Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-207

NORTHRIDGE 138 KV

85 MW Capacity / 85 MW Energy

January 2021

Table of Contents

1 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 Dayton.

2 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 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.

3 General

The Interconnection Customer (IC), has proposed a Storage generating facility located in Montgomery County, Ohio. The installed facilities will have a total capability of 85 MW with 85 MW of this output being recognized by PJM as Capacity.

The proposed in-service date for this project is December 01, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-207
Project Name	NORTHRIDGE 138 KV
State	Ohio
County	Montgomery
Transmission Owner	Dayton
MFO	85
MWE	85
MWC	85
Fuel	Storage
Basecase Study Year	2024

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

AG1-207 will interconnect with the Dayton transmission system along one of the following Points of Interconnection:

Primary POI: North Ridge 138 kV substation.

The AG1-207 queue project will interconnect with the Dayton Power & Light transmission system via a direct connection through a gen-tie line to the existing Northridge 138 kV substation. The existing single breaker configuration at the Northridge substation will be upgraded to a five-breaker ring bus configuration. The Point of Interconnection (POI) will be the 138 kV takeoff structure leaving the new five-breaker ring bus switchyard. Dayton will own the takeoff structure and all attachment hardware. The Interconnection Customer will own the generator lead line conductor terminating onto the structure. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection substation and the associated attachment facilities.

Attachment 1 shows a one-line diagram of the proposed primary direct connection of the (AG1-207) queue generation project to The Dayton Power & Light transmission system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing all the facilities on its side of the POI including the attachment line.

Secondary POI: Vandalia 69 kV substation.

5 Cost Summary

The AG1-207 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$7,290,000
Total System Network Upgrade Costs	$16,700,000
Total Costs	**$23,990,000**

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 2016-36, 2016-25 I.R.B. (6/20/2016). If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

Note that the Dayton findings were made from a conceptual review of this project. A more detailed review of the connection facilities and their cost will be identified in a future study phase. Further note that the cost

estimate data contained in this document should be considered high level estimates since it was produced without a detailed engineering review. The applicant will be responsible for the actual cost of construction.

6 Transmission Owner Scope of Work

The AG1-207 project will interconnect with the Dayton Power and Light transmission system via a new 138 kV five-breaker ring bus switchyard at the Northridge 138 kV substation. The Transmission Owner scope of work associated with this project is to build direct and non-direct connection facilities, along with relaying, metering, RTU, SCADA and other miscellaneous supporting equipment, provide engineering oversight and any remote work required at other adjacent substations due to this interconnection.

The total physical interconnection costs is given in the table below:

6.1 Attachment Facilities

This report assumes that the Interconnection Customer will construct and own the attachment line from its generating facility into the proposed Point of Interconnection as depicted on the one-line diagram in Attachment 1. The IC will also be responsible for the fiber/OPGW that Dayton requires on the generator line for the communication assisted trip scheme. The costs included below are for the necessary protection system review and any subsequent field changes needed to coordinate with IC attachment facilities.

The metering may be classified as an Attachment Facility in future study reports.

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
None	$0
Total Attachment Facility Costs	**$0**

6.2 Direct Connection Cost Estimate

The substation direct connection work for this project includes the construction of a 138 kV five-breaker ring bus switchyard at the Northridge 138 kV substation. There will also be 138 kV transmission line construction required to accommodate the new switchyard. The 138 kV generator lead line will be constructed by the developer and will be terminated onto the 138 kV takeoff structure leaving the new five-breaker ring bus switchyard. The new substation will be equipped with the necessary communication systems to facilitate remote supervisory control of the breakers and status monitoring. Dayton will install the line relaying, communications, and interconnection metering to accommodate the interconnection of the AG1-207 generating facility.

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
Engineering review and commissioning.	$15,000

Description	Total Cost
Install four additional breakers to upgrade the Northridge sub to a new 138 kV five-breaker ring bus switchyard to interconnect the AG1-207 project. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment, and associated facilities.	$7,100,000
138 kV transmission line tie-In work to accommodate AG1-207 Interconnection Switchyard.	$100,000
Total Direct Connection Facility Costs	**$7,215,000**

6.3 Non-Direct Connection Cost Estimate

Relay setting changes will need to be made at the Northridge Substation to facilitate the interconnection of the new generation. Updates will also be required to the remote ends at Miami and Needmore 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
Protection system settings changes at Northridge, Miami and Needmore substations.	$75,000
Total Non-Direct Connection Facility Costs	**$75,000**

7 Schedule

Based on the extent of the Dayton primary Attachment Facilities and the direct and Non-Direct Connection work required to support the AG1-207 generation project, it is expected to take a minimum of **twenty four (24) months** from the date of a fully executed Interconnection Construction Service Agreement to complete the installation. This includes the requirement for the IC to make a preliminary payment to Dayton which funds the Non-Direct Connection work and the first three months of engineering design that is related to the construction of the Attachment Facilities. It further assumes that the IC will provide all rights-of-way, permits, easements, etc. that will be needed. A further assumption is that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined Attachment Facilities and Direct/Non-Direct Connection work, and that all system outages will be allowed when requested.

8 Transmission Owner Analysis

BRANCH	CONTINGENCY	MVAFLOW	AMPFLOW	RATE RATE1/ RATE2	% FLOW AFTER	% FLOW BEFORE	COMMENTS
253077 09STUART 345.00 250167 08DEO_STUART138. 00 1	BASE CASE	325.97	325.97	250.00	130.39	130.35	The overloaded transformer is owned by Duke. Duke to propose reinforcement project(s).
253099 09ATLNTA 69.000 253100 09ATLNTA 345.00 1	BASE CASE	295.65	295.65	250.00	118.26	118.05	Reinforcement Project, r190012 will add a second 250MVA, 345/69kV transformer at Atlanta. AE2-319 is currently responsible for r190012.
253311 AC1-085 MAIN345.00 3WNDTR AC1-085 M WND 1 1	BASE CASE	222.95	222.95	150.00	148.63	148.48	IC equipment. PJM to confirm/update ratings.
253311 AC1-085 MAIN345.00 3WNDTR AC1-085 MAIN WND 1 1	BASE CASE	222.95	222.95	150.00	148.63	148.48	IC equipment. PJM to confirm/update ratings.
253320 AC1-085 COL234.500 3WNDTR AC1-085 M WND 2 1	BASE CASE	211.96	211.96	150.00	141.31	141.21	IC equipment. PJM to confirm/update ratings.
253321 AC1-085 COL134.500 3WNDTR AC1-085 MAIN WND 2 1	BASE CASE	211.96	211.96	150.00	141.31	141.21	IC equipment. PJM to confirm/update ratings.
253322 AC1-069 MAIN69.000 3WNDTR AC1-069 MAIN WND 1 1	BASE CASE	49.68	49.68	36.00	138.00	138.00	IC equipment. PJM to confirm/update ratings.
253324 AC1-069 COL 34.500 3WNDTR AC1-069 MAIN WND 2 1	BASE CASE	49.65	49.65	36.00	137.92	137.92	IC equipment. PJM to confirm/update ratings.
253330 AC1-068 MAIN69.000 3WNDTR AC1-068 MAIN WND 1 1	BASE CASE	49.68	49.68	36.00	138.00	138.00	IC equipment. PJM to confirm/update ratings.
253332 AC1-068 COL 34.500 3WNDTR AC1-068 MAIN WND 2 1	BASE CASE	49.65	49.65	36.00	137.92	137.92	IC equipment. PJM to confirm/update ratings.

BRANCH	CONTINGENCY	MVAFLOW	AMPFLOW	RATE RATE1/ RATE2	% FLOW AFTER	% FLOW BEFORE	COMMENTS
253346 AC2-067 MAIN69.000 3WNDTR AC2-067 MAIN WND 1 1	BASE CASE	58.21	58.21	45.00	129.35	129.35	IC equipment. PJM to confirm/update ratings.
253347 AC2-067 COL134.500 3WNDTR AC2-067 MAIN WND 2 1	BASE CASE	57.32	57.32	45.00	127.38	127.38	IC equipment. PJM to confirm/update ratings.
253348 AC2-067 COL234.500 253349 AC2-067 C 0.3850 1	BASE CASE	-57.53	57.53	52.80	108.96	108.97	IC equipment. PJM to confirm/update ratings.
938700 AE1-092 TAP 138.00 964650 AG1-328 TAP 138.00 1	BASE CASE	223.61	221.40	218.00	101.56	101.15	AG1-328 is in ATSI territory. ATSI to propose reinforcement projects.
938701 AE1-092 GSU 138.00 3WNDTR AE1-092 GSU WND 1 1	BASE CASE	225.35	225.35	153.00	147.28	147.28	IC equipment. PJM to confirm/update ratings.
938702 AE1-092 COL234.500 3WNDTR AE1-092 GSU WND 2 1	BASE CASE	228.12	228.12	153.00	149.10	149.09	IC equipment. PJM to confirm/update ratings.
964650 AG1-328 TAP 138.00 238861 02KIRBY 138.00 1	BASE CASE	222.42	221.34	218.00	101.53	101.12	AG1-328 is in ATSI territory. ATSI to propose reinforcement projects.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6602_HUTCHINGS_CRYSTAL_69KV	-171.18	165.10	165.00	100.06		New overload caused by AG1-207. Supplemental Project # S1846 (Greenville Transformer) will raise the line rating to 200/220MVA.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6611_HUTCHINGS_CROWN_69KV	-171.45	165.36	165.00	100.22	100.15	Supplemental Project # S1846 (Greenville Transformer) will raise the line rating to 200/220MVA.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6625_COVINGTON MINSTER, ROSSBURG_69KV	-174.45	168.24	165.00	101.96	101.93	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6644_COVINGTON_GREENVILLE_69KV	-204.00	196.78	165.00	119.26	119.17	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6656_GARAGE RD WEST MANCHESTER_69KV	-177.61	171.30	165.00	103.82	104.07	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6661_TREATY_ROSSBURG_69KV	-209.31	201.86	165.00	122.34	122.00	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6916_CROWN_BROOKVILLE_69KV	-182.30	175.83	165.00	106.56	106.53	Same comment as above.

BRANCH	CONTINGENCY	MVAFLOW	AMPFLOW	RATE RATE1/ RATE2	% FLOW AFTER	% FLOW BEFORE	COMMENTS
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6932_TREATY_GREENVILLE_69KV	-215.67	207.99	165.00	126.05	125.71	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6937_FORT RECOVERY_ROSSBURG_69KV	-182.91	176.42	165.00	106.92	106.68	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_34591_MIAMI FORT (DUKE)_WEST MILTON 345KV	-171.10	165.02	165.00	100.01	100.11	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_BATH_FB_EE KV	-171.13	165.05	165.00	100.03	100.12	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY MIAMI FB_DD KV	-171.40	165.35	165.00	100.21	101.18	Same comment as above.

8.1 Transmission Owner Analysis: Non-Converged Contingencies

CONTINGENCY	EVENTS	CONVERGED	CONVERGENCE STATE	MVAWORST	MVATOTAL
DAY_34551_ATLANTA_ADKINS_345KV	OPEN LINE FROM BUS 253100 [09ATLNTA 345.00] TO BUS 944520 [AF1-117 TAP 345.00] CKT 1 OPEN LINE FROM BUS 253100 [09ATLNTA 345.00] TO BUS 245769 [05ADKINS 345.00] CKT 1 OPEN LINE FROM BUS 253100 [09ATLNTA 345.00] TO BUS 253099 [09ATLNTA 69.000] CKT 1	FALSE	Blown up	897.9636	12980.4482
DAY_ATLANTA_FB_BB KV	OPEN LINE FROM BUS 253100 [09ATLNTA 345.00] TO BUS 944520 [AF1-117 TAP 345.00] CKT 1 OPEN LINE FROM BUS 253100 [09ATLNTA 345.00] TO BUS 245769 [05ADKINS 345.00] CKT 1 OPEN LINE FROM BUS 253100 [09ATLNTA 345.00] TO BUS 253099 [09ATLNTA 69.000] CKT 1	FALSE	Blown up	897.9636	12980.4482

8.1.1 Transmission Owner Analysis: Non-Converged Contingencies Comments

To solve non-convergence issues identified in this report, Queue Project AE2-319 will require an expansion of the Atlanta 345kV Substation which will include looping in and out AEP's Biers Run-Bixby 345kV line. Reinforcement Project, r190012 ($5,000,000) will add a second 250MVA, 345/69kV transformer at Atlanta and reinforcement project r190013 ($54,798,000) will upgrade the Atlanta 345kV switchyard to a breaker and a half configuration interconnecting AE2-319, AE2-320, existing 345kV line to Adkins, existing 345kV line to Stuart, a new 345kV tie to Biers Run(AEP), and a new 345kV tie to AE2-149 tap between Biers Run and Bixby. This will provide more outlets to balance the influx of new generation in the area. If AE2-319 decides to not move forward, subsequent queue projects may be responsible for the upgrades.

9 Interconnection Customer Requirements

It is understood that the Interconnection Customer (IC) is responsible for all costs associated with this interconnection. The costs above are reimbursable to the Transmission Owner. The cost of the IC's generating plant and the costs for the line connecting the generating plant to the Point of Interconnection are not included in this report; these are assumed to be the IC's responsibility.

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

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.

9.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in Dayton's "Requirements for the connection of Facilities to the Dayton Power & Light company Transmission System" document located at: https://www.pjm.com/planning/design-engineering/to-tech-standards/private-dayton.aspx. Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase.

9.2 Compliance Issues and Interconnection Customer Requirements

The Dayton Power and Light Company (DP&L) has prepared this Facilities Connection Requirements document to ensure compliance with North American Electric Reliability Council (NERC) Reliability Standards and applicable Regional Reliability Organization, sub regional, Power Pool, and individual Transmission Owner planning criteria and facility connection requirements in compliance to NERC Standard FAC-001-2. These connection requirements apply to all generation facilities, transmission facilities, and end-users connecting to the DP&L transmission system. Detailed information outlining DP&L interconnection requirements can be reviewed utilizing the following link:

https://www.pjm.com/~/media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx

10 Revenue Metering and SCADA Requirements

10.1 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 Section 8 of Attachment O.

10.2 Meteorological Data Reporting Requirements

10.3 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

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

11 Summer Peak - Load Flow Analysis - Primary POI

The Queue Project AG1-207 was evaluated as a 85.0 MW (Capacity 85.0 MW) injection at the North Ridge 138 kV substation in the Dayton area. Project AG1-207 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-207 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

None

11.2 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	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
16555598 4	25304 6	09MIAM I	138. 0	DAY	25305 6	09NORTH R	138. 0	DAY	1	13815 13843	tower	234.0	80.05	107.01	DC	63.08

11.3 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	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1673362 86	24345 3	05BEAT TY	345. 0	AEP	24345 4	05BIX BY	345. 0	AEP	1	AEP_P4_#3196_05BE ATTY	breaker	1203. 0	115.0	115.46	DC	12.38

11.4 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	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
16439243 4	94151 0	AE2-148 TAP	345. 0	DAY	94563 0	AF1-228 TAP	345. 0	DAY	1	AEP_P1-2_#762_807 2	operation	1203. 0	120.85	122.11	DC	15.09
16439239 0	94563 0	AF1-228 TAP	345. 0	DAY	24345 3	05BEATT Y	345. 0	AEP	1	AEP_P1-2_#762_807 2	operation	1203. 0	129.23	130.49	DC	15.09
16439239 5	94563 0	AF1-228 TAP	345. 0	DAY	24345 3	05BEATT Y	345. 0	AEP	1	Base Case	operation	1096. 0	101.67	103.02	DC	14.73

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
165555984	1	09MIAMI 138.0 kV - 09NORTHR 138.0 kV Ckt 1	**DAY** r190018 (1218) : Reconductor the existing Conductor, Transmission 636 ACSR 36x1 with 1351 AAC and reconductor the existing Conductor, Transmission 636 ACSR 26x7 with 1351 AAC Project Type : FAC Cost : $15,200,000 Time Estimate : 12.0 Months	$15,200,000
167336286	2	05BEATTY 345.0 kV - 05BIXBY 345.0 kV Ckt 1	**AEP** AEPO0003a (418) : Upgrade/Replace Three 345kV 1600A switches at Beatty station Project Type : FAC Cost : $1,500,000 Time Estimate : 12-18 Months	$1,500,000
			TOTAL COST	$16,700,000

11.6 Flow Gate Details - Primary POI

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

11.6.1 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
165555984	253046	09MIAMI	DAY	253056	09NORTHR	DAY	1	13815 13843	tower	234.0	80.05	107.01	DC	63.08

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
253349	AC2-067 C	-1.8025	Adder	-2.12
963582	AG1-207 BAT	63.0802	50/50	63.0802
WEC	WEC	0.0110	Confirmed LTF	0.0110
CPLE	CPLE	0.0116	Confirmed LTF	0.0116
G-007A	G-007A	0.0863	Confirmed LTF	0.0863
VFT	VFT	0.2322	Confirmed LTF	0.2322
CBM-W2	CBM-W2	0.1165	Confirmed LTF	0.1165
TVA	TVA	0.0126	Confirmed LTF	0.0126
CBM-S2	CBM-S2	0.1462	Confirmed LTF	0.1462
CBM-S1	CBM-S1	0.0023	Confirmed LTF	0.0023
CBM-N	CBM-N	0.0444	Confirmed LTF	0.0444
MEC	MEC	0.0429	Confirmed LTF	0.0429
BLUEG	BLUEG	0.0104	Confirmed LTF	0.0104
TRIMBLE	TRIMBLE	0.0033	Confirmed LTF	0.0033
LAGN	LAGN	0.0228	Confirmed LTF	0.0228
CBM-W1	CBM-W1	0.6730	Confirmed LTF	0.6730

11.6.2 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
167336286	243453	05BEATTY	AEP	243454	05BIXBY	AEP	1	AEP_P4_#3196_05BEATTY	breaker	1203.0	115.0	115.46	DC	12.38

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
250164	08BKJDB1	0.1625	Adder	0.19
250165	08BKJDB2	0.1652	Adder	0.19
251827	WILLYESP	0.4682	Adder	0.55
251828	CLNTESP1	0.7516	Adder	0.88
253097	09YANKEE	2.3576	50/50	2.3576
253261	09MON D	0.2896	50/50	0.2896
253313	**AC1-085 A_C (Suspended)**	**9.3179**	**Adder**	**10.96**
253314	**AC1-085 A_E (Suspended)**	**15.2029**	**Adder**	**17.89**
253316	**AC1-085 B_C (Suspended)**	**9.3179**	**Adder**	**10.96**
253317	**AC1-085 B_E (Suspended)**	**15.2029**	**Adder**	**17.89**
253325	AC1-069 C	12.2543	50/50	12.2543
253326	AC1-069 E	5.7307	50/50	5.7307
253333	AC1-068 C	12.2543	50/50	12.2543
253334	AC1-068 E	5.7307	50/50	5.7307
253338	AC1-165 C	12.1101	50/50	12.1101
253339	AC1-165 E	5.8748	50/50	5.8748
253343	AC1-166 C	12.1101	50/50	12.1101
253344	AC1-166 E	5.8748	50/50	5.8748
253349	AC2-067 C	3.0481	Adder	3.59
253351	AC2-067 E	3.5657	Adder	4.19
253355	AB1-169 CT1	35.0994	Adder	41.29
253356	AB1-169 ST1	25.0772	Adder	29.5
253357	AB1-169 CT2	35.0994	Adder	41.29
253358	AB1-169 ST2	25.0772	Adder	29.5
270156	DARBY CT1	5.6715	50/50	5.6715
270157	DARBY CT2	5.6715	50/50	5.6715
270158	DARBY CT3	5.6023	50/50	5.6023
270159	DARBY CT4	5.5332	50/50	5.5332
270160	DARBY CT5	5.6715	50/50	5.6715
270161	DARBY CT6	5.4640	50/50	5.4640
904721	V4-073 C	0.0223	50/50	0.0223
904722	V4-073 E	0.2305	50/50	0.2305
913222	Y1-054 E	1.5458	Adder	1.82
925984	AC1-074 C	3.9237	Adder	4.62
925985	AC1-074 E	1.6816	Adder	1.98
926014	AC1-078 C	10.4663	50/50	10.4663
926016	AC1-078 E	17.4438	50/50	17.4438
930062	AB1-014 E	7.5196	Adder	8.85
932381	AC2-055 C	1.7489	Adder	2.06
932382	AC2-055 E	2.8535	Adder	3.36
932421	AC2-060 C	6.2011	Adder	7.3
932422	AC2-060 E	3.4881	Adder	4.1

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
932551	AC2-075 C	0.9319	Adder	1.1
932552	AC2-075 E	0.4694	Adder	0.55
932661	AC2-088 C O1	3.4187	Adder	4.02
932662	AC2-088 E O1	2.8133	Adder	3.31
934491	AD1-073 C	1.2790	Adder	1.5
934492	AD1-073 E	0.6589	Adder	0.78
934561	AD1-081 C	2.0933	50/50	2.0933
934562	AD1-081 E	1.0783	50/50	1.0783
935031	AD1-136 C	0.4808	Adder	0.57
935032	AD1-136 E	0.4095	Adder	0.48
935044	AD1-140 C	11.5826	Adder	13.63
935045	AD1-140 E	9.5756	Adder	11.27
936251	AD2-031 C O1	2.3083	Adder	2.72
936252	AD2-031 E O1	2.4298	Adder	2.86
938051	AE1-007 C	0.8742	Adder	1.03
938052	AE1-007 E	1.4263	Adder	1.68
938271	AE1-040 C O1	3.8893	Adder	4.58
938272	AE1-040 E O1	1.9570	Adder	2.3
939141	AE1-144 C O1	6.5416	Adder	7.7
939142	AE1-144 E O1	3.2463	Adder	3.82
940531	AE2-038 C O1	4.3638	Adder	5.13
940532	AE2-038 E O1	2.1615	Adder	2.54
941411	AE2-138 C	13.5195	Adder	15.91
941412	AE2-138 E	5.0003	Adder	5.88
941511	AE2-148 C	153.0479	50/50	153.0479
941512	AE2-148 E	69.2240	50/50	69.2240
941981	AE2-210 C O1	4.6584	Adder	5.48
941982	AE2-210 E O1	1.7523	Adder	2.06
942051	AE2-217 C	10.7342	Adder	12.63
942052	AE2-217 E	7.1561	Adder	8.42
942061	AE2-218 C	10.5003	Adder	12.35
942062	AE2-218 E	7.1322	Adder	8.39
942091	AE2-221 C	28.7622	50/50	28.7622
942092	AE2-221 E	19.1748	50/50	19.1748
942521	AE2-267 C O1	2.6785	Adder	3.15
942522	AE2-267 E O1	1.6556	Adder	1.95
942621	AE2-278 C	7.0147	Adder	8.25
942622	AE2-278 E	4.6791	Adder	5.5
942951	AE2-315	3.4942	50/50	3.4942
942981	AE2-320 C O1	24.1121	50/50	24.1121
942982	AE2-320 E O1	11.9299	50/50	11.9299
943191	AE2-319 C	24.1121	50/50	24.1121
943192	AE2-319 E	11.9299	50/50	11.9299
943201	AE2-318 C	6.1530	Adder	7.24
943202	AE2-318 E	3.0032	Adder	3.53
943771	AF1-045 C	2.8659	Adder	3.37
943772	AF1-045 E	1.9136	Adder	2.25
943943	AF1-062 BAT	19.7540	Merchant Transmission	19.7540
944521	AF1-117 C	51.1940	50/50	51.1940
944522	AF1-117 E	15.7700	50/50	15.7700
944621	AF1-127 C O1	3.7633	Adder	4.43
944622	AF1-127 E O1	1.8535	Adder	2.18

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
944941	AF1-159	1.3364	Adder	1.57
945631	AF1-228 C	40.8186	50/50	40.8186
945632	AF1-228 E	27.2124	50/50	27.2124
945681	AF1-233 C	12.4106	Adder	14.6
945682	AF1-233 E	6.1311	Adder	7.21
945841	AF1-249 C	1.1932	Adder	1.4
945842	AF1-249 E	0.5046	Adder	0.59
945861	AF1-251 C	9.3384	Adder	10.99
945862	AF1-251 E	6.2256	Adder	7.32
945911	AF1-256 C	3.9731	Adder	4.67
945912	AF1-256 E	2.6487	Adder	3.12
946171	AF1-282 C	7.3562	Adder	8.65
946172	AF1-282 E	4.9042	Adder	5.77
946181	AF1-283 C	9.5631	Adder	11.25
946182	AF1-283 E	6.3754	Adder	7.5
957391	AF2-033 C	0.5688	Adder	0.67
957392	AF2-033 E	0.8531	Adder	1.0
957721	AF2-066 C	5.2767	Adder	6.21
957722	AF2-066 E	3.5178	Adder	4.14
957731	AF2-067 C	2.5969	Adder	3.06
957732	AF2-067 E	1.7313	Adder	2.04
957851	AF2-079 C	10.0719	Adder	11.85
957852	AF2-079 E	6.7146	Adder	7.9
958171	AF2-111 C O1	13.3926	Adder	15.76
958172	AF2-111 E O1	8.9284	Adder	10.5
958291	AF2-123 C	1.4556	Adder	1.71
958292	AF2-123 E	2.0068	Adder	2.36
959073	AF2-198 BAT	2.1780	Merchant Transmission	2.1780
959191	AF2-210 C	10.8406	Adder	12.75
959192	AF2-210 E	7.2270	Adder	8.5
960071	AF2-298 C	3.5469	Adder	4.17
960072	AF2-298 E	2.3725	Adder	2.79
960571	AF2-348 C	13.2141	Adder	15.55
960572	AF2-348 E	8.8094	Adder	10.36
962231	AG1-068 C O1	1.6946	Adder	3.76
962232	AG1-068 E O1	1.0779	Adder	2.39
962731	AG1-122 C	2.2023	Adder	4.89
962732	AG1-122 E	1.4769	Adder	3.28
962831	AG1-132	1.3171	Adder	2.92
962931	AG1-142 C	0.0831	Adder	0.18
962932	AG1-142 E	0.0653	Adder	0.14
963581	AG1-207 O1	5.5788	Adder	12.38
963781	AG1-231 C O1	2.3209	50/50	2.3209
963782	AG1-231 E O1	1.5473	50/50	1.5473
WEC	WEC	0.7374	Confirmed LTF	0.7374
LGEE	LGEE	3.5034	Confirmed LTF	3.5034
CPLE	CPLE	0.2471	Confirmed LTF	0.2471
CBM-W2	CBM-W2	26.0198	Confirmed LTF	26.0198
NY	NY	0.9362	Confirmed LTF	0.9362
TVA	TVA	3.4888	Confirmed LTF	3.4888
O-066	O-066	10.8757	Confirmed LTF	10.8757
SIGE	SIGE	0.6340	Confirmed LTF	0.6340

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
CBM-S2	CBM-S2	8.2580	Confirmed LTF	8.2580
CBM-S1	CBM-S1	1.1601	Confirmed LTF	1.1601
G-007	G-007	1.6915	Confirmed LTF	1.6915
MEC	MEC	4.0202	Confirmed LTF	4.0202
LAGN	LAGN	4.2227	Confirmed LTF	4.2227
CBM-W1	CBM-W1	25.9931	Confirmed LTF	25.9931

11.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AB1-014	Hillcrest 138kV	Under Construction
AB1-169	Stuart 345kV	Engineering and Procurement
AC1-068	Atlanta 69kV I	Engineering and Procurement
AC1-069	Atlanta 69kV II	Engineering and Procurement
AC1-074	Jacksonville-Renaker 138kV I	Engineering and Procurement
AC1-078	Beatty-London 138kV	Active
AC1-085	Stuart-Clinton 345kV	Suspended
AC1-165	Atlanta 69kV III	Engineering and Procurement
AC1-166	Atlanta 69kV IV	Engineering and Procurement
AC2-055	Buckskin 69kV	Active
AC2-060	Buckskin 69kV	Active
AC2-067	Camden-Crystal I 69kV	Engineering and Procurement
AC2-075	Great Blue Heron Solar	Active
AC2-088	S. Bethel-Brown 69kV	Engineering and Procurement
AD1-073	Buckskin 69 kV	Active
AD1-081	Beatty-London 138 kV	Active
AD1-136	South Bethel-Brown 69 kV	Engineering and Procurement
AD1-140	Greene-Clark 138 kV	Active
AD2-031	Martinsville-Wilmington 69 kV	Active
AE1-007	Camden-Crystal III 69 kV	Active
AE1-040	Greenfield 69 kV	Active
AE1-144	Goddard-Plumville 138 kV	Active
AE2-038	Goddard-Plumsville 138 kV II	Active
AE2-138	Avon-North Clark 345 kV	Active
AE2-148	Beatty-Greene 345 kV	Active
AE2-210	Avon-North Clark 345 kV	Active
AE2-217	East Springfield-London 138 kV	Active
AE2-218	Eldean 138 kV	Active
AE2-221	Clinton-Stuart 345 kV	Active
AE2-267	Woodsdale 345 kV	Active
AE2-278	Urbana 138 kV	Active
AE2-315	Yankee Tap 69 kV	Active
AE2-318	Ford-Cedarville 138 kV	Active
AE2-319	Atlanta 69kV I	Active
AE2-320	Atlanta 69 kV II	Active
AF1-045	Cedarville-Ford 138 kV	Active
AF1-062	Jug Street 138 kV	Active
AF1-117	Atlanta-Stuart 345 kV	Active
AF1-127	Avon 345 kV	Active

Queue Number	Project Name	Status
AF1-159	Martinsville-Wilmington 69 kV	Active
AF1-228	Beatty-Greene 345 kV	Active
AF1-233	Flemingsburg 138 kV	Active
AF1-249	Nickel 12.47 kV	Active
AF1-251	Avon-North Clark 345 kV	Active
AF1-256	Flemingsburg-Spurlock 138 kV	Active
AF1-282	Stuart-Clinton 345 kV	Active
AF1-283	Stuart-Clinton 345 kV	Active
AF2-033	Miami Fort GT 138 kV	Active
AF2-066	West Manchester-Crown 69kV	Active
AF2-067	West Manchester 69 kV	Active
AF2-079	Greenville 138 kV	Active
AF2-111	North Clark-Spurlock 345 kV	Active
AF2-123	National-Tangy 138 kV	Active
AF2-198	Heath 69 kV	Active
AF2-210	Foster-Garver Road 345 kV	Active
AF2-298	Crown-Brookville 69 kV	Active
AF2-348	North Clark-Spurlock 345 kV	Active
AG1-068	London-Tangy 69 kV	Active
AG1-122	London-National 138 kV	Active
AG1-132	Tait 69 kV	Active
AG1-142	Bethelboro 12.47 kV	Active
AG1-207	Northridge 138 kV	Active
AG1-231	Xenia 69 kV	Active
V4-073	Yankee 12.5kV	In Service
Y1-054	Rochelle 138kV	In Service

11.8 Contingency Descriptions - Primary POI

Contingency Name	Contingency Definition
AEP_P4_#3196_05BEATTY	CONTINGENCY '"AEP_P4_#3196_05BEATTY' 345_302E" / 1549 OPEN BRANCH FROM BUS 243453 TO BUS 244022 CKT 1 / 243453 05BEATTY 345 244022 05COLE 345 1 OPEN BRANCH FROM BUS 243453 TO BUS 243469 CKT 4 / 243453 05BEATTY 345 243469 05BEATTY 138 4 END
AEP_P1-2_#762_8072	CONTINGENCY 'AEP_P1-2_#762_8072' OPEN BRANCH FROM BUS 243453 TO BUS 245769 CKT 1 / 243453 05BEATTY 345 245769 05ADKINS 345 1 END
Base Case	
13815 13843	CONTINGENCY '13815 13843' OPEN BRANCH FROM BUS 253026 TO BUS 253062 CKT 1 / 253026 09GREENE 138 253062 09OVERL1 138 1 OPEN BRANCH FROM BUS 253049 TO BUS 253062 CKT 1 / 253026 09MONUM1 138 253062 09OVERL1 138 1 DISCONNECT BUS 253063 / 253063 09OVERL2 138 END

12 Short Circuit Analysis - Primary POI

The following Breakers are overdutied:

None.

13 Summer Peak - Load Flow Analysis - Secondary POI

The Queue Project AG1-207 was evaluated as a 85.0 MW (Capacity 85.0 MW) injection at the Vandalia 69 kV substation in the Dayton area. Project AG1-207 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-207 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

13.1 Generation Deliverability

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

None

13.2 Multiple Facility Contingency

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

None

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)

None

13.4 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	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
164392500	243233	05TANNER	345.0	AEP	249567	08M.FORT	345.0	DEO&K	1	DEOK_P1_TERMINAL-EAST BEND 4516	operation	2151.0	99.46	100.0	DC	11.88
164392434	941510	AE2-148 TAP	345.0	DAY	945630	AF1-228 TAP	345.0	DAY	1	AEP_P1-2_#762_8072	operation	1203.0	120.85	122.04	DC	14.32
164392390	945630	AF1-228 TAP	345.0	DAY	243453	05BEATTY	345.0	AEP	1	AEP_P1-2_#762_8072	operation	1203.0	129.23	130.43	DC	14.32
164392395	945630	AF1-228 TAP	345.0	DAY	243453	05BEATTY	345.0	AEP	1	Base Case	operation	1096.0	101.67	102.95	DC	13.97

13.5 Contingency Descriptions - Secondary POI

Contingency Name	Contingency Definition
DEOK_P1_TERMINAL-EAST BEND 4516	CONTINGENCY 'DEOK_P1_TERMINAL-EAST BEND 4516' / 1608 OPEN BRANCH FROM BUS 249565 TO BUS 249575 CKT 1 / 249565 08EBEND
AEP_P1-2_#762_8072	CONTINGENCY 'AEP_P1-2_#762_8072' / 1661 OPEN BRANCH FROM BUS 243453 TO BUS 245769 CKT 1 / 243453 05BEATTY 345 245769 05ADKINS 345 1 END
Base Case	

14 Affected Systems

14.1 MISO

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

14.2 LG&E

LG&E Impacts to be determined during later study phases (as applicable).