Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position X3-079

Waretown

February 2012

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, 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 impact study is performed.

The Feasibility 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.

General

The Interconnection Customer (IC), has proposed a solar generating facility located in Waretown, New Jersey. The installed facilities will have a total capability of 20.0 MW with 7.6 MW of this output being recognized by PJM as capacity. This means that the remaining 12.4 MW will be curtailable should a system reliability constraint occur.

Point of Interconnection

X3-079 will interconnect with the Jersey Central Power & Light system at one of two options. Option 1 is to connect at the 34kV line S145 between the Oyster Creek and Waretown substations. Option 2 is to connect at the 34kV line R144 between the Oyster Creek and Waretown substations.

FirstEnergy Analysis

As defined by the Interconnection Customer and shown on Attachment 2, the primary choice of interconnection (POI #1) for the X3-079 Project will be from a tap of the Oyster Creek – Waretown (S145) 34.5 kV line. From this point Jersey Central will construct a 0.5 mile radial line tap, over built on an upgraded distribution pole line. From that pole, Jersey Central will construct one span radial line extension of about 200 foot to a switch pole structure to be constructed, owned, operated and maintained by the Interconnection Customer. The Interconnection Customer will be responsible for the attachment from this point to the X3-079 Project substation. Jersey Central will own, operate and maintain the radial attachment line up to the point of interconnection as defined in Attachment 3. The Interconnection Customer will own, operate and maintain the extension from the point of interconnection to its substation.

The Interconnection Customer has chosen a second choice of interconnection (POI #2). POI #2 is a tap of the Oyster Creek – Waretown (R144) 34.5 kV line. POI #2 requires the same 0.5 mile 34.5 kV line extension as POI #1, except POI #2 requires an overhead road crossing and the S145 line, as the Oyster Creek – Waretown 34.5 kV (R144) Line runs along the east side of Route 9.

In summary, Attachment 3 shows a conceptual one-line diagram of the primary choice Direct Connection facilities that will be required for the X3-079 Project. As indicated, it will be studied as a 20.0 MW injection into the Jersey Central 34.5 kV system at the Oyster Creek – Waretown (S145) 34.5 kV line. SCADA controlled disconnect switches will be needed on several poles as well as the radial tap pole in addition to a circuit breaker and switch on the system side of the generator step-up transformer. The Interconnection Customer will be responsible for acquiring all permits and right of way that may be needed for both the 34.5 kV line tap and the radial line extension line. The Interconnection Customer will also be responsible for acquiring all permits and constructing, owning and operating all facilities on its side of the point of interconnection. A summary of the FE facilities required for the X3-079 Project Direct Connection and their cost estimate is shown on Attachment 4. In accordance with PJM protocol, there is no cost estimate provided for the second choice POI #2.

Power Flow Analysis – Subtransmission 34.5 kV System

A Power Flow study was conducted to determine the reliability impact of the proposed X3-079 Project on the FE Transmission System. This study was completed using a 2013 summer peak and light load power flow that contain a detailed representation of the Jersey Central transmission network in the area of the proposed X3-079 Project. Note that the year 2013 was chosen for study rather than 2015 since this is the first summer period when the X Queue solar projects are scheduled for service. The findings and the recommendations from this analysis are based on a contingency review that was performed to identify the facility loadings and/or voltage conditions that violate the Reliability*First*, PJM or FE Planning Criteria and are attributable to this project.

The results of the FE analysis show that there are no network upgrades required for the deliverability of the X3-079 Project generation to the Jersey Central and PJM transmission systems. There also are no common mode outage reinforcements defined for previous projects for which it will have an impact. These results are applicable to both POI #1 and POI #2.

However, there are numerous other solar generation projects proposed in the vicinity of the X3-079 Project that will contribute to system constraints. In addition, there is the potential for high voltage during light load periods and voltage criteria violations due to swings in the MW output of the cumulative attached solar generation. A conclusion of this analysis is therefore that a curtailment of the X3-079 Project output to its PJM capacity value can be expected at times to maintain the Jersey Central system reliability within the NERC, Regional and FE operations and planning standards if all proposed RTEP Projects proceed. If desired, the Interconnection Customer can fund a Jersey Central project to reinforce the limiting facilities to eliminate these constraints.

Note that a further conclusion of this study is that it will be mandatory for the X3-079 Project to have a range of dynamic reactive capability that supports its operation from a .95 lead to .95 lag power factor. Without a continuous regulation, the FE studies show that the addition of solar projects can cause voltage swings as their output oscillates with moving clouds and system voltages that can exceed the established limits. Should the Interconnection Customer fail to provide a dynamic reactive capability from the X3-079 Project for any reason once interconnected, the Jersey Central and/or PJM Dispatchers may need to take action to curtail both the energy and capacity portion of its output to prevent a non-compliance with voltage criteria.

Short Circuit and Dynamics Analysis

In accordance with the RTEP process, a detailed short circuit analysis was not conducted by PJM since the X3-079 Project connection is to the Jersey Central 34.5 kV system. Therefore, the FE Protection staff conducted a short circuit review of the project connection. An assumption of this study was that solar generation projects will contribute no appreciable fault current to the breakers on the FE transmission system. As defined by EPRI: "Inverters are generally designed to limit fault currents to 130% or less of rated current. Thus they can usually be disregarded when conducting fault studies."[1] Based on this fact, the results of the FE analysis showed that no FE circuit breaker will exceed its interrupting capability with the implementation of the X3-079 Project. Therefore no circuit breaker reinforcements will be required.

System Protection Analysis

An analysis was conducted to assess the impact of the X3-079 Project on the system protection requirements in the area. The results of this review have identified the following:

Under the assumption that the X3-079 Project generation will not supply fault current to the Jersey Central transmission system as defined by the PJM staff, there will be no protection upgrades needed for the Oyster Creek – Waretown (S145) 34.5 kV line. However, the X3-079 Project will be required to have two independent high-speed zones of protection to sense and clear faults on the interconnection transformer.

The fault current values on the Oyster Creek – Waretown (S145) 34.5 kV line are listed below.

[1] EPRI Document TR-111490 "Integration of Distributed Resources in Electric Utility Distribution Systems: Distribution System Behavior Analysis for Suburban Feeder", published November 1998, page 62

	Three Phase	Line-Ground
X/R Ratio	4.4785	5.3796
Fault Current (Amps)	9899.0	6406.3

These values are for the current system configuration. Any system changes in the area could have a significant impact on these values. It will be the Interconnection Customer's responsibility to make any protection upgrades required should this occur.

For the X3-079 Project, a 2-200E, S&C SMD-2C, standard fuse will be required.

The cost estimate for the required FE system protection facilities is included on Attachment 4.

Metering

The Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers.

The FirstEnergy Revenue Metering Requirements may be found in the FirstEnergy Requirements for Transmission Connected Facilities document located at the following links:

www.firstenergycorp.com/feconnect
http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Compliance Issues

The proposed interconnection facilities must be designed in accordance with the FirstEnergy "Requirements for Transmission Connected Facilities" referenced above.

For the X3-079 Project, this includes the provision of a reactive power capability sufficient to maintain a composite power delivery for the facility at the interconnection point at a power factor between .95 leading (absorbing 6.6 MVAR) and .95 lagging (producing 6.6 MVAR). If this capability cannot be provided by the solar units, a dynamic device such as a STATCOM or SVC must be installed at the X3-079 Project substation at the Interconnection Customer's cost.

The Interconnection Customer will be responsible for following the requirements of the "FirstEnergy Wholesale Generation Interconnection (WGI) Manual" and the "FE Approved Vendors and Contractors" documents which are also located at the above link. In addition, the Interconnection Customer will be required to meet all PJM, Reliability*First* and NERC reliability criteria and operating procedures for standards compliance. For example, the Developer will need to properly locate and report the over and under-voltage and over and under-frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and Reliability*First* audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the FE system.

Interconnection Customer Requirements

In addition to the FE facilities, the Interconnection Customer will also be responsible for meeting all criteria as specified in the applicable sections of the "FE Requirements for Transmission Connected Facilities" document. Since the X3-079 Project will be connected to the 34.5 kV

network, the Interconnection Customer will also be responsible for compliance with the FirstEnergy "Technical Requirements for the Interconnection of Parallel-Operated Generation to the FirstEnergy Distribution System". This includes but is not limited to the following:

1. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.

2. The purchase and installation of the standard voice grade (analog) telephone line and associated conduit between the telephone company source and the meter socket or enclosure.

3. A compliance with the FE and PJM generator power factor and voltage control requirements. Note that the X3-079 Project will need to absorb reactive power at the point of interconnection to minimize the voltage change should the units rapidly reduce their output or trip off line.

4. The execution of a back-up service agreement to serve the customer load supplied from the Interconnection Customer 34.5 kV substation when the units are out-of-service. This assumes the intent of the Interconnection Customer is to net the generation with the station load.

5. Any complaints from other customers (e.g. flicker complaints) will have to be corrected by the Interconnection Customer. Correction may include changing operation, reducing generation, disconnecting the generators from the Jersey Central system, or other measures.

6. The purchase and installation of supervisory control and data acquisition (SCADA) equipment to provide information in a compatible format to the FE Transmission System Control Center. The RTU, the communications channel and all related equipment will be furnished and maintained by the Interconnection Customer. The RTU must communicate with the FirstEnergy EMS via DNP 3.0 protocol.

7. The following status, control and metering points will be required:

    a. Interconnection breaker position status and trip control.

    b. Generator real and reactive power output measured at the high-side of the generator step-up transformer.

    c. Generator voltage at the point of interconnection.

8. An installation of two independent high-speed zones of protection to sense and clear faults on the interconnection transformer.

9. A compliance with the inverter standard UL1741 and IEEE 1547, "Standard for Interconnecting Distributed resources with Electrical Power Systems", in addition to the power quality standards defined by Reliability*First* and PJM.

10. A provision of the necessary generator protection, synchronization controls, and fault detection to initiate a trip to protect the X3-079 Project equipment from faults on the Jersey Central System.

11. The Interconnection Customer will not excavate, construct facilities or locate solar panels under the existing FE transmission facilities or on FE right-of-ways without the express permission of FE.

12. A compliance with the PJM Manuals and Operating instructions to have a plant operator on call 24/7 to respond within a minute to reduce the output of X3-079 Project when network constraints occur.

13. The installation of intertie relays at the point of interconnection that either trip the breaker at the point of interconnection or the individual generators beyond the point of interconnection. The function of the intertie relays must include over/under voltage and over/under frequency protection. Note that these intertie relays are in addition to and must be separate from the two relays that provide independent high speed zone of protection to sense and clear faults. They include the installation of an SEL-351-7 (Version 7) relay or its equivalent for power elements, a potential transformer or CCVT's on the high side of the transformer, and current transformers on the high side of the transformer.

14. The Interconnection Customer will cooperate with any requests to coordinate with the Oyster Creek Nuclear Generator Plant, as the Oyster Creek 34.5 kV Substation is common to both the Oyster Creek Nuclear Generator Plant and the X3-079 Project.

The above requirements are in addition to any metering or other requirements imposed by PJM.

Note that an assumption of this study is that the X3-079 Project generation will automatically be disconnected whenever the local area network is islanded. If this assumption is not correct, a direct transfer trip scheme will need to be implemented for such situations at the Interconnection Customer's cost.

Network Impacts

Queue project X3-079 was studied as a(n) 20.0 MW (7.6 MW of which was Capacity) injection into JCPL's system. Project X3-079 was evaluated for compliance with reliability criteria for summer peak conditions in 2015.

Option 1: WARETN S 34.5 kV substation

Potential transmission network impacts are as follows:

Generator Deliverability

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

No violations identified.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)

No violations 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.)

1. (JCPL) The Van-Larrabee 230 kV line (from bus 206318 to bus 206294 ckt 1) loads from 120.59% to 121.56% (DC power flow) of its emergency rating (805 MVA) for the tower contingency 'C5_CNJ-DCT-#12'. This project contributes approximately 8.19 MW to the thermal violation.

```
CONTINGENCY 'C5_CNJ-DCT-#12'
     /* LEISURE VILLAGE-MANITOU A2027 & C2029
  DISCONNECT BRANCH FROM BUS 206295 TO BUS 206297 CKT 1
  DISCONNECT BRANCH FROM BUS 1000 TO BUS 206277 CKT 3
  DISCONNECT BRANCH FROM BUS 206296 TO BUS 1000 CKT 1
  DISCONNECT BRANCH FROM BUS 206296 TO BUS 206276 CKT 4
  DISCONNECT BRANCH FROM BUS 206297 TO BUS 1000 CKT 1
  SET BUS 206296 LOAD TO 0 MW
END
```

2. (JCPL) The Manitou-Whitings 230 kV line (from bus 206297 to bus 206319 ckt 1) loads from 109.36% to 110.54% (DC power flow) of its emergency rating (805 MVA) for the tower contingency 'C5_CNJ-DCT-#12'. This project contributes approximately 9.99 MW to the thermal violation.

```
CONTINGENCY 'C5_CNJ-DCT-#12'
     /* LEISURE VILLAGE-MANITOU A2027 & C2029
  DISCONNECT BRANCH FROM BUS 206295 TO BUS 206297 CKT 1
  DISCONNECT BRANCH FROM BUS 1000 TO BUS 206277 CKT 3
  DISCONNECT BRANCH FROM BUS 206296 TO BUS 1000 CKT 1
  DISCONNECT BRANCH FROM BUS 206296 TO BUS 206276 CKT 4
```

```
  DISCONNECT BRANCH FROM BUS 206297 TO BUS 1000 CKT 1
  SET BUS 206296 LOAD TO 0 MW
END
```

New System Reinforcements

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

None required.

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.)

1. To mitigate the overload on Van-Larrabee 230 kV line, JCPL has proposed to reconductor the 7.5 mile line using 1590 ACSS conductor, upgrade the drop loops, limiting substation condutor, replace the wave trap, upgrade circuit breakers relays, and metering equipment. The upgrade is estimated to cost $14,700,000. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

2 To mitigate the overload on Manitou-Whitings 230 kV line, JCPL has proposed to reconductor the 8.8 mile line using 1590 ACSS conductor, upgrade the drop loops, limiting substation condutor, replace the wave trap, upgrade circuit breakers relays, and metering equipment. The upgrade is estimated to cost $18,860,000. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

Short Circuit

(Report over-dutied breakers.)

None required.

Energy Portion of Interconnection Request

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. 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 analyzes all overload conditions associated with the overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified.

3. (JCPL) The Manitou-Leisure Village K 230 kV line (from bus 206297 to bus 206295 ckt 1) loads from 99.77% to 100.78% (DC power flow) of its emergency rating (805 MVA)

for the operational contingency 'B_CNJ2-SX-#30'. This project contributes approximately 8.45 MW to the thermal violation.

```
CONTINGENCY 'B_CNJ2-SX-#30'
     /* MANITOU - OYSTER CREEK (O1019) 230 KV
  DISCONNECT BRANCH FROM BUS 206297 TO BUS 1000 CKT 1
  DISCONNECT BRANCH FROM BUS 1000 TO BUS 206302 CKT 2
END
```

4. (JCPL) The Oyster Creek-Manitou 230 kV line (from bus 206302 to bus 206297 ckt 1) loads from 174.73% to 176.21% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'B_CNJ2-SX-#30'. This project contributes approximately 12.50 MW to the thermal violation.

```
CONTINGENCY 'B_CNJ2-SX-#30'
     /* MANITOU - OYSTER CREEK (O1019) 230 KV
  DISCONNECT BRANCH FROM BUS 206297 TO BUS 1000 CKT 1
  DISCONNECT BRANCH FROM BUS 1000 TO BUS 206302 CKT 2
END
```

5. (JCPL) The Oyster Creek-Manitou 230 kV line (from bus 206302 to bus 206297 ckt 1) loads from 116.42% to 117.43% (DC power flow) of its normal rating (650 MVA) for non contingency condition. This project contributes approximately 6.90 MW to the thermal violation.

6. (JCPL) The Oyster Creek-MANITOU 230 230 kV line (from bus 206302 to bus 1000 ckt 2) loads from 179.54% to 181.06% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'B_CNJ2-SX-#29'. This project contributes approximately 12.83 MW to the thermal violation.

```
CONTINGENCY 'B_CNJ2-SX-#29'
     /* MANITOU - OYSTER CREEK (N1028) 230 KV
  DISCONNECT BRANCH FROM BUS 206297 TO BUS 206302 CKT 1
END
```

7. (JCPL) The Oyster Creek-MANITOU 230 230 kV line (from bus 206302 to bus 1000 ckt 2) loads from 116.44% to 117.45% (DC power flow) of its normal rating (650 MVA) for non contingency condition. This project contributes approximately 6.90 MW to the thermal violation.

Option 2: 50.0% tap between Waretown R144 Line and R144 Line Tap34.5 kV line

Potential transmission network impacts are as follows:

Generator Deliverability

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

No violations identified.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)

No violations 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.)

1. (JCPL) The Van-Larrabee 230 kV line (from bus 206318 to bus 206294 ckt 1) loads from 120.69% to 121.67% (DC power flow) of its emergency rating (805 MVA) for the tower contingency 'C5_CNJ-DCT-#12'. This project contributes approximately 8.19 MW to the thermal violation.

```
CONTINGENCY 'C5_CNJ-DCT-#12'
     /* LEISURE VILLAGE-MANITOU A2027 & C2029
  DISCONNECT BRANCH FROM BUS 206295 TO BUS 206297 CKT 1
  DISCONNECT BRANCH FROM BUS 1000 TO BUS 206277 CKT 3
  DISCONNECT BRANCH FROM BUS 206296 TO BUS 1000 CKT 1
  DISCONNECT BRANCH FROM BUS 206296 TO BUS 206276 CKT 4
  DISCONNECT BRANCH FROM BUS 206297 TO BUS 1000 CKT 1
  SET BUS 206296 LOAD TO 0 MW
END
```

2. (JCPL) The Manitou-Whitings 230 kV line (from bus 206297 to bus 206319 ckt 1) loads from 109.36% to 110.54% (DC power flow) of its emergency rating (805 MVA) for the tower contingency 'C5_CNJ-DCT-#12'. This project contributes approximately 9.99 MW to the thermal violation.

```
CONTINGENCY 'C5_CNJ-DCT-#12'
     /* LEISURE VILLAGE-MANITOU A2027 & C2029
  DISCONNECT BRANCH FROM BUS 206295 TO BUS 206297 CKT 1
  DISCONNECT BRANCH FROM BUS 1000 TO BUS 206277 CKT 3
  DISCONNECT BRANCH FROM BUS 206296 TO BUS 1000 CKT 1
  DISCONNECT BRANCH FROM BUS 206296 TO BUS 206276 CKT 4
  DISCONNECT BRANCH FROM BUS 206297 TO BUS 1000 CKT 1
  SET BUS 206296 LOAD TO 0 MW
END
```

New System Reinforcements

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

None required.

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.)

None required.

Short Circuit

(Report over-dutied breakers.)

None required.

Energy Portion of Interconnection Request

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. 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 analyzes all overload conditions associated with the overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified.

3. (JCPL) The Oyster Creek-MANITOU 230 230 kV line (from bus 206302 to bus 1000 ckt 2) loads from 179.54% to 181.06% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'B_CNJ2-SX-#29'. This project contributes approximately 12.83 MW to the thermal violation.

```
CONTINGENCY 'B_CNJ2-SX-#29'
     /* MANITOU - OYSTER CREEK (N1028) 230 KV
  DISCONNECT BRANCH FROM BUS 206297 TO BUS 206302 CKT 1
END
```

4. (JCPL) The Oyster Creek-MANITOU 230 230 kV line (from bus 206302 to bus 1000 ckt 2) loads from 116.44% to 117.45% (DC power flow) of its normal rating (650 MVA) for non contingency condition. This project contributes approximately 6.90 MW to the thermal violation.

5. (JCPL) The Manitou-Leisure Village K 230 kV line (from bus 206297 to bus 206295 ckt 1) loads from 99.77% to 100.78% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'B_CNJ2-SX-#30'. This project contributes approximately 8.45 MW to the thermal violation.

```
CONTINGENCY 'B_CNJ2-SX-#30'
     /* MANITOU - OYSTER CREEK (O1019) 230 KV
  DISCONNECT BRANCH FROM BUS 206297 TO BUS 1000 CKT 1
  DISCONNECT BRANCH FROM BUS 1000 TO BUS 206302 CKT 2
END
```

6. (JCPL) The Oyster Creek-Manitou 230 kV line (from bus 206302 to bus 206297 ckt 1) loads from 174.73% to 176.21% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'B_CNJ2-SX-#30'. This project contributes approximately 12.50 MW to the thermal violation.

```
CONTINGENCY 'B_CNJ2-SX-#30'
     /* MANITOU - OYSTER CREEK (O1019) 230 KV
  DISCONNECT BRANCH FROM BUS 206297 TO BUS 1000 CKT 1
  DISCONNECT BRANCH FROM BUS 1000 TO BUS 206302 CKT 2
END
```

7. (JCPL) The Oyster Creek-Manitou 230 kV line (from bus 206302 to bus 206297 ckt 1) loads from 116.42% to 117.43% (DC power flow) of its normal rating (650 MVA) for non contingency condition. This project contributes approximately 6.90 MW to the thermal violation.

Summary

The direct connection of the X3-079 Project to the FE transmission system will require network upgrades to the bulk transmission network. The Interconnection Customer will have a cost responsibility for the Direct Connection of the X3-079 Project to the Jersey Central transmission system and a portion of certain network reinforcements. As shown on Attachment 4, the estimated cost of the Direct Connection facilities is $805,136. This cost includes a CIAC (Contribution in Aid of Construction) Federal Income Tax Gross Up charge of $197,165. This tax may or may not be charged based on whether or not this project meets the eligibility requirements of IRS Notice 88-129.

In addition, the X3-079 Project contributes to network thermal overloads which will require an upgrade of the 230kV line between the Van Hiseville and Larrabee, and between Manitou and Whitings, as defined in the Network Analysis section.

Based on the extent of the FE direct connection and system upgrades required to support this project, it is estimated that it will take two (2) years from the date of a fully executed Interconnection Construction Service Agreement to complete the upgrades required for the X3-079 Project. Full payment of the estimated cost of the project Direct Connection will be required upon execution of the Interconnection Service Agreement/Interconnection Construction Service Agreement (ISA/CSA). Payments for network upgrades will follow PJM protocol. True up of the actual cost versus estimated cost of the project will be performed by FE at the end of the project. As a requirement, the Interconnection Customer must provide the property for the attachment and right-of-way facilities that will be needed at the project initiation. It is also assumed that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined direct connection and network upgrades, and that all 34.5 kV transmission system outages can be scheduled when needed.

Note that the FE findings were made from a conceptual review of this project. A more detailed review of the connection facilities and their cost will be identified in the Impact Study. Further note that the cost estimate data contained in this document should be considered as only ballpark since it was produced without a detailed engineering review. The applicant will be responsible for the actual cost of construction. FE herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any connections to the transmission system.

Attachment 1
Site View

Attachment 2
Aerial View

Attachment 3
Single Line Diagram

Attachment 4
Estimated Costs – Direct Connection Facilities

Item	Description
1	Construct approximately 2700 feet of new 34.5 kV overhead transmission poles and wires, beginning at new transmission line tap. Replace the existing distribution poles with new taller transmission poles, and transfer the distribution facility under-build onto the new poles. Install two (2) new motor operated 34.5 kv, 1200 amp, SCADA controlled load break switches on two poles. Install new manual operated 34.5 kv, 1200 amp load break switch on a new transmission pole to be installed.
2	Transmission overhead service will extend from pole. Jersey Central will install 3 – 1200 amp, non load break, in-line disconnect switches in the span of wire (200 foot max length) extending to the customer owned meter / termination pole location. The customer is responsible to install the pole, guying, and dead end construction to support the transmission service drop.
3	Install overhead transmission metering equipment to be mounted on the customer owned pole
4	Miscellaneous Protection, Fuses, Metering, RTU, SCADA
5	The applicant will be required to obtain any necessary third party rights of way required to extend transmission facilities to their site.
6	No environmental review was conducted as part of this cost estimate. If environmental permitting is needed, an additional $ 25,000 (plus gross up) will be added to estimate.
7	The Interconnection Customer to install a 2-200E, S&C SMD-2C, standard fuse on the tapped connection pole
	Total Connection Costs: $607,971 plus $197,165 tax = $805,136