#V2-001 Howard-Bucyrus Center 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 performance criteria in accordance with the AEP

Interconnection Option 1

Normal System (2013 Summer Conditions) (at full capacity)

- No problems identified.

Single Contingency (2013 Summer Conditions) (at full capacity)

- No problems identified.

Multiple Contingency (2013 Summer Conditions) (at full capacity)

- No problems identified.

Contributions (2013 Summer Conditions) (at full capacity)

- V2-001 contributes to the overload of the Howard – Brookside 138 kV circuit with a C3 multiple contingency, increasing the loading from 136% (235.4 MVA) to 153 % (265.4 MVA) of the summer emergency rating of 173 MVA.

Additional overloads at full capacity (2013 Summer Conditions) (at full capacity)

- V2-001 contributes to the overload of V1-010 – Chatfield 138 kV circuit, increasing the loading from 101% (139.3 MVA) to 110% (151.5 MVA) with a summer normal rating of 138 MVA. V2-001 causes a new overload of the following.

- Chatfield 600A switch overloads to 102% of the summer normal rating of 148 MVA.

Short Circuit Analysis

- No problems identified.

Stability Analysis

- Stability analysis was not performed as part of this Feasibility Study. 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 Upgrades

- The overload on the V1-010-Chatfield circuit can be alleviated by replacing the switch a the Chatfield switch terminal:

  Estimated cost (2009 Dollars): **$100,000**

- The overload on the Howard-Brookside circuit can be alleviated by the following upgrades.

  - Replace Howard switch:
    Estimated Cost (2009 Dollars): **$100,000**

  - Reconductor and rebuild the Howard – Brookside 138 kV circuit (8 miles):
    Estimated Cost (2009 Dollars): **$ 12,000,000**
    - This estimate only includes the reconductoring and rebuild of the AEP 8 mile section of the circuit, it does not include First Energy's 13.74 miles.

  - Replace Howard line riser:
    Estimated Cost (2009 Dollars): **$50,000**

  - Replace Howard wavetrap:
    Estimated Cost (2009 Dollars): **$50,000**

  - Replace Howard metering CT:
    Estimated Cost (2009 Dollars): **$100,000**

  - Reconductor and rebuild the FirstEnergy portion of the Howard-Brookside 138kV circuit (approximately 13.75 miles).
    Estimated cost by PJM: **$15,000,000**

Option 2

Normal System (2013 Summer Conditions) (at full capacity)

- No problems identified.

Normal System (2013 Summer Conditions) (at 13% capacity)

- No problems identified.

Single Contingency (2013 Summer Conditions) (at full capacity)

- No problems identified.

Single Contingency (2013 Summer Conditions) (at 13% capacity)

- No problems identified.

Multiple Contingency (2013 Summer Conditions) (at full capacity)

- No problems identified.

Contributions (2013 Summer Conditions) (at full capacity)

- V2-001 contributes to the overload of the West End Fostoria – Lemoyne 138 kV circuit, increasing the loading from 101% (241.7 MVA) to 104% (247.6 MVA) of the summer normal rating of 239 MVA.

- V2-001 contributes to the overload of the Howard – Brookside 138 kV circuit with a C3 multiple contingency, increasing the loading from 136% (235.4 MVA) to 152 % (262.6 MVA) of the summer emergency rating of 173 MVA.

Additional overloads (2013 Summer Conditions) (at full capacity)

- V2-001 contributes to the overload of Howard – Brookside 138 kV circuit, increasing the loading from 152% (201.9 MVA) to 170% (225.5 MVA) with a summer normal rating of 133 MVA. V2-001 causes a new overload of the following

    1. The Howard metering CT overloads to 105% of the summer normal rating of 215 MVA.
    2. The Howard 138 kV 795 ACSR 26/7 bus overloads to 101% of the summer normal rating of 224 MVA.
    3. The Howard 138 kV 795 ACSR 26/7 riser overloads to 101% of the summer normal rating of 224 MVA.

Short Circuit Analysis

- No problems identified.

Stability Analysis

- Stability analysis was not performed as part of this Feasibility Study. 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 Upgrades (at full capacity)

- The overload on the Lemoyne-West End Fostoria 138kV circuit can be alleviated by reconductoring 24.7 mile line. PJM estimates the cost as **$24,700,000.**

- The overload on the Howard-Brookside 138kVcircuit can be alleviated by the following upgrades.

    - Replace Howard switch:
      Estimated Cost (2009 Dollars): **$100,000**

    - Reconductor and rebuild the Howard – Brookside 138 kV circuit (8 miles):
      Estimated Cost (2009 Dollars): **$ 12,000,000**
        - This estimate only includes the reconductoring and rebuild of the AEP 8 mile section of the circuit, it does not include First Energy's 13.74 miles.

    - Replace Howard line riser:
      Estimated Cost (2009 Dollars): **$50,000**

    - Replace Howard wavetrap:
      Estimated Cost (2009 Dollars): **$50,000**

    - Replace Howard metering CT:
      Estimated Cost (2009 Dollars): **$100,000**

    - Reconductor and rebuild the FirstEnergy portion of the Howard-Brookside 138kV circuit (approximately 13.75 miles).
      Estimated cost by PJM: **$15,000,000**

Network Impacts

The queue V2-001 project was studied as a 97.2MW injection (11.3MW of which was capacity) into AEP's system at the Bucyrus Center 138kV substation. There was a secondary point of interconnection option chosen at the Bucyrus Center 69kV facility. This bus is not modeled in the PJM case; however, the impact to the transmission system should be nearly identical for both options. Project V2-001 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 were identified.

Multiple Facility Contingency
(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

No problems identified.

Short Circuit

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)

None

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

Delivery of Energy Portion of Interconnection Request
(PJM also studied the delivery of the energy portion of this interconnection request. Any 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 Merchant Transmission Interconnection request.
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 will study all overload conditions associated with the overloaded element(s) identified.)

1. The Howard-Brookside 138kV line (from bus 23158 to bus 238586 ckt 1) loads from 107.50% to 128.43% (DC power flow) of its normal rating (133MVA) during non-contingency conditions as a result of V2-001. This project contributes approximately 27.8MW to cause this thermal violation.

2. The Howard-Brookside 138kV line (from bus 23158 to bus 238586 ckt 1) loads from 98.20% to 114.43% (DC power flow) of its emergency rating (173MVA) for the single line outage (02BEAVER 345 - 02DAV-BE 345 - 1) as a result of V2-001. This project contributes approximately 28.1MW to cause this thermal violation.