Generation Interconnection

This analysis was completed to assess the reliability impact for a new generator interconnecting to the PJM system as a capacity resource.

Network Impacts

The #N41 project was studied as an injection of 1200 MW at three different points in the system. Option 1 considers the capacity injection into the mountaineer 765 kV substation. Option 2 considers the capacity injection into the Sporn 138 kV substation. Option 3 considers an injection of 600 MW into the Sporn B 138 kV facility and 600 MW into the Sporn 345 kV facility. Project #N41 was evaluated for compliance with reliability criteria for summer peak conditions in 2008. Potential network impacts were as follows:

Interconnection Option #1: Connection to the Mountaineer 765 kV substation

Generator Deliverability
No problems were identified

Multiple Facility Contingency – Tower Line Outages
No problems were identified

Short Circuit
No identified problems

New System Reinforcements
None identified

Contribution to Previously Identified System Reinforcements

The #N41 will contribute to the costs associated with the following required network reinforcements:

1. Reconductor the Grassy Falls – Nettie 138 kV circuit (3.33 miles) with 1272 ACSR conductor. The #N41 contributes approximately 7 MW to the contingency overloaded facility.

   Estimated cost of the reconductoring is **$1,000,000**.

Interconnection Option #2: Connection to the Sporn 138 kV Substation

Generator Deliverability

1. The #4 Sporn 345/138 kV transformer is overloaded to 160% of its emergency rating (611 MVA) for the outage of the #3 Sporn 345/138 kV transformer. The #N41 contributes approximately 1 GW to the contingency overloaded facility.
2. The Waterford – Muskingum 345 kV circuit is overloaded to 100% of its normal rating (1452 MVA). The #N41 contributes approximately 348 MW to the normally overloaded facility.

3. The #3 Sporn 345/138 kV transformer is overloaded to 106% of its normal rating (492 MVA). The #N41 contributes approximately 535 MW to the normally overloaded facility.

Multiple Facility Contingency – Tower Line Outages

1. The Mahans Lane – Weirton Steel 138 kV circuit is overloaded to 103% of its emergency rating (193 MVA) for the outage of the Tidd – Wylier – Collier 345 kV tower circuit. The #N41 contributes approximately 13 MW to the contingency overloaded facility.

Short Circuit

No identified problems

New System Reinforcements

New system reinforcements for option #2 were not estimated since option #3 was determined to be a better interconnection scenario.

Contribution to Previously Identified System Reinforcements

The #N41 will contribute to the costs associated with the following required network reinforcements:

1. Reinforcements for the Grassy Falls – Netie 138 kV circuit. The #N41 contributes approximately 7 MW to the contingency overloaded facility.
2. Reinforcements for the Crupperneck – Netie 138 kV circuit. The #41 contributes approximately 6 MW to the contingency overloaded facility.

Interconnection Option #3: Connection to the Sporn 138 kV and Sporn 345 kV facilities:

Generator Deliverability

1. The Muskingum – Waterford 345 kV circuit is overloaded to 101% of its normal rating (1452 MVA). The #N41 project's contribution to the normally overloaded facility is as follows:

- The generation at the Sporn 138 kV, with a DFAX of 29%, contributes approximately 174 MW
- The generation at the Sporn 345 kV, with a DFAX of 30%, contributes approximately 182 MW

2. The Sporn B 345/138 kV transformer is overloaded to 109% of its emergency rating (190 MVA) for the outage of the Muskingum – Waterford 345 kV circuit:

- The unit connected to the Sporn 345 kV substation, with a DFAX of 7.3%, contributes approximately 44 MW to the contingency overloaded facility.
- The unit connected to the Sporn 138 kV substation, with a DFAX of 6.9%, contributes approximately 41 MW to the contingency overloaded facility.

Multiple Facility Contingency – Tower Line Outages

No problems were identified

Short Circuit
No identified problems

New System Reinforcements

1. Overloads on the Waterford-Muskingum 345 kV circuit will require reconductoring approximately 1 mile of the circuit out of Waterford and changing line risers at Muskingum. These changes can be accomplished prior to the in-service date of the IGCC. The estimated cost is **$1.2 million**.

2. Overloads on the Sporn B 345/138 kV transformer will require the transformer to be replaced with a 450 MVA transformer. A 4% reactor in series with the transformer will be required to maintain the same through flow impedance as the old transformer. The estimated cost is **$3,500,000**.

Contribution to Previously Identified System Reinforcements

The #N41 will contribute to the costs associated with the following required network reinforcements:

3. Reinforcements for the Grassy Falls – Nettie 138 kV circuit. The #N41 contributes approximately 7 MW to the contingency overloaded facility.
4. Reinforcements for the Crupperneck – Nettie 138 kV circuit. The #41 contributes approximately 6 MW to the contingency overloaded facility.

   Estimated cost of the reconductoring for the Grassy Falls-Nettie circuit is **$1,000,000**.

   Estimated cost for the reconductoring of the Crupperneck-Nettie circuit is **$1,400,000**.

Double Contingincies
The American Electric Power Form 715 filing Annual Transmission Planning and Evaluation Report describes AEP's Planning requirements for double contingencies when evaluating generator connection to the Transmission system as "if as a result of additional generation, the loading on an EHV facility would exceed its emergency rating during double contingencies, the generating plant owner would be responsible for the necessary system modifications to reduce the EHV facility loading to within emergency capability. Alternatively, the generating plant owner would be expected to reduce plant output should double contingency events occur in actual operation to prevent overloads."

Since there is an option to reduce generator output for any double contingency overloads that occur due to the new generating plant and this option would not require reinforcement, PJM has decided to evaluate double contingency conditions for generating projects in the Impact Study. Since any upgrades are identified for such conditions are not mandatory, not providing that information should not affect the overall cost required to interconnect the generating project identified in the Feasibility Study report. In the Impact study report PJM will identify any overloads that occur and provide a cost and time estimate for the system upgrades that will mitigate the overload and identify the operating procedure that could be applied instead of completing the upgrade.

Kammer Transformer Re-Rating

After the feasibility analysis for this project and the others in the N queue were completed, Allegheny Power reduced the rating on the Kammer 765/500kV transformer. Since reevaluating all of the N queue projects would result in a significant delay to the Generator Interconnection process the N queue projects were not evaluated with the new transformer rating. The new rating will be included in the Impact Study evaluation for any N Queue projects that decide to move that stage of the process.

Black Oak-Bedington 500kV and Mt. Storm-Doubs 500kV

Project N41 causes increased loading on Black Oak - Bedington 500 kV and Mt. Storm - Doubs 500 kV. Both of these circuits were identified as reliability problems in the 2009 RTEP Baseline report, however, the baseline required system upgrades are still under development. At the time of the Impact Study for project N41, it is expected that the baseline system upgrade will have been identified and at that time any additional system upgrade needed to support the generation project will be included in the Impact Study."