Generation Interconnection

Feasibility Study Report

for

Queue Project AE1-153

“REMINGTON-GORDONSVILLE 230 KV”

89.4 MW Capacity / 149 MW Energy

January / 2019

Table Of Contents

Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company (VEPCO).

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. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. 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 Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

An Interconnection Customer 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.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a $10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model.

The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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 IC has proposed a new solar generating facility located in Stevensburg (Culpepper County), Virginia. The installed facilities will have a capability of **149 MW** with **89.4 MW** of this output being recognized by PJM as Capacity. The proposed in-service date for the AE1-153 project is **10/23/2020**. **This study does not imply an ITO commitment to this proposed in-service date.**

Queue Number	**AE1-153**
Project Name	REMINGTON-GORDONSVILLE 230 KV
Interconnection Customer	
State	Virginia
County	Culpeper
Transmission Owner	Dominion
MFO	149
MWE	149
MWC	89.4
Fuel	Solar
Basecase Study Year	2022

Primary Point of Interconnection

The AE1-153 project will interconnect with the ITO transmission system via a tap off of the Remington-Gordonville 230 kV line. See one line in **Attachment 1**.

Secondary Point of Interconnection

The IC requested that a secondary POI be reviewed for network impacts. The secondary interconnection chosen was a tap off of the Mitchell DP-Mountain Run 115 kV line.

This report does not provide costs for the physical interconnection of Option 2. It was just analyzed for network impacts to the system. Results are shown in the "Network Impacts – Option 2" section of this report.

Cost Summary

The AE1-153 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$1,800,000
Direct Connection Network Upgrade	$6,300,000
Non Direct Connection Network Upgrades	$1,000,000
Total Costs	$9,100,000

In addition, the AE1-153 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	$

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

Note: PJM Open Access Transmission Tariff (OATT) section 217.3A outline cost allocation rules. The rules are further clarified in PJM Manual 14A Attachment B. The allocation of costs for a network upgrade will start with the first Queue project to cause the need for the upgrade. Later queue projects will receive cost allocation contingent on their contribution to the violation and are allocated to the queues that have not closed less than 5 years following the execution of the first Interconnection Service Agreement which identifies the need for this upgrade.

The Feasibility Study is used to make a preliminary determination of the type and scope of Attachment Facilities, Local Upgrades, and Network Upgrades that will be necessary to accommodate the Interconnection Request and to provide the Interconnection Customer a preliminary estimate of the time that will be required

to construct any necessary facilities and upgrades and the Interconnection Customer's cost responsibility. The System Impact Study provides refined and comprehensive estimates of cost responsibility and construction lead times for new facilities and system upgrades. Facilities Studies will include, commensurate with the degree of engineering specificity as provided in the Facilities Study Agreement, good faith estimates of the cost, determined in accordance with Section 217 of the Tariff,

(a) to be charged to each affected New Service Customer for the Facilities and System Upgrades that are necessary to accommodate this queue project;

(b) the time required to complete detailed design and construction of the facilities and upgrades; and

(c) a description of any site-specific environmental issues or requirements that could reasonably be anticipated to affect the cost or time required to complete construction of such facilities and upgrades.

Transmission Owner Scope of Work

Attachment Facilities

Generation Substation: Install metering and associated protection equipment. Estimated Cost $600,000.

Transmission: Construct approximately one span of 230 kV Attachment line between the generation substation and a new AE1-153 Switching Station. The estimated cost for this work is $1,200,000.

The estimated total cost of the Attachment Facilities is $1,800,000. It is estimated to take 18-24 months to complete this work. These preliminary cost estimates are based on typical engineering costs. A more detailed engineering cost estimates are normally done when the IC provides an exact site plan location for the generation substation during the Facility Study phase. See **Attachment 1**.

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

Description	Total Cost
Substation	$ 600,000
Transmission	$1,200,000
Total Attachment Facility Costs	$1,800,000

Direct Connection Cost Estimate

Substation: Establish the new 230 kV AE1-153 Switching Substation (interconnection substation). The arrangement of the substation will be as shown below in **Attachment 1**: One-Line Diagram. The estimated cost of this work scope is $6,300,000. It is estimated to take 24-36 months to complete this work.

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
Substation	$ 6,300,000
Transmission	$ 0
Total Direct Connection Facility Costs	$ 6,300,000

Non-Direct Connection Cost Estimate

Transmission: Install transmission structure in-line with transmission line to allow the proposed interconnection switching station to be interconnected with the transmission system. Estimated cost is $1,000,000 and it is estimated to take 24-30 months to complete. See **Attachment 1**.

Remote Terminal Work: During the Facilities Study, ITO's System Protection Engineering Department will review transmission line protection as well as anti-islanding required to accommodate the new generation and interconnection substation. System Protection Engineering will determine the minimal acceptable protection requirements to reliably interconnect the proposed generating facility with the transmission system. The review is based on maintaining system reliability by reviewing ITO's protection requirements with the known transmission system configuration which includes generating facilities in the area. This review may determine that transmission line protection and communication upgrades are required at remote substations.

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
Transmission	$1,000,000
Substation (Remote Terminal Work)	TBD in Facilities Study
Total Non-Direct Connection Facility Costs	$1,000,000

Interconnection Customer Requirements

ITO's Facility Connection Requirements as posted on PJM's website
http://www.pjm.com/~/media/planning/plan-standards/private-dominion/facility-connection-requirements1.ashx

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.

Voltage Ride Through Requirements - The Customer Facility shall be designed to remain in service (not trip) for voltages and times as specified for the Eastern Interconnection in Attachment 1 of NERC Reliability Standard PRC-024-1, and successor Reliability Standards, for both high and low voltage conditions, irrespective of generator size, subject to the permissive trip exceptions established in PRC-024-1 (and successor Reliability Standards).

Frequency Ride Through Requirements - The Customer Facility shall be designed to remain in service (not trip) for frequencies and times as specified in Attachment 2 of NERC Reliability Standard PRC-024-1, and successor Reliability Standards, for both high and low frequency condition, irrespective of generator size, subject to the permissive trip exceptions established in PRC-024-1 (and successor Reliability Standards).

Reactive Power - The Generation Interconnection Customer shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading to 0.95 lagging measured at the generator's terminals.

Revenue Metering and SCADA Requirements

PJM Requirements

The IC 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.

Meteorological Data Reporting Requirement

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Temperature (degrees Fahrenheit)
- Atmospheric pressure (hectopascals)
- Irradiance
- Forced outage data

Network Impacts- Option 1

The Queue Project AE1-153 was evaluated as a 149 MW (Capacity 89.4 MW) injection tapping the Remington to Gordonville 230 kV line in the ITO area. Project AE1-153 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-153 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

Generation 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)

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
434053	313703	3UNIONVILLE	DVP	314764	3LOCST G	DVP	1	DVP_P7-1: LN 70-2153-A-A	tower	235.0	96.51	99.06	DC	13.3

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)

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
434051	313703	3UNIONVILLE	DVP	314764	3LOCST G	DVP	1	DVP_P7-1: LN 70-2153-B-A	tower	235.0	100.46	103.01	DC	13.3
434030	314778	3PAY TAP	DVP	314755	3SPOTSYL	DVP	1	DVP_P7-1: LN 70-2153-B-A	tower	260.0	104.56	106.87	DC	13.3
434032	314778	3PAY TAP	DVP	314755	3SPOTSYL	DVP	1	DVP_P7-1: LN 70-2153-A-A	tower	260.0	101.0	103.3	DC	13.3
433965	926000	AC1-076 TAP	DVP	314778	3PAY TAP	DVP	1	DVP_P7-1: LN 70-2153-B-A	tower	260.0	112.85	115.16	DC	13.3
433967	926000	AC1-076 TAP	DVP	314778	3PAY TAP	DVP	1	DVP_P7-1: LN 70-2153-A-A	tower	260.0	109.29	111.59	DC	13.3

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.

None

System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
434032,434030	2	**3PAY TAP 115.0 kV - 3SPOTSYL 115.0 kV Ckt 1**	Description : Wreck & rebuild a 3 mile section of Line 153 between Spotsylvania and Paytes DP (local approval) Time Estimate : 30-36 Months Cost : $6,000,000	$6,000,000
434051,434053	1	**3UNIONVILLE 115.0 kV - 3LOCST G 115.0 kV Ckt 1**	Description : Wreck & rebuild Line a 5 mile section of Line 153 between Unionville and Locust Grove DP (local approval) Time Estimate : 30-36 Months Cost : $10,000,000	$10,000,000
433965,433967	3	**AC1-076 TAP 115.0 kV - 3PAY TAP 115.0 kV Ckt 1**	Description : Wreck & rebuild Line a 3 mile section of Line 153 between Paytes DP and the tap to AC1-076 (Va CPCN) Time Estimate : 24-36 Months Cost : $6,500,000	$6,500,000
		TOTAL COST		**$22,500,000**

Flow Gate Details

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
434051	313703	3UNIONVILLE	DVP	314764	3LOCST G	DVP	1	DVP_P7-1: LN 70-2153-B-A	tower	235.0	100.46	103.01	DC	13.3

Bus #	Bus	MW Impact
925671	AC1-043 C	22.19
925672	AC1-043 E	36.2
926481	AC1-120 C O1	23.12
926482	AC1-120 E O1	11.91
926501	AC1-121 C O1	7.94
926502	AC1-121 E O1	3.74
932781	AC2-102 C	17.75
932782	AC2-102 E	28.96
934861	AD1-115 C	11.09
934862	AD1-115 E	18.1
938081	AE1-010	9.39
939221	AE1-153 C O1	7.98
939222	AE1-153 E O1	5.32
939511	AE1-180 C	7.01
939512	AE1-180 E	4.67
CARR	CARR	0.07
CBM-S1	CBM-S1	0.57
CBM-S2	CBM-S2	0.37
CBM-W1	CBM-W1	0.74
CBM-W2	CBM-W2	3.87
CIN	CIN	0.35
CPLE	CPLE	0.15
G-007	G-007	0.23
IPL	IPL	0.22
LGEE	LGEE	0.1
MEC	MEC	0.67
MECS	MECS	0.35
O-066	O-066	0.77
RENSSELAER	RENSSELAER	0.05
WEC	WEC	0.09

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
434030	314778	3PAY TAP	DVP	314755	3SPOTSYL	DVP	1	DVP_P7-1: LN 70-2153-B-A	tower	260.0	104.56	106.87	DC	13.3

Bus #	Bus	MW Impact
925671	AC1-043 C	22.19
925672	AC1-043 E	36.2
926001	AC1-076 C	17.03
926002	AC1-076 E	27.69
926481	AC1-120 C O1	23.12
926482	AC1-120 E O1	11.91
926501	AC1-121 C O1	7.94
926502	AC1-121 E O1	3.74
932781	AC2-102 C	17.75
932782	AC2-102 E	28.96
934541	AD1-078 C	9.86
934542	AD1-078 E	5.79
934861	AD1-115 C	11.09
934862	AD1-115 E	18.1
938081	AE1-010	23.61
939221	AE1-153 C O1	7.98
939222	AE1-153 E O1	5.32
939511	AE1-180 C	7.01
939512	AE1-180 E	4.67
CARR	CARR	0.07
CBM-S1	CBM-S1	0.57
CBM-S2	CBM-S2	0.37
CBM-W1	CBM-W1	0.74
CBM-W2	CBM-W2	3.87
CIN	CIN	0.35
CPLE	CPLE	0.15
G-007	G-007	0.23
IPL	IPL	0.22
LGEE	LGEE	0.1
MEC	MEC	0.67
MECS	MECS	0.35
O-066	O-066	0.77
RENSSELAER	RENSSELAER	0.05
WEC	WEC	0.09

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
433965	926000	AC1-076 TAP	DVP	314778	3PAY TAP	DVP	1	DVP_P7-1: LN 70-2153-B-A	tower	260.0	112.85	115.16	DC	13.3

Bus #	Bus	MW Impact
925671	AC1-043 C	22.19
925672	AC1-043 E	36.2
926001	AC1-076 C	17.03
926002	AC1-076 E	27.69
926481	AC1-120 C O1	23.12
926482	AC1-120 E O1	11.91
926501	AC1-121 C O1	7.94
926502	AC1-121 E O1	3.74
932781	AC2-102 C	17.75
932782	AC2-102 E	28.96
934861	AD1-115 C	11.09
934862	AD1-115 E	18.1
938081	AE1-010	23.61
939221	AE1-153 C O1	7.98
939222	AE1-153 E O1	5.32
939511	AE1-180 C	7.01
939512	AE1-180 E	4.67
CARR	CARR	0.07
CBM-S1	CBM-S1	0.57
CBM-S2	CBM-S2	0.37
CBM-W1	CBM-W1	0.74
CBM-W2	CBM-W2	3.87
CIN	CIN	0.35
CPLE	CPLE	0.15
G-007	G-007	0.23
IPL	IPL	0.22
LGEE	LGEE	0.1
MEC	MEC	0.67
MECS	MECS	0.35
O-066	O-066	0.77
RENSSELAER	RENSSELAER	0.05
WEC	WEC	0.09

Contingency Name	Contingency Defintion
DVP_P7-1: LN 70-2153-A-A	CONTINGENCY 'EKPC_P4-5_OWEN N44-808' /* SPURLOCK OPEN BRANCH FROM BUS 324293 TO BUS 342007 CKT 1 /* 324293 4OWEN C 138.00 342007 2OWEN CO 69.000 OPEN BRANCH FROM BUS 324290 TO BUS 324293 CKT 1 /* 324290 4OWC TAP 138.00 324293 4OWEN C 138.00 OPEN BRANCH FROM BUS 324253 TO BUS 324290 CKT 1 /* 324253 4GHENT 138.00 324290 4OWC TAP 138.00 OPEN BRANCH FROM BUS 324290 TO BUS 324305 CKT 1 /* 324290 4OWC TAP 138.00 324305 4SCOTTKU 138.00 END
DVP_P7-1: LN 70-2153-B-A	CONTINGENCY 'EKPC_P4-5_OWEN N44-808' /* SPURLOCK OPEN BRANCH FROM BUS 324293 TO BUS 342007 CKT 1 /* 324293 4OWEN C 138.00 342007 2OWEN CO 69.000 OPEN BRANCH FROM BUS 324290 TO BUS 324293 CKT 1 /* 324290 4OWC TAP 138.00 324293 4OWEN C 138.00 OPEN BRANCH FROM BUS 324253 TO BUS 324290 CKT 1 /* 324253 4GHENT 138.00 324290 4OWC TAP 138.00 OPEN BRANCH FROM BUS 324290 TO BUS 324305 CKT 1 /* 324290 4OWC TAP 138.00 324305 4SCOTTKU 138.00 END

Short Circuit

Short Circuit

The following Breakers are overduty:

None

Network Impacts- Option 2

The Queue Project AE1-153 was evaluated as a 149 MW (Capacity 89.4 MW) injection tapping the Mitchell to Mountain Run 115 kV line in the ITO area. Project AE1-153 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-153 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

Generation 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
401407	313703	3UNIONVILLE	DVP	314764	3LOCST G	DVP	1	DVP_P1-2: LN 2-A	single	191.76	74.12	100.74	DC	51.04
401167	314768	3MITCHEL	DVP	314815	3OAK GRE	DVP	1	DVP_P1-2: LN 2-A	single	217.14	62.17	103.34	DC	89.4
401343	926000	AC1-076 TAP	DVP	314778	3PAY TAP	DVP	1	DVP_P1-2: LN 2-A	single	212.44	80.45	104.48	DC	51.04

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
400640	313703	3UNIONVILLE	DVP	314764	3LOCST G	DVP	1	DVP_P4-2: 2T70	breaker	235.0	99.36	135.56	DC	85.07
402263	313703	3UNIONVILLE	DVP	314764	3LOCST G	DVP	1	DVP_P7-1: LN 70-2153-A	tower	235.0	96.58	133.6	DC	87.0
400768	314764	3LOCST G	DVP	926000	AC1-076 TAP	DVP	1	DVP_P4-2: 2T70	breaker	260.0	89.19	121.91	DC	85.07
402298	314764	3LOCST G	DVP	926000	AC1-076 TAP	DVP	1	DVP_P7-1: LN 70-2153-B	tower	260.0	90.21	123.67	DC	87.0
402299	314764	3LOCST G	DVP	926000	AC1-076 TAP	DVP	1	DVP_P7-1: LN 70-2153-A	tower	260.0	86.64	120.1	DC	87.0
400891	314815	3OAK GRE	DVP	313703	3UNIONVILLE	DVP	1	DVP_P4-2: 2T70	breaker	301.0	80.0	108.26	DC	85.07
402378	314815	3OAK GRE	DVP	313703	3UNIONVILLE	DVP	1	DVP_P7-1: LN 70-2153-B	tower	301.0	80.88	109.78	DC	87.0
402379	314815	3OAK GRE	DVP	313703	3UNIONVILLE	DVP	1	DVP_P7-1: LN 70-2153-A	tower	301.0	77.8	106.7	DC	87.0

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
402262	313703	3UNIONVILLE	DVP	314764	3LOCST G	DVP	1	DVP_P7-1: LN 70-2153-B	tower	235.0	100.53	137.55	DC	87.0
400451	314755	3SPOTSYL	DVP	314779	3TDTAVRN	DVP	1	DVP_P4-2: 573T594	breaker	260.0	148.65	163.38	DC	38.3
400510	314775	3NI RVER	DVP	314135	3CHANCE	DVP	1	DVP_P4-2: 573T594	breaker	260.0	134.65	149.38	DC	38.3
400635	314778	3PAY TAP	DVP	314755	3SPOTSYL	DVP	1	DVP_P4-2: 2T70	breaker	260.0	103.1	135.82	DC	85.07
402257	314778	3PAY TAP	DVP	314755	3SPOTSYL	DVP	1	DVP_P7-1: LN 70-2153-B	tower	260.0	104.59	138.05	DC	87.0
402258	314778	3PAY TAP	DVP	314755	3SPOTSYL	DVP	1	DVP_P7-1: LN 70-2153-A	tower	260.0	101.06	134.52	DC	87.0
400473	314779	3TDTAVRN	DVP	314775	3NI RVER	DVP	1	DVP_P4-2: 573T594	breaker	260.0	139.11	153.84	DC	38.3
400575	926000	AC1-076 TAP	DVP	314778	3PAY TAP	DVP	1	DVP_P4-2: 2T70	breaker	260.0	111.43	144.16	DC	85.07
402232	926000	AC1-076 TAP	DVP	314778	3PAY TAP	DVP	1	DVP_P7-1: LN 70-2153-B	tower	260.0	112.88	146.34	DC	87.0
402233	926000	AC1-076 TAP	DVP	314778	3PAY TAP	DVP	1	DVP_P7-1: LN 70-2153-A	tower	260.0	109.31	142.77	DC	87.0

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
401401	313703	3UNIONVILLE	DVP	314764	3LOCST G	DVP	1	DVP_P1-2: LN 2-A	operation	191.76	121.4	165.77	DC	85.07
401406	313703	3UNIONVILLE	DVP	314764	3LOCST G	DVP	1	Base Case	operation	191.76	71.19	98.78	DC	52.92
401996	314345	3MT RUN	DVP	314743	3BRANDY	DVP	1	DVP_P1-2: LN 2-D	operation	331.82	60.79	105.69	DC	149.0
402048	314743	3BRANDY	DVP	926610	AC1-143 TAP	DVP	1	DVP_P1-2: LN 2-D	operation	331.82	55.24	100.14	DC	149.0
401613	314764	3LOCST G	DVP	926000	AC1-076 TAP	DVP	1	DVP_P1-2: LN 2-A	operation	212.44	108.78	148.83	DC	85.07
401161	314768	3MITCHEL	DVP	314815	3OAK GRE	DVP	1	DVP_P1-2: LN 2-A	operation	217.14	140.19	208.81	DC	149.0
401166	314768	3MITCHEL	DVP	314815	3OAK GRE	DVP	1	Base Case	operation	217.14	65.99	108.4	DC	92.07
401395	314778	3PAY TAP	DVP	314755	3SPOTSYL	DVP	1	DVP_P1-2: LN 2-A	operation	212.44	125.8	165.85	DC	85.07
401400	314778	3PAY TAP	DVP	314755	3SPOTSYL	DVP	1	Base Case	operation	212.44	73.57	98.48	DC	52.92
401657	314815	3OAK GRE	DVP	313703	3UNIONVILLE	DVP	1	DVP_P1-2: LN 2-A	operation	224.66	106.83	144.69	DC	85.07
401770	925670	AC1-043 TAP	DVP	314345	3MT RUN	DVP	1	DVP_P1-2: LN 2-D	operation	331.82	93.36	138.27	DC	149.0
401337	926000	AC1-076 TAP	DVP	314778	3PAY TAP	DVP	1	DVP_P1-2: LN 2-A	operation	212.44	136.01	176.05	DC	85.07
401342	926000	AC1-076 TAP	DVP	314778	3PAY TAP	DVP	1	Base Case	operation	212.44	84.51	109.42	DC	52.92
401774	926480	AC1-120 TAP	DVP	314768	3MITCHEL	DVP	1	DVP_P1-2: LN 2-A	operation	331.82	93.36	138.27	DC	149.0
401896	926610	AC1-143 TAP	DVP	314078	3REMNGTN	DVP	1	DVP_P1-2: LN 2-D	operation	331.82	73.26	118.17	DC	149.0
401973	932780	AC2-102 TAP	DVP	926480	AC1-120 TAP	DVP	1	DVP_P1-2: LN 2-A	operation	331.82	69.25	114.16	DC	149.0

Flow Gate Details

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
402262	313703	3UNIONVILLE	DVP	314764	3LOCST G	DVP	1	DVP_P7-1: LN 70-2153-B	tower	235.0	100.53	137.55	DC	87.0

Bus #	Bus	MW Impact
925671	AC1-043 C	22.19
925672	AC1-043 E	36.2
926481	AC1-120 C O1	23.12
926482	AC1-120 E O1	11.91
926501	AC1-121 C O1	7.94
926502	AC1-121 E O1	3.74
932781	AC2-102 C	17.75
932782	AC2-102 E	28.96
934861	AD1-115 C	11.09
934862	AD1-115 E	18.1
938081	AE1-010	9.39
939221	AE1-153 C O2	52.2
939222	AE1-153 E O2	34.8
939511	AE1-180 C	7.01
939512	AE1-180 E	4.67
CARR	CARR	0.07
CBM-S1	CBM-S1	0.57
CBM-S2	CBM-S2	0.37
CBM-W1	CBM-W1	0.73
CBM-W2	CBM-W2	3.84
CIN	CIN	0.34
CPLE	CPLE	0.15
G-007	G-007	0.23
IPL	IPL	0.22
LGEE	LGEE	0.1
MEC	MEC	0.67
MECS	MECS	0.34
O-066	O-066	0.77
RENSSELAER	RENSSELAER	0.05
WEC	WEC	0.09

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
401167	314768	3MITCHEL	DVP	314815	3OAK GRE	DVP	1	DVP_P1-2: LN 2-A	single	217.14	62.17	103.34	DC	89.4

Bus #	Bus	MW Impact
925671	AC1-043 C	38.0
926481	AC1-120 C O1	39.6
926501	AC1-121 C O1	13.6
932781	AC2-102 C	30.4
934861	AD1-115 C	19.0
939221	AE1-153 C O2	89.4

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
402232	926000	AC1-076 TAP	DVP	314778	3PAY TAP	DVP	1	DVP_P7-1: LN 70-2153-B	tower	260.0	112.88	146.34	DC	87.0

Bus #	Bus	MW Impact
925671	AC1-043 C	22.19
925672	AC1-043 E	36.2
926001	AC1-076 C	17.03
926002	AC1-076 E	27.69
926481	AC1-120 C O1	23.12
926482	AC1-120 E O1	11.91
926501	AC1-121 C O1	7.94
926502	AC1-121 E O1	3.74
932781	AC2-102 C	17.75
932782	AC2-102 E	28.96
934861	AD1-115 C	11.09
934862	AD1-115 E	18.1
938081	AE1-010	23.61
939221	AE1-153 C O2	52.2
939222	AE1-153 E O2	34.8
939511	AE1-180 C	7.01
939512	AE1-180 E	4.67
CARR	CARR	0.07
CBM-S1	CBM-S1	0.57
CBM-S2	CBM-S2	0.37
CBM-W1	CBM-W1	0.73
CBM-W2	CBM-W2	3.84
CIN	CIN	0.34
CPLE	CPLE	0.15
G-007	G-007	0.23
IPL	IPL	0.22
LGEE	LGEE	0.1
MEC	MEC	0.67
MECS	MECS	0.34
O-066	O-066	0.77
RENSSELAER	RENSSELAER	0.05
WEC	WEC	0.09

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
402298	314764	3LOCST G	DVP	926000	AC1-076 TAP	DVP	1	DVP_P7-1: LN 70-2153-B	tower	260.0	90.21	123.67	DC	87.0

Bus #	Bus	MW Impact
925671	AC1-043 C	22.19
925672	AC1-043 E	36.2
926481	AC1-120 C O1	23.12
926482	AC1-120 E O1	11.91
926501	AC1-121 C O1	7.94
926502	AC1-121 E O1	3.74
932781	AC2-102 C	17.75
932782	AC2-102 E	28.96
934861	AD1-115 C	11.09
934862	AD1-115 E	18.1
938081	AE1-010	9.39
939221	AE1-153 C O2	52.2
939222	AE1-153 E O2	34.8
939511	AE1-180 C	7.01
939512	AE1-180 E	4.67
CARR	CARR	0.07
CBM-S1	CBM-S1	0.57
CBM-S2	CBM-S2	0.37
CBM-W1	CBM-W1	0.73
CBM-W2	CBM-W2	3.84
CIN	CIN	0.34
CPLE	CPLE	0.15
G-007	G-007	0.23
IPL	IPL	0.22
LGEE	LGEE	0.1
MEC	MEC	0.67
MECS	MECS	0.34
O-066	O-066	0.77
RENSSELAER	RENSSELAER	0.05
WEC	WEC	0.09

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
402378	314815	3OAK GRE	DVP	313703	3UNIONVILLE	DVP	1	DVP_P7-1: LN 70-2153-B	tower	301.0	80.88	109.78	DC	87.0

Bus #	Bus	MW Impact
925671	AC1-043 C	22.19
925672	AC1-043 E	36.2
926481	AC1-120 C O1	23.12
926482	AC1-120 E O1	11.91
926501	AC1-121 C O1	7.94
926502	AC1-121 E O1	3.74
932781	AC2-102 C	17.75
932782	AC2-102 E	28.96
934861	AD1-115 C	11.09
934862	AD1-115 E	18.1
938081	AE1-010	9.39
939221	AE1-153 C O2	52.2
939222	AE1-153 E O2	34.8
939511	AE1-180 C	7.01
939512	AE1-180 E	4.67
CARR	CARR	0.07
CBM-S1	CBM-S1	0.57
CBM-S2	CBM-S2	0.37
CBM-W1	CBM-W1	0.73
CBM-W2	CBM-W2	3.84
CIN	CIN	0.34
CPLE	CPLE	0.15
G-007	G-007	0.23
IPL	IPL	0.22
LGEE	LGEE	0.1
MEC	MEC	0.67
MECS	MECS	0.34
O-066	O-066	0.77
RENSSELAER	RENSSELAER	0.05
WEC	WEC	0.09

Index 6

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
400451	314755	3SPOTSYL	DVP	314779	3TDTAVRN	DVP	1	DVP_P4-2: 573T594	breaker	260.0	148.65	163.38	DC	38.3

Bus #	Bus	MW Impact
925671	AC1-043 C	8.71
925672	AC1-043 E	14.22
926001	AC1-076 C	10.39
926002	AC1-076 E	16.9
926481	AC1-120 C O1	10.65
926482	AC1-120 E O1	5.48
926501	AC1-121 C O1	3.66
926502	AC1-121 E O1	1.72
926611	AC1-143 C O1	3.85
926612	AC1-143 E O1	1.76
926731	AC1-158 C	195.87
926732	AC1-158 E	85.96
932781	AC2-102 C	7.87
932782	AC2-102 E	12.83
934541	AD1-078 C	6.35
934542	AD1-078 E	3.73
934861	AD1-115 C	4.36
934862	AD1-115 E	7.11
938081	AE1-010	14.41
939221	AE1-153 C O2	22.98
939222	AE1-153 E O2	15.32
939511	AE1-180 C	2.22
939512	AE1-180 E	1.48
CARR	CARR	0.01
CATAWBA	CATAWBA	0.01
CBM-S1	CBM-S1	0.06
CBM-W1	CBM-W1	0.16
CBM-W2	CBM-W2	0.47
CIN	CIN	0.07
G-007	G-007	0.04
HAMLET	HAMLET	0.05
IPL	IPL	0.05
LGEE	LGEE	0.02
MEC	MEC	0.12
MECS	MECS	0.1
O-066	O-066	0.14
RENSSELAER	RENSSELAER	0.01
WEC	WEC	0.02

Index 7

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
400510	314775	3NI RVER	DVP	314135	3CHANCE	DVP	1	DVP_P4-2: 573T594	breaker	260.0	134.65	149.38	DC	38.3

Bus #	Bus	MW Impact
925671	AC1-043 C	8.71
925672	AC1-043 E	14.22
926001	AC1-076 C	10.39
926002	AC1-076 E	16.9
926481	AC1-120 C O1	10.65
926482	AC1-120 E O1	5.48
926501	AC1-121 C O1	3.66
926502	AC1-121 E O1	1.72
926611	AC1-143 C O1	3.85
926612	AC1-143 E O1	1.76
926731	AC1-158 C	195.87
926732	AC1-158 E	85.96
932781	AC2-102 C	7.87
932782	AC2-102 E	12.83
934541	AD1-078 C	6.35
934542	AD1-078 E	3.73
934861	AD1-115 C	4.36
934862	AD1-115 E	7.11
938081	AE1-010	14.41
939221	AE1-153 C O2	22.98
939222	AE1-153 E O2	15.32
939511	AE1-180 C	2.22
939512	AE1-180 E	1.48
CARR	CARR	0.01
CATAWBA	CATAWBA	0.01
CBM-S1	CBM-S1	0.06
CBM-W1	CBM-W1	0.16
CBM-W2	CBM-W2	0.47
CIN	CIN	0.07
G-007	G-007	0.04
HAMLET	HAMLET	0.05
IPL	IPL	0.05
LGEE	LGEE	0.02
MEC	MEC	0.12
MECS	MECS	0.1
O-066	O-066	0.14
RENSSELAER	RENSSELAER	0.01
WEC	WEC	0.02

Index 8

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
402257	314778	3PAY TAP	DVP	314755	3SPOTSYL	DVP	1	DVP_P7-1: LN 70-2153-B	tower	260.0	104.59	138.05	DC	87.0

Bus #	Bus	MW Impact
925671	AC1-043 C	22.19
925672	AC1-043 E	36.2
926001	AC1-076 C	17.03
926002	AC1-076 E	27.69
926481	AC1-120 C O1	23.12
926482	AC1-120 E O1	11.91
926501	AC1-121 C O1	7.94
926502	AC1-121 E O1	3.74
932781	AC2-102 C	17.75
932782	AC2-102 E	28.96
934541	AD1-078 C	9.86
934542	AD1-078 E	5.79
934861	AD1-115 C	11.09
934862	AD1-115 E	18.1
938081	AE1-010	23.61
939221	AE1-153 C O2	52.2
939222	AE1-153 E O2	34.8
939511	AE1-180 C	7.01
939512	AE1-180 E	4.67
CARR	CARR	0.07
CBM-S1	CBM-S1	0.57
CBM-S2	CBM-S2	0.37
CBM-W1	CBM-W1	0.73
CBM-W2	CBM-W2	3.84
CIN	CIN	0.34
CPLE	CPLE	0.15
G-007	G-007	0.23
IPL	IPL	0.22
LGEE	LGEE	0.1
MEC	MEC	0.67
MECS	MECS	0.34
O-066	O-066	0.77
RENSSELAER	RENSSELAER	0.05
WEC	WEC	0.09

Index 9

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
400473	314779	3TDTAVRN	DVP	314775	3NI RVER	DVP	1	DVP_P4-2: 573T594	breaker	260.0	139.11	153.84	DC	38.3

Bus #	Bus	MW Impact
925671	AC1-043 C	8.71
925672	AC1-043 E	14.22
926001	AC1-076 C	10.39
926002	AC1-076 E	16.9
926481	AC1-120 C O1	10.65
926482	AC1-120 E O1	5.48
926501	AC1-121 C O1	3.66
926502	AC1-121 E O1	1.72
926611	AC1-143 C O1	3.85
926612	AC1-143 E O1	1.76
926731	AC1-158 C	195.87
926732	AC1-158 E	85.96
932781	AC2-102 C	7.87
932782	AC2-102 E	12.83
934541	AD1-078 C	6.35
934542	AD1-078 E	3.73
934861	AD1-115 C	4.36
934862	AD1-115 E	7.11
938081	AE1-010	14.41
939221	AE1-153 C O2	22.98
939222	AE1-153 E O2	15.32
939511	AE1-180 C	2.22
939512	AE1-180 E	1.48
CARR	CARR	0.01
CATAWBA	CATAWBA	0.01
CBM-S1	CBM-S1	0.06
CBM-W1	CBM-W1	0.16
CBM-W2	CBM-W2	0.47
CIN	CIN	0.07
G-007	G-007	0.04
HAMLET	HAMLET	0.05
IPL	IPL	0.05
LGEE	LGEE	0.02
MEC	MEC	0.12
MECS	MECS	0.1
O-066	O-066	0.14
RENSSELAER	RENSSELAER	0.01
WEC	WEC	0.02

Contingency Name	Contingency Defintion
DVP_P4-2: 573T594	CONTINGENCY 'AEP_P1-2_#768' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND
DVP_P7-1: LN 70-2153-A	CONTINGENCY 'AEP_P1-2_#768' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND
DVP_P1-2: LN 2-A	CONTINGENCY 'AEP_P1-2_#768' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND
DVP_P7-1: LN 70-2153-B	CONTINGENCY 'AEP_P1-2_#768' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND
DVP_P4-2: 2T70	CONTINGENCY 'AEP_P1-2_#768' OPEN BRANCH FROM BUS 241901 TO BUS 242936 CKT 1 / 241901 02LALLEND

Short Circuit

Short Circuit

The following Breakers are overduty:

None

Attachment 1: One Line Diagram