



Via DocuSign

February 28, 2020

Aurora Solar LLC

1125 NW Couch St., Suite 700

Portland, Oregon 97209

Dear Tom Shields,

RE: AE2-072 "East Leipsic-Richland 138 kV" - System Impact Study Report and Facilities Study Agreement

NOTE: To retain the Queue Position, the following must be provided on or before the due date indicated below (see paragraph 6).

- **Executed System Facilities Study Agreement**
- **System Facilities Study Deposit (see paragraph 6)**

Enclosed is a report documenting the results of the **AE2-072 "East Leipsic-Richland 138 kV"** System Impact Study. The results of this study are predicated on a **2022** transmission system based upon PJM's best assumptions at the present time for load growth and connection of proposed new generation additions.

System Impact Studies are performed to determine the facilities required for interconnection and to define the estimated cost and timing for construction of attachment facilities and network upgrades required for the reliable interconnection of a generation project to the PJM system. The costs and associated timing described in the enclosed report are based upon estimates given to PJM by the affected Transmission Owner(s). The costs are your responsibility as the project developer.

The costs associated with the studies are being tabulated and you will receive a final statement/invoice electronically from PJM detailing your balance within 120 days.

Please be advised that all modeling will be completed consistent with Manual 3A. Market settlements cannot begin until these steps have been complete.

Note that Tariff 212.5 milestones require that you have all site permits, water and fuel agreements and associated right of way, and a memorandum of understanding for major equipment at the time you return your executed Interconnection Service Agreement (ISA). It is your responsibility to ensure these requirements are met and if they cannot be met at the time of the return of the ISA, you must demonstrate your due diligence and propose dates when those milestones will be met.

Pursuant to Section 207 of the PJM Tariff, attached is a Facilities Study Agreement for your consideration. The Agreement must be executed via DocuSign within thirty days by (close of business on **March 30, 2020**) to maintain your projects' position in the queue. A refundable deposit in the amount of **\$100,000** must accompany the agreement and be in PJM's possession by the deadline stated above. In addition, this and any other queue requests that you may have in the PJM queue must be in good financial standing, and all information requested in the Milestones (Section 6) portion of the Agreement are required to accompany the signed agreement. Failure to meet these requirements will result in the project's withdrawal from the PJM queue.

Please review and execute the Facilities Study Agreement as specified in DocuSign. Required with the signed agreement, per Section 3 of the enclosed Facilities Study Agreement is a refundable deposit of **\$100,000**

Please send the required study deposit to:

Interconnection Projects Admin
PJM Interconnection, L.L.C.
2750 Monroe Blvd.
Audubon, PA 19403

The following information is provided for wire transfers:

Bank: PNC Bank, NA, New Jersey
ABA Number: 031-207-607
Account Number: 8013589826

Please e-mail PJM at SystemPlanning.Admin@pjm.com with the project name, queue number, date and amount of wire.

Costs for the Impact Study are being tabulated and you will receive an invoice in the near future. If you wish to discuss the Impact Study report or the Facilities Study Agreement in more detail, please call me at 610-635-3479 and or email me at Noorgul.Dada@pjm.com.

Sincerely,
Noorgul Dada



Sr. Engineer
PJM Interconnection Projects

Attachments

PJM (w/attachments): Jonathan Riley – AEP
Pavani Edumala – AEP

Komal Patel – PJM
Bernard O'Hara – PJM
File



**Generation Interconnection
Feasibility Study Report
for
Queue Project AE2-072
EAST LEIPSIC-RICHLAND 138 KV
90 MW Capacity / 150 MW Energy**

October, 2019

Table Of Contents

1	Preface.....	4
2	General.....	6
2.1	Point of Interconnection	7
2.2	Cost Summary.....	7
3	Transmission Owner Scope of Work.....	8
4	Attachment Facilities	8
5	Direct Connection Cost Estimate.....	8
6	Non-Direct Connection Cost Estimate.....	8
7	Incremental Capacity Transfer Rights (ICTRs)	9
8	Schedule.....	10
9	Interconnection Customer Requirements.....	10
10	Revenue Metering and SCADA Requirements	11
10.1	PJM Requirements	11
10.2	AEP Requirements.....	11
11	Network Impacts.....	12
12	Generation Deliverability.....	14
13	Multiple Facility Contingency	14
14	Contribution to Previously Identified Overloads	14
15	Potential Congestion due to Local Energy Deliverability	15
16	System Reinforcements.....	16
17	Flow Gate Details	18
17.1	Index 1	19
17.2	Index 2	20
17.3	Index 3.....	21
17.4	Index 4.....	22
17.5	Index 5	23
17.6	Index 6.....	24
17.7	Index 7	26
17.8	Index 8.....	28
17.9	Index 9.....	29
17.10	Index 10.....	31

18	Affected Systems	34
18.1	LG&E.....	34
18.2	MISO	34
18.3	TVA.....	34
18.4	Duke Energy Progress.....	34
18.5	NYISO	34
19	Contingency Descriptions.....	35
20	Short Circuit.....	37
21	Figure 1: AE2-072 Point of Interconnection (East Leipsic – Richland 138 kV)	38
22	Figure 2: AE2-072 Point of Interconnection (East Leipsic – Richland 138 kV)	39

1 Preface

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

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

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

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a \$10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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

2 General

Aurora Solar, LLC has proposed to install PJM project # AE2-072, a Solar generating facility located in Putnam County, Ohio (See Figure 2). The installed facilities will have a total capability of 150 MW with 90 MW of this output being recognized by PJM as Capacity. The Point of Interconnection will be to AEP owned section of the East Leipsic – Richland 138 kV line (See Figure 1).

The proposed in-service date for this project is December 31, 2021. This study does not imply AEP's commitment to this in-service date.

The objective of this Feasibility Study is to determine budgetary cost estimates and approximate construction timelines for identified transmission facilities required to connect the proposed generating facilities to the AEP transmission system. These reinforcements include the Attachment Facilities, Local Upgrades, and Network Upgrades required for maintaining the reliability of the AEP transmission system.

The Feasibility Study includes Short Circuit and Peak Load steady state power flow analyses. The conduct of power flow studies at other load levels, stability analysis, and coordination with non-PJM Transmission Planners, as required under the PJM planning process, is not performed during the Generation Interconnection Feasibility Study phase of the PJM study process. Additional reinforcement requirements for this Interconnection Request may be defined during the conduct of these additional analyses which shall be performed following execution of the System Impact Study agreement.

Queue Number	AE2-072
Project Name	EAST LEIPSIC-RICHLAND 138 KV
Interconnection Customer	Aurora Solar LLC
State	Ohio
County	Putnam
Transmission Owner	AEP
MFO	150
MWE	150
MWC	90
Fuel	Solar
Base case Study Year	2022

2.1 Point of Interconnection

AE2-072 will interconnect with the AEP transmission system via a new station cut into the AEP owned section of East Leipsic – Richland 138 kV line.

To accommodate the interconnection on the AEP owned section of the East Leipsic – Richland 138 kV line, a new three (3) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus will be constructed (see Figure 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

2.2 Cost Summary

The AE2-072 project will be responsible for the following costs:

Based upon the results of this System Impact Study, the construction of the 150 MW (90 MW Capacity) Solar generating facility of Aurora Solar (PJM Project # AE2-072) will require the following additional interconnection charges. This plan of service will interconnect the proposed Solar generating facility in a manner that will provide operational reliability and flexibility to both the AEP system and the Aurora Solar generating facility.

Description	Total Cost
Attachment Facilities	\$250,000
Direct Connection Network Upgrade	\$6,000,000
Non Direct Connection Network Upgrades	\$1,250,000*
Total Costs	\$7,500,000

*Note: The Richland remote end estimate will have to be provided by ATSI/FE.

In addition, the AE2-072 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	\$90,757,500

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

3 Transmission Owner Scope of Work

4 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	Total Cost
138 kV Revenue Metering	\$250,000
Total Attachment Facility Costs	\$250,000

5 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
Construct a new three (3) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus. Installation of associated protection and control equipment, 138 kV line risers and SCADA will also be required.	\$6,000,000
Total Direct Connection Facility Costs	\$6,000,000

6 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
Upgrade line protection and controls at the East Leipsic 138 kV substation	\$250,000
East Leipsic – Richland 138 kV T-Line Cut In	\$1,000,000
Total Non-Direct Connection Facility Costs	\$1,250,000

Note: The Richland remote end estimate will have to be provided by ATSI/FE.

7 Incremental Capacity Transfer Rights (ICTRs)

Will be determined at a later study phase

8 Schedule

It is anticipated that the time between receipt of executed Agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would generally be between 24 to 36 months after signing Agreement execution.

9 Interconnection Customer Requirements

It is understood that Aurora Solar is responsible for all costs associated with this interconnection. The costs above are reimbursable to AEP. The cost of Aurora Solar's generating plant and the costs for the line connecting the generating plant to the East Leipsic – Richland 138 kV line are not included in this report; these are assumed to be Aurora Solar's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power 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.

Requirement from the PJM Open Access Transmission Tariff:

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.

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 AEP Requirements

The Interconnection Customer will be required to comply with all AEP Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx>

11 Network Impacts

The Queue Project AE2-072 was evaluated as a 150 MW (Capacity 90 MW) injection at the East Leipsic – Richland 138 kV line in the AEP area. Project AE2-072 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-072 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

12 Generation Deliverability

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

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
8667121	239060	02RDGVL	ATSI	239061	02RDGVL+	ATSI	1	ATSI-P1-2-TE-138-001	single	194.0	90.41	100.11	DC	18.82

13 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
2156374	239070	02RICHL	ATSI	238521	02NAOMI	ATSI	1	ATSI-P2-3-TE-138-008	breaker	194.0	98.78	114.95	DC	31.35
2156375	239070	02RICHL	ATSI	238521	02NAOMI	ATSI	1	ATSI-P2-3-TE-138-006	breaker	194.0	97.75	113.92	DC	31.35
1391381	243080	05RILEYC	AEP	243083	05CAMPS	AEP	1	AEP_P4_#6817_05E.LPS C 138_B	breaker	223.0	53.77	121.03	DC	150.0
1391391	243083	05CAMPS	AEP	242989	05E LIMA	AEP	1	AEP_P4_#6817_05E.LPS C 138_B	breaker	223.0	53.14	120.4	DC	150.0
1391359	247000	05YELLWC	AEP	243080	05RILEYC	AEP	1	AEP_P4_#6817_05E.LPS C 138_B	breaker	223.0	56.82	124.08	DC	150.0

14 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
2156444	238569	02BEAVER	ATSI	239725	02LAKEAVE	ATSI	2	ATSI-P2-3-OEC-345-023	breaker	1742.0	105.92	106.42	DC	18.97
2156994	238569	02BEAVER	ATSI	238607	02CARLIL	ATSI	1	ATSI-P7-1-OEC-345-001	tower	1243.0	105.77	106.31	DC	14.77
2156373	239070	02RICHL	ATSI	238521	02NAOMI	ATSI	1	ATSI-P2-3-TE-138-009	breaker	194.0	100.49	116.52	DC	31.09
8667012	239070	02RICHL	ATSI	239060	02RDGVL	ATSI	1	ATSI-P1-2-TE-138-001	single	179.0	101.84	112.35	DC	18.82
2156966	239728	02BLKVR	ATSI	239734	02USSTEEL	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	659.0	101.41	101.95	DC	7.85

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
2156942	239734	02USSTEEL	ATSI	238915	02LRN Q2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	593.0	108.28	108.88	DC	7.85

15 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
8667120	239060	02RDGVL	ATSI	239061	02RDGVL+	ATSI	1	ATSI-P1-2-TE-138-001	operation	194.0	101.24	117.42	DC	31.36
2156819	239070	02RICHL	ATSI	239060	02RDGVL	ATSI	1	Base Case	operation	152.0	93.44	107.89	DC	21.96
8667011	239070	02RICHL	ATSI	239060	02RDGVL	ATSI	1	ATSI-P1-2-TE-138-001	operation	179.0	113.58	131.12	DC	31.36

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
2156373,2156375,2156374	2	02RICHLD 138.0 kV - 02NAOMI 138.0 kV Ckt 1	<u>ATSI</u> TE-004A : Reconductor the transmission line conductor (existing 336 ACSR) with 336 ACSS. Project Type : Facility Cost : \$40,950,000 Time Estimate : 36.0 Months	\$40,950,000
1391381	3	05RILEYC 138.0 kV - 05CAMPSS 138.0 kV Ckt 1	<u>AEP</u> AEPO0013a : Perform Sag Study on 8.6 miles of line with ACSR 636 26/7 Grosbeak conductor. Project Type : FAC Cost : \$34,400 Time Estimate : 6-12 Months	\$34,400
8667121	1	02RDGVL 138.0 kV - 02RDGVL+ 138.0 kV Ckt 1	<u>ATSI</u> TE-005A : Reconductor the existing section of the 336 ACSR 30/7 with with 336 ACSS. The existing line has mixed 1336 ACSR 30/7 and 636 AA 37 conductors. The sections of 636 AA 37 conductors does not need to be reconducted. Project Type : Facility Cost : \$ 9,750,000 Time Estimate : 24.0 Months	\$9,750,000
2156994	7	02BEAVER 345.0 kV - 02CARLIL 345.0 kV Ckt 1	<u>ATSI</u> ATSI Rating Correction: [Rate A: 1380, Rate B: 1646, Rate C: 1730]	\$0
2156966	9	02BLKRVR 138.0 kV - 02USSTEEL 138.0 kV Ckt 1	<u>ATSI</u> OEC-002A : Build a new 138 kV line from Black River to Astor substation Project Type : Facility Cost : \$20,152,700 Time Estimate : 30.0 Months	\$20,152,700
2156942	10	02USSTEEL 138.0 kV - 02LRN Q2 138.0 kV Ckt 1		
2156444	6	02BEAVER 345.0 kV - 02LAKEAVE 345.0 kV Ckt 2	<u>ATSI</u> ATSI Rating Correction: [Rate A: 1534, Rate B: 1878, Rate C: 2120]	\$0
8667012	8	02RICHLD 138.0 kV - 02RDGVL 138.0 kV Ckt 1	<u>ATSI</u> TE-003B : Reconductor the transmission line conductor (existing 336 ACSR) with 336 ACSS 26/7. Reconductor substation conductor (existing 336 ACSR) at Richland with 556 26/7 ACSR. Replace the existing 800 Amp wave trap with a 1,200 Amp wave trap. Project Type : Facility Cost : \$19,500,000 Time Estimate : 30.0 Months	\$19,500,000

ID	Index	Facility	Upgrade Description	Cost
1391359	5	05YELLWC 138.0 kV - 05RILEYC 138.0 kV Ckt 1	<u>AEP</u> AEPO0012a (209) : Perform Sag Study on 3.5 miles of line with ACSR 636 26/7 Grosbeak conductor. Project Type : FAC Cost : \$20,000 Time Estimate : 6-12 Months AEPO0012b (210) : Perform Sag Study on 7 miles of line with ACSR 795 45/7 Tern conductor. Project Type : FAC Cost : \$28,000 Time Estimate : 6-12 Months	\$48,000
1391391	4	05CAMPSS 138.0 kV - 05E LIMA 138.0 kV Ckt 1	<u>AEP</u> AEPO0014a (212) : Perform Sag Study on 5.6 miles of line with ACSR 636 26/7 Grosbeak conductor. Project Type : FAC Cost : \$22,400 Time Estimate : 6-12 Months AEPO0014b (213) : Upgrade three "Sub cond 795 AAC 37 Str." risers at East Lima Project Type : FAC Cost : \$300,000 Time Estimate : 12-18 Months	\$322,400
			TOTAL COST	\$90,757,500

17 Flow Gate Details

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

17.1 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
8667121	239060	02RDGVL	ATSI	239061	02RDGVL+	ATSI	1	ATSI-P1-2-TE-138-001	single	194.0	90.41	100.11	DC	18.82

Bus #	Bus	MW Impact
239064	02RICHG1	0.47
239065	02RICHG2&3	0.92
239067	02RICHG4	5.01
239068	02RICHG5	5.01
239069	02RICHG6	5.01
247567	V2-006 C	2.64
926811	AC1-167 C O1	2.01
926941	AC1-181	0.21
934901	AD1-119 C O1	1.01
940841	AE2-072 C	18.82
943181	AE2-322 C	2.41
CARR	CARR	0.12
CBM-S1	CBM-S1	0.99
CBM-S2	CBM-S2	0.17
CBM-W2	CBM-W2	9.29
CIN	CIN	1.25
CPLE	CPLE	0.04
IPL	IPL	0.83
LGEE	LGEE	0.28
MEC	MEC	2.2
RENSSELAER	RENSSELAER	0.09
WEC	WEC	0.35

17.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
2156373	239070	02RICHLD	ATSI	238521	02NAOMI	ATSI	1	ATSI-P2-3-TE-138-009	breaker	194.0	100.49	116.52	DC	31.09

Bus #	Bus	MW Impact
239064	02RICHG1	0.46
239065	02RICHG2&3	0.91
239067	02RICHG4	4.97
239068	02RICHG5	4.97
239069	02RICHG6	4.97
247567	V2-006 C	2.61
247961	V2-006 E	17.49
926811	AC1-167 C O1	1.99
926812	AC1-167 E O1	0.97
926941	AC1-181	0.21
934901	AD1-119 C O1	1.01
934902	AD1-119 E O1	1.64
940841	AE2-072 C	18.65
940842	AE2-072 E	12.44
943181	AE2-322 C	2.39
943182	AE2-322 E	1.17
CARR	CARR	0.12
CBM-S1	CBM-S1	0.99
CBM-S2	CBM-S2	0.17
CBM-W2	CBM-W2	9.24
CIN	CIN	1.24
CPLE	CPLE	0.04
G-007	G-007	0.28
IPL	IPL	0.83
LGEE	LGEE	0.28
MEC	MEC	2.19
O-066	O-066	1.84
RENSSELAER	RENSSELAER	0.1
WEC	WEC	0.35

17.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC/D C	MW IMPACT
1391381	243080	05RILEY C	AEP	243083	05CAMPS S	AEP	1	AEP_P4_#6817_05E.LPS C 138_B	breaker	223.0	53.77	121.03	DC	150.0

Bus #	Bus	MW Impact
247567	V2-006 C	19.5
247961	V2-006 E	130.5
940841	AE2-072 C	90.0
940842	AE2-072 E	60.0

17.4 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
1391391	243083	05CAMPSS	AEP	242989	05E LIMA	AEP	1	AEP_P4_#6817_05E.LPSC 138_B	breaker	223.0	53.14	120.4	DC	150.0

Bus #	Bus	MW Impact
247567	V2-006 C	19.5
247961	V2-006 E	130.5
940841	AE2-072 C	90.0
940842	AE2-072 E	60.0

17.5 Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC/D C	MW IMPACT
1391359	247000	05YELLWC	AEP	243080	05RILEYC	AEP	1	AEP_P4_#6817_05E.LPS C 138_B	breaker	223.0	56.82	124.08	DC	150.0

Bus #	Bus	MW Impact
247567	V2-006 C	19.5
247961	V2-006 E	130.5
940841	AE2-072 C	90.0
940842	AE2-072 E	60.0

17.6 Index 6

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
2156444	238569	02BEAVER	ATSI	239725	02LAKEAVE	ATSI	2	ATSI-P2-3-OEC-345-023	breaker	1742.0	105.92	106.42	DC	18.97

Bus #	Bus	MW Impact
238564	02BAYSG1	3.86
238670	02DVBSG1	246.72
238979	02NAPMUN	6.72
239171	02WLORG-2	4.45
239172	02WLORG-3	4.52
239173	02WLORG-4	4.53
239174	02WLORG-5	4.55
239293	02BS-PKR	0.34
240968	02BG2 GEN	1.4
240969	02BG4 G1	0.35
240973	02BG6 AMPO	5.46
240975	02PGE GEN	7.21
241902	Y1-069 GE	22.19
247548	V4-010 C	4.22
247567	V2-006 C	2.24
247940	U4-028 E	12.38
247941	U4-029 E	12.38
247947	V4-010 E	28.22
247961	V2-006 E	15.02
900041	V4-011	0.44
925751	AC1-051 C	0.88
925752	AC1-051 E	5.89
931951	AB1-107 1	55.01
931961	AB1-107 2	127.69
932051	AC2-015 C	6.11
932052	AC2-015 E	7.24
932791	AC2-103 C	14.44
932792	AC2-103 E	96.62
934251	AD1-052 C1	2.31
934261	AD1-052 C2	2.31
934461	AD1-070 C O1	5.41
934462	AD1-070 E O1	25.39
934761	AD1-103 C O1	24.27
934762	AD1-103 E O1	162.43
934891	AD1-118	14.45
937021	AD2-136 C O1	6.66
937022	AD2-136 E O1	44.58
937381	AD2-191 C	3.15
937382	AD2-191 E	21.05
938911	AE1-119	113.52

Bus #	Bus	MW Impact
939161	AE1-146 C O1	11.4
939162	AE1-146 E O1	5.42
940841	AE2-072 C	11.38
940842	AE2-072 E	7.59
941741	AE2-174 C	5.65
941742	AE2-174 E	26.46
941761	AE2-176 C	15.5
941762	AE2-176 E	10.33
941781	AE2-181 C	5.32
941782	AE2-181 E	3.55
942661	AE2-282 C O1	7.94
942662	AE2-282 E O1	4.18
CARR	CARR	1.57
CBM-S1	CBM-S1	11.05
CBM-S2	CBM-S2	2.24
CBM-W1	CBM-W1	49.77
CBM-W2	CBM-W2	99.7
CIN	CIN	12.26
CPLE	CPLE	0.54
G-007	G-007	3.48
IPL	IPL	7.85
LGEE	LGEE	2.97
MEC	MEC	24.54
MECS	MECS	52.64
O-066	O-066	22.51
RENSSELAER	RENSSELAER	1.23
WEC	WEC	4.0
Z1-043	Z1-043	15.41

17.7 Index 7

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
2156994	238569	02BEAVER	ATSI	238607	02CARLIL	ATSI	1	ATSI-P7-1-OEC-345-001	tower	1243.0	105.77	106.31	DC	14.77

Bus #	Bus	MW Impact
238572	02BEAVGB	1.21
238670	02DVBSG1	194.55
238979	02NAPMUN	5.29
239171	02WLORG-2	3.49
239172	02WLORG-3	3.55
239173	02WLORG-4	3.56
239174	02WLORG-5	3.57
239175	02WLORG-6	1.83
240968	02BG2 GEN	1.11
240969	02BG4 G1	0.28
240973	02BG6 AMPO	4.32
240975	02PGE GEN	5.7
247548	V4-010 C	3.38
247567	V2-006 C	1.74
247940	U4-028 E	9.85
247941	U4-029 E	9.85
247947	V4-010 E	22.63
247961	V2-006 E	11.65
900041	V4-011	0.34
925751	AC1-051 C	0.7
925752	AC1-051 E	4.67
931951	AB1-107 1	43.58
931961	AB1-107 2	100.67
932051	AC2-015 C	4.85
932052	AC2-015 E	5.74
932791	AC2-103 C	11.36
932792	AC2-103 E	76.02
934251	AD1-052 C1	1.87
934261	AD1-052 C2	1.87
934461	AD1-070 C O1	4.26
934462	AD1-070 E O1	19.98
934761	AD1-103 C O1	19.1
934762	AD1-103 E O1	127.79
934891	AD1-118	11.39
937021	AD2-136 C O1	5.3
937022	AD2-136 E O1	35.46
937381	AD2-191 C	2.5
937382	AD2-191 E	16.74
938911	AE1-119	89.46
939161	AE1-146 C O1	8.94
939162	AE1-146 E O1	4.26

Bus #	Bus	MW Impact
940841	AE2-072 C	8.86
940842	AE2-072 E	5.91
941741	AE2-174 C	4.53
941742	AE2-174 E	21.22
941761	AE2-176 C	12.78
941762	AE2-176 E	8.52
941781	AE2-181 C	4.19
941782	AE2-181 E	2.79
942661	AE2-282 C O1	6.25
942662	AE2-282 E O1	3.29
950241	J419	8.28
953321	J799	15.58
953781	J833	8.28
CARR	CARR	1.08
CBM-S1	CBM-S1	7.8
CBM-S2	CBM-S2	1.34
CBM-W1	CBM-W1	37.97
CBM-W2	CBM-W2	72.04
CIN	CIN	8.97
CPLE	CPLE	0.27
G-007	G-007	2.64
IPL	IPL	5.74
LGEE	LGEE	2.13
MEC	MEC	18.1
MECS	MECS	41.13
O-066	O-066	17.07
RENSSELAER	RENSSELAER	0.86
WEC	WEC	2.98
Z1-043	Z1-043	11.45

17.8 Index 8

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
8667012	239070	02RICHLD	ATSI	239060	02RDGVL	ATSI	1	ATSI-P1-2-TE-138-001	single	179.0	101.84	112.35	DC	18.82

Bus #	Bus	MW Impact
239064	02RICHG1	0.47
239065	02RICHG2&3	0.92
239067	02RICHG4	5.01
239068	02RICHG5	5.01
239069	02RICHG6	5.01
247567	V2-006 C	2.64
926811	AC1-167 C O1	2.01
926941	AC1-181	0.21
934901	AD1-119 C O1	1.01
940841	AE2-072 C	18.82
943181	AE2-322 C	2.41
CARR	CARR	0.12
CBM-S1	CBM-S1	0.99
CBM-S2	CBM-S2	0.17
CBM-W2	CBM-W2	9.29
CIN	CIN	1.25
CPLE	CPLE	0.04
IPL	IPL	0.83
LGEE	LGEE	0.28
MEC	MEC	2.2
RENSSELAER	RENSSELAER	0.09
WEC	WEC	0.35

17.9 Index 9

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
2156966	239728	02BLKRVR	ATSI	239734	02USSTEEL	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	659.0	101.41	101.95	DC	7.85

Bus #	Bus	MW Impact
238571	02BEAVGA	1.2
238572	02BEAVGB	1.22
238670	02DVBSG1	89.84
238979	02NAPMUN	2.71
239174	02WLORG-5	1.43
239175	02WLORG-6	1.85
240968	02BG2 GEN	0.57
240969	02BG4 G1	0.14
240973	02BG6 AMPO	2.25
240975	02PGE GEN	2.96
241908	02LLF_W4-004	0.4
247548	V4-010 C	2.07
247940	U4-028 E	6.02
247941	U4-029 E	6.02
247947	V4-010 E	13.88
900041	V4-011	0.19
925751	AC1-051 C	0.47
925752	AC1-051 E	3.12
931951	AB1-107 1	22.49
931961	AB1-107 2	49.34
932051	AC2-015 C	3.24
932052	AC2-015 E	3.84
932791	AC2-103 C	4.81
932792	AC2-103 E	32.21
934251	AD1-052 C1	1.16
934261	AD1-052 C2	1.16
934461	AD1-070 C O1	2.33
934462	AD1-070 E O1	10.94
934761	AD1-103 C O1	8.09
934762	AD1-103 E O1	54.14
934891	AD1-118	5.63
937021	AD2-136 C O1	3.24
937022	AD2-136 E O1	21.67
937381	AD2-191 C	1.53
937382	AD2-191 E	10.23
938911	AE1-119	44.28
939161	AE1-146 C O1	4.9
939162	AE1-146 E O1	2.33
940841	AE2-072 C	4.71
940842	AE2-072 E	3.14

Bus #	Bus	MW Impact
941741	AE2-174 C	2.78
941742	AE2-174 E	13.01
941761	AE2-176 C	8.91
941762	AE2-176 E	5.94
941781	AE2-181 C	2.14
941782	AE2-181 E	1.43
942661	AE2-282 C O1	3.19
942662	AE2-282 E O1	1.68
942813	AE2-299 BAT	4.33
CARR	CARR	0.77
CBM-S1	CBM-S1	5.02
CBM-S2	CBM-S2	1.13
CBM-W1	CBM-W1	20.54
CBM-W2	CBM-W2	44.21
CIN	CIN	5.39
CPLE	CPLE	0.3
G-007	G-007	1.57
IPL	IPL	3.46
LGEE	LGEE	1.34
MEC	MEC	10.64
MECS	MECS	20.91
O-066	O-066	10.16
RENSSELAER	RENSSELAER	0.6
WEC	WEC	1.72

17.10 Index 10

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
2156942	239734	02USSTEEL	ATSI	238915	02LRN Q2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	593.0	108.28	108.88	DC	7.85

Bus #	Bus	MW Impact
238571	02BEAVGA	1.2
238572	02BEAVGB	1.22
238670	02DVBSG1	89.84
238979	02NAPMUN	2.71
239174	02WLORG-5	1.43
239175	02WLORG-6	1.85
240968	02BG2 GEN	0.57
240969	02BG4 G1	0.14
240973	02BG6 AMPO	2.25
240975	02PGE GEN	2.96
241908	02LLF_W4-004	0.4
247548	V4-010 C	2.07
247940	U4-028 E	6.02
247941	U4-029 E	6.02
247947	V4-010 E	13.88
900041	V4-011	0.19
925751	AC1-051 C	0.47
925752	AC1-051 E	3.12
931951	AB1-107 1	22.49
931961	AB1-107 2	49.34
932051	AC2-015 C	3.24
932052	AC2-015 E	3.84
932791	AC2-103 C	4.81
932792	AC2-103 E	32.21
934251	AD1-052 C1	1.16
934261	AD1-052 C2	1.16
934461	AD1-070 C O1	2.33
934462	AD1-070 E O1	10.94
934761	AD1-103 C O1	8.09
934762	AD1-103 E O1	54.14
934891	AD1-118	5.63
937021	AD2-136 C O1	3.24
937022	AD2-136 E O1	21.67
937381	AD2-191 C	1.53
937382	AD2-191 E	10.23
938911	AE1-119	44.28
939161	AE1-146 C O1	4.9
939162	AE1-146 E O1	2.33
940841	AE2-072 C	4.71
940842	AE2-072 E	3.14

Bus #	Bus	MW Impact
941741	AE2-174 C	2.78
941742	AE2-174 E	13.01
941761	AE2-176 C	8.91
941762	AE2-176 E	5.94
941781	AE2-181 C	2.14
941782	AE2-181 E	1.43
942661	AE2-282 C O1	3.19
942662	AE2-282 E O1	1.68
942813	AE2-299 BAT	4.33
CARR	CARR	0.77
CBM-S1	CBM-S1	5.02
CBM-S2	CBM-S2	1.13
CBM-W1	CBM-W1	20.54
CBM-W2	CBM-W2	44.21
CIN	CIN	5.39
CPLE	CPLE	0.3
G-007	G-007	1.57
IPL	IPL	3.46
LGEE	LGEE	1.34
MEC	MEC	10.64
MECS	MECS	20.91
O-066	O-066	10.16
RENSSELAER	RENSSELAER	0.6
WEC	WEC	1.72

Affected Systems

18 Affected Systems

18.1 LG&E

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

18.2 MISO

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

18.3 TVA

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

18.4 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

18.5 NYISO

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

19 Contingency Descriptions

Contingency Name	Contingency Definition
ATSI-P2-3-TE-138-006	CONTINGENCY 'ATSI-P2-3-TE-138-006' /* NAP MUNI 138 B1 BREAKER DISCONNECT BUS 238979 /* 02NAPMUN 138 DISCONNECT BUS 239061 /* 02RDGVL+ 138 DISCONNECT BUS 239060 /* 02RDGVL 138 END
ATSI-P2-3-TE-138-008	CONTINGENCY 'ATSI-P2-3-TE-138-008' /* NAP MUNI 138 B2 BREAKER DISCONNECT BUS 239061 /* 02RDGVL+ 138 DISCONNECT BUS 239060 /* 02RDGVL 138 END
ATSI-P2-3-TE-138-009	CONTINGENCY 'ATSI-P2-3-TE-138-009' /* STRYKER 13222 BREAKER DISCONNECT BUS 239127 /* 02STRYKE 138 REMOVE MACHINE 1 FROM BUS 239202 /* 02STRYCT 13 DISCONNECT BUS 239202 /* 02STRYCT 13 DISCONNECT BUS 239061 /* 02RDGVL+ 138 DISCONNECT BUS 239060 /* 02RDGVL 138 END
ATSI-P7-1-CEI-345-001-A	CONTINGENCY 'ATSI-P7-1-CEI-345-001-A' /* AVON-BEAVER #1 AND #2 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 238551 TO BUS 239725 CKT 1 /* 02AVON 345 02LAKEAVE 345 DISCONNECT BRANCH FROM BUS 238551 TO BUS 239725 CKT 2 /* 02AVON 345 02LAKEAVE 345 END
Base Case	
ATSI-P1-2-TE-138-001	CONTINGENCY 'ATSI-P1-2-TE-138-001' /* 3-TERMINAL LINE MIDWAY-RICHLAND- WAUSEON 138 DISCONNECT BRANCH FROM BUS 238960 TO BUS 238521 CKT 1 /* 02MIDW K 138 02NAOMI 138 DISCONNECT BRANCH FROM BUS 239070 TO BUS 238521 CKT 1 /* 02RICHLD 138 02NAOMI 138 DISCONNECT BRANCH FROM BUS 238521 TO BUS 239165 CKT 1 /* 02NAOMI 138 02WAUSEO 138 END
AEP_P4_#6817_05E.LPSC 138_B	CONTINGENCY 'AEP_P4_#6817_05E.LPSC 138_B' OPEN BRANCH FROM BUS 239269 TO BUS 940840 CKT 1 / 239269 02RICHLJ 138 940840 AE2-072 TAP 1 OPEN BRANCH FROM BUS 242993 TO BUS 245792 CKT 1 / 242993 05E.LPSC 138 245792 05E.LEIPSC 69.0 1 END
ATSI-P7-1-OEC-345-001	CONTINGENCY 'ATSI-P7-1-OEC-345-001' /* BEAVER-LAKAVE 345 CK 1 & 2 DISCONNECT BRANCH FROM BUS 238569 TO BUS 239725 CKT 1 /* 02BEAVER 345 02LAKEAVE 345 DISCONNECT BRANCH FROM BUS 238569 TO BUS 239725 CKT 2 /* 02BEAVER 345 02LAKEAVE 345 END

Contingency Name	Contingency Definition
ATSI-P2-3-OEC-345-023	CONTINGENCY 'ATSI-P2-3-OEC-345-023' /* BEAVER 345KV BRK B-121 DISCONNECT BRANCH FROM BUS 238569 TO BUS 239725 CKT 1 /* 02BEAVER 345 02LAKEAVE 345 DISCONNECT BRANCH FROM BUS 238569 TO BUS 238607 CKT 1 /* 02BEAVER 345 02CARLIL 345 END

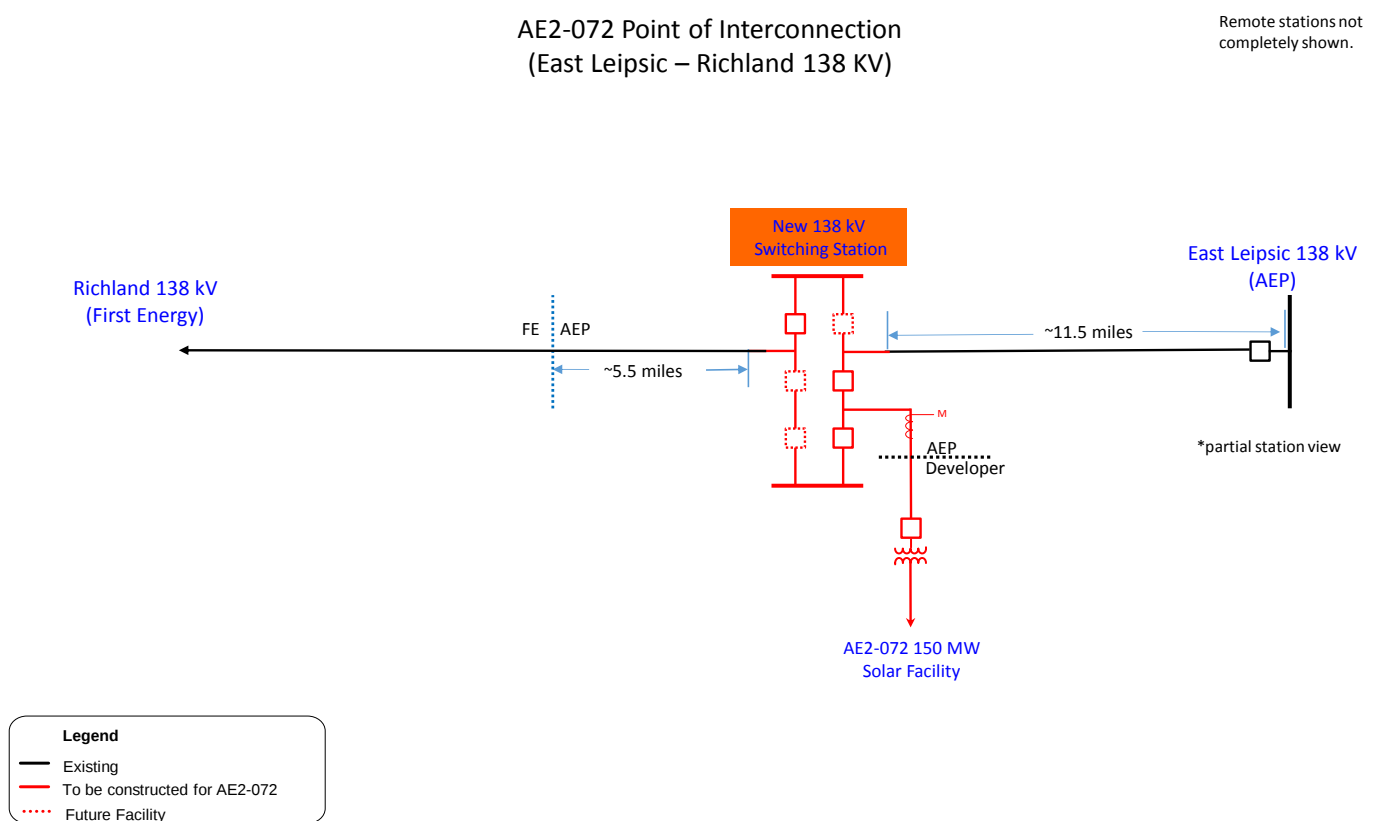
Short Circuit

20 Short Circuit

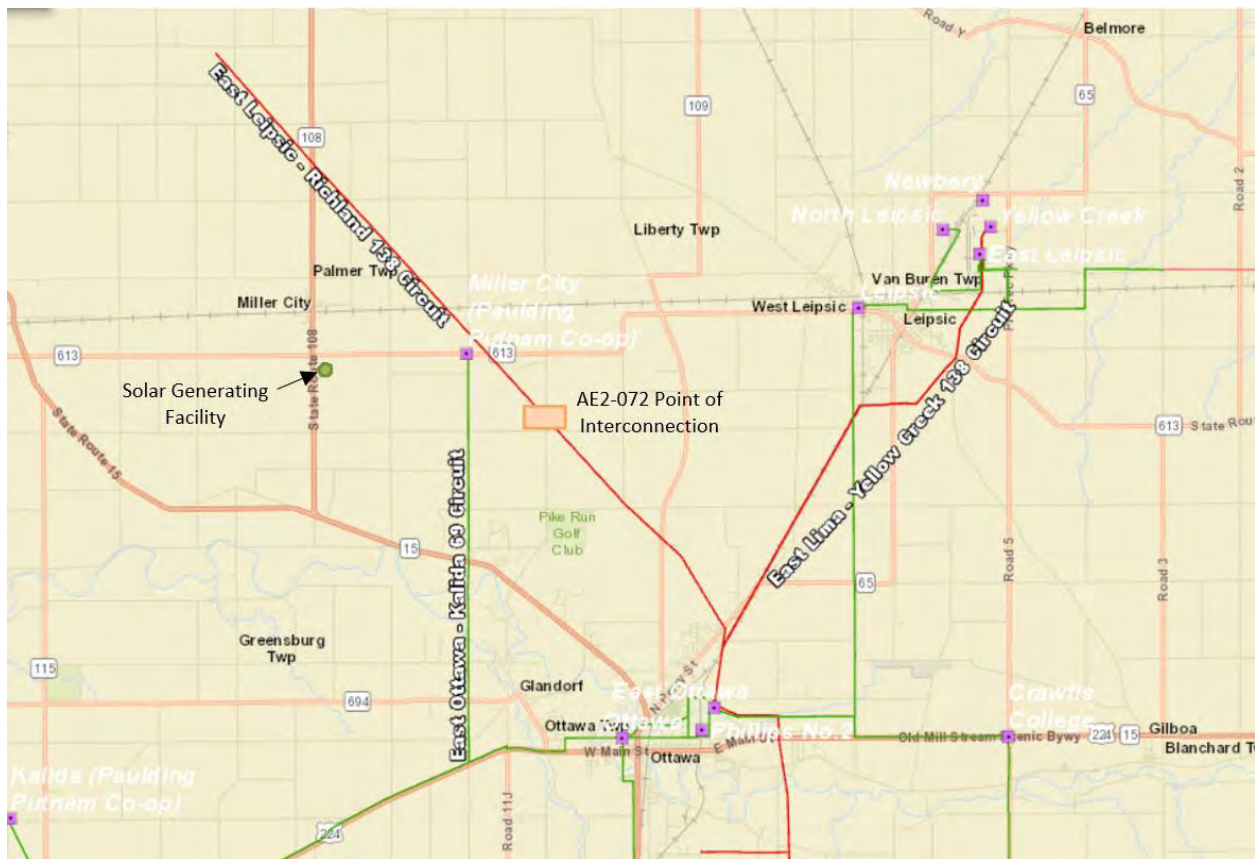
The following Breakers are over-duty

None

21 Figure 1: AE2-072 Point of Interconnection (East Leipsic – Richland 138 kV)
Single-Line Diagram



22 Figure 2: AE2-072 Point of Interconnection (East Leipsic – Richland 138 kV)





**Generation Interconnection
System Impact Study Report
for
Queue Project AE2-072
EAST LEIPSIC-RICHLAND 138 KV
90 MW Capacity / 150 MW Energy**

February, 2020

Table Of Contents

1	Preface	4
2	General.....	5
2.1	Point of Interconnection	6
2.2	Cost Summary.....	6
3	Transmission Owner Scope of Work	7
4	Attachment Facilities	7
5	Direct Connection Cost Estimate	7
6	Non-Direct Connection Cost Estimate	7
7	Incremental Capacity Transfer Rights (ICTRs).....	8
8	Schedule.....	8
9	Interconnection Customer Requirements	8
10	Revenue Metering and SCADA Requirements	9
10.1	PJM Requirements.....	9
10.2	AEP Requirements.....	9
11	Network Impacts.....	10
12	Generation Deliverability	12
13	Multiple Facility Contingency.....	12
14	Contribution to Previously Identified Overloads	12
15	Potential Congestion due to Local Energy Deliverability	12
16	Steady-State Voltage Requirements	13
17	Stability and Reactive Power Requirements for Low Voltage Ride Through.....	13
18	Light Load Analysis	13
19	System Reinforcements	14
20	Flow Gate Details	16
20.1	Index 1	17
20.2	Index 2	19
20.3	Index 3	20
20.4	Index 4	21
20.5	Index 5	22
20.6	Index 6	24

21 Affected Systems..... 29

21.1 LG&E.....29

21.2 MISO29

21.3 TVA.....29

21.4 Duke Energy Progress.....29

21.5 NYISO29

22 Contingency Descriptions 30

23 Short Circuit 32

24 Figure 1: AE2-072 Point of Interconnection (East Leipsic – Richland 138 kV) 33

25 Figure 2: AE2-072 Point of Interconnection (East Leipsic – Richland 138 kV) 34

1 Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

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 System Impact 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.

The Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

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

2 General

Aurora Solar, LLC has proposed to install PJM project # AE2-072, a Solar generating facility located in Putnam County, Ohio (See Figure 2). The installed facilities will have a total capability of 150 MW with 90 MW of this output being recognized by PJM as Capacity. The Point of Interconnection will be to the AEP owned section of the East Leipsic – Richland 138 kV line (See Figure 1).

The proposed in-service date for this project is December 31, 2021. This study does not imply AEP's commitment to this in-service date.

The objective of this System Impact Study is to determine budgetary cost estimates and approximate construction timelines for identified transmission facilities required to connect the proposed generating facilities to the AEP transmission system. These reinforcements include the Attachment Facilities, Local Upgrades, and Network Upgrades required for maintaining the reliability of the AEP transmission system.

Queue Number	AE2-072
Project Name	EAST LEIPSIC-RICHLAND 138 KV
Interconnection Customer	Aurora Solar LLC
State	Ohio
County	Putnam
Transmission Owner	AEP
MFO	150
MWE	150
MWC	90
Fuel	Solar
Base case Study Year	2022

2.1 Point of Interconnection

AE2-072 will interconnect with the AEP transmission system via a new station cut into the AEP owned section of East Leipsic – Richland 138 kV line.

To accommodate the interconnection on the AEP owned section of the East Leipsic – Richland 138 kV line, a new three (3) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus will be constructed (see Figure 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

2.2 Cost Summary

The AE2-072 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$750,000
Direct Connection Network Upgrade	\$6,000,000
Non Direct Connection Network Upgrades	\$1,250,000*
Allocation for New System Upgrades	\$0
Contribution for Previously Identified Upgrades	\$2,324,000
Total Costs	\$10,324,000

*Note: The Richland remote end estimate will have to be provided by ATSI/FE.

The estimates provided in this report are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements. In addition, Stability analysis will be completed during the Facilities Study stage. It is possible that a need for additional upgrades could be identified by these studies.

3 Transmission Owner Scope of Work

4 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	Total Cost
138 kV Revenue Metering	\$250,000
Generator lead first span exiting the POI station, including the first structure outside the fence	\$500,000
Total Attachment Facility Costs	\$750,000

5 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
Construct a new three (3) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus. Installation of associated protection and control equipment, 138 kV line risers and SCADA will also be required.	\$6,000,000
Total Direct Connection Facility Costs	\$6,000,000

6 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
Upgrade line protection and controls at the East Leipsic 138 kV substation	\$250,000
East Leipsic – Richland 138 kV T-Line Cut In	\$1,000,000
Total Non-Direct Connection Facility Costs	\$1,250,000

Note: The Richland remote end estimate will have to be provided by ATSI/FE.

7 Incremental Capacity Transfer Rights (ICTRs)

None

8 Schedule

It is anticipated that the time between receipt of executed Agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would generally be between 24 to 36 months after signing Agreement execution.

9 Interconnection Customer Requirements

It is understood that Aurora Solar is responsible for all costs associated with this interconnection. The costs above are reimbursable to AEP. The cost of Aurora Solar's generating plant and the costs for the line connecting the generating plant to the East Leipsic – Richland 138 kV line are not included in this report; these are assumed to be Aurora Solar's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power 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.

Requirement from the PJM Open Access Transmission Tariff:

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.

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 AEP Requirements

The Interconnection Customer will be required to comply with all AEP Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx>

11 Network Impacts

The Queue Project AE2-072 was evaluated as a 150.0 MW (Capacity 90.0 MW) injection into a tap of the East Leipsic – Richland 138 kV line in the AEP area. Project AE2-072 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-072 was studied with a commercial probability of 1.00. Potential network impacts were as follows:

Summer Peak Load Flow

12 Generation Deliverability

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

None

13 Multiple Facility Contingency

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC/D C	MW IMPAC T
2156491	238654	02DAV-BE	345.0	ATSI	239289	02HAYES	345.0	ATSI	1	ATSI-P2-3-OEC-345-027	breaker	1878.0	99.23	100.0	AC	16.29
2156373	239070	02RICHL D	138.0	ATSI	238521	02NAOM I	138.0	ATSI	1	ATSI-P2-3-TE-138-009	breaker	194.0	85.54	101.06	AC	31.12

14 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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC/D C	MW IMPAC T
2156942	239734	02USSTEE L	138.0	ATSI	238915	02LRN Q2	138.0	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	593.0	100.54	101.71	AC	7.86
39035134	242936	05FOSTOR	345.0	AEP	242942	05SBERW I	345.0	AEP	1	ATSI-P7-1-TE-345-027A	tower	1409.0	102.67	103.56	AC	14.45

15 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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC/D C	MW IMPACT
8667324	238654	02DAV-BE	345.0	ATSI	239289	02HAYES	345.0	ATSI	1	ATSI-P1-2-SYS-345-807	operation	1878.0	99.22	100.0	AC	16.28
8667120	239060	02RDGVL	138.0	ATSI	239061	02RDGVL +	138.0	ATSI	1	ATSI-P1-2-TE-138-001	operation	194.0	87.55	103.6	AC	31.4
8667011	239070	02RICHL D	138.0	ATSI	239060	02RDGVL	138.0	ATSI	1	ATSI-P1-2-TE-138-001	operation	179.0	97.74	115.13	AC	31.4

16 Steady-State Voltage Requirements

(Summary of the VAR requirements based upon the results of the steady-state voltage studies)

To be evaluated during the Facilities Study Phase

17 Stability and Reactive Power Requirements for Low Voltage Ride Through

(Summary of the VAR requirements based upon the results of the dynamic studies)

To be evaluated during the Facilities Study Phase

18 Light Load Analysis

Light Load Studies (applicable to wind, coal, nuclear, and pumped storage projects).

Not required

19 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost	Cost Allocated to AE2-072	Upgrade Number																
39035134	6	05FOSTOR 345.0 kV - 05SBERWI 345.0 kV Ckt 1	Sag Study will be required on the 11.7 mile single circuit line between Fostoria Central and South Berwick. The sag study cost is expected to be 46,800. Time estimate is 6-12 months. New Ratings after sag study: S/N: 1409MVA S/E: 1868MVA. If a rebuild/reconductor is required, the cost estimate is: \$ 23.4 million. This constraint is driven by a prior queue. Per PJM cost allocation rules, AE2-072 does not presently receive cost allocation. Note 1: as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AE2-072 could receive cost allocation. Note 2: Although Queue Project AE2-072, Queue Project AE2-072 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AE2-072 comes into service prior to completion of the upgrade, Queue Project AE2-072 will need an interim study.	\$46,800	\$0	N6476																
2156373	2	02RICHLD 138.0 kV - 02NAOMI 138.0 kV Ckt 1	The stuck breaker contingency as listed and simulated will be invalid once PJM supplemental project S1697 is in-service (projected IS date is 5/25/20). The corrected stuck breaker contingency does not overload this line.	\$4.2 M	\$0	S1697																
2156942	5	02USSTEEL 138.0 kV - 02LRN Q2 138.0 kV Ckt 1	Build a new 138 kV line from Black River to Astor substation. Cost estimate \$20.1527 M. Time estimate 30 months. The cost allocation is as follows: <table><tr><th>Queue</th><th>MW contribution</th><th>Percentage of Cost</th><th>\$ cost (\$20.1527 M)</th></tr><tr><td>AE1-119</td><td>44.2</td><td>76.08%</td><td>15.3313</td></tr><tr><td>AE1-146</td><td>7.2</td><td>12.39%</td><td>2.4974</td></tr><tr><td>AE2-072</td><td>6.7</td><td>11.53%</td><td>2.3240</td></tr></table>	Queue	MW contribution	Percentage of Cost	\$ cost (\$20.1527 M)	AE1-119	44.2	76.08%	15.3313	AE1-146	7.2	12.39%	2.4974	AE2-072	6.7	11.53%	2.3240	\$20.1527 M	\$2.324 M	N6185
Queue	MW contribution	Percentage of Cost	\$ cost (\$20.1527 M)																			
AE1-119	44.2	76.08%	15.3313																			
AE1-146	7.2	12.39%	2.4974																			
AE2-072	6.7	11.53%	2.3240																			

ID	Index	Facility	Upgrade Description	Cost	Cost Allocated to AE2-072	Upgrade Number
2156491	1	02DAV-BE 345.0 kV - 02HAYES 345.0 kV Ckt 1	Reconductor the substation conductor at Davis Besse 345 kV and at Hayes 345 kV with 1590 ACSS bundled (2 conductors per phase). Reconductor the line drop at Hayes 345 kV with 1590 ACSS bundled (2 conductors per phase). Cost estimate \$270 K. Time estimate 6 months. New SE rating 1900 MVA. This constraint is driven by a prior queue for a different contingency. Per PJM cost allocation rules, AE2-072 does not contribute significantly enough to meet the PJM cost allocation thresholds and presently does not receive cost allocation. Note 1: as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AE2-072 could receive cost allocation. Note 2: Although Queue Project AE2-072, Queue Project AE2-072 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AE2-072 comes into service prior to completion of the upgrade, Queue Project AE2-072 will need an interim study.	\$270 K	\$0	N6184.1

20 Flow Gate Details

The following indices 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.

20.1 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
2156491	238654	02DAV-BE	ATSI	239289	02HAYES	ATSI	1	ATSI-P2-3-OEC-345-027	breaker	1878.0	99.23	100.0	AC	16.29

Bus #	Bus	MW Impact
238564	02BAYSG1	3.2687
238670	02DVBSG1 (Deativation : 05/31/20)	30.8372
238885	02LEMOG1	4.3269
238886	02LEMOG2	4.3269
238887	02LEMOG3	4.3269
238888	02LEMOG4	4.3269
238979	02NAPMUN	4.9590
239276	02COLLW 11	-2.3080
239293	02BS-PKR	0.2917
239297	02CPPW41	-2.5873
241902	Y1-069 GE	24.4876
247567	V2-006 C	1.6224
247961	V2-006 E	10.8573
900041	V4-011	0.2737
931951	AB1-107 1	43.1558
931961	AB1-107 2	129.6509
932791	AC2-103 C	12.5955
932792	AC2-103 E	84.3077
934461	AD1-070 C O1	3.2840
934462	AD1-070 E O1	15.4165
934761	AD1-103 C O1	21.1777
934762	AD1-103 E O1	141.7275
934891	AD1-118	14.2940
936601	AD2-075	10.5884
938911	AE1-119	112.3100
939161	AE1-146 C O1	7.1192
939162	AE1-146 E O1	3.3246
940841	AE2-072 C	8.3071
940842	AE2-072 E	5.5381
941781	AE2-181 C	4.6872
941782	AE2-181 E	3.1248
942661	AE2-282 C	6.9990
942662	AE2-282 E	3.6828
950031	J301 C	1.7194
950032	J301 E	6.8777
950041	J308 C	5.3175
950042	J308 E	21.2699
950241	J419	10.2070
950942	J325 E	0.3408
950951	J327 C	2.5557
950952	J327 E	7.6671

Bus #	Bus	MW Impact
951011	J340 C	1.7034
951012	J340 E	5.1102
951051	J354 C	0.8852
951052	J354 E	2.6557
952312	J646 E	0.1469
952971	J793	107.6535
953321	J799	19.2818
953781	J833	10.2070
953811	J839	8.9050
954111	J875	13.1505
965151	J996	7.7240
965591	J1046	5.8025
965691	J1056 C	3.2791
965692	J1056 E	17.7409
965751	J1062	23.2100
965801	J1068 C	3.1278
965802	J1068 E	16.9222
966721	J1173	7.2112
LGEE	LGEE	2.5625
CIN	CIN	10.7947
CPLE	CPLE	0.4518
IPL	IPL	6.8953
G-007	G-007	2.8801
CBM-W2	CBM-W2	87.7648
CBM-W1	CBM-W1	46.4705
MECS	MECS	50.8410
AB2-013	AB2-013	0.0000
WEC	WEC	3.5957
O-066	O-066	18.6219
CBM-S2	CBM-S2	1.8876
CARR	CARR	1.2605
ROWAN /* 35% REVERSE 4479078	ROWAN /* 35% REVERSE 4479078	0.0000
CBM-S1	CBM-S1	9.5827
MEC	MEC	21.9034
Z1-043	Z1-043	0.0000
CHOCTAW /* 35% REVERSE 4566958 4511400	CHOCTAW /* 35% REVERSE 4566958 4511400	0.0000
RENSSELAER	RENSSELAER	0.9929
AE1-042	AE1-042	0.0000

20.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
2156373	239070	02RICHLD	ATSI	238521	02NAOMI	ATSI	1	ATSI-P2-3-TE-138-009	breaker	194.0	85.54	101.06	AC	31.12

Bus #	Bus	MW Impact
239064	02RICHG1	0.5038
239065	02RICHG2&3	0.9938
239067	02RICHG4	5.4049
239068	02RICHG5	5.4049
239069	02RICHG6	5.4049
247567	V2-006 C	2.6179
247961	V2-006 E	17.5196
926811	AC1-167 C O1	1.7013
926812	AC1-167 E O1	0.8253
926941	AC1-181	0.2290
934901	AD1-119 C O1	0.8574
934902	AD1-119 E O1	1.3991
940841	AE2-072 C	18.6705
940842	AE2-072 E	12.4470
943181	AE2-322 C	2.0406
943182	AE2-322 E	0.9975
LGEE	LGEE	0.2915
CIN	CIN	1.2912
CPLE	CPLE	0.0483
IPL	IPL	0.8568
G-007	G-007	0.2636
CBM-W2	CBM-W2	9.7150
WEC	WEC	0.3651
O-066	O-066	1.7027
CBM-S2	CBM-S2	0.1984
CARR	CARR	0.1132
CBM-S1	CBM-S1	1.0497
MEC	MEC	2.2823
RENSSELAER	RENSSELAER	0.0892

20.3 Index 3

None

20.4 Index 4

None

20.5 Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
2156942	239734	02USSTEEL	ATSI	238915	02LRN Q2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	593.0	100.54	101.71	AC	7.86

Bus #	Bus	MW Impact
238571	02BEAVGA	1.2997
238572	02BEAVGB	1.3255
238979	02NAPMUN	2.3062
239174	02WLOG-5	1.5540
239175	02WLOG-6	2.0127
239276	02COLLW 11	-2.0407
239297	02CPPW41	-2.3543
241908	02LLF_W4-004	0.4373
247548	V4-010 C	1.7631
247551	U4-028 C	0.7649
247552	U4-029 C	0.7649
247940	U4-028 E	5.1188
247941	U4-029 E	5.1188
247947	V4-010 E	11.7995
900041	V4-011	0.1600
925751	AC1-051 C	0.3969
925752	AC1-051 E	2.6560
931951	AB1-107 1	19.1382
931961	AB1-107 2	41.9923
932051	AC2-015 C	2.7561
932052	AC2-015 E	3.2656
932791	AC2-103 C	4.0947
932792	AC2-103 E	27.4077
934251	AD1-052 C1	0.9826
934261	AD1-052 C2	0.9826
934461	AD1-070 C O1	1.9829
934462	AD1-070 E O1	9.3085
934761	AD1-103 C O1	6.8847
934762	AD1-103 E O1	46.0744
934891	AD1-118	4.7957
937021	AD2-136 C O1	2.7536
937022	AD2-136 E O1	18.4277
937381	AD2-191 C	1.3003
937382	AD2-191 E	8.7020
938911	AE1-119	37.6805
939161	AE1-146 C O1	4.1982
939162	AE1-146 E O1	1.9605
940841	AE2-072 C	4.0094
940842	AE2-072 E	2.6729
941741	AE2-174 C	2.3633

Bus #	Bus	MW Impact
941742	AE2-174 E	11.0637
941761	AE2-176 C	7.5595
941762	AE2-176 E	5.0396
941781	AE2-181 C	1.8203
941782	AE2-181 E	1.2135
942661	AE2-282 C	2.7180
942662	AE2-282 E	1.4302
942813	AE2-299 BAT	8.1520
LGEE	LGEE	1.3417
CIN	CIN	5.4096
CPLE	CPLE	0.3063
IPL	IPL	3.4713
G-007	G-007	1.5509
CBM-W2	CBM-W2	44.4247
CBM-W1	CBM-W1	20.5834
MECS	MECS	20.9370
AB2-013	AB2-013	0.0000
WEC	WEC	1.7243
O-066	O-066	10.0546
CBM-S2	CBM-S2	1.1431
CARR	CARR	0.7596
CBM-S1	CBM-S1	5.0457
MEC	MEC	10.6861
RENSSELAER	RENSSELAER	0.5973

20.6 Index 6

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
39035134	242936	05FOSTOR	AEP	242942	05SBERWI	AEP	1	ATSI-P7-1-TE-345-027A	tower	1409.0	102.67	103.56	AC	14.45

Bus #	Bus	MW Impact
238564	02BAYSG1	3.0359
238670	02DVBSG1 (Deactivation : 05/31/20)	15.8314
238885	02LEMOG1	3.6609
238886	02LEMOG2	3.6609
238887	02LEMOG3	3.6609
238888	02LEMOG4	3.6609
238979	02NAPMUN	4.4071
239293	02BS-PKR	0.2710
241902	Y1-069 GE	19.0556
247506	U2-041 C (Withdrawn : 12/05/2019)	1.8352
247549	V3-028 C	0.3576
247567	V2-006 C	1.4624
247908	05BLCK-1 E	5.2526
247909	05BLCK-2 E	5.2526
247910	05BLCK-3 E	5.3432
247911	05TIMB G E	5.3876
247919	U2-041 E (Withdrawn : 12/05/2019)	12.2816
247948	V3-028 E	0.5835
247959	V1-011 E	4.2521
247961	V2-006 E	9.7869
900041	V4-011	0.3147
925131	AB2-170 C O1	2.3246
925132	AB2-170 E O1	3.7927
926811	AC1-167 C O1	1.7139
926812	AC1-167 E O1	0.8314
926901	AC1-176 C	0.3390
926902	AC1-176 E	2.2790
931951	AB1-107 1	39.9511
931961	AB1-107 2	100.8909
932301	AC2-044 C	0.4302
932302	AC2-044 E	0.7019
934251	AD1-052 C1	0.7859
934261	AD1-052 C2	0.7859
934461	AD1-070 C O1	3.9508
934462	AD1-070 E O1	18.5467
934741	AD1-101 C O1	1.0504
934742	AD1-101 E O1	1.7142
934891	AD1-118	12.0939
934901	AD1-119 C O1	0.9454
934902	AD1-119 E O1	1.5427

Bus #	Bus	MW Impact
934981	AD1-130 C	5.4114
934982	AD1-130 E	2.5881
936601	AD2-075	7.2533
936671	AD2-086 C	6.4937
936672	AD2-086 E	4.3292
936721	AD2-091 C	2.7680
938681	AE1-090 C	1.0145
938682	AE1-090 E	1.3383
938761	AE1-102 C	0.8830
938762	AE1-102 E	0.5887
938911	AE1-119	95.0235
939161	AE1-146 C O1	8.2894
939162	AE1-146 E O1	3.8711
940031	AE1-245 C	0.9531
940032	AE1-245 E	6.3782
940841	AE2-072 C	7.3692
940842	AE2-072 E	4.9128
941781	AE2-181 C	3.4849
941782	AE2-181 E	2.3232
942041	AE2-216	2.5881
942661	AE2-282 C	5.2036
942662	AE2-282 E	2.7381
942801	AE2-298 C O1	1.4846
942802	AE2-298 E O1	0.9897
943012	AE2-324 BAT	3.8881
943181	AE2-322 C	2.0556
943182	AE2-322 E	1.0049
950031	J301 C	1.5891
950032	J301 E	6.3565
950041	J308 C	4.9111
950042	J308 E	19.6445
950121	J392	19.8637
950241	J419	9.6000
950311	G934 C	1.5408
950312	G934 E	6.1632
950351	J466	2.2983
950361	J469	0.1091
950791	J201 C	0.2792
950792	J201 E	1.1168
950871	J246 C	0.0920
950872	J246 E	0.3681
950942	J325 E	0.3149
950951	J327 C	2.3619
950952	J327 E	7.0857
951011	J340 C	1.5742
951012	J340 E	4.7226
951051	J354 C	0.8182
951052	J354 E	2.4545
951531	J533 C	2.2072
951532	J533 E	8.8288
951571	J538 C	2.1432
951572	J538 E	8.5728

Bus #	Bus	MW Impact
951941	J602 C	2.0879
951942	J602 E	11.2961
952201	J589 C	1.8489
952202	J589 E	10.0031
952312	J646 E	0.1355
952401	J752 C	1.1730
952402	J752 E	6.3460
952611	J717 C	1.9897
952612	J717 E	10.7647
952761	J728 C	1.8525
952762	J728 E	10.0223
952971	J793	99.3345
953071	J794 C	0.1198
953072	J794 E	0.6480
953271	J701 C	0.5678
953272	J701 E	3.0719
953291	J796	15.7119
953321	J799	18.0457
953361	J806	8.4200
953421	J841	46.3952
953771	J832	5.5650
953781	J833	9.6000
953811	J839	8.2220
953941	J857	6.5124
954111	J875	12.5235
965041	J984 C	1.6024
965042	J984 E	8.6696
965091	J989	5.8680
965151	J996	7.4536
965231	J1005	13.1680
965321	J1014 C	3.5580
965322	J1014 E	2.1348
965591	J1046	5.5195
965691	J1056 C	3.1141
965692	J1056 E	16.8479
965751	J1062	22.0780
965781	J1065 C	1.7151
965782	J1065 E	9.2789
965801	J1068 C	2.9216
965802	J1068 E	15.8064
965931	J1083	4.4513
965981	J1088	9.8775
965991	J1089	11.2948
966001	J1090	6.2046
966131	J1103	1.4856
966261	J1117	5.2160
966271	J1119	42.1920
966711	J1172	3.5460
966721	J1173	6.8776
966771	J1178	4.1333
LGEE	LGEE	0.6547
CIN	CIN	4.3855

Bus #	Bus	MW Impact
IPL	IPL	2.7421
G-007	G-007	1.3030
CBM-W2	CBM-W2	32.5640
CBM-W1	CBM-W1	30.5307
MECS	MECS	39.4450
AB2-013	AB2-013	0.0000
WEC	WEC	1.9052
O-066	O-066	8.3654
CARR	CARR	0.4572
CBM-S1	CBM-S1	2.3152
HAMLET	HAMLET	0.2162
MEC	MEC	10.5290
RENSSELAER	RENSSELAER	0.3617
CATAWBA	CATAWBA	0.0952

Affected Systems

21 Affected Systems

21.1 LG&E

None

21.2 MISO

MISO Impacts to be determined during the Facilities Study.

21.3 TVA

None

21.4 Duke Energy Progress

None

21.5 NYISO

None

22 Contingency Descriptions

Contingency Name	Contingency Definition
ATSI-P2-3-TE-138-009	CONTINGENCY 'ATSI-P2-3-TE-138-009' /* STRYKER 13222 BREAKER DISCONNECT BUS 239127 /* 02STRYKE 138 REMOVE MACHINE 1 FROM BUS 239202 /* 02STRYCT 13 DISCONNECT BUS 239202 /* 02STRYCT 13 DISCONNECT BUS 239061 /* 02RDGVL+ 138 DISCONNECT BUS 239060 /* 02RDGVL 138 END
239060(02RDGVL)-239070(02RICHLD)_1	CONTINGENCY '239060(02RDGVL)-239070(02RICHLD)_1' OPEN BRANCH FROM BUS 239060 TO BUS 239070 CKT 1 END
ATSI-P7-1-CEI-345-001-A	CONTINGENCY 'ATSI-P7-1-CEI-345-001-A' /* AVON-BEAVER #1 AND #2 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 238551 TO BUS 239725 CKT 1 /* 02AVON 345 02LAKEAVE 345 DISCONNECT BRANCH FROM BUS 238551 TO BUS 239725 CKT 2 /* 02AVON 345 02LAKEAVE 345 END
ATSI-P7-1-TE-345-027A	CONTINGENCY 'ATSI-P7-1-TE-345-027A' /* DB - X1-027A & DB - HAYES 345 DISCONNECT BRANCH FROM BUS 238654 TO BUS 907060 CKT 1 /* 02DAV-BE 345 X1-027A_AT12 345 DISCONNECT BRANCH FROM BUS 238654 TO BUS 239289 CKT 1 /* 02DAV-BE 345 02HAYES 345 END
ATSI-P1-2-TE-138-001	CONTINGENCY 'ATSI-P1-2-TE-138-001' /* 3-TERMINAL LINE MIDWAY-RICHLAND- WAUSEON 138 DISCONNECT BRANCH FROM BUS 238960 TO BUS 238521 CKT 1 /* 02MIDW K 138 02NAOMI 138 DISCONNECT BRANCH FROM BUS 239070 TO BUS 238521 CKT 1 /* 02RICHLD 138 02NAOMI 138 DISCONNECT BRANCH FROM BUS 238521 TO BUS 239165 CKT 1 /* 02NAOMI 138 02WAUSEO 138 END
ATSI-P2-3-OEC-345-027	CONTINGENCY 'ATSI-P2-3-OEC-345-027' /* BEAVER 345KV BRK B-185 DISCONNECT BRANCH FROM BUS 238569 TO BUS 907060 CKT 1 /* 02BEAVER 345 X1-027A TAP 345 DISCONNECT BRANCH FROM BUS 238569 TO BUS 238570 CKT 2 /* 02BEAVER 345 02BEAVER 138 END
ATSI-P1-2-SYS-345-807	CONTINGENCY 'ATSI-P1-2-SYS-345-807' /* LINE X1-027A TAP TO 02BEAVER 345 CK 1 DISCONNECT BRANCH FROM BUS 907060 TO BUS 238569 CKT 1 /* X1-027A TAP 345 02BEAVER 345 END
ATSI-P7-1-TE-345-029A	CONTINGENCY 'ATSI-P7-1-TE-345-029A' /* X1-027A - BEAVER & BEAVER - HAYES 345 DISCONNECT BRANCH FROM BUS 907060 TO BUS 238569 CKT 1 /* X1-027A_AT12 345 02BEAVER 345 DISCONNECT BRANCH FROM BUS 239289 TO BUS 238569 CKT 1 /* 02HAYES 345 02BEAVER 345 END

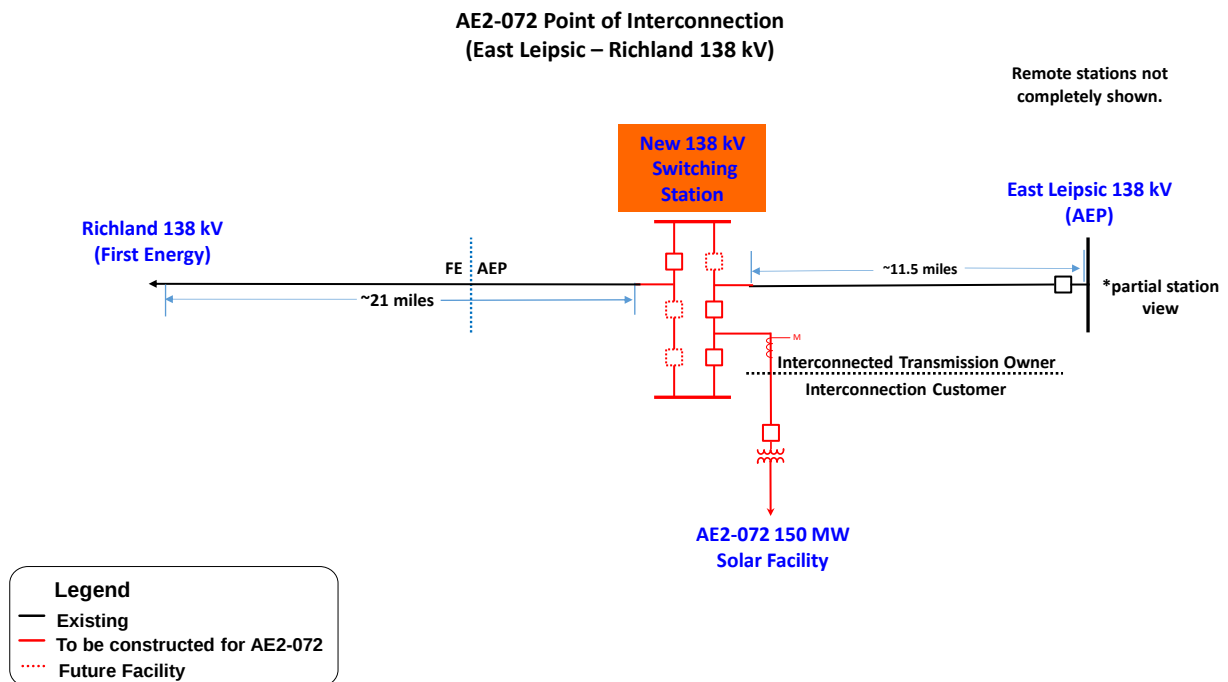
Short Circuit

23 Short Circuit

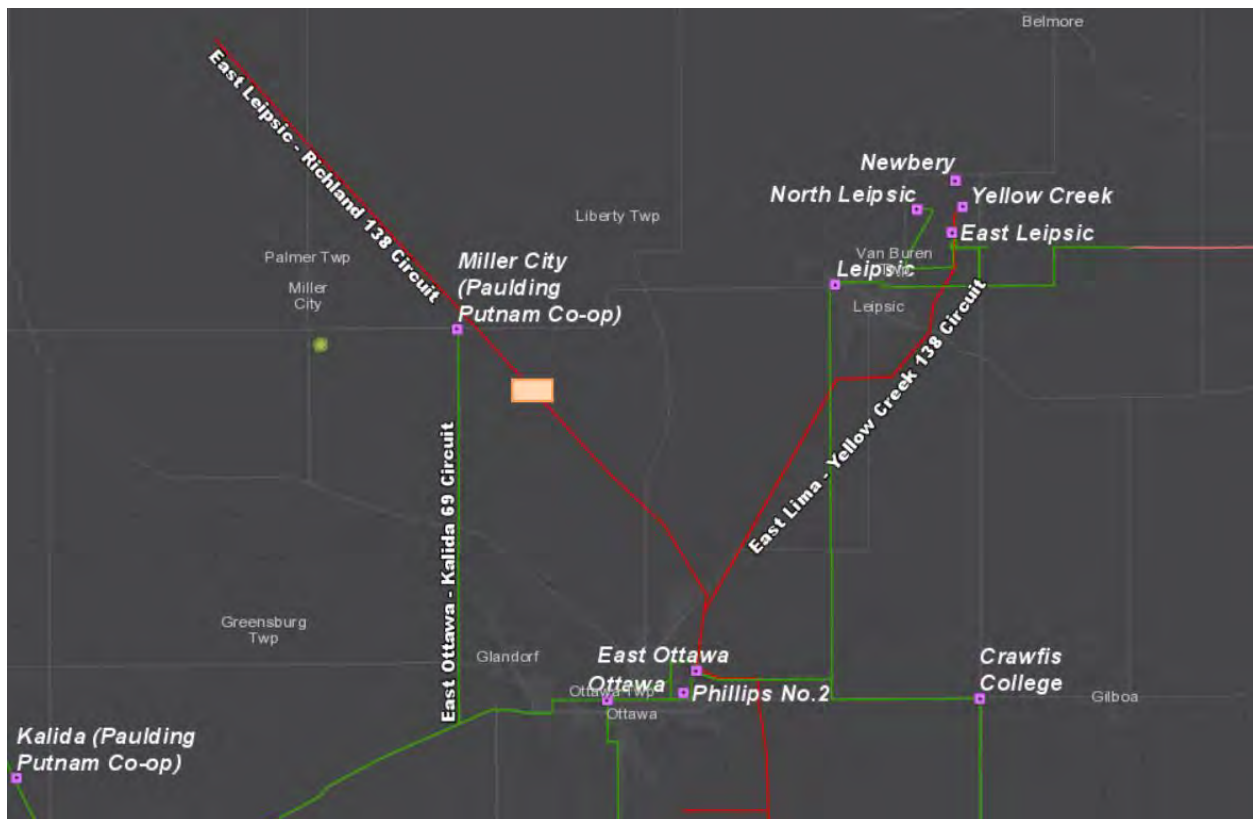
The following Breakers are over-duty

None

24 Figure 1: AE2-072 Point of Interconnection (East Leipsic – Richland 138 kV) Single-Line Diagram



25 Figure 2: AE2-072 Point of Interconnection (East Leipsic – Richland 138 kV)



This foregoing document was electronically filed with the Public Utilities

Commission of Ohio Docketing Information System on

10/7/2020 11:10:51 AM

in

Case No(s). 20-1084-EL-BGN

Summary: Application Exhibit N - PJM Interconnection Studies electronically filed by Teresa Orahod on behalf of Dylan F. Borchers