Revised
Generation Interconnection
Combined Feasibility/System Impact
Study Report

For

PJM Generation Interconnection Request
Queue Position V3-025

Cranbury 13.8kV

March 2010

Preface

The intent of the Combined 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, if any, is included in the System Impact Study.

The 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 associated with them will be addressed when seeking an Interconnection Agreement as outlined below. Developer will also be responsible for providing and installing metering equipment in compliance with applicable PJM and Transmission Owner standards.

General

The Developer has proposed three generating facilities totaling 10.0MW (3.8 MW capacity) solar powered generating facilities. The facilities will be located in Monroe Township, New Jersey, Cranbury, New Jersey, and South Brunswick, New Jersey.

Attachment facilities and local upgrades (if required) along with terms and conditions to interconnect V3-025 will be specified in a separate two party Interconnection Agreement (IA) between the Transmission Owner and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT). From the transmission system perspective, no network impacts were identified as detailed below.

Results of PJM Analysis

Point of Interconnection

V3-025 will interconnect with the Jersey Central Power and Light distribution system as a tap of into each of three existing 34.5 kV distribution circuits from the Cranbury, Costco, and Monroe substations.

Network Impacts

The queue V3-025 project was studied as an injection into JCP&L's 34.5kV system at 3 different points of interconnection. The three interconnection points were the Monroe, Cranbury, and Costco buses, and the amount of generation modeled at each location was 2.25MW (0.855MWC), 5.5MW (2.09MWC), and 2.25MW (0.855MWC) respectively. The project was studied on a combined feasibility-impact basis which utilizes an AC analysis, and incorporates all contingency types. Project V3-025 was evaluated for compliance with reliability criteria for summer peak conditions in 2014.

Potential network impacts were as follows:

Generator Deliverability

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

No problems identified.

Multiple Facility Contingency

(Double Circuit Tower Line, Line with Failed Breaker and, Bus Fault contingencies for the Full energy output.

No problems identified.

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)

No problems identified.

Short Circuit

Not required

New System Reinforcements

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

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project.

None

Stability Analysis

Not required.

Potential Congestion due to Local Energy Deliverability

(PJM also studied the delivery of the energy portion of the surrounding generation. Any potential 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 Transmission Interconnection Request. Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full deliverability for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which analyzes all overload conditions associated with the identified overloaded element(s). As a result of the aggregate energy resources in the area, the following violations were identified:

No problems identified.

Results of First Energy Analysis

2.25 MW Solar Facility at 25 Middlesex Ave, Monroe Twp, NJ

Scope

Generation Interconnection Feasibility Study V3-025 for the Developer examines the capability of Jersey Central Power and Light Co, a FirstEnergy Company's electric distribution system to accept the output of the proposed 2.25 MW solar panel generation located at 25 Middlesex Ave., Monroe Twp, New Jersey with a planned in service date of May 31, 2010.

Local Distribution Circuit Information

This area is presently served by Distribution Circuit# 47715, 3 phase 12.47 kV grounded wye distribution circuit originating from JCP&L's Monroe Substation located 1.6 miles from the proposed site.

Impact on Monroe 47715 Distribution Circuit

Short Circuit Study

Available fault current at the proposed interconnection location without proposed generation is 3,185 Amps-3 phase amps and 2,699 Amps Line to ground amps. Addition of generator contributes 6% to the available 3 phase short circuit current.

The above fault current value provided is calculated at the 12.5 kV voltage level and is based on the existing power system configuration. Future upgrades can occur on the JCP&L/FE power delivery system. The fault current can vary based on these modifications.

Equipment Loading

The output of the proposed 2.25MW solar panel generation facility represents 24% of the recent peak in load and 27% of the minimum load on the distribution circuit feeding this PV facility.

Direct Transfer Trip will be required for load monitoring and control .Distributed generation must not interfere or degrade the quality of service to any other FirstEnergy Corp. customers (service voltage, voltage flicker, harmonics, service reliability etc).

Voltage Study

Analysis study shows no adverse impact on the JCPL System Voltage Profile as a result of the connection of this facility.

Distribution line Regulators are not present on Monroe circuit # 47715 between the IC and Substation.

Circuit protection and co ordination

Main Line: To accommodate the proposed 2.25 MW capacity, JCP&L will install 100 k protective fuses on the three phase primary line to the facility allowing a nominal current of 100 amps of primary current- 2.25 MW of power export. This fuse will coordinate with other protective devices along the main line from the IC back to the sub.

At Substation: Implement Transfer Trip scheme. Replace 3 existing electro-mechanical relays with SEL-351 electronic relays on 2 distribution circuits and on one Transformer Bank at Monroe Substation. Provide wiring, conduit and RTU configuration to tie into customers DTT system at our substation entry point.

At PV Facility: Transfer Trip system will be designed by the customer, and must be approved by JCP&L/FirstEnergy prior to purchase. Typically, these systems utilize fiber optic, leased phone line, or radio communications. The direct transfer trip system must communicate with the distribution circuit breaker located in the JCP&L substation, as well as any in-line fault interrupting devices located between the substation and the point of interconnection (if any). Typically this may involve communication with one or more pole top reclosers.

The customer must install and maintain the direct transfer trip equipment. Equipment needed inside JCP&L facilities may be installed by JCP&L personnel. Periodic testing of the system will be required and the system must be configured to fail in a 'trip' condition- i.e. upon loss of communications, the system must trip the generator off line.

Distributed Generation must not interfere with the proper detection and clearing of faults on the First Energy system.

Additional requirements

- JCP&L will work with the customer to determine the exact interconnection point, based on existing infrastructure layout.
- The preliminary costs associated with rearranging the existing underground switches SW2186MNT and SW61725MNT to provide the spare position to connect the PV facility.
- Interconnect Customer (IC) will install a pad mounted three phase primary metering per the FE Construction Standards of page# 10-400. IC will install the revenue metering CTs and PTs, to be supplied by JCP&L.
- IC provides all trenching, cables and conduit from JCP&L's point of interconnection Switch SW2186MNT to connect his PV generation facilities.
- IC must meet all applicable JCP&L/FirstEnergy standards and requirements which are included in the current Tariff for Service.
- IC's inverter-based generation must be UL listed or certified to comply with the requirements of IEEE 1547.

- IC's main breaker shall be SEL 351 MF relay is required for interconnection protection. All breakers, lightning protection etc should meet JCP&L/FE's minimum BIL Ratings.

- The IC's transformer must be grounded wye to grounded wye.

- IC must meet requirements of N.J.A.C. 14:4-9 ("In front of meter" all power sold to PJM and interconnection standards for Class I Renewable Energy Systems), as well as IEEE 1547, and IEEE 1547.1

- IC must meet applicable FE Distributed Generation Technical requirements for the interconnection of generation to the FE Distribution system.

Infrastructure Upgrade Costs (By JCP&L)

- Conceptual estimate to rearrange the existing underground switches SW 2186 MNT and SW 61725 MNT to provide the spare position to connect the PV facility, install three 100E fuses, primary metering at the interconnection point is $ 50,000

- Substation upgrade cost is $ 160,000

- All JCPL costs are not subject to refundable provisions of the NJ-BPU Tariff for Electric service

Note- this is an estimate based on similar work orders previously worked by JCP&L for the types of work described in the analysis above. It is accurate to within plus or minus 25 percent. Should the customer want to proceed with the connection of this facility a contract with JCPL will be developed based on these costs and a true-up of actual charges will be made at the completion of the project

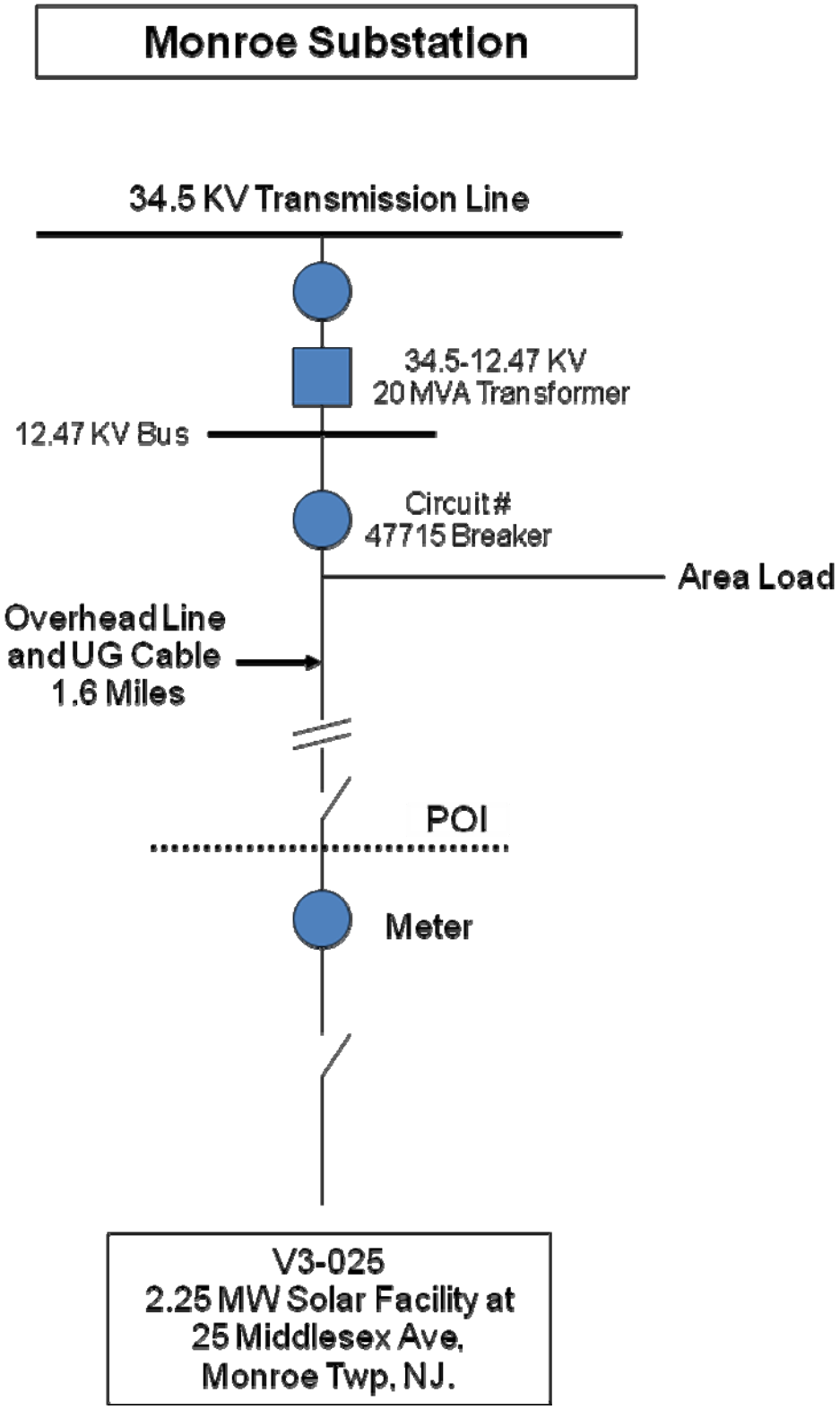
Timetable for Construction

JCP&L estimates 3 months after receipt of funds for design work to be completed.

JCP&L estimates it will require an additional 5 months to complete the identified infrastructure upgrades.

Location

Single Line Diagram



Results of First Energy Analysis

2.25 MW Solar Facility at 380 Deans-Rhode Hall Road, South Brunswick, NJ

Scope

Generation Interconnection Feasibility Study V3-025 for the Developer examines the capability of Jersey Central Power and Light Co, a FirstEnergy Company's electric distribution system to accept the output of the proposed 2.25 MW solar panel generation located at 380 Deans-Rhode Hall Rd. South Brunswick, New Jersey which is just east of New Jersey Turnpike with a planned in service date of May 31, 2010.

Local Distribution Circuit Information

This area is presently served by Distribution Circuit# 47881, 3 phase 12.47 Kv grounded Y distribution circuit originating from JCP&L's Costco Substation located 2.6 miles from the proposed site.

Impact on Costco 47881 Distribution Circuit

Short Circuit Study

Available fault current at the proposed interconnection location without proposed generation is 2,926 Amps-3 phase amps and 2,221 Amps Line to ground amps. Addition of generator contributes 6.5% to the available 3 phase short circuit current.

The above fault current value provided is calculated at the 12.5 kV voltage level and is based on the existing power system configuration. Future upgrades can occur on the JCP&L/FE power delivery system. The fault current can vary based on these modifications.

Equipment Loading

The output of the proposed 2.25MW solar panel generation facility represents 36% of the recent summer peak in load and 56% of the minimum load on the distribution circuit feeding this PV facility. Direct Transfer Trip will be required for load monitoring and control .Distributed generation must not interfere or degrade the quality of service to any other FirstEnergy Corp. customers (service voltage, voltage flicker, harmonics, service reliability etc).

Voltage Study

Analysis study shows no adverse impact on the JCPL System Voltage Profile as a result of the connection of this facility.

No Distribution line Regulators are present on Costco circuit # 47881 between the IC and Substation.

Circuit protection and co ordination

Main Line: To accommodate the proposed 2.25 MW capacity, JCP&L will install 100 k protective fuses on the three phase primary line to the facility allowing a nominal current of 100 amps of primary current- 2.25 MW of power export. This fuse will coordinate with other protective devices along the main line from the IC back to the Costco substation.

At Substation: Implement Transfer Trip scheme. Replace 3 existing electro-mechanical relays with SEL-351 electronic relays on 2 distribution circuits and on one Transformer Bank at Costco Substation. Provide wiring, conduit and RTU configuration to tie into customers DTT system at our substation entry point.

At PV Facility: Transfer Trip system will be designed by the customer, and must be approved by JCP&L/FirstEnergy prior to purchase. Typically, these systems utilize fiber optic, leased phone line, or radio communications. The direct transfer trip system must communicate with the distribution circuit breaker located in the JCP&L substation, as well as any in-line fault interrupting devices located between the substation and the point of interconnection. Typically this may involve communication with one or more pole top reclosers.

The customer must install and maintain the direct transfer trip equipment. Equipment needed inside JCP&L facilities may be installed by JCP&L personnel. Periodic testing of the system will be required and the system must be configured to fail in a 'trip' condition- i.e. upon loss of communications, the system must trip the generator off line.

Distributed Generation must not interfere with the proper detection and clearing of faults on the First Energy system.

Additional requirements

- JCP&L will work with the customer to determine the exact interconnection point, based on existing infrastructure layout.

- The preliminary costs associated with the JCP&L tap line to the interconnection point, consists of extending two spans about 400 feet of three phase #2 ACSR conductor and manually operated disconnect switches.

- Interconnect Customer (IC) will install a pole adjacent to JCP&L's pole as point of interconnection. On this pole the IC will install cutout fuses with load break capability, primary metering transformer bracket per the FE Construction Standards of page# 10-347. IC will also install the revenue metering CTs and PTs, to be supplied by JCP&L.

- IC provides all trenching, cables, riser and conduit to connect his PV generation facilities into the Point of Interconnection.

- IC must meet all applicable JCP&L/FirstEnergy standards and requirements which are included in the current Tariff for Service.

- IC's inverter-based generation must be UL listed or certified to comply with the requirements of IEEE 1547.

- IC's main breaker shall be SEL 351 MF relay is required for interconnection protection. All breakers, lightning protection etc should meet JCP&L/FE's minimum BIL Ratings.

- The IC's transformer must be grounded wye to grounded wye.

- IC must meet requirements of N.J.A.C. 14:4-9 ("In front of meter" all power sold to PJM and interconnection standards for Class I Renewable Energy Systems), as well as IEEE 1547, and IEEE 1547.1

- IC must meet applicable FE Distributed Generation Technical requirements for the interconnection of generation to the FE Distribution system.

Infrastructure Upgrade Costs (By JCP&L)

- Conceptual estimate to extend two spans three phase #2 ACSR conductor about 400 feet, three 100K fuses, manually operable disconnect switch, primary metering at the interconnection point is $ 42,000

- Substation upgrade cost is $ 160,000.

- All JCPL costs are not subject to refundable provisions of the NJ-BPU Tariff for Electric service

Note- this is an estimate based on similar work orders previously worked by JCP&L for the types of work described in the analysis above. It is accurate to within plus or minus 25 percent. Should the customer want to proceed with the connection of this facility a contract with JCPL will be developed based on these costs and a true-up of actual charges will be made at the completion of the project

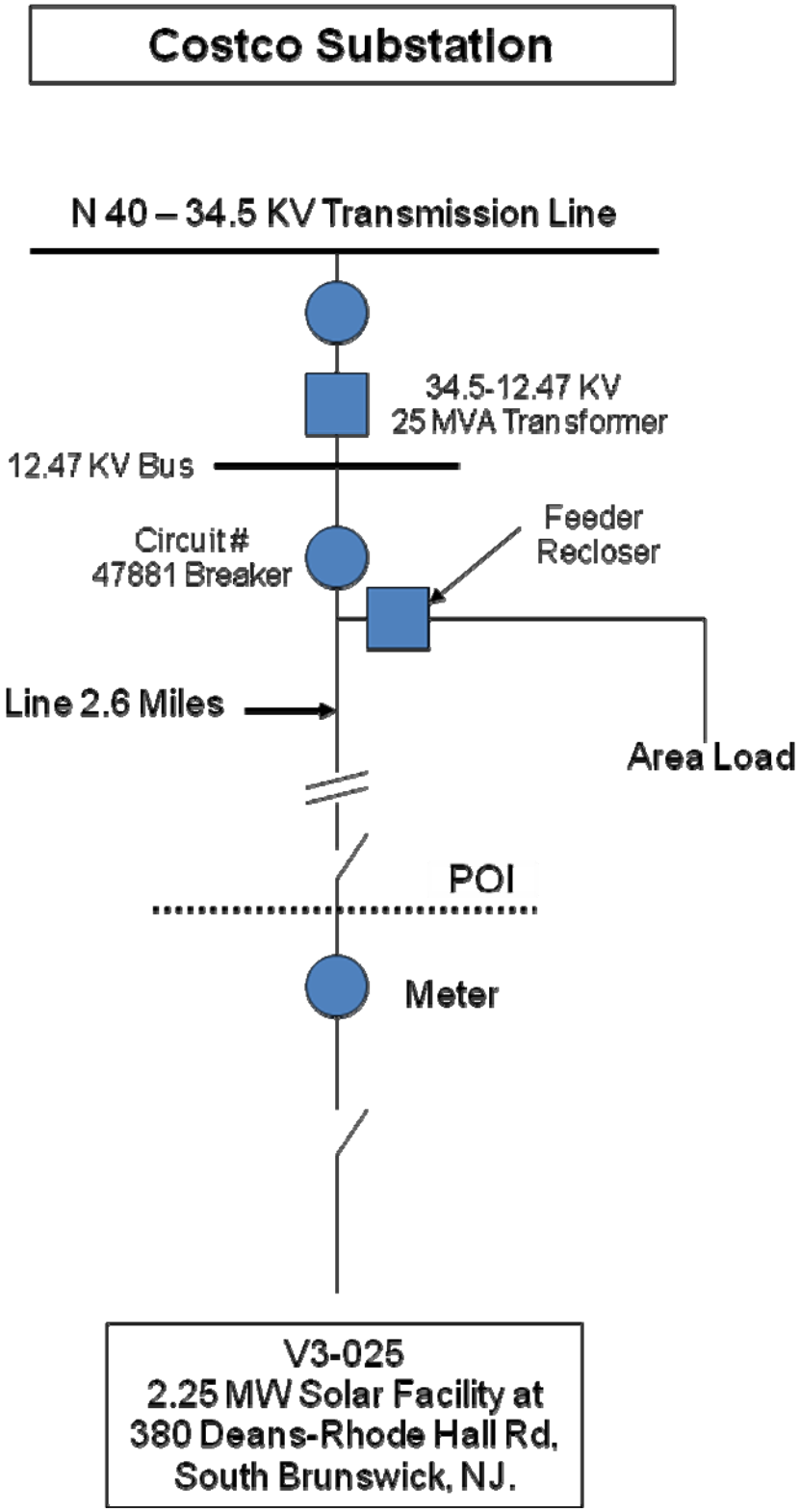
Timetable for Construction

JCP&L estimates 3 months after receipt of funds for design work to be completed.

JCP&L estimates it will require an additional 5 months to complete the identified infrastructure upgrades.

Location

Single Line Diagram



Results of First Energy Analysis

5.5 MW Solar Facility at 257 Prospect Plains Road, Cranbury, NJ

Scope

Generation Interconnection Impact Study V3-025 for the Developer examines the capability of Jersey Central Power and Light Co, a FirstEnergy Company's electric distribution system to accept the output of the proposed customer owned 5.5 MW solar panel generation located at 257 Prospect Plains Rd, Cranbury, New Jersey with a planned in service date of May 31, 2010.

Local Distribution Circuit Information

This area is presently served by Distribution Circuit# 47184, 3 phase 12.47 Kv grounded wye distribution circuit originating from JCP&L's Cranbury Substation located 1.6 miles from the proposed site.

Impact on Cranbury 47184 Distribution Circuit

Short Circuit Study

Available fault current at the proposed interconnection location without proposed generation is 3,133 Amps-3 phase amps and 2,514 Amps Line to ground amps. Addition of generator contributes 12% to the available 3 phase short circuit current.

The above fault current value provided is calculated at the 12.5 kV voltage level and is based on the existing power system configuration. Future upgrades can occur on the JCP&L/FE power delivery system. The fault current can vary based on these modifications.

Equipment Loading

The output of the proposed 5.5MW solar panel generation facility represents 75% of the recent summer peak on the Cranbury 47184 circuit and 173% of the minimum load on this distribution circuit.

During an outage of Cranbury Ckt# 47184 the 5.5 MW generator output exceeds the recorded minimum load on the Substation Transformer feeding this PV facility. Direct Transfer Trip will be required for load monitoring and control .Distributed generation must not interfere or degrade the quality of service to any other FirstEnergy Corp. customers (service voltage, voltage flicker, harmonics, service reliability etc).

Voltage Study

Analysis study shows no adverse impact on the JCPL System Voltage Profile as a result of the connection of this facility.

No Distribution line Regulators are present on Cranbury circuit # 47184 between the IC and Substation.

Circuit protection and co-ordination

Main Line: To accommodate the proposed 5.50 MW capacity, JCP&L will install a Recloser on the three phase primary line to the facility allowing a nominal current of 250 amps of primary current- 5.50 MW of power export. This Recloser will coordinate with other protective devices along the main line from the IC back to the Cranbury substation.

At Substation: Implement Transfer Trip scheme. Replace 3 existing electro-mechanical relays with SEL-351 electronic relays on 2 distribution circuits and on one Transformer Bank at Cranbury Substation. Provide wiring, conduit and RTU configuration to tie into customers DTT system at our substation entry point.

At PV Facility: Transfer Trip system will be designed by the customer, and must be approved by JCP&L/FirstEnergy prior to purchase. Typically, these systems utilize fiber optic, leased phone line, or radio communications. The direct transfer trip system must communicate with the distribution circuit breaker located in the JCP&L substation, as well as any in-line fault interrupting devices located between the substation and the point of interconnection (if any). Typically this may involve communication with one or more pole top reclosers.

The customer must install and maintain the direct transfer trip equipment. Equipment needed inside JCP&L facilities may be installed by JCP&L personnel. Periodic testing of the system will be required and the system must be configured to fail in a 'trip' condition- i.e. upon loss of communications, the system must trip the generator off line.

Distributed Generation must not interfere with the proper detection and clearing of faults on the First Energy system.

Additional requirements:

- JCP&L will work with the customer to determine the exact interconnection point, based on existing infrastructure layout.

- Interconnect Customer (IC) will install pole adjacent to JCP&L's pole as point of interconnection. On this pole IC will install cutout fuses with load break capability, primary metering transformer bracket per the FE Construction Standards of page# 10-347. IC will install the revenue metering CTs and PTs, to be supplied by JCP&L.

- IC provides all trenching, cables and conduit from JCP&L's point of interconnection pole to connect his PV generation facilities.

- IC must meet all applicable JCP&L/FirstEnergy standards and requirements which are included in the current Tariff for Service.

- IC's inverter-based generation must be UL listed or certified to comply with the requirements of IEEE 1547.

- IC's main breaker shall be SEL 351 MF relay is required for interconnection protection. All breakers, lightning protection etc should meet JCP&L/FE's minimum BIL Ratings.

- The IC's transformer must be grounded wye to grounded wye.

- IC must meet requirements of N.J.A.C. 14:4-9 ("In front of meter" all power sold to PJM and interconnection standards for Class I Renewable Energy Systems), as well as IEEE 1547, and IEEE 1547.1

- IC must meet applicable FE Distributed Generation Technical requirements for the interconnection of generation to the FE Distribution system.

Infrastructure Upgrade Costs (By JCP&L):

- Conceptual estimate to extend two spans of three phase 336 AA conductor 250 feet, install manually operable disconnect switch, 300 E fuses, a 3 phase recloser, and primary metering at the interconnection point is $ 110,000.

- Substation upgrade cost is $ 160,000

- All JCPL costs are not subject to refundable provisions of the NJ-BPU Tariff for Electric service

Note- this is an estimate based on similar work orders previously worked by JCP&L for the types of work described in the analysis above. It is accurate to within plus or minus 25 percent. Should the customer want to proceed with the connection of this facility a contract with JCPL will be developed based on these costs and a true-up of actual charges will be made at the completion of the project

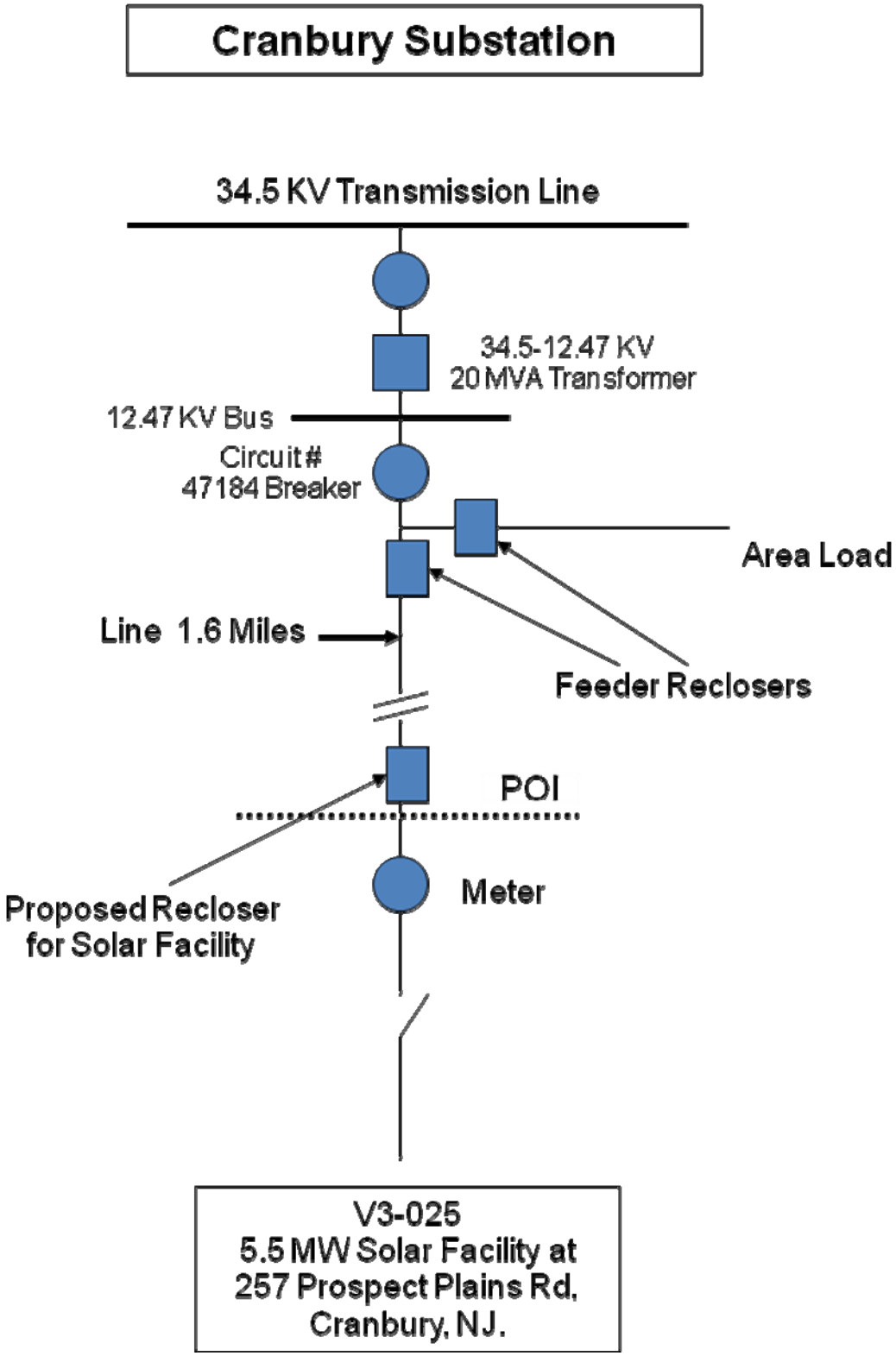
Timetable for Construction:

JCP&L estimates 3 months after receipt of funds for design work to be completed.

JCP&L estimates it will require an additional 5 months to complete the identified infrastructure upgrades.

Location:

Single Line Diagram



Generation Interconnection Combined Feasibility/System Impact Study Report

For

PJM Generation Interconnection Request Queue Position V3-025

Cranbury 13.8kV

January 2010

Preface

The intent of the Combined 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, if any, is included in the System Impact Study.

The 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 associated with them will be addressed when seeking an Interconnection Agreement as outlined below. Developer will also be responsible for providing and installing metering equipment in compliance with applicable PJM and Transmission Owner standards.

General

Recurrent Energy Development Holdings, the Interconnection Customer (IC), has proposed three generating facilities totaling 3.8 MW (10.0 MW capacity) solar powered generating facilities. The facilities will be located in Monroe Township, New Jersey, Cranbury, New Jersey, and South Brunswick, New Jersey.

Attachment facilities and local upgrades (if required) along with terms and conditions to interconnect V3-025 will be specified in a separate two party Interconnection Agreement (IA) between the Transmission Owner and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT). *From the transmission system perspective, no network impacts were identified as detailed below.*

Point of Interconnection

V3-025 will interconnect with the Jersey Central Power and Light distribution system as a tap of into each of three existing 34.5 kV distribution circuits from the Cranbury, Costco, and Monroe substations.

Network Impacts

The queue V3-025 project was studied as an injection into JCP&L's 34.5kV system at 3 different points of interconnection. The three interconnection points were the Monroe, Cranbury, and Costco buses, and the amount of generation modeled at each location was 2.25MW (0.855MWC), 5.5MW (2.09MWC), and 2.25MW (0.855MWC) respectively. The project was studied on a combined feasibility-impact basis which utilizes an AC analysis, and incorporates all contingency types. Project V3-025 was evaluated for compliance with reliability criteria for summer peak conditions in 2014.

Potential network impacts were as follows:

Generator Deliverability

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

No problems identified.

Multiple Facility Contingency

*(Double Circuit Tower Line, Line with Failed Breaker and, Bus Fault contingencies for the **Full** energy output.*

No problems identified.

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)

No problems identified.

Short Circuit

Not required.

New System Reinforcements

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

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project.

None

Stability Analysis

Not required.

Potential Congestion due to Local Energy Deliverability

(PJM also studied the delivery of the energy portion of the surrounding generation. Any potential 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 Transmission Interconnection Request. Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full deliverability for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which analyzes all overload conditions associated with the identified overloaded element(s). As a result of the aggregate energy resources in the area, the following violations were identified:

No problems identified.