

***Generation Interconnection
Feasibility Study Report***

For

***PJM Generation Interconnection Request
Queue Position AC2-062***

***Emerald Switch (AEP) - Kenton (LGE/KU)
138kV***

September 2017

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 #AC2-062, a 55.0 MW (38.0 MW Capacity) solar generating facility in Hancock County, Ohio. The primary point of interconnection is to AEP's Emerald Switch – Kenton (LGE/KU) section of the Hillsboro – Kenton 138 kV tie-line (see Figure 1). The secondary point of interconnection is to AEP's Seaman - Sardinia 69 kV circuit (see Figure 3).

The requested in service date is December 31, 2019.

Attachment Facilities

Primary Point of Interconnection (Emerald Switch - Kenton (LGE/KU) 138kV)

To accommodate the interconnection on the Emerald - Kenton (LGE/KU) 138 kV section of the Hillsboro – Kenton 138 kV tie-line, a new three (3) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus 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. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

New Switching Station Work:

- Construct a new three (3) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus. Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required (see Figure 1).
- **Estimated Station Cost: \$6,300,000**

Direct Connection Cost Estimate

The total preliminary cost estimate for Direct Connection work is given in the following tables below.

For AEP building Direct Connection cost estimates:

Description	Total Cost
Emerald Switch - Kenton (LGE/KU) 138 kV T-Line Cut In	\$1,500,000
Total	\$1,500,000

Table 1

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
138 kV Revenue Metering	\$250,000
Upgrade line protection and controls at the Emerald 138 kV station.	\$250,000
Upgrade line protection and controls at the Wildcat 138 kV substation.	\$250,000
Upgrade line protection and controls at the Kenton (LGE/KU) 138 kV substation.	LGE/KU to provide estimates
Total	\$750,000

Table 2

Secondary Point of Interconnection (Seaman – Sardinia 69kV)

To accommodate the interconnection on the Seaman – Sardinia 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 2). 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 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 new 138 kV switching station 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.

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 AC2-062 was evaluated as a 55.0 MW (Capacity 38.0 MW) injection tapping the Emerald – Kenton (LGE/KU) 138 kV line in the AEP area. Project AC2-062 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-062 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2020

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
462_B3_05MILLBR 138-5_WOMOAB	CONTINGENCY '462_B3_05MILLBR 138-5_WOMOAB' OPEN BRANCH FROM BUS 242988 TO BUS 243042 CKT 1 / 242988 05DOGWOO 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243069 TO BUS 243042 CKT 1 / 243069 05FIREBR 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 243047 CKT 1 / 243042 05MILLBR 138 243047 05N PORT 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 243173 CKT 1 / 243042 05MILLBR 138 243173 05MILLBRK 69.0 1 END
5891_B2_TOR607	CONTINGENCY '5891_B2_TOR607' OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END
7342_B2_TOR7202268	CONTINGENCY '7342_B2_TOR7202268' OPEN BRANCH FROM BUS 246911 TO BUS 243019 CKT 1 / 246911 05HIGHLA 138 243019 05HILLSB 138 1 END
7353_B2_TOR12737	CONTINGENCY '7353_B2_TOR12737' OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 243019 05HILLSB 138 249995 08CLINCO 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1 END
7954_C1_05MILLBR 138-2_A	CONTINGENCY '7954_C1_05MILLBR 138-2_A' OPEN BRANCH FROM BUS 243042 TO BUS 243088 CKT 1 / 243042 05MILLBR 138 243088 05S POIN 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 931350 CKT 1 / 243042 05MILLBR 138 931350 AC2-049 TAP 138 1

Contingency Name	Description
	END
7965_C2_05MILLBR 138-N	CONTINGENCY '7965_C2_05MILLBR 138-N' OPEN BRANCH FROM BUS 242988 TO BUS 243042 CKT 1 / 242988 05DOGWOO 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243069 TO BUS 243042 CKT 1 / 243069 05FIREBR 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 243047 CKT 1 / 243042 05MILLBR 138 243047 05N PORT 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 243173 CKT 1 / 243042 05MILLBR 138 243173 05MILLBRK 69.0 1 OPEN BRANCH FROM BUS 243047 TO BUS 243819 CKT 1 / 243047 05N PORT 138 243819 05N PORTSM 69.0 1 OPEN BRANCH FROM BUS 243819 TO BUS 243826 CKT 1 / 243819 05N PORTSM 69.0 243826 05ORTELCRN 69.0 1 OPEN BRANCH FROM BUS 243819 TO BUS 243822 CKT 1 / 243819 05N PORTSM 69.0 243822 05ROSEMOUN 69.0 1 END
7970_C2_05MILLBR 138-G	CONTINGENCY '7970_C2_05MILLBR 138-G' OPEN BRANCH FROM BUS 242988 TO BUS 243042 CKT 1 / 242988 05DOGWOO 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243069 TO BUS 243042 CKT 1 / 243069 05FIREBR 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243688 TO BUS 243042 CKT 1 / 243688 05FULLER 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243688 TO BUS 342538 CKT 1 / 243688 05FULLER 138 342538 4ARGENTUM 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 243047 CKT 1 / 243042 05MILLBR 138 243047 05N PORT 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 243173 CKT 1 / 243042 05MILLBR 138 243173 MILLBRK 69.0 1 OPEN BRANCH FROM BUS 243688 TO BUS 244686 CKT 1 / 243688 05FULLER 138 244686 VANCEBRG 12.0 1 END
7981_A	CONTINGENCY '7981_A' OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-061 TAP 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END

Contingency Name	Description
7981_B	CONTINGENCY '7981_B' OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061 TAP 138 249995 08CLINCO 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END
8107_C2_05HILLSB 138-C_A	CONTINGENCY '8107_C2_05HILLSB 138-C_A' OPEN BRANCH FROM BUS 246911 TO BUS 243019 CKT 1 / 246911 05HIGHLA 138 243019 05HILLSB 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 END
8107_C2_05HILLSB 138-C_B	CONTINGENCY '8107_C2_05HILLSB 138-C_B' OPEN BRANCH FROM BUS 246911 TO BUS 243019 CKT 1 / 246911 05HIGHLA 138 243019 05HILLSB 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END
8108_C2_05HILLSB 138-D_A	CONTINGENCY '8108_C2_05HILLSB 138-D_A' OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-061 TAP 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END
8109_C2_05HILLSB 138-A_A	CONTINGENCY '8109_C2_05HILLSB 138-A_A' OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB 138 243102 05SINKG8 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049 TAP 138 243102 05SINKG8 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END
DAY_L34509	CONTINGENCY 'DAY_L34509' OPEN LINE FROM BUS 253077 TO BUS 253014 CKT 1 /* 09STUART 345 - 09CLINTO 345 OPEN LINE FROM BUS 253077 TO BUS 253076 CKT 1 /* 09STUART 345 - 09STUART

Contingency Name	Description
	138 END
DAY_L34553-2	CONTINGENCY 'DAY_L34553-2' OPEN LINE FROM BUS 253077 TO BUS 342838 CKT 1 /* 09STUART 345 - 20SPURLK 345 /* BUS 342525 -> 342623. REMOVE UNIT 4 FROM BUS 253077 /* 09STUART 345 - ST GEN4 END
P1-#..B2 SPURLOCK-STUART 34553	CONTINGENCY 'P1-#..B2 SPURLOCK-STUART 34553' OPEN BRANCH FROM BUS 253077 TO BUS 342838 CKT 1 END
P1-#..B2 WARREN-CLINTONCO-HILLSBORO 2381	CONTINGENCY 'P1-#..B2 WARREN-CLINTONCO-HILLSBORO 2381' OPEN BUS 249995 END
P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	CONTINGENCY 'P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381' OPEN BRANCH FROM BUS 249995 TO BUS 931430 CKT 1 END
P7-1..C5 4541MELDAHLSPRLCKSTUARTSPURLOCKDPLEK	CONTINGENCY 'P7-1..C5 4541MELDAHLSPRLCKSTUARTSPURLOCKDPLEK' OPEN BRANCH FROM BUS 342838 TO BUS 249581 CKT 1 OPEN BRANCH FROM BUS 253077 TO BUS 342838 CKT 1 END

Table 3

Generator Deliverability

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

AC2-062 Generator Deliverability														
#	Type	Contingency Name	Affected Area	Facility Description	Bus				Loading		Rating		MW Con.	FG App.
					From	To	Cir.	PF	Initial	Final	Type	MVA		
1	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - DAY	05HILLSB-09MIDDLE 138 kV line	243019	253111	1	DC	97.61	99.57	ER	185	3.62	
2	N-1	7353_B2_TOR12737	AEP - DAY	05HILLSB-09MIDDLE 138 kV line	243019	253111	1	DC	97.5	99.46	ER	185	3.62	
3	Non	Non	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	93.29	95.86	NR	159	4.09	
4	N-1	7342_B2_TOR7202268	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	94.91	97.6	ER	198	5.33	
5	N-1	5891_B2_TOR607	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	93.65	96.11	ER	198	4.86	
6	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	95.34	97.3	ER	185	3.62	
7	N-1	7353_B2_TOR12737	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	95.23	97.19	ER	185	3.62	

AC2-062 Generator Deliverability														
		Contingency	Affected	Facility	Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
8	N-1	7353_B2_TOR12737	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	95.41	98.42	ER	179	5.39	
9	N-1	P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	95.36	98.37	ER	179	5.39	

Table 4

Multiple Facility Contingency

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

AC2-062 Multiple Facility Contingency														
#	Type	Contingency Name	Affected Area	Facility Description	From	Bus To	Cir.	PF	Initial	Final	Rating Type	MVA	MW Con.	FG App.
1	DCTL	7981_B	AEP - AEP	05MILLBR-05N PORT 138 kV line	243042	243047	1	DC	96.47	97.17	ER	185	2.89	
2	DCTL	7981_A	AEP - AEP	05MILLBR-05N PORT 138 kV line	243042	243047	1	DC	89.55	90.25	ER	185	2.89	
3	LFFB	7965_C2_05MILLBR 138-N	AEP - AEP	05MILLBR-05S POIN 138 kV line	243042	243088	1	DC	89.77	90.66	ER	167	3.3	
4	DCTL	7981_B	AEP - AEP	05HIGHLA-05NMARSS 138 kV line	246911	247035	1	DC	97.67	99.57	ER	310	5.89	1
5	DCTL	7981_B	AEP - AEP	05NMARSS-05SEAMAN 138 kV line	247035	243571	1	DC	94.28	96.18	ER	310	5.89	2

Table 5

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)

AC2-062 Contribution to Previously Identified Overloads														
Contingency			Affected Area	Facility Description	Bus		Loading				Rating		MW Con.	FG App.
#	Type	Name			From	To	Cir.	PF	Initial	Final	Type	MVA		
1	DCTL	7981_B	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	237.65	242.84	ER	185	9.59	3
2	LFFB	8107_C2_05HILLS B 138-C_B	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	229.18	234.47	ER	185	9.79	
3	LFFB	8107_C2_05HILLS B 138-C_A	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	229.13	234.42	ER	185	9.79	
4	DCTL	7981_A	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	215.65	220.83	ER	185	9.59	
5	DCTL	7981_B	AEP - AEP	05HILLSB-05HIGHLA 138 kV line	243019	246911	1	DC	130.5	132.89	ER	413	9.88	4
6	LFFB	8108_C2_05HILLS B 138-D_A	AEP - AEP	05HILLSB-05HIGHLA 138 kV line	243019	246911	1	DC	120.08	122.47	ER	413	9.88	
7	DCTL	7981_A	AEP - AEP	05HILLSB-05HIGHLA 138 kV line	243019	246911	1	DC	120.08	122.47	ER	413	9.88	
8	BUS	7954_C1_05MILLB R 138-2_A	AEP - AEP	05HILLSB-05HIGHLA 138 kV	243019	246911	1	DC	101.59	103.55	ER	413	8.08	

AC2-062 Contribution to Previously Identified Overloads														
#	Contingency		Affected Area	Facility Description	Bus				Loading		Rating		MW Con.	FG App.
	Type	Name			From	To	Cir.	PF	Initial	Final	Type	MVA		
				line										
9	BUS	7954_C1_05MILLB R 138-2_A	AEP - DAY	05HILLSB-09MIDDLE 138 kV line	243019	253111	1	DC	157.34	158.6	ER	185	5.21	5
10	LFFB	8107_C2_05HILLS B 138-C_A	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	248.13	253.39	ER	184	9.67	6
11	LFFB	8107_C2_05HILLS B 138-C_B	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	248.07	253.33	ER	184	9.67	
12	LFFB	8109_C2_05HILLS B 138-A_A	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	239.04	244.23	ER	184	9.56	
13	BUS	7954_C1_05MILLB R 138-2_A	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	191.99	196.16	ER	184	7.67	
14	N-1	5891_B2_TOR607	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	102.8	105.44	ER	184	4.86	
15	N-1	7342_B2_TOR7202 268	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	103.58	106.48	ER	184	5.33	
16	LFFB	8107_C2_05HILLS B 138-C_A	AEP - AEP	05MILLBR-05N PORT 138 kV line	243042	243047	1	DC	105.82	106.61	ER	185	3.26	7
17	LFFB	8107_C2_05HILLS B 138-C_B	AEP - AEP	05MILLBR-05N PORT 138 kV line	243042	243047	1	DC	105.82	106.61	ER	185	3.26	
18	LFFB	7970_C2_05MILLB R 138-G	AEP - AEP	05MILLBR-05S POIN 138 kV line	243042	243088	1	DC	113.98	115.05	ER	167	3.96	8
19	DCTL	7981_B	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	243.67	249.02	ER	179	9.59	9
20	LFFB	8107_C2_05HILLS B 138-C_A	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	234.85	240.32	ER	179	9.79	
21	LFFB	8107_C2_05HILLS B 138-C_B	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	234.85	240.32	ER	179	9.79	
22	DCTL	7981_A	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	220.86	226.22	ER	179	9.59	
23	DCTL	7981_B	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	169.36	170.76	ER	150	4.65	10
24	LFFB	8109_C2_05HILLS B 138-A_A	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	164.74	166.2	ER	150	4.85	
25	LFFB	8108_C2_05HILLS B 138-D_A	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	156.33	157.73	ER	150	4.65	
26	DCTL	7981_A	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	156.33	157.73	ER	150	4.65	
27	BUS	7954_C1_05MILLB R 138-2_A	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	137.46	138.66	ER	150	3.99	
28	DCTL	7981_B	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	155.68	157.04	ER	150	4.53	11
29	LFFB	8109_C2_05HILLS B 138-A_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	150.13	151.54	ER	150	4.69	
30	LFFB	8108_C2_05HILLS B 138-D_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	142.85	144.21	ER	150	4.53	
31	DCTL	7981_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	142.85	144.21	ER	150	4.53	

AC2-062 Contribution to Previously Identified Overloads														
#	Contingency		Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating		MW Con.	FG App.
	Type	Name			From	To			Initial	Final	Type	MVA		
32	BUS	7954_C1_05MILLB R 138-2_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	124.03	125.19	ER	150	3.85	
33	DCTL	7981_B	AEP - AEP	05HIGHLA 138/69 kV transformer	246911	243606	3	DC	213.81	215.29	ER	122	3.99	12
34	LFFB	8108_C2_05HILLS B 138-D_A	AEP - AEP	05HIGHLA 138/69 kV transformer	246911	243606	3	DC	199.49	200.96	ER	122	3.99	
35	DCTL	7981_A	AEP - AEP	05HIGHLA 138/69 kV transformer	246911	243606	3	DC	199.49	200.96	ER	122	3.99	
36	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - AEP	05HIGHLA 138/69 kV transformer	246911	243606	3	DC	110.19	111.98	ER	122	2.18	
37	N-1	P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381	AEP - AEP	05HIGHLA 138/69 kV transformer	246911	243606	3	DC	110.11	111.9	ER	122	2.18	
38	DCTL	7981_B	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	159.16	160.56	ER	150	4.65	13
39	LFFB	8109_C2_05HILLS B 138-A_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	154.54	156	ER	150	4.85	
40	LFFB	8108_C2_05HILLS B 138-D_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	146.13	147.53	ER	150	4.65	
41	DCTL	7981_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	146.13	147.53	ER	150	4.65	
42	BUS	7954_C1_05MILLB R 138-2_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	127.26	128.46	ER	150	3.99	
43	LFFB	8107_C2_05HILLS B 138-C_A	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	246.64	251.53	ER	198	9.67	14
44	LFFB	8107_C2_05HILLS B 138-C_B	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	246.59	251.48	ER	198	9.67	
45	LFFB	8109_C2_05HILLS B 138-A_A	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	237.95	242.78	ER	198	9.56	
46	BUS	7954_C1_05MILLB R 138-2_A	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	190.76	194.64	ER	198	7.67	
47	BUS	7954_C1_05MILLB R 138-2_A	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	155.07	156.33	ER	185	5.21	15
48	DCTL	P7-1..C5 4541MELDAHLSP RLCKSTUARTSPU RLOCKDPLEK	AEP - AEP	AC1-089 TAP-05HILLSB 138 kV line	926100	243019	1	DC	143.03	155.93	ER	185	23.86	16
49	LFFB	DAY_L34509	AEP - AEP	AC1-089 TAP-05HILLSB 138 kV line	926100	243019	1	DC	121.61	133.7	ER	185	22.35	
50	LFFB	DAY_L34553-2	AEP - AEP	AC1-089 TAP-05HILLSB 138 kV line	926100	243019	1	DC	120.75	133.12	ER	185	22.89	
51	DCTL	7981_B	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	262.32	267.67	ER	179	9.59	17
52	LFFB	8107_C2_05HILLS B 138-C_B	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	253.5	258.97	ER	179	9.79	
53	LFFB	8107_C2_05HILLS B 138-C_A	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	253.5	258.97	ER	179	9.79	
54	DCTL	7981_A	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	239.51	244.87	ER	179	9.59	

AC2-062 Contribution to Previously Identified Overloads														
#	Contingency		Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating		MW Con.	FG App.
	Type	Name			From	To			Initial	Final	Type	MVA		
55	LFFB	8107_C2_05HILLS B 138-C_B	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	279.94	285.2	ER	184	9.67	18
56	LFFB	8107_C2_05HILLS B 138-C_A	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	279.94	285.2	ER	184	9.67	
57	LFFB	8109_C2_05HILLS B 138-A_A	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	270.6	275.8	ER	184	9.56	
58	BUS	7954_C1_05MILLB R 138-2_A	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	220.13	224.3	ER	184	7.67	
59	N-1	7342_B2_TOR7202 268	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	117.62	120.52	ER	184	5.33	
60	N-1	5891_B2_TOR607	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	116.21	118.86	ER	184	4.86	
61	Non	Non	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	107.58	110.15	NR	159	4.09	
62	DCTL	7981_B	AEP - LGEE	AC2-062 TAP-4KENTON 138 kV line	931440	324267	1	DC	169.39	188.59	ER	185	35.53	19
63	LFFB	8107_C2_05HILLS B 138-C_B	AEP - LGEE	AC2-062 TAP-4KENTON 138 kV line	931440	324267	1	DC	159.02	178.23	ER	185	35.54	
64	LFFB	8107_C2_05HILLS B 138-C_A	AEP - LGEE	AC2-062 TAP-4KENTON 138 kV line	931440	324267	1	DC	159.02	178.23	ER	185	35.54	
65	DCTL	7981_A	AEP - LGEE	AC2-062 TAP-4KENTON 138 kV line	931440	324267	1	DC	151.46	170.67	ER	185	35.53	

Table 6

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

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.

AC2-062 Delivery of Energy Portion of Interconnection Request													
#	Type	Contingency	Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating		MW Con.
		Name			From	To			Initial	Final	Type	MVA	
1	N-1	7353_B2_TOR12737	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	180.32	184.53	ER	185	7.8
2	Non	Non	AEP - AEP	05HILLSB-05HIGHLA 138 kV line	243019	246911	1	DC	115.47	117.56	NR	296	6.18
3	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - AEP	05HILLSB-05HIGHLA 138 kV line	243019	246911	1	DC	104.23	106.14	ER	413	7.92
4	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - DAY	05HILLSB-09MIDDLE 138 kV line	243019	253111	1	DC	164	165.27	ER	185	5.24
5	N-1	7342_B2_TOR7202268	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	191.7	195.89	ER	184	7.71
6	Non	Non	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	177.1	180.82	NR	159	5.92
7	N-1	462_B3_05MILLBR 138-5 WOMOAB	AEP - AEP	05MILLBR-05S POIN 138 kV line	243042	243088	1	DC	89.74	90.63	ER	167	3.29
8	N-1	P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	184.35	188.71	ER	179	7.8
9	N-1	P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	135.73	136.87	ER	150	3.8
10	N-1	7353_B2_TOR12737	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	123.22	124.32	ER	150	3.68
11	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - AEP	05HIGHLA 138/69 kV transformer	246911	243606	3	DC	173.84	175	ER	122	3.16
12	N-1	P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	125.53	126.67	ER	150	3.8
13	N-1	7342_B2_TOR7202268	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	190.62	194.51	ER	198	7.71
14	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	161.73	163	ER	185	5.24
15	N-1	P1-#.B2 SPURLOCK-STUART 34553	AEP - AEP	AC1-089 TAP-05HILLSB 138 kV line	926100	243019	1	DC	117.99	130.37	ER	185	22.89
16	N-1	7353_B2_TOR12737	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	202.15	206.51	ER	179	7.8
17	N-1	7342_B2_TOR7202268	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138	931430	249995	1	DC	219.97	224.16	ER	184	7.71

AC2-062 Delivery of Energy Portion of Interconnection Request													
#	Type	Contingency Name	Affected Area	Facility Description	Bus		Loading		Rating		MW		
				kV line	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.
18	Non	Non	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	205.94	209.67	NR	159	5.92
19	N-1	7353_B2_TOR12737	AEP - LGEE	AC2-062 TAP-4KENTON 138 kV line	931440	324267	1	DC	121.31	139.71	ER	185	34.03

Table 7

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	05HIGHLA-05NMARSS 138 kV line	Rebuild/reconductor 1.0 miles of the ACSR 636 26/7 conductor section 2. Note: This facility is not overloaded by the AC2-061 project as is shown in table 5 above but the AC2 Queue overloads this facility and the AC2-061 project contributes to the overload.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$1,500,000
#2	05NMARSS-05SEAMAN 138 kV line	Rebuild/reconductor 13.20 miles of the ACSR 636 26/7 conductor section 1. Note: This facility is not overloaded by the AC2-061 project as is shown in table 5 above but the AC2 Queue overloads this facility and the AC2-061 project contributes to the overload.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$19,800,000
Total New Network Upgrades				\$21,300,000

Table 8

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)

(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1	05HILLSB-05SINKG8 138 kV line	Rebuild/Reconductor 4.36 miles of ACSR 477 26/7 conductor section 1. An engineering study will need to be conducted to determine if the Relay Compliance Trip limits settings can be adjusted to mitigate the overload. Replace the Sinking Springs jumpers. Replace the Sinking Spring Switch (1200A) Rebuild/Reconductor 8.93 miles of ACSR 477 26/7 conductor section 2.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$20,500,000
#2	05HILLSB-05HIGHLA 138 kV line	4.24 miles of the ACSR 1033.5 54/7 conductor section 2 will need to be rebuilt/reconducted. 3.15 miles of ACSR 1033.5 54/7 conductor section 1 will need to be rebuilt/reconducted. Replace the Highland Wavetrap (2000A) Replace the Hillsboro Wavetrap (2000A)	An approximate construction time would be 24 to 36 months after signing an interconnection agreement	\$11,190,000
#3	05HILLSB-09MIDDLE 138 kV line	22.3 miles of the ACSR 477 26/7 conductor section 1 will need to be rebuilt/reconducted. An engineering study will need to be conducted to determine if the Relay Compliance Trip limits settings at Hillsboro can be adjusted to mitigate the overload. This is an AEP-DP&L tie line therefore; PJM is going to have to coordinate this upgrade with DP&L as well to make sure that their equipment will not set a limit lower than what is required.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement	\$33,450,000
#4	05HILLSB-AC1-089 TAP 138 kV line	Rebuild/reconductor 8.0 miles of the ACSR 477 26/7 conductor section 1.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$12,000,000
#5	05MILLBR-N PORT 138 kV line	A Sag Study will be required on the 3.44 mile ACSR 477 26/7 conductor section 1 to mitigate the overload.	An approximate time for the sag study is 6 to 12 months after signing an interconnection agreement.	\$15,000

Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#6	05MILLBR-05S POIN 138 kV line	A Sag Study will be required on the 8.5 mile ACSR 397.5 30/7 conductor section 1 to mitigate the overload. Replace the South Point risers Replace the Millbrook Park risers An engineering study will need to be conducted to determine if the Relay Thermal limits settings can be adjusted at South Point to mitigate the overload. Replace the Millbrook Park Wavetrap (800A) Replace the Millbrook Park line risers	An approximate time for the sag study is 6 to 12 months after signing an interconnection agreement. An approximate construction time would be 12 to 24 months after signing an interconnection agreement	\$463,000
#7	05SINKG8-AC2-049 TAP 138 kV line	Conduct an engineering study will to determine if the Relay Compliance Trip limits settings at Millbrook Park can be adjusted. Rebuild/reconductor 20.37 miles of the ACSR 477 26/7 conductor section 3. Replace the Millbrook Park line riser. Replace the Millbrook Park Bus and Risers. Replace the Millbrook Park Trap Riser. Replace the Sinking Spring switch (1200A). A Sag Study will be required on the 20.37 mile ACSR 477 26/7 conduction section 2. A Sag Study will be required on the 20.37 mile ACSR 477 26/7 conduction section 1. Conduct an engineering study will to determine if the Thermal limit settings at Millbrook Park can be adjusted.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$31,800,000
#8	05ADAMS- 05WARERD 138 kV line	Rebuild/reconductor 20.50 miles of the ACSR 336.4 30/7 conductor section 1.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$30,780,000
#9	05SEAMAN- 05ADAMS 138 kV line	Rebuild/reconductor 20.50 miles of the ACSR 336.4 30/7 conductor section 1.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$12,000,000
#10	05WARERD- 05WAVERL 138 kV line	Rebuild/reconductor 3.12 miles of the ACSR 336.4 30/7 conductor section 1. Rebuild/reconductor 4.37 miles of the ACSR 336.4 30/7 conductor section 2.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$11,240,000
	05HILLSB-AC2-061	5.0 miles of the ACSR 477 26/7 conductor section 1 will need to be	An approximate construction time would be 24 to 36 months	\$7,500,000

Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#11	Tap 138 kV line	rebuilt/reconductored. An engineering study will need to be conducted to determine if the Relay Compliance Trip limits settings at Hillsboro can be adjusted to mitigate the overload	after signing an interconnection agreement	
#12	05AC2-049 Tap-05MILLBR 138 kV line	An engineering study will need to be conducted to determine if the Relay Compliance Trip limit settings can be adjusted at Millbrook Park to mitigate the overload. 8.50 miles of ACSR 477 26/7 conductor section 3 will need to be rebuilt/reconductored. Replace the Millbrook Park line risers Replace the Millbrook Park bus and risers Replace the Millbrook Park trap riser Replace the Sinking Spring switch (1200A) 20.4 miles of ACSR 477 26/7 conductor section 2 will need to be rebuilt/reconductored. 9.8 miles of ACSR 477 26/7 conductor section 1 will need to be rebuilt/reconductored. An engineering study will need to be conducted to determine if the Relay Thermal limits settings can be adjusted at Millbrook Park to mitigate the overload. Replace the Hillsboro Wavetrap (2000A)	An approximate construction time would be 24 to 36 months after signing an interconnection agreement	\$59,100,000
#13	AC2-062 TAP-4KENTON 138 kV line	Rebuild/reconductor 18.0 miles of the ACSR 477 26/7 conductor section 1. Replace the Emerald SS Jumpers This is an AEP-LGEE tie line therefore; PJM is going to have to coordinate this upgrade with LGEE as well to make sure that their equipment will not set a limit lower than what is required.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$27,050,000
Total Previous Network Upgrades				\$257,088,000

Table 9

The System Reinforcement listed below is not part of the Bulk Electric System (BES), but was identified by AEP and will be required for the interconnection of AC2-062.

#	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1	05HIGHLA 138/69 kV transformer	Replace the 138/69 kV Transformer #3 at Highland	An approximate construction time will be 12 months after signing of an interconnection agreement.	\$1,500,000
			Total Network Upgrades	\$1,500,000

Table 10

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 In-Service Date is shorter than usual and may be difficult to achieve.

Conclusion

Based upon the results of this Feasibility Study, the construction of the 55.0 MW (38.0 MW Capacity) solar generating facility of the IC (PJM Project #AC2-062) 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 generating facility.

Cost Breakdown for Primary Point of Interconnection (Emerald Switch - Kenton (LGE/KU) 138 kV)		
Attachment Cost	New 138 kV Switching Station	\$6,300,000
Direct Connection Cost Estimate	Emerald Switch - Kenton (LGE/KU) 138 kV T-Line Cut In	\$1,500,000
Non-Direct Connection Cost Estimate	138 kV Revenue Metering	\$250,000
	Upgrade line protection and controls at the Emerald 138 kV station.	\$250,000
	Upgrade line protection and controls at the Wildcat 138 kV substation.	\$250,000
	Upgrade line protection and controls at the Kenton (LGE/KU) 138 kV substation.	LGE-KU to provide estimates
	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>	\$21,300,000
	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>	\$257,088,000
	Previous System Reinforcements-Not part of BES <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>	\$1,500,000
Total Estimated Cost for Project AC2-062		\$288,438,000

Table 11

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 AC2-062 was evaluated as a 55.0 MW (Capacity 38.0 MW) injection tapping the Seaman – Sardinia 69 kV line in the AEP area. Project AC2-062 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-062 was studied with a commercial probability of 53%. Potential network impacts were as follows:

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Contingency Descriptions

The following contingencies resulted in overloads:

Option 2	
Contingency Name	Description
462_B3_05MILLBR 138-5_WOMOAB	CONTINGENCY '462_B3_05MILLBR 138-5_WOMOAB' OPEN BRANCH FROM BUS 242988 TO BUS 243042 CKT 1 / 242988 05DOGWOO 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243069 TO BUS 243042 CKT 1 / 243069 05FIREBR 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 243047 CKT 1 / 243042 05MILLBR 138 243047 05N PORT 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 243173 CKT 1 / 243042 05MILLBR 138 243173 05MILLBRK 69.0 1 END
5891_B2_TOR607	CONTINGENCY '5891_B2_TOR607' OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END
7353_B2_TOR12737	CONTINGENCY '7353_B2_TOR12737' OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 243019 05HILLSB 138 249995 08CLINCO 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1 END
7954_C1_05MILLBR 138-2_A	CONTINGENCY '7954_C1_05MILLBR 138-2_A' OPEN BRANCH FROM BUS 243042 TO BUS 243088 CKT 1 / 243042 05MILLBR 138 243088 05S POIN 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 931350 CKT 1 / 243042 05MILLBR 138 931350 AC2-049 TAP 138 1 END
7965_C2_05MILLBR 138-N	CONTINGENCY '7965_C2_05MILLBR 138-N' OPEN BRANCH FROM BUS 242988 TO BUS 243042 CKT 1 / 242988 05DOGWOO 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243069 TO BUS 243042 CKT 1 / 243069 05FIREBR 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 243047 CKT 1 / 243042 05MILLBR 138 243047 05N PORT 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 243173 CKT 1 / 243042 05MILLBR 138 243173 05MILLBRK 69.0 1

Option 2		
Contingency Name	Description	
	OPEN BRANCH FROM BUS 243047 TO BUS 243819 CKT 1 / 243047 05N PORT 138 243819 05N PORTSM 69.0 1 OPEN BRANCH FROM BUS 243819 TO BUS 243826 CKT 1 / 243819 05N PORTSM 69.0 243826 05ORTELCRN 69.0 1 OPEN BRANCH FROM BUS 243819 TO BUS 243822 CKT 1 / 243819 05N PORTSM 69.0 243822 05ROSEMOUN 69.0 1 END	
7970_C2_05MILLBR 138-G	CONTINGENCY '7970_C2_05MILLBR 138-G' OPEN BRANCH FROM BUS 242988 TO BUS 243042 CKT 1 / 242988 05DOGWOO 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243069 TO BUS 243042 CKT 1 / 243069 05FIREBR 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243688 TO BUS 243042 CKT 1 / 243688 05FULLER 138 243042 05MILLBR 138 1 OPEN BRANCH FROM BUS 243688 TO BUS 342538 CKT 1 / 243688 05FULLER 138 342538 4ARGENTUM 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 243047 CKT 1 / 243042 05MILLBR 138 243047 05N PORT 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 243173 CKT 1 / 243042 05MILLBR 138 243173 MILLBRK 69.0 1 OPEN BRANCH FROM BUS 243688 TO BUS 244686 CKT 1 / 243688 05FULLER 138 244686 VANCEBRG 12.0 1 END	
7981_A	CONTINGENCY '7981_A' OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-061 TAP 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END	
7981_B	CONTINGENCY '7981_B' OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061 TAP 138 249995 08CLINCO 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END	
8108_C2_05HILLSB 138-D_A	CONTINGENCY '8108_C2_05HILLSB 138-D_A' OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-061 TAP 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END	

Option 2	
Contingency Name	Description
8109_C2_05HILLSB 138-A_A	CONTINGENCY '8109_C2_05HILLSB 138-A_A' OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB 138 243102 05SINKG8 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049 TAP 138 243102 05SINKG8 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END
8110_C2_05HILLSB 138-B_A	CONTINGENCY '8110_C2_05HILLSB 138-B_A' OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB 138 243102 05SINKG8 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB 138 926100 AC1-089 TAP 138 1 OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049 TAP 138 243102 05SINKG8 138 1 END
8111_C2_05HILLSB 138-A	CONTINGENCY '8111_C2_05HILLSB 138-A' OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB 138 926100 AC1-089 TAP 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-060 TAP 138 1 END
OUTAGE_02AB	CONTINGENCY 'OUTAGE_02AB' DISCONNECT BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 END
P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381	CONTINGENCY 'P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381' OPEN BUS 249995 END
P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	CONTINGENCY 'P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381' OPEN BRANCH FROM BUS 249995 TO BUS 931430 CKT 1 END

Table 12

Generator Deliverability

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

Option 2														
AC2-062 Generator Deliverability														
#	Type	Contingency Name	Affected Area	Facility Description	Bus		Loading		Rating		MW	FG		
					From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - DAY	05HILLSB-09MIDDLE 138 kV line	243019	253111	1	DC	97.08	98.95	ER	185	3.45	
2	N-1	7353_B2_TOR12737	AEP - DAY	05HILLSB-09MIDDLE 138 kV line	243019	253111	1	DC	96.98	98.84	ER	185	3.45	
3	Non	Non	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	93.4	95.87	NR	159	3.93	

Option 2 AC2-062 Generator Deliverability														
#	Type	Contingency Name	Affected Area	Facility Description	From	To	Cir.	PF	Initial	Final	Rating Type	MVA	MW Con.	FG App.
4	N-1	5891_B2_TOR607	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	93.49	95.84	ER	198	4.66	
5	N-1	OUTAGE_02AB	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	92.93	95.29	ER	198	4.66	
6	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	94.81	96.68	ER	185	3.45	
7	N-1	7353_B2_TOR12737	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	94.71	96.57	ER	185	3.45	
8	N-1	7353_B2_TOR12737	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	95.27	97.97	ER	179	4.83	
9	N-1	P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	95.22	97.91	ER	179	4.83	

Table 13

Multiple Facility Contingency

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

AC2-062 Multiple Facility Contingency														
#	Type	Contingency Name	Affected Area	Facility Description	From	To	Cir.	PF	Initial	Final	Rating Type	MVA	MW Con.	FG App.
1	LFFB	7965_C2_05MILLBR 138-N	AEP - AEP	05MILLBR-05S POIN 138 kV line	243042	243088	1	DC	89.77	90.6	ER	167	3.07	

Table 14

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)

AC2-062 Contribution to Previously Identified Overloads														
#	Type	Contingency Name	Affected Area	Facility Description	From	To	Cir.	PF	Initial	Final	Rating Type	MVA	MW Con.	FG App.
1	DCTL	7981_B	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	236.02	240.71	ER	185	8.68	1
2	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	214.01	218.7	ER	185	8.68	
3	DCTL	7981_A	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	214.01	218.7	ER	185	8.68	
4	LFFB	8111_C2_05HILLSB 138-A_A	AEP - DAY	05HILLSB-09MIDDLE 138 kV line	243019	253111	1	DC	161.64	165.13	ER	185	6.46	2
5	BUS	7954_C1_05MILLBR 138-2_A	AEP - DAY	05HILLSB-09MIDDLE 138 kV line	243019	253111	1	DC	156.72	157.91	ER	185	4.86	
6	DCTL	7981_B	AEP - AEP	05HILLSB-AC1-089 TAP 138 kV line	243019	926100	1	DC	144.33	148.2	ER	185	7.15	3
7	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05HILLSB-AC1-089 TAP 138 kV line	243019	926100	1	DC	126.41	130.27	ER	185	7.15	
8	DCTL	7981_A	AEP - AEP	05HILLSB-AC1-089 TAP 138 kV line	243019	926100	1	DC	126.41	130.27	ER	185	7.15	
9	LFFB	8109_C2_05HILLSB 138-A_A	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	237.39	242.27	ER	184	8.99	4

AC2-062 Contribution to Previously Identified Overloads														
#	Contingency		Affected Area	Facility Description	Bus				Loading		Rating		MW Con.	FG App.
	Type	Name			From	To	Cir.	PF	Initial	Final	Type	MVA		
10	BUS	7954_C1_05MILLBR 138-2_A	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	191.85	195.78	ER	184	7.23	
11	N-1	5891_B2_TOR607	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	102.67	105.21	ER	184	4.66	
12	N-1	OUTAGE_02AB	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	102.08	104.61	ER	184	4.66	
13	LFFB	7970_C2_05MILLBR 138-G	AEP - AEP	05MILLBR-05S POIN 138 kV line	243042	243088	1	DC	113.98	114.97	ER	167	3.66	5
14	DCTL	7981_B	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	241.98	246.83	ER	179	8.68	6
15	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	219.17	224.02	ER	179	8.68	
16	DCTL	7981_A	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	219.17	224.02	ER	179	8.68	
17	DCTL	7981_B	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	169.18	183.2	ER	150	21.03	7
18	LFFB	8109_C2_05HILLSB 138-A_A	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	164.55	178.64	ER	150	21.13	
19	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	156.14	170.16	ER	150	21.03	
20	DCTL	7981_A	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	156.14	170.16	ER	150	21.03	
21	BUS	7954_C1_05MILLBR 138-2_A	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	137.75	151.29	ER	150	20.32	
22	DCTL	7981_B	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	155.5	160.44	ER	150	7.41	8
23	LFFB	8109_C2_05HILLSB 138-A_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	149.94	154.92	ER	150	7.47	
24	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	142.67	147.61	ER	150	7.41	
25	DCTL	7981_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	142.67	147.61	ER	150	7.41	
26	BUS	7954_C1_05MILLBR 138-2_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	124.31	128.77	ER	150	6.68	
27	DCTL	7981_B	AEP - AEP	05HIGHLA 138/69 kV transformer	246911	243606	3	DC	214.11	219.06	ER	122	6.04	9
28	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05HIGHLA 138/69 kV transformer	246911	243606	3	DC	199.78	204.73	ER	122	6.04	
29	DCTL	7981_A	AEP - AEP	05HIGHLA 138/69 kV transformer	246911	243606	3	DC	199.78	204.73	ER	122	6.04	
30	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - AEP	05HIGHLA 138/69 kV transformer	246911	243606	3	DC	110.19	113.17	ER	122	3.63	
31	N-1	7353_B2_TOR12737	AEP - AEP	05HIGHLA 138/69 kV transformer	246911	243606	3	DC	110.11	113.08	ER	122	3.63	
32	DCTL	7981_B	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	158.98	173	ER	150	21.03	10
33	LFFB	8109_C2_05HILLSB 138-A_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	154.35	168.44	ER	150	21.13	
34	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	145.94	159.96	ER	150	21.03	

AC2-062 Contribution to Previously Identified Overloads														
#	Contingency		Affected Area	Facility Description	Bus				Loading		Rating		MW Con.	FG App.
	Type	Name			From	To	Cir.	PF	Initial	Final	Type	MVA		
35	DCTL	7981_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	145.94	159.96	ER	150	21.03	
36	BUS	7954_C1_05MILLBR 138-2_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	127.55	141.09	ER	150	20.32	
37	DCTL	7981_B	AEP - AEP	05WLDCAT-05EMERSS 138 kV line	246946	247034	1	DC	171.95	175.82	ER	185	7.15	11
38	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05WLDCAT-05EMERSS 138 kV line	246946	247034	1	DC	154.03	157.9	ER	185	7.15	
39	DCTL	7981_A	AEP - AEP	05WLDCAT-05EMERSS 138 kV line	246946	247034	1	DC	154.03	157.9	ER	185	7.15	
40	DCTL	7981_B	AEP - LGEE	05EMERSS-4KENTON 138 kV line	247034	324267	1	DC	170.65	174.52	ER	185	7.15	12
41	LFFB	8108_C2_05HILLSB 138-D_A	AEP - LGEE	05EMERSS-4KENTON 138 kV line	247034	324267	1	DC	152.73	156.6	ER	185	7.15	
42	DCTL	7981_A	AEP - LGEE	05EMERSS-4KENTON 138 kV line	247034	324267	1	DC	152.73	156.6	ER	185	7.15	
43	LFFB	8109_C2_05HILLSB 138-A_A	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	236.42	240.96	ER	198	8.99	13
44	BUS	7954_C1_05MILLBR 138-2_A	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	190.63	194.28	ER	198	7.23	
45	LFFB	8110_C2_05HILLSB 138-B_A	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	194.36	199.08	ER	198	9.34	
46	LFFB	8111_C2_05HILLSB 138-A	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	159.37	162.86	ER	185	6.46	14
47	BUS	7954_C1_05MILLBR 138-2_A	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	154.45	155.64	ER	185	4.86	
48	DCTL	7981_B	AEP - AEP	AC1-089 TAP-05WLDCAT 138 kV line	926100	246946	1	DC	173.03	176.9	ER	185	7.15	15
49	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	AC1-089 TAP-05WLDCAT 138 kV line	926100	246946	1	DC	155.11	158.98	ER	185	7.15	
50	DCTL	7981_A	AEP - AEP	AC1-089 TAP-05WLDCAT 138 kV line	926100	246946	1	DC	155.11	158.98	ER	185	7.15	
51	DCTL	7981_B	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	260.63	265.48	ER	179	8.68	16
52	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	237.82	242.68	ER	179	8.68	
53	DCTL	7981_A	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	237.82	242.68	ER	179	8.68	
54	LFFB	8109_C2_05HILLSB 138-A_A	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	268.95	273.84	ER	184	8.99	17
55	BUS	7954_C1_05MILLBR 138-2_A	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	219.93	223.86	ER	184	7.23	
56	N-1	5891_B2_TOR607	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	116.09	118.63	ER	184	4.66	
57	N-1	OUTAGE_02AB	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	115.49	118.03	ER	184	4.66	

AC2-062 Contribution to Previously Identified Overloads														
#	Type	Contingency Name	Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating Type	MVA	MW Con.	FG App.
58	Non	Non	DEO&K - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	From 931430	To 249995	1	DC	Initial 107.69	Final 110.17	NR	159	3.93	

Table 15

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

None

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.

AC2-062 Delivery of Energy Portion of Interconnection Request										
Contingency	Affected	Facility Description	Bus	Cir.	PF	Loading	Rating	MW	FG	

#	Type	Name	Area		From	To			Initial	Final	Type	MVA		
1	N-1	7353_B2_TOR12737	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	180.17	183.95	ER	185	6.98	
2	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - DAY	05HILLSB- 09MIDDLE 138 kV line	243019	253111	1	DC	163.38	164.59	ER	185	4.99	
3	N-1	7353_B2_TOR12737	AEP - AEP	05HILLSB-AC1-089 TAP 138 kV line	243019	926100	1	DC	100.96	104.06	ER	185	5.73	
4	N-1	5891_B2_TOR607	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	187.53	191.2	ER	184	6.75	
5	Non	Non	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	177.4	180.98	NR	159	5.69	
6	N-1	462_B3_05MILLBR 138-5_WOMOAB	AEP - AEP	05MILLBR-05S POIN 138 kV line	243042	243088	1	DC	89.74	90.57	ER	167	3.07	
7	N-1	7353_B2_TOR12737	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	184.2	188.1	ER	179	6.98	
8	N-1	P1-#.B2 WARREN- CLINTONCO- HILLSBORO 2381	AEP - AEP	05ADAMS- 05WARERD 138 kV line	243464	246942	1	DC	136	149.48	ER	150	20.22	
9	N-1	7353_B2_TOR12737	AEP - AEP	05SEAMAN- 05ADAMS 138 kV line	243571	243464	1	DC	123.49	127.89	ER	150	6.61	
10	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - AEP	05HIGHLA 138/69 kV transformer	246911	243606	3	DC	174.14	176.08	ER	122	5.25	
11	N-1	P1-#.B2 WARREN- CLINTONCO- HILLSBORO 2381	AEP - AEP	05WARERD- 05WAVERL 138 kV line	246942	243585	1	DC	125.8	139.28	ER	150	20.22	
12	N-1	7353_B2_TOR12737	AEP - AEP	05WLDCAT- 05EMERSS 138 kV line	246946	247034	1	DC	124.28	127.38	ER	185	5.73	
13	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - LGEE	05EMERSS- 4KENTON 138 kV line	247034	324267	1	DC	122.98	126.08	ER	185	5.73	
14	N-1	5891_B2_TOR607	DEO&K - DEO&K	08CLINCO- 08WARRN1 138 kV line	249995	250122	1	DC	185.48	188.89	ER	198	6.75	
15	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	161.11	162.32	ER	185	4.99	
16	N-1	P1-#.B2 WARREN- CLINTONCO- HILLSBORO 2381	AEP - AEP	AC1-089 TAP- 05WLDCAT 138 kV line	926100	246946	1	DC	125.6	128.7	ER	185	5.73	
17	N-1	7353_B2_TOR12737	AEP - AEP	AC2-049 TAP- 05MILLBR 138 kV line	931350	243042	1	DC	202	205.9	ER	179	6.98	
18	N-1	5891_B2_TOR607	DEO&K - DEO&K	AC2-061 TAP- 08CLINCO 138 kV line	931430	249995	1	DC	214.54	218.21	ER	184	6.75	
19	Non	Non	DEO&K - DEO&K	AC2-061 TAP- 08CLINCO 138 kV line	931430	249995	1	DC	206.25	209.83	NR	159	5.69	

Table 16

Figure 1: Primary Point of Interconnection (Emerald Switch - Kenton (LGE-KU) 138kV)

Single Line Diagram

Figure 2: Primary Point of Interconnection (Emerald Switch - Kenton (LGE-KU) 138kV)

Figure 3: Secondary Point of Interconnection (Seaman – Sardinia 69kV)
Single Line Diagram

Figure 4: Secondary Point of Interconnection (Seaman – Sardinia 69kV)

Appendices – Primary POI

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 05HIGHLA-05NMARSS 138 kV line (from bus 246911 to bus 247035 ckt 1) loads from 97.67% to 99.57% (**DC power flow**) of its emergency rating (310 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 5.89 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.73
931121	AC2-019 C	0.77
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.54
931132	AC2-020 E OP	1.42
931192	AC2-027 E	2.02
931221	AC2-031 C	14.63
931222	AC2-031 E	7.2
931281	AC2-042 C	45.72
931282	AC2-042 E	30.48
931351	AC2-049 C	2.96
931352	AC2-049 E	1.97
931381	AC2-055 C OP	1.77
931382	AC2-055 E OP	2.88
931421	AC2-060 C	4.94
931422	AC2-060 E	2.78
931431	AC2-061 C	12.68
931432	AC2-061 E	12.86
931441	AC2-062 C OP	4.07
931442	AC2-062 E OP	1.82
931451	AC2-064 C	6.95
931452	AC2-064 E	4.63
931651	AC2-087 C OP	3.66
931652	AC2-087 E OP	2.9
247592	W4-036	0.93
926061	AC1-085 C	33.18
926062	AC1-085 E	54.14
926101	AC1-089 C	11.16
926102	AC1-089 E	18.22

926631	AC1-144 C	14.69
926632	AC1-144 E	7.14

Appendix 2

(AEP - AEP) The 05NMARSS-05SEAMAN 138 kV line (from bus 247035 to bus 243571 ckt 1) loads from 94.28% to 96.18% (**DC power flow**) of its emergency rating (310 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 5.89 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.73
931121	AC2-019 C	0.77
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.54
931132	AC2-020 E OP	1.42
931192	AC2-027 E	2.02
931221	AC2-031 C	14.63
931222	AC2-031 E	7.2
931281	AC2-042 C	45.72
931282	AC2-042 E	30.48
931351	AC2-049 C	2.96
931352	AC2-049 E	1.97
931381	AC2-055 C OP	1.77
931382	AC2-055 E OP	2.88
931421	AC2-060 C	4.94
931422	AC2-060 E	2.78
931431	AC2-061 C	12.68
931432	AC2-061 E	12.86
931441	AC2-062 C OP	4.07
931442	AC2-062 E OP	1.82
931451	AC2-064 C	6.95
931452	AC2-064 E	4.63
931651	AC2-087 C OP	3.66
931652	AC2-087 E OP	2.9
247592	W4-036	0.93
926061	AC1-085 C	33.18
926062	AC1-085 E	54.14
926101	AC1-089 C	11.16
926102	AC1-089 E	18.22

926631	AC1-144 C	14.69
926632	AC1-144 E	7.14

Appendix 3

(AEP - AEP) The 05HILLSB-05SINKG8 138 kV line (from bus 243019 to bus 243102 ckt 1) loads from 237.65% to 242.84% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 9.59 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.78
931121	AC2-019 C	0.76
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.59
931132	AC2-020 E OP	1.55
931192	AC2-027 E	2.01
931221	AC2-031 C	23.37
931222	AC2-031 E	11.51
931281	AC2-042 C	73.05
931282	AC2-042 E	48.7
931381	AC2-055 C OP	1.86
931382	AC2-055 E OP	3.04
931421	AC2-060 C	5.36
931422	AC2-060 E	3.02
931431	AC2-061 C	20.27
931432	AC2-061 E	20.55
931441	AC2-062 C OP	6.62
931442	AC2-062 E OP	2.96
931651	AC2-087 C OP	3.97
931652	AC2-087 E OP	3.15
247592	W4-036	1.01
924371	AB2-085 C OP	8.23
924372	AB2-085 E OP	3.87
924541	AB2-103 C OP	5.1
924542	AB2-103 E OP	2.4
926061	AC1-085 C	53.03
926062	AC1-085 E	86.52
926101	AC1-089 C	17.87
926102	AC1-089 E	29.16

<i>926631</i>	<i>AC1-144 C</i>	<i>23.48</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>11.41</i>

Appendix 4

(AEP - AEP) The 05HILLSB-05HIGHLA 138 kV line (from bus 243019 to bus 246911 ckt 1) loads from 130.5% to 132.89% (**DC power flow**) of its emergency rating (413 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 9.88 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.92
931132	AC2-020 E OP	2.77
931221	AC2-031 C	24.64
931222	AC2-031 E	12.14
931281	AC2-042 C	77.01
931282	AC2-042 E	51.34
931351	AC2-049 C	5.14
931352	AC2-049 E	3.43
931431	AC2-061 C	21.37
931432	AC2-061 E	21.66
931441	AC2-062 C OP	6.83
931442	AC2-062 E OP	3.05
931451	AC2-064 C	12.07
931452	AC2-064 E	8.05
926061	AC1-085 C	55.9
926062	AC1-085 E	91.2
926101	AC1-089 C	18.8
926102	AC1-089 E	30.67
926631	AC1-144 C	24.75
926632	AC1-144 E	12.03

Appendix 5

(AEP - DAY) The 05HILLSB-09MIDDLE 138 kV line (from bus 243019 to bus 253111 ckt 1) loads from 157.34% to 158.6% (**DC power flow**) of its emergency rating (185 MVA) for the bus fault outage of '7954_C1_05MILLBR 138-2_A'. This project contributes approximately 5.21 MW to the thermal violation.

CONTINGENCY '7954_C1_05MILLBR 138-2_A'

OPEN BRANCH FROM BUS 243042 TO BUS 243088 CKT 1 / 243042
05MILLBR 138 243088 05S POIN 138 1

OPEN BRANCH FROM BUS 243042 TO BUS 931350 CKT 1 / 243042
05MILLBR 138 931350 AC2-049 TAP 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.52
931121	AC2-019 C	0.41
931122	AC2-019 E	0.67
931192	AC2-027 E	1.07
931221	AC2-031 C	12.83
931222	AC2-031 E	6.32
931281	AC2-042 C	40.1
931282	AC2-042 E	26.74
931351	AC2-049 C	5.63
931352	AC2-049 E	3.75
931381	AC2-055 C OP	0.95
931382	AC2-055 E OP	1.56
931431	AC2-061 C	8.66
931432	AC2-061 E	8.77
931441	AC2-062 C OP	3.6
931442	AC2-062 E OP	1.61
931451	AC2-064 C	13.22
931452	AC2-064 E	8.81
916272	Z1-080 E	0.64
924371	AB2-085 C OP	4.69
924372	AB2-085 E OP	2.21
924541	AB2-103 C OP	2.86
924542	AB2-103 E OP	1.34
926061	AC1-085 C	29.11
926062	AC1-085 E	47.5
926101	AC1-089 C	9.8
926102	AC1-089 E	15.99
926631	AC1-144 C	12.89
926632	AC1-144 E	6.26

Appendix 6

(AEP - DEO&K) The 05HILLSB-AC2-061 TAP 138 kV line (from bus 243019 to bus 931430 ckt 1) loads from 248.13% to 253.39% (**DC power flow**) of its emergency rating (184 MVA) for the line fault with failed breaker contingency outage of '8107_C2_05HILLSB 138-C_A'. This project contributes approximately 9.67 MW to the thermal violation.

CONTINGENCY '8107_C2_05HILLSB 138-C_A'

OPEN BRANCH FROM BUS 246911 TO BUS 243019 CKT 1 / 246911
05HIGHLA 138 243019 05HILLSB 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.88
931221	AC2-031 C	24.37
931222	AC2-031 E	12.
931281	AC2-042 C	76.15
931282	AC2-042 E	50.77
931351	AC2-049 C	5.23
931352	AC2-049 E	3.49
931441	AC2-062 C OP	6.68
931442	AC2-062 E OP	2.99
931451	AC2-064 C	12.27
931452	AC2-064 E	8.18
916272	Z1-080 E	2.17
926061	AC1-085 C	55.28
926062	AC1-085 E	90.19
926101	AC1-089 C	18.57
926102	AC1-089 E	30.29
926631	AC1-144 C	24.48
926632	AC1-144 E	11.89

Appendix 7

(AEP - AEP) The 05MILLBR-05N PORT 138 kV line (from bus 243042 to bus 243047 ckt 1) loads from 105.82% to 106.61% (**DC power flow**) of its emergency rating (185 MVA) for the line fault with failed breaker contingency outage of '8107_C2_05HILLSB 138-C_A'. This project contributes approximately 3.26 MW to the thermal violation.

CONTINGENCY '8107_C2_05HILLSB 138-C_A'

OPEN BRANCH FROM BUS 246911 TO BUS 243019 CKT 1 / 246911
05HIGHLA 138 243019 05HILLSB 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
342948	1LOVE HYDRO	2.67
931022	AC2-008 E	0.97
931221	AC2-031 C	8.2
931222	AC2-031 E	4.04
931281	AC2-042 C	25.63
931282	AC2-042 E	17.09
931351	AC2-049 C	7.12
931352	AC2-049 E	4.74
931431	AC2-061 C	5.52
931432	AC2-061 E	5.6
931441	AC2-062 C OP	2.25
931442	AC2-062 E OP	1.01
931451	AC2-064 C	16.7
931452	AC2-064 E	11.14
247613	X4-025	4.37
916272	Z1-080 E	0.41
926061	AC1-085 C	18.6
926062	AC1-085 E	30.36
926101	AC1-089 C	6.25
926102	AC1-089 E	10.2
926631	AC1-144 C	8.24
926632	AC1-144 E	4.

Appendix 8

(AEP - AEP) The 05MILLBR-05S POIN 138 kV line (from bus 243042 to bus 243088 ckt 1) loads from 113.98% to 115.05% (**DC power flow**) of its emergency rating (167 MVA) for the line fault with failed breaker contingency outage of '7970_C2_05MILLBR 138-G'. This project contributes approximately 3.96 MW to the thermal violation.

CONTINGENCY '7970_C2_05MILLBR 138-G'

OPEN BRANCH FROM BUS 242988 TO BUS 243042 CKT 1 / 242988
 05DOGWOO 138 243042 05MILLBR 138 1
 OPEN BRANCH FROM BUS 243069 TO BUS 243042 CKT 1 / 243069 05FIREBR
 138 243042 05MILLBR 138 1
 OPEN BRANCH FROM BUS 243688 TO BUS 243042 CKT 1 / 243688
 05FULLER 138 243042 05MILLBR 138 1
 OPEN BRANCH FROM BUS 243688 TO BUS 342538 CKT 1 / 243688
 05FULLER 138 342538 4ARGENTUM 138 1
 OPEN BRANCH FROM BUS 243042 TO BUS 243047 CKT 1 / 243042
 05MILLBR 138 243047 05N PORT 138 1
 OPEN BRANCH FROM BUS 243042 TO BUS 243173 CKT 1 / 243042
 05MILLBR 138 243173 MILLBRK 69.0 1
 OPEN BRANCH FROM BUS 243688 TO BUS 244686 CKT 1 / 243688
 05FULLER 138 244686 VANCEBRG 12.0 1
 END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.13
931121	AC2-019 C	0.32
931122	AC2-019 E	0.52
931192	AC2-027 E	0.83
931221	AC2-031 C	9.38
931222	AC2-031 E	4.62
931281	AC2-042 C	29.32
931282	AC2-042 E	19.55
931351	AC2-049 C	11.43
931352	AC2-049 E	7.62
931431	AC2-061 C	6.47
931432	AC2-061 E	6.56
931441	AC2-062 C OP	2.73
931442	AC2-062 E OP	1.22
931451	AC2-064 C	26.82
931452	AC2-064 E	17.88
247613	X4-025	7.47
916272	Z1-080 E	0.5
924371	AB2-085 C OP	3.48
924372	AB2-085 E OP	1.64
924541	AB2-103 C OP	2.12
924542	AB2-103 E OP	1.
926061	AC1-085 C	21.28
926062	AC1-085 E	34.73

<i>926101</i>	<i>AC1-089 C</i>	<i>7.2</i>
<i>926102</i>	<i>AC1-089 E</i>	<i>11.74</i>
<i>926631</i>	<i>AC1-144 C</i>	<i>9.42</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>4.58</i>

Appendix 9

(AEP - AEP) The 05SINKG8-AC2-049 TAP 138 kV line (from bus 243102 to bus 931350 ckt 1) loads from 243.67% to 249.02% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 9.59 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.78
931121	AC2-019 C	0.76
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.59
931132	AC2-020 E OP	1.55
931192	AC2-027 E	2.01
931221	AC2-031 C	23.37
931222	AC2-031 E	11.51
931281	AC2-042 C	73.05
931282	AC2-042 E	48.7
931381	AC2-055 C OP	1.86
931382	AC2-055 E OP	3.04
931421	AC2-060 C	5.36
931422	AC2-060 E	3.02
931431	AC2-061 C	20.27
931432	AC2-061 E	20.55
931441	AC2-062 C OP	6.62
931442	AC2-062 E OP	2.96
931651	AC2-087 C OP	3.97
931652	AC2-087 E OP	3.15
247592	W4-036	1.01
924371	AB2-085 C OP	8.23
924372	AB2-085 E OP	3.87
924541	AB2-103 C OP	5.1
924542	AB2-103 E OP	2.4
926061	AC1-085 C	53.03
926062	AC1-085 E	86.52
926101	AC1-089 C	17.87
926102	AC1-089 E	29.16

<i>926631</i>	<i>AC1-144 C</i>	<i>23.48</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>11.41</i>

Appendix 10

(AEP - AEP) The 05ADAMS-05WARERD 138 kV line (from bus 243464 to bus 246942 ckt 1) loads from 169.36% to 170.76% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 4.65 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.34
931121	AC2-019 C	0.59
931122	AC2-019 E	0.96
931131	AC2-020 C OP	0.41
931132	AC2-020 E OP	1.07
931192	AC2-027 E	1.55
931221	AC2-031 C	11.2
931222	AC2-031 E	5.51
931281	AC2-042 C	34.99
931282	AC2-042 E	23.33
931351	AC2-049 C	2.18
931352	AC2-049 E	1.45
931381	AC2-055 C OP	1.33
931382	AC2-055 E OP	2.18
931421	AC2-060 C	3.7
931422	AC2-060 E	2.08
931431	AC2-061 C	9.71
931432	AC2-061 E	9.84
931441	AC2-062 C OP	3.21
931442	AC2-062 E OP	1.44
931451	AC2-064 C	5.11
931452	AC2-064 E	3.41
931651	AC2-087 C OP	2.74
931652	AC2-087 E OP	2.18
247592	W4-036	0.69
924371	AB2-085 C OP	27.11
924372	AB2-085 E OP	12.76
924541	AB2-103 C OP	10.95
924542	AB2-103 E OP	5.15

926061	AC1-085 C	25.4
926062	AC1-085 E	41.44
926101	AC1-089 C	8.57
926102	AC1-089 E	13.99
926631	AC1-144 C	11.25
926632	AC1-144 E	5.46

Appendix 11

(AEP - AEP) The 05SEAMAN-05ADAMS 138 kV line (from bus 243571 to bus 243464 ckt 1) loads from 155.68% to 157.04% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 4.53 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.31
931121	AC2-019 C	0.58
931122	AC2-019 E	0.95
931131	AC2-020 C OP	0.4
931132	AC2-020 E OP	1.06
931192	AC2-027 E	1.53
931221	AC2-031 C	11.02
931222	AC2-031 E	5.43
931281	AC2-042 C	34.44
931282	AC2-042 E	22.96
931351	AC2-049 C	2.17
931352	AC2-049 E	1.45
931381	AC2-055 C OP	1.32
931382	AC2-055 E OP	2.15
931421	AC2-060 C	3.67
931422	AC2-060 E	2.07
931431	AC2-061 C	9.56
931432	AC2-061 E	9.69
931441	AC2-062 C OP	3.13
931442	AC2-062 E OP	1.4
931451	AC2-064 C	5.1
931452	AC2-064 E	3.4
931651	AC2-087 C OP	2.72
931652	AC2-087 E OP	2.16
247592	W4-036	0.69
924541	AB2-103 C OP	10.77
924542	AB2-103 E OP	5.07
926061	AC1-085 C	25.
926062	AC1-085 E	40.79

<i>926101</i>	<i>AC1-089 C</i>	<i>8.43</i>
<i>926102</i>	<i>AC1-089 E</i>	<i>13.75</i>
<i>926631</i>	<i>AC1-144 C</i>	<i>11.07</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>5.38</i>

Appendix 12

(AEP - AEP) The 05HIGHLA 138/69 kV transformer (from bus 246911 to bus 243606 ckt 3) loads from 213.81% to 215.29% (**DC power flow**) of its emergency rating (122 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.99 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.18
931132	AC2-020 E OP	4.19
931221	AC2-031 C	10.01
931222	AC2-031 E	4.93
931281	AC2-042 C	31.29
931282	AC2-042 E	20.86
931351	AC2-049 C	2.18
931352	AC2-049 E	1.45
931431	AC2-061 C	8.68
931432	AC2-061 E	8.8
931441	AC2-062 C OP	2.76
931442	AC2-062 E OP	1.23
931451	AC2-064 C	5.12
931452	AC2-064 E	3.41
924371	AB2-085 C OP	5.85
924372	AB2-085 E OP	2.75
924541	AB2-103 C OP	3.58
924542	AB2-103 E OP	1.68
926061	AC1-085 C	22.71
926062	AC1-085 E	37.06
926101	AC1-089 C	7.63
926102	AC1-089 E	12.45
926631	AC1-144 C	10.06
926632	AC1-144 E	4.89

Appendix 13

(AEP - AEP) The 05WARERD-05WAVERL 138 kV line (from bus 246942 to bus 243585 ckt 1) loads from 159.16% to 160.56% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 4.65 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.34
931121	AC2-019 C	0.59
931122	AC2-019 E	0.96
931131	AC2-020 C OP	0.41
931132	AC2-020 E OP	1.07
931192	AC2-027 E	1.55
931221	AC2-031 C	11.2
931222	AC2-031 E	5.51
931281	AC2-042 C	34.99
931282	AC2-042 E	23.33
931351	AC2-049 C	2.18
931352	AC2-049 E	1.45
931381	AC2-055 C OP	1.33
931382	AC2-055 E OP	2.18
931421	AC2-060 C	3.7
931422	AC2-060 E	2.08
931431	AC2-061 C	9.71
931432	AC2-061 E	9.84
931441	AC2-062 C OP	3.21
931442	AC2-062 E OP	1.44
931451	AC2-064 C	5.11
931452	AC2-064 E	3.41
931651	AC2-087 C OP	2.74
931652	AC2-087 E OP	2.18
247592	W4-036	0.69
924371	AB2-085 C OP	27.11
924372	AB2-085 E OP	12.76
924541	AB2-103 C OP	10.95
924542	AB2-103 E OP	5.15

926061	AC1-085 C	25.4
926062	AC1-085 E	41.44
926101	AC1-089 C	8.57
926102	AC1-089 E	13.99
926631	AC1-144 C	11.25
926632	AC1-144 E	5.46

Appendix 14

(DEO&K - DEO&K) The 08CLINCO-08WARRN1 138 kV line (from bus 249995 to bus 250122 ckt 1) loads from 246.64% to 251.53% (**DC power flow**) of its emergency rating (198 MVA) for the line fault with failed breaker contingency outage of '8107_C2_05HILLSB 138-C_A'. This project contributes approximately 9.67 MW to the thermal violation.

CONTINGENCY '8107_C2_05HILLSB 138-C_A'

OPEN BRANCH FROM BUS 246911 TO BUS 243019 CKT 1 / 246911
05HIGHLA 138 243019 05HILLSB 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.88
931221	AC2-031 C	24.37
931222	AC2-031 E	12.
931281	AC2-042 C	76.15
931282	AC2-042 E	50.77
931351	AC2-049 C	5.23
931352	AC2-049 E	3.49
931431	AC2-061 C	29.12
931432	AC2-061 E	29.52
931441	AC2-062 C OP	6.68
931442	AC2-062 E OP	2.99
931451	AC2-064 C	12.27
931452	AC2-064 E	8.18
916272	Z1-080 E	3.83
926061	AC1-085 C	55.28
926062	AC1-085 E	90.19
926101	AC1-089 C	18.57
926102	AC1-089 E	30.29
926631	AC1-144 C	24.48
926632	AC1-144 E	11.89

Appendix 15

(DAY - DAY) The 09MIDDLE-09OHH 138 kV line (from bus 253111 to bus 253057 ckt 1) loads from 155.07% to 156.33% (**DC power flow**) of its emergency rating (185 MVA) for the bus fault outage of '7954_C1_05MILLBR 138-2_A'. This project contributes approximately 5.21 MW to the thermal violation.

CONTINGENCY '7954_C1_05MILLBR 138-2_A'

OPEN BRANCH FROM BUS 243042 TO BUS 243088 CKT 1 / 243042
05MILLBR 138 243088 05S POIN 138 1

OPEN BRANCH FROM BUS 243042 TO BUS 931350 CKT 1 / 243042
05MILLBR 138 931350 AC2-049 TAP 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.52
931121	AC2-019 C	0.41
931122	AC2-019 E	0.67
931192	AC2-027 E	1.07
931221	AC2-031 C	12.83
931222	AC2-031 E	6.32
931281	AC2-042 C	40.1
931282	AC2-042 E	26.74
931351	AC2-049 C	5.63
931352	AC2-049 E	3.75
931381	AC2-055 C OP	0.95
931382	AC2-055 E OP	1.56
931431	AC2-061 C	8.66
931432	AC2-061 E	8.77
931441	AC2-062 C OP	3.6
931442	AC2-062 E OP	1.61
931451	AC2-064 C	13.22
931452	AC2-064 E	8.81
916272	Z1-080 E	0.64
924371	AB2-085 C OP	4.69
924372	AB2-085 E OP	2.21
924541	AB2-103 C OP	2.86
924542	AB2-103 E OP	1.34
926061	AC1-085 C	29.11
926062	AC1-085 E	47.5
926101	AC1-089 C	9.8
926102	AC1-089 E	15.99
926631	AC1-144 C	12.89
926632	AC1-144 E	6.26

Appendix 16

(AEP - AEP) The AC1-089 TAP-05HILLSB 138 kV line (from bus 926100 to bus 243019 ckt 1) loads from 143.03% to 155.93% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of 'P7-1..C5 4541MELDAHLSRRLCKSTUARTSPURLOCKDPLEK'. This project contributes approximately 23.86 MW to the thermal violation.

CONTINGENCY 'P7-1..C5 4541MELDAHLSRRLCKSTUARTSPURLOCKDPLEK'
OPEN BRANCH FROM BUS 342838 TO BUS 249581 CKT 1
OPEN BRANCH FROM BUS 253077 TO BUS 342838 CKT 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
342957	1SPURLK1G	5.32
931022	AC2-008 E	6.7
931441	AC2-062 C OP	16.49
931442	AC2-062 E OP	7.37
931551	AC2-075 C	3.44
931552	AC2-075 E	1.47
916272	Z1-080 E	0.58
925981	AC1-074 C OP	3.44
925982	AC1-074 E OP	1.47
926101	AC1-089 C	42.72
926102	AC1-089 E	69.71

Appendix 17

(AEP - AEP) The AC2-049 TAP-05MILLBR 138 kV line (from bus 931350 to bus 243042 ckt 1) loads from 262.32% to 267.67% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 9.59 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.78
931121	AC2-019 C	0.76
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.59
931132	AC2-020 E OP	1.55
931192	AC2-027 E	2.01
931221	AC2-031 C	23.37
931222	AC2-031 E	11.51
931281	AC2-042 C	73.05
931282	AC2-042 E	48.7
931351	AC2-049 C	20.15
931352	AC2-049 E	13.43
931381	AC2-055 C OP	1.86
931382	AC2-055 E OP	3.04
931421	AC2-060 C	5.36
931422	AC2-060 E	3.02
931431	AC2-061 C	20.27
931432	AC2-061 E	20.55
931441	AC2-062 C OP	6.62
931442	AC2-062 E OP	2.96
931451	AC2-064 C	47.29
931452	AC2-064 E	31.53
931651	AC2-087 C OP	3.97
931652	AC2-087 E OP	3.15
247592	W4-036	1.01
924371	AB2-085 C OP	8.23
924372	AB2-085 E OP	3.87
924541	AB2-103 C OP	5.1
924542	AB2-103 E OP	2.4

926061	AC1-085 C	53.03
926062	AC1-085 E	86.52
926101	AC1-089 C	17.87
926102	AC1-089 E	29.16
926631	AC1-144 C	23.48
926632	AC1-144 E	11.41

Appendix 18

(DEO&K - DEO&K) The AC2-061 TAP-08CLINCO 138 kV line (from bus 931430 to bus 249995 ckt 1) loads from 279.94% to 285.2% (**DC power flow**) of its emergency rating (184 MVA) for the line fault with failed breaker contingency outage of '8107_C2_05HILLSB 138-C_B'. This project contributes approximately 9.67 MW to the thermal violation.

CONTINGENCY '8107_C2_05HILLSB 138-C_B'

OPEN BRANCH FROM BUS 246911 TO BUS 243019 CKT 1 / 246911
05HIGHLA 138 243019 05HILLSB 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.88
931221	AC2-031 C	24.37
931222	AC2-031 E	12.
931281	AC2-042 C	76.15
931282	AC2-042 E	50.77
931351	AC2-049 C	5.23
931352	AC2-049 E	3.49
931431	AC2-061 C	29.12
931432	AC2-061 E	29.52
931441	AC2-062 C OP	6.68
931442	AC2-062 E OP	2.99
931451	AC2-064 C	12.27
931452	AC2-064 E	8.18
916272	Z1-080 E	2.17
926061	AC1-085 C	55.28
926062	AC1-085 E	90.19
926101	AC1-089 C	18.57
926102	AC1-089 E	30.29
926631	AC1-144 C	24.48
926632	AC1-144 E	11.89

Appendix 19

(AEP - LGEE) The AC2-062 TAP-4KENTON 138 kV line (from bus 931440 to bus 324267 ckt 1) loads from 169.39% to 188.59% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 35.53 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	4.3
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.46
931132	AC2-020 E OP	1.22
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.49
931382	AC2-055 E OP	2.42
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931441	AC2-062 C OP	24.55
931442	AC2-062 E OP	10.98
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.16
931652	AC2-087 E OP	2.51
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31
924541	AB2-103 C OP	4.25
924542	AB2-103 E OP	2.

926061	AC1-085 C	43.08
926062	AC1-085 E	70.28
926101	AC1-089 C	20.33
926102	AC1-089 E	33.17
926631	AC1-144 C	19.07
926632	AC1-144 E	9.27

Appendices - Secondary POI

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 05HILLSB-05SINKG8 138 kV line (from bus 243019 to bus 243102 ckt 1) loads from 236.02% to 240.71% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 8.68 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.78
931121	AC2-019 C	0.76
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.64
931132	AC2-020 E OP	1.68
931192	AC2-027 E	2.01
931221	AC2-031 C	23.37
931222	AC2-031 E	11.51
931281	AC2-042 C	73.05
931282	AC2-042 E	48.7
931381	AC2-055 C OP	1.51
931382	AC2-055 E OP	2.47
931421	AC2-060 C	5.36
931422	AC2-060 E	3.02
931431	AC2-061 C	20.27
931432	AC2-061 E	20.55
931441	AC2-062 C OP	6.
931442	AC2-062 E OP	2.68
931651	AC2-087 C OP	3.93
931652	AC2-087 E OP	3.12
247592	W4-036	1.01
924371	AB2-085 C OP	8.23
924372	AB2-085 E OP	3.87
924541	AB2-103 C OP	5.1
924542	AB2-103 E OP	2.4
926061	AC1-085 C	53.03
926062	AC1-085 E	86.52
926101	AC1-089 C	17.87
926102	AC1-089 E	29.16

<i>926631</i>	<i>AC1-144 C</i>	<i>23.48</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>11.41</i>

Appendix 2

(AEP - DAY) The 05HILLSB-09MIDDLE 138 kV line (from bus 243019 to bus 253111 ckt 1) loads from 161.64% to 165.13% (**DC power flow**) of its emergency rating (185 MVA) for the line fault with failed breaker contingency outage of '8111_C2_05HILLSB 138-_A'. This project contributes approximately 6.46 MW to the thermal violation.

CONTINGENCY '8111_C2_05HILLSB 138-_A'

OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB
138 926100 AC1-089 TAP 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB
138 931430 AC2-060 TAP 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931121	AC2-019 C	0.54
931122	AC2-019 E	0.88
931131	AC2-020 C OP	0.43
931132	AC2-020 E OP	1.13
931192	AC2-027 E	1.42
931221	AC2-031 C	16.99
931222	AC2-031 E	8.37
931281	AC2-042 C	53.11
931282	AC2-042 E	35.41
931351	AC2-049 C	3.7
931352	AC2-049 E	2.47
931381	AC2-055 C OP	1.02
931382	AC2-055 E OP	1.66
931421	AC2-060 C	3.62
931422	AC2-060 E	2.04
931441	AC2-062 C OP	4.46
931442	AC2-062 E OP	2.
931451	AC2-064 C	8.69
931452	AC2-064 E	5.8
931651	AC2-087 C OP	2.65
931652	AC2-087 E OP	2.1
247592	W4-036	0.68
924371	AB2-085 C OP	6.32
924372	AB2-085 E OP	2.97
924541	AB2-103 C OP	3.81
924542	AB2-103 E OP	1.79
926061	AC1-085 C	38.55
926062	AC1-085 E	62.9
926631	AC1-144 C	17.07
926632	AC1-144 E	8.29

Appendix 3

(AEP - AEP) The 05HILLSB-AC1-089 TAP 138 kV line (from bus 243019 to bus 926100 ckt 1) loads from 144.33% to 148.2% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 7.15 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.51
931132	AC2-020 E OP	1.33
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.2
931382	AC2-055 E OP	1.96
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931441	AC2-062 C OP	4.94
931442	AC2-062 E OP	2.21
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.12
931652	AC2-087 E OP	2.48
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31
924541	AB2-103 C OP	4.25
924542	AB2-103 E OP	2.
926061	AC1-085 C	43.08

<i>926062</i>	<i>AC1-085 E</i>	<i>70.28</i>
<i>926631</i>	<i>AC1-144 C</i>	<i>19.07</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>9.27</i>

Appendix 4

(AEP - DEO&K) The 05HILLSB-AC2-061 TAP 138 kV line (from bus 243019 to bus 931430 ckt 1) loads from 237.39% to 242.27% (**DC power flow**) of its emergency rating (184 MVA) for the line fault with failed breaker contingency outage of '8109_C2_05HILLSB 138-A_A'. This project contributes approximately 8.99 MW to the thermal violation.

CONTINGENCY '8109_C2_05HILLSB 138-A_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.83
931121	AC2-019 C	0.77
931122	AC2-019 E	1.26
931131	AC2-020 C OP	0.64
931132	AC2-020 E OP	1.68
931192	AC2-027 E	2.04
931221	AC2-031 C	23.89
931222	AC2-031 E	11.77
931281	AC2-042 C	74.67
931282	AC2-042 E	49.78
931381	AC2-055 C OP	1.52
931382	AC2-055 E OP	2.47
931421	AC2-060 C	5.37
931422	AC2-060 E	3.02
931441	AC2-062 C OP	6.21
931442	AC2-062 E OP	2.78
931651	AC2-087 C OP	3.94
931652	AC2-087 E OP	3.12
247592	W4-036	1.01
916272	Z1-080 E	2.18
924371	AB2-085 C OP	8.72
924372	AB2-085 E OP	4.1
924541	AB2-103 C OP	5.31
924542	AB2-103 E OP	2.5
926061	AC1-085 C	54.2
926062	AC1-085 E	88.44
926101	AC1-089 C	18.22
926102	AC1-089 E	29.73
926631	AC1-144 C	24.

926632	<i>AC1-144 E</i>	<i>11.66</i>
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Appendix 5

(AEP - AEP) The 05MILLBR-05S POIN 138 kV line (from bus 243042 to bus 243088 ckt 1) loads from 113.98% to 114.97% (**DC power flow**) of its emergency rating (167 MVA) for the line fault with failed breaker contingency outage of '7970_C2_05MILLBR 138-G'. This project contributes approximately 3.66 MW to the thermal violation.

CONTINGENCY '7970_C2_05MILLBR 138-G'

OPEN BRANCH FROM BUS 242988 TO BUS 243042 CKT 1 / 242988
 05DOGWOO 138 243042 05MILLBR 138 1
 OPEN BRANCH FROM BUS 243069 TO BUS 243042 CKT 1 / 243069 05FIREBR
 138 243042 05MILLBR 138 1
 OPEN BRANCH FROM BUS 243688 TO BUS 243042 CKT 1 / 243688
 05FULLER 138 243042 05MILLBR 138 1
 OPEN BRANCH FROM BUS 243688 TO BUS 342538 CKT 1 / 243688
 05FULLER 138 342538 4ARGENTUM 138 1
 OPEN BRANCH FROM BUS 243042 TO BUS 243047 CKT 1 / 243042
 05MILLBR 138 243047 05N PORT 138 1
 OPEN BRANCH FROM BUS 243042 TO BUS 243173 CKT 1 / 243042
 05MILLBR 138 243173 MILLBRK 69.0 1
 OPEN BRANCH FROM BUS 243688 TO BUS 244686 CKT 1 / 243688
 05FULLER 138 244686 VANCEBRG 12.0 1
 END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.13
931121	AC2-019 C	0.32
931122	AC2-019 E	0.52
931192	AC2-027 E	0.83
931221	AC2-031 C	9.38
931222	AC2-031 E	4.62
931281	AC2-042 C	29.32
931282	AC2-042 E	19.55
931351	AC2-049 C	11.43
931352	AC2-049 E	7.62
931431	AC2-061 C	6.47
931432	AC2-061 E	6.56
931441	AC2-062 C OP	2.53
931442	AC2-062 E OP	1.13
931451	AC2-064 C	26.82
931452	AC2-064 E	17.88
247613	X4-025	7.47
916272	Z1-080 E	0.5
924371	AB2-085 C OP	3.48
924372	AB2-085 E OP	1.64
924541	AB2-103 C OP	2.12
924542	AB2-103 E OP	1.
926061	AC1-085 C	21.28
926062	AC1-085 E	34.73

<i>926101</i>	<i>AC1-089 C</i>	<i>7.2</i>
<i>926102</i>	<i>AC1-089 E</i>	<i>11.74</i>
<i>926631</i>	<i>AC1-144 C</i>	<i>9.42</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>4.58</i>

Appendix 6

(AEP - AEP) The 05SINKG8-AC2-049 TAP 138 kV line (from bus 243102 to bus 931350 ckt 1) loads from 241.98% to 246.83% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 8.68 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.78
931121	AC2-019 C	0.76
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.64
931132	AC2-020 E OP	1.68
931192	AC2-027 E	2.01
931221	AC2-031 C	23.37
931222	AC2-031 E	11.51
931281	AC2-042 C	73.05
931282	AC2-042 E	48.7
931381	AC2-055 C OP	1.51
931382	AC2-055 E OP	2.47
931421	AC2-060 C	5.36
931422	AC2-060 E	3.02
931431	AC2-061 C	20.27
931432	AC2-061 E	20.55
931441	AC2-062 C OP	6.
931442	AC2-062 E OP	2.68
931651	AC2-087 C OP	3.93
931652	AC2-087 E OP	3.12
247592	W4-036	1.01
924371	AB2-085 C OP	8.23
924372	AB2-085 E OP	3.87
924541	AB2-103 C OP	5.1
924542	AB2-103 E OP	2.4
926061	AC1-085 C	53.03
926062	AC1-085 E	86.52
926101	AC1-089 C	17.87
926102	AC1-089 E	29.16

<i>926631</i>	<i>AC1-144 C</i>	<i>23.48</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>11.41</i>

Appendix 7

(AEP - AEP) The 05ADAMS-05WARERD 138 kV line (from bus 243464 to bus 246942 ckt 1) loads from 169.18% to 183.2% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 21.03 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.34
931121	AC2-019 C	0.59
931122	AC2-019 E	0.96
931131	AC2-020 C OP	0.44
931132	AC2-020 E OP	1.16
931192	AC2-027 E	1.55
931221	AC2-031 C	11.2
931222	AC2-031 E	5.51
931281	AC2-042 C	34.99
931282	AC2-042 E	23.33
931351	AC2-049 C	2.18
931352	AC2-049 E	1.45
931381	AC2-055 C OP	1.04
931382	AC2-055 E OP	1.7
931421	AC2-060 C	3.7
931422	AC2-060 E	2.08
931431	AC2-061 C	9.71
931432	AC2-061 E	9.84
931441	AC2-062 C OP	14.53
931442	AC2-062 E OP	6.5
931451	AC2-064 C	5.11
931452	AC2-064 E	3.41
931651	AC2-087 C OP	2.71
931652	AC2-087 E OP	2.15
247592	W4-036	0.69
924371	AB2-085 C OP	27.11
924372	AB2-085 E OP	12.76
924541	AB2-103 C OP	10.95
924542	AB2-103 E OP	5.15

926061	AC1-085 C	25.4
926062	AC1-085 E	41.44
926101	AC1-089 C	8.57
926102	AC1-089 E	13.99
926631	AC1-144 C	11.25
926632	AC1-144 E	5.46

Appendix 8

(AEP - AEP) The 05SEAMAN-05ADAMS 138 kV line (from bus 243571 to bus 243464 ckt 1) loads from 155.5% to 160.44% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 7.41 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.31
931121	AC2-019 C	0.58
931122	AC2-019 E	0.95
931131	AC2-020 C OP	0.44
931132	AC2-020 E OP	1.15
931192	AC2-027 E	1.53
931221	AC2-031 C	11.02
931222	AC2-031 E	5.43
931281	AC2-042 C	34.44
931282	AC2-042 E	22.96
931351	AC2-049 C	2.17
931352	AC2-049 E	1.45
931381	AC2-055 C OP	1.04
931382	AC2-055 E OP	1.69
931421	AC2-060 C	3.67
931422	AC2-060 E	2.07
931431	AC2-061 C	9.56
931432	AC2-061 E	9.69
931441	AC2-062 C OP	5.12
931442	AC2-062 E OP	2.29
931451	AC2-064 C	5.1
931452	AC2-064 E	3.4
931651	AC2-087 C OP	2.69
931652	AC2-087 E OP	2.14
247592	W4-036	0.69
924541	AB2-103 C OP	10.77
924542	AB2-103 E OP	5.07
926061	AC1-085 C	25.
926062	AC1-085 E	40.79

<i>926101</i>	<i>AC1-089 C</i>	<i>8.43</i>
<i>926102</i>	<i>AC1-089 E</i>	<i>13.75</i>
<i>926631</i>	<i>AC1-144 C</i>	<i>11.07</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>5.38</i>

Appendix 9

(AEP - AEP) The 05HIGHLA 138/69 kV transformer (from bus 246911 to bus 243606 ckt 3) loads from 214.11% to 219.06% (**DC power flow**) of its emergency rating (122 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 6.04 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.18
931132	AC2-020 E OP	4.55
931221	AC2-031 C	10.01
931222	AC2-031 E	4.93
931281	AC2-042 C	31.29
931282	AC2-042 E	20.86
931351	AC2-049 C	2.18
931352	AC2-049 E	1.45
931431	AC2-061 C	8.68
931432	AC2-061 E	8.8
931441	AC2-062 C OP	4.17
931442	AC2-062 E OP	1.87
931451	AC2-064 C	5.12
931452	AC2-064 E	3.41
924371	AB2-085 C OP	5.85
924372	AB2-085 E OP	2.75
924541	AB2-103 C OP	3.58
924542	AB2-103 E OP	1.68
926061	AC1-085 C	22.71
926062	AC1-085 E	37.06
926101	AC1-089 C	7.63
926102	AC1-089 E	12.45
926631	AC1-144 C	10.06
926632	AC1-144 E	4.89

Appendix 10

(AEP - AEP) The 05WARERD-05WAVERL 138 kV line (from bus 246942 to bus 243585 ckt 1) loads from 158.98% to 173.0% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 21.03 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.34
931121	AC2-019 C	0.59
931122	AC2-019 E	0.96
931131	AC2-020 C OP	0.44
931132	AC2-020 E OP	1.16
931192	AC2-027 E	1.55
931221	AC2-031 C	11.2
931222	AC2-031 E	5.51
931281	AC2-042 C	34.99
931282	AC2-042 E	23.33
931351	AC2-049 C	2.18
931352	AC2-049 E	1.45
931381	AC2-055 C OP	1.04
931382	AC2-055 E OP	1.7
931421	AC2-060 C	3.7
931422	AC2-060 E	2.08
931431	AC2-061 C	9.71
931432	AC2-061 E	9.84
931441	AC2-062 C OP	14.53
931442	AC2-062 E OP	6.5
931451	AC2-064 C	5.11
931452	AC2-064 E	3.41
931651	AC2-087 C OP	2.71
931652	AC2-087 E OP	2.15
247592	W4-036	0.69
924371	AB2-085 C OP	27.11
924372	AB2-085 E OP	12.76
924541	AB2-103 C OP	10.95
924542	AB2-103 E OP	5.15

926061	AC1-085 C	25.4
926062	AC1-085 E	41.44
926101	AC1-089 C	8.57
926102	AC1-089 E	13.99
926631	AC1-144 C	11.25
926632	AC1-144 E	5.46

Appendix 11

(AEP - AEP) The 05WLDCAT-05EMERSS 138 kV line (from bus 246946 to bus 247034 ckt 1) loads from 171.95% to 175.82% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 7.15 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	4.3
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.51
931132	AC2-020 E OP	1.33
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.2
931382	AC2-055 E OP	1.96
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931441	AC2-062 C OP	4.94
931442	AC2-062 E OP	2.21
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.12
931652	AC2-087 E OP	2.48
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31
924541	AB2-103 C OP	4.25
924542	AB2-103 E OP	2.

926061	AC1-085 C	43.08
926062	AC1-085 E	70.28
926101	AC1-089 C	20.33
926102	AC1-089 E	33.17
926631	AC1-144 C	19.07
926632	AC1-144 E	9.27

Appendix 12

(AEP - LGEE) The 05EMERSS-4KENTON 138 kV line (from bus 247034 to bus 324267 ckt 1) loads from 170.65% to 174.52% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 7.15 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	4.3
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.51
931132	AC2-020 E OP	1.33
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.2
931382	AC2-055 E OP	1.96
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931441	AC2-062 C OP	4.94
931442	AC2-062 E OP	2.21
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.12
931652	AC2-087 E OP	2.48
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31
924541	AB2-103 C OP	4.25
924542	AB2-103 E OP	2.

926061	AC1-085 C	43.08
926062	AC1-085 E	70.28
926101	AC1-089 C	20.33
926102	AC1-089 E	33.17
926631	AC1-144 C	19.07
926632	AC1-144 E	9.27

Appendix 13

(DEO&K - DEO&K) The 08CLINCO-08WARRN1 138 kV line (from bus 249995 to bus 250122 ckt 1) loads from 236.42% to 240.96% (**DC power flow**) of its emergency rating (198 MVA) for the line fault with failed breaker contingency outage of '8109_C2_05HILLSB 138-A_A'. This project contributes approximately 8.99 MW to the thermal violation.

CONTINGENCY '8109_C2_05HILLSB 138-A_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.83
931121	AC2-019 C	0.77
931122	AC2-019 E	1.26
931131	AC2-020 C OP	0.64
931132	AC2-020 E OP	1.68
931192	AC2-027 E	2.04
931221	AC2-031 C	23.89
931222	AC2-031 E	11.77
931281	AC2-042 C	74.67
931282	AC2-042 E	49.78
931381	AC2-055 C OP	1.52
931382	AC2-055 E OP	2.47
931421	AC2-060 C	5.37
931422	AC2-060 E	3.02
931431	AC2-061 C	28.84
931432	AC2-061 E	29.24
931441	AC2-062 C OP	6.21
931442	AC2-062 E OP	2.78
931651	AC2-087 C OP	3.94
931652	AC2-087 E OP	3.12
247592	W4-036	1.01
916272	Z1-080 E	3.82
924371	AB2-085 C OP	8.72
924372	AB2-085 E OP	4.1
924541	AB2-103 C OP	5.31
924542	AB2-103 E OP	2.5
926061	AC1-085 C	54.2
926062	AC1-085 E	88.44
926101	AC1-089 C	18.22

926102	AC1-089 E	29.73
926631	AC1-144 C	24.
926632	AC1-144 E	11.66

Appendix 14

(DAY - DAY) The 09MIDDLE-09OHH 138 kV line (from bus 253111 to bus 253057 ckt 1) loads from 159.37% to 162.86% (**DC power flow**) of its emergency rating (185 MVA) for the line fault with failed breaker contingency outage of '8111_C2_05HILLSB 138-_A'. This project contributes approximately 6.46 MW to the thermal violation.

CONTINGENCY '8111_C2_05HILLSB 138-_A'

OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB
138 926100 AC1-089 TAP 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB
138 931430 AC2-060 TAP 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931121	AC2-019 C	0.54
931122	AC2-019 E	0.88
931131	AC2-020 C OP	0.43
931132	AC2-020 E OP	1.13
931192	AC2-027 E	1.42
931221	AC2-031 C	16.99
931222	AC2-031 E	8.37
931281	AC2-042 C	53.11
931282	AC2-042 E	35.41
931351	AC2-049 C	3.7
931352	AC2-049 E	2.47
931381	AC2-055 C OP	1.02
931382	AC2-055 E OP	1.66
931421	AC2-060 C	3.62
931422	AC2-060 E	2.04
931441	AC2-062 C OP	4.46
931442	AC2-062 E OP	2.
931451	AC2-064 C	8.69
931452	AC2-064 E	5.8
931651	AC2-087 C OP	2.65
931652	AC2-087 E OP	2.1
247592	W4-036	0.68
924371	AB2-085 C OP	6.32
924372	AB2-085 E OP	2.97
924541	AB2-103 C OP	3.81
924542	AB2-103 E OP	1.79
926061	AC1-085 C	38.55
926062	AC1-085 E	62.9
926631	AC1-144 C	17.07
926632	AC1-144 E	8.29

Appendix 15

(AEP - AEP) The AC1-089 TAP-05WLDCAT 138 kV line (from bus 926100 to bus 246946 ckt 1) loads from 173.03% to 176.9% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 7.15 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.51
931132	AC2-020 E OP	1.33
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.2
931382	AC2-055 E OP	1.96
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931441	AC2-062 C OP	4.94
931442	AC2-062 E OP	2.21
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.12
931652	AC2-087 E OP	2.48
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31
924541	AB2-103 C OP	4.25
924542	AB2-103 E OP	2.
926061	AC1-085 C	43.08

926062	AC1-085 E	70.28
926101	AC1-089 C	20.33
926102	AC1-089 E	33.17
926631	AC1-144 C	19.07
926632	AC1-144 E	9.27

Appendix 16

(AEP - AEP) The AC2-049 TAP-05MILLBR 138 kV line (from bus 931350 to bus 243042 ckt 1) loads from 260.63% to 265.48% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 8.68 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.78
931121	AC2-019 C	0.76
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.64
931132	AC2-020 E OP	1.68
931192	AC2-027 E	2.01
931221	AC2-031 C	23.37
931222	AC2-031 E	11.51
931281	AC2-042 C	73.05
931282	AC2-042 E	48.7
931351	AC2-049 C	20.15
931352	AC2-049 E	13.43
931381	AC2-055 C OP	1.51
931382	AC2-055 E OP	2.47
931421	AC2-060 C	5.36
931422	AC2-060 E	3.02
931431	AC2-061 C	20.27
931432	AC2-061 E	20.55
931441	AC2-062 C OP	6.
931442	AC2-062 E OP	2.68
931451	AC2-064 C	47.29
931452	AC2-064 E	31.53
931651	AC2-087 C OP	3.93
931652	AC2-087 E OP	3.12
247592	W4-036	1.01
924371	AB2-085 C OP	8.23
924372	AB2-085 E OP	3.87
924541	AB2-103 C OP	5.1
924542	AB2-103 E OP	2.4

926061	AC1-085 C	53.03
926062	AC1-085 E	86.52
926101	AC1-089 C	17.87
926102	AC1-089 E	29.16
926631	AC1-144 C	23.48
926632	AC1-144 E	11.41

Appendix 17

(DEO&K - DEO&K) The AC2-061 TAP-08CLINCO 138 kV line (from bus 931430 to bus 249995 ckt 1) loads from 268.95% to 273.84% (**DC power flow**) of its emergency rating (184 MVA) for the line fault with failed breaker contingency outage of '8109_C2_05HILLSB 138-A_A'. This project contributes approximately 8.99 MW to the thermal violation.

CONTINGENCY '8109_C2_05HILLSB 138-A_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.83
931121	AC2-019 C	0.77
931122	AC2-019 E	1.26
931131	AC2-020 C OP	0.64
931132	AC2-020 E OP	1.68
931192	AC2-027 E	2.04
931221	AC2-031 C	23.89
931222	AC2-031 E	11.77
931281	AC2-042 C	74.67
931282	AC2-042 E	49.78
931381	AC2-055 C OP	1.52
931382	AC2-055 E OP	2.47
931421	AC2-060 C	5.37
931422	AC2-060 E	3.02
931431	AC2-061 C	28.84
931432	AC2-061 E	29.24
931441	AC2-062 C OP	6.21
931442	AC2-062 E OP	2.78
931651	AC2-087 C OP	3.94
931652	AC2-087 E OP	3.12
247592	W4-036	1.01
916272	Z1-080 E	2.18
924371	AB2-085 C OP	8.72
924372	AB2-085 E OP	4.1
924541	AB2-103 C OP	5.31
924542	AB2-103 E OP	2.5
926061	AC1-085 C	54.2
926062	AC1-085 E	88.44
926101	AC1-089 C	18.22

926102	AC1-089 E	29.73
926631	AC1-144 C	24.
926632	AC1-144 E	11.66