Revised Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AE1-247

Barren County-Summer Shade 161 kV

February 2019

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 / battery storage generating facility located in Barren County, KY. The installed facilities will have a total capability of 205 MW with 137.1 MW of this output being recognized by PJM as capacity. The capacity & energy rights are associated with the solar generating facility only. The proposed in-service date for this project is June 1, 2022. **This study does not imply a EKPC commitment to this in-service date.**

Point of Interconnection

AE1-247 will interconnect with the EKPC transmission system along one of the following Points of Interconnection:

1. Along the Barren County - Summer Shade 161kV Line
2. At the Barren County 161kV Switchyard

Cost Summary

The AE1-247 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrades	$ 5,270,000
Non Direct Connection Network Upgrades	$ 100,000
Total Costs	**$ 5,370,000**

In addition, the AE1-247 project may be responsible for a contribution to the following costs:

Description	Total Cost
System Upgrades	$ 24,450,000
Total Costs	**$ 24,450,000**

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

Attachment Facilities

No Attachment Facilities are required to support this interconnection request.

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 161 kV switching station near Hiseville, KY including associated transmission line work. Preliminary TOL Provided Estimated Time to Construct: 24 months	$ 5,270,000
Total Direct Connection Facility Costs	**$ 5,270,000**

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 the Barren County 161kV switchyard	$ 50,000
Adjust remote, relaying, and metering settings at the Summer Shade 161kV switchyard	$ 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.

3. The Interconnection Customer seeking to interconnect a wind generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per item 5.iv. of Schedule H to the Interconnection Service Agreement.

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

Network Impacts

Option 1

The Queue Project AE1-247 was evaluated as a 205 MW (Capacity 137.1 MW) injection tapping the Barren to Summer Shade 161 kV line in the EKPC area. Project AE1-247 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-247 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2022

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Contingency Definition
EKPC_P4-2_SSHAD S11-1004	CONTINGENCY 'EKPC_P4-2_SSHAD S11-1004' /* SUMMERSHADE OPEN BRANCH FROM BUS 940050 TO BUS 342814 CKT 1 /* 940050 AE1-247 TAP 161.00 342814 5SUMM SHADE 161.00 OPEN BRANCH FROM BUS 342811 TO BUS 342814 CKT 1 /* 342811 5SUMM SHAD T161.00 342814 5SUMM SHADE 161.00 OPEN BRANCH FROM BUS 342733 TO BUS 342814 CKT 1 /* 342733 5GREEN CO 161.00 342814 5SUMM SHADE 161.00 END
EKPC_P1-2_BARR-SUMSH161-B	CONTINGENCY 'EKPC_P1-2_BARR-SUMSH161-B' /* BARREN CO - SUMMERSHADE OPEN BRANCH FROM BUS 940050 TO BUS 342814 CKT 1 /* 940050 AE1-247 TAP 161.00 342814 5SUMM SHADE 161.00 END
AEP_P1-2_#10136	CONTINGENCY 'AEP_P1-2_#10136' OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1 OPEN BRANCH FROM BUS 243209 TO BUS 243443 CKT 2 / 243209 05ROCKPT 765 243443 05RKG2 26.0 2 REMOVE UNIT 2H FROM BUS 243443 / 243443 05RKG2 26.0 REMOVE UNIT 2L FROM BUS 243443 / 243443 05RKG2 26.0 END
EKPC_P7-1_COOP 161 DBL 2	CONTINGENCY 'EKPC_P7-1_COOP 161 DBL 2' /* COOPER - ELIHU 161 & COOPER - LAUREL DAM 161 OPEN BRANCH FROM BUS 324141 TO BUS 342718 CKT 1 /* 324141 5ELIHU 161.00 342718 5COOPER2 161.00 OPEN BRANCH FROM BUS 342718 TO BUS 342757 CKT 1 /* 342718 5COOPER2 161.00 342757 5LAUREL DAM 161.00 END

Contingency Name	Contingency Definition
EKPC_P4-2_SSHAD S11-1044	CONTINGENCY 'EKPC_P4-2_SSHAD S11-1044' /* SUMMERSHADE OPEN BRANCH FROM BUS 940050 TO BUS 342814 CKT 1 /* 940050 AE1-247 TAP 161.00 342814 5SUMM SHADE 161.00 OPEN BRANCH FROM BUS 342700 TO BUS 342811 CKT 1 /* 342700 5BULLITT CO 161.00 342811 5SUMM SHAD T161.00 OPEN BRANCH FROM BUS 342811 TO BUS 360334 CKT 1 /* 342811 5SUMM SHAD T161.00 360334 5SUMMER SHAD161.00 OPEN BRANCH FROM BUS 342811 TO BUS 342814 CKT 1 /* 342811 5SUMM SHAD T161.00 342814 5SUMM SHADE 161.00 END
EKPC_P7-1_LAURL 161 DBL	CONTINGENCY 'EKPC_P7-1_LAURL 161 DBL' /* LAUREL CO - LAUREL DAM 161 & LAUREL CO - TYNER 161 OPEN BRANCH FROM BUS 342754 TO BUS 342757 CKT 1 /* 342754 5LAUREL CO 161.00 342757 5LAUREL DAM 161.00 OPEN BRANCH FROM BUS 342754 TO BUS 342781 CKT 1 /* 342754 5LAUREL CO 161.00 342781 5PITTSBURG 161.00 OPEN BRANCH FROM BUS 342781 TO BUS 342820 CKT 1 /* 342781 5PITTSBURG 161.00 342820 5TYNER 161.00 END
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
Base Case	
EKPC_P4-5_LAURL S50-1024	CONTINGENCY 'EKPC_P4-5_LAURL S50-1024' /* LAUREL CO OPEN BUS 342754 /* 5LAUREL CO DROPS BUS OPEN BRANCH FROM BUS 324688 TO BUS 342781 CKT 1 /* 324688 2PITTSKU 69.000 342781 5PITTSBURG 161.00 OPEN BRANCH FROM BUS 342781 TO BUS 342820 CKT 1 /* 342781 5PITTSBURG 161.00 342820 5TYNER 161.00 END
EKPC_P1-2_LAUR-L DAM161	CONTINGENCY 'EKPC_P1-2_LAUR-L DAM161' /* LAUREL CO - LAUREL DAM OPEN BRANCH FROM BUS 342754 TO BUS 342757 CKT 1 /* 342754 5LAUREL CO 161.00 342757 5LAUREL DAM 161.00 END

Generator Deliverability

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

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
299301	341059	2BARREN CO	EKPC	341651	2HORSECAVE J	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	single	90.0	76.37	123.1	DC	42.06
299068	342694	5BARREN CO	EKPC	341059	2BARREN CO	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	single	109.0	74.11	199.54	DC	137.1
299073	342694	5BARREN CO	EKPC	341059	2BARREN CO	EKPC	1	Base Case	single	89.0	70.0	102.83	DC	29.22
299597	342718	5COOPER2	EKPC	324141	5ELIHU	LGEE	1	EKPC_P1-2_LAUR-LDAM161	single	277.0	102.88	108.45	DC	15.43

Note: Please see Attachment 2 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)

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
298538	341059	2BARREN CO	EKPC	341651	2HORSECAVE J	EKPC	1	EKPC_P4-2_SSHADS11-1004	breaker	90.0	97.6	167.93	DC	63.3
298539	341059	2BARREN CO	EKPC	341651	2HORSECAVE J	EKPC	1	EKPC_P4-2_SSHADS11-1044	breaker	90.0	92.08	162.52	DC	63.39
300028	342287	2SOMERSET KU	EKPC	324531	2FERGUSON SO	LGEE	1	EKPC_P7-1_COOP 161 DBL 2	tower	105.0	106.9	113.74	DC	15.89
298876	342718	5COOPER2	EKPC	324141	5ELIHU	LGEE	1	EKPC_P4-5_LAURLS50-1024	breaker	277.0	106.39	114.7	DC	22.99
300017	342718	5COOPER2	EKPC	324141	5ELIHU	LGEE	1	EKPC_P7-1_LAURL 161 DBL	tower	277.0	106.43	114.73	DC	22.99

Note: Please see Attachment 2 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

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)

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT

299250	324114	7TRIMBLE CO	LGEE	248000	06CLIFTY	OVEC	1	AEP_P1-2_#363	single	1451.0	166.53	168.24	DC	24.72
299253	324114	7TRIMBLE CO	LGEE	248000	06CLIFTY	OVEC	1	AEP_P1-2_#10136	single	1451.0	161.07	162.78	DC	24.79
299255	324114	7TRIMBLE CO	LGEE	248000	06CLIFTY	OVEC	1	Base Case	single	1134.0	159.42	161.57	DC	24.35

Note: Please see Attachment 2 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

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.

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
299251	324114	7TRIMBLE CO	LGEE	248000	06CLIFTY	OVEC	1	Base Case	operation	1134.0	164.14	167.35	DC	36.41
299252	324114	7TRIMBLE CO	LGEE	248000	06CLIFTY	OVEC	1	AEP_P1-2_#363	operation	1451.0	162.53	165.08	DC	36.97
299300	341059	2BARREN CO	EKPC	341651	2HORSECAVE J	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	operation	90.0	89.76	159.64	DC	62.89
299347	341059	2BARREN CO	EKPC	341542	2GOODNIGHT	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	operation	90.0	74.63	143.51	DC	100.94
299442	341275	2CAVE CITY J	EKPC	341272	2CAVE CITY	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	operation	46.0	55.63	129.51	DC	41.17
299475	341542	2GOODNIGHT	EKPC	341548	2GORIN PRK J	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	operation	98.0	70.32	124.96	DC	100.94
299474	341548	2GORIN PRK J	EKPC	341491	2FOX HOLLOW	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	operation	98.0	70.32	124.96	DC	100.94
299067	342694	5BARREN CO	EKPC	341059	2BARREN CO	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	operation	109.0	110.16	297.89	DC	205.0
299069	342694	5BARREN CO	EKPC	341059	2BARREN CO	EKPC	1	Base Case	operation	89.0	79.61	128.7	DC	43.69
299596	342718	5COOPER2	EKPC	324141	5ELIHU	LGEE	1	EKPC_P1-2_LAUR-L DAM161	operation	277.0	106.34	114.67	DC	23.07
299591	940050	AE1-247 TAP	EKPC	342814	5SUMM SHADE	EKPC	1	Base Case	operation	186.0	56.38	114.83	DC	161.31

System Reinforcements

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

ID	Index	Facility	Upgrade Description	Cost
298538,298539,299301	1	**2BARREN CO 69.0 kV - 2HORSECAVE J 69.0 kV Ckt 1**	Description : Increase MOT of Barren-KU Horscave Jct 69kV 795 MCM 26x7 ACSR conductor to 302°F (~2.43 miles); Uprate CT associated with Barren Co-Horsecave Jct 69kV to minimum 166 MVA Summer LTE; Upgrade jumpers associated with Barren Co 69kV bus to 2-500 MCM 37 CU conductor Time Estimate : 6 Months Cost : $150,000	$150,000
300017,298876,299597	3	**5COOPER2 161.0 kV - 5ELIHU 161.0 kV Ckt 1**	EKPC Description : Increase MOT of Cooper-KU Elihu 161kV 795 MCM 26x7 ACSR conductor to 302°F (~6.7 miles) Time Estimate : 12.0 Months Cost : $600,000 LGEE The external (i.e. Non-PJM) Transmission Owner, LGEE, will not evaluate this violation until the impact study phase.	$600,000
299250,299253,299255	5	**7TRIMBLE CO 345.0 kV - 06CLIFTY 345.0 kV Ckt 1**	In order to mitigate the overloads, 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.	$17,400,000
299073,299068	2	**5BARREN CO 161.0 kV - 2BARREN CO 69.0 kV Ckt 1**	Description : Upgrade Barren Co 161/69kV auto to 150 MVA and add second 161/69kV 150 MVA auto in parallel plus associated 161kV bus work; Uprate high side and two low side CTs to minimum 230 MVA Summer LTE; Rebuild Barren Co 69kV bus using 3" IPS AL 6063; Upgrade jumper to 2-500 MCM conductor; Upgrade W59-628 circuit breaker to 2000A; Upgrade W59-623 disconnect switch to 2000A; Uprate OC relay to minimum 230 MVA Summer LTE Time Estimate : 30 Months Cost : $6,300,000	$6,300,000
300028	4	**2SOMERSET KU 69.0 kV - 2FERGUSON SO 69.0 kV Ckt 1**	EKPC Description : No Violation. EKPC emergency rating 152 MVA LGEE The external (i.e. Non-PJM) Transmission Owner, LGEE, will not evaluate this violation until the impact study phase.	$0
			TOTAL COST	**$24,450,000**

Network Impacts

Option 2

The Queue Project AE1-247 was evaluated as a 205 MW (Capacity 137.1 MW) injection at the Barren County 161 kV substation in the EKPC area. Project AE1-247 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-247 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2022

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Contingency Definition
EKPC_P4-2_SSHAD S11-1004	CONTINGENCY 'EKPC_P4-2_SSHAD S11-1004' /* SUMMERSHADE OPEN BRANCH FROM BUS 940040 TO BUS 342814 CKT 1 /* 940040 AE1-246 TAP 161.00 342814 5SUMM SHADE 161.00 OPEN BRANCH FROM BUS 342811 TO BUS 342814 CKT 1 /* 342811 5SUMM SHAD T161.00 342814 5SUMM SHADE 161.00 OPEN BRANCH FROM BUS 342733 TO BUS 342814 CKT 1 /* 342733 5GREEN CO 161.00 342814 5SUMM SHADE 161.00 END
EKPC_P1-2_BARR-SUMSH161-B	CONTINGENCY 'EKPC_P1-2_BARR-SUMSH161-B' /* BARREN CO - SUMMERSHADE OPEN BRANCH FROM BUS 940040 TO BUS 342814 CKT 1 /* 940040 AE1-246 TAP 161.00 342814 5SUMM SHADE 161.00 END
EKPC_P7-1_COOP 161 DBL 2	CONTINGENCY 'EKPC_P7-1_COOP 161 DBL 2' /* COOPER - ELIHU 161 & COOPER - LAUREL DAM 161 OPEN BRANCH FROM BUS 324141 TO BUS 342718 CKT 1 /* 324141 5ELIHU 161.00 342718 5COOPER2 161.00 OPEN BRANCH FROM BUS 342718 TO BUS 342757 CKT 1 /* 342718 5COOPER2 161.00 342757 5LAUREL DAM 161.00 END
AEP_P1-2_#10136	CONTINGENCY 'AEP_P1-2_#10136' OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1 OPEN BRANCH FROM BUS 243209 TO BUS 243443 CKT 2 / 243209 05ROCKPT 765 243443 05RKG2 26.0 2 REMOVE UNIT 2H FROM BUS 243443 / 243443 05RKG2 26.0 REMOVE UNIT 2L FROM BUS 243443 / 243443 05RKG2 26.0 END

Contingency Name	Contingency Definition
EKPC_P7-1_LAURL 161 DBL	CONTINGENCY 'EKPC_P7-1_LAURL 161 DBL' /* LAUREL CO - LAUREL DAM 161 & LAUREL CO - TYNER 161 OPEN BRANCH FROM BUS 342754 TO BUS 342757 CKT 1 /* 342754 5LAUREL CO 161.00 342757 5LAUREL DAM 161.00 OPEN BRANCH FROM BUS 342754 TO BUS 342781 CKT 1 /* 342754 5LAUREL CO 161.00 342781 5PITTSBURG 161.00 OPEN BRANCH FROM BUS 342781 TO BUS 342820 CKT 1 /* 342781 5PITTSBURG 161.00 342820 5TYNER 161.00 END
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
Base Case	
EKPC_P4-5_LAURL S50-1024	CONTINGENCY 'EKPC_P4-5_LAURL S50-1024' /* LAUREL CO OPEN BUS 342754 /* 5LAUREL CO DROPS BUS OPEN BRANCH FROM BUS 324688 TO BUS 342781 CKT 1 /* 324688 2PITTSKU 69.000 342781 5PITTSBURG 161.00 OPEN BRANCH FROM BUS 342781 TO BUS 342820 CKT 1 /* 342781 5PITTSBURG 161.00 342820 5TYNER 161.00 END
EKPC_P1-2_LAUR-L DAM161	CONTINGENCY 'EKPC_P1-2_LAUR-L DAM161' /* LAUREL CO - LAUREL DAM OPEN BRANCH FROM BUS 342754 TO BUS 342757 CKT 1 /* 342754 5LAUREL CO 161.00 342757 5LAUREL DAM 161.00 END

Generator Deliverability

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

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
245943	341059	2BARREN CO	EKPC	341651	2HORSECAVE J	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	single	90.0	76.48	123.21	DC	42.06
245797	342694	5BARREN CO	EKPC	341059	2BARREN CO	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	single	109.0	74.06	199.72	DC	137.1
245802	342694	5BARREN CO	EKPC	341059	2BARREN CO	EKPC	1	Base Case	single	89.0	69.57	103.12	DC	29.86
246246	342718	5COOPER2	EKPC	324141	5ELIHU	LGEE	1	EKPC_P1-2_LAUR-LDAM161	single	277.0	102.88	108.45	DC	15.41

Note: Please see Attachment 3 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)

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
245293	341059	2BARREN CO	EKPC	341651	2HORSECAVE J	EKPC	1	EKPC_P4-2_SSHADS11-1004	breaker	90.0	97.71	168.04	DC	63.3
246583	342287	2SOMERSET KU	EKPC	324531	2FERGUSON SO	LGEE	1	EKPC_P7-1_COOP 161 DBL 2	tower	105.0	106.96	113.8	DC	15.87
245627	342718	5COOPER2	EKPC	324141	5ELIHU	LGEE	1	EKPC_P4-5_LAURLS50-1024	breaker	277.0	106.4	114.69	DC	22.97
246577	342718	5COOPER2	EKPC	324141	5ELIHU	LGEE	1	EKPC_P7-1_LAURL 161 DBL	tower	277.0	106.44	114.73	DC	22.97

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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)

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
245900	324114	7TRIMBLE CO	LGEE	248000	06CLIFTY	OVEC	1	AEP_P1-2_#363	single	1451.0	166.52	168.23	DC	24.72
245902	324114	7TRIMBLE	LGEE	248000	06CLIFTY	OVEC	1	AEP_P1-	single	1451.0	161.06	162.77	DC	24.8

		CO						2_#10136						
245904	324114	7TRIMBLE CO	LGEE	248000	06CLIFTY	OVEC	1	Base Case	single	1134.0	159.42	161.57	DC	24.35

Note: Please see Attachment 3 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

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.

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
245899	324114	7TRIMBLE CO	LGEE	248000	06CLIFTY	OVEC	1	Base Case	operation	1134.0	164.14	167.35	DC	36.41
245901	324114	7TRIMBLE CO	LGEE	248000	06CLIFTY	OVEC	1	AEP_P1-2_#363	operation	1451.0	162.52	165.07	DC	36.97
245942	341059	2BARREN CO	EKPC	341651	2HORSECAVE J	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	operation	90.0	89.87	159.75	DC	62.89
246008	341059	2BARREN CO	EKPC	341542	2GOODNIGHT	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	operation	90.0	74.63	143.51	DC	100.94
246085	341275	2CAVE CITY J	EKPC	341272	2CAVE CITY	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	operation	46.0	55.57	129.72	DC	41.17
246125	341542	2GOODNIGHT	EKPC	341548	2GORIN PRK J	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	operation	98.0	70.3	125.06	DC	100.94
246124	341548	2GORIN PRK J	EKPC	341491	2FOX HOLLOW	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	operation	98.0	70.3	125.06	DC	100.94
245796	342694	5BARREN CO	EKPC	341059	2BARREN CO	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	operation	109.0	110.12	298.07	DC	205.0
245798	342694	5BARREN CO	EKPC	341059	2BARREN CO	EKPC	1	Base Case	operation	89.0	78.98	129.15	DC	44.65
246245	342718	5COOPER2	EKPC	324141	5ELIHU	LGEE	1	EKPC_P1-2_LAUR-LDAM161	operation	277.0	106.35	114.66	DC	23.04
246240	940040	AE1-246 TAP	EKPC	342814	5SUMM SHADE	EKPC	1	Base Case	operation	186.0	56.54	114.67	DC	160.35

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.

Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
298538	341059	2BARRENCO	EKPC	341651	2HORSECAVEJ	EKPC	1	EKPC_P4-2_SSHADS11-1004	breaker	90.0	97.6	167.93	DC	63.3

Bus #	Bus	MW Impact
940041	AE1-246 C O1	24.92
940042	AE1-246 E O1	12.13
940051	AE1-247 C O1	42.33
940052	AE1-247 E O1	20.96
BLUEG	BLUEG	0.97
CANNELTON	CANNELTON	0.16
CBM-N	CBM-N	0.01
CBM-S1	CBM-S1	0.9
CBM-S2	CBM-S2	0.28
CBM-W2	CBM-W2	3.18
CPLE	CPLE	0.09
DEARBORN	DEARBORN	0.04
EDWARDS	EDWARDS	0.0
ELMERSMITH	ELMERSMITH	0.31
G-007A	G-007A	0.03
GIBSON	GIBSON	0.04
MEC	MEC	0.29
NEWTON	NEWTON	0.02
NYISO	NYISO	0.03
O-066A	O-066A	0.01
TILTON	TILTON	0.04
TRIMBLE	TRIMBLE	0.1
VFT	VFT	0.08

Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
299068	342694	5BARREN CO	EKPC	341059	2BARREN CO	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	single	109.0	74.11	199.54	DC	137.1

Bus #	Bus	MW Impact
940041	AE1-246 C O1	80.7
940051	AE1-247 C O1	137.1

Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
300017	342718	5COOPER2	EKPC	324141	5ELIHU	LGEE	1	EKPC_P7-1_LAURL 161 DBL	tower	277.0	106.43	114.73	DC	22.99

Bus #	Bus	MW Impact
342900	1COOPER1 G	9.88
342903	1COOPER2 G	19.23
342945	1LAUREL 1G	5.98
939131	AE1-143 C	10.07
939132	AE1-143 E	4.99
940041	AE1-246 C O1	9.04
940042	AE1-246 E O1	4.4
940051	AE1-247 C O1	15.38
940052	AE1-247 E O1	7.62
CARR	CARR	0.06
CBM-S1	CBM-S1	3.77
CBM-S2	CBM-S2	0.41
CBM-W1	CBM-W1	1.16
CBM-W2	CBM-W2	18.98
CIN	CIN	0.56
CPLE	CPLE	0.09
DEARBORN	DEARBORN	0.09
G-007	G-007	0.17
IPL	IPL	0.23
MEC	MEC	2.27
O-066	O-066	0.56
RENSSELAER	RENSSELAER	0.05
TRIMBLE	TRIMBLE	0.02
WEC	WEC	0.15

Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
300028	342287	2SOMERSET KU	EKPC	324531	2FERGUSON SO	LGEE	1	EKPC_P7-1_COOP 161 DBL 2	tower	105.0	106.9	113.74	DC	15.89

Bus #	Bus	MW Impact
342900	1COOPER1 G	4.81
342903	1COOPER2 G	9.33
939131	AE1-143 C	6.45
939132	AE1-143 E	3.2
940041	AE1-246 C O1	6.25
940042	AE1-246 E O1	3.04
940051	AE1-247 C O1	10.63
940052	AE1-247 E O1	5.26
CARR	CARR	0.03
CBM-S1	CBM-S1	2.57
CBM-S2	CBM-S2	0.28
CBM-W1	CBM-W1	1.02
CBM-W2	CBM-W2	13.35
CIN	CIN	0.5
CPLE	CPLE	0.06
DEARBORN	DEARBORN	0.02
G-007	G-007	0.08
IPL	IPL	0.23
MEC	MEC	1.69
O-066	O-066	0.27
RENSSELAER	RENSSELAER	0.02
WEC	WEC	0.13

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
299250	324114	7TRIMBLE CO	LGEE	248000	06CLIFTY	OVEC	1	AEP_P1-2_#363	single	1451.0	166.53	168.24	DC	24.72

Bus #	Bus	MW Impact
342900	1COOPER1 G	2.62
342903	1COOPER2 G	5.09
342918	1JKCT 1G	2.08
342921	1JKCT 2G	2.08
342924	1JKCT 3G	2.08
342927	1JKCT 4G	1.38
342930	1JKCT 5G	1.37
342933	1JKCT 6G	1.38

Bus #	Bus	MW Impact
342936	1JKCT 7G	1.38
342939	1JKCT 9G	1.41
342942	1JKCT 10G	1.41
342945	1LAUREL 1G	1.48
900404	X3-028 C	112.28
925981	AC1-074 C O1	4.95
930461	AB1-087	41.17
930471	AB1-088	41.17
932551	AC2-075 C	1.17
933441	AC2-157 C	5.69
935011	AD1-134	8.72
936281	AD2-036 C	3.53
936381	AD2-048 C	4.33
936571	AD2-072 C O1	12.3
936821	AD2-105 C O1	4.09
936831	AD2-106 C O1	2.15
936841	AD2-107 C O1	1.42
939131	AE1-143 C	11.66
940041	AE1-246 C O1	14.55
940051	AE1-247 C O1	24.72
940091	AE1-251 C O1	9.83
952471	J708	48.68
952811	J759	11.5
952821	J762	35.66
952861	J783 C	10.91
953281	J795	4.18
953611	J800	16.61
953831	J842 C	3.57
953841	J843 C	3.85
953931	J856	11.03
AE1-042	AE1-042	13.48
CARR	CARR	0.23
CBM-S1	CBM-S1	45.72
CBM-S2	CBM-S2	4.7
CBM-W1	CBM-W1	9.48
CBM-W2	CBM-W2	190.24
CIN	CIN	28.82
CPLE	CPLE	1.32
DEARBORN	DEARBORN	0.57
IPL	IPL	15.39
LGEE	LGEE	27.67
MEC	MEC	20.09
RENSSELAER	RENSSELAER	0.18
WEC	WEC	1.46

Attachment 2. Flowgate Details – Option 2

Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
245293	341059	2BARRENCO	EKPC	341651	2HORSECAVEJ	EKPC	1	EKPC_P4-2_SSHADS11-1004	breaker	90.0	97.71	168.04	DC	63.3

Bus #	Bus	MW Impact
940041	AE1-246 C O2	24.92
940042	AE1-246 E O2	12.13
940051	AE1-247 C O2	42.33
940052	AE1-247 E O2	20.96
BLUEG	BLUEG	0.97
CANNELTON	CANNELTON	0.16
CBM-N	CBM-N	0.01
CBM-S1	CBM-S1	0.9
CBM-S2	CBM-S2	0.28
CBM-W2	CBM-W2	3.18
CPLE	CPLE	0.09
DEARBORN	DEARBORN	0.04
EDWARDS	EDWARDS	0.0
ELMERSMITH	ELMERSMITH	0.31
G-007A	G-007A	0.03
GIBSON	GIBSON	0.04
MEC	MEC	0.29
NEWTON	NEWTON	0.02
NYISO	NYISO	0.03
O-066A	O-066A	0.01
TILTON	TILTON	0.04
TRIMBLE	TRIMBLE	0.1
VFT	VFT	0.08

Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
245797	342694	5BARREN CO	EKPC	341059	2BARREN CO	EKPC	1	EKPC_P1-2_BARR-SUMSH161-B	single	109.0	74.06	199.72	DC	137.1

Bus #	Bus	MW Impact
940041	AE1-246 C O2	80.7
940051	AE1-247 C O2	137.1

Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
246577	342718	5COOPER2	EKPC	324141	5ELIHU	LGEE	1	EKPC_P7-1_LAURL 161 DBL	tower	277.0	106.44	114.73	DC	22.97

Bus #	Bus	MW Impact
342900	1COOPER1 G	9.88
342903	1COOPER2 G	19.23
342945	1LAUREL 1G	5.98
939131	AE1-143 C	10.07
939132	AE1-143 E	4.99
940041	AE1-246 C O2	9.05
940042	AE1-246 E O2	4.41
940051	AE1-247 C O2	15.36
940052	AE1-247 E O2	7.61
CARR	CARR	0.06
CBM-S1	CBM-S1	3.77
CBM-S2	CBM-S2	0.41
CBM-W1	CBM-W1	1.16
CBM-W2	CBM-W2	18.98
CIN	CIN	0.56
CPLE	CPLE	0.09
DEARBORN	DEARBORN	0.09
G-007	G-007	0.17
IPL	IPL	0.23
MEC	MEC	2.27
O-066	O-066	0.56
RENSSELAER	RENSSELAER	0.05
TRIMBLE	TRIMBLE	0.02
WEC	WEC	0.15

Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
246583	342287	2SOMERSET KU	EKPC	324531	2FERGUSON SO	LGEE	1	EKPC_P7-1_COOP 161 DBL 2	tower	105.0	106.96	113.8	DC	15.87

Bus #	Bus	MW Impact
342900	1COOPER1 G	4.81
342903	1COOPER2 G	9.33
939131	AE1-143 C	6.45
939132	AE1-143 E	3.2
940041	AE1-246 C O2	6.25
940042	AE1-246 E O2	3.05
940051	AE1-247 C O2	10.62
940052	AE1-247 E O2	5.26
CARR	CARR	0.03
CBM-S1	CBM-S1	2.57
CBM-S2	CBM-S2	0.28
CBM-W1	CBM-W1	1.01
CBM-W2	CBM-W2	13.32
CIN	CIN	0.5
CPLE	CPLE	0.06
DEARBORN	DEARBORN	0.02
G-007	G-007	0.08
IPL	IPL	0.23
MEC	MEC	1.69
O-066	O-066	0.28
RENSSELAER	RENSSELAER	0.02
WEC	WEC	0.13

Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
245900	324114	7TRIMBLE CO	LGEE	248000	06CLIFTY	OVEC	1	AEP_P1-2_#363	single	1451.0	166.52	168.23	DC	24.72

Bus #	Bus	MW Impact
342900	1COOPER1 G	2.62
342903	1COOPER2 G	5.09
342918	1JKCT 1G	2.08
342921	1JKCT 2G	2.08
342924	1JKCT 3G	2.08
342927	1JKCT 4G	1.38
342930	1JKCT 5G	1.37
342933	1JKCT 6G	1.38
342936	1JKCT 7G	1.38
342939	1JKCT 9G	1.41

Bus #	Bus	MW Impact
342942	1JKCT 10G	1.41
342945	1LAUREL 1G	1.48
900404	X3-028 C	112.28
925981	AC1-074 C O1	4.95
930461	AB1-087	41.17
930471	AB1-088	41.17
932551	AC2-075 C	1.17
933441	AC2-157 C	5.69
935011	AD1-134	8.72
936281	AD2-036 C	3.53
936381	AD2-048 C	4.33
936571	AD2-072 C O1	12.3
936821	AD2-105 C O1	4.09
936831	AD2-106 C O1	2.15
936841	AD2-107 C O1	1.42
939131	AE1-143 C	11.66
940041	AE1-246 C O2	14.55
940051	AE1-247 C O2	24.72
940091	AE1-251 C O2	13.09
952471	J708	48.68
952811	J759	11.5
952821	J762	35.66
952861	J783 C	10.91
953281	J795	4.18
953611	J800	16.61
953831	J842 C	3.57
953841	J843 C	3.85
953931	J856	11.03
AE1-042	AE1-042	13.48
CARR	CARR	0.23
CBM-S1	CBM-S1	45.71
CBM-S2	CBM-S2	4.7
CBM-W1	CBM-W1	9.47
CBM-W2	CBM-W2	190.22
CIN	CIN	28.82
CPLE	CPLE	1.32
DEARBORN	DEARBORN	0.57
IPL	IPL	15.39
LGEE	LGEE	27.67
MEC	MEC	20.08
RENSSELAER	RENSSELAER	0.18
WEC	WEC	1.46