Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AD1-101

Continental 69kV

April 2018

Preface

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

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

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

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General

The interconnection customer (IC) proposes to install PJM Project #AD1-101, a 49.9 MW (18.96 MW Capacity) solar generating facility in Paulding County, Ohio (see Figure 1). The primary point of interconnection is a direct connection to AEP's Continental 69 kV substation. The secondary point of interconnection is to AEP's Continental – Kalida 69kV circuit (see Figure 3).

The requested in service date is October 31, 2020.

Attachment Facilities

Primary Point of Interconnection (Continental 69kV Substation)

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

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

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

Non-Direct Connection Cost Estimate

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

For AEP building Non-Direct Connection cost estimates:

Description	Estimated Cost
69 kV Revenue Metering	$200,000
Upgrade line protection and controls at the Continental 69 kV substation.	$200,000
Total	**$400,000**

Table 1

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Secondary Point of Interconnection (Continental - Kalida 69kV)

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

Interconnection Customer Requirements

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

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

Requirement from the PJM Open Access Transmission Tariff:

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

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

Revenue Metering and SCADA Requirements

PJM Requirements

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

AEP Requirements

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

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

Option 1

Network Impacts

The Queue Project AD1-101 was evaluated as a 49.9 MW (Capacity 18.96 MW) injection at the Continental 69 kV substation in the AEP area. Project AD1-101 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-101 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2021

Contingency Descriptions

The following contingencies resulted in overloads:

Option 1	
Contingency Name	**Description**
AEP_P7-1_#6676_T131-FSA	OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA 138 243017 05HAVILN 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1 / 242991 05E SIDE 138 243051 05NDELPH 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1 / 242991 05E SIDE 138 243108 05STRLN1 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051 05NDELPH 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051 05NDELPH 138 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 245874 TO BUS 243175 CKT 1 / 245874 05E DELPHO 69.0 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 245878 TO BUS 243175 CKT 1 / 245878 05FTJENNG8 69.0 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 243175 TO BUS 245902 CKT 1 / 243175 05N DELPHO 69.0 245902 05S DELPHO 69.0 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 END
AEP_P7-1_#6676	OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA 138 243017 05HAVILN 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1 / 242991 05E SIDE 138 243051 05NDELPH 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1 / 242991 05E SIDE 138 243108 05STRLN1 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051 05NDELPH 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051 05NDELPH 138 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 245874 TO BUS 243175 CKT 1 / 245874 05E DELPHO 69.0 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 245878 TO BUS 243175 CKT 1 / 245878 05FTJENNG8 69.0 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 243175 TO BUS 245902 CKT 1 / 243175 05N DELPHO 69.0 245902 05S DELPHO 69.0 1 END
AEP_P4_#7528_05ALLEN 138-T131-FSA	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1

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Option 1	
Contingency Name	**Description**
	OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051 05NDELPH 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051 05NDELPH 138 243175 05N DELPHO 69.0 1 END
AEP_P4_#7528_05ALLEN 138-	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 END
AEP_P7-1_#7372	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 END
AEP_P1-2_#7501	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 END

Table 2

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Generator Deliverability

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

None

Multiple Facility Contingency

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

AD1-101 Multiple Facility Contingency															
	Contingency		Affected		Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	DCTL	AEP_P7-1_#6676_T131-FSA	AEP - AEP	05TIMBSS-05TILLMA 138 kV line	246950	243383	1	DC	95.18	97.25	ER	~~332~~ 240	6.85	
2	DCTL	AEP_P7-1_#6676	AEP - AEP	05TIMBSS-05TILLMA 138 kV line	246950	243383	1	DC	94.94	97.0	ER	~~332~~ 240	6.85	

Table 3

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

AD1-101 Contribution to Previously Identified Overloads														
	Contingency		Affected	Facility	Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	LFFB	AEP_P4_#7528_05ALLEN 138-T131-FSA	AEP - AEP	05HAVILN-05E LIMA 138 kV line	243017	242989	1	DC	122.74	126.63	ER	220	8.53	
1	LFFB	AEP_P4_#7528_05ALLEN 138-	AEP - AEP	05NDELPH-05E SIDE 138 kV line	243051	242991	1	DC	102.46	109.0	ER	167	10.9	
3	DCTL	AEP_P7-1_#7372	AEP - AEP	05NDELPH-05E SIDE 138 kV line	243051	242991	1	DC	102.46	109.0	ER	167	10.9	

Table 4

Steady-State Voltage Requirements

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

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Affected System Analysis & Mitigation

LGEE Impacts:

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

MISO Impacts:

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

Duke, Progress & TVA Impacts:

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

OVEC Impacts:

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

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

AD1-101 Delivery of Energy Portion of Interconnection Request														
		Contingency	Affected	Bus					Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	N-1	AEP_P1-2_#7501	AEP - AEP	05HAVILN-05E LIMA 138 kV line	243017	242989	1	DC	122.97	125.53	ER	220	5.62	

Table 5

New System Reinforcements

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

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

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Table 6

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Previous System Reinforcements

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

Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1	05HAVILN-05E LIMA 138 kV line	E Lima Wavetrap and Haviland Wavetrap will need to be replaced Replace E lima and Haviland Line risers Rebuild/reconductor 5.5 miles of ACSR 556.5 ~ 26/7 ~ Dove conductor section	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	$8,500,000
#2	05NDELPH-05E SIDE 138 kV line	A sag study will be required on the 1.92 mile section of the ACSR 397.5 ~ 30/7 ~ Lark conductor section 3 to mitigate the overload.	Sag study: 6 to 12 months. Rebuild. The standard time required for construction differs from state to state. An Approximate construction would be 24 to 36 months after signing an interconnection agreement.	$15,000
			Total Network Upgrades	**$8,515,000**

Table 7

Schedule

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

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

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Conclusion

Based upon the results of this Feasibility Study, the construction of the 49.9 MW (18.96 MW Capacity) solar generating facility of the IC (PJM Project #AD1-101) 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 (Continental 69 kV Substation)		
Attachment Cost	Expand Continental 69 kV Substation	$600,000
Non-Direct Connection Cost Estimate	69 kV Revenue Metering	$200,000
	Upgrade line protection and controls at the Continental 69 kV substation.	$200,000
	New System Reinforcements *(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)*	$50,000
	Previous System Reinforcements *(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)*	$8,565,000
	Total Estimated Cost for Project AD1-101	**$9,615,000**

Table 8

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

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Option 2

Network Impacts

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

Summer Peak Analysis – 2021

Contingency Descriptions

The following contingencies resulted in overloads:

Option 1	
Contingency Name	**Description**
AEP_P7-1_#6676_T131-FSA	OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA 138 243017 05HAVILN 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1 / 242991 05E SIDE 138 243051 05NDELPH 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1 / 242991 05E SIDE 138 243108 05STRLN1 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051 05NDELPH 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051 05NDELPH 138 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 245874 TO BUS 243175 CKT 1 / 245874 05E DELPHO 69.0 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 245878 TO BUS 243175 CKT 1 / 245878 05FTJENNG8 69.0 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 243175 TO BUS 245902 CKT 1 / 243175 05N DELPHO 69.0 245902 05S DELPHO 69.0 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 END
AEP_P7-1_#6676	OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA 138 243017 05HAVILN 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1 / 242991 05E SIDE 138 243051 05NDELPH 138 1 OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1 / 242991 05E SIDE 138 243108 05STRLN1 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051 05NDELPH 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051 05NDELPH 138 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 245874 TO BUS 243175 CKT 1 / 245874 05E DELPHO 69.0 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 245878 TO BUS 243175 CKT 1 / 245878 05FTJENNG8 69.0 243175 05N DELPHO 69.0 1 OPEN BRANCH FROM BUS 243175 TO BUS 245902 CKT 1 / 243175 05N DELPHO 69.0 245902 05S DELPHO 69.0 1 END
AEP_P4_#7528_05ALLEN 138-T131-FSA	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265

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Option 1	
Contingency Name	**Description**
	05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051 05NDELPH 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051 05NDELPH 138 243175 05N DELPHO 69.0 1 END
AEP_P4_#7528_05ALLEN 138-	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 END
AEP_P7-1_#7372	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 END
AEP_P1-2_#7501	OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 246265 CKT 1 / 246264 05ST R14 8 34.5 246265 05TILLMAN 34.5 1 END

Table 9

Generator Deliverability

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

None

Multiple Facility Contingency

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

AD1-119 Multiple Facility Contingency															
		Contingency	Affected		Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	DCTL	AEP_P7-1_#6676_T131-FSA	AEP - AEP	05TIMBSS-05TILLMA 138 kV line	246950	243383	1	DC	94.92	96.72	ER	332	5.99	1
2	DCTL	AEP_P7-1_#6676	AEP - AEP	05TIMBSS-05TILLMA 138 kV line	246950	243383	1	DC	94.67	96.47	ER	332	5.99	1

Table 10

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Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

AD1-119 Contribution to Previously Identified Overloads															
		Contingency	Affected	Facility	Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	LFFB	AEP_P4_#7528_05ALLEN 138-T131-FSA	AEP - AEP	05HAVILN-05E LIMA 138 kV line	243017	242989	1	DC	117.68	121.37	ER	220	8.09	
2	LFFB	AEP_P4_#7528_05ALLEN 138-	AEP - AEP	05NDELPH-05E SIDE 138 kV line	243051	242991	1	DC	100.18	107.17	ER	167	11.55	
3	DCTL	AEP_P7-1_#7372	AEP - AEP	05NDELPH-05E SIDE 138 kV line	243051	242991	1	DC	100.18	107.17	ER	167	11.55	

Table 11

Steady-State Voltage Requirements

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

Affected System Analysis & Mitigation

LGEE Impacts:

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

MISO Impacts:

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

Duke, Progress & TVA Impacts:

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

OVEC Impacts:

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

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Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

AD1-119 Delivery of Energy Portion of Interconnection Request															
		Contingency	Affected		Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	N-1	AEP_P1-2_#7501	AEP - AEP	05HAVILN-05E LIMA 138 kV line	243017	242989	1	DC	117.76	120.05	ER	220	5.01	

Table 12

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

Single Line Diagram

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Figure 2: Primary Point of Interconnection (Continental 69 kV Substation)

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Figure 3: Secondary Point of Interconnection (Continental – Kalida 69 kV)

Single Line Diagram

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Figure 4: Secondary Point of Interconnection (Continental – Kalida 69 kV)

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Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.

It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

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Appendix 1

(AEP - AEP) The 05TIMBSS-05TILLMA 138 kV line (from bus 246950 to bus 243383 ckt 1) loads from 95.18% to 97.25% (**DC power flow**) of its emergency rating (332 MVA) for the tower line contingency outage of 'AEP_P7-1_#6676_T131-FSA'. This project contributes approximately 6.85 MW to the thermal violation.

CONTINGENCY 'AEP_P7-1_#6676_T131-FSA'
OPEN BRANCH FROM BUS 242989 TO BUS 243017 CKT 1 / 242989 05E LIMA 138 243017 05HAVILN 138 1
OPEN BRANCH FROM BUS 242991 TO BUS 243051 CKT 1 / 242991 05E SIDE 138 243051 05NDELPH 138 1
OPEN BRANCH FROM BUS 242991 TO BUS 243108 CKT 1 / 242991 05E SIDE 138 243108 05STRLN1 138 1
OPEN BRANCH FROM BUS 243051 TO BUS 247521 CKT 1 / 243051 05NDELPH 138 247521 T-131 C 138 1
OPEN BRANCH FROM BUS 243051 TO BUS 243175 CKT 1 / 243051 05NDELPH 138 243175 05N DELPHO 69.0 1
OPEN BRANCH FROM BUS 245874 TO BUS 243175 CKT 1 / 245874 05E DELPHO 69.0 243175 05N DELPHO 69.0 1
OPEN BRANCH FROM BUS 245878 TO BUS 243175 CKT 1 / 245878 05FTJENNG8 69.0 243175 05N DELPHO 69.0 1
OPEN BRANCH FROM BUS 243175 TO BUS 245902 CKT 1 / 243175 05N DELPHO 69.0 245902 05S DELPHO 69.0 1
OPEN BRANCH FROM BUS 243242 TO BUS 247521 CKT 1 / 243242 05ALLEN 138 247521 T-131 C 138 1
END

Bus Number	*Bus Name*	*Full Contribution*
246953	*05TIMB G C*	*5.06*
247911	*05TIMB G E*	*103.83*
934741	*AD1-101 C O1*	*2.6*
934742	*AD1-101 E O1*	*4.25*
934901	*AD1-119 C O1*	*8.28*
934902	*AD1-119 E O1*	*13.52*
247534	*R-048 C*	*4.19*
247928	*R-048 E*	*16.77*
247607	*V1-011 C*	*10.13*
247959	*V1-011 E*	*67.8*
247608	*V1-012 C*	*15.2*
247960	*V1-012 E*	*101.69*
926811	*AC1-167 C*	*10.01*
926812	*AC1-167 E*	*4.86*
926901	*AC1-176 C*	*6.53*
926902	*AC1-176 E*	*43.92*

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Appendix 2

(AEP - AEP) The 05HAVILN-05E LIMA 138 kV line (from bus 243017 to bus 242989 ckt 1) loads from 122.74% to 126.63% (**DC power flow**) of its emergency rating (220 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#7528_05ALLEN 138-T131-FSA'. This project contributes approximately 8.53 MW to the thermal violation.

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

Bus Number	*Bus Name*	*Full Contribution*
246953	*05TIMB G C*	*3.75*
247911	*05TIMB G E*	*76.88*
934741	*AD1-101 C O1*	*3.24*
934742	*AD1-101 E O1*	*5.29*
934901	*AD1-119 C O1*	*6.23*
934902	*AD1-119 E O1*	*10.16*
247534	*R-048 C*	*3.15*
247928	*R-048 E*	*12.61*
247607	*V1-011 C*	*8.27*
247959	*V1-011 E*	*55.37*
247608	*V1-012 C*	*12.41*
247960	*V1-012 E*	*83.05*
926811	*AC1-167 C*	*8.47*
926812	*AC1-167 E*	*4.11*
926901	*AC1-176 C*	*4.84*
926902	*AC1-176 E*	*32.52*

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Appendix 3

(AEP - AEP) The 05NDELPH-05E SIDE 138 kV line (from bus 243051 to bus 242991 ckt 1) loads from 102.46% to 109.0% (**DC power flow**) of its emergency rating (167 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#7528_05ALLEN 138-'. This project contributes approximately 10.9 MW to the thermal violation.

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

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

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