Generation Interconnection Feasibility Study Report

Queue Position AB2-104

Tidd-Wylie Ridge 345 kV

(Revised)

December 2016

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

General

Interconnection Customer has proposed a combined-cycle natural gas generating facility located approximately 10.4 miles south of Wylie Ridge substation on the Tidd-Wylie Ridge 345 kV line located in Brooke County, West Virginia. The installed facilities will have a capability of 65 MW with 65 MW of this output being recognized by PJM as capacity. Note that this project is an increase to the Interconnection Customer's AA2-121 project, which will share the same property and connection point. The AA2-121 project will have a capability of 685 MW with 685 MW being recognized as capacity. The total capability of the combined AA2-121 and AB2-104 projects will be 750 MW with 750 MW being recognized by PJM as capacity. The proposed in-service date for the AB2-104 project is June 1, 2020. **This study does not imply a Monongahela Power Company (or MonPower) commitment to this in-service date.**

Point of Interconnection

AB2-104 will interconnect with the MonPower transmission system through the same Point of Interconnection of prior project AA2-121. The interconnection of AA2-121 project was provided by constructing a new three-breaker ring bus switching station on the Tidd-Wylie Ridge 354 kV line as shown in the one-line diagram in Appendix 2.

Network Impacts

The Queue Project AB2-104 was evaluated as a 65.0 MW (Capacity 65.0 MW) uprate to the AA2-121 project in the APS area. Project AB2-104 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-104 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

None

Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

None

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

Steady-State Voltage Requirements

To be determined at later study stages.

Short Circuit

None

Affected System Analysis & Mitigation

MISO Impacts:

MISO Impacts to be determined during later study phases (as applicable).

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.

Not Applicable

Light Load Analysis - 2020

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

System Reinforcements

Short Circuit

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

None

Stability and Reactive Power Requirement

To be determined at later study stages.

Summer Peak Load Flow Analysis Reinforcements

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

Light Load Load Flow Analysis Reinforcements

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

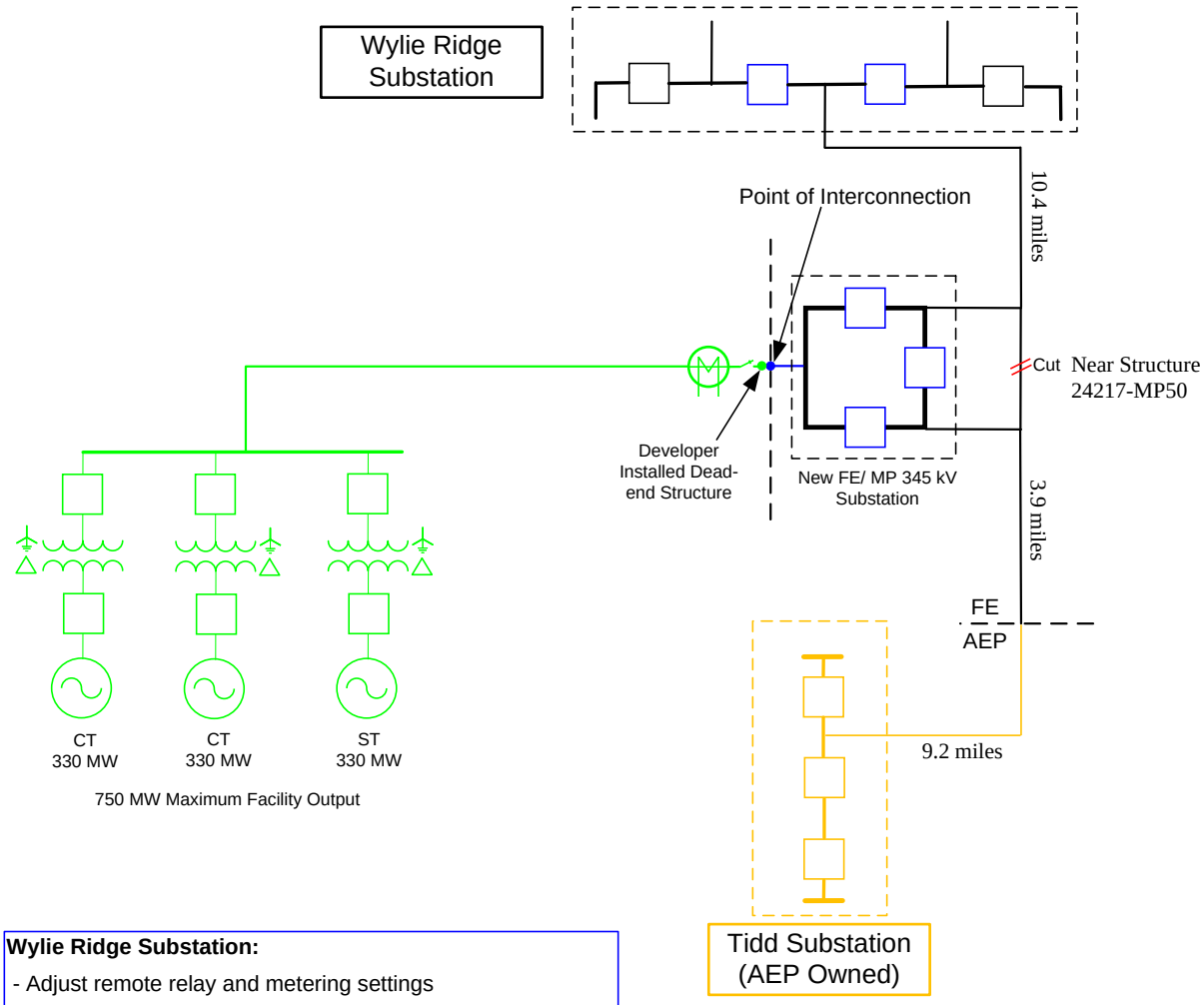
(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

None

Appendix 1
Facility Location

Appendix 2

Interconnection Simplified One-Line Diagram
PJM Queue Position: AB2-104



Wylie Ridge Substation:

- Adjust remote relay and metering settings

AA2-121 Interconnection Station:

- Adjust remote relay and metering settings

Note:

-Addition of 65 MW capacity increase to AA2-121 for a total MFO of 750 MW.

EXISTING FACILITIES
FE
CUSTOMER FACILITIES

Generation Interconnection Feasibility Study Report

Queue Position AB2-104

Tidd-Wylie Ridge 345 kV (II)

(Revised)

August 2016

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

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Point of Interconnection

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Network Impacts

The Queue Project AB2-104 was evaluated as a 65.0 MW (Capacity 65.0 MW) uprate to the AA2-121 project in the AEP area. Project AB2-104 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-104 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

None

Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

None

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. (AEP - AP) The AA2-121 TAP-01WYLIE R 345 kV line (from bus 922161 to bus 235707 ckt 1) loads from 116.28% to 119.72% (**DC power flow**) of its normal rating (1166 MVA) for the single line contingency outage of 'P12_301'. This project contributes approximately 40.16 MW to the thermal violation.

```
CONTINGENCY 'P12_301'
  OPEN BRANCH FROM BUS 242946 TO BUS 253965 CKT 1  / 242946 05TIDD 345 253965 15COLLIE 345 1
  END
```

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

Steady-State Voltage Requirements

To be determined at later study stages.

Short Circuit

(Summary of impacted circuit breakers)

None

Affected System Analysis & Mitigation

LGEE Impacts:

LGEE Impacts to be determined during later study phases (as applicable).

MISO Impacts:

MISO Impacts to be determined during later study phases (as applicable).

Duke, Progress & TVA Impacts:

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

OVEC Impacts:

OVEC Impacts to be determined during later study phases (as applicable).

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.

Not Applicable

Light Load Analysis - 2020

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

System Reinforcements

Short Circuit

None

Stability and Reactive Power Requirement

To be determined at later study stages.

Summer Peak Load Flow Analysis Reinforcements

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)

1. (AEP - AP) The AA2-121 TAP-01WYLIE R 345 kV line (from bus 922161 to bus 235707 ckt 1) loads from 116.28% to 119.72% (**DC power flow**) of its normal rating (1166 MVA) for the single line contingency outage of 'P12_301'. This project contributes approximately 40.16 MW to the thermal violation.

AEP
Reinforcement: Rebuild/Reconductor the ACSR 954 45/7 Rail conductor section. New ratings will be 1542/1878 MVA (SN/SE)
Cost: $20.8 Million
Time: 36 months

AP
No upgrades required.

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

Light Load Load Flow Analysis Reinforcements

New System Reinforcements
(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

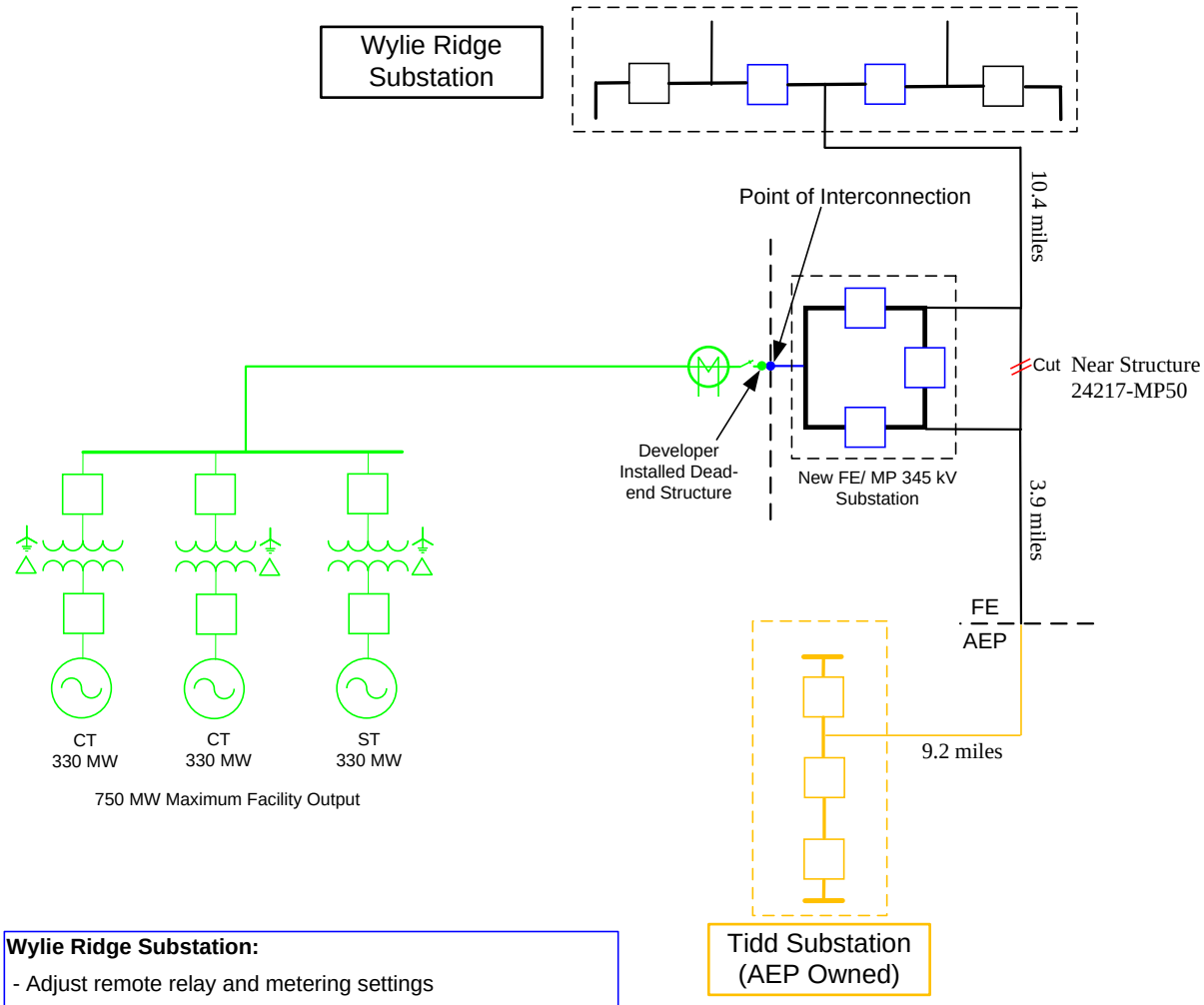
Contribution to Previously Identified System Reinforcements
(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

None

Appendix 1
Facility Location

Appendix 2

Interconnection One-Line Diagram
PJM Queue Project Number: AB2-104



Wylie Ridge Substation:

- Adjust remote relay and metering settings

AA2-121 Interconnection Station:

- Adjust remote relay and metering settings

Note:

-Addition of 65 MW capacity increase to AA2-121 for a total MFO of 750 MW.

EXISTING FACILITIES
FE
CUSTOMER FACILITIES

Appendix 3

This Appendix contains additional information about the flowgate presented in the body of the report. A description of the flowgate and its contingency is included for convenience. However, the intent of this appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in this Appendix section are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of the project.

(AEP - AP) The AA2-121 TAP-01WYLIE R 345 kV line (from bus 922161 to bus 235707 ckt 1) loads from 116.28% to 119.72% (**DC power flow**) of its normal rating (1166 MVA) for the single line contingency outage of 'P12_301'. This project contributes approximately 40.16 MW to the thermal violation.

CONTINGENCY 'P12_301'
OPEN BRANCH FROM BUS 242946 TO BUS 253965 CKT 1 / 242946 05TIDD 345 253965 15COLLIE 345 1
END

See next page for projects contributions to flowgate

Appendix 3 -Continued

Bus Number	*Bus Name*	*Full Contribution*
235344	*01HANNIB*	*0.36*
243190	*05CDG1*	*11.33*
243191	*05CDG2*	*41.84*
243185	*05CDG3*	*44.38*
243622	*05CVG4*	*9.11*
243624	*05CVG6*	*4.73*
243189	*05MLG2*	*19.26*
247202	*05WSHG1A*	*3.27*
247203	*05WSHG1B*	*3.27*
247204	*05WSHG1S*	*4.66*
247237	*05WTRG1A*	*2.74*
247238	*05WTRG1B*	*2.74*
247239	*05WTRG1C*	*2.74*
247240	*05WTRG1S*	*6.41*
247581	*W3-111 C*	*0.67*
247582	*W3-112 C*	*0.5*
247583	*W3-113 C*	*0.5*
247628	*Y2-050*	*27.06*
247632	*Y3-068 OP1*	*65.19*
920912	*AA1-014*	*0.46*
921992	*AA2-098*	*2.39*
922162	*AA2-121*	*423.2*
922312	*AA2-141*	*4.13*
923312	*AB1-140*	*1.2*
923342	*AB1-143*	*1.2*
923422	*AB1-157*	*1.2*
924441	*AB2-093*	*59.67*
924521	*AB2-101*	*3.71*
924551	*AB2-104*	*40.16*
924871	*AB2-141 C*	*46.48*