Generation Interconnection

System Impact Study Report

for

Queue Project AD2-038

“Powerton”

150 MW Energy /26.4 MW Capacity

Initial Release: January 2021

Revision 1: May 2022

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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 ComEd.

2 Revision History

Revision 0 – Issued January 2021

Revision 1 – Issued May 2022. The revised report updates the Summer Peak and Light Load Analysis to include retooled load flow analysis results.

3 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.

4 General

The Interconnection Customer (IC), has proposed a wind generating facility to be located in LaSalle County, Illinois. The installed facilities will have a total capability of 150 MW with 26.4 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project will need be determined during the Facilities Study phase.

Queue Number	AD2-038
Project Name	POWERTON
Interconnection Customer	Heartland Wind LLC
State	Illinois
County	LaSalle
Transmission Owner	ComEd
MFO	150
MWE	150
MWC	26.4
Fuel	Wind
Basecase Study Year	2021

5 Point of Interconnection

The Interconnection Customer AD2-038 proposes to interconnect the 150 MW windfarm to ComEd transmission system by looping in the Powerton Station 3 - Nevada TSS 98 345 kV line 0303 approximately 49 miles from Powerton Station 3.

6 Cost Summary

The AD2-038 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$1,000,000
Direct Connection Network Upgrade (ComEd build)	$23,500,000
Non Direct Connection Network Upgrades	$2,000,000
Total Costs	**$26,500,000**

In addition, the AD2-038 project may be responsible for a contribution to the following costs.

Description	Total Cost
Allocation toward System Network Upgrade Costs (Summer Peak and Light Load)	**$8,739,000**

Cost allocations for network upgrades are provided in Section 11.5 and 12.5. As the AD2-038 project progress through the study process, projects may withdraw, which may result in changes to your cost allocation.

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.

Note 2: 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.

7 Transmission Owner Scope of Work

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.

The IC AD2-038 generator lead will interconnect to a new 345kV Interconnection Substation. This interconnection would require one 345kV line MOD, a dead-end structure and revenue metering as shown in the one-line diagram.

Description	Total Cost
Installation of one 345kV line MOD, one dead-end structure and one set of revenue metering (see notes below on cost estimate)	$1,000,000
Total Attachment Facility Costs	**$1,000,000**

Direct Connection Cost Estimate

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

To accommodate interconnection of AD2-038, a new 345kV Interconnection Substation would be built looping in the 345kV line 0303 between Powerton Station 3 and the proposed Nevada TSS 98 (to be built under PJM queue AA1-018), to interconnect IC's generator lead line.

The scope of work includes installation of three 345kV circuit breakers in "breaker-and-a-half" bus configuration and tie in the Interconnection Substation to the 345kV line 0303 between Powerton Station 3 and the proposed Nevada TSS 98 (to be built under PJM queue AA1-018), as shown in the one-line diagram below.

The Interconnection Customer is responsible for constructing all the facilities on the Interconnection Customer side of the point of interconnection outside of the Interconnection Substation. It is assumed for the purposes of this report that the IC will obtain the site for the Interconnection Substation and right-of-way between the Interconnection Substation and the 345kV transmission line.

In the event, that the IC exercises the option to build the interconnecting substation, the IC will be required to construct all interconnection facilities that will be turned over to ComEd in accordance with ComEd published standards and PJM Tariff.

ComEd would design, engineer and construct the tie in of the Interconnection Substation to 345kV line 0303. There are two 345kV lines 1227 and 1202 between the proposed Interconnection Substation and line 0303. Accordingly, this tie-in would require raising these two 345kV lines for line crossing. The estimated cost for Direct Connection Network Upgrade is given below.

For Option to Build Direct Connection cost estimates:

Description	Total Cost
Installation of a new 345kV substation as described above	N/A
Transmission line tie in work (foundations, structures, conductors)	$3,500,000
ComEd oversight and testing	$1,500,000
Total Cost Estimate (see notes below on cost estimate)	**$5,000,000**

For ComEd building the interconnecting substation cost estimates:

Description	Total Cost
Installation of a new 345kV substation as described above	20,000,000
Transmission line tie in work (foundations, structures, conductors)	$3,500,000
Total Cost Estimate (see notes below on cost estimate)	**$23,500,000**

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.

The integration of the new 345kV Interconnection Substation would require relay/communications/SCADA

upgrades at the Powerton Station 3 and Nevada TSS 98. The ComEd cost is given below:

Description	Total Cost
Relay/communications/SCADA upgrades at Powerton Station 3	**$1,000,000**
Relay/communications/SCADA upgrades at Nevada TSS 98	$1,000,000
Total Non-Direct Connection Facility Costs	**$2,000,000**

Notes on Cost Estimate:

1) These estimates are Order-of-Magnitude estimates of the costs that ComEd would bill to the customer for this interconnection. These estimates are based on a one-line electrical diagram of the project and the information provided by the IC.

2) There were no site visits performed for these estimates. There may be costs related to specific site related issues that are not identified in these estimates. The site reviews will be performed during the Facilities Study or during detailed engineering.

3) These estimates are not a guarantee of the maximum amount payable by the IC and the actual costs of ComEd's work may differ significantly from these estimates. The IC will be responsible for paying actual costs of ComEd's work in accordance with Sections 212.1 and 217 of the PJM Open Access Transmission Tariff.

4) The IC is responsible for all engineering, procurement, testing and construction of all equipment on the IC's side of the POI.

5) These cost estimates do not include cost of acquiring right-of-way for the transmission line and purchasing any additional land, if needed, for the line terminations. The need and cost of acquiring property and associated legal costs will be investigated during Facilities Study for this project.

8 Schedule

ComEd would take approximately 24-months to construct the substation and transmission line work after the ISA / ICSA are signed. See Section 11.5 and 12.5 for Network Upgrade schedules.

9 Transmission Owner Analysis

See Section 6.

10 Interconnection Customer Requirements

The Interconnection Customer is responsible for all design and construction related activities on the Interconnection Customer's side of the Point of Interconnection.

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 ComEd Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

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.

12 Summer Peak Analysis

The Queue Project AD2-038 was evaluated as a 150.0 MW (Capacity 26.4 MW) injection at the tap of the Powerton Station 3 – Nevada 345 kV line in the ComEd area. Project AD2-038 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-038 was studied with a commercial probability of 100%. 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)

#	Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Ckt	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Flowgate Appendix
1	BUS	COMED_P2-2_116_GG-345R__2	CE - CE	GOODINGS ;4B-GOODINGS ;3B 345 kV line	270770	270766	1	AC	99.81	100.87		1802	22.27	
2	LFFB	COMED_P4_116-45-TR82___	CE - CE	GOODINGS ;4B-GOODINGS ;3B 345 kV line	270770	270766	1	AC	99.81	100.87		1802	22.27	

Notes:

Violation 1: ComEd SSTE rating is 2083 MVA (Not a violation)

Violation 2: ComEd SSTE rating is 2083 MVA (Not a violation)

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)

#	Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Ckt	Power Flow	Loading % Initial	Loading % Final	Rating Type	Rating MVA	MW Contribution	Flowgate Appendix
3	LFFB	AEP_P4_#2978_05DUMONT 765	MISO NIPS - AEP	17STILLWELL-05DUMONT 345 kV line	255113	243219	1	AC	109.25	110.52	ER	1409	20.96	1
4	LFFB	COMED_P4_116-45-L11614_	CE - CE	GOODINGS ;4B-GOODINGS ;3B 345 kV line	270770	270766	1	AC	104.29	105.35		1802	22.24	2

Notes:

Violation 3: AEP SE rating is 1409 MVA (Valid violation)

Violation 4: ComEd SSTE rating is 2083 MVA (Not a violation)

12.4 Potential Congestion due to Local Energy Deliverability

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

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

1. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 104.73% to 106.04% (AC power flow) of its normal rating (1409 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 21.46 MW to the thermal violation.

CONTINGENCY 'COMED_P1-2_695_B2'
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTO; 765 1
END

2. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 91.36% to 92.95% (AC power flow) of its emergency rating (1399 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 18.37 MW to the thermal violation.

CONTINGENCY 'COMED_P1-2_695_B2'
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTO; 765 1
END

3. (CE - CE) The AB1-122 TAP-DRESDEN ; R 345 kV line (from bus 930760 to bus 270717 ckt 1) loads from 104.76% to 106.21% (AC power flow) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1202__B-S-A'. This project contributes approximately 19.52 MW to the thermal violation.

CONTINGENCY 'COMED_P1-2_345-L1202__B-S-A'
TRIP BRANCH FROM BUS 270716 TO BUS 930770 CKT 1 / DRESDEN ; B 345 AB1-122 TAP 345
END

12.5 System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

Facility	Upgrade Description	Cost	Cost Allocation	Upgrade Number
17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1)	**AEP** AEP SE rating is 1409 MVA. AEP Reinforcement: **Project ID**: n4058 **Description**: Sag mitigation work will include the replacement of tower 20 with a custom steel pole, replacement of tower 24 with a custom H-frame and the removal of swing angle brackets on 2 structures. Cost estimate is $1.613M. New SE rating will be 1718 MVA limited by a Dumont wavetrap. **Type**: FAC **Cost:** $1,613,000 **Time Estimate**: 6-12 Months **Ratings**: 1718 MVA SE **Notes:** 1. Since the cost of the upgrade is less than $5M, based on PJM cost allocation criteria, AD2-038 currently does not receive cost allocation towards this upgrade. 2. As changes to the PJM queue process occur (such as prior queued projects withdrawing from the queue,	$1,613,000	$0	N4058

	reducing in size, etc.) AD2-038 could receive cost allocation. 3. Although Queue Project AD2-038 may not presently have cost responsibility for this upgrade, Queue Project AD2-134 may need this upgrade in-service to be deliverable to the PJM system. 4. If Queue Project AD2-038 comes into service prior to completion of the upgrade, Queue Project AD2-038 will need an interim study. **MISO** MISO Rating 1409/1779 MVA (SN/SE), no upgrade required.			
GOODINGS ;4B-GOODINGS ;3B 345 kV line (from bus 270770 to bus 270766 ckt 1)	**ComEd:** The applicable SSTE rating is 2083 MVA and is sufficient. No upgrade required.	$0	$0	N/A
	Total	**$1,613,000**	**$0**	

12.6 Summer Peak Appendices

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.

Appendix 1

(MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 109.25% to 110.52% (AC power flow) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 20.96 MW to the thermal violation.

CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
OPEN BRANCH FROM BUS 243206 TO BUS 243207 CKT 1 / 243206 05DUMONT 765 05GRNTWN
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTON ; 765 1
END

Bus Number	*Bus Name*	*Full Contribution*
932881	*AC2-115 1*	*2.77*
932891	*AC2-115 2*	*2.77*
932921	*AC2-116*	*0.97*
932931	*AC2-117*	*5.87*
933411	*AC2-154 C*	*3.06*
933412	*AC2-154 E*	*4.99*
933911	*AD1-013 C O1*	*2.14*
933912	*AD1-013 E O1*	*3.42*
933931	*AD1-016 C*	*1.08*
933932	*AD1-016 E*	*1.76*
934051	*AD1-031 C O1*	*3.32*
934052	*AD1-031 E O1*	*5.42*
934431	*AD1-067 C*	*0.15*
934432	*AD1-067 E*	*0.64*
934701	*AD1-098 C O1*	*8.01*
934702	*AD1-098 E O1*	*5.85*
934721	*AD1-100 C*	*22.64*
934722	*AD1-100 E*	*105.64*
934871	*AD1-116 C*	*1.1*
934872	*AD1-116 E*	*1.8*
934971	*AD1-129 C*	*1.05*
934972	*AD1-129 E*	*0.7*
935001	*AD1-133 C O1*	*24.37*

935002	*AD1-133 E O1*	*16.25*
934101	*AD2-000 1*	*6.74*
934111	*AD2-000 2*	*6.95*
936291	*AD2-038 C O1*	*3.69*
936292	*AD2-038 E O1*	*17.27*
936371	*AD2-047 C O1*	*5.47*
936372	*AD2-047 E O1*	*26.72*
936461	*AD2-060*	*3.22*
936511	*AD2-066 C O1*	*9.79*
936512	*AD2-066 E O1*	*6.53*
936791	*AD2-102 C*	*16.5*
936792	*AD2-102 E*	*11.*
937001	*AD2-134 C*	*3.01*
937002	*AD2-134 E*	*12.03*
937311	*AD2-172 C*	*2.87*
937312	*AD2-172 E*	*3.96*
937401	*AD2-194 C1*	*9.06*
937411	*AD2-194 C2*	*9.05*
937531	*AD2-214 C*	*5.16*
937532	*AD2-214 E*	*3.44*
LTF	*BIG_CAJUN1 /* 35% REVERSE 4646887 4392735*	*< 0.01*
LTF	*BLUEG*	*0.19*
294401	*BSHIL;1U E*	*9.99*
294410	*BSHIL;2U E*	*9.99*
LTF	*CARR*	*0.91*
LTF	*CATAWBA*	*0.18*
274890	*CAYUG;1U E*	*15.98*
274891	*CAYUG;2U E*	*15.98*
LTF	*CBM-S1*	*4.04*
LTF	*CBM-W1*	*73.51*
LTF	*CBM-W2*	*62.69*
LTF	*CIN*	*3.03*
LTF	*CLIFTY*	*8.19*

274849	*CRESCENT ;1U*	*5.64*
274859	*EASYR;U1 E*	*12.83*
274860	*EASYR;U2 E*	*12.83*
LTF	*G-007*	*2.39*
290051	*GSG-6; E*	*12.17*
LTF	*HAMLET*	*0.41*
LTF	*IPL*	*1.29*
940531	*J351*	*434.12*
951131	*J643*	*25.78*
938961	*J847*	*13.12*
275149	*KEMPTON ;1E*	*22.53*
990901	*L-005 E*	*14.7*
290108	*LEEDK;1U E*	*28.24*
LTF	*MEC*	*45.43*
274850	*MENDOTA H;RU*	*6.28*
293061	*N-015 E*	*17.74*
293516	*O-009 E1*	*10.64*
293517	*O-009 E2*	*5.4*
293518	*O-009 E3*	*5.95*
293715	*O-029 E*	*11.38*
293716	*O-029 E*	*6.24*
293717	*O-029 E*	*5.73*
293771	*O-035 E*	*7.46*
LTF	*O-066*	*15.32*
293644	*O22 E1*	*12.1*
293645	*O22 E2*	*23.49*
290021	*O50 E*	*22.59*
294392	*P-010 E*	*22.52*
294763	*P-046 E*	*10.94*
274888	*PILOT HIL;1E*	*22.53*
274830	*PWR VTREC;1U*	*7.1*
274831	*PWR VTREC;2U*	*7.1*
LTF	*RENSSELAER*	*0.72*
LTF	*ROWAN* */* 35% REVERSE 4479078*	*< 0.01*

274789	*SE CHICAG;6U*	*1.34*
274790	*SE CHICAG;7U*	*1.34*
274791	*SE CHICAG;8U*	*1.34*
295111	*SUBLETTE E*	*3.17*
LTF	*TRIMBLE*	*0.06*
299993	*U3-031C*	*6.3*
LTF	*WEC*	*9.32*
295109	*WESTBROOK E*	*6.51*
910542	*X3-005 E*	*1.01*
915011	*Y3-013 1*	*4.37*
915021	*Y3-013 2*	*4.37*
915031	*Y3-013 3*	*4.37*
916502	*Z1-106 E1*	*1.47*
916504	*Z1-106 E2*	*1.47*
916512	*Z1-107 E*	*3.06*
916522	*Z1-108 E*	*2.89*
917501	*Z2-087 C*	*3.22*
917502	*Z2-087 E*	*21.53*
918051	*AA1-018 C*	*2.83*
918052	*AA1-018 E*	*18.94*
919221	*AA1-146*	*20.55*
919581	*AA2-030*	*20.55*
920272	*AA2-123 E*	*2.84*
930481	*AB1-089*	*76.61*
930761	*AB1-122 1*	*83.4*
930771	*AB1-122 2*	*85.95*
924041	*AB2-047 C O1*	*4.02*
924042	*AB2-047 E O1*	*26.91*
924471	*AB2-096*	*49.33*
925301	*AB2-191 C*	*1.17*
925302	*AB2-191 E*	*1.61*
925581	*AC1-033 C*	*1.64*
925582	*AC1-033 E*	*10.95*
926311	*AC1-109 1*	*2.21*
926321	*AC1-109 2*	*2.21*

926331	*AC1-110 1*	*2.21*
926341	*AC1-110 2*	*2.21*
926351	*AC1-111 1*	*0.89*
926361	*AC1-111 2*	*0.89*
926371	*AC1-111 3*	*0.89*
926381	*AC1-111 4*	*0.89*
926391	*AC1-111 5*	*0.89*
926401	*AC1-111 6*	*0.89*
927511	*AC1-113 1*	*1.39*
927522	*AC1-113 2*	*1.39*
926431	*AC1-114*	*2.77*
927451	*AC1-142A 1*	*4.89*
927461	*AC1-142A 2*	*4.89*
926821	*AC1-168 C*	*1.35*
926822	*AC1-168 E*	*9.05*
926841	*AC1-171 C*	*1.17*
926842	*AC1-171 E*	*7.83*
927531	*AC1-185 1*	*0.8*
927541	*AC1-185 2*	*0.8*
927551	*AC1-185 3*	*0.8*
927561	*AC1-185 4*	*0.8*
927571	*AC1-185 5*	*0.8*
927581	*AC1-185 6*	*0.8*
927591	*AC1-185 7*	*0.8*
927601	*AC1-185 8*	*0.8*
927091	*AC1-204 1*	*84.21*
927101	*AC1-204 2*	*84.18*
927201	*AC1-214 C*	*2.39*
927202	*AC1-214 E*	*7.61*

Appendix 2

(CE - CE) The GOODINGS ;4B-GOODINGS ;3B 345 kV line (from bus 270770 to bus 270766 ckt 1) loads from 104.29% to 105.35% (AC power flow) of its load dump rating (1802 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L11614_'. This project contributes approximately 22.24 MW to the thermal violation.

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CONTINGENCY 'COMED_P4_116-45-L11614_'
  TRIP BRANCH FROM BUS 270667 TO BUS 270665 CKT 1          / B ISL;RT 345 B ISL; R 345
  TRIP BRANCH FROM BUS 270667 TO BUS 270927 CKT 1          / B ISL;RT 345 WILTO; R 345
  TRIP BRANCH FROM BUS 270769 TO BUS 270667 CKT 1          / GOODI;2R 345 B ISL;RT 345
  DISCONNECT BUS 270769                                    / GOODI;2R 345
  END
```

Bus Number	*Bus Name*	*Full Contribution*
932881	*AC2-115 1*	*1.64*
932891	*AC2-115 2*	*1.64*
932921	*AC2-116*	*0.57*
933911	*AD1-013 C O1*	*1.2*
933912	*AD1-013 E O1*	*1.92*
933931	*AD1-016 C*	*0.63*
933932	*AD1-016 E*	*1.02*
934051	*AD1-031 C O1*	*2.21*
934052	*AD1-031 E O1*	*3.6*
934431	*AD1-067 C*	*0.09*
934432	*AD1-067 E*	*0.36*
934701	*AD1-098 C O1*	*4.52*
934702	*AD1-098 E O1*	*3.3*
934871	*AD1-116 C*	*1.11*
934872	*AD1-116 E*	*1.81*
934971	*AD1-129 C*	*0.62*
934972	*AD1-129 E*	*0.41*
935001	*AD1-133 C O1*	*14.64*
935002	*AD1-133 E O1*	*9.76*
934101	*AD2-000 1*	*5.27*

934111	*AD2-000 2*	*7.53*
936291	*AD2-038 C O1*	*3.92*
936292	*AD2-038 E O1*	*18.33*
936511	*AD2-066 C O1*	*6.41*
936512	*AD2-066 E O1*	*4.27*
936791	*AD2-102 C*	*9.82*
936792	*AD2-102 E*	*6.55*
937001	*AD2-134 C*	*1.69*
937002	*AD2-134 E*	*6.76*
937311	*AD2-172 C*	*1.72*
937312	*AD2-172 E*	*2.37*
937401	*AD2-194 C1*	*11.98*
937411	*AD2-194 C2*	*11.91*
937531	*AD2-214 C*	*3.31*
937532	*AD2-214 E*	*2.21*
LTF	*BLUEG*	*1.02*
294401	*BSHIL;1U E*	*6.6*
294410	*BSHIL;2U E*	*6.6*
LTF	*CANNELTON*	*0.03*
LTF	*CARR*	*0.37*
LTF	*CATAWBA*	*0.05*
LTF	*CBM-S1*	*1.96*
LTF	*CBM-W1*	*37.27*
LTF	*CBM-W2*	*32.72*
LTF	*CLIFTY*	*6.02*
274849	*CRESCENT ;1U*	*3.58*
274859	*EASYR;U1 E*	*7.89*
274860	*EASYR;U2 E*	*7.89*
LTF	*ELMERSMITH*	*0.01*
274733	*ELWOOD EC;3P*	*5.32*
274735	*ELWOOD EC;4P*	*5.32*
274728	*ELWOOD EC;5P*	*5.35*
274730	*ELWOOD EC;6P*	*5.35*
274732	*ELWOOD EC;7P*	*5.35*
274734	*ELWOOD EC;8P*	*5.35*

274736	*ELWOOD EC;9P*	*5.35*
LTF	*G-007*	*0.96*
LTF	*GIBSON*	*0.05*
290051	*GSG-6; E*	*6.83*
LTF	*HAMLET*	*0.13*
990901	*L-005 E*	*9.75*
290108	*LEEDK;1U E*	*15.34*
LTF	*MEC*	*29.76*
274850	*MENDOTA H;RU*	*3.53*
293516	*O-009 E1*	*6.73*
293517	*O-009 E2*	*3.42*
293518	*O-009 E3*	*3.77*
293715	*O-029 E*	*7.2*
293716	*O-029 E*	*3.95*
293717	*O-029 E*	*3.63*
293771	*O-035 E*	*4.73*
LTF	*O-066*	*6.17*
293644	*O22 E1*	*23.65*
293645	*O22 E2*	*45.9*
290021	*O50 E*	*24.99*
294763	*P-046 E*	*6.54*
274830	*PWR VTREC;1U*	*4.15*
274831	*PWR VTREC;2U*	*4.15*
LTF	*RENSSELAER*	*0.29*
295111	*SUBLETTE E*	*1.78*
274861	*TOP CROP ;1U*	*1.06*
274862	*TOP CROP ;2U*	*2.05*
LTF	*TRIMBLE*	*0.21*
LTF	*WEC*	*5.59*
295109	*WESTBROOK E*	*3.66*
915011	*Y3-013 1*	*2.58*
915021	*Y3-013 2*	*2.58*
915031	*Y3-013 3*	*2.58*
916502	*Z1-106 E1*	*0.81*
916504	*Z1-106 E2*	*0.8*

916522	*Z1-108 E*	*1.66*
918051	*AA1-018 C*	*2.84*
918052	*AA1-018 E*	*19.01*
919221	*AA1-146*	*12.91*
919581	*AA2-030*	*12.91*
920272	*AA2-123 E*	*1.65*
930481	*AB1-089*	*45.23*
930761	*AB1-122 1*	*65.14*
930771	*AB1-122 2*	*93.17*
924471	*AB2-096*	*28.83*
925301	*AB2-191 C*	*0.66*
925302	*AB2-191 E*	*0.9*
925581	*AC1-033 C*	*1.08*
925582	*AC1-033 E*	*7.24*
926311	*AC1-109 1*	*1.14*
926321	*AC1-109 2*	*1.14*
926331	*AC1-110 1*	*1.24*
926341	*AC1-110 2*	*1.24*
927511	*AC1-113 1*	*0.82*
927522	*AC1-113 2*	*0.82*
926431	*AC1-114*	*1.64*
927451	*AC1-142A 1*	*3.87*
927461	*AC1-142A 2*	*3.9*
926841	*AC1-171 C*	*0.79*
926842	*AC1-171 E*	*5.29*
927531	*AC1-185 1*	*0.49*
927541	*AC1-185 2*	*0.49*
927551	*AC1-185 3*	*0.49*
927561	*AC1-185 4*	*0.49*
927571	*AC1-185 5*	*0.49*
927581	*AC1-185 6*	*0.49*
927591	*AC1-185 7*	*0.49*
927601	*AC1-185 8*	*0.49*
927091	*AC1-204 1*	*111.41*
927101	*AC1-204 2*	*110.8*

927201	*AC1-214 C*	*1.52*
927202	*AC1-214 E*	*4.83*

13 Light Load Analysis

The Queue Project AD2-038 was evaluated as a 150 MW injection into a tap of the Powerton – Nevada (AA1-018) 345 kV line in the ComEd area. Project AD2-038 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-038 was studied with a commercial probability of 100%. Potential network impacts were as follows:

13.1 Generation Deliverability

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

None

13.2 Multiple Facility Contingency

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

#	Type	Contingency Name	Affected Area	Facility Description	From Bus	To Bus	Circuit	AC/DC	Initial Loading %	Final Loading%	Type	Rating	MW Contribution	Flowgate Appendix
1	LFFB	COMED_P4_112-65-BT2-3__	CE - CE	WILTON ; 765/345 kV transformer	275233	270644	1	DC	100	101.26	LDR	1379	17.41	1

Note:
Violation 1 - AEP SE: 1469 MVA (Not a violation)

13.3 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)

#	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	Flowgate Appendix
2	270926	WILTON ; B	CE	275232	WILTON ;3M	CE	1	COMED_P4_112-65-BT5-6__	breaker	1379.0	109.28	110.04	DC	17.04	2
3	270927	WILTON ; R	CE	275233	WILTON ;4M	CE	1	COMED_P4_112-65-BT2-3__	breaker	1379.0	111.67	112.45	DC	17.41	3

13.4 Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.
Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

None

13.5 System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

<table>
<tr><th>Facility</th><th>Upgrade Description</th><th>Cost</th><th>Cost Allocation</th><th>Upgrade Number</th></tr>
<tr><td>WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1)
&
WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1)</td><td><u>ComEd:</u>
ComEd SSTE rating is 1469 MVA.

<u>ComEd Reinforcement:</u>
<u>Project ID:</u> N5145
<u>Description:</u> Build out the Wilton 765kV bus thereby allowing for 765kV L11216 (currently on Bus 6) to be relocated to Bus 8. Along with this line relocation, installation of 2- 765kV BT CB’s (6-8 & 8-2).
<u>Cost:</u> $50,000,000 (ComEd increased cost from $12M to $50M).
<u>Time Estimate:</u> 30 Months
<u>Ratings:</u> This will eliminate the stuck breaker contingencies '112-65-BT2-3__' & '112-65- BT5-6__'. No other contingency updates needed.

Cost Allocation table:
<table>
<tr><th>Queue</th><th>MW Contribution</th><th>Cost %</th><th>Cost ($50M)</th></tr>
<tr><td>AD1-100</td><td>82.2</td><td>82.52%</td><td>$41.261 M</td></tr>
<tr><td>AD2-038</td><td>17.4</td><td>17.48%</td><td>$8.739 M</td></tr>
</table>
</td><td>$50,000,000</td><td>$8,739,000</td><td>N5145</td></tr>
<tr><td></td><td>Total</td><td>$50,000,000</td><td>$8,739,000</td><td></td></tr>
</table>

13.6 Light Load Appendices

Light Load 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.

Appendix 1

(CE - CE) The WILTON ; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 100.0% to 101.26% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT2-3__'. This project contributes approximately 17.41 MW to the thermal violation.

CONTINGENCY 'COMED_P4_112-65-BT2-3__'
TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 / WILTO; 765 COLLI; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 / WILTO;3M 345 WILTO; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345
TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33
END

Bus Number	*Bus Name*	*Full Contribution*
934431	*AD1-067 C*	*0.13*
934432	*AD1-067 E*	*0.53*
934721	*AD1-100 C*	*27.41*
934722	*AD1-100 E*	*128.33*
936291	*AD2-038 C O1*	*2.26*
936292	*AD2-038 E O1*	*15.15*
936371	*AD2-047 C O1*	*2.24*
936372	*AD2-047 E O1*	*24.13*
937001	*AD2-134 C*	*2.48*
937002	*AD2-134 E*	*9.91*
274857	*BIG SKY ;U1*	*1.32*
274858	*BIG SKY ;U2*	*1.32*
274877	*BISHOP HL;1U*	*1.03*
274878	*BISHOP HL;2U*	*1.03*
294401	*BSHIL;1U E*	*4.13*
294410	*BSHIL;2U E*	*4.13*
274848	*CAMPGROVE;RU*	*1.52*
274890	*CAYUG;1U E*	*7.99*
274891	*CAYUG;2U E*	*7.99*
274863	*CAYUGA RI;1U*	*2.*

274864	CAYUGA RI;2U	2.
274849	CRESCENT ;1U	2.84
274859	EASYR;U1 E	5.26
274860	EASYR;U2 E	5.26
274856	ECOGROVE ;U1	1.12
274871	GR RIDGE ;2U	2.43
274847	GR RIDGE ;BU	1.91
274855	GSG-6 ;RU	1.25
290051	GSG-6; E	5.01
275149	KEMPTON ;1E	9.23
990901	L-005 E	6.07
274872	LEE DEKAL;1U	2.8
290108	LEEDK;1U E	11.65
274850	MENDOTA H;RU	2.88
274879	MINONK ;1U	2.32
293061	N-015 E	7.65
293513	O-009 C1	1.09
293514	O-009 C2	0.55
293515	O-009 C3	0.61
293516	O-009 E1	4.38
293517	O-009 E2	2.22
293518	O-009 E3	2.45
293712	O-029 C	1.17
293713	O-029 C	0.64
293714	O-029 C	0.59
293715	O-029 E	4.68
293716	O-029 E	2.57
293717	O-029 E	2.36
293771	O-035 E	3.09
293644	O22 E1	4.93
293645	O22 E2	9.57
290021	O50 E	9.3
294392	P-010 E	9.72
294763	P-046 E	4.48
274888	PILOT HIL;1E	9.23

274887	*PILOT HIL;1U*	*2.31*
274881	*PLEAS RDG;2U*	*2.31*
274851	*PROVIDENC;RU*	*0.77*
274662	*QUAD CITI;1U*	*117.62*
274663	*QUAD CITI;2U*	*117.7*
290261	*S-027 C*	*1.99*
290265	*S-028 C*	*1.99*
295110	*SUBLETTE C*	*0.18*
295111	*SUBLETTE E*	*1.3*
274861	*TOP CROP ;1U*	*1.23*
274862	*TOP CROP ;2U*	*2.39*
274853	*TWINGROVE;U1*	*7.95*
274854	*TWINGROVE;U2*	*7.95*
905082	*W4-005 E*	*23.*
274874	*WALNR;2U*	*2.29*
294502	*WALNR;2U E*	*9.15*
295108	*WESTBROOK C*	*0.41*
295109	*WESTBROOK E*	*2.68*
916211	*Z1-072*	*0.52*
916221	*Z1-073*	*0.34*
917501	*Z2-087 C*	*1.51*
917502	*Z2-087 E*	*20.21*
918051	*AA1-018 C*	*2.37*
918052	*AA1-018 E*	*15.83*
920272	*AA2-123 E*	*2.92*
924041	*AB2-047 C O1*	*3.72*
924042	*AB2-047 E O1*	*24.92*
924261	*AB2-070 C O1*	*2.11*
924262	*AB2-070 E O1*	*14.13*
925301	*AB2-191 C*	*1.2*
925302	*AB2-191 E*	*1.66*
925581	*AC1-033 C*	*1.35*
925582	*AC1-033 E*	*9.06*
925771	*AC1-053 C*	*2.09*
925772	*AC1-053 E*	*13.99*

926821	*AC1-168 C O1*	*1.12*
926822	*AC1-168 E O1*	*7.49*
926841	*AC1-171 C O1*	*0.96*
926842	*AC1-171 E O1*	*6.43*
927202	*AC1-214 E O1*	*6.31*

Appendix 2

(CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 109.28% to 110.04% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT5-6__'. This project contributes approximately 17.04 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT5-6__'
  TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
  TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
  TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
  TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
  END
```

Bus Number	*Bus Name*	*Full Contribution*
934431	*AD1-067 C*	*0.12*
934432	*AD1-067 E*	*0.52*
934721	*AD1-100 C*	*26.88*
934722	*AD1-100 E*	*125.84*
935141	*AD1-148*	*3.78*
936291	*AD2-038 C O1*	*2.22*
936292	*AD2-038 E O1*	*14.82*
936371	*AD2-047 C O1*	*2.2*
936372	*AD2-047 E O1*	*23.63*
937001	*AD2-134 C*	*2.43*
937002	*AD2-134 E*	*9.71*
274857	*BIG SKY ;U1*	*1.29*
274858	*BIG SKY ;U2*	*1.29*
274877	*BISHOP HL;1U*	*1.01*
274878	*BISHOP HL;2U*	*1.01*
294401	*BSHIL;1U E*	*4.04*
294410	*BSHIL;2U E*	*4.04*
274848	*CAMPGROVE;RU*	*1.49*
274890	*CAYUG;1U E*	*7.83*
274891	*CAYUG;2U E*	*7.83*

274863	*CAYUGA RI;1U*	*1.96*
274864	*CAYUGA RI;2U*	*1.96*
274849	*CRESCENT ;1U*	*2.78*
274859	*EASYR;U1 E*	*5.15*
274860	*EASYR;U2 E*	*5.15*
274856	*ECOGROVE ;U1*	*1.1*
937871	*G858*	*2.27*
274871	*GR RIDGE ;2U*	*2.38*
274847	*GR RIDGE ;BU*	*1.87*
274855	*GSG-6 ;RU*	*1.23*
290051	*GSG-6; E*	*4.91*
937751	*H008*	*2.36*
937881	*H071*	*2.39*
937801	*J112*	*0.33*
938091	*J395*	*7.79*
938111	*J407*	*12.06*
938131	*J416*	*12.24*
938231	*J443*	*2.71*
938241	*J449*	*12.89*
938691	*J614*	*4.23*
939261	*J715*	*1.67*
939262	*J715 E*	*6.66*
939861	*J844*	*4.33*
939862	*J844 E*	*17.31*
939571	*J855*	*1.24*
939572	*J855 E*	*4.98*
939711	*J897*	*1.48*
939712	*J897 E*	*5.93*
939721	*J898*	*1.28*
939722	*J898 E*	*5.13*
939771	*J926*	*1.36*
939772	*J926 E*	*5.45*
939791	*J928*	*1.34*
939792	*J928 E*	*5.34*
275149	*KEMPTON ;1E*	*9.04*

990901	*L-005 E*	*5.95*
274872	*LEE DEKAL;1U*	*2.74*
290108	*LEEDK;1U E*	*11.41*
274850	*MENDOTA H;RU*	*2.82*
274879	*MINONK ;1U*	*2.28*
293061	*N-015 E*	*7.5*
293513	*O-009 C1*	*1.07*
293514	*O-009 C2*	*0.54*
293515	*O-009 C3*	*0.6*
293516	*O-009 E1*	*4.29*
293517	*O-009 E2*	*2.18*
293518	*O-009 E3*	*2.4*
293712	*O-029 C*	*1.14*
293713	*O-029 C*	*0.63*
293714	*O-029 C*	*0.58*
293715	*O-029 E*	*4.58*
293716	*O-029 E*	*2.51*
293717	*O-029 E*	*2.31*
293771	*O-035 E*	*3.03*
293644	*O22 E1*	*4.83*
293645	*O22 E2*	*9.37*
290021	*O50 E*	*9.1*
294392	*P-010 E*	*9.52*
294763	*P-046 E*	*4.38*
274888	*PILOT HIL;1E*	*9.04*
274887	*PILOT HIL;1U*	*2.26*
274881	*PLEAS RDG;2U*	*2.26*
274851	*PROVIDENC;RU*	*0.76*
274662	*QUAD CITI;1U*	*115.18*
274663	*QUAD CITI;2U*	*115.24*
290261	*S-027 C*	*1.95*
290265	*S-028 C*	*1.95*
295110	*SUBLETTE C*	*0.18*
295111	*SUBLETTE E*	*1.28*
274861	*TOP CROP ;1U*	*1.21*

274862	*TOP CROP ;2U*	*2.34*
274853	*TWINGROVE;U1*	*7.8*
274854	*TWINGROVE;U2*	*7.8*
276150	*W2-048 E*	*1.04*
905082	*W4-005 E*	*22.54*
274874	*WALNR;2U*	*2.24*
294502	*WALNR;2U E*	*8.96*
295108	*WESTBROOK C*	*0.4*
295109	*WESTBROOK E*	*2.63*
909052	*X2-022 E*	*14.46*
916211	*Z1-072*	*0.51*
916221	*Z1-073*	*0.34*
917501	*Z2-087 C*	*1.48*
917502	*Z2-087 E*	*19.81*
918051	*AA1-018 C*	*2.32*
918052	*AA1-018 E*	*15.49*
920272	*AA2-123 E*	*2.86*
924041	*AB2-047 C O1*	*3.65*
924042	*AB2-047 E O1*	*24.43*
924261	*AB2-070 C O1*	*2.07*
924262	*AB2-070 E O1*	*13.84*
925301	*AB2-191 C*	*1.18*
925302	*AB2-191 E*	*1.62*
925581	*AC1-033 C*	*1.32*
925582	*AC1-033 E*	*8.87*
925771	*AC1-053 C*	*2.05*
925772	*AC1-053 E*	*13.71*
926821	*AC1-168 C O1*	*1.09*
926822	*AC1-168 E O1*	*7.34*
926841	*AC1-171 C O1*	*0.94*
926842	*AC1-171 E O1*	*6.3*
927202	*AC1-214 E O1*	*6.18*

Appendix 3

(CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 111.67% to 112.45% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT2-3__'. This project contributes approximately 17.41 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT2-3__'
  TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
  TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
  TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
  TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
  END
```

Bus Number	*Bus Name*	*Full Contribution*
934431	*AD1-067 C*	*0.13*
934432	*AD1-067 E*	*0.53*
934721	*AD1-100 C*	*27.41*
934722	*AD1-100 E*	*128.33*
935141	*AD1-148*	*3.85*
936291	*AD2-038 C O1*	*2.26*
936292	*AD2-038 E O1*	*15.15*
936371	*AD2-047 C O1*	*2.24*
936372	*AD2-047 E O1*	*24.13*
937001	*AD2-134 C*	*2.48*
937002	*AD2-134 E*	*9.91*
274857	*BIG SKY ;U1*	*1.32*
274858	*BIG SKY ;U2*	*1.32*
274877	*BISHOP HL;1U*	*1.03*
274878	*BISHOP HL;2U*	*1.03*
294401	*BSHIL;1U E*	*4.13*
294410	*BSHIL;2U E*	*4.13*
274848	*CAMPGROVE;RU*	*1.52*
274890	*CAYUG;1U E*	*7.99*
274891	*CAYUG;2U E*	*7.99*

274863	*CAYUGA RI;1U*	*2.*
274864	*CAYUGA RI;2U*	*2.*
274849	*CRESCENT ;1U*	*2.84*
274859	*EASYR;U1 E*	*5.26*
274860	*EASYR;U2 E*	*5.26*
274856	*ECOGROVE ;U1*	*1.12*
937871	*G858*	*2.32*
274871	*GR RIDGE ;2U*	*2.43*
274847	*GR RIDGE ;BU*	*1.91*
274855	*GSG-6 ;RU*	*1.25*
290051	*GSG-6; E*	*5.01*
937751	*H008*	*2.41*
937881	*H071*	*2.44*
937801	*J112*	*0.33*
938091	*J395*	*7.96*
938111	*J407*	*12.31*
938131	*J416*	*12.5*
938231	*J443*	*2.77*
938241	*J449*	*13.16*
938691	*J614*	*4.32*
939261	*J715*	*1.7*
939262	*J715 E*	*6.8*
939861	*J844*	*4.42*
939862	*J844 E*	*17.68*
939571	*J855*	*1.27*
939572	*J855 E*	*5.08*
939711	*J897*	*0.95*
939712	*J897 E*	*3.8*
939721	*J898*	*1.31*
939722	*J898 E*	*5.24*
939771	*J926*	*1.39*
939772	*J926 E*	*5.57*
939791	*J928*	*1.36*
939792	*J928 E*	*5.45*
275149	*KEMPTON ;1E*	*9.23*

990901	*L-005 E*	*6.07*
274872	*LEE DEKAL;1U*	*2.8*
290108	*LEEDK;1U E*	*11.65*
274850	*MENDOTA H;RU*	*2.88*
274879	*MINONK ;1U*	*2.32*
293061	*N-015 E*	*7.65*
293513	*O-009 C1*	*1.09*
293514	*O-009 C2*	*0.55*
293515	*O-009 C3*	*0.61*
293516	*O-009 E1*	*4.38*
293517	*O-009 E2*	*2.22*
293518	*O-009 E3*	*2.45*
293712	*O-029 C*	*1.17*
293713	*O-029 C*	*0.64*
293714	*O-029 C*	*0.59*
293715	*O-029 E*	*4.68*
293716	*O-029 E*	*2.57*
293717	*O-029 E*	*2.36*
293771	*O-035 E*	*3.09*
293644	*O22 E1*	*4.93*
293645	*O22 E2*	*9.57*
290021	*O50 E*	*9.3*
294392	*P-010 E*	*9.72*
294763	*P-046 E*	*4.48*
274888	*PILOT HIL;1E*	*9.23*
274887	*PILOT HIL;1U*	*2.31*
274881	*PLEAS RDG;2U*	*2.31*
274851	*PROVIDENC;RU*	*0.77*
274662	*QUAD CITI;1U*	*117.62*
274663	*QUAD CITI;2U*	*117.7*
290261	*S-027 C*	*1.99*
290265	*S-028 C*	*1.99*
295110	*SUBLETTE C*	*0.18*
295111	*SUBLETTE E*	*1.3*
274861	*TOP CROP ;1U*	*1.23*

274862	*TOP CROP ;2U*	*2.39*
274853	*TWINGROVE;U1*	*7.95*
274854	*TWINGROVE;U2*	*7.95*
276150	*W2-048 E*	*1.06*
905082	*W4-005 E*	*23.*
274874	*WALNR;2U*	*2.29*
294502	*WALNR;2U E*	*9.15*
295108	*WESTBROOK C*	*0.41*
295109	*WESTBROOK E*	*2.68*
909052	*X2-022 E*	*14.75*
916211	*Z1-072*	*0.52*
916221	*Z1-073*	*0.34*
917501	*Z2-087 C*	*1.51*
917502	*Z2-087 E*	*20.21*
918051	*AA1-018 C*	*2.37*
918052	*AA1-018 E*	*15.83*
920272	*AA2-123 E*	*2.92*
924041	*AB2-047 C O1*	*3.72*
924042	*AB2-047 E O1*	*24.92*
924261	*AB2-070 C O1*	*2.11*
924262	*AB2-070 E O1*	*14.13*
925301	*AB2-191 C*	*1.2*
925302	*AB2-191 E*	*1.66*
925581	*AC1-033 C*	*1.35*
925582	*AC1-033 E*	*9.06*
925771	*AC1-053 C*	*2.09*
925772	*AC1-053 E*	*13.99*
926821	*AC1-168 C O1*	*1.12*
926822	*AC1-168 E O1*	*7.49*
926841	*AC1-171 C O1*	*0.96*
926842	*AC1-171 E O1*	*6.43*
927202	*AC1-214 E O1*	*6.31*

14 Short Circuit Analysis

The following breakers are overdutied:

None

14.1 System Reinforcements - Short Circuit

None

15 Stability and Reactive Power

To be completed during the Facilities Study phase.

16 Affected Systems

16.1 MISO

No Preliminary MISO system impacts have been identified by MISO. MISO has stated that they do need to retool their analysis to determine final MISO system impacts. This will be completed during the Facilities Study phase.

17 Attachment 1: One Line Diagram