

# Clearview Solar I, LLC

Clearview Solar

Exhibit E

System Impact Reports

**Case No. 20-1362-EL-BGN**



**Generation Interconnection  
System Impact Study Report  
for  
Queue Project AF1-078  
EAST SIDNEY-QUINCY 138 KV  
30.4 MW Capacity / 80 MW Energy**

August 2020

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## 1 Introduction

This System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 205, as well as the System Impact Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Dayton

## 2 Preface

The intent of the 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 an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, 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 System 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.

### 3 General

The Interconnection Customer (IC) has proposed an uprate to a planned/existing Solar generating facility located at 40.266347 latitude and -84.009411 longitude in Champaign County Ohio. This project is an increase to the Interconnection Customer's AE2-206 project, which will share the same point of interconnection. The AF1-078 queue position is a 45 MW uprate (18.9 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 144 MW with 60.48 MW of this output being recognized by PJM as Capacity.

The proposed in-service date for this uprate project is November 30, 2021. This study does not imply a TO 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 ITO transmission system. These reinforcements include the Attachment Facilities, Local Upgrades, and Network Upgrades required for maintaining the reliability of the ITO transmission system.

<b>Queue Number</b>	<b>AF1-078</b>
<b>Project Name</b>	EAST SIDNEY-QUINCY 138 KV
<b>State</b>	Ohio
<b>County</b>	Champaign
<b>Transmission Owner</b>	Dayton
<b>MFO</b>	144
<b>MWE</b>	45
<b>MWC</b>	18.9
<b>Fuel</b>	Solar
<b>Basecase Study Year</b>	2023

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

## 4 Point of Interconnection

The AF1-078 “East Sidney-Quincy 138 kV” uprate project will interconnect behind the same Point of Interconnection (POI) as the AE2-206 “East Sidney-Quincy 138 kV”. The AE2-206 and AF1-078 projects will interconnect with The Dayton Power & Light Company transmission system via a new 138 kV three-breaker ring bus switchyard that will tap the East Sidney-Quincy 138 kV Line. The Point of Interconnection (POI) will be the 138kV takeoff structure leaving the new three breaker ring bus switchyard. Dayton will own the takeoff structure and all attachment hardware. The Interconnection Customer will own the generator lead line conductor terminating onto the structure. The new interconnection substation be located approximately 2.5 miles from Quincy Substation. This is the primary Point of Interconnection (POI) chosen by the IC. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection substation and the associated attachment facilities.

Attachment 1 shows a one-line diagram of the proposed primary direct connection of the (AF1-078) generation project to The Dayton Power & Light transmission system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing all of the facilities on its side of the POI including the attachment line.

## 5 Cost Summary

The AE2-206 “East Sidney-Quincy 138 kV” project is responsible for the interconnection facilities to the Dayton Power and Light system. AF1-078 “East Sidney-Quincy 138 kV” will share the same interconnection facilities.

Should the AE2-206 project elect not to move forward, the AF1-078 project would assume the complete responsibility of the interconnection facilities.

The AF1-078 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$15,000
Direct Connection Network Upgrade	\$0
Non Direct Connection Network Upgrades	\$30,000
Allocation for New System Upgrades*	\$1,500,000
Contribution to Previously Identified Upgrades*	\$0
<b>Total Costs</b>	<b>\$1,545,000</b>

\*As your project progresses through the study process and other projects modify their request or withdraw, then your cost allocation could change.

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Note 1: PJM Open Access Transmission Tariff (OATT) section 217.3A outline cost allocation rules. The rules are further clarified in PJM Manual 14A Attachment B. The allocation of costs for a network upgrade will start with the first Queue project to cause the need for the upgrade. Later queue projects will receive cost allocation contingent on their contribution to the violation and are allocated to the queues that have not closed less than 5 years following the execution of the first Interconnection Service Agreement which identifies the need for this upgrade.



## 6 Transmission Owner Scope of Work

The AF1-078 project will use the same interconnection facilities as the AE2-206 project, so the only Transmission Owner work associated with this project is to provide engineering oversight and make remote relay setting changes at the A2-206 interconnection substation and the Shelby and Logan substations.

Should the AE2-206 project elect not to move forward, the AF1-078 project would assume the responsibility of the interconnection facilities. This would include the installation of a new 138kV three breaker ring bus, any transmission line work, and any associated system upgrades.

### 6.1 Attachment Facilities

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

The metering may be classified as an Attachment Facility in future study reports. If separate metering for the AF1-078 project will be required, it will need to be installed on the generator side of the interconnection since there will be a single generator lead line for both the A2-206 and AF1-078 projects.

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
Engineering review and commissioning.	\$15,000
<b>Total Attachment Facility Costs</b>	<b>\$15,000</b>

## 6.2 Direct Connection Cost Estimate

The AE2-206 project will be responsible for the connection facilities, therefore, there is no Direct Connection scope of work required for this project.

Should the AE2-206 project elect not to move forward, the AF1-078 project would assume the responsibility of the interconnection facilities.

Description	Total Cost
None	\$0
<b>Total Attachment Facility Costs</b>	<b>\$0</b>

## 6.3 Non-Direct Connection Cost Estimate

The total Non-Direct Connection cost estimate for the AF1-078 project is approximately \$30,000.

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

Should the AE2-206 project elect not to move forward, the Non-Direct Connection costs for AF1-078 would increase to account for the remote end relay changes that were associated with AE2-206.

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

## 7 Incremental Capacity Transfer Rights (ICTRs)

None.

## 8 Schedule

Based on the extent of the Dayton primary Attachment Facilities and Non-Direct Connection work required to support the AF1-078 generation project, it is expected to take a minimum of **twelve (12) months** from the date of a fully executed Interconnection Construction Service Agreement to complete the installation. This includes the requirement for the IC to make a preliminary payment to Dayton which funds the Non-Direct Connection work and the first three months of engineering design that is related to the construction of the Attachment Facilities. It further assumes that the IC will provide all rights-of-way, permits, easements, etc. that will be needed. A further assumption is that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined Attachment Facilities and Non-Direct Connection work, and that all system outages will be allowed when requested.

## 9 Transmission Owner Analysis

Dayton analysis on their underlying system found no system overloads caused by AF1-078.

## 10 Interconnection Customer Requirements

### 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.

### System Protection

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

### Compliance Issues and Interconnection Customer Requirements

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

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

### Power Factor Requirements

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

## 11 Revenue Metering and SCADA Requirements

### 11.1 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.

### 11.2 Meteorological Data Reporting Requirements

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

- Back Panel temperature (Fahrenheit)
- Irradiance (Watts/meter<sup>2</sup>)
- Ambient air temperature (Fahrenheit) – (Accepted, not required)
- Wind speed (meters/second) – (Accepted, not required)
- Wind direction (decimal degrees from true north) – (Accepted, not required)

### 11.3 Dayton Requirements

The Interconnection Customer will be required to comply with all Dayton Revenue Metering Requirements for Generation Interconnection Customers as outlined in the link below. The Revenue Metering Requirements may be found within the Dayton Power & Light Co. "Requirements for the Connection of Facilities to the Dayton Power & Light Co. Transmission System" document located at the following link:

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

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

## 12 Summer Peak Analysis

The Queue Project AF1-078 was evaluated as a 45.0 MW (Capacity 18.9 MW) injection as an uprate to AE2-206 tapping the East Sidney to Quincy 138 kV line in the Dayton area. Project AF1-078 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-078 was studied with a commercial probability of 100.0 %. Potential network impacts were as follows:

### 12.1 Generation Deliverability

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

None

### 12.2 Multiple Facility Contingency

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC/D C	MW IMPACT
43412605	243453	05BEATY	345.0	AEP	243454	05BIXBY	345.0	AEP	1	AEP_P4_#3196_05BEATTY 345_302E	breaker	1203.0	99.8	100.05	AC	3.42

### 12.3 Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

None

### 12.4 Steady-State Voltage Requirements

None

### 12.5 Potential Congestion due to Local Energy Deliverability

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

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

None

## 12.6 System Reinforcements

ID	Idx	Facility	Upgrade Description	Cost	Cost Allocated to AF1-078	Upgrade Number
43412605	1	05BEATTY 345.0 kV - 05BIXBY 345.0 kV Ckt 1	Upgrade/Replace Three 345kV 1600A switches at Beatty station. Time Estimate: 12-18 months New expected SE rating to be 1409 MVA	\$1.5 M	\$1.5 M	N6741.1
			<b>Total Cost</b>	<b>\$1,500,000</b>	<b>\$1,500,000</b>	

Note : For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates \$0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently \$0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.



## 12.7 Flow Gate Details

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

## 12.7.1 Index 1

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
43412605	243453	05BEATTY	AEP	243454	05BIXBY	AEP	1	AEP_P4_#3196_05BEATTY 345_302E	breaker	1203.0	99.8	100.05	AC	3.42

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
250164	08BKJDB1	0.1469	Adder	0.17
250165	08BKJDB2	0.1469	Adder	0.17
251827	WILLYESP	0.4712	Adder	0.55
251828	CLNTESP1	0.4769	Adder	0.56
251829	CLNTESP2	0.3179	Adder	0.37
253110	09ADKINS	38.2293	50/50	38.2293
253261	09MON D	0.3295	50/50	0.3295
904722	V4-073 E	0.2008	Adder	0.24
913222	Y1-054 E	1.5361	Adder	1.81
918802	AA1-099 E	0.3179	Adder	0.37
923522	AB1-169 C OP	129.0580	Adder	151.83
925921	AC1-068 C	12.4613	50/50	12.4613
925922	AC1-068 E	5.8275	50/50	5.8275
925931	AC1-069 C	12.4613	50/50	12.4613
925932	AC1-069 E	5.8275	50/50	5.8275
925981	AC1-074 C O1	4.1045	Adder	4.83
925982	AC1-074 E O1	1.7591	Adder	2.07
926011	AC1-078 C O1	7.9028	Adder	9.3
926012	AC1-078 E O1	13.1713	Adder	15.5
926061	AC1-085 C	23.9993	50/50	23.9993
926062	AC1-085 E	39.1567	50/50	39.1567
926101	AC1-089 C O1 (Suspended)	4.2282	Adder	4.97
926102	AC1-089 E O1 (Suspended)	6.8987	Adder	8.12
926791	AC1-165 C	12.3147	50/50	12.3147
926792	AC1-165 E	5.9741	50/50	5.9741
926801	AC1-166 C	12.3147	50/50	12.3147
926802	AC1-166 E	5.9741	50/50	5.9741
927181	AC1-212 C	0.1259	Adder	0.15
927182	AC1-212 E	1.1923	Adder	1.4
930062	AB1-014 E	8.0743	Adder	9.5
932381	AC2-055 C	1.8563	Adder	2.18
932382	AC2-055 E	3.0287	Adder	3.56
932421	AC2-060 C	6.5819	Adder	7.74
932422	AC2-060 E	3.7023	Adder	4.36
932431	AC2-061 C	4.2970	Adder	5.06
932432	AC2-061 E	4.3562	Adder	5.12
932462	AC2-066 E	4.8446	Adder	5.7
932481	AC2-068 C	3.1055	Adder	3.65
932482	AC2-068 E	5.0860	Adder	5.98
932551	AC2-075 C	0.9748	Adder	1.15

932552	AC2-075 E	0.4911	Adder	0.58
932661	AC2-088 C O1	4.0545	Adder	4.77
932662	AC2-088 E O1	3.3365	Adder	3.93
932841	AC2-111 C O1	2.0631	Adder	2.43
932842	AC2-111 E O1	3.3661	Adder	3.96
934491	AD1-073 C	1.3575	Adder	1.6
934492	AD1-073 E	0.6993	Adder	0.82
934561	AD1-081 C	1.5806	Adder	1.86
934562	AD1-081 E	0.8142	Adder	0.96
935031	AD1-136 C	0.5702	Adder	0.67
935032	AD1-136 E	0.4857	Adder	0.57
935041	AD1-140 C O1	11.5451	Adder	13.58
935042	AD1-140 E O1	9.5446	Adder	11.23
936251	AD2-031 C O1	2.4102	Adder	2.84
936252	AD2-031 E O1	3.9325	Adder	4.63
936381	AD2-048 C	3.3765	Adder	3.97
936382	AD2-048 E	1.6846	Adder	1.98
938051	AE1-007 C	0.8906	Adder	1.05
938052	AE1-007 E	1.4531	Adder	1.71
938271	AE1-040 C O1	4.0682	Adder	4.79
938272	AE1-040 E O1	2.0470	Adder	2.41
938921	AE1-120	4.5841	Adder	5.39
939141	AE1-144 C O1	6.9404	Adder	8.17
939142	AE1-144 E O1	3.4442	Adder	4.05
940531	AE2-038 C O1	4.6298	Adder	5.45
940532	AE2-038 E O1	2.2933	Adder	2.7
941411	AE2-138 C	14.2422	Adder	16.76
941412	AE2-138 E	5.2677	Adder	6.2
941511	AE2-148 C	184.5141	50/50	184.5141
941512	AE2-148 E	83.4563	50/50	83.4563
941941	AE2-206 C O1	2.6857	Adder	3.16
941942	AE2-206 E O1	3.7088	Adder	4.36
941981	AE2-210 C O1	4.9075	Adder	5.77
941982	AE2-210 E O1	1.8459	Adder	2.17
942051	AE2-217 C	9.8217	Adder	11.55
942052	AE2-217 E	6.5478	Adder	7.7
942061	AE2-218 C	10.6381	Adder	12.52
942062	AE2-218 E	7.2259	Adder	8.5
942091	AE2-221 C	30.1482	50/50	30.1482
942092	AE2-221 E	20.0988	50/50	20.0988
942521	AE2-267 C O1	2.7190	Adder	3.2
942522	AE2-267 E O1	1.6806	Adder	1.98
942621	AE2-278 C	6.8019	Adder	8.0
942622	AE2-278 E	4.5371	Adder	5.34
942951	AE2-315	3.0438	Adder	3.58
942981	AE2-320 C O1	24.5195	50/50	24.5195
942982	AE2-320 E O1	12.1315	50/50	12.1315
943111	AE2-339 C	1.8479	Adder	2.17
943112	AE2-339 E	0.9102	Adder	1.07
943191	AE2-319 C O1	24.5195	50/50	24.5195
943192	AE2-319 E O1	12.1315	50/50	12.1315
943201	AE2-318 C	6.6299	Adder	7.8
943202	AE2-318 E	3.2360	Adder	3.81

943771	AF1-045	3.0880	Adder	3.63
943773	AF1-045 E	2.0620	Adder	2.43
943943	AF1-062 BAT	20.4660	Merchant Transmission	20.4660
944031	AF1-071 C	0.5158	Adder	0.61
944032	AF1-071 E	0.8415	Adder	0.99
944101	AF1-078 C	1.2208	Adder	1.44
944102	AF1-078 E	1.6858	Adder	1.98
944521	AF1-117 C	52.2505	50/50	52.2505
944522	AF1-117 E	16.0955	50/50	16.0955
944621	AF1-127 C O1	3.9619	Adder	4.66
944622	AF1-127 E O1	1.9514	Adder	2.3
944941	AF1-159	1.3954	Adder	1.64
945561	AF1-221 C O1	9.3053	Adder	10.95
945562	AF1-221 E O1	2.7970	Adder	3.29
945631	AF1-228 C	45.6212	50/50	45.6212
945632	AF1-228 E	30.4141	50/50	30.4141
945681	AF1-233 C	13.1671	Adder	15.49
945682	AF1-233 E	6.5049	Adder	7.65
945841	AF1-249 C	1.2139	Adder	1.43
945842	AF1-249 E	0.4509	Adder	0.53
945861	AF1-251 C	9.8343	Adder	11.57
945862	AF1-251 E	6.5562	Adder	7.71
945911	AF1-256 C	4.2155	Adder	4.96
945912	AF1-256 E	2.8103	Adder	3.31
946171	AF1-282 C	9.4734	50/50	9.4734
946172	AF1-282 E	6.3156	50/50	6.3156
946181	AF1-283 C	12.3154	50/50	12.3154
946182	AF1-283 E	8.2103	50/50	8.2103
946511	AF1-315 C O1	3.5762	Adder	4.21
946512	AF1-315 E O1	2.3841	Adder	2.8
WEC	WEC	0.7421	Confirmed LTF	0.7421
LGEE	LGEE	3.2353	Confirmed LTF	3.2353
CPL	CPL	0.2375	Confirmed LTF	0.2375
CBM-W2	CBM-W2	24.2915	Confirmed LTF	24.2915
NY	NY	0.9329	Confirmed LTF	0.9329
TVA	TVA	3.5490	Confirmed LTF	3.5490
O-066	O-066	11.0880	Confirmed LTF	11.0880
CBM-S2	CBM-S2	4.5720	Confirmed LTF	4.5720
CBM-S1	CBM-S1	26.5654	Confirmed LTF	26.5654
G-007	G-007	1.7098	Confirmed LTF	1.7098
MEC	MEC	4.0853	Confirmed LTF	4.0853
CBM-W1	CBM-W1	23.0059	Confirmed LTF	23.0059

## 12.8 Queue Dependencies

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

Queue Number	Project Name	Status
AA1-099	Clinton Co. 34.5kV	In Service
AB1-014	Hillcrest 138kV	Under Construction
AB1-169	Stuart 345kV	Engineering and Procurement
AC1-068	Atlanta 69kV I	Engineering and Procurement
AC1-069	Atlanta 69kV II	Engineering and Procurement
AC1-074	Jacksonville-Renaker 138kV I	Active
AC1-078	Beatty-London 138kV	Active
AC1-085	Stuart-Clinton 345kV	Engineering and Procurement
AC1-089	Hillsboro-Wildcat 138kV	Suspended
AC1-165	Atlanta 69kV III	Engineering and Procurement
AC1-166	Atlanta 69kV IV	Engineering and Procurement
AC1-212	Minster 69kV	Engineering and Procurement
AC2-055	Buckskin 69kV	Active
AC2-060	Buckskin 69kV	Active
AC2-061	Hillsboro-Clinton 138kV	Active
AC2-066	Hillcrest 138kV	Under Construction
AC2-068	Camden-Crystal II 69kV	Engineering and Procurement
AC2-075	Great Blue Heron Solar	Active
AC2-088	S. Bethel-Brown 69kV	Engineering and Procurement
AC2-111	College Corner 138kV	Active
AD1-073	Buckskin 69 kV	Active
AD1-081	Beatty-London 138 kV	Active
AD1-136	South Bethel-Brown 69 kV	Engineering and Procurement
AD1-140	Greene-Clark 138 kV	Active
AD2-031	Martinsville-Wilmington 69 kV	Active
AD2-048	Cynthia-Headquarters 69 kV	Active
AE1-007	Camden-Crystal III 69 kV	Active
AE1-040	Greenfield 69 kV	Active
AE1-120	Hillcrest 138 kV	Engineering and Procurement
AE1-144	Goddard-Plumville 138 kV	Active
AE2-038	Goddard-Plumville 138 kV II	Active
AE2-138	Avon-North Clark 345 kV	Active
AE2-148	Beatty-Greene 345 kV	Active
AE2-206	East Sidney-Quincy 138 kV	Active
AE2-210	Avon-North Clark 345 kV	Active
AE2-217	East Springfield-London 138 kV	Active
AE2-218	Eldean 138 kV	Active
AE2-221	Clinton-Stuart 345 kV	Active
AE2-267	Woodsdale 345 kV	Active

<b>AE2-278</b>	Urbana 138 kV	Active
<b>AE2-315</b>	Yankee Tap 69 kV	Active
<b>AE2-318</b>	Ford-Cedarville 138 kV	Active
<b>AE2-319</b>	Atlanta 69kV I	Active
<b>AE2-320</b>	Atlanta 69 kV II	Active
<b>AE2-339</b>	Avon 138 kV	Active
<b>AF1-045</b>	Cedarville-Ford 138 kV	Active
<b>AF1-062</b>	Jug Street 138 kV	Active
<b>AF1-071</b>	College Corner 138 kV	Active
<b>AF1-078</b>	East Sidney-Quincy 138 kV	Active
<b>AF1-117</b>	Atlanta-Stuart 345 kV	Active
<b>AF1-127</b>	Avon 345 kV	Active
<b>AF1-159</b>	Martinsville-Wilmington 69 kV	Active
<b>AF1-221</b>	College Corner-Drewersburg 138 kV	Active
<b>AF1-228</b>	Beatty-Greene 345 kV	Active
<b>AF1-233</b>	Flemingsburg 138 kV	Active
<b>AF1-249</b>	Nickel 12.47 kV	Active
<b>AF1-251</b>	Avon-North Clark 345 kV	Active
<b>AF1-256</b>	Flemingsburg-Spurlock 138 kV	Active
<b>AF1-282</b>	Stuart-Clinton 345 kV	Active
<b>AF1-283</b>	Stuart-Clinton 345 kV	Active
<b>AF1-315</b>	Cedarville-Ford 138 kV	Active
<b>V4-073</b>	Yankee 12.5kV	In Service
<b>Y1-054</b>	Rochelle 138kV	In Service

## 12.9 Contingency Descriptions

Contingency Name	Contingency Definition
<b>AEP_P4_#3196_05BEATTY 345_302E</b>	CONTINGENCY 'AEP_P4_#3196_05BEATTY 345_302E' OPEN BRANCH FROM BUS 243453 TO BUS 244022 CKT 1 / 243453 05BEATTY 345 244022 05COLE 345 1 OPEN BRANCH FROM BUS 243453 TO BUS 243468 CKT 4 / 243453 05BEATTY 345 243468 05BEATTX 138 4 END

### **13 Light Load Analysis**

Not Required.

### **14 Short Circuit Analysis**

The following Breakers are overdutied

None.

### **15 Stability and Reactive Power**

To be determined in the Facilities Study Phase

### **16 Affected Systems**

#### **16.1 MISO**

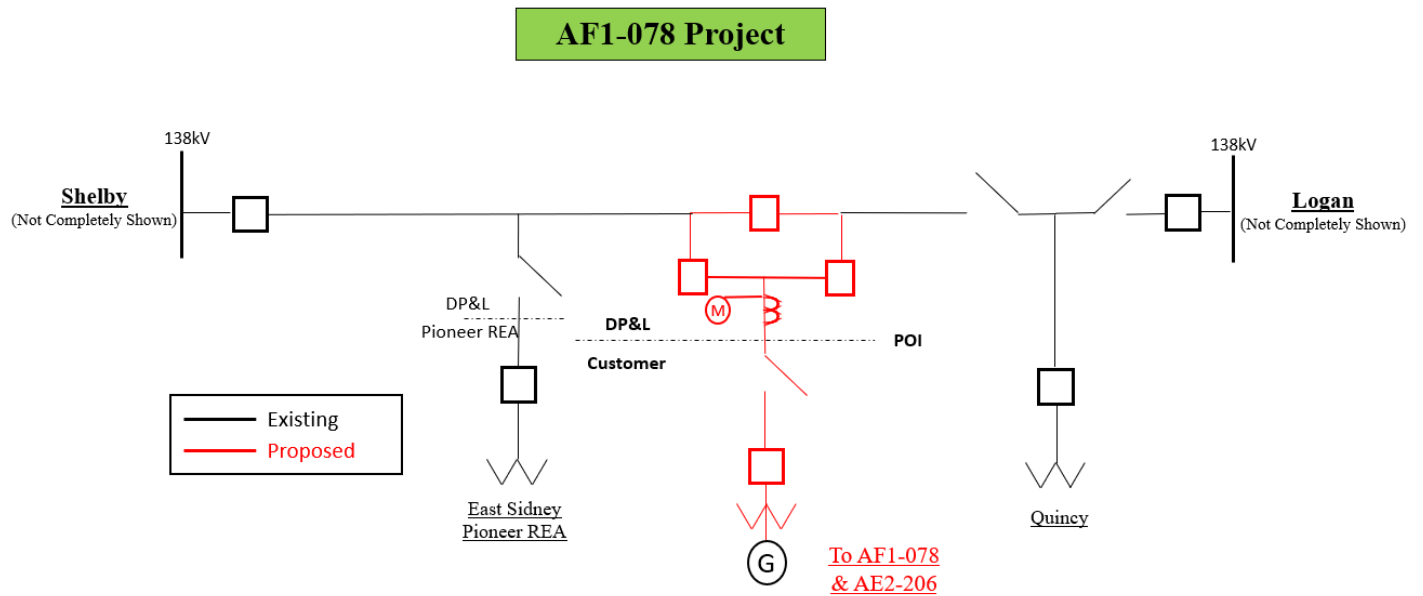
MISO Impacts to be determined during later study phases (as applicable).

#### **16.2 LG&E**

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



## 17 Attachment 1: One-Line Diagram



Note: AF1-078 will be responsible for all proposed facilities if the AE2-206 is removed from the interconnection queue or if AF1-078 proceeds with a construction schedule at an earlier stage than AE2-206.

## 18 Attachment 2: Site Location





**Generation Interconnection  
System Impact Study Report  
for  
Queue Project AE2-206  
EAST SIDNEY-QUINCY 138 KV  
41.58 MW Capacity / 99 MW Energy**

February 2020

## 1 Preface

The intent of the System Impact 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 reinforcement costs may be shared with other projects, and the allocations tables are included in this report, if applicable.

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

The 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.

## 2 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Champaign County, Ohio. The installed facilities will have a total capability of 99 MW with 41.58 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is November 30, 2021. This study does not imply a TO commitment to this in-service date.

<b>Queue Number</b>	<b>AE2-206</b>
<b>Project Name</b>	<b>EAST SIDNEY-QUINCY 138 KV</b>
<b>Interconnection Customer</b>	Clearview Solar I, LLC
<b>State</b>	Ohio
<b>County</b>	Champaign
<b>Transmission Owner</b>	Dayton
<b>MFO</b>	99
<b>MWE</b>	99
<b>MWC</b>	41.58
<b>Fuel</b>	Solar
<b>Basecase Study Year</b>	2022

### 2.1 Point of Interconnection

AE2-206 will interconnect with the Dayton Power and Light Company transmission system via a new 138 kV three-breaker ring bus switchyard that will tap the East Sidney-Quincy 138 kV Line. The Point of Interconnection (POI) will be the 138kV takeoff structure leaving the new three breaker ring bus switchyard. Dayton will own the takeoff structure and all attachment hardware. The Interconnection Customer will own the generator lead line conductor terminating onto the structure.

See Attachment 1 for a one line of the physical interconnection point.

## 2.2 Cost Summary

The AE2-206 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$0
Direct Connection Network Upgrade	\$3,700,000
Non Direct Connection Network Upgrades	\$150,000
<b>Total Costs</b>	<b>\$3,850,000</b>

In addition, the AE2-206 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	\$0

### 3 Attachment Facilities

There are no Attachment Facilities to be constructed by the Transmission Owner.

This report assumes that the Interconnection Customer will construct and own the attachment line from its generating facility into the proposed Point of Interconnection as depicted on the one-line diagram in Attachment 1. The IC will also be responsible for the fiber/OPGW that Dayton requires on the generator line for the communication assisted trip scheme.

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

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

Description	Total Cost
None	\$0
<b>Total Attachment Facility Costs</b>	<b>\$0</b>

#### 4 Direct Connection Cost Estimate

The direct connection cost estimate for the AE2-206 project is approximately \$3,700,000. The substation direct connection work for this project includes the construction of a 138 kV three breaker ring bus switchyard which will be tapped off the East Sidney-Quincy 138 kV line. There will also be 138 kV transmission line construction required to loop in and out of the new switchyard. The 138 kV generator lead line will be constructed by the developer and will be terminated onto the 138 kV takeoff structure leaving the new three breaker ring bus switchyard. The new 138 kV substation will be equipped with the necessary communication systems to facilitate remote supervisory control of the circuit breakers and status monitoring of facilities. Dayton will install the line relaying, communications, and interconnection metering to accommodate the interconnection of the AE2- 206 generator.

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
Install a new 138 kV three breaker ring bus switchyard to interconnect the AE2-206 project. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment, and associated facilities.	\$3,200,000
Transmission 138kV Line Tie-In work to loop in and out of the new AE2-206 Interconnection Switchyard	\$500,000
<b>Total Direct Connection Facility Costs</b>	<b>\$3,700,000</b>



## 5 Non-Direct Connection Cost Estimate

The substation non-direct connection cost estimate for the AE2-206 project is approximately \$150,000. Remote end relaying will need to be evaluated for settings changes and possible replacements at Shelby and Logan Substations to facilitate the interconnection of the new generation.

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

Description	Total Cost
Protection System changes at Shelby Substation	\$75,000
Protection System changes at Logan Substation	\$75,000
Total Non-Direct Connection Facility Costs	\$150,000

## 6 Schedule

Based on the extent of the Dayton primary Direct Connection and Non-Direct Connection upgrades required to support the AE2-206 generation project, it is expected to take a minimum of **18 months** from the date of a fully executed Interconnection Construction Service Agreement to complete the installation subject to market conditions and vendor lead times. This includes the requirement for the Interconnection Customer to make a preliminary payment to Dayton which funds the first three months of engineering design that is related to the construction of the Non-Direct Connection facilities. It assumes that there will be no environmental or permitting issues to implement the Non-Direct Connection upgrades for this project and that all system outages will be allowed when requested.

## 7 Transmission Owner Analysis

### Power Flow Analysis

PJM performed a power flow analysis of the transmission system using a 2022 summer peak load flow model and the results were verified by Dayton. Additionally, Dayton performed an analysis of its underlying transmission <100 kV system. No issues were identified.

### Short Circuit Analysis

PJM performed a short circuit analysis and the results were verified by Dayton. The connection of [QUEUE] project to the system does not result in any newly overdutied circuit breakers on the Dayton transmission system.

### Stability Analysis

PJM performed the dynamic stability analysis and the results were reviewed by Dayton. There were no stability concerns identified in PJM's study.

## **8 Interconnection Customer Requirements**

### **8.1 Dayton Interconnection Requirements**

#### **System Protection**

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

#### **Compliance Issues and Interconnection Customer Requirements**

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

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

#### **Power Factor Requirements**

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

#### **8.1 Dayton Notes**

The AE2-206 generator may be required to curtail for various N-1 contingencies to avoid N-1-1 loading issues. Revenue Metering and SCADA Requirements

#### **8.2 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.

### 8.3 Dayton Power and Light Company Requirements

The Interconnection Customer will be required to comply with all Dayton Revenue Metering Requirements for Generation Interconnection Customers as outlined in the link below. The Revenue Metering Requirements may be found within the Dayton Power & Light Co. “Requirements for the Connection of Facilities to the Dayton Power & Light Co. Transmission System” document located at the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-dayton/dayton-facilities-connectionrequirements.ashx>

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

## 9 Network Impacts

The Queue Project AE2-206 was evaluated as a 99.0 MW (Capacity 41.6 MW) injection into a tap of the East Sidney – Quincy 138 kV line in the Dayton area. Project AE2-206 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-206 was studied with a commercial probability of 1.00. Potential network impacts were as follows:

## Summer Peak Load Flow

## **10 Generation Deliverability**

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

None

## **11 Multiple Facility Contingency**

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

None

## **12 Contribution to Previously Identified Overloads**

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

None

## **13 Potential Congestion due to Local Energy Deliverability**

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

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

None

## **14 System Reinforcements**

None

## 15 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.

—  
None.



## Affected Systems

## **16 Affected Systems**

### **16.1 LG&E**

None.

### **16.2 MISO**

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

### **16.3 TVA**

None.

### **16.4 Duke Energy Progress**

None.

### **16.5 NYISO**

None.

## 17 Stability

Generator Interconnection Request AE2-206 is for a 99 MW Maximum Facility Output (MFO) solar generating facility, which consists of 48 SMA Sunny Central SC2200 solar inverters. The AE2-206 solar generating facility will be located in Champaign County, Ohio.

The AE2-206 solar generating facility will connect to the Dayton Power & Light Company (DP&L) transmission system via a new 138 kV three-breaker ring bus substation. The new substation will tap on the existing East Sidney – Quincy 138 kV circuit and be constructed adjacent to the circuit. The Point of Interconnection (POI) will be where the Interconnection Customer gen-tie line terminates at the new substation. The new substation is 3.35 miles from East Sidney substation.

This report describes a dynamic simulation analysis of AE2-206 as part of the overall system impact study. The load flow scenario for the analysis was based on the RTEP 2022 peak load case, modified to include applicable queue projects. AE2-206 has been dispatched online at maximum power output, with unity power factor and approximately 1.00 pu voltage at the generator terminals.

AE2-206 was tested for compliance with NERC, PJM, Transmission Owner, and other applicable criteria. 60 contingencies were studied, each with a 20 second simulation time period (with 1.0 second initial run prior to any events). The studied faults include:

- a) Steady state operation (Category P0);
- b) Three phase faults with normal clearing time on the intact network (Category P1);
- c) Single phase to ground faults with delayed clearing due to a stuck breaker (Category P4);
- d) Single phase faults placed at 80% of the line with delayed (Zone 2) clearing at line end remote from the fault due to primary communications/relay failure (Category P5);

For all 60 fault contingencies tested on the 2022 peak load case:

- a) AE2-206 was able to ride through the faults (except for faults where protective action trips a generator(s)).
- b) Post-contingency oscillations were positively damped with a damping margin of at least 3%.
- c) Following fault clearing, all bus voltages recover to a minimum of 0.7 per unit after 2.5 seconds (except where protective action isolates that bus).
- d) No transmission element trips, other than those either directly connected or designed to trip as a consequence of that fault.

Please also note that the project AE2-206 does not meet the 0.95 leading and lagging reactive power requirement at the high side of the facility main transformer. It requires additional 16.47 MVar capacitive reactive power.

## 18 Light Load Analysis

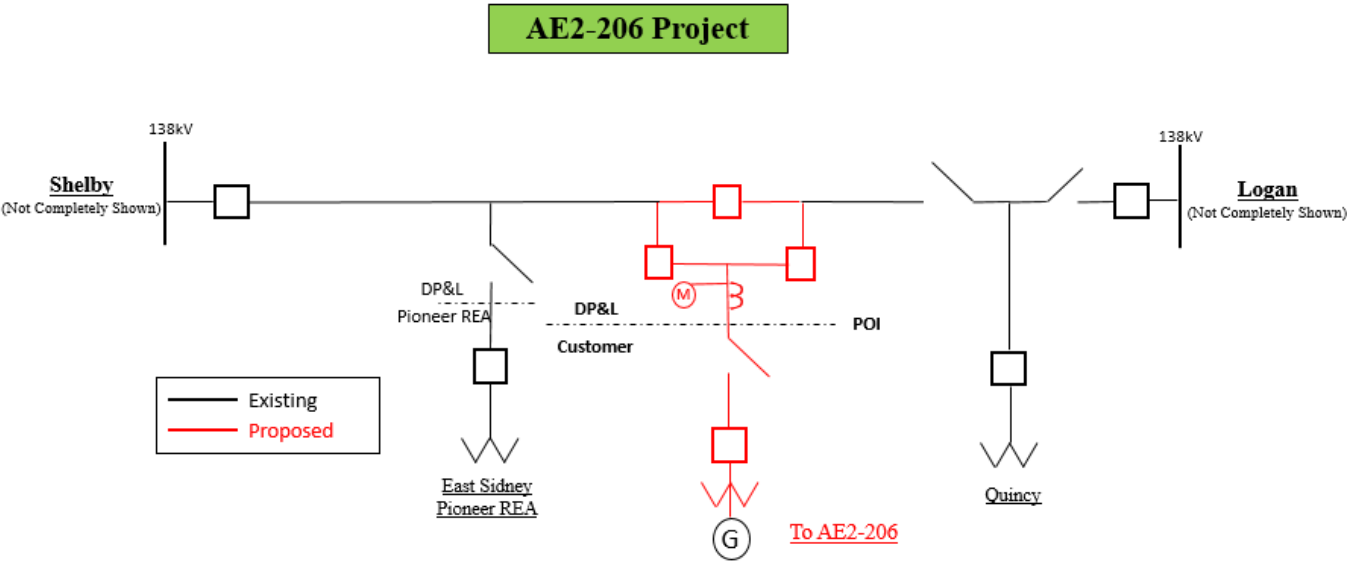
Not applicable.

## 19 Short Circuit

The following Breakers are over duty

None.

Attachment 1. : One Line Diagram



**This foregoing document was electronically filed with the Public Utilities**

**Commission of Ohio Docketing Information System on**

**12/17/2020 5:52:31 PM**

**in**

**Case No(s). 20-1362-EL-BGN**

Summary: Application - Part 7 of 31 Ex. E System Impact Study Reports electronically filed by Christine M.T. Pirik on behalf of Clearview Solar I, LLC