PJM Interconnection

Merchant Transmission Interconnection Feasibility Study

V1-005 Elrama-Mitchell 138kV

PJM Website Version

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General

The transmission developer has proposed an increase in the transfer capability between the Elrama and Mitchell Substations. The Elrama Substation is located in the Duquesne Light Company territory, in Union Township, Washington County, Pennsylvania. The Mitchell Substation is located in the Allegheny Power territory. The Elrama and Mitchell substations are connected with a 138kV circuit, approximately 3.9 miles in length, known as Elrama-Mitchell (Z-11). The developer requested that the final summer normal rating of the Elrama-Mitchell (Z-11) circuit be 3000A.

The developer originally submitted three separate Merchant Transmission queue requests. Since they all involved the same and/or associated facilities, the three requests were combined under this one queue position. The original queue requests were as follows:

1. Original U4-031 - Replace the existing 954 ACSR conductor with a high temperature/low sag conductor, in service 7/1/2010.
2. Original V1-005 - Upgrade the line circuit breaker and associated disconnects at Elrama, and upgrade the line terminal equipment at Mitchell substation, in service 1/1/2010. (Per specifications in queue project P-56)
3. Original V1-006 - Upgrade the No. 5 and Synchronous 138kV buses at the Elrama substation, in service 7/1/2010 (Per specifications in queue project P-56)

This V1-005 project in the PJM Merchant Transmission Interconnection Queue is the consolidation of the three projects listed and described above.

This feasibility study is a comprehensive analysis that assesses the practicality and cost of incorporating the proposed transmission facilities into the Duquesne Light Company (DLCO) system and the Allegheny Power (AP) system. This study identifies the system constraints relating to the project and the necessary attachment facilities, local upgrades, and network upgrades. The study includes estimates of cost responsibility and construction lead times for facilities and upgrades. In accordance with the process set forth in PJM's Manual 14A, *Generation and Transmission Interconnection Process*, the study included a short-circuit analysis performed by DLCO, as well as a comprehensive load flow analysis and a review of PJM's stability study. DLCO and AP have provided estimates of the type, scope, cost, and lead time for construction of facilities where known. If developer elects to pursue this project further, additional analysis will be completed including the engineering design work necessary to begin construction and good-faith estimates of cost and lead times for detailed design and construction of the facilities and upgrades.

This feasibility study was completed by both Transmission Owners in conjunction with PJM. The study is an evaluation of the reliability impact of the new facilities and their connections on the interconnected transmission system. The load flow analysis was performed to ensure compliance with NERC Reliability Standards and applicable Regional, sub-regional, Power Pool, and DLCO system planning criteria and facility connection requirements. The Network Upgrades identified herein are the final results of

the analysis, identifying areas where system improvements must be made to meet the applicable criteria.

The parties involved have coordinated and cooperated on the assessment of the reliability impacts of new facilities on the interconnected transmission systems. While these studies were performed independently, the results have been jointly evaluated and coordinated.

DLCO study assumptions include a load flow analysis of single or N-1, double circuit tower line, stuck breaker, and bus fault contingencies. The study was performed on the 69kV and above network, based on summer peak load conditions with all facilities modeled in-service for the projected 2010 Summer in-service date. PJM's analysis was performed on the 2013 base case. If the project goes to construction, PJM will perform interim studies for the period between the in-service date and 2013.

PJM Feasibility Analysis

Network Impacts

The queue V1-005 merchant transmission project is an upgrade to the Elrama-Mitchell 138kV circuit. The reinforcement involves several components including a line reconductoring, circuit breaker replacements, and bus upgrades. Project V1-005 was evaluated for compliance with reliability criteria for summer peak conditions in 2013. 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, Stuck 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.

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)

None.

Short Circuit

Not required

DLCO did not identify any overdutied breakers directly resulting from this project.

Requested Upgrade Costs, Schedules, and Rating Impacts

The scope of work and estimated cost are listed below, identified by descriptions associated with the original queue submissions:

Reconductoring (U4-031)

This estimate is based on reconductoring the Elrama-Mitchell (Z-11) circuit with double circuit DRAKE 795 ACSS/TW conductor. This conductor will have a summer normal rating of 3000A. The estimated cost for the line reconductoring includes engineering, the removal of the existing 954 ACSR conductor, the installation of the new conductor, the installation of new suspension and strain hardware, and the required structure modifications.

Reconductoring alone will not increase the overall rating of the Elrama-Mitchell (Z-11) circuit. The 2000A line circuit breaker will remain the limiting factor of this circuit.

The total cost for reconductoring the line is estimated to be **$ 4,239,116** in 2009 dollars. The schedule will require 2-3 months for equipment procurement followed by an additional 2-3 months for construction, for a total of 4-6 months from the execution of all necessary agreements.

Elrama Breaker Replacements and Mitchell Line Terminal Upgrade (V1-005)

The DLCO portion of work involves substation upgrades at Elrama that include the replacement of the Elrama-Mitchell 138kV line breaker and two associated disconnects as well as the No. 5-Sync bus tie breaker and two associated disconnects. The replacement equipment will have a summer normal rating of 3000A.

The total cost for replacing the two breakers and associated disconnect switches is estimated to be **$ 1,170,821** in 2009 dollars. The schedule will require 9 months for equipment procurement followed by an additional 1-2 months for construction, for a total of 10-12 months from the execution of all necessary agreements.

The AP portion of the work addresses the upgrade of the Mitchell Substation. This includes the following: Replace the existing 3" SPS aluminum tubing bus with 4" SPS aluminum tubing bus to accommodate 3000A continuous loading at 30C. Replace the No. 1-2 and No. 2-3 138kV bus tie breakers with 3000A, 138kV 63KAIC breakers. Replace 4-138kV vertical break breaker disconnect switches with 3000A, 138kV vertical break breaker disconnect switches. Replace all bus clamps, insulators and connectors. Assume reuse of the existing bus support structures. On the Elrama 138kV terminal, replace the existing 138kV breaker and metering accuracy bushing CT's with a 3000A, 138kV, 63KAIC breaker with metering accuracy bushing CT's. Replace the existing 2-138kV sidebreak line and bus side breaker disconnects with 2-3000A, 138kV CBA breaker disconnect switches. Replace line and bus risers, and associated equipment. No replacement of metering equipment in the existing control building is included in this estimate.

The total cost for the AP portion of the work is **$1,538,427** in 2009 dollars. The schedule for the AP portion will require 18 months from the execution of all necessary agreements.

The combined DLCO and AP work will cost **$2,709,248** in 2009 dollars. Assuming concurrent work by DLCO and AP, the total time for the Elrama and Mitchell work will be 18 months from the execution of all necessary agreements.

Replacing the breakers and associated disconnect switches at Elrama and the similar upgrades at Mitchell Substation would give an incremental increase to the overall rating of the Elrama-Mitchell (Z-11) circuit. The 2100A Elrama No. 5 138kV bus will become the limiting factor.

Elrama Bus Upgrades (V1-006)

The No. 5 138kV bus and the 138kV Synchronous bus at Elrama will need to be upgraded. These buses are currently comprised of 2000 and 1000 mcm bare stranded copper conductor. The ratings of both substation bus conductors (2100A and 1410A

summer normal, respectively) are insufficient to support the possible increase in flow on Elrama-Mitchell once its rating has increased to 3000 A. The buses will be replaced with 5" aluminum pipe.

The total cost for the 138kV bus work is estimated to be **$ 1,068,579** in 2009 dollars. The lead time for the bus upgrade portion of this project is estimated to be 2 months for the procurement of equipment and 2-3 months for construction, for a total of 4-5 months from the execution of the necessary agreements.

For all schedule estimates stated in this report, delays can occur caused by weather, equipment lead time, site preparation, unforeseen equipment failures, and unavailability of outages to perform the work. All costs include Tax Gross-up and are subject to adjustment for labor rate and material cost changes based on the actual project schedule.