Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AE1-169

Titusville 115 kV

May 2019

Preface

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

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

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

General

The Interconnection Customer (IC), has proposed a solar generating facility located in Venango County, PA. The installed facilities will have a total capability of 85 MW with 55 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is July 1, 2021. **This study does not imply a Mid-Atlantic Interstate Transmission (Penelec) commitment to this in-service date.**

Point of Interconnection

AE1-169 will interconnect with the MAIT Transmission system along one of the following points of interconnection:

- Titusville - Grand View 115kV Line
- Titusville - Union City 115kV Line

Cost Summary

The AE1-169 project will be responsible for the following costs:

Description	Total Cost	
Attachment Facilities	$	10,000
Direct Connection Network Upgrades	$	5,738,500
Non Direct Connection Network Upgrades	$	3,460,900
Total Costs	**$**	**9,209,400**

The transmission and substation costs given above exclude the Contribution in Aid of Construction ("CIAC") Federal Income Tax Gross up charge. If at a future date Federal CIAC taxes are deemed necessary by the IRS for this project, ATSI shall be reimbursed by the Interconnection Customer for such taxes. ATSI estimates the tax, if applicable, would be approximately $1,877,100.

In addition, the AE1-169 project may be responsible for a contribution to the following costs:

Description	Total Cost
System Upgrades	$ 143,584,100

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

General Information

Queue Position: AE1-169

Interconnected Transmission Owner ("TO"): Mid-Atlantic Interstate Transmission, LLC ("MAIT")

Impacted TO(s) (if applicable): Mid-Atlantic Interstate Transmission, LLC ("MAIT")

PJM Zone: Pennsylvania Electric Company

FE Operating Company or Planning Region: Pennsylvania Electric Company

Customer Connection Request

Requested Backfeed Date: 5/1/2021

Requested Commercial Operation Date: 7/1/2021

This study does not imply a FirstEnergy commitment to these dates.

New Facilities		Existing Facilities	
Capacity:	55.2 MW	Capacity:	0 MW
Energy:	85 MW	Energy:	0 MW
MFO[1]:	85 MW	MFO:	0 MW
Fuel:	Solar	Prior Queue Position(s):	n/a

[1] Maximum Facility Output

Point of Interconnection

Primary Point of Interconnection: Grandview - Titusville 115 kV Line

Secondary Point of Interconnection: Titusville – Union City 115 kV Line

Attachment Facilities

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	Activity Cost
Install attachment facility line and associated hardware to accept the Interconnection Customer generator lead line	$ 10,000
Total Attachment Facility Costs	**$ 10,000**

Direct Connection Cost Estimate

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

Description	Total Cost
New 3 breaker 115kV ring bus	$ 5,738,500
Total Direct Connection Facility Costs	**$ 5,738,500**

Non-Direct Connection Cost Estimate

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

Description	Total Cost
Loop the Grandview-Titusville 115kV line into the new substation at a point approximately 3.9 miles from Titusville substation.	$ 2,452,900
Titusville 115kV Substation - Replace line relaying and install anti-islanding equipment	$ 252,000
Grandview 115kV Substation - Replace line relaying and install anti-islanding equipment	$ 252,000
Union City 115kV Substation - Replace line relaying and install anti-islanding equipment	$ 252,000
Erie South 115kV Substation - Replace line relaying and install anti-islanding equipment	$ 252,000
Total Non-Direct Connection Facility Costs	**$ 3,460,900**

Transmission Owner Scope of Work

Primary POI

The interconnection of the project at the Primary POI will be accomplished by constructing a new 115 kV three (3) breaker ring bus and looping the Grandview - Titusville 115 kV line into the new station. The new substation will be located approximately 3.9 miles from Titusville substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection switching station and the associated attachment facilities. The IC will also be responsible for the rough grade of the property and an access road to the proposed three breaker ring bus site. The project will also require non-direct connection upgrades at Erie South, Grandview, Titusville, and Union City substations.

A summary of the connection facilities that will be required for the Primary POI and their estimated costs are shown in the cost table above. Based on this scope of work, it is expected to take a minimum of 20 months after the signing of an Interconnection Construction Service Agreement. This include preliminary payment that compensates FE for the first three months of the engineering design work that is related to the construction of the AE1-169 interconnection substation. This assumes 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 direct connection and network upgrades, and that PJM will allow all transmission system outages when requested.

Secondary POI

The interconnection of the project at the Secondary POI will be accomplished by constructing a new 115 kV three (3) breaker ring bus and looping the Titusville – Union City 115 kV line into the new station. The new substation will be located approximately 3.9 miles from Titusville substation. A full scope of work or estimated cost is not provided for the Secondary POI.

Interconnection Customer Requirements

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

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

4. The purchase and installation of a fully rated 115 kV circuit breaker to protect the AE1-169 generator lead line. A single circuit breaker must be used to protect this line; if the project has several GSU transformers, the individual GSU transformer breakers cannot be used to protect this line.

5. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.

6. The purchase and installation of supervisory control and data acquisition ("SCADA") equipment to provide information in a compatible format to the FE Transmission System Control Center.

7. Compliance with the FE and PJM generator power factor and voltage control requirements.

8. The execution of a back-up service agreement to serve the customer load supplied from the AE1-169 generation project metering point when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

9. **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 FE transmission system.

The IC will also be required to meet all PJM, ReliabilityFirst, and NERC reliability criteria and operating procedures for standards compliance. For example, the IC will need to properly locate and report the over and under voltage and over and under frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and ReliabilityFirst audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the FE system.

Revenue Metering and SCADA Requirements

PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

Metering

The IC will be require to comply with all FE revenue metering requirements for generation interconnection customers which can be found in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx.

FE Requirements

The Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "FirstEnergy Requirements for Transmission Connected Facilities" document located at the following links:

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

System Protection

The IC must design it's Customer Facilities in accordance with all applicable standards, including the standards in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.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.

The IC has requested a non-standard GSU transformer winding configuration. This transformer is in violation of section 14.2.6 of FE's "Requirements for Transmission Connected Facilities" document and will not be accepted. The GSU transformer must have a grounded wye connection on the high (utility) side and a delta connection on the low (generator) side.

Network Impacts

Option 1

The Queue Project AE1-169 was evaluated as a 85 MW (Capacity 55.2 MW) injection tapping the Titusville to Grandview 115 kV line in the PENELEC area. Project AE1-169 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-169 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2022

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Contingency Definition
PJM_P1_APS_B_G692	CONTINGENCY 'PJM_P1_APS_B_G692' / 200011 KEYSTONE 500 235104 01CABOT 500 1 OPEN BRANCH FROM BUS 200011 TO BUS 235104 CKT 1 END
ATSI-P2-3-OEE-138-139T	CONTINGENCY 'ATSI-P2-3-OEE-138-139T' /* CRANBERRY 500KV BRKR FAILURE-B6 DISCONNECT BRANCH FROM BUS 239280 TO BUS 239281 CKT 2 /* 02CRNBRY 500 02CRNBRY 138 DISCONNECT BRANCH FROM BUS 239280 TO BUS 235104 CKT 1 /* 02CRNBRY 500 01CABOT 500 END
PN-P2-3-PN-345-001AT	CONTINGENCY 'PN-P2-3-PN-345-001AT' /* HOMER CITY 345KV BKR 301 DISCONNECT BRANCH FROM BUS 200769 TO BUS 235129 CKT 1 /* 26HOMER CY 345 01ARMSTRONG 345 END
PN-P2-3-PN-500-001F	CONTINGENCY 'PN-P2-3-PN-500-001F' /* KEYSTONE 500KV BKR 6 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200005 CKT 1 /* KEYSTONE 500 CONEM-GH 500 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 TO BUS 200907 CKT 4/* KEYSTONE 500 26KEYSTONE 230 26KEYSTN#4 20.00 REDUCE BUS 200011 SHUNT BY 100 PERCENT /* KEYSTONE 500 END
ATSI-P2-3-CEI-138-124	CONTINGENCY 'ATSI-P2-3-CEI-138-124' /* AT BUS 138KV_ BRKR FAILURE - Q-8-AT-T_ Q-3-AT-C_ (OR BUS FAULT - SECT. 3) DISCONNECT BRANCH FROM BUS 238544 TO BUS 239082 CKT 8 /* 02ASH_3 138 02S8-ATT 345 DISCONNECT BRANCH FROM BUS 238544 TO BUS 238543 CKT ZB /* 02ASH_3 138 02ASH_2 138 DISCONNECT BRANCH FROM BUS 238544 TO BUS 239098 CKT 1 /* 02ASH_3 138 02SBRNQ4 138 DISCONNECT BRANCH FROM BUS 238544 TO BUS 239182 CKT 1 /* 02ASH_3 138 02ZNQ-16 138 DISCONNECT BUS 238544 /* 02ASH_3 138 DISCONNECT BUS 238692 /* 02ELKEM 138 END
ATSI-P2-4-CEI-138-125	CONTINGENCY 'ATSI-P2-4-CEI-138-125' /* AT BUS 138KV_ BRKR FAILURE - Q-2-3-AT-TIE DISCONNECT BRANCH FROM BUS 238544 TO BUS 239082 CKT 8 /* 02ASH_3 138 02S8-ATT 345 DISCONNECT BRANCH FROM BUS 238544 TO BUS 238543 CKT ZB /* 02ASH_3 138 02ASH_2 138 DISCONNECT BRANCH FROM BUS 238544 TO BUS 239098 CKT 1 /* 02ASH_3 138 02SBRNQ4 138 DISCONNECT BRANCH FROM BUS 238544 TO BUS 239182 CKT 1 /* 02ASH_3 138 02ZNQ-16 138 DISCONNECT BRANCH FROM BUS 238543 TO BUS 238542 CKT ZB /* 02ASH_2 138 02ASH_1 138 DISCONNECT BRANCH FROM BUS 238543 TO BUS 239096 CKT 1 /* 02ASH_2 138 02SBRNQ2 138 DISCONNECT BRANCH FROM BUS 238543 TO BUS 239097 CKT 1 /* 02ASH_2 138 02SBRNQ3 138

	DISCONNECT BRANCH FROM BUS 238543 TO BUS 238545 CKT 1 /* 02ASH_2 138 02ASHTG5 18 DISCONNECT BUS 238543 /* 02ASH_2 138 DISCONNECT BUS 238545 /* 02ASHTG5 18 DISCONNECT BUS 238544 /* 02ASH_3 138 DISCONNECT BUS 238692 /* 02ELKEM 138 END
ATSI-P7-1-CEI-345-012	CONTINGENCY 'ATSI-P7-1-CEI-345-012' /* PERRY-EASTLAKE AND PERRY-NORTHFIELD 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 238684 TO BUS 239036 CKT 1 /* 02EASTLK 345 02PERRY 345 DISCONNECT BRANCH FROM BUS 239358 TO BUS 239036 CKT 1 /* 02NFIELD 345 02PERRY 345 END
ATSI-P7-1-CEI-345-016	CONTINGENCY 'ATSI-P7-1-CEI-345-016' /* PERRY-NORTHFEILD AND PERRY-LC 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 239036 TO BUS 239358 CKT 1 /* 02PERRY 345 02NFIELD 345 DISCONNECT BRANCH FROM BUS 239036 TO BUS 239334 CKT 1 /* 02PERRY 345 02L.CENTER 345 END
PN-P2-3-PN-500-001J	CONTINGENCY 'PN-P2-3-PN-500-001J' /* KEYSTONE 500KV BKR 16 DISCONNECT BRANCH FROM BUS 200011 TO BUS 235104 CKT 1 /* KEYSTONE 500 01CABOT 500 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 TO BUS 200907 CKT 4/* KEYSTONE 500 26KEYSTONE 230 26KEYSTN#4 20.00 REDUCE BUS 200011 SHUNT BY 100 PERCENT /* KEYSTONE 500 END
PN-P2-3-PN-500-002A	CONTINGENCY 'PN-P2-3-PN-500-002A' /* CONEMAUGH 500KV BKR 1 DISCONNECT BRANCH FROM BUS 200005 TO BUS 200912 CKT 3 /* CONEM-GH 500 26CONEMAGH 230 DISCONNECT BUS 200031 /* CONE G2 22 END
Base Case	
PN-P2-3-PN-345-004J	CONTINGENCY 'PN-P2-3-PN-345-004J' /* ERIE WEST STUCK BKR B 79 DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1 /* 26ERIE W 345 26WAYNE 345 END
ATSI-P2-3-OEE-138-138T	CONTINGENCY 'ATSI-P2-3-OEE-138-138T' /* CRANBERRY 500KV BRKR FAILURE-B5 DISCONNECT BRANCH FROM BUS 239280 TO BUS 239281 CKT 1 /* 02CRNBRY 500 02CRNBRY 138 DISCONNECT BRANCH FROM BUS 239280 TO BUS 235104 CKT 1 /* 02CRNBRY 500 01CABOT 500 END
AP-P2-3-WP-500-463T	CONTINGENCY 'AP-P2-3-WP-500-463T' /* 470 DISCONNECT BRANCH FROM BUS 235104 TO BUS 239280 CKT 1 /* 01CABOT 500 02CRNBRY 500 DISCONNECT BRANCH FROM BUS 235104 TO BUS 235153 CKT 2 /* 01CABOT 500 01CABOT 138 DISCONNECT BRANCH FROM BUS 235104 TO BUS 235153 CKT 4 /* 01CABOT 500 01CABOT 138 END

Generator Deliverability

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

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
169156	238547	02AT	ATSI	239036	02PERRY	ATSI	1	Base Case	single	1534.0	99.65	100.56	DC	14.99

Note: Please see Attachment 3 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

Multiple Facility Contingency

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

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
775035	200585	26TITUSVIL	PENELEC	200571	26UNION CY	PENELEC	1	PN-P2-3-PN-345-004J	breaker	120.0	85.08	107.38	DC	26.77
774882	200767	26HOMER CT	PENELEC	200795	26SHELOCTA	PENELEC	1	PN-P2-3-PN-500-002A	breaker	917.0	99.5	100.1	DC	12.23
775158	200795	26SHELOCTA	PENELEC	200810	26KEYSTONE	PENELEC	1	PN-P2-3-PN-345-001AT	breaker	917.0	99.69	100.06	DC	7.55
775150	200810	26KEYSTONE	PENELEC	999429	STAR568	PENELEC	3	PN-P2-3-PN-500-001F	breaker	612.0	100.46	101.08	DC	8.28
168466	238547	02AT	ATSI	239036	02PERRY	ATSI	1	ATSI-P2-4-CEI-138-125	breaker	1891.0	100.35	101.02	DC	28.06
168467	238547	02AT	ATSI	239036	02PERRY	ATSI	1	ATSI-P2-3-CEI-138-124	breaker	1891.0	100.35	101.02	DC	28.06

Note: Please see Attachment 3 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

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
168391	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	ATSI-P2-3-OEE-138-138T	breaker	1900.0	112.94	113.63	DC	29.23
168392	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	ATSI-P2-3-OEE-138-139T	breaker	1900.0	112.94	113.63	DC	29.23
168393	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	AP-P2-3-WP-500-463T	breaker	1900.0	112.93	113.63	DC	29.23

168394	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	PN-P2-3-PN-500-001J	breaker	1900.0	112.17	112.85	DC	28.76
168938	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	single	1560.0	121.01	122.03	DC	17.23
774952	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	ATSI-P2-3-OEE-138-138T	breaker	1900.0	112.94	113.63	DC	29.23
774953	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	ATSI-P2-3-OEE-138-139T	breaker	1900.0	112.94	113.63	DC	29.23
774954	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	AP-P2-3-WP-500-463T	breaker	1900.0	112.93	113.63	DC	29.23
774955	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	PN-P2-3-PN-500-001J	breaker	1900.0	112.17	112.85	DC	28.76
775601	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	single	1560.0	121.01	122.03	DC	17.23
169410	239036	02PERRY	ATSI	239334	02L.CENTER	ATSI	1	ATSI-P7-1-CEI-345-012	tower	1667.0	131.88	132.45	DC	21.06
169455	239036	02PERRY	ATSI	238684	02EASTLK	ATSI	1	ATSI-P7-1-CEI-345-016	tower	1667.0	124.67	125.22	DC	20.4
169456	239082	02S8-ATT	ATSI	238544	02ASH_3	ATSI	8	ATSI-P7-1-CEI-345-016	tower	423.0	123.67	124.28	DC	5.73

Note: Please see Attachment 3 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

Short Circuit

(Summary of impacted circuit breakers)

None.

Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
168937	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	operation	1560.0	126.46	127.29	DC	28.72
168939	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	PJM_P1_APS_B_G692	operation	1900.0	111.89	112.57	DC	28.44
775600	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	operation	1560.0	126.46	127.29	DC	28.72
775602	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	PJM_P1_APS_B_G692	operation	1900.0	111.89	112.57	DC	28.44
775974	200767	26HOMER CT	PENELEC	200795	26SHELOCTA	PENELEC	1	Base Case	operation	731.0	103.03	103.59	DC	9.01
169155	238547	02AT	ATSI	239036	02PERRY	ATSI	1	Base Case	operation	1534.0	104.49	105.22	DC	24.98

System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

ID	Index	Facility	Upgrade Description	Cost
168466,168467, 169156	1	02AT 345.0 kV - 02PERRY 345.0 kV Ckt 1	**ATSI** Description : Reconductor 23 miles of Perry-Ashtabula-Erie West 345kV line and replace terminal equipment at Perry to bring line rating up to 2078 MVA. Time Estimate : 26 Months Cost : $53,356,800	$53,356,800
775035	2	26TITUSVIL 115.0 kV - 26UNION CY 115.0 kV Ckt 1	**PENELEC** Description : Upgrade terminal equipment at Union City. Time Estimate : 6.0 Months Cost : $23,900	$23,900
774882	3	26HOMER CT 230.0 kV - 26SHELOCTA 230.0 kV Ckt 1	**PENELEC** Description : No Violation. The emergency rating of this line is 923 MVA and therefore is not overloaded.	$0
775158	4	26SHELOCTA 230.0 kV - 26KEYSTONE 230.0 kV Ckt 1	**PENELEC** Description : No Violation. The emergency rating of this facility if 923 MVA and therefore is not overloaded.	$0
775150	5	26KEYSTONE 230.0 kV - STAR568 1.0 kV Ckt 3	**PENELEC** Description : Supplemental upgrade s1736: Replace the existing Keystone 351 MVA 500/230 kV transformer and Install a 500 kV high side breaker. The supplemental project has an projected in-service date of 12/31/2019.	$0
168391,168392, 168393,168394, 168938,774952, 774953,774954, 774955, 775601	6	26ERIE W 345.0 kV - 02AT 345.0 kV Ckt 1	**PENELEC** Description : Reconductor line and upgrade terminal equipment at Erie West. Time Estimate : 18.0 Months Cost : $28,072,200	$28,072,200
169410	7	02PERRY 345.0 kV - 02L.CENTER 345.0 kV Ckt 1	**ATSI** Description : Reconductor Perry-Leroy Center 345kV line with bundled 795 ACSS conductor. Upgrade terminal ends at Perry and Leroy Center to bring line ratings to 2255 MVA STE. Time Estimate : Months Cost : $13,502,600	$13,502,600
169455	8	02PERRY 345.0 kV - 02EASTLK 345.0 kV Ckt 1	**ATSI** Description : Reconductor Perry-Eastlake 345kV line with bundled 795 ACSS conductor. Time Estimate : 26 Months Cost : $48,628,600	$48,628,600
169456	9	02S8-ATT 345.0 kV - 02ASH_3 345.0 kV Ckt 1	**ATSI** Description : No Violation - Actual rating is 701 MVA	$0
			TOTAL COST	**$143,584,100**

Network Impacts

Option 2

The Queue Project AE1-169 was evaluated as a 85 MW (Capacity 55.2 MW) injection tapping the Titusville to Union City 115 kV line in the PENELEC area. Project AE1-169 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-169 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2022

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Contingency Definition
PJM_P1_APS_B_G692	CONTINGENCY 'PJM_P1_APS_B_G692' / 200011 KEYSTONE 500 235104 01CABOT 500 1 OPEN BRANCH FROM BUS 200011 TO BUS 235104 CKT 1 END
AP-P2-3-WP-500-463T	CONTINGENCY 'AP-P2-3-WP-500-463T' /* 470 DISCONNECT BRANCH FROM BUS 235104 TO BUS 239280 CKT 1 /* 01CABOT 500 02CRNBRY 500 DISCONNECT BRANCH FROM BUS 235104 TO BUS 235153 CKT 2 /* 01CABOT 500 01CABOT 138 DISCONNECT BRANCH FROM BUS 235104 TO BUS 235153 CKT 4 /* 01CABOT 500 01CABOT 138 END
PN-P2-3-PN-500-001F	CONTINGENCY 'PN-P2-3-PN-500-001F' /* KEYSTONE 500KV BKR 6 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200005 CKT 1 /* KEYSTONE 500 CONEM-GH 500 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 TO BUS 200907 CKT 4/* KEYSTONE 500 26KEYSTONE 230 26KEYSTN#4 20.00 REDUCE BUS 200011 SHUNT BY 100 PERCENT /* KEYSTONE 500 END
ATSI-P2-3-CEI-138-124	CONTINGENCY 'ATSI-P2-3-CEI-138-124' /* AT BUS 138KV_ BRKR FAILURE - Q-8-AT-T_ Q-3-AT-C_ (OR BUS FAULT - SECT. 3) DISCONNECT BRANCH FROM BUS 238544 TO BUS 239082 CKT 8 /* 02ASH_3 138 02S8-ATT 345 DISCONNECT BRANCH FROM BUS 238544 TO BUS 238543 CKT ZB /* 02ASH_3 138 02ASH_2 138 DISCONNECT BRANCH FROM BUS 238544 TO BUS 239098 CKT 1 /* 02ASH_3 138 02SBRNQ4 138 DISCONNECT BRANCH FROM BUS 238544 TO BUS 239182 CKT 1 /* 02ASH_3 138 02ZNQ-16 138 DISCONNECT BUS 238544 /* 02ASH_3 138 DISCONNECT BUS 238692 /* 02ELKEM 138 END
ATSI-P2-4-CEI-138-125	CONTINGENCY 'ATSI-P2-4-CEI-138-125' /* AT BUS 138KV_ BRKR FAILURE - Q-2-3-AT-TIE DISCONNECT BRANCH FROM BUS 238544 TO BUS 239082 CKT 8 /* 02ASH_3 138 02S8-ATT 345 DISCONNECT BRANCH FROM BUS 238544 TO BUS 238543 CKT ZB /* 02ASH_3 138 02ASH_2 138 DISCONNECT BRANCH FROM BUS 238544 TO BUS 239098 CKT 1 /* 02ASH_3 138 02SBRNQ4 138 DISCONNECT BRANCH FROM BUS 238544 TO BUS 239182 CKT 1 /* 02ASH_3 138 02ZNQ-16 138 DISCONNECT BRANCH FROM BUS 238543 TO BUS 238542 CKT ZB /* 02ASH_2 138 02ASH_1 138 DISCONNECT BRANCH FROM BUS 238543 TO BUS 239096 CKT 1 /* 02ASH_2 138 02SBRNQ2 138 DISCONNECT BRANCH FROM BUS 238543 TO BUS 239097 CKT 1 /* 02ASH_2 138 02SBRNQ3 138 DISCONNECT BRANCH FROM BUS 238543 TO BUS 238545 CKT 1 /* 02ASH_2 138 02ASHTG5 18 DISCONNECT BUS 238543 /* 02ASH_2 138 DISCONNECT BUS 238545 /* 02ASHTG5 18 DISCONNECT BUS 238544 /* 02ASH_3 138 DISCONNECT BUS 238692 /* 02ELKEM 138 END

Contingency Name	Contingency Definition
ATSI-P7-1-CEI-345-012	CONTINGENCY 'ATSI-P7-1-CEI-345-012' /* PERRY-EASTLAKE AND PERRY-NORTHFIELD 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 238684 TO BUS 239036 CKT 1 /* 02EASTLK 345 02PERRY 345 DISCONNECT BRANCH FROM BUS 239358 TO BUS 239036 CKT 1 /* 02NFIELD 345 02PERRY 345 END
ATSI-P7-1-CEI-345-016	CONTINGENCY 'ATSI-P7-1-CEI-345-016' /* PERRY-NORTHFEILD AND PERRY-LC 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 239036 TO BUS 239358 CKT 1 /* 02PERRY 345 02NFIELD 345 DISCONNECT BRANCH FROM BUS 239036 TO BUS 239334 CKT 1 /* 02PERRY 345 02L.CENTER 345 END
ATSI-P2-3-OEE-138-139T	CONTINGENCY 'ATSI-P2-3-OEE-138-139T' /* CRANBERRY 500KV BRKR FAILURE-B6 DISCONNECT BRANCH FROM BUS 239280 TO BUS 239281 CKT 2 /* 02CRNBRY 500 02CRNBRY 138 DISCONNECT BRANCH FROM BUS 239280 TO BUS 235104 CKT 1 /* 02CRNBRY 500 01CABOT 500 END
Base Case	
PN-P2-3-PN-345-004J	CONTINGENCY 'PN-P2-3-PN-345-004J' /* ERIE WEST STUCK BKR B 79 DISCONNECT BRANCH FROM BUS 200599 TO BUS 200595 CKT 1 /* 26ERIE W 345 26WAYNE 345 END
ATSI-P2-3-OEE-138-138T	CONTINGENCY 'ATSI-P2-3-OEE-138-138T' /* CRANBERRY 500KV BRKR FAILURE-B5 DISCONNECT BRANCH FROM BUS 239280 TO BUS 239281 CKT 1 /* 02CRNBRY 500 02CRNBRY 138 DISCONNECT BRANCH FROM BUS 239280 TO BUS 235104 CKT 1 /* 02CRNBRY 500 01CABOT 500 END

Generator Deliverability

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

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
140069	238547	02AT	ATSI	239036	02PERRY	ATSI	1	Base Case	single	1534.0	99.66	100.63	DC	15.96

Note: Please see Attachment 3 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

Multiple Facility Contingency

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

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
757413	200810	26KEYSTONE	PENELEC	999428	STAR569	PENELEC	3	PN-P2-3-PN-500-001F	breaker	612.0	100.12	100.72	DC	8.04
139473	238547	02AT	ATSI	239036	02PERRY	ATSI	1	ATSI-P2-4-CEI-138-125	breaker	1891.0	100.36	101.94	DC	29.87
139474	238547	02AT	ATSI	239036	02PERRY	ATSI	1	ATSI-P2-3-CEI-	breaker	1891.0	100.36	101.94	DC	29.87

								138-124						
757215	939380	AE1-169 TAP	PENELEC	200571	26UNION CY	PENELEC	1	PN-P2-3-PN-345-004J	breaker	120.0	84.99	114.15	DC	34.98

Note: Please see Attachment 3 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

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
139372	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	ATSI-P2-3-OEE-138-138T	breaker	1900.0	112.94	114.58	DC	31.03
139373	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	ATSI-P2-3-OEE-138-139T	breaker	1900.0	112.94	114.58	DC	31.03
139374	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	AP-P2-3-WP-500-463T	breaker	1900.0	112.94	114.57	DC	31.03
139835	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	single	1560.0	121.02	122.11	DC	18.34
757208	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	ATSI-P2-3-OEE-138-139T	breaker	1900.0	112.94	114.58	DC	31.03
757209	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	ATSI-P2-3-OEE-138-138T	breaker	1900.0	112.94	114.58	DC	31.03
757210	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	AP-P2-3-WP-500-463T	breaker	1900.0	112.94	114.57	DC	31.03
757806	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	single	1560.0	121.02	122.11	DC	18.34
140207	239036	02PERRY	ATSI	239334	02L.CENTER	ATSI	1	ATSI-P7-1-CEI-345-012	tower	1667.0	131.89	133.24	DC	22.42
140250	239036	02PERRY	ATSI	238684	02EASTLK	ATSI	1	ATSI-P7-1-CEI-345-016	tower	1667.0	124.68	125.98	DC	21.72
140260	239082	02S8-ATT	ATSI	238544	02ASH_3	ATSI	8	ATSI-P7-1-CEI-345-016	tower	423.0	123.67	124.32	DC	6.1

Note: Please see Attachment 3 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Attachment.

Short Circuit

(Summary of impacted circuit breakers)

None.

Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
139834	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	operation	1560.0	126.47	128.43	DC	30.57
139836	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	PJM_P1_APS_B_G692	operation	1900.0	111.9	113.49	DC	30.3
757805	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	operation	1560.0	126.47	128.43	DC	30.57
757807	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	PJM_P1_APS_B_G692	operation	1900.0	111.9	113.49	DC	30.3
758166	200767	26HOMER CT	PENELEC	200795	26SHELOCTA	PENELEC	1	Base Case	operation	731.0	102.71	103.27	DC	8.99
140068	238547	02AT	ATSI	239036	02PERRY	ATSI	1	Base Case	operation	1534.0	104.49	106.22	DC	26.6

Appendices

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

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

Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
168467	238547	02AT	ATSI	239036	02PERRY	ATSI	1	ATSI-P2-3-CEI-138-124	breaker	1891.0	100.35	101.02	DC	28.06

Bus #	Bus	MW Impact
200805	26COLVER13	14.57
200823	26MHP_X3-003	7.64
200828	26HNSMLK 1	2.84
200829	26HNSMLK 2	2.84
200830	26HNSMLK 3	2.84
200831	26HNSMLK 4	2.84
200832	26HNSMLK 5	2.84
200849	26LAKVU GN	0.36
200894	26K02	8.81
201201	26WRREN CT	2.96
203999	P-047 E	13.9
236828	01GRAYMONT	0.56
290086	Q-036 E	5.45
293393	V3-030E	3.47
294573	P-028 E	15.46
903643	W3-099 C OP1	5.69
903644	W3-099 E OP1	38.07
914101	Y2-055	9.8
915951	Y3-092 FTIR	553.52
916051	Z1-038	2.55
916202	Z1-069 E	11.41
916351	Z1-091	3.12
918682	AA1-082 E	8.69
918701	AA1-085 C	1.62
918702	AA1-085 E	10.79
918871	AA1-106	3.2
919201	AA1-144 O1	24.71

Bus #	Bus	MW Impact
919491	AA2-000	75.52
920341	AA2-132	3.43
925512	AC1-025 E	0.2
930411	AB1-082	4.36
930511	AB1-092	2.77
931092	AB1-160 E	3.26
932571	AC2-077	4.0
935191	AD1-154	3.59
936421	AD2-055	5.71
936991	AD2-133 C	2.45
936992	AD2-133 E	11.21
938951	AE1-123	3.87
939171	AE1-147 C	1.68
939172	AE1-147 E	1.12
939291	AE1-160 C	4.33
939292	AE1-160 E	2.49
939381	AE1-169 C O1	16.84
939382	AE1-169 E O1	11.22
AA2-500	AA2-500	246.15
BAYOU	BAYOU	3.39
BIG_CAJUN1	BIG_CAJUN1	5.16
BIG_CAJUN2	BIG_CAJUN2	10.38
BLUEG	BLUEG	18.59
CALDERWOOD	CALDERWOOD	1.59
CANNELTON	CANNELTON	1.11
CATAWBA	CATAWBA	0.82
CBM-N	CBM-N	7.45
CHEOAH	CHEOAH	1.45
CHILHOWEE	CHILHOWEE	0.52
CHOCTAW	CHOCTAW	3.39
COFFEEN	COFFEEN	2.0
COTTONWOOD	COTTONWOOD	13.52
DEARBORN	DEARBORN	5.03
DUCKCREEK	DUCKCREEK	4.5
EDWARDS	EDWARDS	2.07
ELMERSMITH	ELMERSMITH	1.9
FARMERCITY	FARMERCITY	1.3
G-007A	G-007A	9.43
GIBSON	GIBSON	0.78
HAMLET	HAMLET	2.4
NEWTON	NEWTON	5.19
NYISO	NYISO	32.61
O-066A	O-066A	4.54
PRAIRIE	PRAIRIE	9.39
SANTEETLA	SANTEETLA	0.42
SMITHLAND	SMITHLAND	0.71
TATANKA	TATANKA	2.4
TILTON	TILTON	2.45
TRIMBLE	TRIMBLE	2.07
TVA	TVA	5.53
UNIONPOWER	UNIONPOWER	2.42
VFT	VFT	25.9

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
775035	200585	26TITUSVIL	PENELEC	200571	26UNION CY	PENELEC	1	PN-P2-3-PN-345-004J	breaker	120.0	85.08	107.38	DC	26.77

Bus #	Bus	MW Impact
200662	26SCRUB GR	1.69
935191	AD1-154	1.14
938951	AE1-123	1.46
939291	AE1-160 C	4.62
939292	AE1-160 E	2.65
939381	AE1-169 C O1	16.06
939382	AE1-169 E O1	10.71
BAYOU	BAYOU	0.17
BIG_CAJUN1	BIG_CAJUN1	0.26
BIG_CAJUN2	BIG_CAJUN2	0.53
BLUEG	BLUEG	0.98
CALDERWOOD	CALDERWOOD	0.08
CANNELTON	CANNELTON	0.06
CARR	CARR	0.07
CATAWBA	CATAWBA	0.04
CHEOAH	CHEOAH	0.07
CHILHOWEE	CHILHOWEE	0.03
CHOCTAW	CHOCTAW	0.17
COFFEEN	COFFEEN	0.11
COTTONWOOD	COTTONWOOD	0.69
DEARBORN	DEARBORN	0.31
DUCKCREEK	DUCKCREEK	0.24
EDWARDS	EDWARDS	0.11
ELMERSMITH	ELMERSMITH	0.1
FARMERCITY	FARMERCITY	0.07
G-007A	G-007A	0.4
GIBSON	GIBSON	0.04
HAMLET	HAMLET	0.1
NEWTON	NEWTON	0.28
O-066A	O-066A	0.18
PRAIRIE	PRAIRIE	0.5
RENSSELAER	RENSSELAER	0.05
SANTEETLA	SANTEETLA	0.02
SMITHLAND	SMITHLAND	0.04
TATANKA	TATANKA	0.13
TILTON	TILTON	0.13
TRIMBLE	TRIMBLE	0.11
TVA	TVA	0.28
UNIONPOWER	UNIONPOWER	0.12
VFT	VFT	1.07

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
774882	200767	26HOMER CT	PENELEC	200795	26SHELOCTA	PENELEC	1	PN-P2-3-PN-500-002A	breaker	917.0	99.5	100.1	DC	12.23

Bus #	Bus	MW Impact
200805	26COLVER13	15.41
200809	26SITHE	2.46
200823	26MHP_X3-003	6.24
200833	26SEWRDB34	29.9
200834	26SW_E13_K22	1.03
200835	26DSGENWIN	2.53
200837	26HOMER C1	42.45
200838	26HOMER C2	35.27
200839	26HOMER C3	37.34
200846	26FORWARD	0.28
200864	K-013 E	7.38
200883	Q-053 E	13.45
200886	26ARWF_N39	0.78
200888	26HIGHLAND	0.62
200894	26K02	7.97
200925	26R32	0.72
203034	26NA_O38_P22	0.69
203999	P-047 E	15.02
236828	01GRAYMONT	0.56
290086	Q-036 E	9.03
292350	K-023	7.78
292542	L-013 1	7.78
293301	N-039 E	20.43
293393	V3-030E	5.99
293432	R-040 E	0.44
293603	O-018 E	16.21
293802	O-038 E	12.77
293902	O-048 E	7.0
294515	P-022 E	5.11
294573	P-028 E	12.63
294903	P-060 E	12.37
296332	R-032 E	18.7
903643	W3-099 C OP1	1.89
903644	W3-099 E OP1	12.63
913142	Y1-033 E OP1	6.41
914101	Y2-055	4.98
916051	Z1-038	2.08
916202	Z1-069 E	12.07
916351	Z1-091	2.7
917672	Z2-108 E	4.86
918682	AA1-082 E	7.74

Bus #	Bus	MW Impact
918701	AA1-085 C	1.56
918702	AA1-085 E	10.37
918871	AA1-106	3.07
919201	AA1-144 O1	22.03
919491	AA2-000	68.91
920341	AA2-132	3.02
925512	AC1-025 E	0.21
930411	AB1-082	4.37
930511	AB1-092	2.53
931092	AB1-160 E	3.45
932571	AC2-077	4.25
932981	AC2-122 C	4.62
932982	AC2-122 E	7.54
935191	AD1-154	2.84
936421	AD2-055	5.21
936991	AD2-133 C	4.06
936992	AD2-133 E	18.58
938351	AE1-053	1.29
938881	AE1-116	1.29
938951	AE1-123	2.57
938991	AE1-128 C	21.86
938992	AE1-128 E	14.57
939171	AE1-147 C	1.68
939172	AE1-147 E	1.12
939291	AE1-160 C	1.82
939292	AE1-160 E	1.05
939341	AE1-165 C	3.72
939342	AE1-165 E	2.48
939381	AE1-169 C O1	7.34
939382	AE1-169 E O1	4.89
AA2-200	AA2-200	54.63
AA2-500	AA2-500	193.02
BAYOU	BAYOU	0.76
BIG_CAJUN1	BIG_CAJUN1	1.18
BIG_CAJUN2	BIG_CAJUN2	2.37
BLUEG	BLUEG	3.22
CALDERWOOD	CALDERWOOD	0.43
CANNELTON	CANNELTON	0.2
CATAWBA	CATAWBA	0.31
CBM-N	CBM-N	4.43
CHEOAH	CHEOAH	0.39
CHILHOWEE	CHILHOWEE	0.14
CHOCTAW	CHOCTAW	0.8
COFFEEN	COFFEEN	0.33
COTTONWOOD	COTTONWOOD	2.99
DEARBORN	DEARBORN	0.07
DUCKCREEK	DUCKCREEK	0.67
EDWARDS	EDWARDS	0.3
ELMERSMITH	ELMERSMITH	0.34
FARMERCITY	FARMERCITY	0.22
G-007	G-007	0.38
GIBSON	GIBSON	0.13
HAMLET	HAMLET	1.06
NEWTON	NEWTON	0.86
NYISO	NYISO	19.27
O-066	O-066	0.91

Bus #	Bus	MW Impact
PRAIRIE	PRAIRIE	1.66
SANTEETLA	SANTEETLA	0.12
SMITHLAND	SMITHLAND	0.14
TATANKA	TATANKA	0.38
TILTON	TILTON	0.37
TRIMBLE	TRIMBLE	0.36
TVA	TVA	1.29
UNIONPOWER	UNIONPOWER	0.58

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
775158	200795	26SHELOCTA	PENELEC	200810	26KEYSTONE	PENELEC	1	PN-P2-3-PN-345-001AT	breaker	917.0	99.69	100.06	DC	7.55

Bus #	Bus	MW Impact
200636	26IUP CO-G	0.68
200805	26COLVER13	28.2
200809	26SITHE	2.14
200823	26MHP_X3-003	5.79
200833	26SEWRDB34	22.33
200834	26SW_E13_K22	0.91
200835	26DSGENWIN	2.23
200837	26HOMER C1	36.87
200838	26HOMER C2	33.72
200839	26HOMER C3	35.7
200846	26FORWARD	0.25
200864	K-013 E	6.52
200883	Q-053 E	11.91
200888	26HIGHLAND	0.54
200894	26K02	7.09
200925	26R32	0.63
202158	26CON.GEN1	0.16
203999	P-047 E	13.74
236828	01GRAYMONT	0.48
290086	Q-036 E	8.18
292350	K-023	6.87
292542	L-013 1	6.87
293301	N-039 E	16.44
293393	V3-030E	7.11
293432	R-040 E	0.39
293603	O-018 E	14.17
293802	O-038 E	10.28
293902	O-048 E	6.19
294515	P-022 E	4.11
294573	P-028 E	11.72
294903	P-060 E	10.93
296332	R-032 E	16.35
903643	W3-099 C OP1	1.26
903644	W3-099 E OP1	8.45
913142	Y1-033 E OP1	5.66
914101	Y2-055	3.83
916051	Z1-038	1.93
916202	Z1-069 E	10.87
916351	Z1-091	2.45
917672	Z2-108 E	4.3
918682	AA1-082 E	7.04

Bus #	Bus	MW Impact
918701	AA1-085 C	1.33
918702	AA1-085 E	8.89
918871	AA1-106	2.77
919201	AA1-144 O1	20.02
919491	AA2-000	59.84
920341	AA2-132	2.73
925512	AC1-025 E	0.18
930411	AB1-082	3.89
930511	AB1-092	2.2
931092	AB1-160 E	3.11
932571	AC2-077	3.83
932981	AC2-122 C	4.08
932982	AC2-122 E	6.66
935191	AD1-154	3.39
936421	AD2-055	4.52
936991	AD2-133 C	3.68
936992	AD2-133 E	16.83
938351	AE1-053	1.14
938881	AE1-116	1.14
938951	AE1-123	1.86
938991	AE1-128 C	19.29
938992	AE1-128 E	12.86
939171	AE1-147 C	1.44
939172	AE1-147 E	0.96
939291	AE1-160 C	1.12
939292	AE1-160 E	0.64
939341	AE1-165 C	3.25
939342	AE1-165 E	2.17
939381	AE1-169 C O1	4.53
939382	AE1-169 E O1	3.02
AA2-200	AA2-200	57.03
AA2-500	AA2-500	175.17
BAYOU	BAYOU	1.13
BIG_CAJUN1	BIG_CAJUN1	1.75
BIG_CAJUN2	BIG_CAJUN2	3.52
BLUEG	BLUEG	5.48
CALDERWOOD	CALDERWOOD	0.59
CANNELTON	CANNELTON	0.33
CATAWBA	CATAWBA	0.38
CBM-N	CBM-N	4.32
CHEOAH	CHEOAH	0.54
CHILHOWEE	CHILHOWEE	0.19
CHOCTAW	CHOCTAW	1.17
COFFEEN	COFFEEN	0.57
COTTONWOOD	COTTONWOOD	4.5
DEARBORN	DEARBORN	0.74
DUCKCREEK	DUCKCREEK	1.23
EDWARDS	EDWARDS	0.56
ELMERSMITH	ELMERSMITH	0.57
FARMERCITY	FARMERCITY	0.37
G-007A	G-007A	1.11
GIBSON	GIBSON	0.22
HAMLET	HAMLET	1.23
NEWTON	NEWTON	1.49
NYISO	NYISO	18.74
O-066A	O-066A	0.62

Bus #	Bus	MW Impact
PRAIRIE	PRAIRIE	2.78
SANTEETLA	SANTEETLA	0.16
SMITHLAND	SMITHLAND	0.22
TATANKA	TATANKA	0.67
TILTON	TILTON	0.68
TRIMBLE	TRIMBLE	0.61
TVA	TVA	1.9
UNIONPOWER	UNIONPOWER	0.84
VFT	VFT	3.38

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
775150	200810	26KEYSTONE	PENELEC	999429	STAR568	PENELEC	3	PN-P2-3-PN-500-001F	breaker	612.0	100.46	101.08	DC	8.28

Bus #	Bus	MW Impact
200636	26IUP CO-G	0.49
200805	26COLVER13	21.44
200809	26SITHE	1.46
200823	26MHP_X3-003	4.5
200833	26SEWRDB34	16.72
200834	26SW_E13_K22	0.65
200835	26DSGENWIN	1.57
200837	26HOMER C1	25.14
200838	26HOMER C2	20.98
200839	26HOMER C3	22.21
200846	26FORWARD	0.18
200864	K-013 E	4.66
200883	Q-053 E	8.77
200888	26HIGHLAND	0.39
200894	26K02	5.48
200925	26R32	0.46
202158	26CON.GEN1	0.12
203999	P-047 E	9.63
236828	01GRAYMONT	0.39
290086	Q-036 E	6.2
292350	K-023	4.83
292542	L-013 1	4.83
293301	N-039 E	12.09
293393	V3-030E	5.33
293432	R-040 E	0.27
293603	O-018 E	10.29
293802	O-038 E	7.56
293902	O-048 E	4.35
294515	P-022 E	3.02
294573	P-028 E	9.11
294903	P-060 E	7.81
296332	R-032 E	11.88
903643	W3-099 C OP1	1.12
903644	W3-099 E OP1	7.46
913142	Y1-033 E OP1	3.89
914101	Y2-055	3.07
916051	Z1-038	1.5
916202	Z1-069 E	7.57
916351	Z1-091	1.82
917672	Z2-108 E	3.02
918682	AA1-082 E	5.28

Bus #	Bus	MW Impact
918701	AA1-085 C	1.09
918702	AA1-085 E	7.29
918871	AA1-106	2.05
919201	AA1-144 O1	15.05
919491	AA2-000	47.78
920341	AA2-132	1.99
925512	AC1-025 E	0.15
930411	AB1-082	2.73
930511	AB1-092	1.75
931092	AB1-160 E	2.16
932571	AC2-077	2.67
932981	AC2-122 C	2.87
932982	AC2-122 E	4.68
935191	AD1-154	2.93
936421	AD2-055	3.61
936991	AD2-133 C	2.79
936992	AD2-133 E	12.75
938351	AE1-053	0.8
938881	AE1-116	0.81
938951	AE1-123	1.97
938991	AE1-128 C	13.9
938992	AE1-128 E	9.27
939171	AE1-147 C	1.19
939172	AE1-147 E	0.79
939291	AE1-160 C	1.22
939292	AE1-160 E	0.7
939341	AE1-165 C	2.38
939342	AE1-165 E	1.59
939381	AE1-169 C O1	4.97
939382	AE1-169 E O1	3.31
AA2-500	AA2-500	132.94
BAYOU	BAYOU	1.67
BIG_CAJUN1	BIG_CAJUN1	2.56
BIG_CAJUN2	BIG_CAJUN2	5.16
BLUEG	BLUEG	8.5
CALDERWOOD	CALDERWOOD	0.85
CANNELTON	CANNELTON	0.51
CATAWBA	CATAWBA	0.5
CBM-N	CBM-N	3.79
CHEOAH	CHEOAH	0.78
CHILHOWEE	CHILHOWEE	0.28
CHOCTAW	CHOCTAW	1.71
COFFEEN	COFFEEN	0.88
COTTONWOOD	COTTONWOOD	6.64
DEARBORN	DEARBORN	1.29
DUCKCREEK	DUCKCREEK	1.92
EDWARDS	EDWARDS	0.87
ELMERSMITH	ELMERSMITH	0.88
FARMERCITY	FARMERCITY	0.58
G-007A	G-007A	4.12
GIBSON	GIBSON	0.35
HAMLET	HAMLET	1.58
NEWTON	NEWTON	2.3
NYISO	NYISO	16.47
O-066A	O-066A	1.99
PRAIRIE	PRAIRIE	4.25

Bus #	Bus	MW Impact
SANTEETLA	SANTEETLA	0.23
SMITHLAND	SMITHLAND	0.34
TATANKA	TATANKA	1.04
TILTON	TILTON	1.06
TRIMBLE	TRIMBLE	0.94
TVA	TVA	2.79
UNIONPOWER	UNIONPOWER	1.22
VFT	VFT	11.35

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
775601	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	single	1560.0	121.01	122.03	DC	17.23

Bus #	Bus	MW Impact
200608	26PINEY #1	1.09
200642	26SENECA#1	10.49
200643	26SENECA#2	11.18
200644	26SENECA#3	0.97
200662	26SCRUB GR	4.22
200805	26COLVER13	14.91
200823	26MHP_X3-003	7.82
200828	26HNSMLK 1	2.91
200829	26HNSMLK 2	2.91
200830	26HNSMLK 3	2.91
200831	26HNSMLK 4	2.91
200832	26HNSMLK 5	2.91
200849	26LAKVU GN	0.37
201201	26WRREN CT	3.02
903643	W3-099 C OP1	5.82
914101	Y2-055	10.03
915951	Y3-092 FTIR	566.47
916051	Z1-038	2.61
916351	Z1-091	3.2
918701	AA1-085 C	1.66
918871	AA1-106	3.28
919201	AA1-144 O1	25.29
919491	AA2-000	77.3
920341	AA2-132	3.51
930411	AB1-082	4.46
930511	AB1-092	2.84
932571	AC2-077	4.09
935191	AD1-154	3.67
936421	AD2-055	5.84
936991	AD2-133 C	2.51
938951	AE1-123	3.97
939171	AE1-147 C	1.72
939291	AE1-160 C	4.43
939381	AE1-169 C O1	17.23
AA2-500	AA2-500	251.93
BAYOU	BAYOU	3.47
BIG_CAJUN1	BIG_CAJUN1	5.28
BIG_CAJUN2	BIG_CAJUN2	10.63
BLUEG	BLUEG	19.03
CALDERWOOD	CALDERWOOD	1.63
CANNELTON	CANNELTON	1.14
CATAWBA	CATAWBA	0.84
CBM-N	CBM-N	7.63

Bus #	Bus	MW Impact
CHEOAH	CHEOAH	1.49
CHILHOWEE	CHILHOWEE	0.54
CHOCTAW	CHOCTAW	3.47
COFFEEN	COFFEEN	2.04
COTTONWOOD	COTTONWOOD	13.84
DEARBORN	DEARBORN	5.15
DUCKCREEK	DUCKCREEK	4.61
EDWARDS	EDWARDS	2.12
ELMERSMITH	ELMERSMITH	1.94
FARMERCITY	FARMERCITY	1.33
G-007A	G-007A	9.66
GIBSON	GIBSON	0.8
HAMLET	HAMLET	2.46
NEWTON	NEWTON	5.31
NYISO	NYISO	33.38
O-066A	O-066A	4.65
PRAIRIE	PRAIRIE	9.62
SANTEETLA	SANTEETLA	0.43
SMITHLAND	SMITHLAND	0.73
TATANKA	TATANKA	2.45
TILTON	TILTON	2.5
TRIMBLE	TRIMBLE	2.12
TVA	TVA	5.66
UNIONPOWER	UNIONPOWER	2.48
VFT	VFT	26.52

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
169410	239036	02PERRY	ATSI	239334	02L.CENTER	ATSI	1	ATSI-P7-1-CEI-345-012	tower	1667.0	131.88	132.45	DC	21.06

Bus #	Bus	MW Impact
200805	26COLVER13	10.94
200823	26MHP_X3-003	5.74
200828	26HNSMLK 1	2.13
200829	26HNSMLK 2	2.13
200830	26HNSMLK 3	2.13
200831	26HNSMLK 4	2.13
200832	26HNSMLK 5	2.13
200849	26LAKVU GN	0.27
200894	26K02	6.61
201201	26WRREN CT	2.22
203999	P-047 E	10.44
236828	01GRAYMONT	0.42
239035	02PERRG1	845.05
290086	Q-036 E	4.09
293393	V3-030E	2.6
294573	P-028 E	11.61
903643	W3-099 C OP1	4.27
903644	W3-099 E OP1	28.56
914101	Y2-055	7.35
915951	Y3-092 FTIR	415.3
916051	Z1-038	1.91
916202	Z1-069 E	8.56
916351	Z1-091	2.35
918682	AA1-082 E	6.53
918701	AA1-085 C	1.22
918702	AA1-085 E	8.1
918871	AA1-106	2.4
919201	AA1-144 O1	18.55
919491	AA2-000	56.69
920341	AA2-132	2.57
925512	AC1-025 E	0.15
930411	AB1-082	3.27
930511	AB1-092	2.08
931092	AB1-160 E	2.45
932571	AC2-077	3.0
935191	AD1-154	2.69
936421	AD2-055	4.29
936991	AD2-133 C	1.84
936992	AD2-133 E	8.41
938951	AE1-123	2.91
939171	AE1-147 C	1.26
939172	AE1-147 E	0.84

Bus #	Bus	MW Impact
939291	AE1-160 C	3.25
939292	AE1-160 E	1.87
939381	AE1-169 C O1	12.63
939382	AE1-169 E O1	8.42
AA2-500	AA2-500	184.8
BAYOU	BAYOU	2.55
BIG_CAJUN1	BIG_CAJUN1	3.88
BIG_CAJUN2	BIG_CAJUN2	7.81
BLUEG	BLUEG	13.99
CALDERWOOD	CALDERWOOD	1.2
CANNELTON	CANNELTON	0.84
CATAWBA	CATAWBA	0.61
CBM-N	CBM-N	5.59
CHEOAH	CHEOAH	1.09
CHILHOWEE	CHILHOWEE	0.39
CHOCTAW	CHOCTAW	2.55
COFFEEN	COFFEEN	1.5
COTTONWOOD	COTTONWOOD	10.17
DEARBORN	DEARBORN	3.8
DUCKCREEK	DUCKCREEK	3.39
EDWARDS	EDWARDS	1.56
ELMERSMITH	ELMERSMITH	1.43
FARMERCITY	FARMERCITY	0.98
G-007A	G-007A	7.09
GIBSON	GIBSON	0.59
HAMLET	HAMLET	1.81
NEWTON	NEWTON	3.91
NYISO	NYISO	24.49
O-066A	O-066A	3.41
PRAIRIE	PRAIRIE	7.07
SANTEETLA	SANTEETLA	0.32
SMITHLAND	SMITHLAND	0.54
TATANKA	TATANKA	1.8
TILTON	TILTON	1.84
TRIMBLE	TRIMBLE	1.56
TVA	TVA	4.16
UNIONPOWER	UNIONPOWER	1.82
VFT	VFT	19.48

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
169455	239036	02PERRY	ATSI	238684	02EASTLK	ATSI	1	ATSI-P7-1-CEI-345-016	tower	1667.0	124.67	125.22	DC	20.4

Bus #	Bus	MW Impact
200805	26COLVER13	10.59
200823	26MHP_X3-003	5.55
200828	26HNSMLK 1	2.07
200829	26HNSMLK 2	2.07
200830	26HNSMLK 3	2.07
200831	26HNSMLK 4	2.07
200832	26HNSMLK 5	2.07
200849	26LAKVU GN	0.26
200894	26K02	6.4
201201	26WRREN CT	2.15
203999	P-047 E	10.11
236828	01GRAYMONT	0.41
239035	02PERRG1	804.69
290086	Q-036 E	3.96
293393	V3-030E	2.52
294573	P-028 E	11.24
903643	W3-099 C OP1	4.14
903644	W3-099 E OP1	27.68
914101	Y2-055	7.13
915951	Y3-092 FTIR	402.53
916051	Z1-038	1.85
916202	Z1-069 E	8.29
916351	Z1-091	2.27
918682	AA1-082 E	6.32
918701	AA1-085 C	1.18
918702	AA1-085 E	7.84
918871	AA1-106	2.33
919201	AA1-144 O1	17.96
919491	AA2-000	54.89
920341	AA2-132	2.49
925512	AC1-025 E	0.15
930411	AB1-082	3.17
930511	AB1-092	2.02
931092	AB1-160 E	2.37
932571	AC2-077	2.91
935191	AD1-154	2.61
936421	AD2-055	4.15
936991	AD2-133 C	1.78
936992	AD2-133 E	8.14
938951	AE1-123	2.82
939171	AE1-147 C	1.22
939172	AE1-147 E	0.82

Bus #	Bus	MW Impact
939291	AE1-160 C	3.15
939292	AE1-160 E	1.81
939381	AE1-169 C O1	12.24
939382	AE1-169 E O1	8.16
AA2-500	AA2-500	178.89
BAYOU	BAYOU	2.46
BIG_CAJUN1	BIG_CAJUN1	3.74
BIG_CAJUN2	BIG_CAJUN2	7.53
BLUEG	BLUEG	13.48
CALDERWOOD	CALDERWOOD	1.16
CANNELTON	CANNELTON	0.8
CATAWBA	CATAWBA	0.59
CBM-N	CBM-N	5.41
CHEOAH	CHEOAH	1.05
CHILHOWEE	CHILHOWEE	0.38
CHOCTAW	CHOCTAW	2.46
COFFEEN	COFFEEN	1.45
COTTONWOOD	COTTONWOOD	9.8
DEARBORN	DEARBORN	3.63
DUCKCREEK	DUCKCREEK	3.26
EDWARDS	EDWARDS	1.5
ELMERSMITH	ELMERSMITH	1.38
FARMERCITY	FARMERCITY	0.94
G-007A	G-007A	6.84
GIBSON	GIBSON	0.56
HAMLET	HAMLET	1.75
NEWTON	NEWTON	3.76
NYISO	NYISO	23.7
O-066A	O-066A	3.29
PRAIRIE	PRAIRIE	6.81
SANTEETLA	SANTEETLA	0.31
SMITHLAND	SMITHLAND	0.52
TATANKA	TATANKA	1.74
TILTON	TILTON	1.77
TRIMBLE	TRIMBLE	1.5
TVA	TVA	4.01
UNIONPOWER	UNIONPOWER	1.76
VFT	VFT	18.8

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
169456	239082	02S8-ATT	ATSI	238544	02ASH_3	ATSI	8	ATSI-P7-1-CEI-345-016	tower	423.0	123.67	124.28	DC	5.73

Bus #	Bus	MW Impact
239035	02PERRG1	85.13
903643	W3-099 C OP1	1.16
903644	W3-099 E OP1	7.77
914101	Y2-055	2.0
915951	Y3-092 FTIR	113.0
939291	AE1-160 C	0.88
939292	AE1-160 E	0.51
939381	AE1-169 C O1	3.44
939382	AE1-169 E O1	2.29
AA2-500	AA2-500	50.4
BAYOU	BAYOU	0.7
BIG_CAJUN1	BIG_CAJUN1	1.07
BIG_CAJUN2	BIG_CAJUN2	2.15
BLUEG	BLUEG	3.84
CALDERWOOD	CALDERWOOD	0.33
CANNELTON	CANNELTON	0.23
CATAWBA	CATAWBA	0.17
CBM-N	CBM-N	1.53
CHEOAH	CHEOAH	0.3
CHILHOWEE	CHILHOWEE	0.11
CHOCTAW	CHOCTAW	0.7
COFFEEN	COFFEEN	0.41
COTTONWOOD	COTTONWOOD	2.79
DEARBORN	DEARBORN	1.06
DUCKCREEK	DUCKCREEK	0.93
EDWARDS	EDWARDS	0.43
ELMERSMITH	ELMERSMITH	0.39
FARMERCITY	FARMERCITY	0.27
G-007A	G-007A	1.95
GIBSON	GIBSON	0.16
HAMLET	HAMLET	0.49
NEWTON	NEWTON	1.08
NYISO	NYISO	6.69
O-066A	O-066A	0.94
PRAIRIE	PRAIRIE	1.95
SANTEETLA	SANTEETLA	0.09
SMITHLAND	SMITHLAND	0.15
TATANKA	TATANKA	0.5
TILTON	TILTON	0.51
TRIMBLE	TRIMBLE	0.43
TVA	TVA	1.14
UNIONPOWER	UNIONPOWER	0.5

Bus #	Bus	MW Impact
VFT	VFT	5.35

Attachment 4. Flowgate Details – Option 2

Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
139474	238547	02AT	ATSI	239036	02PERRY	ATSI	1	ATSI-P2-3-CEI-138-124	breaker	1891.0	100.36	101.94	DC	29.87

Bus #	Bus	MW Impact
200805	26COLVER13	14.57
200823	26MHP_X3-003	7.64
200828	26HNSMLK 1	2.84
200829	26HNSMLK 2	2.84
200830	26HNSMLK 3	2.84
200831	26HNSMLK 4	2.84
200832	26HNSMLK 5	2.84
200849	26LAKVU GN	0.36
200894	26K02	8.81
201201	26WRREN CT	2.96
203999	P-047 E	13.9
236828	01GRAYMONT	0.56
290086	Q-036 E	5.45
293393	V3-030E	3.47
294573	P-028 E	15.46
903643	W3-099 C OP1	5.69
903644	W3-099 E OP1	38.07
914101	Y2-055	9.8
915951	Y3-092 FTIR	553.52
916051	Z1-038	2.55
916202	Z1-069 E	11.41
916351	Z1-091	3.12
918682	AA1-082 E	8.69
918701	AA1-085 C	1.62
918702	AA1-085 E	10.79
918871	AA1-106	3.2
919201	AA1-144 O1	24.71
919491	AA2-000	75.52
920341	AA2-132	3.43
925512	AC1-025 E	0.2
930411	AB1-082	4.36
930511	AB1-092	2.77
931092	AB1-160 E	3.26
932571	AC2-077	4.0
935191	AD1-154	3.59
936421	AD2-055	5.71

Bus #	Bus	MW Impact
936991	AD2-133 C	2.45
936992	AD2-133 E	11.21
938951	AE1-123	3.87
939171	AE1-147 C	1.68
939172	AE1-147 E	1.12
939291	AE1-160 C	4.33
939292	AE1-160 E	2.49
939381	AE1-169 C O2	17.92
939382	AE1-169 E O2	11.95
AA2-500	AA2-500	246.16
BAYOU	BAYOU	3.39
BIG_CAJUN1	BIG_CAJUN1	5.16
BIG_CAJUN2	BIG_CAJUN2	10.38
BLUEG	BLUEG	18.59
CALDERWOOD	CALDERWOOD	1.6
CANNELTON	CANNELTON	1.11
CATAWBA	CATAWBA	0.82
CBM-N	CBM-N	7.45
CHEOAH	CHEOAH	1.45
CHILHOWEE	CHILHOWEE	0.52
CHOCTAW	CHOCTAW	3.39
COFFEEN	COFFEEN	2.0
COTTONWOOD	COTTONWOOD	13.52
DEARBORN	DEARBORN	5.03
DUCKCREEK	DUCKCREEK	4.5
EDWARDS	EDWARDS	2.07
ELMERSMITH	ELMERSMITH	1.9
FARMERCITY	FARMERCITY	1.3
G-007A	G-007A	9.43
GIBSON	GIBSON	0.78
HAMLET	HAMLET	2.4
NEWTON	NEWTON	5.19
NYISO	NYISO	32.61
O-066A	O-066A	4.54
PRAIRIE	PRAIRIE	9.4
SANTEETLA	SANTEETLA	0.42
SMITHLAND	SMITHLAND	0.71
TATANKA	TATANKA	2.4
TILTON	TILTON	2.45
TRIMBLE	TRIMBLE	2.07
TVA	TVA	5.53
UNIONPOWER	UNIONPOWER	2.42
VFT	VFT	25.9

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
757413	200810	26KEYSTONE	PENELEC	999428	STAR569	PENELEC	3	PN-P2-3-PN-500-001F	breaker	612.0	100.12	100.72	DC	8.04

Bus #	Bus	MW Impact
200636	26IUP CO-G	0.49
200805	26COLVER13	21.44
200809	26SITHE	1.46
200823	26MHP_X3-003	4.5
200833	26SEWRDB34	16.72
200834	26SW_E13_K22	0.65
200835	26DSGENWIN	1.57
200837	26HOMER C1	25.14
200838	26HOMER C2	20.98
200839	26HOMER C3	22.21
200846	26FORWARD	0.18
200864	K-013 E	4.66
200883	Q-053 E	8.77
200888	26HIGHLAND	0.39
200894	26K02	5.48
200925	26R32	0.46
202158	26CON.GEN1	0.12
203999	P-047 E	9.63
236828	01GRAYMONT	0.39
290086	Q-036 E	6.2
292350	K-023	4.83
292542	L-013 1	4.83
293301	N-039 E	12.09
293393	V3-030E	5.33
293432	R-040 E	0.27
293603	O-018 E	10.29
293802	O-038 E	7.56
293902	O-048 E	4.35
294515	P-022 E	3.02
294573	P-028 E	9.11
294903	P-060 E	7.81
296332	R-032 E	11.88
903643	W3-099 C OP1	1.12
903644	W3-099 E OP1	7.46
913142	Y1-033 E OP1	3.89
914101	Y2-055	3.07
916051	Z1-038	1.5
916202	Z1-069 E	7.57
916351	Z1-091	1.82
917672	Z2-108 E	3.02
918682	AA1-082 E	5.28

Bus #	Bus	MW Impact
918701	AA1-085 C	1.09
918702	AA1-085 E	7.29
918871	AA1-106	2.05
919201	AA1-144 O1	15.05
919491	AA2-000	47.78
920341	AA2-132	1.99
925512	AC1-025 E	0.15
930411	AB1-082	2.73
930511	AB1-092	1.75
931092	AB1-160 E	2.16
932571	AC2-077	2.67
932981	AC2-122 C	2.87
932982	AC2-122 E	4.68
935191	AD1-154	2.93
936421	AD2-055	3.61
936991	AD2-133 C	2.79
936992	AD2-133 E	12.75
938351	AE1-053	0.8
938881	AE1-116	0.81
938951	AE1-123	1.97
938991	AE1-128 C	13.9
938992	AE1-128 E	9.27
939171	AE1-147 C	1.19
939172	AE1-147 E	0.79
939291	AE1-160 C	1.22
939292	AE1-160 E	0.7
939341	AE1-165 C O2	2.35
939342	AE1-165 E O2	1.57
939381	AE1-169 C O2	4.82
939382	AE1-169 E O2	3.21
AA2-500	AA2-500	132.94
BAYOU	BAYOU	1.67
BIG_CAJUN1	BIG_CAJUN1	2.56
BIG_CAJUN2	BIG_CAJUN2	5.16
BLUEG	BLUEG	8.5
CALDERWOOD	CALDERWOOD	0.85
CANNELTON	CANNELTON	0.51
CATAWBA	CATAWBA	0.5
CBM-N	CBM-N	3.79
CHEOAH	CHEOAH	0.78
CHILHOWEE	CHILHOWEE	0.28
CHOCTAW	CHOCTAW	1.71
COFFEEN	COFFEEN	0.88
COTTONWOOD	COTTONWOOD	6.64
DEARBORN	DEARBORN	1.29
DUCKCREEK	DUCKCREEK	1.92
EDWARDS	EDWARDS	0.87
ELMERSMITH	ELMERSMITH	0.88
FARMERCITY	FARMERCITY	0.58
G-007A	G-007A	4.12
GIBSON	GIBSON	0.35
HAMLET	HAMLET	1.58
NEWTON	NEWTON	2.3
NYISO	NYISO	16.47
O-066A	O-066A	1.99
PRAIRIE	PRAIRIE	4.25

Bus #	Bus	MW Impact
SANTEETLA	SANTEETLA	0.23
SMITHLAND	SMITHLAND	0.34
TATANKA	TATANKA	1.04
TILTON	TILTON	1.06
TRIMBLE	TRIMBLE	0.94
TVA	TVA	2.79
UNIONPOWER	UNIONPOWER	1.22
VFT	VFT	11.35

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
757215	939380	AE1-169 TAP	PENELEC	200571	26UNION CY	PENELEC	1	PN-P2-3-PN-345-004J	breaker	120.0	84.99	114.15	DC	34.98

Bus #	Bus	MW Impact
200662	26SCRUB GR	1.69
935191	AD1-154	1.14
938951	AE1-123	1.46
939291	AE1-160 C	4.62
939292	AE1-160 E	2.65
939381	AE1-169 C O2	20.99
939382	AE1-169 E O2	13.99
BAYOU	BAYOU	0.17
BIG_CAJUN1	BIG_CAJUN1	0.26
BIG_CAJUN2	BIG_CAJUN2	0.53
BLUEG	BLUEG	0.98
CALDERWOOD	CALDERWOOD	0.08
CANNELTON	CANNELTON	0.06
CARR	CARR	0.07
CATAWBA	CATAWBA	0.04
CHEOAH	CHEOAH	0.07
CHILHOWEE	CHILHOWEE	0.03
CHOCTAW	CHOCTAW	0.17
COFFEEN	COFFEEN	0.11
COTTONWOOD	COTTONWOOD	0.69
DEARBORN	DEARBORN	0.31
DUCKCREEK	DUCKCREEK	0.24
EDWARDS	EDWARDS	0.11
ELMERSMITH	ELMERSMITH	0.1
FARMERCITY	FARMERCITY	0.07
G-007A	G-007A	0.4
GIBSON	GIBSON	0.04
HAMLET	HAMLET	0.1
NEWTON	NEWTON	0.28
O-066A	O-066A	0.18
PRAIRIE	PRAIRIE	0.5
RENSSELAER	RENSSELAER	0.05
SANTEETLA	SANTEETLA	0.02
SMITHLAND	SMITHLAND	0.04
TATANKA	TATANKA	0.13
TILTON	TILTON	0.13
TRIMBLE	TRIMBLE	0.11
TVA	TVA	0.28
UNIONPOWER	UNIONPOWER	0.12
VFT	VFT	1.07

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
757806	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	single	1560.0	121.02	122.11	DC	18.34

Bus #	Bus	MW Impact
200608	26PINEY #1	1.09
200642	26SENECA#1	10.49
200643	26SENECA#2	11.18
200644	26SENECA#3	0.97
200662	26SCRUB GR	4.22
200805	26COLVER13	14.91
200823	26MHP_X3-003	7.82
200828	26HNSMLK 1	2.91
200829	26HNSMLK 2	2.91
200830	26HNSMLK 3	2.91
200831	26HNSMLK 4	2.91
200832	26HNSMLK 5	2.91
200849	26LAKVU GN	0.37
201201	26WRREN CT	3.02
903643	W3-099 C OP1	5.82
914101	Y2-055	10.03
915951	Y3-092 FTIR	566.47
916051	Z1-038	2.61
916351	Z1-091	3.2
918701	AA1-085 C	1.66
918871	AA1-106	3.28
919201	AA1-144 O1	25.29
919491	AA2-000	77.29
920341	AA2-132	3.51
930411	AB1-082	4.46
930511	AB1-092	2.84
932571	AC2-077	4.09
935191	AD1-154	3.67
936421	AD2-055	5.84
936991	AD2-133 C	2.51
938951	AE1-123	3.97
939171	AE1-147 C	1.72
939291	AE1-160 C	4.43
939381	AE1-169 C O2	18.34
AA2-500	AA2-500	251.94
BAYOU	BAYOU	3.47
BIG_CAJUN1	BIG_CAJUN1	5.28
BIG_CAJUN2	BIG_CAJUN2	10.63
BLUEG	BLUEG	19.03
CALDERWOOD	CALDERWOOD	1.63
CANNELTON	CANNELTON	1.14
CATAWBA	CATAWBA	0.84
CBM-N	CBM-N	7.63

Bus #	Bus	MW Impact
CHEOAH	CHEOAH	1.49
CHILHOWEE	CHILHOWEE	0.54
CHOCTAW	CHOCTAW	3.47
COFFEEN	COFFEEN	2.04
COTTONWOOD	COTTONWOOD	13.84
DEARBORN	DEARBORN	5.15
DUCKCREEK	DUCKCREEK	4.61
EDWARDS	EDWARDS	2.12
ELMERSMITH	ELMERSMITH	1.95
FARMERCITY	FARMERCITY	1.33
G-007A	G-007A	9.66
GIBSON	GIBSON	0.8
HAMLET	HAMLET	2.46
NEWTON	NEWTON	5.31
NYISO	NYISO	33.38
O-066A	O-066A	4.65
PRAIRIE	PRAIRIE	9.62
SANTEETLA	SANTEETLA	0.43
SMITHLAND	SMITHLAND	0.73
TATANKA	TATANKA	2.45
TILTON	TILTON	2.5
TRIMBLE	TRIMBLE	2.12
TVA	TVA	5.66
UNIONPOWER	UNIONPOWER	2.48
VFT	VFT	26.52

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
140207	239036	02PERRY	ATSI	239334	02L.CENTER	ATSI	1	ATSI-P7-1-CEI-345-012	tower	1667.0	131.89	133.24	DC	22.42

Bus #	Bus	MW Impact
200805	26COLVER13	10.94
200823	26MHP_X3-003	5.74
200828	26HNSMLK 1	2.13
200829	26HNSMLK 2	2.13
200830	26HNSMLK 3	2.13
200831	26HNSMLK 4	2.13
200832	26HNSMLK 5	2.13
200849	26LAKVU GN	0.27
200894	26K02	6.61
201201	26WRREN CT	2.22
203999	P-047 E	10.44
236828	01GRAYMONT	0.42
239035	02PERRG1	845.04
290086	Q-036 E	4.09
293393	V3-030E	2.6
294573	P-028 E	11.61
903643	W3-099 C OP1	4.27
903644	W3-099 E OP1	28.56
914101	Y2-055	7.35
915951	Y3-092 FTIR	415.3
916051	Z1-038	1.91
916202	Z1-069 E	8.56
916351	Z1-091	2.35
918682	AA1-082 E	6.52
918701	AA1-085 C	1.22
918702	AA1-085 E	8.1
918871	AA1-106	2.4
919201	AA1-144 O1	18.55
919491	AA2-000	56.69
920341	AA2-132	2.57
925512	AC1-025 E	0.15
930411	AB1-082	3.27
930511	AB1-092	2.08
931092	AB1-160 E	2.45
932571	AC2-077	3.0
935191	AD1-154	2.69
936421	AD2-055	4.29
936991	AD2-133 C	1.84
936992	AD2-133 E	8.41
938951	AE1-123	2.91
939171	AE1-147 C	1.26
939172	AE1-147 E	0.84

Bus #	Bus	MW Impact
939291	AE1-160 C	3.25
939292	AE1-160 E	1.87
939381	AE1-169 C O2	13.45
939382	AE1-169 E O2	8.97
AA2-500	AA2-500	184.81
BAYOU	BAYOU	2.55
BIG_CAJUN1	BIG_CAJUN1	3.88
BIG_CAJUN2	BIG_CAJUN2	7.82
BLUEG	BLUEG	13.99
CALDERWOOD	CALDERWOOD	1.2
CANNELTON	CANNELTON	0.84
CATAWBA	CATAWBA	0.61
CBM-N	CBM-N	5.59
CHEOAH	CHEOAH	1.09
CHILHOWEE	CHILHOWEE	0.39
CHOCTAW	CHOCTAW	2.55
COFFEEN	COFFEEN	1.5
COTTONWOOD	COTTONWOOD	10.18
DEARBORN	DEARBORN	3.8
DUCKCREEK	DUCKCREEK	3.39
EDWARDS	EDWARDS	1.56
ELMERSMITH	ELMERSMITH	1.43
FARMERCITY	FARMERCITY	0.98
G-007A	G-007A	7.09
GIBSON	GIBSON	0.59
HAMLET	HAMLET	1.81
NEWTON	NEWTON	3.91
NYISO	NYISO	24.49
O-066A	O-066A	3.41
PRAIRIE	PRAIRIE	7.07
SANTEETLA	SANTEETLA	0.32
SMITHLAND	SMITHLAND	0.54
TATANKA	TATANKA	1.8
TILTON	TILTON	1.84
TRIMBLE	TRIMBLE	1.56
TVA	TVA	4.16
UNIONPOWER	UNIONPOWER	1.82
VFT	VFT	19.48

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
140250	239036	02PERRY	ATSI	238684	02EASTLK	ATSI	1	ATSI-P7-1-CEI-345-016	tower	1667.0	124.68	125.98	DC	21.72

Bus #	Bus	MW Impact
200805	26COLVER13	10.59
200823	26MHP_X3-003	5.55
200828	26HNSMLK 1	2.07
200829	26HNSMLK 2	2.07
200830	26HNSMLK 3	2.07
200831	26HNSMLK 4	2.07
200832	26HNSMLK 5	2.07
200849	26LAKVU GN	0.26
200894	26K02	6.4
201201	26WRREN CT	2.15
203999	P-047 E	10.11
236828	01GRAYMONT	0.41
239035	02PERRG1	804.69
290086	Q-036 E	3.96
293393	V3-030E	2.52
294573	P-028 E	11.24
903643	W3-099 C OP1	4.14
903644	W3-099 E OP1	27.68
914101	Y2-055	7.12
915951	Y3-092 FTIR	402.53
916051	Z1-038	1.85
916202	Z1-069 E	8.29
916351	Z1-091	2.27
918682	AA1-082 E	6.32
918701	AA1-085 C	1.18
918702	AA1-085 E	7.84
918871	AA1-106	2.33
919201	AA1-144 O1	17.96
919491	AA2-000	54.89
920341	AA2-132	2.49
925512	AC1-025 E	0.15
930411	AB1-082	3.17
930511	AB1-092	2.02
931092	AB1-160 E	2.37
932571	AC2-077	2.91
935191	AD1-154	2.61
936421	AD2-055	4.15
936991	AD2-133 C	1.78
936992	AD2-133 E	8.14
938951	AE1-123	2.82
939171	AE1-147 C	1.22
939172	AE1-147 E	0.82

Bus #	Bus	MW Impact
939291	AE1-160 C	3.15
939292	AE1-160 E	1.81
939381	AE1-169 C O2	13.03
939382	AE1-169 E O2	8.69
AA2-500	AA2-500	178.9
BAYOU	BAYOU	2.46
BIG_CAJUN1	BIG_CAJUN1	3.74
BIG_CAJUN2	BIG_CAJUN2	7.53
BLUEG	BLUEG	13.48
CALDERWOOD	CALDERWOOD	1.16
CANNELTON	CANNELTON	0.81
CATAWBA	CATAWBA	0.59
CBM-N	CBM-N	5.41
CHEOAH	CHEOAH	1.05
CHILHOWEE	CHILHOWEE	0.38
CHOCTAW	CHOCTAW	2.46
COFFEEN	COFFEEN	1.45
COTTONWOOD	COTTONWOOD	9.81
DEARBORN	DEARBORN	3.64
DUCKCREEK	DUCKCREEK	3.26
EDWARDS	EDWARDS	1.5
ELMERSMITH	ELMERSMITH	1.38
FARMERCITY	FARMERCITY	0.94
G-007A	G-007A	6.84
GIBSON	GIBSON	0.56
HAMLET	HAMLET	1.75
NEWTON	NEWTON	3.76
NYISO	NYISO	23.7
O-066A	O-066A	3.29
PRAIRIE	PRAIRIE	6.81
SANTEETLA	SANTEETLA	0.31
SMITHLAND	SMITHLAND	0.52
TATANKA	TATANKA	1.74
TILTON	TILTON	1.77
TRIMBLE	TRIMBLE	1.5
TVA	TVA	4.01
UNIONPOWER	UNIONPOWER	1.76
VFT	VFT	18.79

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
140260	239082	02S8-ATT	ATSI	238544	02ASH_3	ATSI	8	ATSI-P7-1-CEI-345-016	tower	423.0	123.67	124.32	DC	6.1

Bus #	Bus	MW Impact
239035	02PERRG1	85.13
903643	W3-099 C OP1	1.16
903644	W3-099 E OP1	7.77
914101	Y2-055	2.0
915951	Y3-092 FTIR	113.0
939291	AE1-160 C	0.88
939292	AE1-160 E	0.51
939381	AE1-169 C O2	3.66
939382	AE1-169 E O2	2.44
AA2-500	AA2-500	50.4
BAYOU	BAYOU	0.7
BIG_CAJUN1	BIG_CAJUN1	1.07
BIG_CAJUN2	BIG_CAJUN2	2.15
BLUEG	BLUEG	3.85
CALDERWOOD	CALDERWOOD	0.33
CANNELTON	CANNELTON	0.23
CATAWBA	CATAWBA	0.17
CBM-N	CBM-N	1.53
CHEOAH	CHEOAH	0.3
CHILHOWEE	CHILHOWEE	0.11
CHOCTAW	CHOCTAW	0.7
COFFEEN	COFFEEN	0.41
COTTONWOOD	COTTONWOOD	2.79
DEARBORN	DEARBORN	1.06
DUCKCREEK	DUCKCREEK	0.93
EDWARDS	EDWARDS	0.43
ELMERSMITH	ELMERSMITH	0.39
FARMERCITY	FARMERCITY	0.27
G-007A	G-007A	1.95
GIBSON	GIBSON	0.16
HAMLET	HAMLET	0.49
NEWTON	NEWTON	1.08
NYISO	NYISO	6.69
O-066A	O-066A	0.94
PRAIRIE	PRAIRIE	1.95
SANTEETLA	SANTEETLA	0.09
SMITHLAND	SMITHLAND	0.15
TATANKA	TATANKA	0.5
TILTON	TILTON	0.51
TRIMBLE	TRIMBLE	0.43
TVA	TVA	1.14
UNIONPOWER	UNIONPOWER	0.5

Bus #	Bus	MW Impact
VFT	VFT	5.35