PJM Generator Interconnection Request
Queue AB2-093
Ormet-Kammer 138 kV
Feasibility Study Report

September 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

The Interconnection Customer (IC) proposes to install PJM Project #AB2-093, a 485.0 MW (485.0 MW Capacity) 1x1 Single Shaft Combined Cycle Gas Turbine generating facility in Hannibal, OH. The primary point of interconnection for the generating facility will be to interconnect to a newly proposed nine (9) circuit breaker 138 kV switching station connecting to AEP's Ormet – Kammer 138 kV line. The secondary point of interconnection for the generating facility will be to interconnect to the existing Ormet 138 kV substation, the existing Ormet substation facilities will have to be retired and a new switching station identical to the one proposed for the primary point of interconnection will be constructed at the existing Ormet substation location.

The requested Backfeed date is **May 1, 2019**.
The requested in-service date is **February 15, 2020**.

Attachment Facilities

Primary Point of Interconnection (Ormet – Kammer 138 kV Line)

To accommodate the interconnection on the Ormet – Kammer 138 kV line a new nine (9) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement will be constructed (see Figure 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required. The new interconnection switching station will be expandable to accommodate future projects in the area.

New Switching Station Work and Cost:

- Construct a new nine (9) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement. Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required.
- **Estimated Station Cost: $13,000,000**

Protection and Relay Work and Cost:

- Install line protection and controls at the new 138 kV switching station.
- **Estimated Cost: $1,000,000**
- Upgrade line protection and controls at the Kammer 138 kV substation to coordinate with the new 138 kV switching station.
- **Estimated Cost: $500,000**

Secondary Point of Interconnection (Ormet 138 kV Substation)

To accommodate the interconnection at the existing Ormet 138 kV substation, the existing Ormet substation facilities will have to be retired and a new switching station identical to the one proposed for the primary point of interconnection will be constructed at the existing Ormet substation location.

New Switching Station Work and Cost:

- Construct a new nine (9) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement at the existing Ormet substation location. Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required.

Protection and Relay Work and Cost:

- Install line protection and controls at the new 138 kV switching station.
- Upgrade line protection and controls at the Kammer 138 kV substation to coordinate with the new 138 kV switching station.

It is understood that IC is responsible for all costs associated with this interconnection. The costs above are reimbursable to AEP. The cost of IC's generating plant and the costs for the line connecting the generating plant to IC's switching station are not included in this report; these are assumed to be IC's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

Local and 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 parameters prescribed in the AEP FERC Form 715[1] and Connection Requirements for AEP Transmission System[2]. Therefore, these criteria were used to assess the impact of the proposed facility on the AEP System. The

1 https://www.aep.com/about/codeofconduct/OASIS/TransmissionStudies/GuideLines/AEP_East_FERC_715_2016_Final_Part_4.pdf

2 https://www.aep.com/about/codeofconduct/OASIS/TransmissionStudies/Requirements/AEP_Interconnection_Requirements_rev1.pdf

Queue Project AB2-093 was evaluated as a 485.0 MW (Capacity 485.0 MW) injection at the Ormet 138kV substation in the AEP area. Project AB2-093 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-093 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)

AB2-093 Generator Deliverability													
#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Loading Initial	Loading Final	Rating Type	Rating MVA	MW Con.	FG App.
1	Non	Non	AEP - AEP	05KAMMR1-05G WASH 138 kV line	243026	243012	81.74	103.66	NR	389	85.27	
2	N-1	GWASHINGTON-DILLES_138KV_CKT2	AEP - AEP	05DILESBTMZ1-05HOLLOW 138 kV line	247840	247131	78.08	92.17	ER	456	64.22	1
3	N-1	DILLESZ2_HOLLOWAY _138KV	AEP - AEP	05DILESBTMZ1-05HOLLOW 138 kV line	247840	247131	78.04	92.12	ER	456	64.22	

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

Multiple Facility Contingency

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

AB2-093 Multiple Facility Contingency												
#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Loading Initial	Loading Final	Rating Type	Rating MVA	MW Con.	FG App.
1	DCTL	476	AEP - AEP	05KAMMR1-05G WASH 138 kV line	243026	243012	93.11	109.83	ER	550	91.96	2

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

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

Short Circuit

(Summary of impacted circuit breakers)

- The sixteen (16) 138 kV circuit breakers over-dutied by AB2-093 at the Kammer 138 kV substation will have to be replaced.

Bus Name	BREAKER	Rating Type	Breaker Capacity (Amps)	Duty Percent With ab2-093_op1_aep	Duty Percent Without ab2-093_op1_aep	Duty Percent Difference
05KAMMR1 138.kV	I	T	103999.9	105.91%	97.50%	8.42%
05KAMMR1 138.kV	I1	T	103999.9	105.91%	97.50%	8.42%
05KAMMR1 138.kV	J	T	103999.9	105.91%	97.50%	8.42%
05KAMMR1 138.kV	J2	T	103999.9	105.91%	97.50%	8.42%
05KAMMR1 138.kV	F2	T	103999.9	105.63%	97.39%	8.24%
05KAMMR1 138.kV	G	T	103999.9	105.63%	97.39%	8.24%
05KAMMR1 138.kV	G2	T	103999.9	105.63%	97.39%	8.24%
05KAMMR1 138.kV	F	T	103999.9	104.92%	97.39%	7.53%
05KAMMR1 138.kV	H	T	103999.9	104.92%	97.39%	7.53%
05KAMMR1 138.kV	H2	T	103999.9	104.92%	97.39%	7.53%
05KAMMR1 138.kV	I2	T	103999.9	104.92%	97.39%	7.53%
05KAMMR1 138.kV	D	T	103999.9	104.15%	95.68%	8.47%
05KAMMR1 138.kV	D2	T	103999.9	104.15%	95.68%	8.47%
05KAMMR1 138.kV	F1	T	103999.9	103.37%	94.89%	8.47%
05KAMMR1 138.kV	E	T	103999.9	103.10%	94.63%	8.47%
05KAMMR1 138.kV	E2	T	103999.9	103.10%	94.63%	8.47%
05KAMMR1 138.kV	I	T	103999.9	104.77%	97.44%	7.33%
05KAMMR1 138.kV	I1	T	103999.9	104.77%	97.44%	7.33%
05KAMMR1 138.kV	J	T	103999.9	104.77%	97.44%	7.33%
05KAMMR1 138.kV	J2	T	103999.9	104.77%	97.44%	7.33%
05KAMMR1 138.kV	F	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	H	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	H2	T	103999.9	104.19%	97.34%	6.85%

Bus Name	BREAKER	Rating Type	Breaker Capacity (Amps)	Duty Percent With ab2-093_op1_aep	Duty Percent Without ab2-093_op1_aep	Duty Percent Difference
05KAMMR1 138.kV	I2	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	F2	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	G	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	G2	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	D	T	103999.9	103.03%	95.63%	7.40%
05KAMMR1 138.kV	D2	T	103999.9	103.03%	95.63%	7.40%
05KAMMR1 138.kV	F1	T	103999.9	102.24%	94.85%	7.39%
05KAMMR1 138.kV	E	T	103999.9	101.97%	94.59%	7.38%
05KAMMR1 138.kV	E2	T	103999.9	101.97%	94.59%	7.38%

- Analysis found 2 new breakers to be over-duty in the APS transmission area; this project is connected in AEP but causes over-duty breakers in APS. Please note that the newly identified over-duty breakers were previously identified in the System Impact Study for AA2-121; if these results are valid, the cost allocation will be determined in the SIS phase for AB2-093.

Bus Name	BREAKER	Rating Type	Breaker Capacity (Amps)	Duty Percent With ab2-093_op1_aep	Duty Percent Without ab2-093_op1_aep	Duty Percent Difference
WYLIE RG 138.kV	W-2	T	60567.5	100.02%	99.96%	0.06%
WYLIE RG 138.kV	W-6	T	60567.5	100.02%	99.96%	0.06%

Stability Analysis

To be determined in the System Impact Study

Voltage Variations

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.

None

Additional Limitations of Concern

None

Summer Peak Load Flow Analysis Reinforcements for Primary Point of Interconnection

New System Reinforcements

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

Generator Deliverability

#	Contingency Name	Facility Description	Mitigation	Cost
1	Non	05KAMMR1-05G WASH 138 kV line	Reconductor 0.08 miles of the ACSR 1590 (54/19) Falcon conductor section 2	$100,000
			Replace the George Washington Wavetrap (2000A).	$100,000
			Replace the Kammer Wavetrap (2000A).	$100,000
2	GWASHINGTON-DILLES_138KV_CKT2	05DILESBTMZ1-05HOLLOW 138 kV line	Reconductor 2.4 miles of the 6-wired Burger Loop 138kV line, from Holloway Sub to structure 4014, with 556 ACSS to replace the existing 605 ACSR.	$2,670,700
3	DILLESZ2_HOLLOWAY_138KV	05DILESBTMZ1-05HOLLOW 138 kV line	Same as #2	Same as #2
			Total	**$2,970,700**

Multiple Facility Contingency

#	Contingency Name	Facility Description	Mitigation	Cost
1	476	05KAMMR1-05G WASH 138 kV line	**Same as Generator Deliverability Table #1**	
			Total	**-**

Contribution to Previously Identified Overloads

None

Network Upgrades

- Replace the sixteen (16) 138 kV circuit breakers over-dutied by AB2-093 at the Kammer 138 kV substation.
- **Estimated Cost: $13,600,000**
- **Note:** All of the over-dutied circuit breakers at Kammer are brand new 80kA units and replacing them may not be the best option. Custom replacement breakers would be required and could be very costly. Alternatives to replacing these circuit breakers will be considered in the System Impact Study.
- Short Circuit analysis also found two new breakers to be over-duty in the APS transmission area; this project is connected in AEP but causes over-duty breakers in APS. Please note that the newly identified over-duty breakers were previously identified in the System Impact Study for AA2-121; if these results are valid, the cost allocation will be determined in the SIS phase for AB2-093.

Network Upgrade Number (NUN)	Description	Cost
n5098.2	Replace Breaker WK-2 at Wylie Ridge 345 kV from 50 kA to 63 kA	$798,917
n5098.6	Replace Breaker WK-6 at Wylie Ridge 345 kV from 50 kA to 63 kA	$798,917
	Total	**$1,597,833**

Schedule

It is anticipated that the time between receipt of executed agreements and Commercial Operation may range from 18 to 24 months if no line work is required. If line work is required, construction time would be between 36 to 48 months after signing an interconnection agreement.

Conclusion

Based upon the results of this Feasibility Study, the construction of the 485.0 MW (485.0 MW Capacity) natural gas generating facility (PJM Project #AB2-093) will require the following additional interconnection charges. This plan of service will interconnect the proposed generating facility in a manner that will provide operational reliability and flexibility to both the AEP system and the IC's natural gas generating facility.

Cost Breakdown for AB2-093 Primary POI	
Attachment Facilities	$13,000,000
Line Protection and Controls	$1,500,000
Generator Deliverability (Gen Deliv.)	$2,970,700
Multiple Facility Contingency (same as Gen Deliv. above)	
Contribution to Previously Identified Overloads	$20,800,000
Short Circuit (18 New Breakers)	$15,197,833
Total	**$32,668,533**

The estimates are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements.

Additional Interconnection Customer Responsibilities:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the 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 the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

Appendix 1

(AEP - AEP) The 05DILESBTMZ1-05HOLLOW 138 kV line (from bus 247840 to bus 247131 ckt 1) loads from 78.08% to 92.17% (**DC power flow**) of its emergency rating (456 MVA) for the single line contingency outage of 'GWASHINGTON-DILLES_138KV_CKT2'. This project contributes approximately 64.22 MW to the thermal violation.

CONTINGENCY 'GWASHINGTON-DILLES_138KV_CKT2'
OPEN BRANCH FROM BUS 243012 TO BUS 247852 CKT 1 / 243012 05G WASH 138 247839 05DILLES BTM 138 2
END

Bus Number	*Bus Name*	*Full Contribution*
235344	*01HANNIB*	*0.51*
243189	*05MLG2*	*11.33*
247632	*Y3-068 OP1*	*175.15*
921992	*AA2-098*	*6.43*
923312	*AB1-140*	*3.21*
923342	*AB1-143*	*3.21*
923422	*AB1-157*	*3.21*
924441	*AB2-093*	*64.22*
924521	*AB2-101*	*9.96*
924871	*AB2-141 C*	*124.89*

Appendix 2

(AEP - AEP) The 05KAMMR1-05G WASH 138 kV line (from bus 243026 to bus 243012 ckt 1) loads from 93.11% to 109.83% (**DC power flow**) of its emergency rating (550 MVA) for the tower line contingency outage of '476'. This project contributes approximately 91.96 MW to the thermal violation.

CONTINGENCY '476'
OPEN BRANCH FROM BUS 242931 TO BUS 247130 CKT 1 / 242931 05BEVERL 345 247130 05HOLLOW 345 1
OPEN BRANCH FROM BUS 242937 TO BUS 242948 CKT 1 / 242937 05KAMMER 345 242948 05WBELLA 345 1
END

Bus Number	*Bus Name*	*Full Contribution*
243189	*05MLG2*	*19.78*
244996	*05ROSEVALL*	*-0.06*
923312	*AB1-140*	*-4.3*
924441	*AB2-093*	*91.96*

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Protection and Relay Work and Cost:

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Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

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)

AB2-093 Contribution to Previously Identified Overloads													
#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Loading Initial	Loading Final	Rating Type	Rating MVA	MW Con.	FG App.
1	N-1	P12_301	AEP - AP	AA2-121 TAP-01WYLIE R 345 kV line	922161	235707	114.17	119.8	NR	1166	65.65	3
2	N-1	8971_B2	AEP - AP	AA2-121 TAP-01WYLIE R 345 kV line	922161	235707	107.92	112.81	NR	1166	56.98	

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

Short Circuit

(Summary of impacted circuit breakers)

- The sixteen (16) 138 kV circuit breakers over-dutied by AB2-093 at the Kammer 138 kV substation will have to be replaced.

Bus Name	BREAKER	Rating Type	Breaker Capacity (Amps)	Duty Percent With ab2-093_op1_aep	Duty Percent Without ab2-093_op1_aep	Duty Percent Difference
05KAMMR1 138.kV	I	T	103999.9	105.91%	97.50%	8.42%
05KAMMR1 138.kV	I1	T	103999.9	105.91%	97.50%	8.42%
05KAMMR1 138.kV	J	T	103999.9	105.91%	97.50%	8.42%
05KAMMR1 138.kV	J2	T	103999.9	105.91%	97.50%	8.42%
05KAMMR1 138.kV	F2	T	103999.9	105.63%	97.39%	8.24%
05KAMMR1 138.kV	G	T	103999.9	105.63%	97.39%	8.24%
05KAMMR1 138.kV	G2	T	103999.9	105.63%	97.39%	8.24%
05KAMMR1 138.kV	F	T	103999.9	104.92%	97.39%	7.53%
05KAMMR1 138.kV	H	T	103999.9	104.92%	97.39%	7.53%
05KAMMR1 138.kV	H2	T	103999.9	104.92%	97.39%	7.53%
05KAMMR1 138.kV	I2	T	103999.9	104.92%	97.39%	7.53%
05KAMMR1 138.kV	D	T	103999.9	104.15%	95.68%	8.47%
05KAMMR1 138.kV	D2	T	103999.9	104.15%	95.68%	8.47%
05KAMMR1 138.kV	F1	T	103999.9	103.37%	94.89%	8.47%
05KAMMR1 138.kV	E	T	103999.9	103.10%	94.63%	8.47%
05KAMMR1 138.kV	E2	T	103999.9	103.10%	94.63%	8.47%
05KAMMR1 138.kV	I	T	103999.9	104.77%	97.44%	7.33%

Bus Name	BREAKER	Rating Type	Breaker Capacity (Amps)	Duty Percent With ab2-093_op1_aep	Duty Percent Without ab2-093_op1_aep	Duty Percent Difference
05KAMMR1 138.kV	I1	T	103999.9	104.77%	97.44%	7.33%
05KAMMR1 138.kV	J	T	103999.9	104.77%	97.44%	7.33%
05KAMMR1 138.kV	J2	T	103999.9	104.77%	97.44%	7.33%
05KAMMR1 138.kV	F	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	H	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	H2	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	I2	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	F2	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	G	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	G2	T	103999.9	104.19%	97.34%	6.85%
05KAMMR1 138.kV	D	T	103999.9	103.03%	95.63%	7.40%
05KAMMR1 138.kV	D2	T	103999.9	103.03%	95.63%	7.40%
05KAMMR1 138.kV	F1	T	103999.9	102.24%	94.85%	7.39%
05KAMMR1 138.kV	E	T	103999.9	101.97%	94.59%	7.38%
05KAMMR1 138.kV	E2	T	103999.9	101.97%	94.59%	7.38%

- Analysis found 2 new breakers to be over-duty in the APS transmission area; this project is connected in AEP but causes over-duty breakers in APS. Please note that the newly identified over-duty breakers were previously identified in the System Impact Study for AA2-121; if these results are valid, the cost allocation will be determined in the SIS phase for AB2-093.

Bus Name	BREAKER	Rating Type	Breaker Capacity (Amps)	Duty Percent With ab2-093_op1_aep	Duty Percent Without ab2-093_op1_aep	Duty Percent Difference
WYLIE RG 138.kV	W-2	T	60567.5	100.02%	99.96%	0.06%
WYLIE RG 138.kV	W-6	T	60567.5	100.02%	99.96%	0.06%

Stability Analysis

To be determined in the System Impact Study

Voltage Variations

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.

None

Additional Limitations of Concern

None

Summer Peak Load Flow Analysis Reinforcements for Primary Point of Interconnection

New System Reinforcements

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

Generator Deliverability

#	Contingency Name	Facility Description	Mitigation	Cost
1	Non	05KAMMR1-05G WASH 138 kV line	Reconductor 0.08 miles of the ACSR 1590 (54/19) Falcon conductor section 2	$100,000
			Replace the George Washington Wavetrap (2000A).	$100,000
			Replace the Kammer Wavetrap (2000A).	$100,000
2	GWASHINGTON-DILLES_138KV_CKT2	05DILESBTMZ1-05HOLLOW 138 kV line	Reconductor 2.4 miles of the 6-wired Burger Loop 138kV line, from Holloway Sub to structure 4014, with 556 ACSS to replace the existing 605 ACSR.	$2,670,700
3	DILLESZ2_HOLLOWAY_138KV	05DILESBTMZ1-05HOLLOW 138 kV line	Same as #2	Same as #2
			Total	**$2,970,700**

Multiple Facility Contingency

#	Contingency Name	Facility Description	Mitigation	Cost
1	476	05KAMMR1-05G WASH 138 kV line	**Same as Generator Deliverability Table #1**	
			Total	**-**

Contribution to Previously Identified Overloads

#	Contingency Name	Facility Description	Mitigation	Cost
1	P12_301	AA2-121 TAP-01WYLIE R 345 kV line	Reinforcement: Rebuild/Reconductor the ACSR 954 45/7 Rail conductor section. New ratings will be 1542/1878 MVA (SN/SE)	$20,800,000
2	8971_B2	AA2-121 TAP-01WYLIE R 345 kV line	Same as #1	Same as #1
			Total	

Network Upgrades

- Replace the sixteen (16) 138 kV circuit breakers over-dutied by AB2-093 at the Kammer 138 kV substation.
- **Estimated Cost: $13,600,000**
- **Note:** All of the over-dutied circuit breakers at Kammer are brand new 80kA units and replacing them may not be the best option. Custom replacement breakers would be required and could be very costly. Alternatives to replacing these circuit breakers will be considered in the System Impact Study.
- Short Circuit analysis also found two new breakers to be over-duty in the APS transmission area; this project is connected in AEP but causes over-duty breakers in APS. Please note that the newly identified over-duty breakers were previously identified in the System Impact Study for AA2-121; if these results are valid, the cost allocation will be determined in the SIS phase for AB2-093.

Network Upgrade Number (NUN)	Description	Cost
n5098.2	Replace Breaker WK-2 at Wylie Ridge 345 kV from 50 kA to 63 kA	$798,917
n5098.6	Replace Breaker WK-6 at Wylie Ridge 345 kV from 50 kA to 63 kA	$798,917
	Total	**$1,597,833**

Schedule

It is anticipated that the time between receipt of executed agreements and Commercial Operation may range from 18 to 24 months if no line work is required. If line work is required, construction time would be between 36 to 48 months after signing an interconnection agreement.

Conclusion

Based upon the results of this Feasibility Study, the construction of the 485.0 MW (485.0 MW Capacity) natural gas generating facility (PJM Project #AB2-093) will require the following additional interconnection charges. This plan of service will interconnect the proposed generating facility in a manner that will provide operational reliability and flexibility to both the AEP system and the IC's natural gas generating facility.

Cost Breakdown for AB2-093 Primary POI	
Attachment Facilities	$13,000,000
Line Protection and Controls	$1,500,000
Generator Deliverability	$2,970,700
Multiple Facility Contingency (same as Gen Deliv. above)	
Contribution to Previously Identified Overloads	$20,800,000
Short Circuit (18 New Breakers)	$15,197,833
Total	**$53,468,533**

The estimates are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements.

Additional Interconnection Customer Responsibilities:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the 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 the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

Appendix 1

(AEP - AEP) The 05DILESBTMZ1-05HOLLOW 138 kV line (from bus 247840 to bus 247131 ckt 1) loads from 78.08% to 92.17% (**DC power flow**) of its emergency rating (456 MVA) for the single line contingency outage of 'GWASHINGTON-DILLES_138KV_CKT2'. This project contributes approximately 64.22 MW to the thermal violation.

CONTINGENCY 'GWASHINGTON-DILLES_138KV_CKT2'
OPEN BRANCH FROM BUS 243012 TO BUS 247852 CKT 1 / 243012 05G WASH 138 247839 05DILLES BTM 138 2
END

Bus Number	*Bus Name*	*Full Contribution*
235344	*01HANNIB*	*0.51*
243189	*05MLG2*	*11.33*
247632	*Y3-068 OP1*	*175.15*
921992	*AA2-098*	*6.43*
923312	*AB1-140*	*3.21*
923342	*AB1-143*	*3.21*
923422	*AB1-157*	*3.21*
924441	*AB2-093*	*64.22*
924521	*AB2-101*	*9.96*
924871	*AB2-141 C*	*124.89*

Appendix 2

(AEP - AEP) The 05KAMMR1-05G WASH 138 kV line (from bus 243026 to bus 243012 ckt 1) loads from 93.11% to 109.83% (**DC power flow**) of its emergency rating (550 MVA) for the tower line contingency outage of '476'. This project contributes approximately 91.96 MW to the thermal violation.

CONTINGENCY '476'
OPEN BRANCH FROM BUS 242931 TO BUS 247130 CKT 1 / 242931 05BEVERL 345 247130 05HOLLOW 345 1
OPEN BRANCH FROM BUS 242937 TO BUS 242948 CKT 1 / 242937 05KAMMER 345 242948 05WBELLA 345 1
END

Bus Number	*Bus Name*	*Full Contribution*
243189	*05MLG2*	*19.78*
244996	*05ROSEVALL*	*-0.06*
923312	*AB1-140*	*-4.3*
924441	*AB2-093*	*91.96*

Appendix 3

(AEP - AP) The AA2-121 TAP-01WYLIE R 345 kV line (from bus 922161 to bus 235707 ckt 1) loads from 114.17% to 119.8% (**DC power flow**) of its normal rating (1166 MVA) for the single line contingency outage of 'P12_301'. This project contributes approximately 65.65 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

Bus Number	*Bus Name*	*Full Contribution*
235344	*01HANNIB*	*0.41*
243190	*05CDG1*	*11.34*
243191	*05CDG2*	*41.45*
243185	*05CDG3*	*43.96*
243622	*05CVG4*	*9.27*
243624	*05CVG6*	*4.81*
243189	*05MLG2*	*20.31*
247202	*05WSHG1A*	*3.27*
247203	*05WSHG1B*	*3.27*
247204	*05WSHG1S*	*4.67*
247237	*05WTRG1A*	*2.76*
247238	*05WTRG1B*	*2.76*
247239	*05WTRG1C*	*2.76*
247240	*05WTRG1S*	*6.47*
247581	*W3-111 C*	*0.7*
247582	*W3-112 C*	*0.52*
247583	*W3-113 C*	*0.52*
247628	*Y2-050*	*26.75*
247632	*Y3-068 OP1*	*80.92*
920912	*AA1-014*	*0.46*
921992	*AA2-098*	*2.97*
922162	*AA2-121*	*422.1*
922312	*AA2-141*	*4.15*
923312	*AB1-140*	*1.48*
923342	*AB1-143*	*1.48*
923422	*AB1-157*	*1.48*
924441	*AB2-093*	*65.65*
924521	*AB2-101*	*4.6*
924551	*AB2-104*	*40.05*
924871	*AB2-141 C*	*57.7*