

X4-025 Millbrook Park 138kV

Generation Interconnection

Local Network Impacts

The impact of the proposed generating facility on the AEP System was assessed for adherence with applicable reliability criteria. AEP planning criteria require that the transmission system meet single contingency performance criteria in accordance with the AEP FERC Form 715. Therefore, this criterion was used to assess the impact of the proposed facility on the AEP System. This project was studied as a 130 MW net capacity consistent with the interconnection application. The results are summarized below.

Normal System (2015 Summer Conditions)

- The North Portsmouth 138/69 kV transformer is loaded to **103.3%** of its normal rating

Single Contingency (2015 Summer Conditions)

- Outage of Millbrook Park 138/69 kV transformer – The North Portsmouth 138/69 kV transformer is loaded to **107.8%** of its emergency rating.

Double Contingency (2014 Summer Conditions)

- No problems identified.

Short Circuit Analysis

- No problems identified.

Stability Analysis

- Stability studies were not performed as part of this Feasibility Study and are not normally performed as part of a Feasibility Study effort. The stability assessments are part of the System Impact Study. Based upon the results of this future System Impact Study, the extent of system upgrades could change and the associated costs could be significantly different.

Local/Network Upgrades

To facilitate the #X4-025 generation, upgrades are required to alleviate a resulting transformer overload.

The AEP construction scope includes:

- Upgrade existing 138/69 kV transformer at North Portsmouth station.
Estimated Cost: **\$2,000,000**
- Install 138 kV breaker and switches and remove MOAB and high speed ground switch at high side of 138/69 kV transformer at North Portsmouth station.
Estimated Cost: **\$900,000**
- Install 69 kV breaker and switches at low side of 138/69 kV transformer at North Portsmouth station.
Estimated Cost: **\$350,000**
- 138 & 69 kV remote relaying
Estimated Cost: **\$300,000**

Total Estimated System Upgrade Cost: **\$3,550,000**

Network Impacts

The Queue Project #X4-025 was studied as a(n) 130.0MW(Capacity130.0MW) injection at Millbrook 138kV substation in the AEP area. Project #X4-025 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. 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

Short Circuit

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

The 138kV "M" circuit breaker at Millbrook Park was found to be over-dutied after installation of the X4-025 project..

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With x4-025_AEP	Duty Percent Without x4-025_AEP	Duty Percent Difference	Note
0	05MILLBR 138.kV	M	T	113.20%	90.50%	22.70%	New Over-duty

The study also showed a significant fault current contribution (i.e. above 3%) for 2 already identified over-duty circuit breakers, the Millbrook Park “O” and “H” breakers.

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With x4-025_AEP	Duty Percent Without x4-025_AEP	Duty Percent Difference	Note
0	05MILLBR 138.kV	O	T	138.30%	113.20%	25.10%	Over 100%, > 3% contribution
0	05MILLBR 138.kV	H	T	135.50%	105.20%	30.30%	Over 100%, > 3% contribution

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. The Baker 765/345 kV transformer (from bus 242523 to bus 242510 ckt 2) loads from 101.22% to 102.59% (**DC power flow**) of its rating (1587 MVA) for the single line contingency ('317_B3'). This project contributes approximately 21.74 MW to the thermal violation.

CONTINGENCY '317_B3'

OPEN BRANCH FROM BUS 242510 TO BUS 242523 CKT 1 / 242510 05BAKER
765 242523 05BAKER 345 1
END

New System Reinforcements

1. The estimated cost to replace the “M” 138kV circuit breaker at Millbrook Park is **\$300,000.**

Contribution to Previously Identified Reinforcements

1. The overload on the Baker 765/345kV transformer can be alleviated by Adding one 765/345 kV transformer rated 2250 MVA, with associated transformer protection package: \$43,000,000. Station Work: In the Baker Station 765 kV yard: add a new 765 kV box bay structure: \$2,000,000. Lead time from placement of order to delivery: 24 months
2. The estimated cost to replace the “O” 138kV circuit breaker at Millbrook Park is **\$300,000**.
3. The estimated cost to replace the “H” 138kV circuit breaker at Millbrook Park is **\$300,000**.