



**Generation Interconnection
Feasibility Study Report
for
Queue Project AE2-281
POWERTON-GOODINGS GROVE
7 MW Capacity / 50 MW Energy**

July, 2019

Table of Contents

- 1 Preface..... 4
- 2 General..... 6
 - 2.1 Primary 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..... 9
- 6 Non-Direct Connection Cost Estimate..... 9
- 7 Schedule..... 9
- 8 Transmission Owner Analysis..... 10
- 9 Interconnection Customer Requirements..... 11
 - 10 Revenue Metering and SCADA Requirements 12
 - 11 Network Impacts for Primary Point of Interconnection 13
 - 12 Generation Deliverability 15
 - 13 Multiple Facility Contingency 15
 - 14 Contribution to Previously Identified Overloads 15
 - 15 Potential Congestion due to Local Energy Deliverability..... 15
 - 16 System Reinforcements..... 16
 - 17 Flow Gate Details 17
 - 17.1 Index 1 18
 - 17.2 Index 2 20
- 18 Affected Systems 24
 - 18.1 LG&E..... 24
 - 18.2 MISO 24
 - 18.3 TVA..... 24
 - 18.4 Duke Energy Progress..... 24
 - 18.5 NYISO 24
- 19 Short Circuit..... 27
- 20 Secondary Point of Interconnection General 28
 - 20.1 Secondary Point of Interconnection..... 29
 - 20.2 Cost Summary..... 29

21 Network Impacts for Secondary Point of Interconnection.....30

22 Generation Deliverability32

23 Multiple Facility Contingency32

24 Contribution to Previously Identified Overloads32

25 Potential Congestion due to Local Energy Deliverability.....32

26 Flow Gate Details33

27 Short Circuit.....36

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 and inverters 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 or inverters 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

The Interconnection Customer (IC), has proposed a wind generating facility located in Woodford County, Illinois. This request is an addition to AE1-163 and the additional facilities will have a capability of 50 MW with 7 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is June 1, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AE2-281
Project Name	POWERTON-GOODINGS GROVE
State	Illinois
County	Woodford
Transmission Owner	ComEd
MFO	400
MWE	50
MWC	7
Fuel	Wind
Basecase Study Year	2022

2.1 Primary Point of Interconnection

Queue Position AE2-281, a 50 MW wind farm proposes to interconnect with the ComEd transmission system by tying to the 350 MW AE1-163 interconnected to 345kV Powerton- Nevada (proposed) transmission line 0303 as Primary POI for PJM queue position AE1-163.

2.2 Cost Summary

The AE2-281 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$200,000
Direct Connection Network Upgrade	\$none
Non Direct Connection Network Upgrades	\$none
Total Costs	\$200,000

In addition, the AE2-281 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	\$none

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

3 Transmission Owner Scope of Work

4 Attachment Facilities

To accommodate interconnection of AE2-281, the relaying, SCADA, Communication and metering between Freedom Wind Woodford and Dee Mac Road Substation would be reviewed and upgraded if needed. The preliminary cost estimate for the Attachment Facilities is estimated at \$ 200,000.

5 Direct Connection Cost Estimate

None

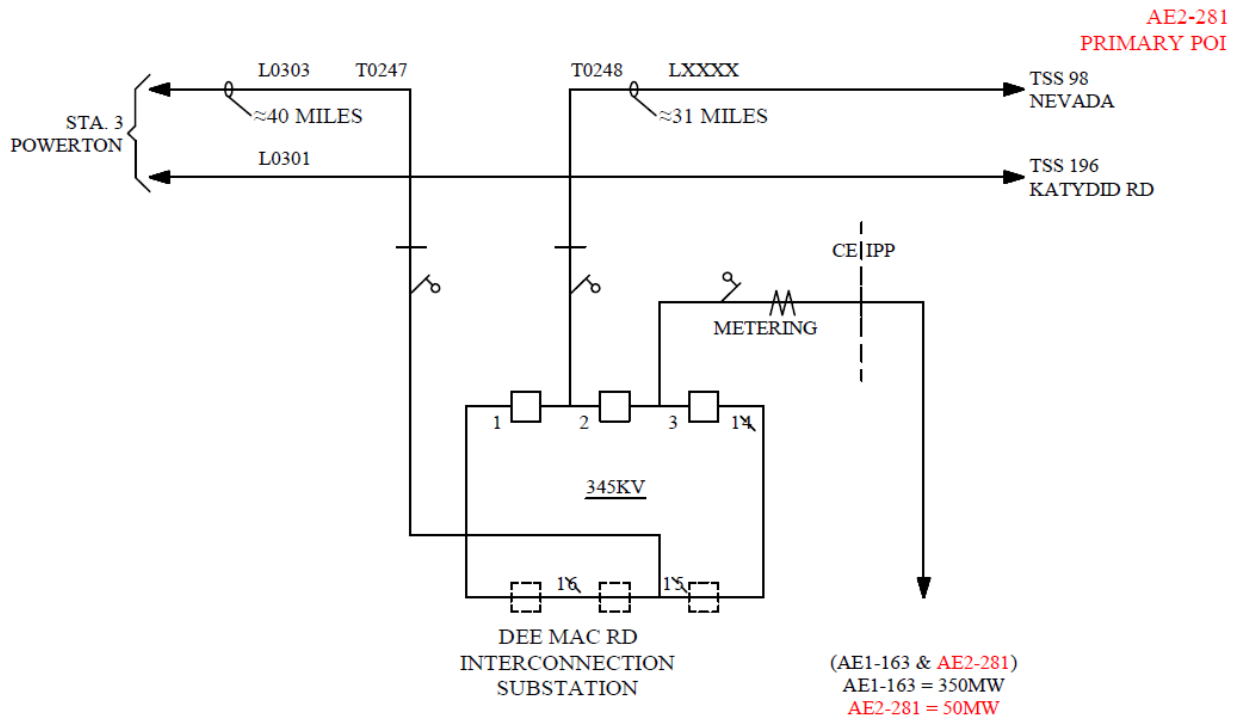
6 Non-Direct Connection Cost Estimate

None

7 Schedule

To be determined

8 Transmission Owner Analysis



9 Interconnection Customer Requirements

ComEd interconnection requirements can be found at <https://www.pjm.com/planning/design-engineering/to-tech-standards/private-comed.aspx>

To the extent that these Applicable Technical Requirements and Standards may conflict with the terms and conditions of the Tariff, the Tariff shall control.

ComEd distribution line drops to move customer cranes and heavy equipment is not part of PJM process. The customer should directly contact ComEd New Business Group to arrange for line drops, if needed.

10 Revenue Metering and SCADA 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 Network Impacts for Primary Point of Interconnection

The Queue Project AE2-281 was evaluated as a 50.0 MW (Capacity 7.0 MW) injection tapping the Powerton to Goodings Grove 345kV line in the ComEd area. Project AE2-281 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-281 was studied with a commercial probability of 0.53. 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)

None

13 Multiple Facility Contingency

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

None

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
8935731	918050	AA1-018 TAP	CE	270769	GOODINGS ;2R	CE	1	COMED_P7_345-L1202__B-S+_345-L1227__R-S-A	tower	1494.0	109.03	110.44	DC	21.06
8935794	936290	AD2-038 TAP	CE	918050	AA1-018 TAP	CE	1	COMED_P7_345-L1202__B-S+_345-L1227__R-S-A	tower	1494.0	103.23	104.64	DC	21.07

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
8935163	270855	POWERTON ;R	CE	349662	7TAZEWELL	AMIL	1	COMED_P1-2_345-L1202__B-S-A	operation	1479.0	149.29	150.85	DC	23.0

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
8935794	2	AD2-038 TAP 345.0 kV - AA1-018 TAP 345.0 kV Ckt 1	No Reinforcement Needed. Not a valid violation	\$0
8935731	1	AA1-018 TAP 345.0 kV - GOODINGS ;2R 345.0 kV Ckt 1	No Reinforcement Needed. Not a valid violation	\$0
			TOTAL COST	\$0

If “No Reinforcement Needed. Not a valid violation” was provided as the Upgrade Description for a facility in the System Reinforcements table then that facility met one of the following conditions:

- a. The loading on the facility at your queue position was less than 100%; therefore, the facility is not yet overloaded, but may be overloaded by end of the AE2 queue.
- b. The TO reviewed their ratings on the facility and determined that the current rating was greater than the rating in PJM’s model. This new rating was greater than the loading at your queue position making the violation invalid.
- c. The TO reviewed the contingency and determined that contingency was not valid; therefore the violation is invalid. Any contingency corrections will be assessed and corrected in the AE2 impact study phase.

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.

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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
8935731	918050	AA1-018 TAP	CE	270769	GOODINGS ;2R	CE	1	COMED_P7_345-L1202_B-S+_345-L1227_R-S-A	tower	1494.0	109.03	110.44	DC	21.06

Bus #	Bus	MW Impact
274677	POWERTON ;5U	19.72
274678	POWERTON ;6U	19.77
274879	MINONK ;1U	1.03
290021	O50 E	33.67
293644	O22 E1	6.49
293645	O22 E2	12.6
294401	BSHIL;1U E	4.59
294410	BSHIL;2U E	4.59
918051	AA1-018 C	1.5
918052	AA1-018 E	82.42
919621	AA2-039 C	1.12
919622	AA2-039 E	7.48
925581	AC1-033 C	0.75
925582	AC1-033 E	5.03
926841	AC1-171 C O1	0.64
926842	AC1-171 E O1	4.28
930741	AB1-122 1O1	102.44
930751	AB1-122 2O1	121.01
934051	AD1-031 C O1	1.52
934052	AD1-031 E O1	2.49
934101	AD1-039 1	10.04
934111	AD1-039 2	11.86
934871	AD1-116 C	4.8
934872	AD1-116 E	7.83
936291	AD2-038 C O1	8.21
936292	AD2-038 E O1	54.98
938851	AE1-113 C O1	15.24
938852	AE1-113 E O1	47.9
939321	AE1-163 C O1	20.64
939322	AE1-163 E O1	126.8
939631	AE1-193 C O1	3.72
939632	AE1-193 E O1	24.92
939681	AE1-198 C O1	11.06
939682	AE1-198 E O1	9.39
939861	AE1-222 1	113.13
939871	AE1-222 2	133.64
942421	AE2-255 C O1	5.26
942422	AE2-255 E O1	15.78
942651	AE2-281 C	2.95
942652	AE2-281 E	18.11

Bus #	Bus	MW Impact
954702	J844 E	20.15
990901	L-005 E	7.0
CARR	CARR	0.05
CBM-S1	CBM-S1	2.43
CBM-S2	CBM-S2	0.5
CBM-W1	CBM-W1	4.36
CBM-W2	CBM-W2	37.47
CIN	CIN	0.82
CPL	CPL	0.14
G-007	G-007	0.13
IPL	IPL	0.39
LGEE	LGEE	0.08
MEC	MEC	14.92
O-066	O-066	0.84
RENSSELAER	RENSSELAER	0.04
Z1-043	Z1-043	13.44

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
8935794	936290	AD2-038 TAP	CE	918050	AA1-018 TAP	CE	1	COMED_P7_345-L1202__B-S+_345-L1227__R-S-A	tower	1494.0	103.23	104.64	DC	21.07

Bus #	Bus	MW Impact
274677	POWERTON ;5U	19.73
274678	POWERTON ;6U	19.78
274879	MINONK ;1U	1.03
290021	O50 E	33.69
293644	O22 E1	6.5
293645	O22 E2	12.62
293771	O-035 E	3.09
294401	BSHIL;1U E	4.59
294410	BSHIL;2U E	4.59
916211	Z1-072 E	2.34
919621	AA2-039 C	1.12
919622	AA2-039 E	7.49
925581	AC1-033 C	0.75
925582	AC1-033 E	5.04
926841	AC1-171 C O1	0.64
926842	AC1-171 E O1	4.29
927201	AC1-214 C O1	0.99
927202	AC1-214 E O1	3.15
930741	AB1-122 1O1	102.49
930751	AB1-122 2O1	121.07
934051	AD1-031 C O1	1.53
934052	AD1-031 E O1	2.49
934101	AD1-039 1	10.04
934111	AD1-039 2	11.86
936291	AD2-038 C O1	8.22
936292	AD2-038 E O1	54.99
938851	AE1-113 C O1	15.24
938852	AE1-113 E O1	47.92
939321	AE1-163 C O1	20.65
939322	AE1-163 E O1	126.83
939631	AE1-193 C O1	3.73
939632	AE1-193 E O1	24.96
939681	AE1-198 C O1	11.07
939682	AE1-198 E O1	9.41
939861	AE1-222 1	113.19
939871	AE1-222 2	133.7
942421	AE2-255 C O1	5.26
942422	AE2-255 E O1	15.79
942651	AE2-281 C	2.95
942652	AE2-281 E	18.12

Bus #	Bus	MW Impact
951631	J456 C	1.31
951632	J456 E	7.1
953951	J859	8.12
954702	J844 E	20.15
990901	L-005 E	7.01
CARR	CARR	0.05
CBM-S1	CBM-S1	2.46
CBM-S2	CBM-S2	0.52
CBM-W1	CBM-W1	4.42
CBM-W2	CBM-W2	37.73
CIN	CIN	0.85
CPLE	CPLE	0.14
G-007	G-007	0.12
IPL	IPL	0.41
LGEE	LGEE	0.09
MEC	MEC	14.97
O-066	O-066	0.77
RENSSELAER	RENSSELAER	0.04
Z1-043	Z1-043	13.47

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).

Contingency Name	Contingency Definition
COMED_P7_345-L1202__B-S_+_345-L1227__R-S-A	CONTINGENCY 'COMED_P7_345-L1202__B-S_+_345-L1227__R-S-A' TRIP BRANCH FROM BUS 270716 TO BUS 930750 CKT 1 / DRESDEN ; B 345 AB1-122 TAP 345 TRIP BRANCH FROM BUS 930740 TO BUS 270717 CKT 1 / AB1-122 TAP 345 DRESDEN ; R 345 END
COMED_P1-2_345-L1202__B-S-A	CONTINGENCY 'COMED_P1-2_345-L1202__B-S-A' TRIP BRANCH FROM BUS 270716 TO BUS 930750 CKT 1 / DRESDEN ; B 345 AB1-122 TAP 345 END

Short Circuit

19 Short Circuit

No issues identified.

20 Secondary Point of Interconnection General

Queue Position AE2-281, a 50 MW wind farm proposes to interconnect with the ComEd transmission system by tying to the 350 MW to be interconnected to Powerton- Katydid Road 345kV transmission line 0301 as Secondary POI for PJM queue position AE1-163.

20.1 Secondary Point of Interconnection

Queue Position AE2-281, a 50 MW wind farm proposes to interconnect with the ComEd transmission system by tying to the 350 MW Freedom Wind Woodford to be interconnected to Powerton- Katydid Road 345kV transmission line 0301 as Secondary POI for PJM queue position AE1-163.

20.2 Cost Summary

Will be supplied in Impact Study should the Interconnection Customer elect this option.

21 Network Impacts for Secondary Point of Interconnection

The Queue Project AE2-281 was evaluated as a 50.0 MW (Capacity 7.0 MW) injection tapping the Powerton ;B to Katydid ;B 345 kV line in the ComEd area. Project AE2-281 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-281 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

22 Generation Deliverability

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

None

23 Multiple Facility Contingency

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

None

24 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

25 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
336932	270697	COLLINS ;R	CE	275168	COLLINS ;2M	CE	1	COMED_P1-2_765-L2315__-S	operation	1379.0	99.91	100.06	DC	4.47
336585	270855	POWERTON ;R	CE	349662	7TAZEWELL	AMIL	1	COMED_P1-2_345-L1202__B-S-A	operation	1479.0	148.28	149.76	DC	21.95

26 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.

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None.

Contingency Name	Contingency Definition
COMED_P1-2_765-L2315__-S	CONTINGENCY 'COMED_P1-2_765-L2315__-S' TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1 / COLLI; 765 PLANO; 765 END
COMED_P1-2_345-L1202__B-S-A	CONTINGENCY 'COMED_P1-2_345-L1202__B-S-A' TRIP BRANCH FROM BUS 270716 TO BUS 930750 CKT 1 / DRESDEN ; B 345 AB1-122 TAP 345 END

Short Circuit

27 Short Circuit

No issues identified