#P54 – Sporn-Waterford

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 #P54 project was studied as a 1035 MW capacity resource at two distinct points of interconnection in the AEP system. Option #1 considers the injection to be a tap of the Sporn-N42 345 kV line, while Option #2 considers it to be a tap of the Amos-Sporn and Sporn-Kanawha River 345 kV tower circuit. Project #P54 was evaluated for compliance with reliability criteria for summer peak conditions in 2010. Potential network impacts were as follows:

Option 1: Tapping into the Sporn-N42 345 kV line:

Generator Deliverability

1. The Muskingum-Ohio Central 345 kV line loads to 107% of its normal rating (972 MVA) for N-0 conditions. Project #P54 contributes approximately 61 MW to cause this overload.
2. The Poston to Eliot 138 kV line loads to 100% of its emergency rating (301 MVA) for the outage of the Muskingum-Waterford 345 kV line. The #P54 contributes approximately 26 MW to cause this overload.
3. The Sporn-P54 345 line loads to 129% of its emergency rating (1918 MVA) for the outage of the Muskingum-Waterford 345 kV line for loss of the Muskingum-Waterford 345 kV line. The #P54 contributes approximately 1030 MW to cause this overload.

Multiple Facility Contingency

No identified problems

Normal System

4. The Waterford – Muskingum River 345 kV line overloads under an N-0 condition. The limiting elements of this line are approximately 1 mile of conductor and the line risers at Muskingum.
5. The Sporn A-Rutland 138kV line overloads under N-0 conditions to 101% of its normal rating (297 MVA). The P54 project contributes approximately 17 MW to cause this overload.

Single Contingency

6. The Waterford – Muskingum River 345 kV line also overloads under an N-1 condition for an outage of the Sporn – AMP Ohio Station 345 kV line.

Short Circuit

No problems identified

Contribution to Previously Identified Overloads

1. Contribution of 124 MW to further overload the Harrison-Prunty Town 500 kV line, which was originally caused by the #O69 project for outage of the 500 kV line from the G30_W51 to Ft. Martin.
2. Contribution of 115 MW to further overload the Kammer 765/500 kV transformer previously caused by the N42 project for loss of the Harrison to Belmont 500 kV line.
3. Contribution of 411 MW to further overload the Waterford-Muskingum 345 kV. The overload was originally caused by the N42 for N-0 conditions
4. Contribution of 13 MW to further overload the Mahans Lane-Tidd 138 kV line previously identified as a base case overload for the Tidd-Collier 345 kV tower circuit outage. The corresponding network upgrades are being prepared by APS.

New System Reinforcements

1. The overload of the Muskingum – Ohio Central 345 kV line under an N-0 condition can be alleviated by replacing the 1600A line switch, the line's service entrance conductor, a bus and risers with higher rated equipment. The Estimated Cost* to do this work is **$1,300,000.**

2. The overload of the Poston – Elliot 138 kV line can be alleviated by rebuilding the line with 7.2 miles of higher rating conductors, replacing a 1200A circuit breaker, a 1200A wave-trap, bus conductors & line risers at Poston substation. The Estimated Cost* to do this work is **$10,200,000.**

3. The overload of the Sporn-P54 345 kV can be alleviated by reconductoring approximately 2.2 miles of the existing 6-wire line. The Estimated Cost* to reconductor the line is **$5,600,000.**

4. The normal system overload on the Waterford-Muskingum 345kV circuit can be alleviated by reconductoring approximately 1 mile of the circuit out of Waterford and changing line risers at Muskingum. (Upgrade # n0479) This upgrade originally defined for the N42 project. These changes can be accomplished prior to May 2010. The estimated cost is **$1.2 million**.

5. The overload on the Sporn A-Rutland 138kV line can be alleviated by replacing the service entrance line. The Estimated Cost* to replace the service entrance line is **$900,000**.

6. The single contingency overload on the Waterford-Muskingum 345kV circuit can be alleviated by reconductoring an additional 5 miles of the existing line. The estimated cost for the additional reconductoring is **$12,500,000**.

Fixes for Contribution to Previously Identified System Reinforcements

1. The Harrison-Pruntytown 500kV line overload can be alleviated by construction of a second 500kV line between Fort Martin SS and the proposed North Longview SS and additions at Fort Martin and North Longview Switching Stations.

Second Fort Martin - North Longview 500kV line. Install a 1.5 mile 500kV line consisting of 8 structures between Fort Martin and North Longview. Assume R/W acquisition will be required. (This cost can be highly variable).

Estimated cost Line	**$2,150,000**
Estimated cost R/W	**$ 500,000**

Fort Martin Switching Station Extend the 2 main 500kV buses and install a new 500kV cross bus with 2 500kV breakers, 4 switches, 3 CVTs, 3 line arresters and a 500kV deadend structure.

Estimated cost **$4,150,000**

North Longview Switching Station Install 3 500kV breakers, 6 switches, 2 bus CVTs, 500kV deadend structure, 3 line arresters and 3 line CVTs

Estimated cost **$3,200,000**

Estimated costs are in 2009 dollars.

This project will have an allocated portion of the costs for this upgrade.

2. The overload of the Kammer transformer can be alleviated by replacing the existing 1500 MVA transformer with three single phase units rated at 600 MVA each and a 600 MVA spare and replacing other substation equipment as required. (Upgrade # n0480) The estimated cost for the replacement is **$ 18,000,000.** The estimated lead time for replacement is 24 months. This project will have an allocated portion of the costs for this upgrade.

3. The Waterford-Muskingum River upgrades are described above. This project will have an allocated portion of those costs.

4. The Mahans Lane-Tidd 138kV line overload can be alleviated by rebuilding and replacing 7.3 miles of 556 conductor with 954 conductor. The estimated cost is **$1,750,000.**

Option 2: Tapping into the Sporn-Amos and Sporn-Kanawah R 345 kV tower circuit:

Generator Deliverability

1. The Muskingum-Ohio Central 345 kV line loads to 101% of its normal rating (972 MVA) for N-0 conditions. Project #P54 contributes approximately 27 MW to cause this overload.

2. The Poston to Eliot 138 kV line loads to 100% of its emergency rating (301 MVA) for the outage of the Muskingum-Waterford 345 kV line. The #P54 contributes approximately 26 MW to cause this overload.

Multiple Facility Contingency

No problems identified

Normal System

3. The Waterford – Muskingum River 345 kV line overloads under an N-0 condition. The limiting elements of this line are approximately 1 mile of conductor and the line risers at Muskingum.

4. The Sporn A-Rutland 138kV line overloads under N-0 conditions to 101% of its normal rating (297 MVA). The P54 project contributes approximately 17 MW to cause this overload.

Short Circuit

No problems identified

Contribution to Previously Identified Overloads

1. Contribution of 113 MW to further overload the Harrison-Prunty Town 500 kV line for the loss of the loss of the Ft. Martin-G30_W51 500 kV line. This thermal violation was first caused by the O69 project.
2. Contribution of 111 MW to further overload the Kammer 765/500 kV transformer for the loss of Harrison-Belmont 500 kV line. This violation was originally caused by the N42 project.
3. Contribution of 223 MW to further overload the Waterford-Muskingum 345 kV line for N-0 conditions. This violation was originally cause by the N42 project.
4. Contribution of 10 MW to further overload the Mahans Lane-Tidd 138 kV line previously identified as a base case overload for the Tidd-Collier 345 kV tower circuit outage.

New System Reinforcements

1. The overload of the Muskingum – Ohio Central 345 kV line under an N-0 condition can be alleviated by replacing the 1600A line switch, the line's service entrance conductor, a bus and risers with higher rated equipment. The Estimated Cost* to do this work is **$1,300,000.**

2 The overload of the Poston – Elliot 138 kV line can be alleviated by rebuilding the line with 7.2 miles of higher rating conductors, replacing a 1200A circuit breaker, a 1200A wave-trap, bus conductors & line risers at Poston substation. The Estimated Cost* to do this work is **$10,200,000.**

3 The overload on the Sporn A-Rutland 138kV line can be alleviated by replacing the service entrance line. The Estimated Cost* to replace the service entrance line is **$900,000**.

Fixes for Contribution to Previously Identified System Reinforcements

1. The Harrison-Pruntytown 500kV line overload can be alleviated by construction of a second 500kV line between Fort Martin SS and the proposed North Longview SS and additions at Fort Martin and North Longview Switching Stations.

Second Fort Martin - North Longview 500kV line. Install a 1.5 mile 500kV line consisting of 8 structures between Fort Martin and North Longview. Assume R/W acquisition will be required. (This cost can be highly variable).

Estimated cost Line	**$2,150,000**
Estimated cost R/W	**$ 500,000**

Fort Martin Switching Station Extend the 2 main 500kV buses and install a new 500kV cross bus with 2 500kV breakers, 4 switches, 3 CVTs, 3 line arresters and a 500kV deadend structure.

Estimated cost **$4,150,000**

North Longview Switching Station Install 3 500kV breakers, 6 switches, 2 bus CVTs, 500kV deadend structure, 3 line arresters and 3 line CVTs

Estimated cost **$3,200,000**

Estimated costs are in 2009 dollars.

This project will have an allocated portion of the costs for this upgrade.

2 The overload of the Kammer transformer can be alleviated by replacing the existing 1500 MVA transformer with three single phase units rated at 600 MVA each and a 600 MVA spare and replacing other substation equipment as required. (Upgrade # n0480) The estimated cost for the replacement is **$ 18,000,000.** The estimated lead time for replacement is 24 months. This project will have an allocated portion of the costs for this upgrade.

3 The Waterford-Muskingum River upgrades are described below. This project will have an allocated portion of those costs.

The normal system overload on the Waterford-Muskingum 345kV circuit can be alleviated by reconductoring approximately 1 mile of the circuit out of Waterford and changing line risers at Muskingum. (Upgrade # n0479) This upgrade originally defined for the N42 project. These changes can be accomplished prior to May 2010. The estimated cost is **$1.2 million**.

4. The Mahans Lane-Tidd 138kV line overload can be alleviated by rebuilding and replacing 7.3 miles of 556 conductor with 954 conductor. The estimated cost is **$1,750,000.**

Potential Issues

1. The Fort Martin-G30_W51 500 kV line loads to 99% of its emergency rating (3502 MVA) for the outage of the Prunty Town-Harrison 500 kV line. The P54 contributes 127 MW to the loading of this facility.