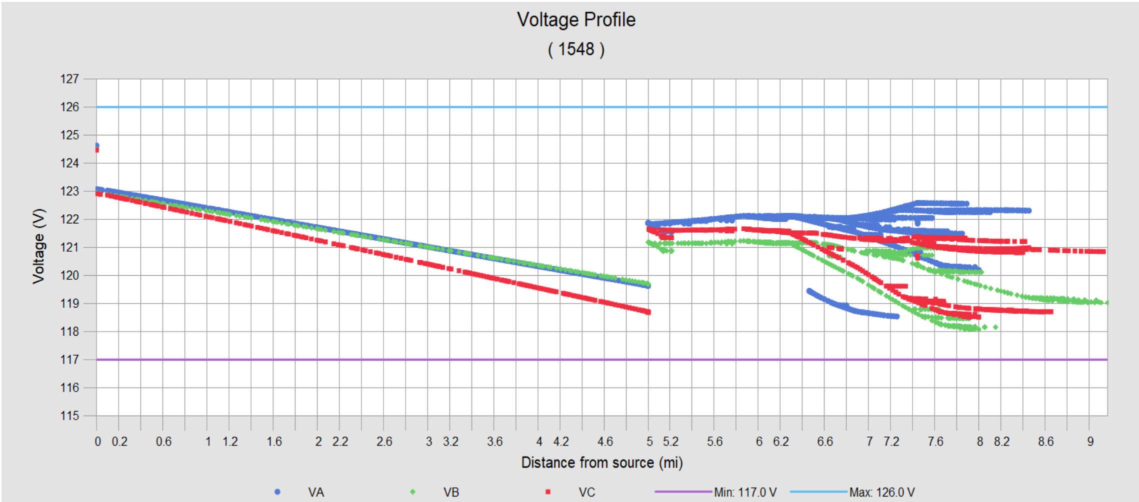


Figure 14: Feeder 1548, Peak Load, Trace of Feeder, Generation On (Mitigated)

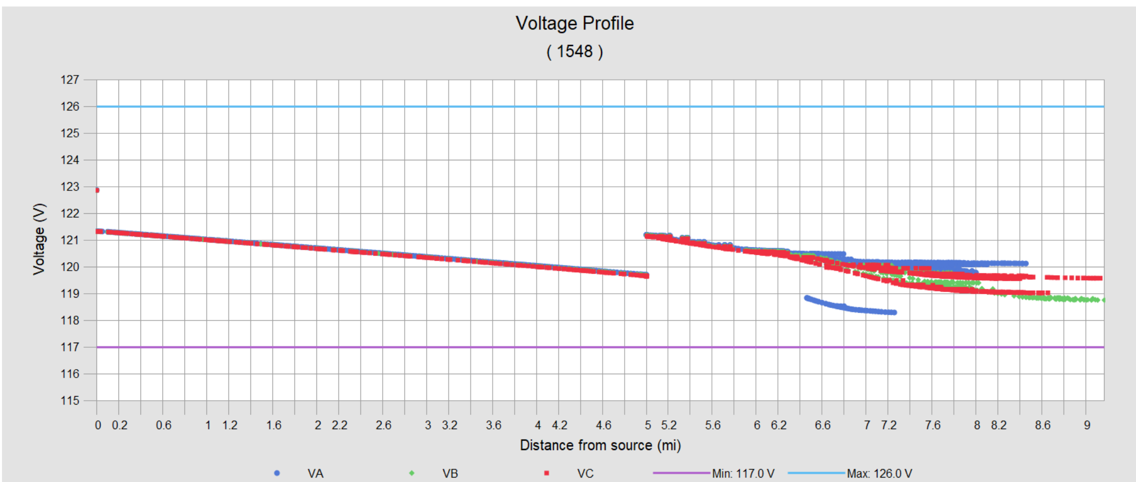


Figure 15: Feeder 1548, Off-Peak Load, Trace of Feeder, Generation Off (Mitigated)

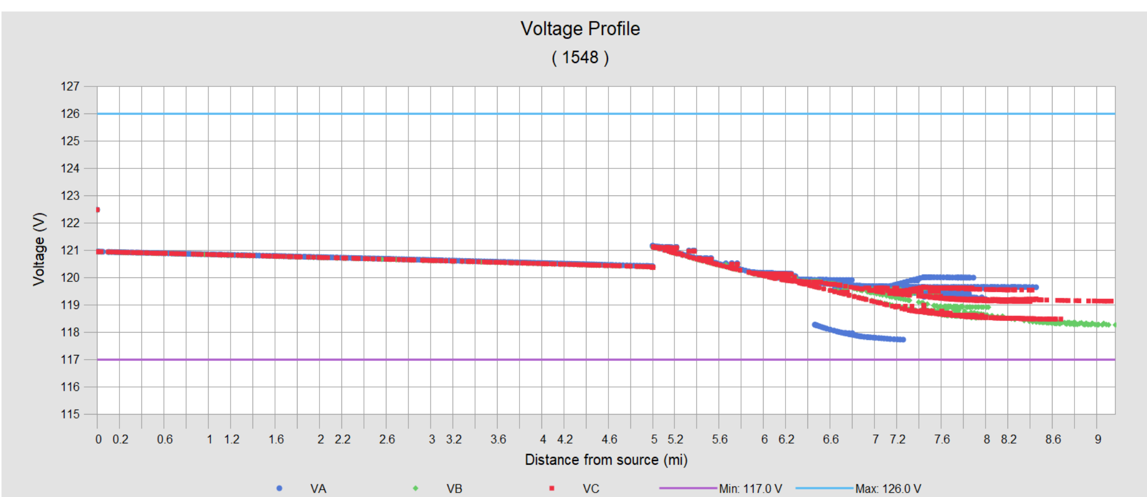


Figure 16: Feeder 1548, Off-Peak Load, Trace of Feeder, Generation On (Mitigated)

The following Table 7 and Figures 17-22 summarize the impact of this mitigation for voltage fluctuation scenarios. **The remainder of the analyses in this report will assume these mitigations are in place:**

Scenario	Voltage @ Full Output	Voltage @ No Output	ΔV/% change	Resulting tap change operations	Results
Peak					
Station Bus	122.9	123.0	0.1V/0.0%	0	Pass
Line Regulators	121.6	120.0	1.6V/1.3%	2	Pass*
Project POI	121.4	119.5	1.9V/1.6%	N/A	Pass
Off-Peak					
Station Bus	120.9	121.3	0.4V/0.3%	0	Pass
Line Regulators	121.3	120.4	0.9V/0.7%	1	Pass
Project POI	119.7	119.0	0.7V/0.6%	N/A	Pass
Criteria	ΔV<3% at POI, No Excessive Tap Operation				Pass*

Table 7: Voltage Fluctuation Summary

*The proposed mitigation reduces voltage fluctuation below the 3% criteria and reduces the number of tap change operations. United Illuminating needs to confirm that the proposed changes are consistent with existing voltage control strategy on this feeder, and that the resulting regulator tap change operations will be acceptable.

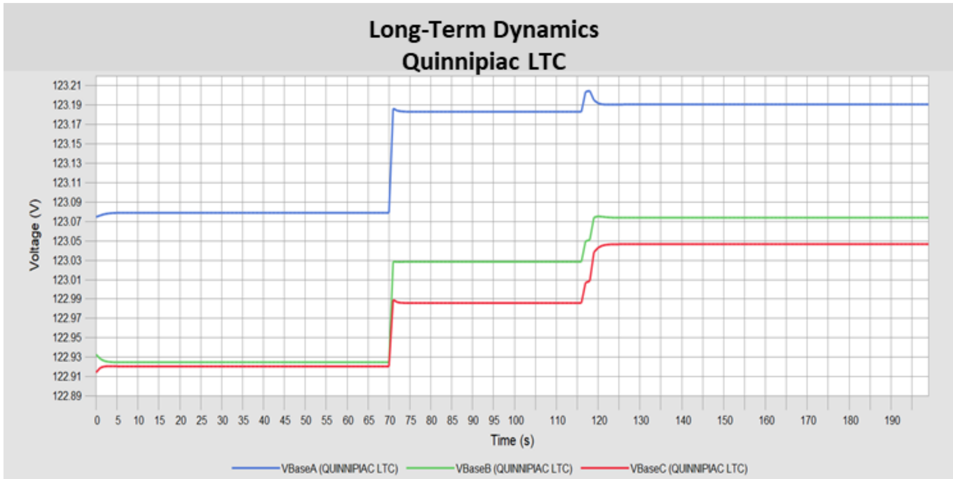


Figure 17: Peak Load, Quinnipiac Station Bus, Generation Shutoff at 70sec

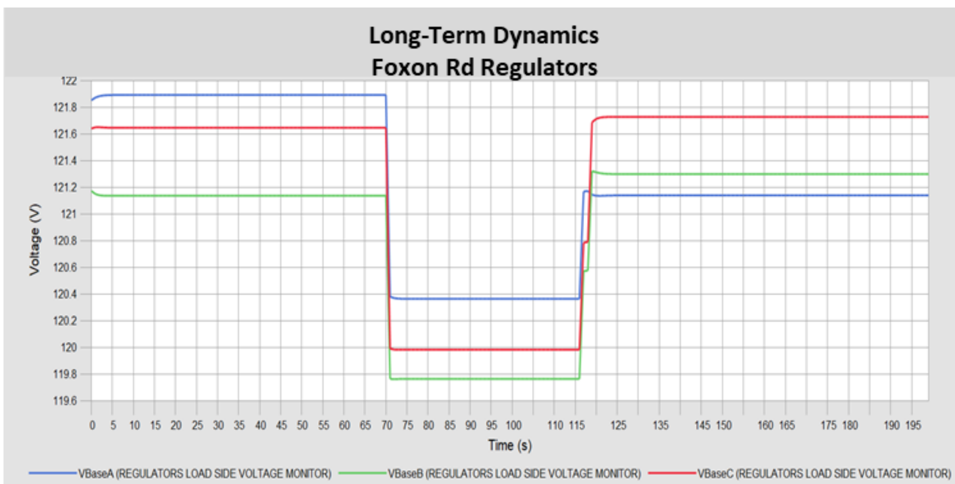


Figure 18: Peak Load, Foxon Rd Regulators, Generation Shutoff at 70sec

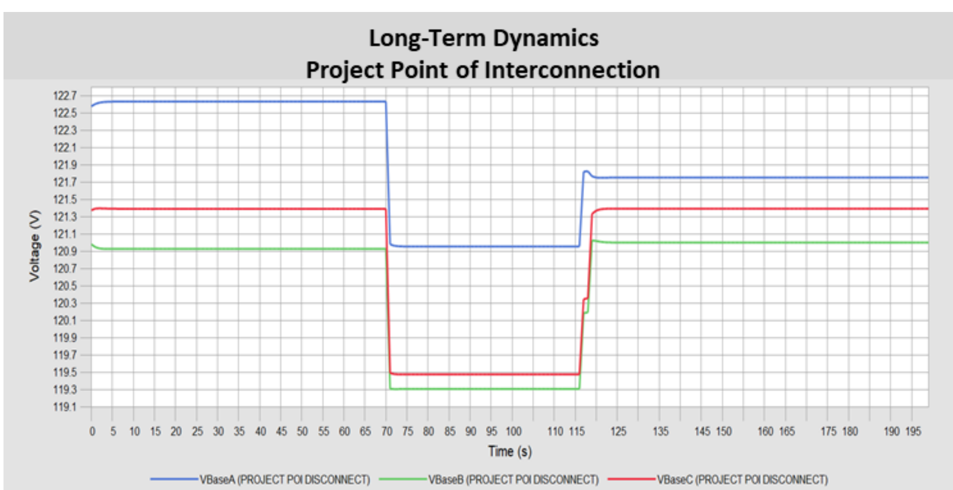


Figure 19: Peak Load, Project POI, Generation Shutoff at 70sec

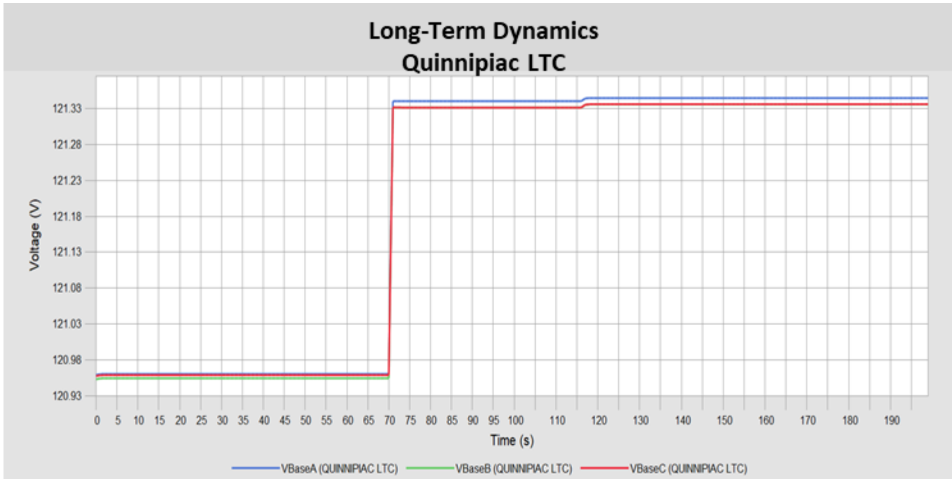


Figure 20: Off-Peak Load, Quinnipiac Station Bus, Generation Shutoff at 70sec

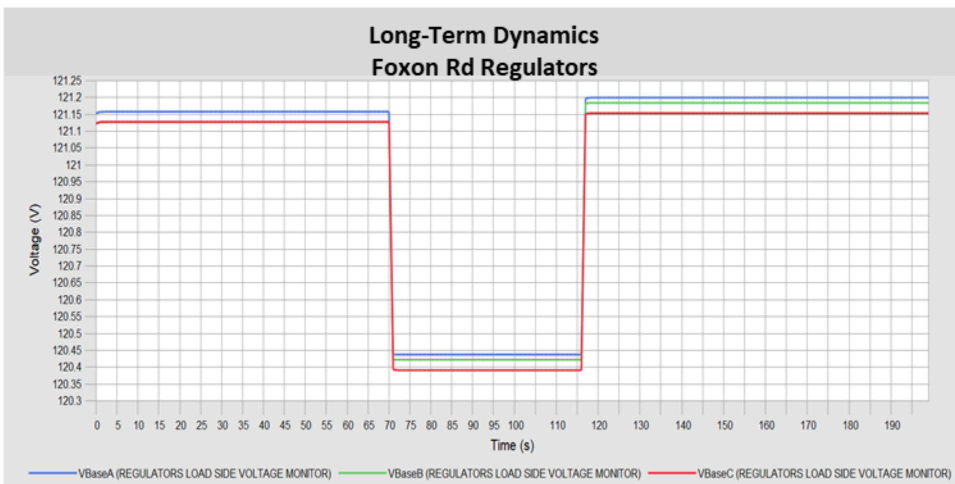


Figure 21: Off-Peak Load, Foxon Rd Regulators, Generation Shutoff at 70sec

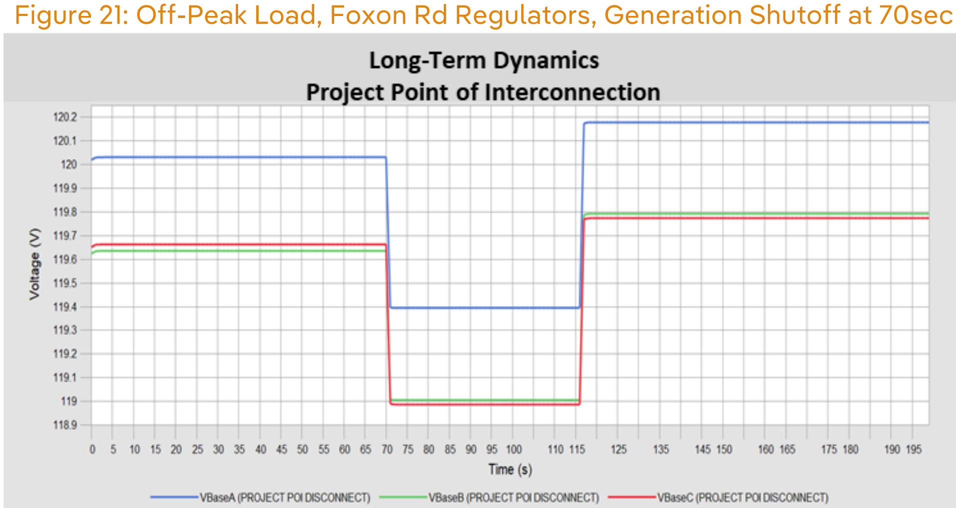


Figure 22: Off-Peak Load, Project POI, Generation Shutoff at 70sec

4.3. Interconnection Transformer

UI's interconnection guidelines specify a utility grade interconnection transformer for generators of this size. The 4,000 kW photovoltaic system will be interconnected to the distribution system through two medium voltage (13.8 kV) 2,000 KVA GSU transformers, 13,800V G-Wye / 600V G-Wye, Z=5.75%, X/R=5.19. This transformer is assumed to be utility grade, with an assumed Basic Impulse Insulation Level (BIL) of #95 kV. With the above specs and assumptions, this transformer will meet specifications for this application and be acceptable for use with no adverse impacts and be insulated from lightning.

4.4. Harmonics

The inverters used for this project are expected to have low current-distortion levels to ensure compatibility with other equipment connected to the utility system. They are expected to comply with the latest approved version of IEEE Standard 1547 waveform distortion limitations.

The evaluation of harmonic impacts is a crucial step in integration of large generation projects with the power grid. The photovoltaic system equipment is expected to have low current-distortion levels to ensure compatibility with other equipment connected to the utility system.

According to the datasheet provided for the inverters (KACO 125 TL3 125kW) the harmonics characteristics (THD) are <3 % and all individual harmonics meet criteria. Therefore, the project passes this section of the study.

The impact of harmonic current injected by individual DGs may be amplified via parallel resonance, which occur due to interaction between the power factor correction capacitor banks and substation transformers. In turn, interaction of harmonic currents from the devices with high impedance caused due to parallel resonance leads to a high harmonic distortion in voltage. Such high harmonic voltage can adversely impact system equipment and other customer loads.

If harmonic (voltage distortion) complaints result from operation this DG, the generator equipment may be disconnected from the Company's system until the generator resolves the problem. The Total Demand Distortion (TDD) from the facility will be measured at the point of common coupling (PCC). Under no circumstances may the harmonic current distortion, originating from the DG, be greater than the values listed in the latest approved version the IEEE 1547 Standard.

4.5. System Imbalance Impact

Like other distribution systems, the UI 13.8 kV distribution system experiences voltage and current imbalance because of uneven loading between phases. To not adversely impact the operation of the distribution system, the interconnection of this DG project should not increase the imbalance of the distribution system beyond the criteria limits set forth by UI.

A summary of the worst 3-phase voltage imbalance before and after the interconnection of this DG is summarized below in Table 8.

Scenario	Largest 3-phase Imbalance Before DG	Largest 3-phase Imbalance After DG	Results
Peak	1.29%	1.35%	Pass
Off-Peak	0.57%	0.59 %	Pass
Criteria	Voltage Imbalance <3%		Pass

Table 8: Voltage Imbalance Results

A summary of the current imbalance at the start of the feeder before and after the implementation of this project is summarized in the Table 9 below.

Scenario	Feeder Head Phase Currents Before Project	Feeder Head Max Phase Current Differential Before Project	Feeder Head Max Phase Current Unbalance Before Project	Feeder Head Phase Currents After Project	Feeder Head Max Phase Current Differential After Project	Feeder Head Max Phase Current Unbalance Before Project	Results
Peak Load	373 A 363 A 379 A	16 A	1.4 %	212 A 206 A 219 A	13 A	6.1 %	Pass
Off-Peak Load	104 A 104 A 104 A	0 A	0.0 %	-91 A -91 A -91 A	0 A	0.0 %	Pass
Criteria	*See Below						Pass

Table 9: current imbalance at the start of the feeder

*From TM 1.61.00 AVANGRID Distribution Planning Criteria document:
A distribution circuit should be assessed for load balancing solutions when the most heavily loaded phase exceeds the average phase loading by over 15% or if phases are unbalanced by more than: 25 Amps for circuits at 35 kV class1; 50 amps for circuits in the 15 kV class2; and 100 Amps for circuits in the 5 kV class3.

The implementation of this project does not materially affect the voltage or current imbalance of the circuit.

4.6. Effective grounding/Ferroresonance

Ferroresonance refers to a special kind of resonance that involves system capacitance and the iron-core inductance of a transformer. Typically, the system capacitance of concern is the 15kV underground (UG) service entrance cable capacitance since it is most likely to be isolated with the transformer.

Ferroresonance generally occurs during a system imbalance, usually during switching, or when there is an open-phase condition with the conductor supplying the transformer. This unbalanced condition places capacitance in series with transformer magnetizing impedance. This can result in high over-voltages that may lead to failures in transformers, cables, arresters, and customer equipment.

The transformer's primary connection is a critical parameter in the analysis of ferroresonance.

Certain transformer winding connections are highly susceptible to ferroresonance, and some winding connections are less susceptible to ferroresonance. Transformers that are delta connected on the primary side (13.8 kV) are more susceptible to ferro resonance than those connected grounded wye. Also, there is a greater chance of ferro resonance when the transformer is lightly loaded, which will be the case due to a DG feeding into the distribution system when the feeder load falls below that of the DG's output.

Over-voltages greater than 1.25 p.u. can damage equipment during an open-phase condition. Analysis indicates that a primary UG cable run from the switching device to the transformer that has a high capacitance in combination with a lightly loaded transformer can lead to a ferroresonance susceptible condition.

The two (2) 2,000 KVA GSU transformers, 13,800V G-Wye / 600V G-Wye interconnection transformers will be less susceptible to ferroresonance. Connection of this system will also introduce a relatively small amount of underground cable to the system.

As a result, no additional actions are required to meet compliance in this area.

4.7. Unintentional Islanding Screening

The generator must adhere to IEEE Standard 1547 that mandates a DG must detect an unintentional islanding condition and cease to energize the Electric Power System (EPS) within two seconds of the occurrence. An islanding condition results whenever the DG continues to power a location even though electrical grid power from the local EPS is no longer present. This would occur if the feeder breaker were opened for any reason other than for a fault on the feeder, or if any other manual switching device in the feeder main line to the DG is opened. It should be noted that there may be interaction with other generators on the feeder. This operation can create hazards to personnel, other customers, and the general public, and may cause equipment damage. Because of the hazards involved, islanding must be avoided.

The Sandia National Laboratories Guidelines Report1 Suggested Guidelines for Assessment of DG Unintentional Islanding Risk analyses are used to perform preliminary screens and determine the risk of islanding.

The preliminary Sandia ROI screening results indicate that the risk of an unintentional island exists with this project, at the substation transformer level. The inverters identified for this proposal appear to meet the requirements of UL-1741. However, the inverter specification sheet does not indicate compliance with UL-1741 SA – CA Rule 21 or HECO Rule 14H. See Appendix A for Inverter Detail and Appendix C for screening results.

The issues that arise from islanding depend on the DG system configuration like transformer connections and type of generation. The photovoltaic generation system does not pass the Sandia Screen and requires a full time domain study of the substation from UI. The Sandia Screening documentation can be found in Appendix C.

4.8. Distribution Thermal Loading.

Excessive thermal loading of distribution equipment can lead to damage or failure of facilities. The interconnection of new DG facilities can create conditions where the direction of flow is changed and even increased from normal conditions. The change in loading across distribution facilities needs to be evaluated to ensure that the project does not create an overload condition. Table 10 below summarizes the highest percent loading of distribution facilities on the circuit.

Scenario	Highest % Loaded Device Before DG	Highest % Loading before DG	Highest % Loaded Device After DG	Highest % Loading After DG	Results
Peak	75KVA Step XF at OH_PRI_156446	93.4%	100K Fuse at OH_PRI_102648	162%	Fail
Off-Peak	75KVA Step XF at OH_PRI_156446	54%	100K Fuse at OH_PRI_102648	166%	Fail
Criteria	No facilities higher than 100% Rating				Pass*

Table 10: Distribution Thermal Loading Results

*The existing set of 100K fuses on the West Pond Rd tap off of Foxon Rd will be overloaded due to generation reverse power flow, and must be either removed or replaced with a more capable 3-phase device. Aside from this issue, the photovoltaic system will not create any additional distribution facilities beyond 100% of their rating so it is considered passing.

4.9. Substation Thermal/Load Flow.

Distribution systems have historically been designed for a constant direction of flow from source to load. Introducing distributed generation has the potential to change that direction under certain conditions. Identifying if this flow can change is a critical element of evaluating the interconnection of the photovoltaic system. This element of the study entails evaluating whether or not there will be backflow through the feeder into the substation transformer secondary bus. The magnitude of any backflow is identified for further evaluation

Scenario	Backflow Present?	Magnitude of backflow (mw)	Results
Feeder			
Peak	No	N/A	Pass
Off-Peak	Yes	1.32	Pass
Station XF			
Peak	No	N/A	Pass
Off-Peak	No	N/A	Pass
Criteria	No Backflow, Substation facilities loaded below 100% of rating		Pass

Table 11: Load Flow Results

Based on the results the proposed DG interconnection creates a feeder backflow condition seen by the circuit breaker at the feeder's head. It can happen during feeder minimum load and maximum generation in the new DG facility. The amount of backflow into the station bus is minimal, however the substation equipment and protection systems should be verified to be able to operate with reverse power flow. Reverse flow on Transformer B at Quinnipiac Substation is not expected as a result of this project. However, it does bring the transformer close enough to reverse flow to merit close monitoring by UI.

No substation facilities showed thermal loading violations as a result of this addition. For these reasons, the project passes this portion of the impact study.

5. CONCLUSION

The 4,000 kW photovoltaic system was evaluated against the interconnection criteria described and summarized in this report using the source from Quinnipiac Substation Feeder #1548. Both peak and off-peak models were evaluated.

The following changes to the feeder and the proposed project will be necessary to implement the requested project interconnection:

- **Modify operating mode of 900 KVAR capacitor bank on Foxon Rd (RT 80), near Library Pl (Cyme section OH_PRI_1514177) from radio control to Fixed ON.**
- Change the Foxon Rd regulator control settings to "Cogeneration" mode, Voltage Setpoint = 122V, Bandwidth = 2V, and remove the Line Drop Compensation (LDC) settings (R=0, X=0). These will also be the settings for reverse power flow.
- Remove or replace the existing set of 100K fuses on the West Pond Rd tap off of Foxon Rd with a more capable 3-phase protection device.
- Operate the PV project at a 97% var-absorbing PF.

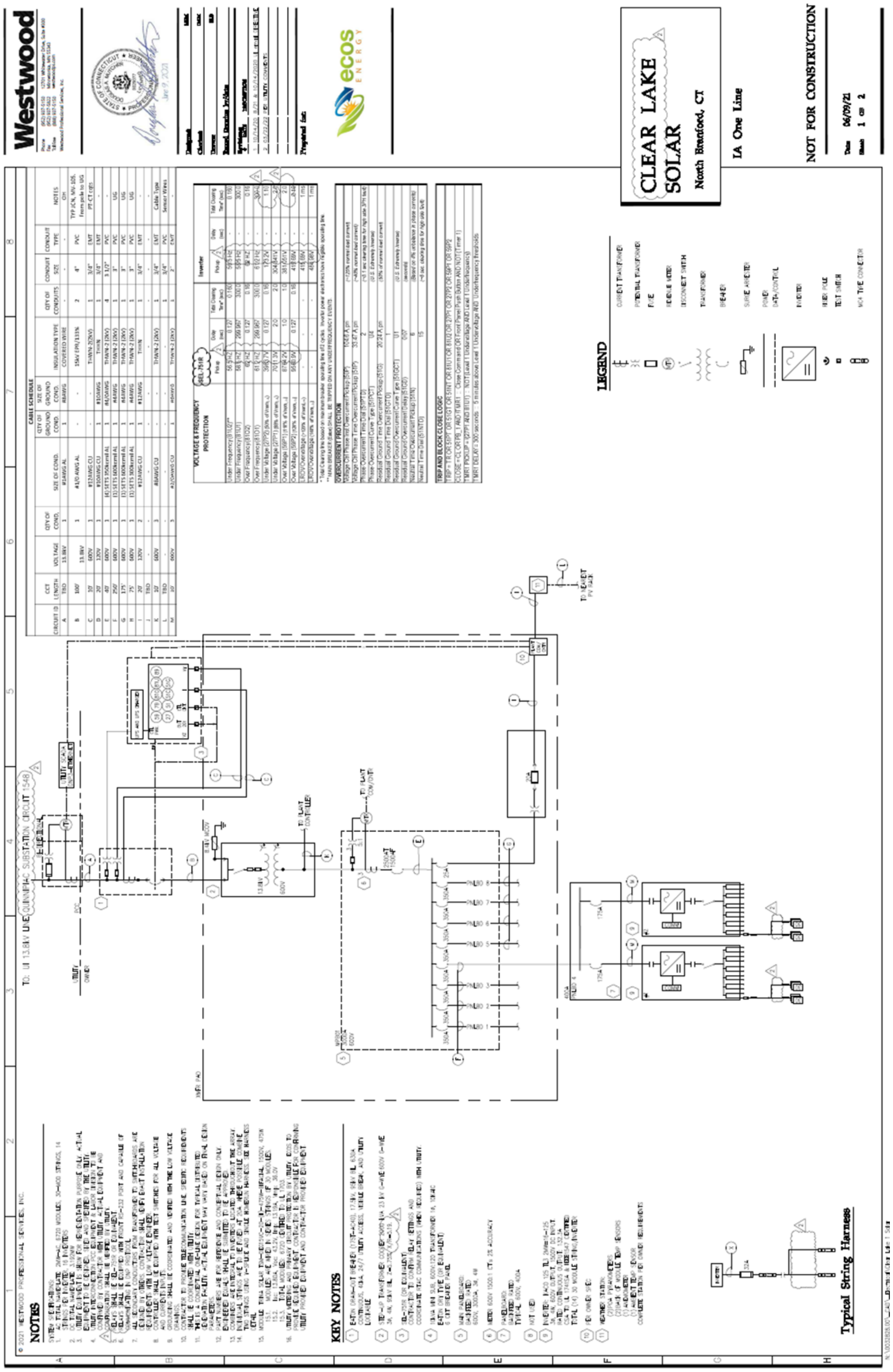
Based on the results, the photovoltaic system may be interconnected once the backflow at the substation, and the potential for excessive regulator tap change operations have been verified to not be an issue. Should either of these issues pose a problem, possible options for implementing this project are listed below:

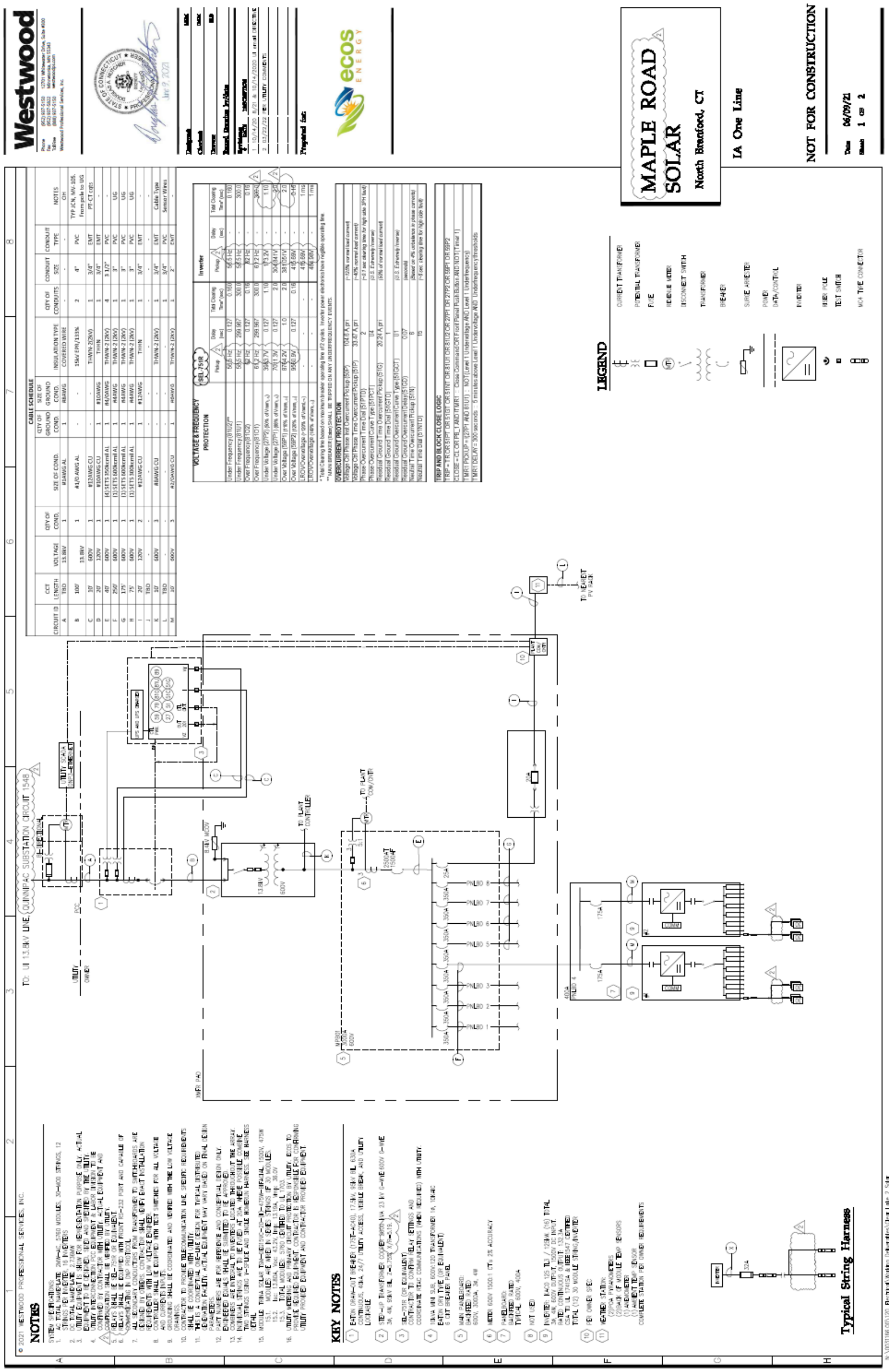
- Downsize project proposal
- Discuss potential use of smart inverter Volt-Var settings to reduce voltage fluctuation and regulator tap operation

Protection and Control teams should verify all possible impact in coordination or any other that could impact a reliable and secure operation of the feeder.

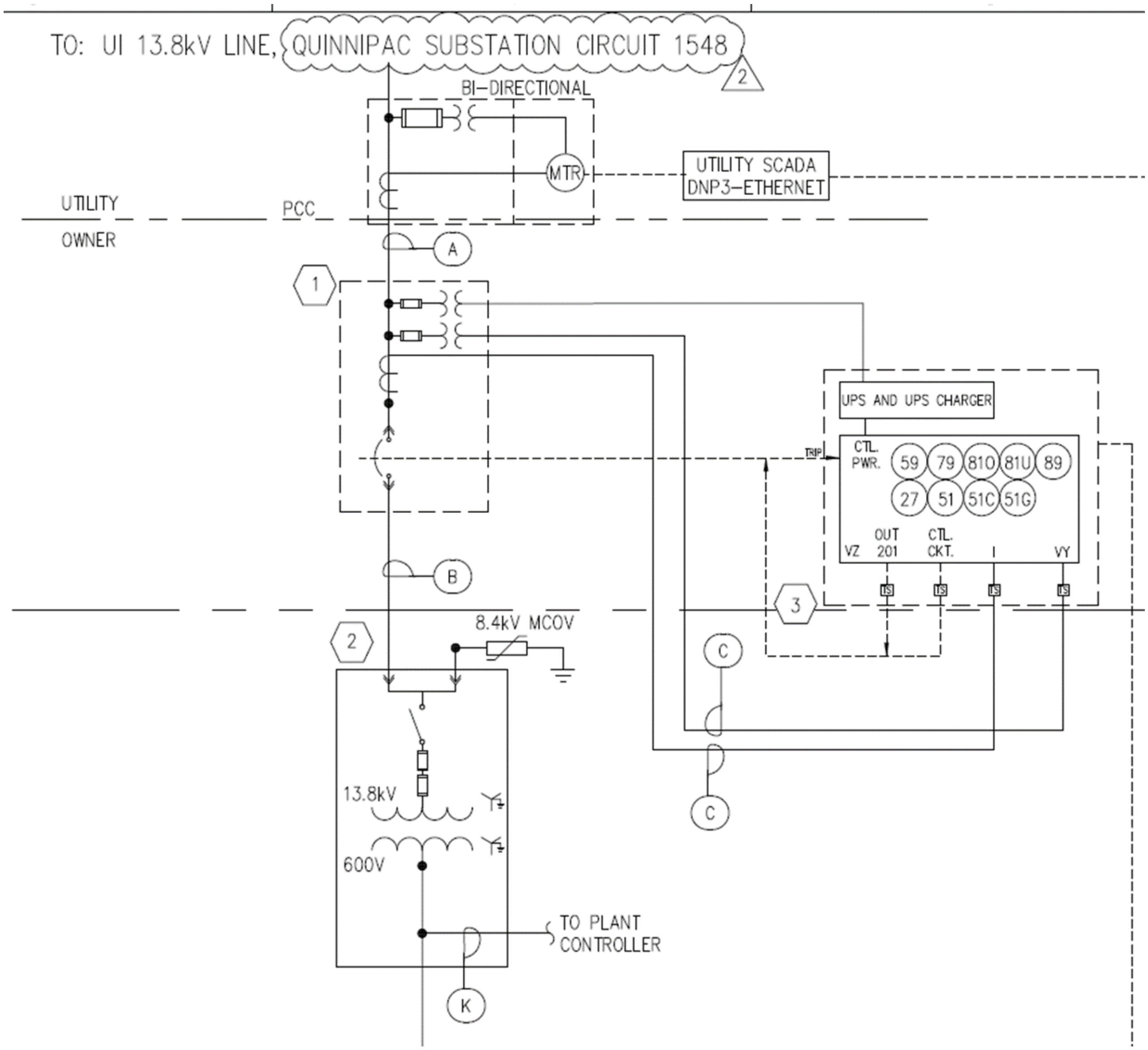
Additional studies not undertaken as part of this study, such as short circuit and protection criteria, may require system improvements or modifications for interconnection.

Appendix A - CUSTOMER ONE-LINE DIAGRAMS




Westwood
ecos ENERGY
MAPLE ROAD SOLAR
North Branford, CT
IA One Line
NOT FOR CONSTRUCTION
NOTES
KEY NOTES
LEGEND
Typical String Harness

Zoom of PCC and Step Up Transformer (same for both projects):



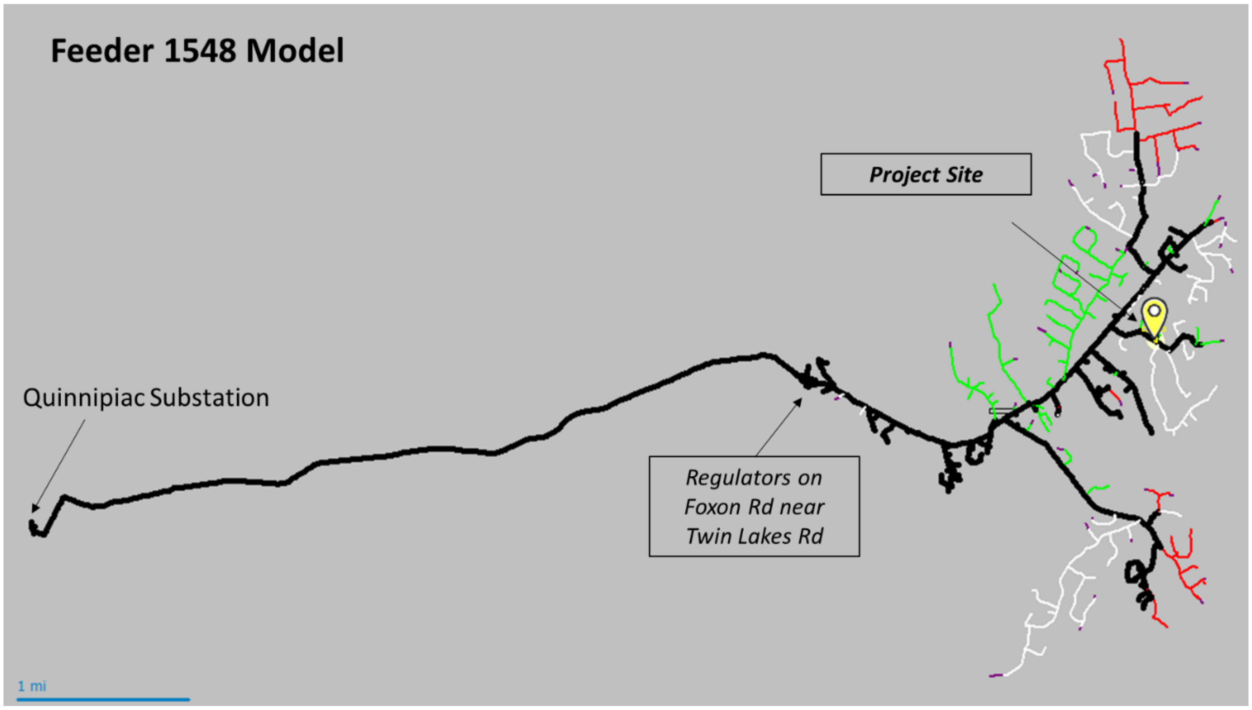
Technical Data

KACO 125TL3 Inverter Specifications

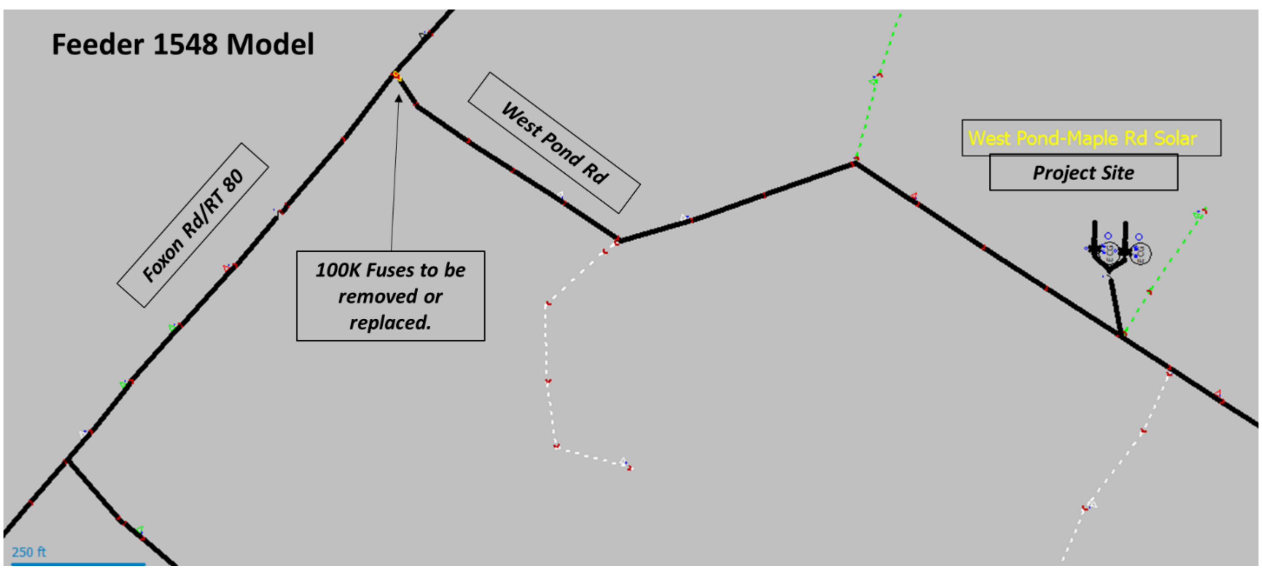
DC input data	125 TL3
Max. recommended PV generator power	187 500 W
MPP range	875 – 1 300 V
Operating range	875 – 1 450 V
Rated DC voltage / start voltage	900 V / 1 000 V
Max. no-load voltage	1 500 V
Max. input current	160 A
Max. short circuit current $I_{sc\,max}$	300 A
Number of MPP tracker	1
Connection per tracker	1 - 2
AC output data	
Rated output	125 000 VA
Max. power	137 500 VA
Line voltage	600 V (3P+PE)
Voltage range (Ph-Ph)	480 – 760 V
Rated frequency (range)	50 Hz / 60 Hz (45 – 65 Hz)
Rated current	3 x 120.3 A
Max. current	3 x 132.3 A
Reactive power / cos phi	0 – 100 % Som / 0.3 ind. – 0.30 cap.
Max. total harmonic distortion (THD)	≤ 3 %
Number of grid phases	3
General data	
Max. efficiency	99.2 %
Europ. efficiency	99.1 %
CEC efficiency	99.0 %
Standby consumption	< 10 W
Circuitry topology	transformerless
Mechanical data	
Display	LEDs
Control units	webserver, supports mobile devices
Interfaces	Ethernet (Modbus TCP, Sunspec) RS485 (Modbus RTU, Sunspec, KACO-protocol) USB, optional: 4-DI, WIFI
Fault signalling relay	potential-free NOC max. 30 V / 1 A
DC connection	cable lug, max. 240 mm² (0.372 in²) Cu or Al
AC connection	cable lug, max. 240 mm² (0.372 in²) Cu or Al
Ambient temperature	-25 °C – +60 °C [1]
Humidity	0 – 100 %
Max. installation elevation (above MSL)	3 000 m
Min. distance from coast	500 m
Cooling	temperature controlled fan
Protection class	IP66 / NEMA 4X
Noise emission	59.2 db (A)
H x W x D	719 x 699 x 450 mm
Weight	78.2 kg
Certifications	
Safety	UL62109-1, UL1741, CSA-C22.2 No. 62109-1, CSA-C22.2 No. 62109-2, CSA-C22.2 No. 107.1 IEC 62109-1/-2, EN 61000-6-1/-2/-3, EN 61000-3-11/-12
Grid connection rule	overview see homepage / download area

[1] Power derating at high ambient temperatures

Appendix B - FEEDER MODEL DIAGRAMS



Zoom of Project Location



Appendiz C - LROV RESULTS AND SANDIA SCREEN RESULTS

Project Information		
1	Project Number	DER 3173 and 3174
2	Developer	PLH Vineyard Sky LLC
3	Project Size (MW)	4
4	Generator Type	SOLAR
5	Inverter Manufacturer	KACO
6	Model Number	KACO 125TL3
Loading Information		
1	Substation	Quinnipiac Substation
2	Substation Transformer (STXF)	No.B Bank
3	Minimum MW on STXF	10071
4	MVAR	1000
5	Power Factor	99.00%
6	Timestamp	
7	Aggregated DG on STXF (MW)	11945
Load Rejection Overvoltage (LROV) Screen		
1	LROV Ratio	1.19 **SANDIA SCREENING REQUIRED**
2	Triggering Project (if LROV failed)	
3	HECO Compliance	Certificate Not Provided
SANDIA SCREENING REQUIRED		
Comments:		

Sandia Screen – Circuit Level

Step 1: Aggregate generation and minimum load on Circuit 1542			
1	Aggregate generation size (AC nameplate rating) kW	**5,024**	
2	Minimum day-time load, kW	**3,474**	
3	Is the aggregate DG size less than 2/3 of minimum daytime load of substation?	**NO**	
CHECK			
Follow Step 2			
Step 2: DG Requires Volt/VAR Operation			
1	Does the DG Project require to operate in Volt/VAR Mode?	**NO**	
CHECK			
Follow Step 3			
Step 3: VAR Imbalances on the Circuit			
1	Largest value of steady state power factor on potential islanding section with all DER off, PF in %	**99%**	
CHECK			
Follow Step 4			
Step 4:Non-inverter based DG and inverter based DG			
1	Sum of all non-inverter based DG (rotating machine) nameplate size on Circuit, kW	**0**	
2	Sum of all DG nameplate rating on circuit (both rotating DG and inverter-based DG), kW	**5,024**	
CHECK			
Follow step 5			
Step 5: Number of inverters and inverter manufactures			
		kW	**Number of Inverter**
1	Sum of all DG nameplate rating in the substation (inverter-based DG only), kW// Total number of inverters	**5,024**	**142**
2	Sum of all inverter nameplate rating from West Pond Rd Project, kW	**4,000**	**32**
	Sum of all inverter nameplate rating from small scale PV, kW	**1,024**	**110**
		0	**0**
		0	**0**
		0	**0**
		0	**0**
		0	**0**
3	D40: are less than 2/3, of the total DG on the circuit, from a single manufacturer in the potential island? E40: Is the total sum of inverters more than 10 AND are less than 2/3, of the total number of inverters on the circuit, from a single manufacturer in the potential island?	**NO**	**NO**
PASS			

SANDIA Screen - PASS, No Additional Study Required

K&A Team Comments:
Proposed project has 32 - KACO 125TL3 inverters.

Sandia Screen – Station Transformer Level

Step 1: Aggregate generation and minimum load in the substation			
1	Aggregate generation size (AC nameplate rating) at substation, kW	11,945	
2	Minimum day-time load at substation, kW	10,071	
3	Is the aggregate DG size less than 2/3 of minimum daytime load of substation?	NO	
CHECK			
Follow Step 2			
Step 2: DG Requires Volt/VAR Operation			
1	Does the DG Project require to operate in Volt/VAR Mode?	NO	
CHECK			
Follow Step 3			
Step 3: VAR Imbalances in the substation			
1	Largest value of steady state power factor on potential islanding section with all DER off, PF in %	99%	
CHECK			
Follow Step 4			
Step 4:Non-inverter based DG and inverter based DG			
1	Sum of all non-inverter based DG (rotating machine) nameplate size at substation, kW	300	
2	Sum of all DG nameplate rating at substation (both rotating DG and inverter-based DG), kW	12,245	
CHECK			
Follow step 5			
Step 5: Number of inverters and inverter manufactures			
		kW	**Number of Inverter**
1	Sum of all DG nameplate rating in the substation (inverter-based DG only), kW// Total number of inverters	11,624	329
2	Sum of all inverter nameplate rating from West Pond Rd Project, kW	4,000	32
	Sum of all inverter nameplate rating from Fuel Cells, kW	4,200	3
	Sum of all inverter nameplate rating from other PV, kW	3,424	294
	Sum of all inverter nameplate rating from manufacturer 4, kW	0	0
	Sum of all inverter nameplate rating from manufacturer 5, kW	0	0
	Sum of all inverter nameplate rating from manufacturer 6, kW	0	0
	Sum of all inverter nameplate rating from manufacturer 7, kW	0	0
3	D40: are less than 2/3, of the total DG in the substation, from a single manufacturer in the potential island? E40: Is the total sum of inverters more than 10 AND are less than 2/3, of the total number of inverters in the substation, from a single manufacturer in the potential island?	YES	NO
FAIL			

SANDIA Screen - FAIL, Additional Study Required

K&A Team Comments:

Proposed project has 32 - KACO 125TL3 inverters.
Existing Fuel Cell projects - assumed inverter based, with one inverter per project.
300 KW hydro synchronous generator on circuit 1540