

***Generation Interconnection
Feasibility Study Report***

For

***PJM Generation Interconnection Request
Queue Position AD1-119***

Payne 69kV

April 2018

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 #AD1-119, a 49.9 MW (18.96 MW Capacity) solar generating facility in Paulding County, Ohio (see Figure 1). The primary point of interconnection is a direct connection to AEP's Payne 69 kV substation. The secondary point of interconnection is to AEP's Payne – Antwerp 69 kV section of the Payne – South Hicksville 69 kV circuit (see Figure 3).

The requested in Backfeed date is August 1, 2020.

The requested in service date is October 31, 2020.

Attachment Facilities

Primary Point of Interconnection (Payne 69 kV Substation)

To accommodate the interconnection at the Payne 69 kV substation, the substation will have to be expanded requiring the installation of one (1) 69 kV circuit breakers (see Figure 1). Installation of associated protection and control equipment, 69 kV line risers, SCADA, and 69 kV revenue metering will also be required.

Direct Connection at the Payne 69 kV Substation Work and Cost:

- Expand the substation requiring the installation of one (1) new 69 kV circuit breakers (see Figure 1). Installation of associated protection and control equipment, 69 kV line risers, SCADA, and 69 kV revenue metering will also be required.
- **Estimated Station Cost: \$600,000**
- **Note:** The Interconnection Customer may be required to go offline for routine circuit breaker maintenance.

Non-Direct Connection Cost Estimate

The total preliminary cost estimate for Non-Direct Connection work is given in the following table below:

For AEP building Non-Direct Connection cost estimates:

Description	Estimated Cost
69 kV Revenue Metering	\$200,000
Upgrade line protection and controls at the Payne 69 kV substation.	\$200,000

Description	Estimated Cost
Total	\$400,000

Table 1

Secondary Point of Interconnection (Payne - Antwerp 69kV)

To accommodate the interconnection on the Payne - Antwerp 69 kV section of the Payne – South Hicksville 69 kV circuit, a new three (3) circuit breaker 69 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus will be constructed (see Figure 3). Installation of associated protection and control equipment, 69 kV line risers, SCADA, and 69 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

Interconnection Customer Requirements

It is understood that The IC is responsible for all costs associated with this interconnection. The cost of The IC's generating plant and the costs for the line connecting the generating plant to the Payne 69 kV substation are not included in this report; these are assumed to be The 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.

Requirement from the PJM Open Access Transmission Tariff:

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.

Revenue Metering and SCADA Requirements

PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

AEP Requirements

The Interconnection Customer will be required to comply with all AEP Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx>

Option 1

Network Impacts

The Queue Project AD1-119 was evaluated as a 49.9 MW (Capacity 18.96 MW) injection at the Payne 69 kV substation in the AEP area. Project AD1-119 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-119 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2021

Contingency Descriptions

The following contingencies resulted in overloads:

Option 1		
Contingency Name	Description	
AEP_P7-1_#6676_T131-FSA	OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1	/ 242989 05E LIMA 138 243017 05HAVILN 138 1
	OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1	/ 242991 05E SIDE 138 243051 05NDELPH 138 1
	OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1	/ 242991 05E SIDE 138 243108 05STRLN1 138 1
	OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1	/ 243051 05NDELPH 138 247521 T-131 C 138 1
	OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1	/ 243051 05NDELPH 138 243175 05N
	DELPHO 69.0 1	
	OPEN BRANCH FROM BUS 245874 TO BUS 243175 CKT 1	/ 245874 05E DELPHO 69.0 243175 05N
	DELPHO 69.0 1	
	OPEN BRANCH FROM BUS 245878 TO BUS 243175 CKT 1	/ 245878 05FTJENNG8 69.0 243175 05N
	DELPHO 69.0 1	
	OPEN BRANCH FROM BUS 243175 TO BUS 245902 CKT 1	/ 243175 05N DELPHO 69.0 245902 05S
	DELPHO 69.0 1	
	OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1	/ 243242 05ALLEN 138 247521 T-131 C 138 1

Option 1	
Contingency Name	Description
	END
AEP_P7-1_#6676	OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA 138 243017 05HAVILN 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1 / 242991 05E SIDE 138 243051 05NDELPH 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1 / 242991 05E SIDE 138 243108 05STRLN1 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051 05NDELPH 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051 05NDELPH 138 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 245874 TO BUS 243175 CKT 1 / 245874 05E DELPHO 69.0 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 245878 TO BUS 243175 CKT 1 / 245878 05FTJENNG8 69.0 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 243175 TO BUS 245902 CKT 1 / 243175 05N DELPHO 69.0 245902 05S DELPHO 69.0 1 END
ATSI-P2-4-TE-138-002T	BREAKER (LJ TIE) DISCONNECT BUS 239065 /* 02RICHG2&3 13 DISCONNECT BUS 238522 /* 02RCHLN 69 DISCONNECT BUS 238556 /* 02AYERSV 138 DISCONNECT BUS 238511 /* 02GMC-J 138 DISCONNECT BRANCH FROM BUS 239269 TO BUS 239070 CKT ZB /* 02RICHLJ 138 02RICHLD 138 DISCONNECT BUS 242993 /* 05E.LPSC 138 END
ATSI-P2-2-TE-138-003T	REDUCE BUS 239269 SHUNT BY 100 PERCENT /* 02RICHLJ 138 DISCONNECT BUS 239065 /* 02RICHG2&3 13 DISCONNECT BUS 238522 /* 02RCHLN 69 DISCONNECT BRANCH FROM BUS 239070 TO BUS 239269 CKT ZB /* 02RICHLD 138 02RICHLJ 138 DISCONNECT BRANCH FROM BUS 239269 TO BUS 239060 CKT 1 /* 02RICHLJ 138 02RDGVL 138 DISCONNECT BUS 238556 /* 02AYERSV 138 DISCONNECT BUS 238511 /* 02GMC-J 138 DISCONNECT BRANCH FROM BUS 239269 TO BUS 242993 CKT 1 /* 02RICHLJ 138 05E.LPSC 138 DISCONNECT BUS 239269 /* 02RICHLJ 138 END
ATSI-P2-3-TE-138-005T	BREAKER (RIDGEVILLE) DISCONNECT BUS 239061 /* 02RDGVL+ 138 REDUCE BUS 239269 SHUNT BY 100 PERCENT /* 02RICHLJ 138 DISCONNECT BUS 239065 /* 02RICHG2&3 13 DISCONNECT BUS 238522 /* 02RCHLN 69 DISCONNECT BUS 239060 /* 02RDGVL 138 DISCONNECT BRANCH FROM BUS 239269 TO BUS 242993 CKT 1 /* 02RICHLJ 138 05E.LPSC 138 DISCONNECT BRANCH FROM BUS 239269 TO BUS 238511 CKT 1 /* 02RICHLJ 138 02GMC-J 138 DISCONNECT BUS 238511 /* 02GMC-J 138 DISCONNECT BUS 238556 /* 02AYERSV 138 END
AEP_P4_#7528_05ALLEN 138-T131-FSA	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051 05NDELPH 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051 05NDELPH 138 243175 05N DELPHO 69.0 1 END

Option 1	
Contingency Name	Description
	END
AEP_P4_#7528_05ALLEN 138-	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 END
AEP_P7-1_#7372	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 END

Table 2

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)

AD1-119 Multiple Facility Contingency														
#	Contingency		Affected Area	Facility Description	Bus			PF	Loading		Rating		MW Con.	FG App.
	Type	Name			From	To	Cir.		Initial	Final	Type	MVA		
1	DCTL	AEP_P7-1_#6676_T131-FSA	AEP - AEP	05TIMBSS-05TILLMA 138 kV line	246950	243383	1	DC	97.25	103.81	ER	332	21.8	1
2	DCTL	AEP_P7-1_#6676	AEP - AEP	05TIMBSS-05TILLMA 138 kV line	246950	243383	1	DC	97.0	103.56	ER	332	21.8	1

Table 3

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)

AD1-119 Contribution to Previously Identified Overloads														
#	Type	Contingency Name	Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating	MW	FG	
					From	To			Initial	Final	Type	MVA	Con.	App.
1	LFFB	ATSI-P2-4-TE-138-002T	FE - FE	02RICHLD-02NAOMI 138 kV	239070	238521	1	DC	122.37	124.54	ER	194	3.27	
2	BUS	ATSI-P2-2-TE-138-003T	FE - FE	02RICHLD-02NAOMI 138 kV	239070	238521	1	DC	121.95	124.12	ER	194	3.26	
3	LFFB	ATSI-P2-3-TE-138-005T	FE - FE	02RICHLD-02NAOMI 138 kV	239070	238521	1	DC	118.03	120.2	ER	194	3.26	
4	LFFB	AEP_P4_#7528_05ALLEN 138-T131-FSA	AEP - AEP	05HAVILN-05E LIMA 138 kV line	243017	242989	1	DC	126.63	134.12	ER	220	16.39	
5	LFFB	AEP_P4_#7528_05ALLEN 138-	AEP - AEP	05NDELPH-05E SIDE 138 kV line	243051	242991	1	DC	109.0	112.22	ER	167	5.36	
6	DCTL	AEP_P7-1_#7372	AEP - AEP	05NDELPH-05E SIDE 138 kV line	243051	242991	1	DC	109.0	112.22	ER	167	5.36	

Table 4

Steady-State Voltage Requirements

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

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.

AD1-119 Delivery of Energy Portion of Interconnection Request														
#	Contingency		Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating		MW Con.	FG App.
	Type	Name			From	To			Initial	Final	Type	MVA		
1	N-1	AEP_P1-2_#7501	AEP - AEP	05HAVILN-05E LIMA 138 kV line	243017	242989	1	DC	125.53	132.34	ER	220	14.96	
2	N-1	None	AEP - AEP	05HAVILN-05E LIMA 138 kV line	243017	242989	1	DC	104.83	109.58	NR	167	7.9	

Table 5

New System Reinforcements

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

Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1	05TIMBSS-05TILLMA 138 kV line	Replace the Timber Switch riser to Milan line.	An approximate construction time would be 12 months after signing an interconnection agreement.	\$50,000
Total Network Upgrades				\$50,000

Table 6

Previous System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)

First energy Reinforcements:

Violation #	Overloaded Element	Contingency Label	Contingency Description	Rating (MVA)	% Loading	FE Comments/Reinforcements
1	Richland - Naomi 138 kV line	ATSI-P2-4-TE-138-002T	Richland 138 kV LJ Bus Tie Breaker 13249 Failure	194	108.29	Proposed Upgrade: Existing PJM baseline project to relocate the Richland to Ridgeville 138KV line from Richland J bus to K, extend the K bus and install a new breaker at Richland substation (b2875). This project has a 6/1/2019 ISD.
2	Richland - Naomi 138 kV line	ATSI-P2-2-TE-138-003T	Richland 138 kV J Bus Outage	194	107.87	Proposed Upgrade: Existing PJM baseline project to relocate the Richland to Ridgeville 138KV line from Richland J bus to K, extend the K bus and install a new breaker at Richland substation (b2875). This project has a 6/1/2019 ISD.
3	Richland - Naomi 138 kV line	ATSI-P2-3-TE-138-005T	Richland 138 kV Breaker 13246 Failure	194	103.95	Proposed Upgrade: Existing PJM baseline project to relocate the Richland to Ridgeville 138KV line from Richland J bus to K, extend the K bus and install a new breaker at Richland substation (b2875). This project has a 6/1/2019 ISD.

Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#4	05HAVILN-05E LIMA 138 kV line	E Lima Wavetrap and Haviland Wavetrap will need to be replaced Replace E lima and Haviland Line risers Rebuild/reconductor 5.5 miles of ACSR 556.5 ~ 26/7 ~ Dove conductor section	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$8,500,000
#5 & #6	05NDELPH-05E SIDE 138 kV line	A sag study will be required on the 1.92 mile section of the ACSR 397.5 ~ 30/7 ~ Lark conductor section 3 to mitigate the overload.	Sag study: 6 to 12 months. Rebuild. The standard time required for construction differs from state to state. An Approximate construction would be 24 to 36 months after signing an interconnection agreement.	\$15,000
Total Network Upgrades				\$8,515,000

Table 7

Schedule

It is anticipated that the time between receipt of executed agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would be between 24 to 36 months after signing an interconnection agreement.

Note: The time provided between anticipated normal completion of System Impact, Facilities Studies, subsequent execution of ISA and ICSA documents, and the proposed Backfeed Date is shorter than usual and may be difficult to achieve.

Conclusion

Based upon the results of this Feasibility Study, the construction of the IC's 49.9 MW (18.96 MW Capacity) solar generating facility (PJM Project #AD1-119) 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 generating facility.

Cost Breakdown for the Primary Point of Interconnection (Payne 69 kV Substation)		
Attachment Cost	Expand Payne 69 kV Substation	\$600,000
Non-Direct Connection Cost Estimate	69 kV Revenue Metering	\$200,000
	Upgrade line protection and controls at the Payne 69 kV substation.	\$200,000
	New System Reinforcements <i>(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)</i>	\$50,000
	Previous System Reinforcements <i>(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)</i>	\$8,565,000
Total Estimated Cost for Project AD1-119		\$9,615,000

Table 8

The estimates are preliminary in nature, as they were determined without the benefit of detailed engineering studies. The cost of remediation for sag limited conductors is not included in this estimate. Final estimates will require an on-site review and coordination to determine final construction requirements.

Option 2

Network Impacts

The Queue Project AD1-119 was evaluated as a 49.9 MW (Capacity 19.0 MW) injection tapping Payne to Antwerp 69kV line in the AEP area. Project AD1-119 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-119 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2021

Contingency Descriptions

The following contingencies resulted in overloads:

Option 1		
Contingency Name	Description	
AEP_P7-1_#6676_T131-FSA	OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1	/ 242989 05E LIMA 138 243017 05HAVILN 138 1
	OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1	/ 242991 05E SIDE 138 243051 05NDELPH 138 1
	OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1	/ 242991 05E SIDE 138 243108 05STRLN1 138 1
	OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1	/ 243051 05NDELPH 138 247521 T-131 C 138 1
	OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1	/ 243051 05NDELPH 138 243175 05N DELPHO 69.0 1
	OPEN BRANCH FROM BUS 245874 TO BUS 243175 CKT 1	/ 245874 05E DELPHO 69.0 243175 05N DELPHO 69.0 1
	OPEN BRANCH FROM BUS 245878 TO BUS 243175 CKT 1	/ 245878 05FTJENNG8 69.0 243175 05N DELPHO 69.0 1
	OPEN BRANCH FROM BUS 243175 TO BUS 245902 CKT 1	/ 243175 05N DELPHO 69.0 245902 05S DELPHO 69.0 1
	OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1	/ 243242 05ALLEN 138 247521 T-131 C 138 1
	END	
AEP_P7-1_#6676	OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1	/ 242989 05E LIMA 138 243017 05HAVILN 138 1
	OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1	/ 242991 05E SIDE 138 243051 05NDELPH 138 1
	OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1	/ 242991 05E SIDE 138 243108 05STRLN1 138 1
	OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1	/ 243051 05NDELPH 138 247521 T-131 C 138 1
	OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1	/ 243051 05NDELPH 138 243175 05N DELPHO 69.0 1
	OPEN BRANCH FROM BUS 245874 TO BUS 243175 CKT 1	/ 245874 05E DELPHO 69.0 243175 05N DELPHO 69.0 1
	OPEN BRANCH FROM BUS 245878 TO BUS 243175 CKT 1	/ 245878 05FTJENNG8 69.0 243175 05N DELPHO 69.0 1
	OPEN BRANCH FROM BUS 243175 TO BUS 245902 CKT 1	/ 243175 05N DELPHO 69.0 245902 05S DELPHO 69.0 1
	END	
ATSI-P2-4-TE-138-002T	DISCONNECT BUS 239065	/* 02RICHG2&3 13
	DISCONNECT BUS 238522	/* 02RCHLN 69
	DISCONNECT BUS 238556	/* 02AYERSV 138
	DISCONNECT BUS 238511	/* 02GMC-J 138
	DISCONNECT BRANCH FROM BUS 239269 TO BUS 239070 CKT ZB	/* 02RICHLJ 138 02RICHLD 138
	DISCONNECT BUS 242993	/* 05E.LPSC 138

Option 1	
Contingency Name	Description
	END
ATSI-P2-2-TE-138-003T	REDUCE BUS 239269 SHUNT BY 100 PERCENT /* 02RICHLJ 138 DISCONNECT BUS 239065 /* 02RICHG2&3 13 DISCONNECT BUS 238522 /* 02RCHLN 69 DISCONNECT BRANCH FROM BUS 239070 TO BUS 239269 CKT ZB /* 02RICHLJ 138 02RICHLJ 138 DISCONNECT BRANCH FROM BUS 239269 TO BUS 239060 CKT 1 /* 02RICHLJ 138 02RDGVL 138 DISCONNECT BUS 238556 /* 02AYERSV 138 DISCONNECT BUS 238511 /* 02GMC-J 138 DISCONNECT BRANCH FROM BUS 239269 TO BUS 242993 CKT 1 /* 02RICHLJ 138 05E.LPSC 138 DISCONNECT BUS 239269 /* 02RICHLJ 138 END
ATSI-P2-3-TE-138-005T	DISCONNECT BUS 239061 /* 02RDGVL+ 138 REDUCE BUS 239269 SHUNT BY 100 PERCENT /* 02RICHLJ 138 DISCONNECT BUS 239065 /* 02RICHG2&3 13 DISCONNECT BUS 238522 /* 02RCHLN 69 DISCONNECT BUS 239060 /* 02RDGVL 138 DISCONNECT BRANCH FROM BUS 239269 TO BUS 242993 CKT 1 /* 02RICHLJ 138 05E.LPSC 138 DISCONNECT BRANCH FROM BUS 239269 TO BUS 238511 CKT 1 /* 02RICHLJ 138 02GMC-J 138 DISCONNECT BUS 238511 /* 02GMC-J 138 DISCONNECT BUS 238556 /* 02AYERSV 138 END
AEP_P4_#7528_05ALLEN 138-T131-FSA	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051 05NDELPH 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051 05NDELPH 138 243175 05N DELPHO 69.0 1 END
AEP_P4_#7528_05ALLEN 138-	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 END
AEP_P7-1_#7372	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 END
AEP_P1-2_#7501	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1

Option 1		
Contingency Name	Description	
	OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 END	

Table 9

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)

AD1-119 Multiple Facility Contingency														
#	Contingency		Affected Area	Facility Description	Bus			PF	Loading		Rating		MW Con.	FG App.
	Type	Name			From	To	Cir.		Initial	Final	Type	MVA		
1	DCTL	AEP_P7-1_#6676_T131-FSA	AEP - AEP	05TIMBSS-05TILLMA 138 kV line	246950	243383	1	DC	97.72	102.35	ER	332	18.71	1
2	DCTL	AEP_P7-1_#6676	AEP - AEP	05TIMBSS-05TILLMA 138 kV line	246950	243383	1	DC	96.47	102.11	ER	332	18.71	1

Table 10

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)

AD1-119 Contribution to Previously Identified Overloads														
#	Type	Contingency Name	Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating	MW	FG	
					From	To			Initial	Final	Type	MVA	Con.	App.
1	LFFB	ATSI-P2-4-TE-138-002T	FE - FE	02RICHLD-02NAOMI 138 kV	239070	238521	1	DC	107.06	108.32	ER	194	3.69	
2	BUS	ATSI-P2-2-TE-138-003T	FE - FE	02RICHLD-02NAOMI 138 kV	239070	238521	1	DC	106.68	107.95	ER	194	3.68	
3	LFFB	ATSI-P2-3-TE-138-005T	FE - FE	02RICHLD-02NAOMI 138 kV	239070	238521	1	DC	102.72	103.98	ER	194	3.68	
4	LFFB	AEP_P4_#7528_05ALLEN 138-T131-FSA	AEP - AEP	05HAVILN-05E LIMA 138 kV line	243017	242989	1	DC	121.37	127.87	ER	220	14.21	
5	LFFB	AEP_P4_#7528_05ALLEN 138-	AEP - AEP	05NDELPH-05E SIDE 138 kV line	243051	242991	1	DC	107.17	108.45	ER	167	4.71	
6	DCTL	AEP_P7-1_#7372	AEP - AEP	05NDELPH-05E SIDE 138 kV line	243051	242991	1	DC	107.17	108.45	ER	167	5.36	

Table 11

Steady-State Voltage Requirements

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

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.

AD1-119 Delivery of Energy Portion of Interconnection Request														
#	Type	Contingency	Affected Area	Facility Description	Bus				Loading		Rating		MW Con.	FG App.
		Name			From	To	Cir.	PF	Initial	Final	Type	MVA		
1	N-1	AEP_P1-2_#7501	AEP - AEP	05HAVILN-05E LIMA 138 kV line	243017	242989	1	DC	120.05	125.96	ER	220	12.96	

Table 12

Figure 1: Primary Point of Interconnection (Payne 69 kV Substation)

Single Line Diagram

AD1-119 Primary Point of Interconnection

Remote stations not completely shown.

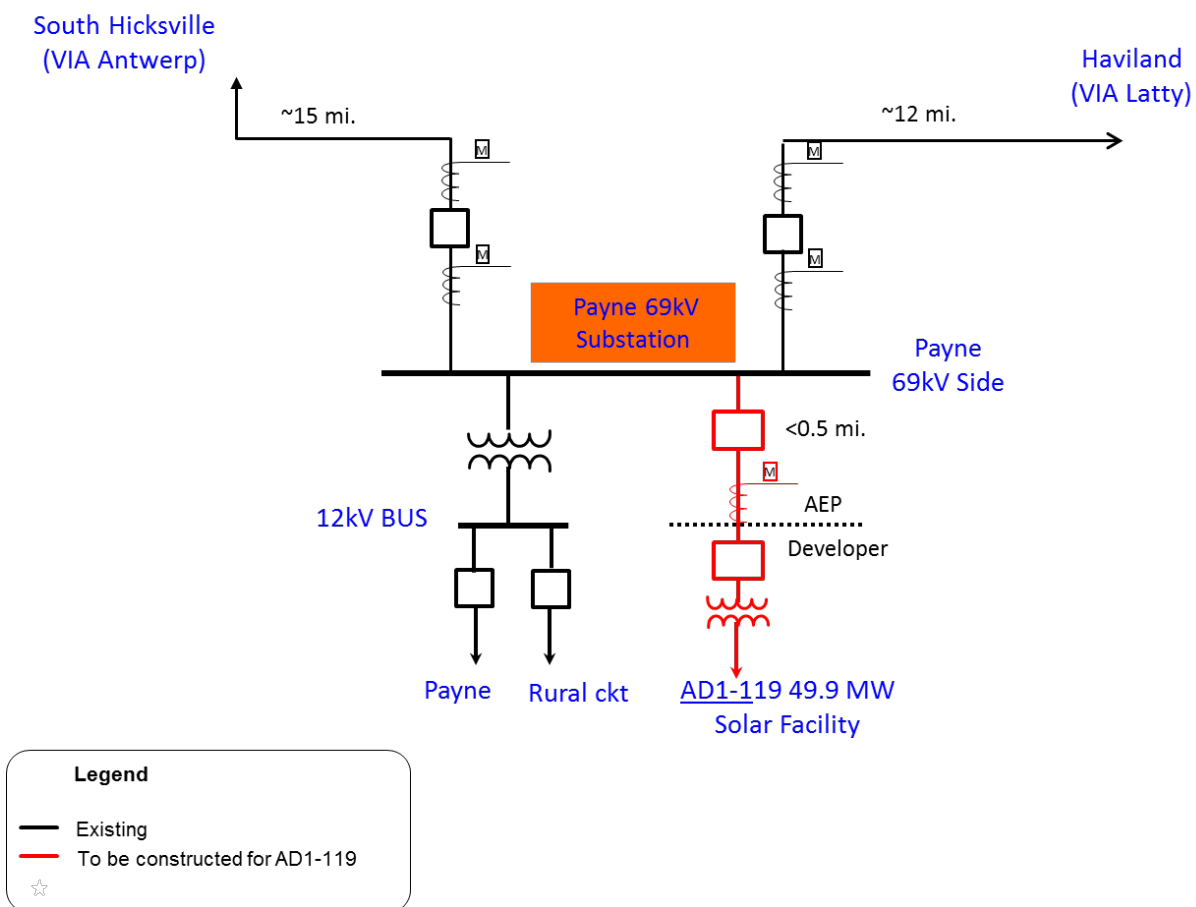
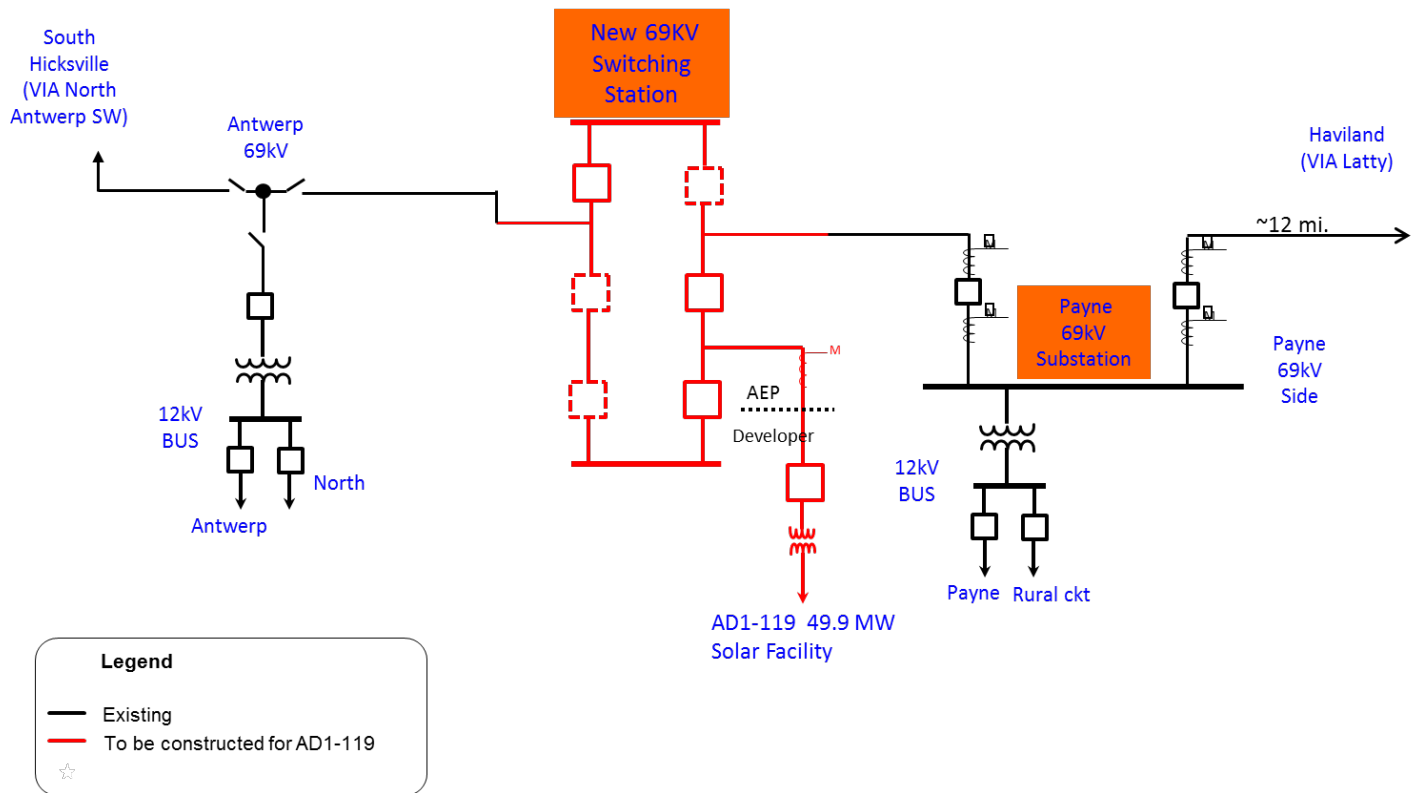


Figure 3: Secondary Point of Interconnection (New 69 kV Substation)

Single Line Diagram

**AD1-119 Secondary Point of Interconnection
Antwerp– Payne 69KV**



Appendices – Option 1

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 05TIMBSS-05TILLMA 138 kV line (from bus 246950 to bus 243383 ckt 1) loads from 96.95% to 103.51% (**DC power flow**) of its emergency rating (332 MVA) for the tower line contingency outage of 'AEP_P7-1_#6676_T131-FSA'. This project contributes approximately 21.8 MW to the thermal violation.

CONTINGENCY 'AEP_P7-1_#6676_T131-FSA'

OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA
138 243017 05HAVILN 138 1
OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1 / 242991 05E SIDE
138 243051 05NDELPH 138 1
OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1 / 242991 05E SIDE
138 243108 05STRLN1 138 1
OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051
05NDELPH 138 247521 T-131 C 138 1
OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051
05NDELPH 138 243175 05N DELPHO 69.0 1
OPEN BRANCH FROM BUS 245874 TO BUS 243175 CKT 1 / 245874 05E
DELPHO 69.0 243175 05N DELPHO 69.0 1
OPEN BRANCH FROM BUS 245878 TO BUS 243175 CKT 1 / 245878
05FTJENNG8 69.0 243175 05N DELPHO 69.0 1
OPEN BRANCH FROM BUS 243175 TO BUS 245902 CKT 1 / 243175 05N
DELPHO 69.0 245902 05S DELPHO 69.0 1
OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN
138 247521 T-131 C 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
246953	05TIMB G C	5.06
247911	05TIMB G E	103.83
934741	AD1-101 C OI	2.6
934742	AD1-101 E OI	4.25
934901	AD1-119 C OI	8.28
934902	AD1-119 E OI	13.52
247534	R-048 C	4.19
247928	R-048 E	16.78
247607	V1-011 C	10.13
247959	V1-011 E	67.8
247608	V1-012 C	15.2
247960	V1-012 E	101.7
926811	AC1-167 C	10.01
926812	AC1-167 E	4.86
926901	AC1-176 C	6.53
926902	AC1-176 E	43.92

Appendix 2

(FE - FE) The 02RICHLD-02NAOMI 138 kV line (from bus 239070 to bus 238521 ckt 1) loads from 107.12% to 108.29% (**DC power flow**) of its emergency rating (194 MVA) for the line fault with failed breaker contingency outage of 'ATSI-P2-4-TE-138-002T'. This project contributes approximately 3.26 MW to the thermal violation.

CONTINGENCY 'ATSI-P2-4-TE-138-002T'

/* RICHLAND 13249

BREAKER (LJ TIE)

DISCONNECT BUS 239065

/* 02RICHG2&3 13

DISCONNECT BUS 238522

/* 02RCHLN 69

DISCONNECT BUS 238556

/* 02AYERSV 138

DISCONNECT BUS 238511

/* 02GMC-J 138

DISCONNECT BRANCH FROM BUS 239269 TO BUS 239070 CKT ZB
138 02RICHLD 138

/* 02RICHLJ

DISCONNECT BUS 242993

/* 05E.LPSC 138

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
240968	02BG2 GEN	-0.36
239064	02RICHG1	1.07
239067	02RICHG4	11.51
239068	02RICHG5	11.51
239069	02RICHG6	11.51
934901	AD1-119 C O1	1.24
934902	AD1-119 E O1	2.02
247534	R-048 C	0.63
247928	R-048 E	2.51
926811	AC1-167 C	2.38
926812	AC1-167 E	1.16
926941	AC1-181	2.49

Appendix 3

(AEP - AEP) The 05HAVILN-05E LIMA 138 kV line (from bus 243017 to bus 242989 ckt 1) loads from 121.63% to 129.12% (**DC power flow**) of its emergency rating (220 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#7528_05ALLEN 138-T131-FSA'. This project contributes approximately 16.39 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#7528_05ALLEN 138-T131-FSA'

OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN
138 243383 05TILLMA 138 1

OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN
138 247521 T-131 C 138 1

OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383
05TILLMA 138 246950 05TIMBSS 138 1

OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383
05TILLMA 138 246265 05TILLMAN 34.5 1

OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14
8 34.5 246265 05TILLMAN 34.5 1

OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051
05NDELPH 138 247521 T-131 C 138 1

OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051
05NDELPH 138 243175 05N DELPHO 69.0 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
246953	05TIMB G C	3.75
247911	05TIMB G E	76.88
934741	AD1-101 C O1	3.24
934742	AD1-101 E O1	5.29
934901	AD1-119 C O1	6.23
934902	AD1-119 E O1	10.16
247534	R-048 C	3.15
247928	R-048 E	12.61
247607	VI-011 C	8.27
247959	VI-011 E	55.37
247608	VI-012 C	12.41
247960	VI-012 E	83.05
926811	AC1-167 C	8.47
926812	AC1-167 E	4.11
926901	AC1-176 C	4.84
926902	AC1-176 E	32.52

Appendix 4

(AEP - AEP) The 05NDELPH-05E SIDE 138 kV line (from bus 243051 to bus 242991 ckt 1) loads from 106.76% to 109.99% (**DC power flow**) of its emergency rating (167 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#7528_05ALLEN 138-'. This project contributes approximately 5.36 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#7528_05ALLEN 138-'

OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN
138 243383 05TILLMA 138 1

OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN
138 247521 T-131 C 138 1

OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383
05TILLMA 138 246950 05TIMBSS 138 1

OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383
05TILLMA 138 246265 05TILLMAN 34.5 1

OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14
8 34.5 246265 05TILLMAN 34.5 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
247911	05TIMB G E	10.99
934741	AD1-101 C O1	4.14
934742	AD1-101 E O1	6.76
934901	AD1-119 C O1	2.04
934902	AD1-119 E O1	3.32
247534	R-048 C	1.03
247928	R-048 E	4.13
247521	T-131 C	4.32
247925	T-131 E	88.06
247607	V1-011 C	1.18
247959	V1-011 E	7.92
247608	V1-012 C	1.77
247960	V1-012 E	11.88
926811	AC1-167 C	3.23
926812	AC1-167 E	1.57
926861	AC1-173 C	7.27
926862	AC1-173 E	48.43
926901	AC1-176 C	0.69
926902	AC1-176 E	4.65

Appendices – Option 2

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 gauge 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 05TIMBSS-05TILLMA 138 kV line (from bus 246950 to bus 243383 ckt 1) loads from 96.72% to 102.35% (**DC power flow**) of its emergency rating (332 MVA) for the tower line contingency outage of 'AEP_P7-1_#6676_T131-FSA'. This project contributes approximately 18.71 MW to the thermal violation.

CONTINGENCY 'AEP_P7-1_#6676_T131-FSA'

OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA
138 243017 05HAVILN 138 1
OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1 / 242991 05E SIDE
138 243051 05NDELPH 138 1
OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1 / 242991 05E SIDE
138 243108 05STRLN1 138 1
OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051
05NDELPH 138 247521 T-131 C 138 1
OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051
05NDELPH 138 243175 05N DELPHO 69.0 1
OPEN BRANCH FROM BUS 245874 TO BUS 243175 CKT 1 / 245874 05E
DELPHO 69.0 243175 05N DELPHO 69.0 1
OPEN BRANCH FROM BUS 245878 TO BUS 243175 CKT 1 / 245878
05FTJENNG8 69.0 243175 05N DELPHO 69.0 1
OPEN BRANCH FROM BUS 243175 TO BUS 245902 CKT 1 / 243175 05N
DELPHO 69.0 245902 05S DELPHO 69.0 1
OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN
138 247521 T-131 C 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
246953	05TIMB G C	5.06
247911	05TIMB G E	103.83
934741	AD1-101 C O2	2.28
934742	AD1-101 E O2	3.72
934901	AD1-119 C O2	7.11
934902	AD1-119 E O2	11.6
LTF	AMIL	0.03
LTF	BAYOU	0.09
LTF	BIG_CAJUN1	0.13
LTF	BIG_CAJUN2	0.26
LTF	BLUEG	0.17
LTF	CALDERWOOD	0.03
LTF	CANNELTON	0.03
LTF	CATAWBA	0.01
LTF	CBM-N	< 0.01
LTF	CELEVELAND	0.04
LTF	CHEOAH	0.03

<i>LTF</i>	<i>CHILHOWEE</i>	<i>0.01</i>
<i>LTF</i>	<i>CHOCTAW</i>	<i>0.08</i>
<i>LTF</i>	<i>CLIFTY</i>	<i>0.47</i>
<i>LTF</i>	<i>COTTONWOOD</i>	<i>0.34</i>
<i>LTF</i>	<i>EDWARDS</i>	<i>0.06</i>
<i>LTF</i>	<i>ELMERSMITH</i>	<i>0.09</i>
<i>LTF</i>	<i>FARMERCITY</i>	<i>0.04</i>
<i>LTF</i>	<i>G-007A</i>	<i>0.03</i>
<i>LTF</i>	<i>GIBSON</i>	<i>0.07</i>
<i>LTF</i>	<i>HAMLET</i>	<i>0.04</i>
<i>LTF</i>	<i>MECS</i>	<i>0.4</i>
<i>LTF</i>	<i>MORGAN</i>	<i>0.13</i>
<i>LTF</i>	<i>NEWTON</i>	<i>0.15</i>
<i>LTF</i>	<i>NYISO</i>	<i>0.1</i>
<i>LTF</i>	<i>O-066A</i>	<i>0.01</i>
<i>LTF</i>	<i>PRAIRIE</i>	<i>0.27</i>
<i>247534</i>	<i>R-048 C</i>	<i>4.19</i>
<i>247928</i>	<i>R-048 E</i>	<i>16.78</i>
<i>LTF</i>	<i>ROWAN</i>	<i>0.03</i>
<i>LTF</i>	<i>SANTEETLA</i>	<i>< 0.01</i>
<i>LTF</i>	<i>SMITHLAND</i>	<i>0.02</i>
<i>LTF</i>	<i>TATANKA</i>	<i>0.07</i>
<i>LTF</i>	<i>TILTON</i>	<i>0.08</i>
<i>LTF</i>	<i>TRIMBLE</i>	<i>0.03</i>
<i>LTF</i>	<i>TVA</i>	<i>0.06</i>
<i>LTF</i>	<i>UNIONPOWER</i>	<i>0.05</i>
<i>247607</i>	<i>V1-011 C</i>	<i>10.13</i>
<i>247959</i>	<i>V1-011 E</i>	<i>67.8</i>
<i>247608</i>	<i>V1-012 C</i>	<i>15.2</i>
<i>247960</i>	<i>V1-012 E</i>	<i>101.7</i>
<i>LTF</i>	<i>VFT</i>	<i>0.07</i>
<i>LTF</i>	<i>X1-078</i>	<i>0.02</i>
<i>926811</i>	<i>AC1-167 C</i>	<i>10.01</i>
<i>926812</i>	<i>AC1-167 E</i>	<i>4.86</i>
<i>926901</i>	<i>AC1-176 C</i>	<i>6.53</i>
<i>926902</i>	<i>AC1-176 E</i>	<i>43.92</i>

Appendix 2

(FE - FE) The 02RICHLD-02NAOMI 138 kV line (from bus 239070 to bus 238521 ckt 1) loads from 107.06% to 108.32% (**DC power flow**) of its emergency rating (194 MVA) for the line fault with failed breaker contingency outage of 'ATSI-P2-4-TE-138-002T'. This project contributes approximately 3.69 MW to the thermal violation.

CONTINGENCY 'ATSI-P2-4-TE-138-002T'

/* RICHLAND 13249

BREAKER (LJ TIE)

DISCONNECT BUS 239065

/* 02RICHG2&3 13

DISCONNECT BUS 238522

/* 02RCHLN 69

DISCONNECT BUS 238556

/* 02AYERSV 138

DISCONNECT BUS 238511

/* 02GMC-J 138

DISCONNECT BRANCH FROM BUS 239269 TO BUS 239070 CKT ZB
138 02RICHLD 138

/* 02RICHLJ

DISCONNECT BUS 242993

/* 05E.LPSC 138

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
240968	02BG2 GEN	-0.36
239064	02RICHG1	1.07
239067	02RICHG4	11.51
239068	02RICHG5	11.51
239069	02RICHG6	11.51
934901	AD1-119 C O2	1.4
934902	AD1-119 E O2	2.29
LTF	CARR	0.17
LTF	CBM-S1	1.07
LTF	CBM-S2	0.28
LTF	CBM-W1	0.21
LTF	CBM-W2	8.58
LTF	CIN	1.49
LTF	CPL	0.04
LTF	DEARBORN	1.91
LTF	G-007	0.31
LTF	IPL	0.99
LTF	LGEE	0.22
LTF	MEC	2.89
LTF	O-066	1.06
247534	R-048 C	0.63
247928	R-048 E	2.51
LTF	RENSSELAER	0.13
LTF	ROSETON	0.97
LTF	WEC	0.48
926811	AC1-167 C	2.38

<i>926812</i>	<i>ACI-167 E</i>	<i>1.16</i>
<i>926941</i>	<i>ACI-181</i>	<i>2.49</i>

Appendix 3

(AEP - AEP) The 05HAVILN-05E LIMA 138 kV line (from bus 243017 to bus 242989 ckt 1) loads from 121.37% to 127.87% (**DC power flow**) of its emergency rating (220 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#7528_05ALLEN 138-T131-FSA'. This project contributes approximately 14.21 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#7528_05ALLEN 138-T131-FSA'
 OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN
 138 243383 05TILLMA 138 1
 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN
 138 247521 T-131 C 138 1
 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383
 05TILLMA 138 246950 05TIMBSS 138 1
 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383
 05TILLMA 138 246265 05TILLMAN 34.5 1
 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14
 8 34.5 246265 05TILLMAN 34.5 1
 OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051
 05NDELPH 138 247521 T-131 C 138 1
 OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051
 05NDELPH 138 243175 05N DELPHO 69.0 1
 END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
246953	05TIMB G C	3.75
247911	05TIMB G E	76.88
934741	AD1-101 C O2	3.07
934742	AD1-101 E O2	5.02
934901	AD1-119 C O2	5.4
934902	AD1-119 E O2	8.81
LTF	CARR	0.03
LTF	CATAWBA	< 0.01
LTF	CBM-S1	0.22
LTF	CBM-W1	2.1
LTF	CBM-W2	2.34
LTF	CIN	0.39
LTF	G-007	0.08
LTF	HAMLET	< 0.01
LTF	IPL	0.26
LTF	LGEE	0.04
LTF	MEC	0.97
LTF	MECS	0.36
LTF	O-066	0.26
247534	R-048 C	3.15
247928	R-048 E	12.61

<i>LTF</i>	<i>RENSSELAER</i>	<i>0.03</i>
<i>LTF</i>	<i>ROSETON</i>	<i>0.18</i>
<i>LTF</i>	<i>ROWAN</i>	<i>< 0.01</i>
<i>247607</i>	<i>VI-011 C</i>	<i>8.27</i>
<i>247959</i>	<i>VI-011 E</i>	<i>55.37</i>
<i>247608</i>	<i>VI-012 C</i>	<i>12.41</i>
<i>247960</i>	<i>VI-012 E</i>	<i>83.05</i>
<i>LTF</i>	<i>WEC</i>	<i>0.17</i>
<i>926811</i>	<i>ACI-167 C</i>	<i>8.47</i>
<i>926812</i>	<i>ACI-167 E</i>	<i>4.11</i>
<i>926901</i>	<i>ACI-176 C</i>	<i>4.84</i>
<i>926902</i>	<i>ACI-176 E</i>	<i>32.52</i>

Appendix 4

(AEP - AEP) The 05NDELPH-05E SIDE 138 kV line (from bus 243051 to bus 242991 ckt 1) loads from 107.17% to 108.45% (**DC power flow**) of its emergency rating (167 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#7528_05ALLEN 138-'. This project contributes approximately 4.71 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#7528_05ALLEN 138-'

OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN
138 243383 05TILLMA 138 1

OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN
138 247521 T-131 C 138 1

OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383
05TILLMA 138 246950 05TIMBSS 138 1

OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383
05TILLMA 138 246265 05TILLMAN 34.5 1

OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14
8 34.5 246265 05TILLMAN 34.5 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
247911	05TIMB G E	10.99
934741	AD1-101 C O2	4.39
934742	AD1-101 E O2	7.16
934901	AD1-119 C O2	1.79
934902	AD1-119 E O2	2.92
LTF	BLUEG	0.02
LTF	CALDERWOOD	< 0.01
LTF	CARR	0.01
LTF	CATAWBA	< 0.01
LTF	CBM-W1	1.
LTF	CBM-W2	0.41
LTF	CELEVELAND	0.03
LTF	CHEOAH	< 0.01
LTF	CHILHOWEE	< 0.01
LTF	CIN	0.07
LTF	CLIFTY	0.26
LTF	G-007	0.04
LTF	HAMLET	0.03
LTF	IPL	0.05
LTF	MEC	0.29
LTF	MECS	0.46
LTF	MORGAN	< 0.01
LTF	O-066	0.12
247534	R-048 C	1.03
247928	R-048 E	4.13

<i>LTF</i>	<i>RENSSELAER</i>	<i>< 0.01</i>
<i>LTF</i>	<i>ROSETON</i>	<i>0.06</i>
<i>LTF</i>	<i>ROWAN</i>	<i>0.02</i>
<i>LTF</i>	<i>SANTEETLA</i>	<i>< 0.01</i>
<i>247521</i>	<i>T-131 C</i>	<i>4.32</i>
<i>247925</i>	<i>T-131 E</i>	<i>88.06</i>
<i>LTF</i>	<i>TRIMBLE</i>	<i>< 0.01</i>
<i>LTF</i>	<i>TVA</i>	<i>< 0.01</i>
<i>LTF</i>	<i>UNIONPOWER</i>	<i>< 0.01</i>
<i>247607</i>	<i>VI-011 C</i>	<i>1.18</i>
<i>247959</i>	<i>VI-011 E</i>	<i>7.92</i>
<i>247608</i>	<i>VI-012 C</i>	<i>1.77</i>
<i>247960</i>	<i>VI-012 E</i>	<i>11.88</i>
<i>LTF</i>	<i>WEC</i>	<i>0.06</i>
<i>926811</i>	<i>AC1-167 C</i>	<i>3.23</i>
<i>926812</i>	<i>AC1-167 E</i>	<i>1.57</i>
<i>926861</i>	<i>AC1-173 C</i>	<i>7.27</i>
<i>926862</i>	<i>AC1-173 E</i>	<i>48.43</i>
<i>926901</i>	<i>AC1-176 C</i>	<i>0.69</i>
<i>926902</i>	<i>AC1-176 E</i>	<i>4.65</i>