Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AD2-072

Van Arsdell-Mercer Industrial 69kV

July 2018

Preface

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

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

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

General

The Interconnection Customer (IC), has proposed a solar generating facility located in Mercer County, Kentucky. The installed facilities will have a total capability of 100 MW with 67.1 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is December 1, 2021. **This study does not imply a EKPC commitment to this in-service date.**

Point of Interconnection

AD2-072 will interconnect with the EKPC transmission system along one of the following points of interconnection:

- Van Arsdell - Mercer Industrial 69 kV line
- Mercer County Industrial Park 69kV substation

Cost Summary

The AD2-072 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 250,000
Direct Connection Network Upgrades	$ 2,700,000
Non Direct Connection Network Upgrades	$ 100,000
Total Costs	**$ 3,050,000**

In addition, the AD2-072 project may be responsible for a contribution to the following costs:

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Description	Total Cost
New System Upgrades	$ 9,950,000
Previously Identified Upgrades	$ 17,400,000
Total Costs	**$ 27,350,000**

Cost allocations for these upgrades will be provided in the System Impact Study Report.

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Attachment Facilities

The total preliminary cost estimate for the Attachment Facilities work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Install a 69 kV switch structure at the point of demarcation. Estimated Time: 18 months.	$ 250,000
Total Direct Connection Facility Costs	**$ 250,000**

Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Build 69kv switching station along the Van Arsdell - Mercer Industrial 69 kV line including associated transmission line work. Estimated Time: 18 months.	$ 2,700,000
Total Direct Connection Facility Costs	**$ 2,700,000**

Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Adjust remote, relaying, and metering settings at Van Arsdell - 69kV Sub.	$ 50,000
Adjust remote, relaying, and metering settings at Mercer Industrial 69 kV Sub.	$ 50,000
Total Non-Direct Connection Facility Costs	**$ 100,000**

Interconnection Customer Requirements

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.

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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.

EKPC Requirements

The Interconnection Customer will be required to comply with all EKPC Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "EKPC Facility Connection Requirements" document located at the following link:

http://www.pjm.com/planning/design-engineering/to-tech-standards/ekpc.aspx

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Network Impacts

Option 1

The Queue Project AD2-072 was evaluated as a 100.0 MW (Capacity 67.1 MW) injection at the tap of the Van Arsdell - Mercer Industrial 69 kV line in the EKPC area. Project AD2-072 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-072 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:

Contingency Name	Description
AEP_P1-2_#363	CONTINGENCY 'AEP_P1-2_#363' OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1 END
AEP_P1-3_#8818	CONTINGENCY 'AEP_P1-3_#8818' OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNU 765 242924 05HANG R 765 1 OPEN BRANCH FROM BUS 242921 TO BUS 242934 CKT 1 / 242921 05CORNU 765 242934 05CORNU 345 1 REMOVE UNIT 1A FROM BUS 247245 / 247245 05HRKG1A 18.0 REMOVE UNIT 1B FROM BUS 247246 / 247246 05HRKG1B 18.0 REMOVE UNIT 1S FROM BUS 247247 / 247247 05HRKG1S 18.0 REMOVE UNIT 2A FROM BUS 247248 / 247248 05HRKG2A 18.0 REMOVE UNIT 2B FROM BUS 247249 / 247249 05HRKG2B 18.0 REMOVE UNIT 2S FROM BUS 247250 / 247250 05HRKG2S 18.0 END

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Contingency Name	Description
DEO&K P1-* P2-1 RED BANK-SG-ZIMMER 4545	CONTINGENCY 'DEO&K P1-* P2-1 RED BANK-SG-ZIMMER 4545' OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 END
DEO&K P1-* P2-1 ZIMMER-MELDAHL 34576	CONTINGENCY 'DEO&K P1-* P2-1 ZIMMER-MELDAHL 34576' OPEN BRANCH FROM BUS 249577 TO BUS 249581 CKT 1 END
DEO&K P2-3/4 P4-* 1493_RED BANK	CONTINGENCY 'DEO&K P2-3/4 P4-* 1493_RED BANK' OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 OPEN BRANCH FROM BUS 249571 TO BUS 250092 CKT 1 END
DEO&K P2-3/4 P4-* 816_SILVERGROVE	CONTINGENCY 'DEO&K P2-3/4 P4-* 816_SILVERGROVE' OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 249988 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 250042 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 250052 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 250053 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 END

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Contingency Name	Description
DEO&K P7-1 CIRCUIT1883&4545REDBANKSILGRVZIMMER	CONTINGENCY 'DEO&K P7-1 CIRCUIT1883&4545REDBANKSILGRVZIMMER' OPEN BRANCH FROM BUS 249989 TO BUS 250080 CKT 1 OPEN BRANCH FROM BUS 250079 TO BUS 250080 CKT Z1 OPEN BRANCH FROM BUS 250079 TO BUS 250092 CKT 1 OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 END

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Generator Deliverability

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

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Ref
1	N-1	DEO&K P1-* P2-1 ZIMMER-MELDAHL 34576	EKPC - DAY	7SPURLOCK-09STUART 345 kV line	342838	253077	1	DC	99.79	100.65	ER	1374	11.74	

Note: Please see Attachment 1 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

Multiple Facility Contingency

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

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)

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Ref
2	N-1	AEP_P1-2_#363	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV line	324114	248000	1	DC	190.85	191.76	ER	1370	12.29	1
3	Non	Non	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV line	324114	248000	1	DC	136.5	137.52	NR	1134	11.5	

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#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Ref
4	N-1	AEP_P1-3_#8818	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV line	324114	248000	1	DC	114.35	115.19	ER	1370	11.5	
5	LFFB	DEO&K P2-3/4 P4-*816_SILVERGROVE	EKPC - DAY	7SPURLOCK-09STUART 345 kV line	342838	253077	1	DC	108.39	108.9	ER	1374	15.14	2
6	LFFB	DEO&K P2-3/4 P4-*1493_REDBANK	EKPC - DAY	7SPURLOCK-09STUART 345 kV line	342838	253077	1	DC	108.29	108.81	ER	1374	15.11	
7	DCTL	DEO&K P7-1 CIRCUIT1883&4545REDBANKSILGRVZIMMER	EKPC - DAY	7SPURLOCK-09STUART 345 kV line	342838	253077	1	DC	108.24	108.75	ER	1374	15.11	

Note: Please see Attachment 1 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

Short Circuit

(Summary of impacted circuit breakers)

None

Steady-State Voltage Requirements

(Summary of the VAR requirements based upon the results of the steady-state voltage studies)

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Steady State Voltage Studies to be conducted during later study phases

Stability and Reactive Power Requirement for Low Voltage Ride Through

(Summary of the VAR requirements based upon the results of the dynamic studies)

Stability Studies to be conducted during later study phases

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).

Winter Analysis - 2021

Winter Studies to be conducted during later study phases

Light Load Analysis - 2021

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Light Load Studies to be conducted during later study phases

Potential Congestion due to Local Energy Deliverability

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.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

	Contingency		Affected		Bus			Power	Loading %		Rating		MW	
#	Type	Name	Area	Facility Description	From	To	Circuit	Flow	Initial	Final	Type	MVA	Contribution	Ref
8	N-1	AEP_P1-2_#363	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV line	324114	248000	1	DC	180.8	182.17	ER	1370	18.31	
9	Non	Non	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV line	324114	248000	1	DC	138.34	139.86	NR	1134	17.15	
10	N-1	DEO&K P1-* P2-1 RED BANK-SG-ZIMMER 4545	EKPC - DAY	7SPURLOCK-09STUART 345 kV line	342838	253077	1	DC	108.23	108.74	ER	1374	15.11	
11	Non	Non	EKPC - DAY	7SPURLOCK-09STUART 345 kV line	342838	253077	1	DC	99.68	100.21	NR	1240	14.56	

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Overloads Identified by EKPC on the lower voltage system:

New System Reinforcements

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

Violation #12

Monitored: Van Arsdell – AD2-072 Tap 69kV (342406-936570)
Contingency: AD2-072 Tap – Mercer Industrial 69kV (936570-341857)
Thermal Overload: 101.61 MVA (103.68%)
Project: Reconductor Van Arsdell-AD2-072 Tap 69kV line section using 795 MCM conductor at 212°F (4.3 miles)
New Ratings: 114/127/133 (N/LTE/LD)
Estimated Cost: $3,100,000-$4,800,000
The cost of this project will depend on the amount of work needed to upgrade the Van Arsdell – AD2-072 Tap 69kV line section to use 795 MCM conductor.
Estimated Time: 24 months

Violation #13

Monitored: Mercer Industrial – AD2-072 Tap 69kV (341857-936570)
Contingency: AD2-072 Tap – Van Arsdell 69kV (936570-342406)
Thermal Overload: 101.40 MVA (103.47%)
Project: Reconductor Mercer Industrial-AD2-072 Tap 69kV line section using 795 MCM conductor at 212°F (4.3 miles)
New Ratings: 114/127/133 (N/LTE/LD)
Estimated Cost: $3,100,000-$4,800,000
Estimated Time: 24 months
The cost of this project will depend on the amount of work needed to upgrade the Mercer Industrial – AD2-072 Tap 69kV line section to use 795 MCM conductor.

Violation #14

Monitored: Hunt Farm Jct – Perryville 69kV (341671-342061)
Contingency: AD2-072 Tap – Van Arsdell 69kV (936570-342406)
Thermal Overload: 48.19 MVA (104.76%)
Project: Increase MOT of 266 MCM conductor on Hunt Farm Jct-Perryville 69kV line section to 212°F (5.27 miles)

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New Ratings: 57/63/66 (N/LTE/LD)
Estimated Cost: $350,000
Estimated Time: 12 months

It should be noted that EKPC will complete an evaluation to determine if either of these line sections can be upgraded to an operating temperature of 212°F in the System Impact Study Report. If either line section has constraints that will make the upgrade unfeasible, EKPC would then recommend a rebuild of the line section. EKPC would need to complete a LiDAR survey of each line section, and an initial design review to determine if the high temperature upgrade is possible on these line sections- which will be completed in the Impact Study Phase.

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	Network Upgrade Number	Upgrade Cost
#1 5, 6, 7	7SPURLOCK-09STUART 345 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: • EKPC: Reconductor EKPC's portion of the Spurlock-Stuart 345kV line with 954 ACSS (PJM Upgrade Id: b2879.2). New EKPC ratings will be S/N: 1466 MVA, S/E: 1710 MVA. The scheduled in-service date is 12/31/2018. • DAY: Replace wavetrap at the Stuart 345 kV substation – Already proposed as part of generation retirement project (PJM Upgrade Id: b2879.1). This upgrade is in-service as of 06/01/2018. This reinforcement was identified as a baseline project; Therefore this project does not have cost responsibility for this upgrade, however it may be responsible for acceleration costs.		**$ 0**

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Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
#12	Van Arsdell – AD2-072 Tap 69kV	In order to mitigate the overloads of facilities above, the following reinforcements are required: • Project: Reconductor Van Arsdell-AD2-072 Tap 69kV line section using 795 MCM conductor at 212°F (4.3 miles) • New Ratings: 114/127/133 (N/LTE/LD) • Estimated Cost: $3,100,000-$4,800,000 • The cost of this project will depend on the amount of work needed to upgrade the Van Arsdell – AD2-072 Tap 69kV line section to use 795 MCM conductor. • Estimated Time: 24 months		**$ 4,800,000**
#13	Mercer Industrial – AD2-072 Tap 69kV	In order to mitigate the overloads of facilities above, the following reinforcements are required: • Project: Reconductor Mercer Industrial-AD2-072 Tap 69kV line section using 795 MCM conductor at 212°F (4.3 miles) • New Ratings: 114/127/133 (N/LTE/LD) • Estimated Cost: $3,100,000-$4,800,000 • Estimated Time: 24 months • The cost of this project will depend on the amount of work needed to upgrade the Mercer Industrial – AD2-072 Tap 69kV line section to use 795 MCM conductor.		**$ 4,800,000**
#14	Hunt Farm Jct – Perryville 69kV	In order to mitigate the overloads of facilities above, the following reinforcements are required: • Project: Increase MOT of 266 MCM conductor on Hunt Farm Jct-Perryville 69kV line section to 212°F (5.27 miles) • New Ratings: 57/63/66(N/LTE/LD) • Estimated Cost: $350,000 • Estimated Time: 12 months		**$ 350,000**
			Total New Network Upgrades	**$ 9,950,000**

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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)

Violation #	Overloaded Facility	Upgrade Description	Network Upgrade Number	Upgrade Cost
#2, 3, 4	7TRIMBLE-06CLIFTY 345 kV line	In order to mitigate the overloads of facilities above, the following reinforcements are required: • To relieve the Trimble – Clifty 345 kV line overload: LG&E upgrade is to reconductor the line with a high temperature conductor and upgrade any necessary terminal equipment to achieve expected ratings of 2610/2610 MVA SN/SE. Cost estimate is $17.4M with a time estimate of 18 months. PJM Network Upgrade N5469.	N5469	**$ 17,400,000**
			Total New Network Upgrades	**$ 17,400,000**

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Network Impacts

Option 2

The Queue Project AD2-072 was evaluated as a 100.0 MW (Capacity 67.1 MW) injection to the Mercer County Industrial Park 69kV substation in the EKPC area. Project AD2-072 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-072 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:

Contingency Name	Description
AEP_P1-2_#363	CONTINGENCY 'AEP_P1-2_#363' OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1 END
AEP_P1-3_#8818	CONTINGENCY 'AEP_P1-3_#8818' OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNU 765 242924 05HANG R 765 1 OPEN BRANCH FROM BUS 242921 TO BUS 242934 CKT 1 / 242921 05CORNU 765 242934 05CORNU 345 1 REMOVE UNIT 1A FROM BUS 247245 / 247245 05HRKG1A 18.0 REMOVE UNIT 1B FROM BUS 247246 / 247246 05HRKG1B 18.0 REMOVE UNIT 1S FROM BUS 247247 / 247247 05HRKG1S 18.0 REMOVE UNIT 2A FROM BUS 247248 / 247248 05HRKG2A 18.0 REMOVE UNIT 2B FROM BUS 247249 / 247249 05HRKG2B 18.0 REMOVE UNIT 2S FROM BUS 247250 / 247250 05HRKG2S 18.0 END

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Contingency Name	Description
DEO&K P1-* P2-1 RED BANK-SG-ZIMMER 4545	CONTINGENCY 'DEO&K P1-* P2-1 RED BANK-SG-ZIMMER 4545' OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 END
DEO&K P1-* P2-1 ZIMMER-MELDAHL 34576	CONTINGENCY 'DEO&K P1-* P2-1 ZIMMER-MELDAHL 34576' OPEN BRANCH FROM BUS 249577 TO BUS 249581 CKT 1 END
DEO&K P2-3/4 P4-* 1493_RED BANK	CONTINGENCY 'DEO&K P2-3/4 P4-* 1493_RED BANK' OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 OPEN BRANCH FROM BUS 249571 TO BUS 250092 CKT 1 END
DEO&K P2-3/4 P4-* 816_SILVERGROVE	CONTINGENCY 'DEO&K P2-3/4 P4-* 816_SILVERGROVE' OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 249988 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 250042 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 250052 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 250053 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 END

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Contingency Name	Description
DEO&K P7-1 CIRCUIT1883&4545REDBANKSILGRVZIMMER	CONTINGENCY 'DEO&K P7-1 CIRCUIT1883&4545REDBANKSILGRVZIMMER' OPEN BRANCH FROM BUS 249989 TO BUS 250080 CKT 1 OPEN BRANCH FROM BUS 250079 TO BUS 250080 CKT Z1 OPEN BRANCH FROM BUS 250079 TO BUS 250092 CKT 1 OPEN BRANCH FROM BUS 249573 TO BUS 249577 CKT 1 OPEN BRANCH FROM BUS 249573 TO BUS 250097 CKT 1 OPEN BRANCH FROM BUS 249571 TO BUS 249573 CKT 1 END

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Generator Deliverability

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

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Ref
1	N-1	DEO&K P1-* P2-1 ZIMMER-MELDAHL 34576	EKPC - DAY	7SPURLOCK-09STUART 345 kV line	342838	253077	1	DC	99.79	100.66	ER	1374	11.87	

Note: Please see Attachment 1 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

Multiple Facility Contingency

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

None

Contribution to Previously Identified Overloads

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

#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Ref
2	N-1	AEP_P1-2_#363	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV line	324114	248000	1	DC	190.85	191.75	ER	1370	12.19	1
3	Non	Non	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV line	324114	248000	1	DC	136.5	137.51	NR	1134	11.38	

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#	Contingency Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Ref
4	N-1	AEP_P1-3_#8818	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV line	324114	248000	1	DC	114.35	115.18	ER	1370	11.38	
5	LFFB	DEO&K P2-3/4 P4-*816_SILVERGROVE	EKPC - DAY	7SPURLOCK-09STUART 345 kV line	342838	253077	1	DC	108.39	108.91	ER	1374	15.28	2
6	LFFB	DEO&K P2-3/4 P4-*1493_REDBANK	EKPC - DAY	7SPURLOCK-09STUART 345 kV line	342838	253077	1	DC	108.29	108.81	ER	1374	15.25	
7	DCTL	DEO&K P7-1 CIRCUIT1883&4545REDBANKSILGRVZIMMER	EKPC - DAY	7SPURLOCK-09STUART 345 kV line	342838	253077	1	DC	108.23	108.75	ER	1374	15.25	

Note: Please see Attachment 1 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

Short Circuit

(Summary of impacted circuit breakers)

None

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Potential Congestion due to Local Energy Deliverability

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.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

	Contingency		Affected		Bus			Power	Loading %		Rating		MW	
#	Type	Name	Area	Facility Description	From	To	Circuit	Flow	Initial	Final	Type	MVA	Contribution	Ref
8	N-1	AEP_P1-2_#363	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV line	324114	248000	1	DC	180.8	182.16	ER	1370	18.17	
9	Non	Non	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV line	324114	248000	1	DC	138.34	139.84	NR	1134	16.97	
10	N-1	DEO&K P1-* P2-1 RED BANK-SG-ZIMMER 4545	EKPC - DAY	7SPURLOCK-09STUART 345 kV line	342838	253077	1	DC	108.22	108.74	ER	1374	15.25	
11	Non	Non	EKPC - DAY	7SPURLOCK-09STUART 345 kV line	342838	253077	1	DC	99.67	100.22	NR	1240	14.68	

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Attachment 1. Flowgate Details – Option 1

Appendices

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

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

Appendix 1

(LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 190.85% to 191.76% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of 'AEP_P1-2_#363'. This project contributes approximately 12.29 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
247287	05AND G3	0.76
243442	05RKG1	37.19
243443	05RKG2	36.63
342900	1COOPER1 G	2.98
342903	1COOPER2 G	5.78
342918	1JKCT 1G	2.34
342921	1JKCT 2G	2.34
342924	1JKCT 3G	2.34
342927	1JKCT 4G	1.55
342930	1JKCT 5G	1.54
342933	1JKCT 6G	1.55
342936	1JKCT 7G	1.55
342939	1JKCT 9G	1.59
342942	1JKCT 10G	1.59
342945	1LAUREL 1G	1.68
932551	AC2-075 C	1.08
933441	AC2-157 C	8.16
LTF	AD1-092	3.63
LTF	AD1-093	6.12
LTF	AD1-094	1.1

Bus Number	Bus Name	Full Contribution
LTF	CBM-W1	21.42
LTF	CBM-W2	141.33
LTF	CIN	25.73
LTF	CLIFTY	95.03
LTF	CPLE	1.18
LTF	DEARBORN	0.51
LTF	IPL	15.7
981181	J708	40.82
981521	J759	9.35
981531	J762	29.43
981571	J783	9.25
938311	J795	3.66
938731	J800	15.73
938861	J829	12.54
938921	J842 C	3.98
938931	J843 C	4.32
939021	J856	9.32
274650	KINCAID ;1U	5.91
274651	KINCAID ;2U	5.89
LTF	LGEE	19.02

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Bus Number	Bus Name	Full Contribution
935011	AD1-134	8.34
935141	AD1-148	2.47
936281	AD2-036 C	3.24
936381	AD2-048 C	3.93
936571	AD2-072 C O1	12.29
936771	AD2-100 C	6.97
936821	AD2-105 C O1	3.75
936831	AD2-106 C O1	1.99
936841	AD2-107 C O1	1.29
LTF	CARR	0.33
LTF	CBM-S1	40.52
LTF	CBM-S2	6.89

Bus Number	Bus Name	Full Contribution
LTF	MEC	21.85
LTF	RENSSELAER	0.26
LTF	ROSETON	1.87
LTF	WEC	1.74
900404	X3-028 C	161.12
LTF	Z1-043	8.38
930461	AB1-087	59.08
930471	AB1-088	59.08
LTF	AB2-013	5.1
927331	AC1-040 C	9.43
925981	AC1-074 C	4.53

Appendix 2

(EKPC - DAY) The 7SPURLOCK-09STUART 345 kV line (from bus 342838 to bus 253077 ckt 1) loads from 108.39% to 108.9% (**DC power flow**) of its emergency rating (1374 MVA) for the line fault with failed breaker contingency outage of 'DEO&K P2-3/4 P4-* 816_SILVERGROVE'. This project contributes approximately 15.14 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
251970	08MELDL1	2.61
251971	08MELDL2	2.61
251972	08MELDL3	2.62
251968	08ZIMRHP	51.51
342957	1SPURLK1G	26.81
342960	1SPURLK2G	51.09
342963	1SPURLK3G	26.85
342966	1SPURLK4G	26.85
932461	AC2-066 C	-3.77
932551	AC2-075 C	3.72
932552	AC2-075 E	1.83
935011	AD1-134	18.23
936281	AD2-036 C	11.11
936282	AD2-036 E	5.56
936381	AD2-048 C	12.52
936382	AD2-048 E	6.25
936571	AD2-072 C O1	10.16

Bus Number	Bus Name	Full Contribution
936842	AD2-107 E O1	3.18
LTF	CARR	0.54
LTF	CBM-S1	13.05
LTF	CBM-S2	3.14
LTF	CBM-W1	9.01
LTF	CBM-W2	48.66
LTF	CIN	6.29
LTF	CPLE	0.44
LTF	DEARBORN	0.85
LTF	G-007	1.31
LTF	IPL	4.2
LTF	LGEE	4.1
LTF	MEC	8.31
LTF	O-066	8.43
LTF	RENSSELAER	0.42
LTF	ROSETON	3.06
LTF	WEC	0.77

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Bus Number	Bus Name	Full Contribution
936572	AD2-072 E O1	4.98
936821	AD2-105 C O1	4.71
936822	AD2-105 E O1	6.5
936831	AD2-106 C O1	2.95
936832	AD2-106 E O1	4.08
936841	AD2-107 C O1	2.31

Bus Number	Bus Name	Full Contribution
925981	AC1-074 C	15.56
925982	AC1-074 E	6.67
926101	AC1-089 C	5.59
926102	AC1-089 E	9.12
926951	AC1-182	6.6

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Attachment 1. Flowgate Details – Option 2

Appendix 1

(LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 190.85% to 191.75% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of 'AEP_P1-2_#363'. This project contributes approximately 12.19 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
247287	05AND G3	0.76
243442	05RKG1	37.19
243443	05RKG2	36.63
342900	1COOPER1 G	2.98
342903	1COOPER2 G	5.78
342918	1JKCT 1G	2.34
342921	1JKCT 2G	2.34
342924	1JKCT 3G	2.34
342927	1JKCT 4G	1.55
342930	1JKCT 5G	1.54
342933	1JKCT 6G	1.55
342936	1JKCT 7G	1.55
342939	1JKCT 9G	1.59
342942	1JKCT 10G	1.59
342945	1LAUREL 1G	1.68
932551	AC2-075 C	1.08
933441	AC2-157 C	8.16
LTF	AD1-092	3.63
LTF	AD1-093	6.12
LTF	AD1-094	1.1
935011	AD1-134	8.34
935141	AD1-148	2.47
936281	AD2-036 C	3.24
936381	AD2-048 C	3.93
936571	AD2-072 C O2	12.19
936771	AD2-100 C	6.97
936821	AD2-105 C	3.71

Bus Number	Bus Name	Full Contribution
LTF	CBM-W1	21.42
LTF	CBM-W2	141.33
LTF	CIN	25.73
LTF	CLIFTY	95.03
LTF	CPLE	1.18
LTF	DEARBORN	0.51
LTF	IPL	15.7
981181	J708	40.82
981521	J759	9.35
981531	J762	29.43
981571	J783	9.25
938311	J795	3.66
938731	J800	15.73
938861	J829	12.54
938921	J842 C	3.98
938931	J843 C	4.32
939021	J856	9.32
274650	KINCAID ;1U	5.91
274651	KINCAID ;2U	5.89
LTF	LGEE	19.02
LTF	MEC	21.85
LTF	RENSSELAER	0.26
LTF	ROSETON	1.87
LTF	WEC	1.74
900404	X3-028 C	161.12
LTF	Z1-043	8.38
930461	AB1-087	59.08

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	O2	
936831	AD2-106 C O2	1.96
936841	AD2-107 C O2	1.3
LTF	CARR	0.33
LTF	CBM-S1	40.52
LTF	CBM-S2	6.89

930471	AB1-088	59.08
LTF	AB2-013	5.1
927331	AC1-040 C	9.43
925981	AC1-074 C	4.53

Appendix 2

(EKPC - DAY) The 7SPURLOCK-09STUART 345 kV line (from bus 342838 to bus 253077 ckt 1) loads from 108.39% to 108.91% (**DC power flow**) of its emergency rating (1374 MVA) for the line fault with failed breaker contingency outage of 'DEO&K P2-3/4 P4-* 816_SILVERGROVE'. This project contributes approximately 15.28 MW to the thermal violation.

Bus Number	Bus Name	Full Contribution
251970	08MELDL1	2.61
251971	08MELDL2	2.61
251972	08MELDL3	2.62
251968	08ZIMRHP	51.51
342957	1SPURLK1G	26.81
342960	1SPURLK2G	51.09
342963	1SPURLK3G	26.85
342966	1SPURLK4G	26.85
932461	AC2-066 C	-3.77
932551	AC2-075 C	3.72
932552	AC2-075 E	1.83
935011	AD1-134	18.23
936281	AD2-036 C	11.11
936282	AD2-036 E	5.56
936381	AD2-048 C	12.52
936382	AD2-048 E	6.25
936571	AD2-072 C O2	10.25
936572	AD2-072 E O2	5.03
936821	AD2-105 C O2	4.71
936822	AD2-105 E O2	6.5
936831	AD2-106 C O2	2.94
936832	AD2-106 E O2	4.06
936841	AD2-107 C O2	2.41

Bus Number	Bus Name	Full Contribution
936842	AD2-107 E O2	3.33
LTF	CARR	0.54
LTF	CBM-S1	13.05
LTF	CBM-S2	3.14
LTF	CBM-W1	9.01
LTF	CBM-W2	48.66
LTF	CIN	6.29
LTF	CPLE	0.44
LTF	DEARBORN	0.85
LTF	G-007	1.31
LTF	IPL	4.2
LTF	LGEE	4.1
LTF	MEC	8.31
LTF	O-066	8.43
LTF	RENSSELAER	0.42
LTF	ROSETON	3.06
LTF	WEC	0.77
925981	AC1-074 C	15.56
925982	AC1-074 E	6.67
926101	AC1-089 C	5.59
926102	AC1-089 E	9.12
926951	AC1-182	6.6

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