Generation Interconnection Feasibility Study Report Web Version

For

PJM Generation Interconnection Request Queue Position X3-003

Mehoopany 115 kV Project

January 2012

Feasibility Study Report

Mehoopany 115kV (X3-003) Generation Project

Introduction

This Feasibility Study report provides the documentation of an assessment that has been performed by FirstEnergy (FE) in response to a request made by the Interconnection Customer or (IC) for the connection of a 20 MW behind the meter Mehoopany 115kV (X3-003) Generation Project to the Penelec Transmission System. IC has proposed a commercial operation date of March 2013 for the proposed project. As per the PJM study process, the Mehoopany 115kV (X3-003) Project assessment was accomplished by: 1. Evaluating the reliability impact of the proposed facilities and connection on the interconnected transmission system by the performance of a power flow study; 2. Ensuring compliance with the NERC, ReliabilityFirst, PJM and FE Reliability Standards by identifying the system reinforcements that will need to be installed for an interconnection of the proposed project; 3. Coordinating and cooperating with the PJM staff and Interconnection Customer by participating in project meetings and issuing this report as a part of the RTEP study process; 4. Performing a Steady State, Short-Circuit and Dynamics Study as necessary; 5. Conducting all studies in accordance with the PJM Manuals, the "FE Requirements for Transmission Connected Facilities", and the "FE Study Guide".

Connection Facilities

In compliance with PJM protocol, Interconnection Customer has submitted a "Form of Generation Interconnection Feasibility Study Agreement" to PJM and a proposed single line diagram that identifies its plan to install a 64 MW natural gas fired combustion turbine at its Mehoopany Plant in Wyoming County, Pennsylvania. The IC desires to sell up to 20 MW of the generator's output into the PJM market. The remaining generation will offset the IC's load. The IC did not designate any portion of the 20 MW Maximum Facility Output as capacity generation. Therefore, this project was studied as a 20 MW energy only generator. For purposes of this report, the Project has therefore been designated as the Mehoopany 115kV (X3-003) Project to reflect its interconnection voltage and its proximity to the Mehoopany 115kV substation.

The IC will connect the proposed generator onto the existing customer-owned 115kV bus. No construction by FirstEnergy will be required for the direct connection of this project. Relay setting adjustments may be required by FE; the cost to perform these changes is included in the Engineering Oversight and Commissioning cost. A summary of the Mehoopany 115kV (X3-003) Project direct connection facilities that will be required and their estimated costs are shown on Attachment 3. A one-line diagram for this project is shown in Attachment 2.

PJM Interconnection Study Results

The following is the report describing the results of the analysis performed by PJM engineers with respect to the transmission system impacts.

Network Impacts

Queue project X3-003 was studied as a 20.0 MW (0.0 MW of which was Capacity) injection into PENELEC's system at the MEHOOPNY 115.0 kV substation. Project X3-003 was evaluated for compliance with reliability criteria for summer peak conditions in 2015.

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.)

No violations identified.

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

Not 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.*

1. (PENELEC) The X2-023 TAP-North Meshoppen 115 kV line (from bus 909190 to bus 200677 ckt 2) loads from 108.34% to 122.32% (DC power flow) of its emergency rating (143 MVA) for the operational contingency 'B_PN115-LS-#141'. This project contributes approximately 19.99 MW to the thermal violation.

```
CONTINGENCY 'B_PN115-LS-#141'     /* MEHOOPANY - NORTH MESHOPPEN
(NMM1) 115 KV
  DISCONNECT BRANCH FROM BUS 200699 TO BUS 200677 CKT 1
  DISCONNECT BUS 200699
END
```

2. (PENELEC) The North Meshoppen-Oxbow 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 200.16% to 201.82% (DC power flow) of its emergency rating (608 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 10.08 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-XF-#133A_X1_018_A'     /* LEWISTOWN 230/115KV
BANK #3 FAULT
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 907140 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548
CKT 2
END
```

3. (PENELEC) The North Meshoppen-Oxbow 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 221.84% to 223.91% (DC power flow) of its normal rating (478

MVA) for non contingency condition. This project contributes approximately 9.88 MW to the thermal violation.

4. (PENELEC) The X1-109 TAP-East Towanda 230 kV line (from bus 907910 to bus 200675 ckt 1) loads from 152.15% to 153.26% (DC power flow) of its emergency rating (549 MVA) for the operational contingency 'B_PN230-SX-#47'. This project contributes approximately 6.09 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#47'     /* LACKAWANNA-OXBOW-NORTH
MESHOPPEN 230 KV
  DISCONNECT BRANCH FROM BUS 200706 TO BUS 200708 CKT 1
  DISCONNECT BRANCH FROM BUS 200708 TO BUS 208009 CKT 1
  DISCONNECT BRANCH FROM BUS 200706 TO BUS 200825 CKT 3
  DISCONNECT BRANCH FROM BUS 200825 TO BUS 200677 CKT 3
  DISCONNECT BRANCH FROM BUS 200708 TO BUS 200709 CKT 1
  DISCONNECT BUS 200708
  DISCONNECT BUS 200825
END
```

5. (PENELEC) The X2-021 TAP-Erie East 230 kV line (from bus 909170 to bus 200654 ckt 1) loads from 99.95% to 100.01% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 1.88 MW to the thermal violation.

6. (PENELEC/NYISO) The East Sayre-N.WAV115 115 kV line (from bus 200676 to bus 130836 ckt 1) loads from 97.91% to 100.03% (DC power flow) of its emergency rating (128 MVA) for the operational contingency 'B_PN230-SX-#47'. This project contributes approximately 2.72 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#47'     /* LACKAWANNA-OXBOW-NORTH
MESHOPPEN 230 KV
  DISCONNECT BRANCH FROM BUS 200706 TO BUS 200708 CKT 1
  DISCONNECT BRANCH FROM BUS 200708 TO BUS 208009 CKT 1
  DISCONNECT BRANCH FROM BUS 200706 TO BUS 200825 CKT 3
  DISCONNECT BRANCH FROM BUS 200825 TO BUS 200677 CKT 3
  DISCONNECT BRANCH FROM BUS 200708 TO BUS 200709 CKT 1
  DISCONNECT BUS 200708
  DISCONNECT BUS 200825
END
```

7. (PENELEC/PL) The Oxbow-Lackawanna Bus 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 197.59% to 199.29% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 10.51 MW to the thermal violation.

CONTINGENCY 'B_PN230-XF-#133A_X1_018_A' /* LEWISTOWN 230/115KV BANK #3 FAULT
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 907140 CKT 1
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 2
END

8. (PENELEC/PL) The Oxbow-Lackawanna Bus 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 217.20% to 219.31% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 10.30 MW to the thermal violation.

9. (PENELEC) The North Meshoppen-North Meshoppen 2 Reactor 115 kV line (from bus 200677 to bus 200825 ckt 3) loads from 197.78% to 202.0% (DC power flow) of its emergency rating (188 MVA) for the operational contingency 'B_PN230-SX-#11_X1_109B'. This project contributes approximately 7.92 MW to the thermal violation.

CONTINGENCY 'B_PN230-SX-#11_X1_109B' /* EAST TOWANDA - N MESHOPPEN (ETP) 230 KV & N MESHOPPEN BK 4
 DISCONNECT BRANCH FROM BUS 907910 TO BUS 200706 CKT 1
 DISCONNECT BRANCH FROM BUS 200706 TO BUS 200677 CKT 4
END

10. (PENELEC) The North Meshoppen 2 Reactor-North Meshoppen 115/230 kV transformer (from bus 200825 to bus 200706 ckt 3) loads from 197.78% to 202.0% (DC power flow) of its emergency rating (188 MVA) for the operational contingency 'B_PN230-SX-#11_X1_109B'. This project contributes approximately 7.92 MW to the thermal violation.

CONTINGENCY 'B_PN230-SX-#11_X1_109B' /* EAST TOWANDA - N MESHOPPEN (ETP) 230 KV & N MESHOPPEN BK 4
 DISCONNECT BRANCH FROM BUS 907910 TO BUS 200706 CKT 1
 DISCONNECT BRANCH FROM BUS 200706 TO BUS 200677 CKT 4
END

Transmission Owner's Analysis Results

The following is the report generated by the Transmission Owner (TO) based on their analysis of the project's impacts on the lower voltage system and the costs and schedules for any transmission and distribution system upgrades.

Power Flow Analysis

A Power Flow study was conducted to determine the reliability impact of the proposed Mehoopany 115kV (X3-003) Project on the FE Transmission System. This included the performance of a contingency analysis to identify any facility overload or voltage condition that violates the FE Planning Criteria. Any such violation that is either directly attributable to this project or for which it will have a shared responsibility is included in this report with a least cost plan identified to mitigate them.

The power flow analysis was performed using a 2015 summer peak load base case provided by the PJM staff. This base case included a detailed representation of the Penelec transmission system in the area of the Mehoopany 115kV substation. A simulation of all possible contingencies within the NERC and FE Planning Standards that are impacted by the Project was conducted to test for criteria compliance.

The results from the study Power Flow Analysis showing a comparison of the FE and PJM contingency study results are detailed on Attachment 4. As shown, the conclusion from this analysis is that there are no new upgrades required for the Project. However, the PJM and FE findings show that there are criteria violations which will have an impact on network congestion and local energy deliverability. Interconnection Customer will therefore be subject to generation curtailment in order to mitigate these violations.

Short Circuit and Dynamics Analysis

A short circuit analysis has been performed by PJM and the findings were confirmed by FE. The findings show that no circuit breakers are newly over dutied with the addition of the Mehoopany 115kV (X3-003) Project. The study also showed no significant fault current contribution to the breakers which are near the over-duty limit.

Metering

Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. These FE requirements are detailed on Attachment 7 of this report.

Compliance Issues

Interconnection Customer will be responsible for meeting all FE criteria as defined in the FE Requirements for Transmission Connected Facilities document. While the voltage analysis is not performed for the feasibility study, any voltage criteria violations that would require the plant to provide reactive power, that determination of reactive power requirements will be determined in the system impact study.

The IC must also meet all PJM, ReliabilityFirst and NERC reliability criteria and operating procedures required for standards compliance. For example, the Interconnection Customer 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 ReliabilityFirst 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.

FE Facility Upgrades and Costs

The results from the PJM and FE Power Flow Analysis (Attachment 4) show that there are no FE criteria violations that are directly attributable to the capacity of the Mehoopany 115kV (X3-003) Project. Therefore in accordance with the RTEP procedures defined in the PJM Open Access Transmission Tariff and PJM Manuals, Interconnection Customer is not responsible for network upgrades. However, the PJM and FE findings show that there are criteria violations which will have an impact on network congestion and local energy deliverability. Interconnection Customer will therefore be subject to generation curtailment in order to mitigate these violations. Note that the FE and PJM study results differ due to the differences in the study process and power flow programs utilized.

Note that all cost estimates contained in this document were produced without a detailed engineering review and are therefore subject to error. More accurate estimates will be determined as a part of the System Impact Study. The IC will be responsible for the actual cost of the direct connection that is implemented. FE herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any reinforcements to the transmission system.

Interconnection Customer Requirements

In addition to the FE facilities, 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 including:

1. The purchase and installation of a fully rated circuit breaker on the high side of the X3-003 115/13.8kV step-up transformer.

2. 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.

3. The purchase and installation of an 115kV interconnection metering instrument transformer. FE will provide the ratio and accuracy specifications based on the customer load and generation levels.

4. The purchase and installation of a revenue class meter for each unit to measure the power delivered in compliance with the FE standards.

5. 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.

6. The establishment of dedicated communication circuits for SCADA report to the FE Transmission System Control Center.

7. A compliance with the FE and PJM generator power factor and voltage control requirements.

8. The execution of a back-up service agreement to serve the customer load supplied from the X3-003 115kV interconnection substation when the units are out-of-service. This assumes the intent of Interconnection Customer is to net the generation with the load.

The above requirements are in addition to any metering required by PJM.

Summary

The Mehoopany 115kV (X3-003) Project direct connection for the Primary POI will require the facility upgrades defined in Attachment 3. As shown, the total estimated cost is $85,200. This cost includes a CIAC (Contribution in Aid of Construction) Federal Income Tax Gross Up charge of $19,900. This tax may or may not be charged based on whether or not this project meets the eligibility requirements of IRS Notice 88-129.

Based on the scope of the direct connection for the Primary POI, it is expected to take a minimum of one (1) year from the signing of a Connection Service Agreement to complete the installation required for the Mehoopany 115kV (X3-003) Project. This includes a preliminary payment that compensates FE for the first three months of the engineering design work that is related to the construction of the X3-003 115kV interconnection substation. It also assumes that the Interconnection Customer will provide the property for the X3-003 115kV interconnection substation and all right-of-way, permits, easements, etc. that will be needed. A further assumption is 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 PJM will allow all transmission system outages when requested.

Attachment 1
Mehoopany 115kV (X3-003) Project
Project Location

None Provided

Attachment 2
Mehoopany 115kV (X3-003) Project
Substation Configuration

Attachment 3
Mehoopany 115kV (X3-003) Project
Direct Connection Requirements

Upgrade ID	Description	Total Cost	Tax	Cost
EOC	Engineering Oversight and Commissioning	$85,200	$19,900	$65,300
Total		$85,200	$19,900	$65,300

Attachment 3
Mehoopany 115kV (X3-003) Project
FE Contingency Analysis Results

Delivery of Energy										
				Rating		FE Results		PJM Results		
Contingency	Type	Contingency Description	Overloaded Facility	N	4 Hr	MVA	% Rating	MVA	% Rating	FE Comments
B_PN115-LS-#141	Single	Mehoopany - North Meshoppen #1	X2-023 TAP - North Meshoppen 115kV		143	174.6	122.1	174.9	122.32	
B_PN230-XF-#133A_X1_018_A	Single	Lewistown 230-115 #3 Bank Fault	North Meshoppen - Oxbow 230kV		608	1037.6	170.7	1227.1	201.82	
	Base		North Meshoppen - Oxbow 230kV	478		932	195	1070.3	223.91	
B_PN230-SX-#47	Single	Lackawanna - North Meshoppen 230kV	X1-109 TAP - East Towanda		549	841.1	153.2	841.4	153.26	
	Base		X2-021 TAP - Erie East	488		521.5	106.9	488.0	100.01	
B_PN230-SX-#47	Single	Lackawanna - North Meshoppen 230kV	East Sayre - North Wavery 115kV		128			128.0	100.03	PJM M03 Operating Procedure opens line for overload.
B_PN230-XF-#133A_X1_018_A	Single	Lewistown 230-115 #3 Bank Fault	Oxbow - Lackawanna 230kV		617	1037.3	168.1	1229.6	199.29	
	Base		Oxbow - Lackawanna 230kV	488		930.5	190.7	1070.2	219.31	
B_PN230-SX-#11_X1_109B	Single	East Toawanda - North Meshoppen 230kV	North Meshoppen 115kV Reactor		188	323.1	171.8	379.8	202.00	
B_PN230-SX-#11_X1_109B	Single	East Toawanda - North Meshoppen 230kV	North Meshoppen 230-115 #3 Bank		188	323.1	171.8	379.8	202.00	

Attachment 5
Mehoopany 115kV (X3-003) Project
FE Network Facility Reinforcement Conceptual Costs Estimates

Not Required

Attachment 6
Mehoopany 115kV (X3-003) Project
FE Network Facility Reinforcement Conceptual One Line Diagrams

Not Required

Attachment 7
FE Revenue Metering Requirements

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
www.pjm.com/planning/design-engineering/to-tech-standards.aspx