PJM Generator Interconnection Request
Queue AA1-121
South Granville 12 kV
Feasibility/Impact Study Report

June 2015

Preface

The intent of the Feasibility/System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the Feasibility Study, but the actual allocation will be deferred until the Feasibility/System Impact Study is performed.

The Feasibility/System Impact Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

This report is divided into two sections:

Part I – AEP Distribution Planning Analysis and Results
Part II – Transmission Planning Analysis and Results

Part I - AEP Distribution Planning Analysis and Results

Request

Denison University (Generator), as an Interconnection Customer (IC) of the PJM regional transmission operator (RTO), submitted an interconnection request to connect a battery-powered distributed generation (DG) facility capable of 2.0 MW maximum output power to AEP Ohio distribution facilities.

Disclaimer

The contents of this feasibility/impact study apply only to the facility described in the attached Distributed Generation (DG) Interconnection Request application. All modeling is based on the Point of Common Coupling (PCC) at AEP Ohio/Ohio Power primary meter pole number 40830504B30045 located at 400 College Street, Granville, Ohio.

Modeling and Assumptions

The Generator includes a 2 MVA lithium ion battery connected to a Parker 890GTB-2200 inverter. The output of the inverter will connect to a 2500kVA, 480V(Δ) – 12.47 kV(GY), Z = 5.75%, step-up transformer. The output of the transformers will connect to the PCC.

The Generator will be served from South Granville Station, circuit 423802, a radial configuration, three-phase multi-grounded four-wire wye system. The 423802 circuit is served from the distribution 12 kV main bus via T1, a 69(Δ)kV – 12.47(GY) 12/16/20 MVA transformer. The 12.47 kV winding of this transformer features a Load Tap Changer (LTC) for voltage regulation of the 12 kV main bus. Nominal frequency is 60 Hertz.

The Generator intends to participate at 2 MW in the ancillary services schedule 2 and schedule 3 PJM wholesale marketplace. The output of the DG is varied based upon the Dynamic Regulation signal from PJM. This signal ranges from a value of 1.0 representing maximum battery output, to a value of -1.0 representing maximum battery charging. This signal is delivered to the DG in two second intervals. While it is most common for this signal to increase and decrease by small increments, historical analysis of this signal indicates that the fluctuations can be much more extreme.

For this study, a transition from maximum output (1.0) to maximum charge (-1.0) and maximum charge to maximum output was thoroughly analyzed in the *System Voltage Levels* portion of this study. The customer communicated battery operational parameters are:

1. The battery system will not have a change of more than 2 MW in 2 seconds. (If the signal did go from +1 to -1 then the system would require 4 seconds to reach the desired level)
2. The battery system will only have an interval change greater than 1.5 MW once per minute (or less). (interval meaning the 2 second signal)
3. The battery system will only have an interval change greater than 0.8 MW twice per minute or less.

The batteries require 2.0 MW during their charging periods. The inverters will operate at or very near unity power factor. The maximum fault current contribution of the inverters, as a percentage of full load current, is 120%. The Parker 890GTB-2200 inverter is not UL1741-2005 listed. The UL 1741 – 2005 listing is pending per the inverter literature supplied. The customer will have to test the DG system per IEEE 1547.1 unless documented proof of UL1741 – 2005 certification is provided to AEP prior to commissioning.

AEP Fault Values and Thevenin Impedances

The following are AEP symmetrical fault values and AEP Thevenin impedances calculated at the Generator PCC without DG facility connected. The nominal voltage can vary +/- 5%.

423802

- LLL = 4257 A   LG = 3670 A
- Z1 = Z2 = 0.2204 + j 1.7694 ohms

- Z0 = 0.5581 + j 2.5840 ohms

Analysis

Cymdist Version 7.1r02 was utilized to model the DG effects on the following:

1. System Load Flows
2. System Voltage Levels
3. System Fault Levels and Overcurrent Protection

System Load Flows

The system model indicates that no AEP equipment will experience conditions exceeding equipment rating due to the Generator operating under peak load, light load, or abnormal operating conditions.

Load flow

Assuming an abnormal condition of the Generator exporting all of its capacity into 423802 during peak loading condition produces 1994 kW flowing into the area electric power system (EPS) through the PCC. The capacity will be used by circuit 423802 load before backflow occurs through the 423802 circuit breaker at the South Granville station.

Assuming an abnormal condition of the Generator exporting all of its capacity into 423802 during light loading condition produces 1994 kW flowing into the area electric power system (EPS) through the PCC. Roughly 1100 kW will backflow into the 423802 circuit breaker (breaker B) at the South Granville station. This capacity will not backflow through T1 into the 69 kV system. It will flow through the circuit breaker A in South Granville station and serve circuit 423801 load. The backflow into the 423802 circuit breaker caused by the DG will require a re-coordination study for AEP protective circuit devices. The Generator's main protective device will need to be coordinated with the 423802 circuit breaker control settings.

System Voltage Levels

The customer communicated battery operational parameters are:

4. The battery system will not have a change of more than 2 MW in 2 seconds. (If the signal did go from +1 to -1 then the system would require 4 seconds to reach the desired level)
5. The battery system will only have an interval change greater than 1.5MW once per minute (or less). (interval meaning the 2 second signal)
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Of the 3 operational parameters, item 1 is the most restrictive so that parameter was modeled first. If it returned no operational concerns (system voltage level violations) then item 2 and item 3 would also not return any operational concerns.

Circuit studies were conducted at both peak loading and light loading conditions. With the South Granville circuits (423801 and 428302) modeled at peak loading conditions and the battery at maximum output (2.0 MW total). A transient stability study was created with the battery transitioning from full discharge to full charge (a 4 MW swing) over 4 seconds. An additional transient stability study was created with the battery transitioning from full charge to full discharge (a 4 MW swing) over 4 seconds. This entire process was repeated with the circuit modeled at light loading conditions.

Generator modeling on the South Granville station circuit indicates that the transition from maximum output to maximum charging load will cause a decrease in system voltage of 0.92% at the customer PCC and 0.91% at the end of circuit 423802. The transition from maximum charging load to maximum output causes an increase in system voltage of 0.92% at the customer PCC and 0.91% at the end of circuit 423802. These transient voltage fluctuations will not be perceptible to other customers on the AEP distribution system if the customer adheres to their self-declared battery operational parameters.

System Fault Levels and Overcurrent Protection

The addition of this DG equipment will subject AEP overcurrent protection devices to increased fault current. These increases, measured at the PCC, are outlined as follows:

- With no DG equipment connected:
    - LLL = 4257 A   LG = 3670 A
- With DG equipment connected:
    - LLL = 4356 A   LG = 4509 A

The fault contribution increase caused by the DG will require a re-coordination study for AEP protective circuit devices. Additionally, the Generator's main protective device will need to be coordinated with the 423802 circuit breaker control settings. As per the primary metering guidelines, the generator shall include a loss of phase protection scheme.

Distribution project design will set the 423802 breaker reclose instantaneous time to minimum 3 seconds, to allow the Generator time to isolate itself during an island condition.

System Protection

The Generator responsibilities include providing adequate protection to AEP facilities due to events arising from the operation of the Generator under all AEP distribution system and Generator operating conditions. The Generator is responsible for protecting their own facility under all AEP distribution system operating conditions whether the Generator is connected to AEP facilities or not including but not limited to:

1. Abnormal voltage or frequency
2. Loss of a single phase of supply
3. Equipment failure
4. Distribution system faults
5. Lightning
6. Excessive harmonic voltages
7. Excessive negative sequence voltages
8. Separation from supply
9. Loss of synchronization

IEEE Standard 1547-2003 "Standard for Interconnecting Distributed Resources with Electric Power Systems" is the basis for interconnection technical requirements for system protection.
The interconnection system hardware and software used by a Distributed Resource to meet the technical requirements do not have to be located at the Point of Common Coupling. However, the technical requirements shall be met at the Point of Common Coupling. For additional information on interconnection technical requirements please refer to the AEP Interconnection Guide and IEEE 1547-2003.

The cost of any damage resulting from a system condition caused by the installation and/or operation of the DG will be borne by the owner of the DG facility.

Abnormal distribution system events will be addressed on an individual basis through the AEP system operator. Corrective action shall be based on the judgment of the AEP system operator. Possible corrective action can include but is not limited to DG isolation from the distribution system.

This review has been limited to items which may affect the AEP system or to suggestions which may improve operations. The Generator must take all necessary steps to assure compliance with all laws, ordinances, building codes and other applicable regulations. Approval of this connection by AEP, when granted, is not an endorsement of a particular design nor does it assure fitness to accomplish an intended function.

Any additional AEP work to mitigate power quality issues not foreseen by this study but associated with the interconnection will be at the sole cost and expense of the Generator.

Summary

AEP System Improvements for Interconnection

1. Install all metering necessary.
2. Install a communication system to tie the AEP primary metering into the AEP remote data monitoring system at South Granville station.
3. Re-coordinate circuit 423802 overcurrent protection scheme and automatic reclosing intervals to incorporate the Generator's 12.47 kV main protective device.
4. Set the transformer Load Tap Changer control at South Granville Station to allow for reverse power flow. This does not require the existing station transformer be taken out of service.

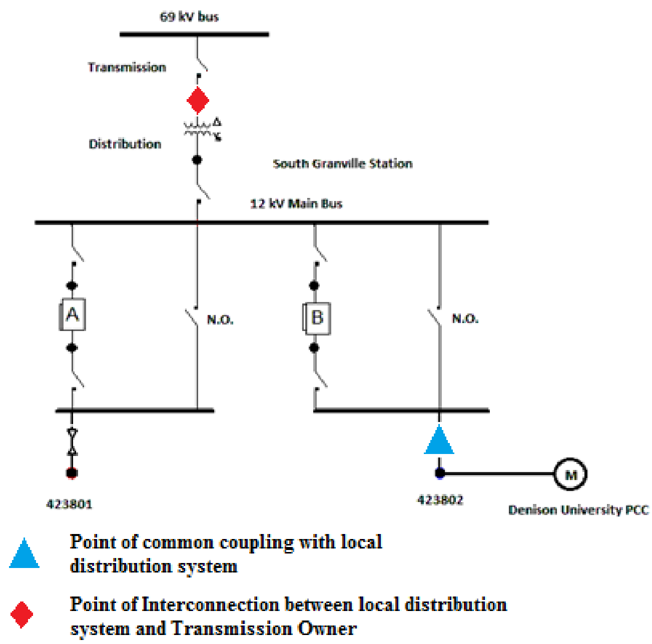
Metering

The DG delivery into and out of the AEP system will be metered at 12.47 kV. AEP will install a new 12.47 kV primary metering installation (dual meter) at the PCC for ancillary load billing and operational monitoring.

Communication

An AEP communication system will be installed to remotely monitor load and other quantities in real time as metered at the PCC for operational and planning purposes.

Simplified One-Line Diagram



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The output of the DG is varied based upon the Dynamic Regulation signal from PJM. This signal ranges from a value of 1.0 representing maximum battery output, to a value of -1.0 representing maximum battery charging. This signal is delivered to the DG in two second intervals. While it is most common for this signal to increase and decrease by small increments, historical analysis of this signal indicates that some of the fluctuations can be much more extreme. For the purposes of this study, a transition from maximum output (1.0) to maximum charge (-1.0) was thoroughly analyzed in the *System Voltage Levels* portion of this study. The customer self-declared battery operational parameters are:

1. The battery system will not have a change of more than 2 MW in 2 seconds. (If the signal did go from +1 to -1 then the system would require 4 seconds to reach the desired level)
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Assuming an abnormal condition of the Generator exporting all of its capacity into 423802 during light loading condition produces 1994 kW flowing into the area electric power system (EPS) through the PCC. Roughly 1100 kW will backflow into the 423802 circuit breaker (breaker B) at the South Granville station. This capacity will not backflow through T1 into the 69 kV system. It will flow through the circuit breaker A in South Granville station and serve circuit 423801 load. The backflow into the 423802 circuit breaker caused by the DG will require a re-coordination study for AEP protective circuit devices. The Generator's main protective device will need to be coordinated with the 423802 circuit breaker control settings.

Generator Requirements for Interconnection

The connection of the Denison battery will cause backflow into the 423802 circuit breaker. AEP must conduct an over current protection coordination study and possibly install new settings on the 423802 circuit breaker. Ohio Administrative Code (OAC) 4901:1 – 22 incorporates IEEE 1547 through reference. The Parker 890GTB-2200 inverter is not UL1741-2005 listed. The UL 1741 – 2005 listing is pending per the inverter literature supplied. The customer will have to test the DG system per IEEE 1547.1 unless documented proof of UL1741 – 2005 certification is provided to AEP.

A. AEP requires that the Generator install a group-operated load break disconnecting device located on their first structure beyond the PCC. The disconnecting device must be accessible to AEP personnel, suitable for use by AEP personnel at all times and suitable for use by AEP as a protective tagging location. The disconnecting device shall have a visible open gap when in the open position and be capable of being locked in the open position. Each disconnecting device must have a ground grid designed in accordance with specifications to be provided by AEP. Operation must be restricted to AEP personnel and properly trained operators designated by the Generator. The disconnecting device must comply with the applicable current ANSI Standard from the C37 series of standards that specifies the requirements for circuit breakers, reclosers and interrupting switches.
B. The Customer is required to install a three phase automatic isolating device (including a loss of phase protection scheme) beyond the aforementioned group-operated load break disconnecting device. This device will isolate faults on the Customer-owned 12.47 kV equipment. The Customer shall contact AEP Ohio Project Design to coordinate the device or other 12.47kV protective equipment with AEP protective settings.
C. Ground Current Sources - The Generator must have the capability to detect line-to-ground faults. The Generator shall provide adequate protection to comply with IEEE Standard 1547 to clear their generation source for all types of faults on the AEP system including any breaker failure event. Adequate protection requires that all fault types are cleared before equipment damage occurs to AEP facilities. If the Generator fails to provide adequate protection for faults on the AEP system, then the Generator will pay all costs associated with resulting facility damages.
D. Automatic Reclosing – Automatic high speed reclosing is applied to the transmission circuits supplying South Granville Station. When any AEP source breakers trip and isolate the Generator's facilities, the Generator shall ensure that their generation equipment is disconnected from AEP facilities in accordance with requirements established in IEEE Standard 1547 item 4.2 and all item 4.2 sub-items prior to automatic reclosing by AEP. Automatic reclosing out-of-phase with the Generator's generation equipment may cause damage to the Generator's equipment. The Generator is solely responsible for the protection of their equipment from automatic reclosing by AEP.
E. All synchronization of the Generator with AEP must be done by the Generator.
F. The Generator must inform AEP if they desire remote access to real time primary metering information at the time they indicate their desire to proceed with this project.
G. The Generator has indicated that they will maintain output at unity power factor. The Generator must ensure that it does not export or import reactive power (vars) to the extent that it would drive voltage at the PCC outside of the 114-126 volt limit for all system loading conditions. The Generator may be asked by AEP to export or import reactive power to support system conditions.

Cost to the Generator

The conceptual estimate for the cost of AEP improvements previously described is $250,000. Federal Gross-Up Tax, at the applicable rate, must be added to the total cost of the improvements.

The process for AEP to design and construct these improvements will take approximately six to nine months from the time an agreement is reached between AEP and the Generator to proceed.

Distribution Line (SCADA)	*Labor*	$50,000
	Material	$25,000
Distribution Station		$2,000
Metering	*Labor*	$115,000
	Material	$58,000
	Total	**$250,000**

Distribution Line

The SCADA connection will cost approximately $75,000. The installation of the fiber optic conductor from the station to the PCC will cost approximately $50,000 in labor and $25,000 in material.

Distribution Station

Distribution station work will cost approximately $2,000 in labor.

Metering

The metering connections will cost approximately $173,000. The installation of the fiber optic conductor from the station to the PCC will cost approximately $115,000 in labor and $58,000 in material.

Part II – Transmission Planning Analysis and Results

Network Impacts

The Queue Project AA1-121 was studied as a 2.0 MW (Capacity 0.0 MW) injection at the South Granville 69 kV substation in the AEP area. Project AA1-121 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AA1-121 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Summer Peak Analysis - 2018

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

None

Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

None

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

None

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

None

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

None

Light Load Analysis - 2018

Not required

System Reinforcements

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

None

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

Not required

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

Not required

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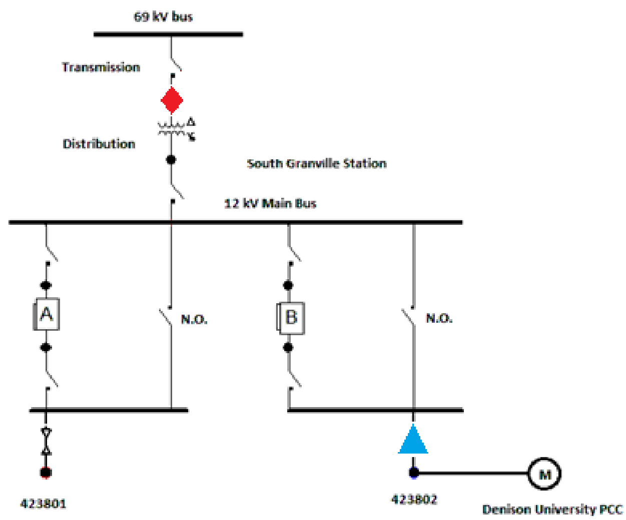

Point of common coupling with local distribution system

Point of Interconnection between local distribution system and Transmission Owner

Generator modeling on the South Granville station circuit indicates that the transition from maximum output to maximum charging load will cause a decrease in system voltage of 0.92% at the customer PCC and 0.91% at the end of circuit 423802. The transition from maximum charging load to maximum output causes an increase in system voltage of 0.92% at the customer PCC and 0.91% at the end of circuit 423802. These transient voltage fluctuations will not be perceptible to other customers on the AEP distribution system if the customer adheres to their self-declared battery operational parameters.

The output of the DG is varied based upon the Dynamic Regulation signal from PJM. This signal ranges from a value of 1.0 representing maximum battery output, to a value of -1.0 representing maximum battery charging. This signal is delivered to the DG in two second intervals. While it is most common for this signal to increase and decrease by small increments, historical analysis of this signal indicates that some of the fluctuations can be much more extreme. For the purposes of this study, a transition from maximum output (1.0) to maximum charge (-1.0) was thoroughly analyzed in the *System Voltage Levels* portion of this study. The customer self-declared battery operational parameters are:

1. The battery system will not have a change of more than 2 MW in 2 seconds. (If the signal did go from +1 to -1 then the system would require 4 seconds to reach the desired level)
2. The battery system will only have an interval change greater than 1.5MW once per minute (or less). (interval meaning the 2 second signal)
3. The battery system will only have an interval change greater than 0.8MW twice per minute or less.

Assuming an abnormal condition of the Generator exporting all of its capacity into 423802 during light loading condition produces 1994 kW flowing into the area electric power system (EPS) through the PCC. Roughly 1100 kW will backflow into the 423802 circuit breaker (breaker B) at the South Granville station. This capacity will not backflow through T1 into the 69 kV system. It will flow through the circuit breaker A in South Granville station and serve circuit 423801 load. The backflow into the 423802 circuit breaker caused by the DG will require a re-coordination study for AEP protective circuit devices. The Generator's main protective device will need to be coordinated with the 423802 circuit breaker control settings.

Generator Requirements for Interconnection

The connection of the Denison battery will cause backflow into the 423802 circuit breaker. AEP must conduct an over current protection coordination study and possibly install new settings on the 423802 circuit breaker. Ohio Administrative Code (OAC) 4901:1 – 22 incorporates IEEE 1547 through reference. The Parker 890GTB-2200 inverter is not UL1741-2005 listed. The UL 1741 – 2005 listing is pending per the inverter literature supplied. The customer will have to test the DG system per IEEE 1547.1 unless documented proof of UL1741 – 2005 certification is provided to AEP.

A. AEP requires that the Generator install a group-operated load break disconnecting device located on their first structure beyond the PCC. The disconnecting device must be accessible to AEP personnel, suitable for use by AEP personnel at all times and suitable for use by AEP as a protective tagging location. The disconnecting device shall have a visible open gap when in the open position and be capable of being locked in the open position. Each disconnecting device must have a ground grid designed in accordance with specifications to be provided by AEP. Operation must be restricted to AEP personnel and properly trained operators designated by the Generator. The disconnecting device must comply with the applicable current ANSI Standard from the C37 series of standards that specifies the requirements for circuit breakers, reclosers and interrupting switches.
B. The Customer is required to install a three phase automatic isolating device (including a loss of phase protection scheme) beyond the aforementioned group-operated load break disconnecting device. This device will isolate faults on the Customer-owned 12.47 kV equipment. The Customer shall contact AEP Ohio Project Design to coordinate the device or other 12.47kV protective equipment with AEP protective settings.
C. Ground Current Sources - The Generator must have the capability to detect line-to-ground faults. The Generator shall provide adequate protection to comply with IEEE Standard 1547 to clear their generation source for all types of faults on the AEP system including any breaker failure event. Adequate protection requires that all fault types are cleared before equipment damage occurs to AEP facilities. If the Generator fails to provide adequate protection for faults on the AEP system, then the Generator will pay all costs associated with resulting facility damages.
D. Automatic Reclosing – Automatic high speed reclosing is applied to the transmission circuits supplying South Granville Station. When any AEP source breakers trip and isolate the Generator's facilities, the Generator shall ensure that their generation equipment is disconnected from AEP facilities in accordance with requirements established in IEEE Standard 1547 item 4.2 and all item 4.2 sub-items prior to automatic reclosing by AEP. Automatic reclosing out-of-phase with the Generator's generation equipment may cause damage to the Generator's equipment. The Generator is solely responsible for the protection of their equipment from automatic reclosing by AEP.
E. All synchronization of the Generator with AEP must be done by the Generator.
F. The Generator must inform AEP if they desire remote access to real time primary metering information at the time they indicate their desire to proceed with this project.
G. The Generator has indicated that they will maintain output at unity power factor. The Generator must ensure that it does not export or import reactive power (vars) to the extent that it would drive voltage at the PCC outside of the 114-126 volt limit for all system loading conditions. The Generator may be asked by AEP to export or import reactive power to support system conditions.

Cost to the Generator

The conceptual estimate for the cost of AEP improvements previously described is $250,000. Federal Gross-Up Tax, at the applicable rate, must be added to the total cost of the improvements.

The process for AEP to design and construct these improvements will take approximately six to nine months from the time an agreement is reached between AEP and the Generator to proceed.

Distribution Line (SCADA)	*Labor*	$50,000
	Material	$25,000
Distribution Station		$2,000
Metering	*Labor*	$115,000
	Material	$58,000
	Total	**$250,000**

Distribution Line

The SCADA connection will cost approximately $75,000. The installation of the fiber optic conductor from the station to the PCC will cost approximately $50,000 in labor and $25,000 in material.

Distribution Station

Distribution station work will cost approximately $2,000 in labor.

Metering

The metering connections will cost approximately $173,000. The installation of the fiber optic conductor from the station to the PCC will cost approximately $115,000 in labor and $58,000 in material.

Part II – Transmission Planning Analysis and Results

Network Impacts

The Queue Project AA1-121 was studied as a 2.0 MW (Capacity 0.0 MW) injection at the South Granville 69 kV substation in the AEP area. Project AA1-121 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AA1-121 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Summer Peak Analysis - 2018

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

None

Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

None

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

None

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

None

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

None

Light Load Analysis - 2018

Not required

System Reinforcements

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

None

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

Not required

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

Not required