



**Generation Interconnection  
Feasibility Study Report  
for  
Queue Project AG1-249  
MECHANICSBURG-DARBY 138 KV  
48 MW Capacity / 80 MW Energy**

January 2021

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## 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 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.

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 Solar generating facility located in Union County, Ohio. The installed facilities will have a total capability of 80 MW with 48 MW of this output being recognized by PJM as Capacity.

The proposed in-service date for this project is October 31, 2023. This study does not imply a TO commitment to this in-service date.

<b>Queue Number</b>	<b>AG1-249</b>
<b>Project Name</b>	MECHANICSBURG-DARBY 138 KV
<b>State</b>	Ohio
<b>County</b>	Union
<b>Transmission Owner</b>	Dayton
<b>MFO</b>	80
<b>MWE</b>	80
<b>MWC</b>	48
<b>Fuel</b>	Solar
<b>Basecase Study Year</b>	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

The AG1-249 project will interconnect with The Dayton Power & Light transmission system between the Urbana 138kV and the Darby 138kV substation. The Point of Interconnection (POI) will tap in between the Darby 138kV and the tapped Mechanicsburg Sub. The new interconnection will be approximately 7.3 miles from Darby and 8.5 miles from Mechanicsburg. 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 connection of the (AG1-249) 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.

## 5 Cost Summary

The AG1-249 project will be responsible for the following costs:

Description	Total Cost
<b>Total Physical Interconnection Costs</b>	\$5,045,000
<b>Total System Network Upgrade Costs</b>	\$35,468,000
<b>Total Costs</b>	<b>\$40,513,000</b>

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 AG1-249 will interconnect with the Dayton Power and Light Company transmission system via a new 138kV three-breaker ring bus switchyard that will tap the Urbana to Darby 138kV line. 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
<b>Total Attachment Facility Costs</b>	<b>\$0</b>

### 6.2 Direct Connection Cost Estimate

The substation direct connection work for this project includes the construction of a 138kV three-breaker ring bus switchyard, tapped off between Mechanicsburg and Darby portion of the Urbana to Darby 138kV line. There will also be 138kV transmission line construction work required to accommodate the new switchyard. The 138kV IC generator lead line will be constructed by the developer and will be terminated onto the 138kV takeoff structure leaving the new three-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 AG1-249 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

<b>Description</b>	<b>Total Cost</b>
Install a new 138kV three-breaker ring bus switchyard to interconnect the AG1-249 project. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment, and associated facilities.	\$4,000,000
138 kV transmission line tie-In work to accommodate new AG1-249 Interconnection Switchyard	\$1,000,000
<b>Total Direct Connection Facility Costs</b>	<b>\$5,015,000</b>

### 6.3 Non-Direct Connection Cost Estimate

Remote relay setting changes will need to be made at the Urbana and Darby Substations to facilitate the interconnection of the new generation.

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.

<b>Description</b>	<b>Total Cost</b>
Urbana 138kV Substation - protection system settings changes	\$15,000
Darby 138kV Substation - protection system settings changes	\$15,000
<b>Total Non-Direct Connection Facility Costs</b>	<b>\$30,000</b>

## 7 Schedule

Based on the extent of the Dayton primary Attachment Facilities and Non-Direct Connection work required to support the AG1-249 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 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	326.53	326.53	250.00	130.61	130.39	The overloaded transformer is owned by Duke. Duke to propose reinforcement project(s).
253099 09ATLNTA 69.000 253100 09ATLNTA 345.00 1	BASE CASE	296.29	296.29	250.00	118.51	118.26	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 3WINDTR AC1-085 M WND 1 1	BASE CASE	223.09	223.09	150.00	148.72	148.63	IC equipment. PJM to confirm/update ratings.
253311 AC1- 085 MAIN345.00 3WINDTR AC1-085 MAIN WND 1 1	BASE CASE	223.09	223.09	150.00	148.72	148.63	IC equipment. PJM to confirm/update ratings.
253320 AC1- 085 COL234.500 3WINDTR AC1-085 M WND 2 1	BASE CASE	212.05	212.05	150.00	141.37	141.31	IC equipment. PJM to confirm/update ratings.
253321 AC1- 085 COL134.500 3WINDTR AC1-085 MAIN WND 2 1	BASE CASE	212.05	212.05	150.00	141.37	141.31	IC equipment. PJM to confirm/update ratings.
253322 AC1- 069 MAIN69.000 3WINDTR 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 3WINDTR 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 3WINDTR 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 3WINDTR 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.
253346 AC2-067 MAIN 69.000 3WINDTR 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.
<b>BRANCH</b>	<b>CONTINGENCY</b>	<b>MVAFLOW</b>	<b>AMPFLOW</b>	<b>RATE RATE1/ RATE2</b>	<b>% FLOW AFTER</b>	<b>% FLOW BEFORE</b>	<b>COMMENTS</b>
253347 AC2-067 COL 134.500 3WINDTR 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 COL 234.500 253349 AC2-067 C 0.3850 1	BASE CASE	-57.53	57.53	52.80	108.96	108.96	IC equipment. PJM to confirm/update ratings.
938700 AE1-092 TAP 138.00 964650 AG1-328 TAP 138.00 1	BASE CASE	224.97	222.74	218.00	102.18	101.56	AG1-328 is in ATSI territory. ATSI to propose reinforcement projects.
938701 AE1-092 GSU 138.00 3WINDTR AE1-092 GSU WND 1 1	BASE CASE	225.34	225.34	153.00	147.28	147.28	IC equipment. PJM to confirm/update ratings.
938702 AE1-092 COL 234.500 3WINDTR AE1-092 GSU WND 2 1	BASE CASE	228.16	228.16	153.00	149.13	149.10	IC equipment. PJM to confirm/update ratings.
964650 AG1-328 TAP 138.00 238861 02KIRBY 138.00 1	BASE CASE	223.76	222.69	218.00	102.15	101.53	AG1-328 is in ATSI territory. ATSI to propose reinforcement projects.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6602_HU TCHINGS_CRY STAL_69KV	-171.08	165.00	165.00	100.00	100.05	Existing 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_HU TCHINGS_CRO WN_69KV	-171.34	165.25	165.00	100.15	100.20	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_CO VINGTON MIN STER, ROSSBURG_69 KV	-174.33	168.12	165.00	101.89	101.95	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6644_CO VINGTON GRE ENVILLE_69K V	-203.90	196.68	165.00	119.20	119.26	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6656_GA RAGE RD WEST MANCHESTER 69KV	-177.49	171.19	165.00	103.75	103.79	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6661_TR EATY_ROSSBU RG_69KV	-209.37	201.93	165.00	122.38	122.36	Same comment as above.

253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY 6916 CR OWN BROOKVI LLE_69KV	-182.16	175.69	165.00	106.48	106.54	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY_6932_TR EATY_GREENV ILLE_69KV	-215.73	208.05	165.00	126.09	126.06	Same comment as above.
253089 09WMILTN 138.00 957850 AF2-079 TAP 138.00 1	DAY 6937 FO RT RECOVERY_RO SSBURG_69KV	-182.96	176.47	165.00	106.95	106.94	Same comment as above.
<b>BRANCH</b>	<b>CONTINGENCY</b>	<b>MVAFLOW</b>	<b>AMPFLOW</b>	<b>RATE RATE1/ RATE2</b>	<b>% FLOW AFTER</b>	<b>% FLOW BEFORE</b>	<b>COMMENTS</b>
253025 09GIVENS 138.00 253085 09URBANA 138.00 1	DAY_DARBY_1 38KV TO AG1-249 138KV	224.62	220.30	220.00	100.14		New overload caused by AG1-249. Reinforcement project # r190014 will replace the current wave trap with a 1200A wave trap making the new rating at 221/272. The projected cost of this reinforcement is approximately \$100,000. The cost responsibility lies with AG1-249.
253085 09URBANA 138.00 239278 02BRDVIE 138.00 1	DAY_DARBY_1 38KV TO AG1-249 138KV	282.88	277.56	272.00	102.04		New overload caused by AG1-249. Reinforcement project # r190015 will reconductor the transmission line from Urbana to Broadview with 1351 AAC. The new line rating after the project would be 272/314. The projected cost of this reinforcement is approximately \$3,750,000. The cost responsibility lies with AG1-249.
253021 09DARBY 138.00 963960 AG1-249 TAP 138.00 1	DAY_URBANA_ FB_D KV	-248.30	243.13	220.00	110.51		New overload caused by AG1-249. Reinforcement project # r190014 will replace the current wave trap with a 1200A wave trap making the new rating at 221/272. The projected cost of this reinforcement is approximately \$100,000. The cost responsibility lies with AG1-249.

## 8.1 Transmission Owner Analysis: Non-Converged Contingencies

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

	[09ATLNTA 69.000] CKT 1				
DAY_ATLANTA_FB_BB KV	<p>OPEN LINE FROM BUS 253100 [09ATLNTA 345.00] TO BUS 944520 [AF1-117 TAP 345.00] CKT 1</p> <p>OPEN LINE FROM BUS 253100 [09ATLNTA 345.00] TO BUS 245769 [05ADKINS 345.00] CKT 1</p> <p>OPEN LINE FROM BUS 253100 [09ATLNTA 345.00] TO BUS 253099 [09ATLNTA 69.000] CKT 1</p>	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>

### 9.3 Power Factor Requirements

The IC shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the high-side of the facility substation transformer(s) connected to the Dayton transmission system.

## 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

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

- Back Panel temperature (Fahrenheit) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Irradiance (Watts/meter<sup>2</sup>) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Ambient air temperature (Fahrenheit) - (Accepted, not required)
- Wind speed (meters/second) - (Accepted, not required)
- Wind direction (decimal degrees from true north) - (Accepted, not required)

### 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

The Queue Project AG1-249 was evaluated as a 80.0 MW (Capacity 48.0 MW) injection tapping the Mechanicsburg to Darby 138 kV line in the Dayton area. Project AG1-249 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-249 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)

None

### 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
161628021	926010	AC1-078 TAP	138.0	ATSI	243469	05BEATTY	138.0	AEP	1	ATSI-P2-2-OES-138-054	bus	242.0	143.53	147.46	DC	9.5

### 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
164438705	926010	AC1-078 TAP	138.0	ATSI	243469	05BEATTY	138.0	AEP	1	Base Case	operation	200.0	141.64	143.13	DC	6.61
164438706	926010	AC1-078 TAP	138.0	ATSI	243469	05BEATTY	138.0	AEP	1	ATSI-P1-2-OES-138-022A-A	operation	242.0	134.05	135.51	DC	7.84

### 11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
161628021	1	AC1-078 TAP 138.0 kV - 05BEATTY 138.0 kV Ckt 1	<p><u>AEP</u> AEPO0002a (416) : AEP Only: Upgrade relaying at Beatty Project Type : FAC Cost : \$200,000 Time Estimate : 12-18 Months</p> <p><u>AEP</u> AEPO0002b (417) : Upgrade/Replace 138 kV 1200A wave trap at Beatty station Project Type : FAC Cost : \$100,000 Time Estimate : 12-18 Months</p> <p><u>ATSI</u> OES-007A (930) : Reconductor approx. 14 miles of Beatty-London 138 kV, from AC1-078 to Beatty Project Type : FAC Cost : \$35,168,000 Time Estimate : 66.0 Months</p>	\$35,468,000
			TOTAL COST	\$35,468,000

## 11.6 Flow Gate Details

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".

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## 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
161628021	926010	AC1-078 TAP	ATSI	243469	05BEATTY	AEP	1	ATSI-P2-2-OES-138-054	bus	242.0	143.53	147.46	DC	9.5

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
926014	AC1-078 C	52.5908	50/50	52.5908
926016	AC1-078 E	87.6513	50/50	87.6513
934561	AD1-081 C	10.5182	50/50	10.5182
934562	AD1-081 E	5.4184	50/50	5.4184
935044	AD1-140 C	14.6172	50/50	14.6172
935045	AD1-140 E	12.0843	50/50	12.0843
937240	AD2-163_C1	18.4321	50/50	18.4321
937241	AD2-163_C2	18.4321	50/50	18.4321
937248	AD2-163_E1	9.0557	50/50	9.0557
937249	AD2-163_E2	9.0557	50/50	9.0557
942051	AE2-217 C	57.4398	50/50	57.4398
942052	AE2-217 E	38.2932	50/50	38.2932
942621	AE2-278 C	19.4595	50/50	19.4595
942622	AE2-278 E	12.9802	50/50	12.9802
942861	AE2-305 C	8.8653	50/50	8.8653
942862	AE2-305 E	5.9102	50/50	5.9102
943131	AE2-342 C	2.7524	50/50	2.7524
943132	AE2-342 E	1.3556	50/50	1.3556
943851	AF1-053 C	3.0309	50/50	3.0309
943852	AF1-053 E	4.5463	50/50	4.5463
943861	AF1-054 C	4.3758	50/50	4.3758
943862	AF1-054 E	2.9172	50/50	2.9172
958291	AF2-123 C	13.1333	50/50	13.1333
958292	AF2-123 E	18.1061	50/50	18.1061
962231	AG1-068 C O1	19.4450	50/50	19.4450
962232	AG1-068 E O1	12.3683	50/50	12.3683
962731	AG1-122 C	26.7129	50/50	26.7129
962732	AG1-122 E	17.9149	50/50	17.9149
963961	AG1-249 C	5.7005	50/50	5.7005
963962	AG1-249 E	3.8003	50/50	3.8003
WEC	WEC	0.0813	Confirmed LTF	0.0813
LGEE	LGEE	0.3192	Confirmed LTF	0.3192
CPL	CPL	0.0027	Confirmed LTF	0.0027
CBM-W2	CBM-W2	2.4909	Confirmed LTF	2.4909
NY	NY	0.0857	Confirmed LTF	0.0857
TVA	TVA	0.2996	Confirmed LTF	0.2996
O-066	O-066	1.0230	Confirmed LTF	1.0230
SIGE	SIGE	0.0611	Confirmed LTF	0.0611
CBM-S2	CBM-S2	0.4489	Confirmed LTF	0.4489
CBM-S1	CBM-S1	0.1015	Confirmed LTF	0.1015
G-007	G-007	0.1596	Confirmed LTF	0.1596

<b>Bus #</b>	<b>Bus</b>	<b>Gendeliv MW Impact</b>	<b>Type</b>	<b>Full MW Impact</b>
<b>MEC</b>	MEC	0.4179	Confirmed LTF	0.4179
<b>LAGN</b>	LAGN	0.3797	Confirmed LTF	0.3797
<b>CBM-W1</b>	CBM-W1	3.2106	Confirmed LTF	3.2106

## 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
AC1-078	Beatty-London 138kV	Active
AD1-081	Beatty-London 138 kV	Active
AD1-140	Greene-Clark 138 kV	Active
AD2-163	Broadview-Tangy 138 kV	Active
AE2-217	East Springfield-London 138 kV	Active
AE2-278	Urbana 138 kV	Active
AE2-305	Givens-Mechanicsburg 138 kV	Active
AE2-342	Woodstock 69 kV	Active
AF1-053	Givens-Mechanicsburg 138 kV	Active
AF1-054	Givens-Mechanicsburg 138 kV	Active
AF2-123	National-Tangy 138 kV	Active
AG1-068	London-Tangy 69 kV	Active
AG1-122	London-National 138 kV	Active
AG1-249	Mechanicsburg-Darby 138 kV	Active

## 11.8 Contingency Descriptions

Contingency Name	Contingency Definition
Base Case	
ATSI-P1-2-OES-138-022A-A	CONTINGENCY 'ATSI-P1-2-OES-138-022A-A' /* LONDON - TANGY 138KV LINE FAULT DISCONNECT BRANCH FROM BUS 958290 TO BUS 239134 CKT 1 /* AF2-123 TAP 138 02TANGY 138 END
ATSI-P2-2-OES-138-054	CONTINGENCY 'ATSI-P2-2-OES-138-054' /* TANGY 138 BUS FAULT DISCONNECT BRANCH FROM BUS 239134 TO BUS 239264 CKT 1 /* 02TANGY 138 02DBP 138 DISCONNECT BRANCH FROM BUS 239134 TO BUS 239218 CKT 1 /* 02TANGY 138 02SSCIOT 138 DISCONNECT BRANCH FROM BUS 239134 TO BUS 238574 CKT 1 /* 02TANGY 138 02BELPT+ 138 DISCONNECT BRANCH FROM BUS 239134 TO BUS 958290 CKT 1 /* 02TANGY 138 AF2- 123 TAP 138 DISCONNECT BRANCH FROM BUS 239133 TO BUS 239134 CKT 3 /* 02TANGY 345 02TANGY 138 DISCONNECT BRANCH FROM BUS 239133 TO BUS 239134 CKT 4 /* 02TANGY 345 02TANGY 138 DISCONNECT BRANCH FROM BUS 239133 TO BUS 239134 CKT 5 /* 02TANGY 345 02TANGY 138 DISCONNECT BRANCH FROM BUS 239134 TO BUS 239135 CKT 1 /* 02TANGY 138 02TANGY 69 DISCONNECT BRANCH FROM BUS 239134 TO BUS 239135 CKT 2 /* 02TANGY 138 02TANGY 69 END

## 12 Short Circuit Analysis

The following Breakers are overdutied:

None.

## **13 Affected Systems**

### **13.1 MISO**

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

### **13.2 LG&E**

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