System Impact Study
For
WED Coventry, LLC & WED Coventry Two, LLC
Piggy Lane.
Coventry, RI 02816

2-1500 kW Three-Phase, Converter Based Synchronous Wind Turbine Generators

Interconnection to National Grid's 12.47 kV System

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Executive Summary

National Grid ("the Company") has completed the Impact Study, for the interconnection of the WED Energy, LLC, the ("Interconnecting Customer" or "IC"), proposed total 3000 kW comprised of two (2) 1500 kW Wind Turbine Facilities ("the Facilities") to its 12.47 kV distribution system ("the Projects") and presents the conclusions of the study herein. The requirements specified are exclusive to this project and are based upon the information submitted by the IC at the time the Interconnection Applications ("IA") were submitted. Any further design changes made by the IC post IA without National Grid's knowledge, review, and/or approval will render the findings of this report null and void.

Pursuant to R.I.P.U.C. No. 2078 requirements, the proposed Facility is an Independent Power Producer ("IPP") consisting of two (2) 1500 kW (AC) ("WIND TURBINE") renewable systems. The Facilities will be located at Piggy Lane, Coventry, RI 02816 and will be connected on the customer's side of new primary metering points at the points of common coupling (PCC) on the 54F1 circuit ("Point of Interconnection" or "POI").

The purpose of this study was to:

- Conduct, as applicable, steady-state, stability, short circuit, and extreme contingency analyses and perform assessments of reliability performance of the Company's Electric Power System ("EPS") within the area of interconnection, with and without the proposed Facility, in accordance and applicable with reliability standards and study practices, and in compliance with the applicable codes, standards, and guidelines listed in Section 5.1 of the Company's *Electric System Bulletin No. 756 Appendix C: Distributed Generation Connected to National Grid Distribution Facilities Per The Massachusetts Standards for Interconnecting Distributed Generation ("ESB756D")* to determine the incremental impact and any potential adverse impacts associated with the interconnection of the Facility to the EPS.

- Determine any System Modifications required.

- Develop a planning grade cost estimate of facilities required to interconnection the Facility to the EPS.

- Provide a report describing the results of the Impact Study.

The study determined the interconnection of the Facility to be feasible with certain operating conditions. The necessary System Modifications include, but be not limited to, the installation of zero sequence overvoltage protection and Direct Transfer Trip, (DTT) at Coventry 54

substation, two new 12.47 kV primary services with metering at each Point of Common Coupling ("PCC"), and installation of a pole top recloser and load break switch between each PCC and POI. The PCC shall be at the Interconnection Customer's deadend structures on the customer's side of each of the two primary metering points, and the POI shall be at pole 49-12 off Piggy Lane.

Cost Estimates

The total estimated planning grade cost of the work associated with the interconnection of the Facility, is **$1,126,540.00** +/-25%, and includes:

System Modifications to Company EPS $907,000
Engineering, design, construction and testing for revenue
Metering, feeder modifications, reclosers, disconnect switches,
And remote stations modifications

Interconnecting Customer Interconnection Facilities ("ICIF") $22,400
Engineering review and acceptance, and compliance
Verification of the ICIFs including all required drawings
And equipment spec reviews, relay settings, and construction
And testing assistance by engineering

Tax Liability[1] $197,140
Applied to all capital associated with System Modifications

This planning grade estimate will be deemed withdrawn if not accepted by the Customer within ninety (90) calendar days of receipt of the study. **Additional costs will be involved when the required pole work takes place in Verizon Maintenance Areas and/or special environmental permitting is required. The costs associated with Verizon's work will be billed directly to the customer from Verizon. It will be the responsibility of the customer to obtain any and all easements and required permitting for work that takes place on private property.**

Estimated Schedule

The estimated duration for the Company to complete construction of the System Modifications is 18-24 months, however, the schedule driver can be impacted by unknown factors over which the company has no control. The schedule driver may be impacted by the need for

[1] The estimated tax liability was calculated using the rate at the time the estimate was completed (11.29%). Actual costs shall be reflective of the tax liability rate at the time of invoicing.

special permitting and remediation required for construction adjacent wetlands and a registered superfund site.

The interconnection schedule is contingent on the Interconnecting Customer's successful compliance with the requirements outlined in this report and timely completion of its obligations as defined in *ESB756D, Exhibit 2: Company Requirements for Projects Not Eligible for the Simplified Process*. The schedule for the Company's work shall be addressed during the development, or after the execution, of the Interconnection Agreement.

1.0 Introduction

WED Energy, LLC has requested a Distributed Generation interconnection for two (2) 1500 kW, 3000 KW total, Converter based, Synchronous Wind Turbine, renewable systems to an electrical circuit in National Grid's EPS. The Interconnection Customer's proposed In-Service date included in the Interconnection Application dated January 3, 2012 is October, 2013, however, the requested in service date is not binding.

In accordance with the R.I.P.U.C. NO. 2078 tariff, the Company has completed an Impact Study to determine the scope of the required modifications to its EPS and/or the Facility for providing the requested interconnection service.

1.1 Study Objective

The primary objectives of this Impact Study are to:

1. Identify the System Modifications necessary for the Project to reliably interconnect to the Company's system[2];

2. Identify deficiencies in the proposed Facility;

3. Identify operating restrictions;

4. Identify and describe the equipment, engineering, procurement, construction, installation, testing and commissioning work, needed to build the System Modifications and integrate them with the Interconnecting Customer's Interconnection Facilities ("ICIF");

5. Provide good faith planning grade cost estimates, within a tolerance of +/- 25%, for the System Modifications identified in Objective #1 and engineering review and acceptance of the ICIFs; and

[2]Draft design and settings may require a detailed study at a later phase in the process.

6. Provide a good faith estimate of the time required to complete the construction and installation of the System Modifications.

2.0 Project Description

2.1 Facility

As depicted in the Interconnecting Customer's Site Diagram and One Line Diagrams (*Appendix A Site Diagrams and One- Lines, Figures: 2, 3, & 4, respectively*), there will be two 1500 kW sites, for a total of 3000 kW. Each site will consist of:

Site 1 WED (RI-14319785)

- (1) Goldwind GW82-1500, 1500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.
- The output of the power converter is connected to a 1600 kVA 690V/12.47 kV step up transformer with delta primary and wye-grounded secondary windings. The output of the step up transformer is connected to a 1600 kVA 12.47 kV/12.47 kV isolation transformer with wye reactively grounded primary and delta secondary windings. A pad mounted 15 kV class neutral reactor is also connected to the neutral of the isolation transformer.
- The output of the isolation transformer is connected to a 15 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The output of the vacuum breaker is connected to a pole mounted, gang operated three phase, 15 kV class, 600A, lockable, load break switch. The Pole Mounted disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

Site 2 WEDII (RI-14462941)

- (1) Goldwind GW82-1500, 1500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.
- The output of the power converter is connected to a 1600 kVA 690V/12.47 kV step up transformer with delta primary and wye-grounded secondary windings. The output of the step up transformer is connected to a 1600 kVA 12.47 kV/12.47 kV isolation transformer with wye reactively grounded primary and delta secondary windings. A pad mounted 15 kV class neutral reactor is also connected to the neutral of the isolation transformer.
- The output of the isolation transformer is connected to a 15 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.

- The output of the vacuum breaker is connected to a pole mounted, gang operated three phase, 15 kV class, 600A, lockable, load break switch. The Pole Mounted disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

The facilities will export power as they are proposed to be independent power producers. Once all documentation have been received, National Grid will issue a request for bidirectional meters that are adequate for net metering.

2.2 Service Configuration

The proposed location of the Facilities are normally served by National Grid's 7.2/12.47 kV three-phase, 4 wire, multi grounded wye, effectively-grounded EPS.

Based on the Project design at the time the study was performed, the Interconnection Facilities shall consist of a 3-phase line extension from pole 49-12, off Piggy Lane, Coventry, RI onto the property and to two (2) PCCs, one for RI-14319785 and one for RI-14462941. Pole 49-12 off Piggy Lane will be considered the POI for both projects. The line extension will be constructed by National Grid, and shall consist of seven (7) poles, approximately 700' of line, two (2) load break switches, two (2) pole-top reclosers, and two (2) primary metering assemblies, and all associated equipment to be located on the private property. (*See Appendix B-Interconnection Configuration & EPS Modifications*, *Figure 5: POI & PCC Configuration)*. The area of the proposed POI and PCC is near wetlands and a registered superfund site, additional permitting and special soil remediation methods may be required.

In accordance with the National Grid Specifications for Electrical Installations ("ESB 750 Series"), the Interconnection Customer shall install the deadend pole directly after each primary metering assembly, and the Company shall frame it, deadend its conductors, and install anchors and guys. On each deadend pole, the Interconnection Customer shall install a gang operated disconnect on the pole, and complete connections from the switch to the Company's conductors. (Additional detail is provided in ESB756D, Section 5.4.1.3 and Exhibit 7.)

The Point of Common Coupling (PCC) will be designated as the Customer side of the aforementioned connections. National Grid will install bi-

directional meters once all required documentation has been received. The Company's Design Personnel will determine the exact location of the Company's facilities and the customer's dead end pole. The Interconnecting Customer shall be responsible for obtaining all easements required for the line extension in accordance with the Company's requirements.

2.3 Area EPS

This area is normally supplied by National Grid's 54F1 feeder that originates out of National Grid's Coventry substation, a 12,470 V multigrounded and effectively grounded distribution feeder.

There are three sets of line fuses between the POI and substation, Pole 49 Perry Hill Rd, Pole 38 Perry Hill Rd, and Pole 35 Old Summit Rd. For an interconnection of this size, these single phase line fuses will cause coordination problems and must be replaced with reclosers. For this project the Line fuses on pole 49 Perry Hill Rd will be replaced with a recloser on pole 49-50 Piggy Lane, the line fuses on pole 38 Perry Hill Rd will be removed, and the fuses on pole 35 Old Summit Rd will be replaced by a recloser at the same location and a fused cutout (40K) will be installed on pole 50 Perry Hill Rd. (*See Appendix B- Interconnection Configuration & EPS Modifications*, *Figure 6: 54F1 Modifications)*.

The ability to generate is contingent on the proposed DG Facility being served by the 54F1 feeder during normal operating conditions. Under abnormal operating conditions, or if it is not supplied by the 54F1 feeder, it is not guaranteed that the DG Facility will be allowed to operate.

The current 54F1 characteristics are as follows:

- The daytime loading on 54F1 feeder has varied between a peak of 9.3 MVA and a minimum of 2.5 MVA, at time of expected maximum generation, over the past year.

- Total aggregate generation interconnected/in-process on the 54F1 feeder is 1500 kW including this application at this time.

- The 54F1 feeder is regulated by single phase regulators located within the substation and has no additional voltage regulators installed outside the substation between the POI and the substation.

- The 54F1 has five (5) existing line reclosers installed outside the substation. One (1) is installed between the POI and the substation feeder breaker.

- The 54F1 feeder has 1800 kVAR of capacitance installed outside the substation.

Location	Size (kVAR)	Control
P 107 Hill Farm Rd / Coventry	600	T/V
P 63 Victory Hwy / Coventry	600	T/V
P 577 Flat river Rd / Coventry	600	T/V

Table 1 - 54F1 Capacitor Locations

No capacitor modifications are required as a result of this interconnection.

2.4 Revenue Metering Requirements

If not already provided, the Interconnecting Customer shall provide a telecommunication line to National Grid's revenue meters in accordance with ESB756D, Section 5.4.2. The Customer should provide an analog /POTS (Plain Old Telephone Service) phone line to each National Grid owned revenue meter location. The phone line must be capable of direct inward dial without human intervention or interference from other devices such as fax machines, etc. National Grid will specify, test, install, and own the voltage and current transformers necessary to meet the metering requirements for this project. (See *Appendix C - Outdoor Meter Installations, Figures 7- 8: Revenue Meter Phone Line Installation Guide)*

The Interconnecting Customer is responsible for all costs associated with the line construction

3.0 Power Flow Analysis

The power flow analysis was substantially performed using CYMDIST. A model of the 54F1 circuit was developed based on data extracted from the National Grid GIS and field verified on March, 2013.

The analysis considered cases at minimum and peak load, at time of expected maximum generation for the following cases:

- The 54F1 in a normal configuration Peak load of 9.3 MVA @ 94% PF Lagging

- The 54F1 in normal configuration Min load of 2.5 MVA @ 99 % PF Leading.

3.1 General Loading Analysis

An analysis of the feeder loading, with and without the wind turbine system operating, was performed and demonstrated that the addition of the DG Facility will not create thermal loading problems on the 54F1 circuit, or at Coventry Substation. Specifically, no conductor, or transformer overloads occur. All National Grid owned mainline conductor and distribution facilities are thermally large enough to accommodate the added capacity from the 1500 kW Wind Turbine facility.

3.2 Reverse Power Flow

The possibility of the Facility causing reverse power flow into the Company's EPS was reviewed. At peak export (i.e., 1500 kW), the excess generation from the Facility will be absorbed by the 54F1 circuit.

3.3 Voltage Analysis

The supply circuits are regulated and therefore the Company is obligated to hold voltages at customer service points to defined limits in ANSI Standard C84.1- 2006. The Wind Turbine interconnections shall not contribute to greater than a 3.0% change in voltage on the EPS under any conditions.

In summary, there are no reports of overvoltage conditions on the Company's EPS with the generation interconnection site at full power during studied cases.

The Company will not be held liable for any power quality issues that may develop with any customers as result of the interconnection of this generation.

3.4 Flicker Analysis

The *IEEE Recommended Practice for Measurement and Limits of Voltage Fluctuations and Associated Light Flicker on AC Power Systems*, IEEE Std. 1453-2004 provides guidance on flicker and voltage fluctuations.

Based upon the Flicker Data received on January 16, 2014, the predicted flicker and voltage fluctuations are expected to be acceptable.

4.0 Short Circuit and Protection Analysis Company Facilities

The Company performed a protection review of WED Energy, LLC proposed interconnection of a 1500 kW Wind Turbine, converter based generator to the 54F1, a 12.47 kV distribution circuit served from Coventry Substation. This review will identify EPS enhancements that are necessary to complete the interconnection project and its ability to meet R.I.P.U.C. NO. 2078 interconnection tariff and the requirements of The Company's ESB 756D. The protection impact study will address the following items:

4.1 Temporary Over-Voltages on Transmission Supply

Detailed analysis of the load to generation match on the Coventry T1 supply transformer, which supplies the 54F1 circuit, during minimum load and maximum generation conditions indicates that both facilities combined poses significant risk of causing temporary over-voltage condition to develop on the 23 kV system. Consequently, zero sequence overvoltage protection will be required to be installed on the 23 kV side of the Coventry, 23 kV- 12.47 kV Grd-Y/7.2 kV, supply transformer (T1).

4.2 Fault Current Contributions

Tables 2 & 3 summarize the generation effect on fault current levels at each PCC for Facility 1 and Facilities 1 & 2 combined, respectively. These fault currents are within existing equipment ratings and will not upset existing device coordination on the feeder. The customer is responsible for ensuring that their own equipment is rated to withstand the available fault current according to the NEC and National Grid ESB 750, which specifies that the fault current should be no more than 80% of the device interrupting rating.

Fault Duty Pre and Post Project
RI -14319785 With 15 Ohm Neutral grounding Reactor

Pre-Project:			Post-Project				
Fault Location	Fault Type	Pre-Project Amps	Post-Project Amps	*Δ%	System Impedance @ PCC Post Project		
12.47 kV Substation Bus	Line to Grd	4039	4113	1.83%	Positive Sequence Impedance (Ω)	Negative Sequence Impedance (Ω)	Zero Sequence Impedance (Ω)
	Three Phase	3443	3530	2.53%			
12.47 kV PCC RI-14319785	Line to Grd	NA	900	NA	1.248+j4.079	2.988+j 6.074	4.191+j11.611

	Three Phase	NA	1191	NA			
*Δ% = (Post-Pre)/Pre							

Table 2 - Fault Current Levels (in amperes) Facility 1 (RI-14319785)

Fault Duty Pre and Post Project RI -14319785 & RI - 14462941 Combined 15 ohm Neutral Grounding Reactor on each Isolation Transformer							
Pre-Project:			Post-Project				
Fault Location	Fault Type	Pre-Project Amps	Post-Project Amps	*Δ%	System Impedance @ PCC Post Project		
					Positive Sequence Impedance (Ω)	Negative Sequence Impedance (Ω)	Zero Sequence Impedance (Ω)
12.47 kV Substation Bus	Line to Grd	4039	4167	3.17%			
	Three Phase	3443	3610	4.85%			
12.47 kV PCC RI-14319785	Line to Grd	NA	1038	NA	0.704+j3.017	2.996+j6.079	2.778+j9.631
	Three Phase	NA	1288	NA			
12.47 kV PCC RI-14462941	Line to Grd	NA	1009	NA	0.761+3.092	3.160+j6.208	2.899+j9.949
	Three Phase	NA	1256	NA			
*Δ% = (Post-Pre)/Pre							

Table 3 Fault Current Levels (in Amperes) Facilities 1 & 2 Combined (RI-14319785 & RI-14462941 Combined)

The 12.47 kV system impedance shown at the PCC and is in ohms. The value is taken from the model developed using ASPEN Oneliner. The model was based on the proposed installation of a neutral grounding reactor with an impedance of 15 ohms on the primary neutral of each of the customer's proposed 1600 kVA, 12470V Y – 12470V Delta isolation transformers, each with a 5% impedance, where, each is in series with a 12470 V Delta - 690 V Grd-Y/ 398 V generator step-up transformer, each with an impedance of 6%. Refer to (*Appendix A Site Diagrams and One-Lines, Figures: 2, 3, & 4, respectively*). If a different configuration is used other than that depicted in the one-line of record, provided for evaluation, the Short Circuit and Protection Analysis will need to be re-evaluated.

The customer is responsible for ensuring that their equipment is rated to withstand the available fault current.

5.0 Protection Analysis Customer Facilities

The protection review consisted of a review of customer's transformer connection and protection scheme and assessment of protection and transfer trip requirements. This Facility shall comply with the relevant provisions of R.I.P.U.C. NO. 2078 Dec 2009 and requirements of ESB-756D, as applicable. Please note that applicable sections of ESB-756D are referenced for information purposes and may not comprise the entirety of applicable sections. The key requirements for this Project include, but are not limited to:

5.1 Disconnect Switch

Per ESB 756D, Section 5.6 & R.I.P.U.C. NO. 2078: The Facility shall provide a disconnect switch (or comparable device mutually agreed upon by the Parties) at the point of Facility interconnection that can be opened for isolation. The switch shall be in a location easily accessible to Company personnel at all times. The switch shall be gang operated, have a visible break when open, be rated to interrupt the maximum generator output and be capable of being locked open, tagged, and grounded on the Company side by Company personnel. The Company shall exercise such right in accordance with Section 7.0 of the interconnection tariff.

The Customer's one-line shows the required disconnect switch and meets the requirement. The Customer must provide the Company with 24/7 unlimited access and control of this switch.

5.2 Unintentional islanding

Inverters/converters shall be in compliance with ESB 756D 5.7.10.1 Photovoltaic Generation and R.I.P.U.C. NO. 2078 section 4.2.1 General requirements, where all inverters must be IEEE 1547 compliant and UL-1741 certified inverters shall be equipped with an internal anti islanding scheme and active under voltage (27), over voltage (59), zero sequence over voltage (59N), under frequency (81U) and over frequency (81O) relays.

The Goldwind converters are not UL 1741-2005/ IEEE1547 compliant. Analysis indicates that there is likely ability for these facilities to remain in operation in excess of 2 seconds should and islanding condition develop.

5.3 Direct Transfer Tripping

Refer to section 5.2 above, a direct transfer tripping system, if one is required by either the Interconnecting Customer or by the Company, shall use equipment generally accepted for use by the Company and shall, at the option of the Company, use dual channels.

DTT will be required for this interconnection, the requirements are as follows:

- National Grid's Standard is model S00763PF which uses the Guard Before Trip feature for DTT applications.

- The generator breaker should be tripped for relay/breaker Loss of Potential (LOP), Relay failure, loss of Guard signal, and receive the trip signal. Relay failure, LOP and loss of guard signal should have a 30s delay to trip the breaker. This is to avoid nuisance tripping due to the system transients.

- Since National Grid does not specify the relay type, any timer that is equivalent to an ABB RXKL1 is acceptable.

- When the order actually takes place, both the transmitter and receiver should be ordered from RFL as a package.

- Even if there are different orders for the transmitter and the receiver, the receiver order from the customer and the transmitter order from National Grid, RFL needs to be informed of this to insure that the two devices will talk to each other. RFL will test them together before shipping to National Grid/customer.

- National Grid will also specify all trip and guard frequencies. National Grid uses default settings of the groups 3 and 5 to set the guard and trip frequencies.

    - Group 3:
      Tone 1 Tx: 1540Hz (trip) 1690Hz (Guard)
      Tone 1 Rx: 2030Hz (Trip) 1880Hz (Guard)

    - Group 5:
      Tone 2 Tx: 2220 Hz (Trip) 2370 Hz (Guard)
      Tone 2 Rx: 2710Hz (Trip) 2560 Hz (Guard)

5.4 Interconnection Interrupting Device

In accordance with ESB 756D, Sections 5.7.2 and 5.7.10.1

The Customer's one-line meets the above requirement.

5.5 Synchronizing Devices

The project is inverter/converter based, not applicable.

5.6 Transformers

The Company reserves the right to specify the winding connections for the transformer between the Company's voltage and the Facility's voltage (Interface Transformer) as well as whether it is to be grounded or ungrounded at the Company's voltage. **Refer to ESB-756D section 5.7.**

This project has two proposed facilities, each with a 1600 kVA, 12.47 kV, reactively grounded Wye, primary, with a fully insulated and isolated neutral with a 12.47 kV Delta secondary, with an impedance of 5.0%, isolation transformer, in series with a 1600 kVA, 12.47 kV, Delta primary, with a 690 V Grd-Y /398 V secondary, with an impedance of 6.0% generator step-up, (GSU), transformer.

The proposed configurations are acceptable provided each isolation transformer is grounded through its own 15 ohm neutral grounding reactor.

5.7 Voltage Relays

Voltage relays shall be frequency compensated to provide a uniform response in the range of 40 to 70 Hz. Refer to ESB 756D section 5.7.6. For a primary wye (high side) / delta (low side) transformer, requires voltage sensing on the delta winding. This can be accomplished using wye-grounded / wye-grounded VTs connected to the delta.

The existing one line depicts primary voltage sensing on the wye primary of each isolation transformer, where (27, 59, & 51C 51GC elements), on each SEL 351A relay control each primary main breaker at each facility. The one-line does not meet the requirement. Voltage sensing must be placed on the delta winding

5.8 Overcurrent Relays

Per section 5.7.8 of the ESB 756D Overcurrent protection is required on the high side of the DG Customer's interface transformer to detect faults on the Company's EPS. Voltage controlled overcurrent elements (51C) are required for both phase and ground. At a minimum, these relays shall utilize voltage sensing via Yg-Yg VTs on the transformer's secondary or primary to detect the single line-to-ground faults on either the primary or secondary sides of the transformer. The 51C elements shall trip the high side/or low side interrupting device. Typical 51C pickup setting are generally less than rated generation output and in this application the use of **US Extremely inverse (U4) TCC is preferred** .

The one-line shows the required 51C elements, however, the settings must be altered (Pickups lowered) to meet the above requirements.

5.9 Protective Relay Hard-Wire Requirement:

Unless authorized otherwise by the Company, protective relays must be hardwired to the device they are tripping. Further, interposing computer or programmable logic controller or the like is not permitted in the trip chain between the relay and the device being tripped.

The customer's one-line must be updated to meet these requirements.

5.10 Protective Relaying Redundancy

Refer to ESB 756D converter-based WIND TURBINE Generator Equal or Above 500k. The relays at the inverter terminal shall provide the redundant protection for voltage and frequency elements. However, the relay equipped for overcurrent protection has no redundancy, National Grid requires that the relay alarm contact should be wired to trip the switchgear when the relay fails, not in service or the DC supply voltage to the relay is lost. There will be 2s time delay in tripping the switchgear. A timer needs to be added to the switchgear's trip circuit or the internal relays must be programmed to include the delay.

An updated stamped one-line must be submitted satisfying this requirement.

5.11 Protective Relay Supply

Refer to ESB 756D section 5.7.10.4. Where protective relays are required in this Section, their control circuits shall be DC powered from a battery and battery charger system. Solid state relays shall be self-powered, or DC powered from a battery and battery charger system. If the Facility uses a

Company-acceptable non-latching interconnection contactor, AC powered relaying may be allowed provided the relay and its method of application are fail safe, meaning that if the relay fails or if the voltage and/or frequency of its AC power source deviate from the relay's design requirements for power, the relay or a separate fail-safe power monitoring relay acceptable to the Company will trip the generator, after a 2 second time delay, by opening the coil circuit of the interconnection contactor.

The relay control power has not been shown to be battery powered, a new one-line must be submitted that meets the requirement.

5.12 Current Transformers ("CT")

Refer to ESB 750C section 5.7.4.1. CT ratios and accuracy classes shall be chosen such that secondary current is less than 5 amperes and transformation errors are consistent with Company practices.

The one-line shows 300:5 CTs and meets requirement.

5.13 Voltage Sensing and Voltage Transformers ("VT")s and Connections

Transformer options based on the selected transformer configuration to detect the Under Voltage, and provide voltage detection for a voltage controlled over current (51C) element. Refer to ESB 756D sections 5.7.4.2 and 5.7.8. For a primary wye-reactively grounded isolation transformer with a secondary delta transformer in series with a delta primary – wye grounded secondary generator step-up transformer: At a minimum, wye-grounded - wye-grounded VTs shall be installed on the transformer's delta to detect line to ground faults. If it is within the relay's capability, the relay may be direct connected to the transformer delta.

The one-line shows 60:1 VTs configured Y grounded – Y grounded, connected to the primary wye of the isolation transformer, but lacks the required Y grounded – Y grounded VTs on the delta windings of the isolation and GSU transformers. A new one-line must be submitted that meets this requirement.

5.14 High-Speed Protection

The Facility may be required to use high-speed protection if time-delayed protection would result in degradation in the existing sensitivity or speed of the protection systems on the Company's EPS.

High speed protection is not required.

5.15 Service Entrance Equipment

The Interconnection Customer shall furnish, install, own, and maintain service entrance equipment in accordance with applicable requirements set forth in ESB 750, Section 5, and ESB756D, Section 5.4.1.3 and Exhibit 7.

The Customer's project one-line meets the above requirement.

5.16 Surge-Withstand capability

The interconnection system shall have the capability to withstand voltage and current surges in accordance with the environments defined in IEEE Standard C62.41.2-2002 or IEEE Standard C37.90.1-2002 as applicable.

5.17 Additional Requirement

The R.I.P.U.C. No. 2078, requires that, the Distributed Resources (DR) cease to energize the area EPS within 2 seconds, refer to IEEE1547 and UL1741. The Interconnection system's response to abnormal frequencies. Section 4.2.3.2.1 requires that NPCC Directory 12 Figure 1 Curve "Standards for Setting Underfrequency Trip Protection for Generators" for the Eastern Interconnection be followed. It is important that clearing time should be the time that the relay trips plus breaker operating time.

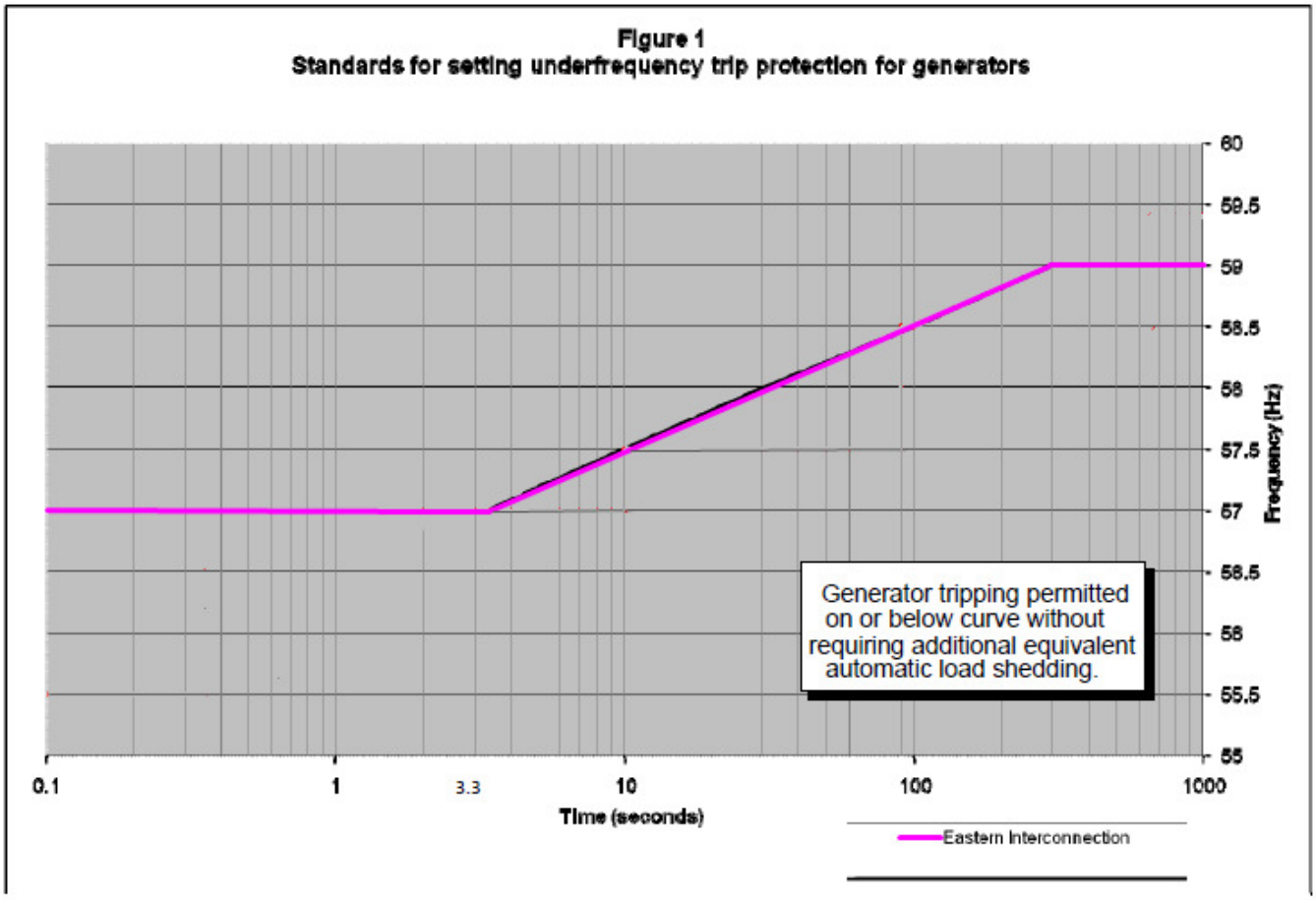

Figure 1: NPCC Directory 12 Figure 1 Curve

The under frequency setting points should also comply with the NPCC standard for setting under frequency trip protection. Per the NPCC Directory 12 Figure 1Curve, if the setting falls above the curve, there must be an equivalent amount of load shed when tripped, which in this case cannot be done and therefore the 81 under frequency must be set on or below the curve. Per NPCC Directory 12 Figure 1 Curve for the Eastern Interconnection:

The inverters/converters', and or, generator's internal relays shall also meet the NPCC Directory 12 Figure 1 Curve requirements for the Eastern Interconnection.

The IC must submit a PE stamped one-line that provides the inverters' internal relay settings.

The submitted settings for the generators' internal settings do not meet the requirements of Figure 1 above and a new PE stamped one-line with corrected settings must be submitted for review and approval.

5.18 Protection Scheme Assessment

The customer must submit a PE stamped one line which includes the required redundant relay settings, inverter internal relay settings, and meets all the requirements specified within this document, to the Company for review and approval before an interconnection application can move forward.

6.0 Telemetry and Telecommunications

The IC is an Independent Power Producer (IPP) and consequently no RTU is required.

7.0 Inspection, Compliance Verification, Customer Testing, and Energization Requirements

7.1 Inspections and Compliance Verification

For this study, the DG Facility is deemed as an Independent Power Producer pursuant to applicable RI state jurisdictional requirements. A municipal electrical inspection approval certificate from the local authority having jurisdiction is required of the DG Customer's facilities (i.e. primary service entrance conduit, primary switchgear, wiring, and generation equipment). The Company must receive the DG Customer's Draft set of installation drawings, equipment data, and test plan for the functional verification tests at least four (4) weeks before the Company's field audit.

The DG Customer shall adhere to all other Company related verification and compliance requirements as set forth in the applicable ESB 750 series documents. These and documented acceptance testing requirements of these facilities will be specified during the Draft design review of the Project prior to the Company's field audit and energization.

7.2 Testing and Commissioning

The Interconnection Customer shall submit initial relay settings to the Company no later than twenty-one (21) calendar days following the Company's acceptance of the Facility's service connection's Draft MA state licensed professional engineer sealed design. If changes/updates are necessary, the Company will notify the Interconnection Customer three (3) business days after the initial relay settings were received, and the Interconnection Customer shall submit the revised settings within seven (7) calendar days from such notification. Within three (3) business days of receipt of the proposed Draft relay settings, the Company shall provide comments on and/or acceptance of the settings. If the process must continue beyond the above evolution due to errors in the relay settings, the Company retains the right to extend the Testing and Commissioning process, as needed, to ensure the Draft relay settings are correct.

Assuming no major issues occurring with the relay settings, the Interconnection Customer shall submit a Testing and Commissioning Plan (TCP) to the Company for review and acceptance, no later than forty-five (45) calendar days following the Company's acceptance of the Facilities Draft design. The TCP must be Finalized, including Company acceptance, no later than six (6) weeks prior to functional testing.

7.3 Energization and Synchronization

The "Generator Disconnect Switch" at the interconnection point shall remain "open" until successful completion of the Company's field audit and witness testing. Prior to the start of construction, the DG Customer shall designate an Energization Coordinator (EC), and prepare and submit an Energization Plan (EP) to the Company for review and comment. The energization schedule shall be submitted to the Company and communicated with the Company's local Regional Control Center at least two (2) weeks in advance of proposed energization. Further details of the EP and synchronization requirements will be specified during the Draft design review of the Project.

The DG Customer shall submit as-built design drawings to the Company 90 days following commercial operation of their DG Facility.

8.0 Cost Estimates

The non-binding good faith cost planning grade estimate for the Company's work associated with the interconnection of this Facility to the EPS, as identified in this report, is **$1,126,540.00** +/-25%, and includes:

RI-14319785 & 14462941						
National Grid Work Item	**Conceptual Cost +/-25% Planning Grade Cost Estimate not including Tax Liability**				**Associated Tax Liability $ @ Applied to capital**	Total Customer Costs includes Tax Liability on Capital Portion
System Modifications NECO	**Pre-Tax Total $**	**Capital**	**O&M**	**Removal**	**22.58%**	**Total $**
54F1 Modifications Install reclosers on pole 49-50 Piggy Ln and pole 35 Logbridge Rd Install Loadbreak on pole 38 Perry Hill	$133,000.00	$127,000.00	$6,000.00	$0.00	$28,680.00	$161,680.00
Install zerosequency OV protection on Covetry 23- 12.47 kV Grd-Y /7.2 kV supply transformer and DTT on 54F1 feeder recloser	$491,000.00	$463,000.00	$28,000.00	$0.00	$104,550.00	$595,550.00
Build 3 Phase line extension from Pole 31 onto customer property, included in this work is the installation of (1) Loadbreak switch , (1) recloser, and (1) Primary Metering assembly. Also includes pole replacements P30, P31, & P32 Reynolds Rd	$283,000.00	$283,000.00	$0.00	$0.00	$63,910.00	$346,910.00
SUBTOTAL System Modifications NECO	**$907,000.00**	**$873,000.00**	**$34,000.00**	**$0.00**	**$197,140.00**	**$1,104,140.00**
Interconnecting Customer Interconnection Facilities ("ICIF")	**Pre-Tax Total $**	**Capital**	**O&M**	**Removal**	**22.58%**	**Total $**
Witness Testing	$5,000.00	$0.00	$5,000.00	$0.00	$0.00	$5,000.00
EMS Integration	$5,600.00	$0.00	$5,600.00	$0.00	$0.00	$5,600.00
Program Management	$1,800.00	$0.00	$1,800.00	$0.00	$0.00	$1,800.00
Review and Implementation of protective device settings	$10,000.00	$0.00	$10,000.00	$0.00	$0.00	$10,000.00
SUBTOTAL	**$22,400.00**	**$0.00**	**$22,400.00**	**$0.00**	**$0.00**	**$22,400.00**
	Pre-Tax Total $	**Capital**	**O&M**	**Removal**	**Tax Liability**	**Total $**
TOTALS	**$929,400.00**	**$873,000.00**	**$56,400.00**	**$0.00**	**$197,140.00**	**$1,126,540.00**

Table 4 - Cost Estimates

This **$1,126,540.00 +/- 25%total** planning grade estimate is based on information provided by the Interconnecting Customer for the study, and is prepared using historical cost data from similar projects. The associated tax effect liability included is the result of an IRS rule, which states that all costs for construction collected by

National Grid, as well as the value of donated property, are considered taxable income.[3]

This estimate is valid for ninety (90) calendar days from the issuance of this report. If the Interconnection Customer elects to proceed with this project after the ninety (90) calendar days, a revised estimate may be required.

9.0 Conclusion

The project was found to be feasible. It will be allowed to interconnect with certain modifications and additions to the local National Grid distribution Electric Power System (EPS) the Interconnecting Customer's equipment. The estimated planning grade cost for the Company's work associated with the Project is **$1,126,540.00** +/- 25%.

The present interconnection configuration and protection scheme submitted for review must be modified to meet National Grid's specific protection requirements. The customer must submit a PE stamped electrical one-line along with the required relay settings, that meets all the requirements specified within this document, to National Grid for review and approval, before an interconnection application can move forward.

A Detailed Study with +/- 10% estimates may be required if the total project cost, less tax liability, is greater than $500,000. The Company shall issue a Detailed Study Agreement for execution if required.

A milestone schedule shall be included in the Interconnection Agreement and shall be reflective of the tasks identified in ESB756D, Exhibit 2. Upon execution of the Interconnection Agreement, and prior to advancing the project, the Interconnecting Customer shall provide a detailed project schedule, inclusive of the Exhibit 2 tasks referenced above. After completion of Draft design and all associated applications, fees, permitting and easement requirements are satisfied, System Modifications for this Project will be placed in queue for construction.

If an Interconnecting Customer fails to meet the R.I.P.U.C. No 2078, Section 3.4 Time Frames and does not provide the necessary information required by the Company within the longer of 15 days or half the time allotted to the Company to perform a given step, or as extended by mutual agreement, then the Company may terminate the application and the Interconnecting Customer must re-apply.

[3] Actual charges shall include the tax rate in effect at the time the charges are incurred.

Note: Authorization for parallel operation will not be issued without a fully executed Interconnection Agreement, receipt of the necessary insurance documentation, and successful completion of the Company approved witness testing. Such authorization shall be provided in writing.

10.0 Revision History

Version	Date	Description of Revision
1.0	04/17/14	Final for RI-14319785/14462941, WED & WEDII Energy, LLC

Appendix A IC Site and One-line Diagrams

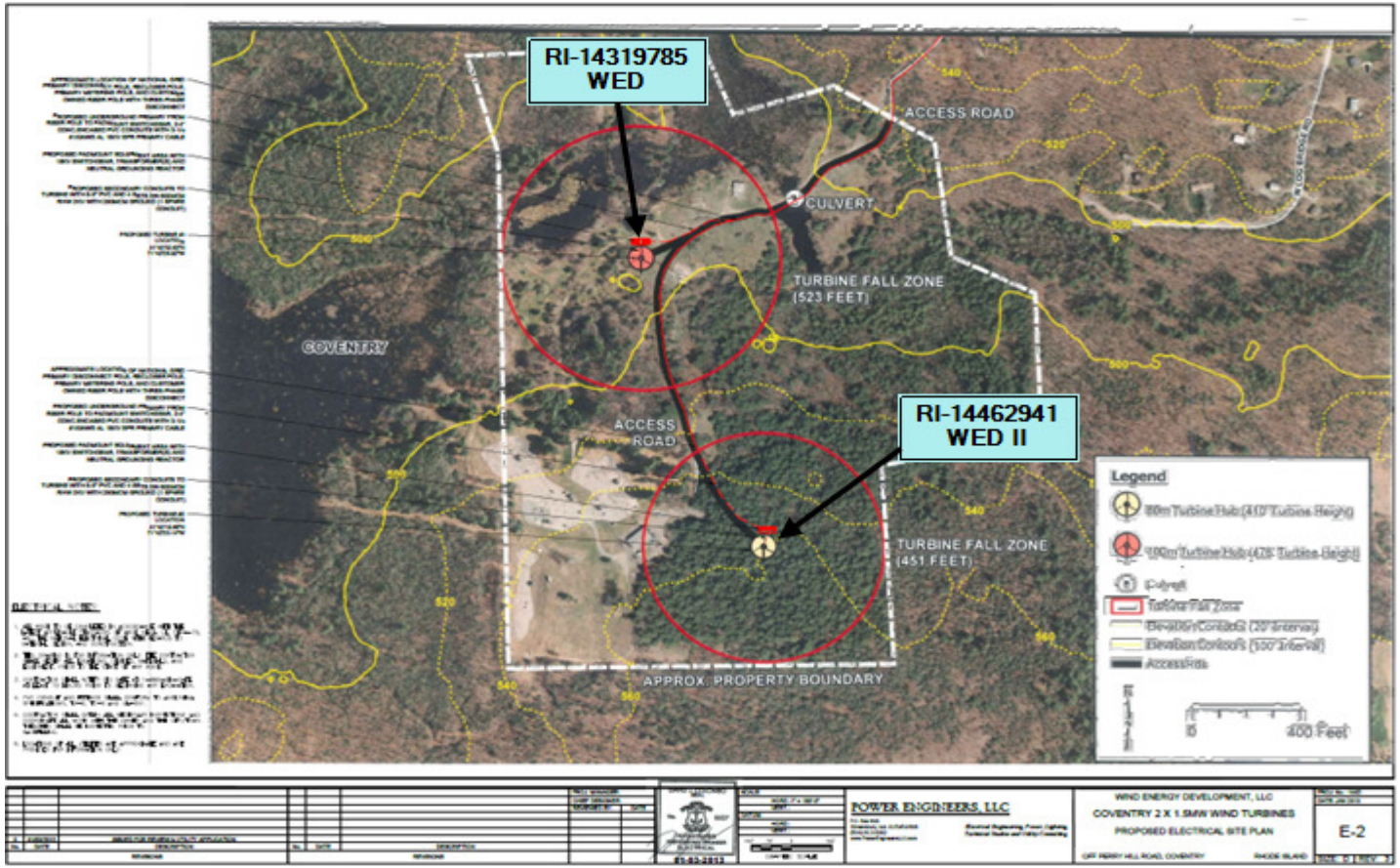

Figure 2: Site Diagram

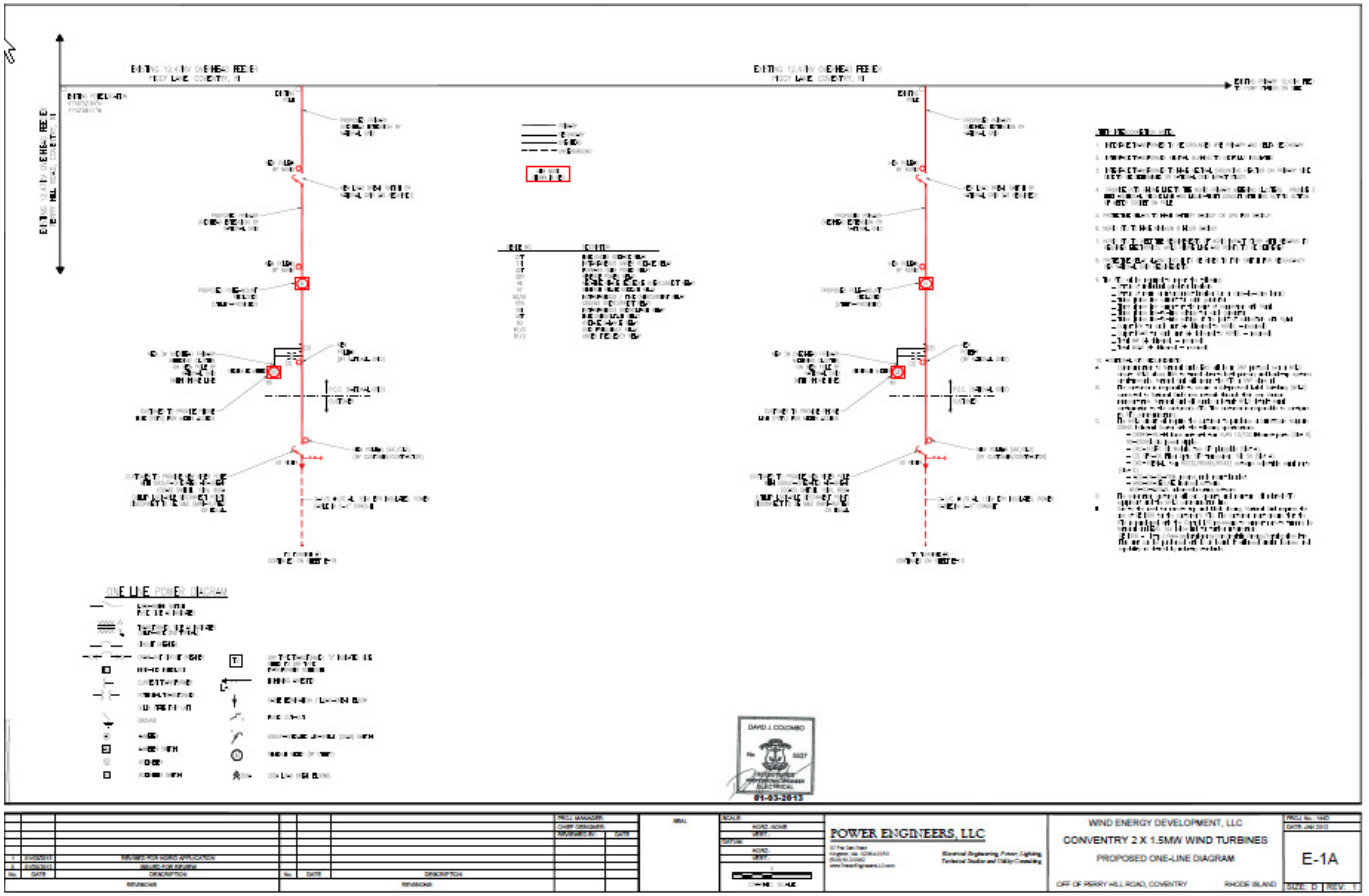

Figure 3: Project One-Line

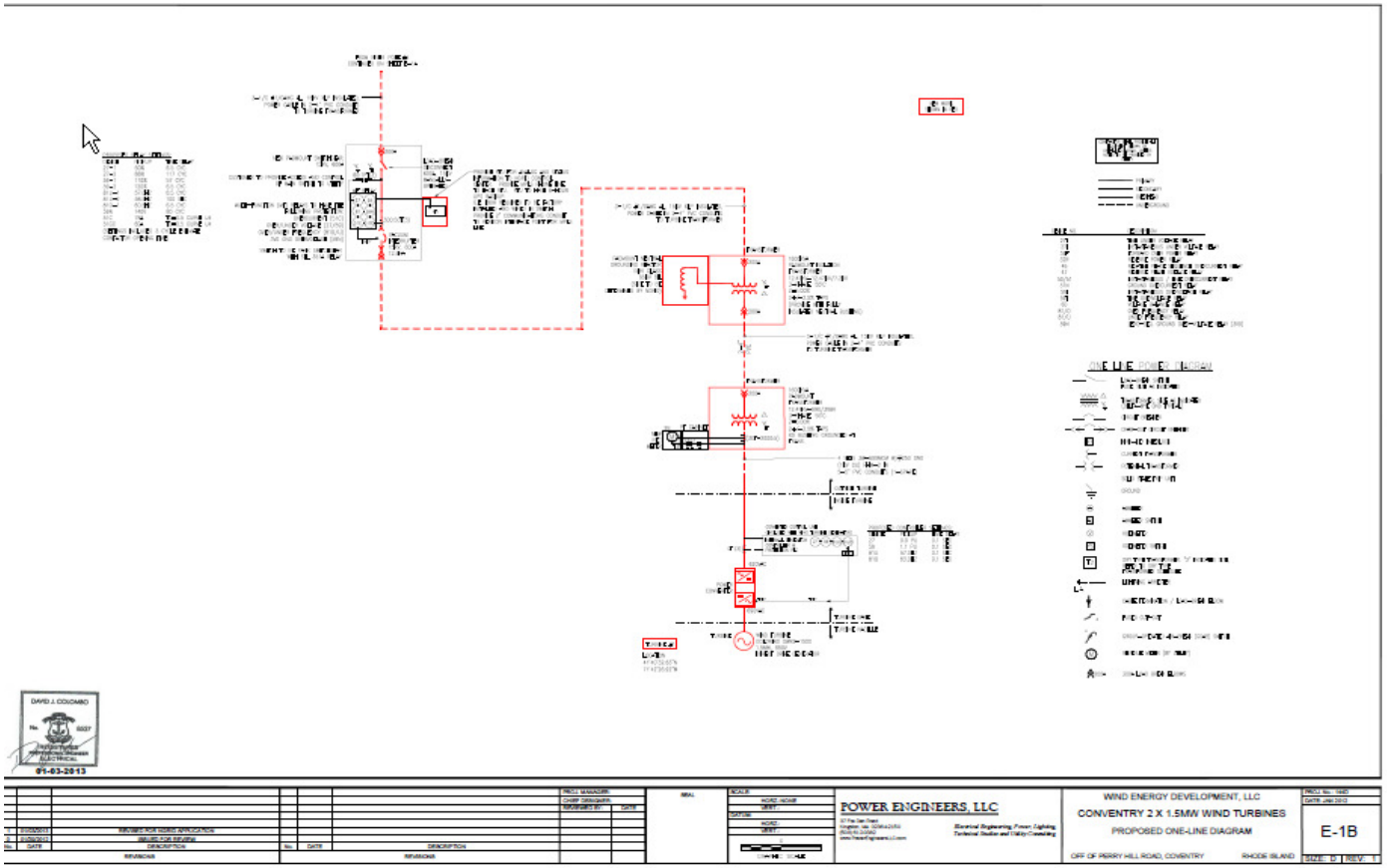

Figure 4: Project One-Line

Appendix B Interconnection Configuration & EPS Modifications

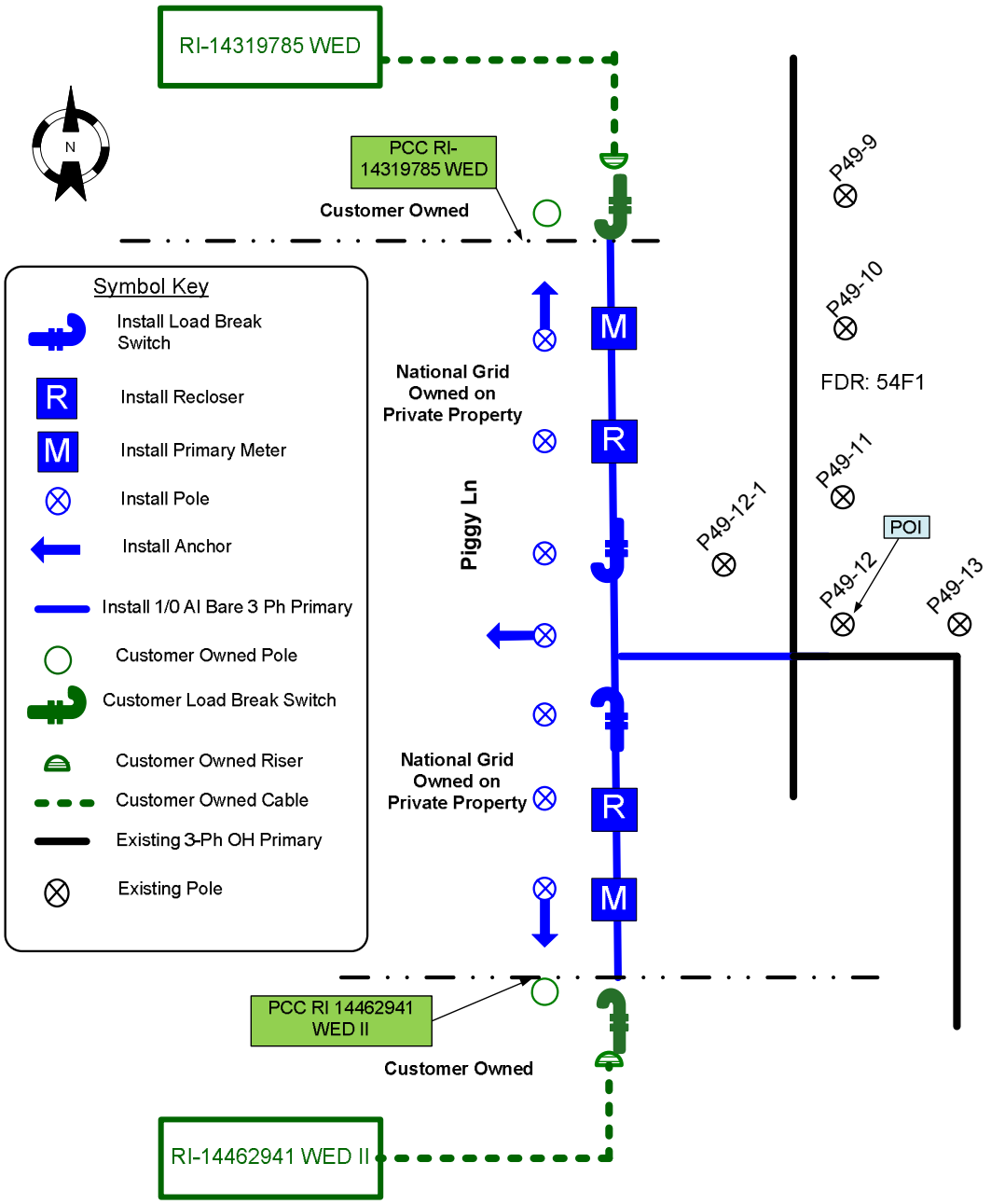

Figure 5: POI – PCC Configuration

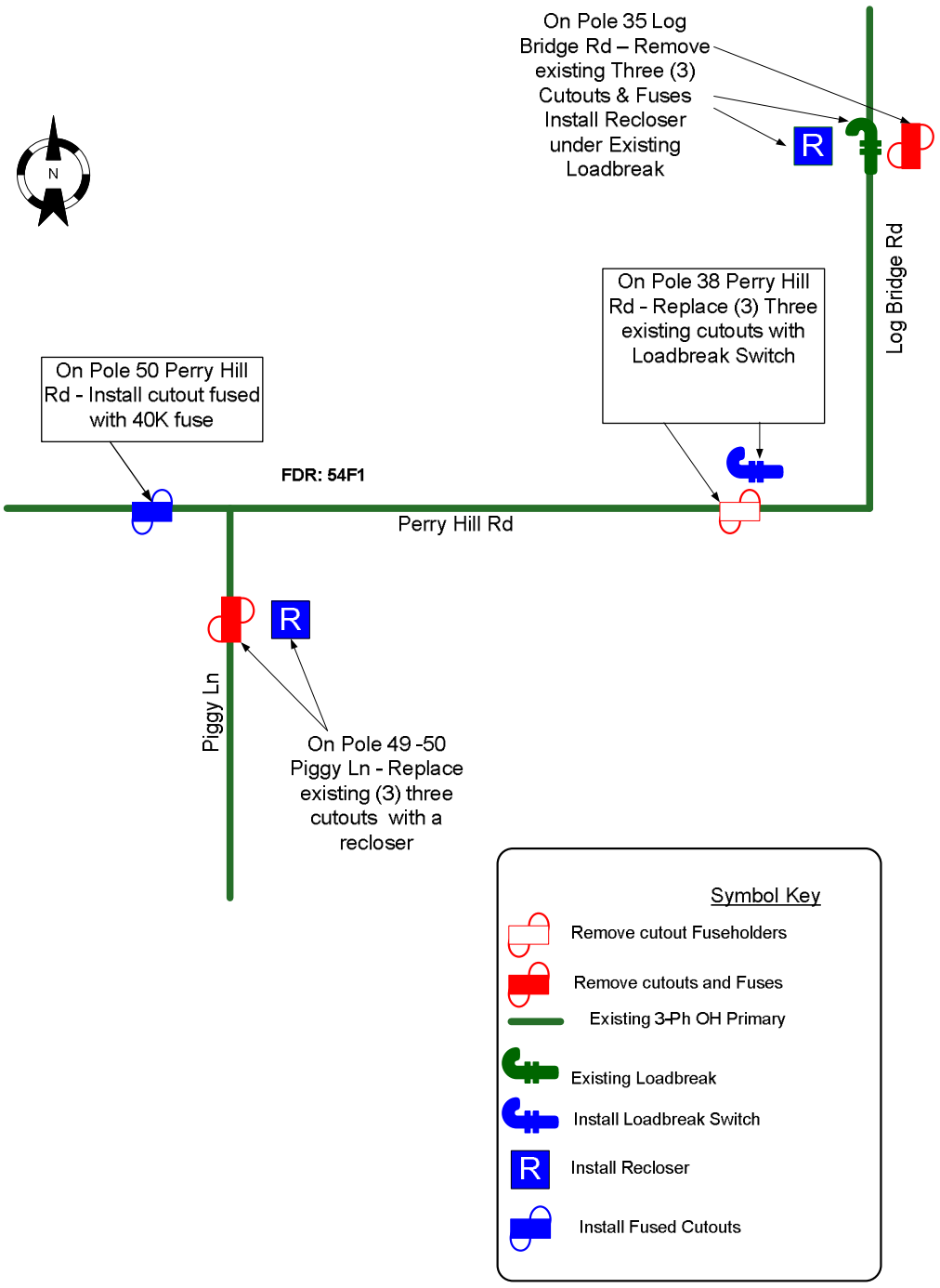

Figure 6: 54F1 Modifications

Appendix C Outdoor Meter Installations

REVENUE METERING PHONE LINE INSTALLATION GUIDE

An analog phone line to National Grid's revenue meter shall be provided by the Customer. The analog phone line must be capable of direct inward dial without human intervention or interference from other devices such as fax machines, etc. The phone line can be a phone (extension) off the customers PBX phone system, or it may be a separate dedicated phone line as provided by the Telephone Company. The following is to be used as a guide, please contact the Company if additional information is required. The most common installations are outlined below, Wall mounted Meter Installation, Outdoor Padmount Transformer Meter Installation, and Outdoor Pole Mounted Meter Installation.

1) WALL MOUNTED METER INSTALLATION
If the meter is wall mounted indoor or outdoor the customer shall provide a telephone line within 12" of the meter socket and additional equipment as described and shown below in figures 1A & 1B. National Grid will connect the meter to the customer provided phone line.

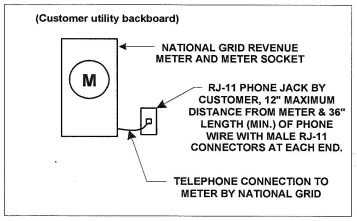

Figure 1A – Indoor Meter Installation
not to scale

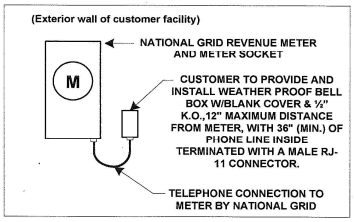

Figure 1B – Outdoor Meter Installation
not to scale

2) OUTDOOR PADMOUNT TRANSFORMER METER INSTALLATION
If the meter is mounted outside on the secondary compartment of the padmount transformer as shown below the conduit shall stub up and roughly line up with the bottom or side knock out of the meter socket and terminate into a weatherproof box or fitting. A liquid tight flexible conduit whip with end bushing and locknut of sufficient length to reach and terminate at the knockout location of the meter socket with three feet of telephone wire coiled (and terminated with a male RJ-11 connector) at its end shall be connected to the weatherproof box or fitting. National Grid will connect the conduit whip to the meter socket and terminate the telephone wire to the meter (see figure 2 below).

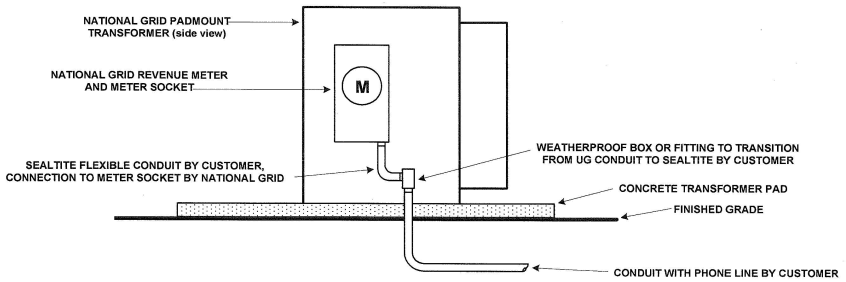

Figure 2 – Outdoor Padmount Transfomer Meter Installation
not to scale

Figure 7: Revenue Meter Phone Line Installation Guide (1 of 2)

3) OUTDOOR POLE MOUNTED METER INSTALLATION
If the meter is located outdoor on a Company owned utility pole as part of a primary metering installation the Customer will install and connect a phone line from the Telephone Company provided termination interface box, the line shall be terminated with a RJ-11 male connector and be of sufficient length to reach the meter socket and create a drip loop, as well as additional line for final connection to the meter. The customer is responsible for the Telephone Company phone line installation. (see figure 3 below).

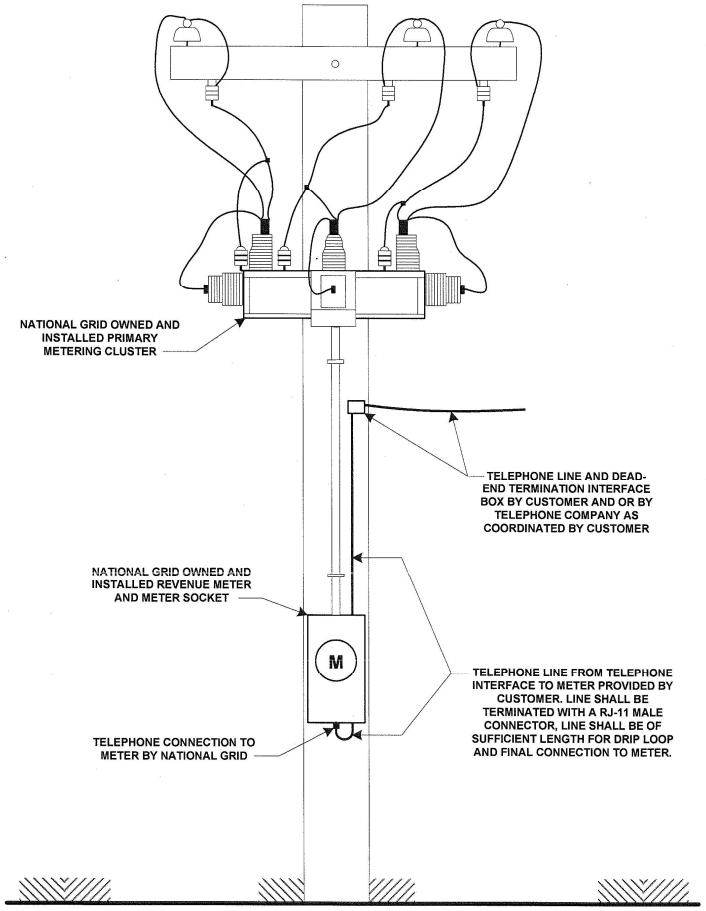

Figure 3 – Outdoor Pole Mounted Meter Installation
not to scale

Figure 8: Revenue Meter Phone Line Installation Guide 2 of 2