

#Y3-035 – Mole Creek 345kV Generation Interconnection

General

The Interconnection Customer is proposing a 97.5MW (12.68MW Capacity) wind facility to be interconnected to the ComEd transmission system and located in Woodford County, IL. The proposed in-service date for this project is June 1, 2015 and is currently under review.

This Generation Interconnection Feasibility Study provides analysis results to aid the Interconnection Customer in assessing the practicality and cost of incorporating the facility into the PJM system.

Facilities to Accommodate the Interconnection

Scope of Direct Connection Work

The Y3-035 project will directly connect to the TSS 908 Mole Creek 345kv substation. To accommodate this interconnection, installation of a new breaker to the existing Mole Creek ring 345kV bus, relaying, metering, RTU, SCADA and other miscellaneous supporting equipment will be required. The direct connects are estimated to cost approximately **\$5,000,000** to interconnect and take a minimum of **18 to 24 months** after the receipt of an executed Construction Service Agreement to complete this work. The cost estimate above does not include any of the upgrades listed in the Network Impacts section of the report.

The Interconnection Customer is responsible for constructing all of the Interconnection Customer-owned facilities on the Interconnection Customer's side of the Point of Interconnection.

Revenue Metering and SCADA Requirements

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

For ComEd: The Interconnection Customer (IC) will install equipment necessary to provide bi-directional Revenue Metering (KWH, KVARH) and real time data (KW, KVAR, circuit breaker status, and 345 kV voltage) for IC's generating Resource. See ComEd Applicable Standards available on the PJM website ("TO Standards") – "Exelon Energy Delivery Interconnection Guidelines (Generators Greater than 20 MW)".

Network Impacts

The Y3-035 project was studied as a 97.5MW (12.7MW Capacity) injection into the ComEd area as a tap of the MOLCR;B 345kV line. Project Y3-035 was evaluated for compliance with reliability criteria for summer peak conditions in 2017.

Potential network impacts were as follows:

Table 1: Contingency List	
Contingency Name	Description
023-65-BT2-3__	CONTINGENCY '023-65-BT2-3__' TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1 / COLLI; 765 PLANO; 765 END
023-65-BT4-5__	CONTINGENCY '023-65-BT4-5__' TRIP BRANCH FROM BUS 275168 TO BUS 270607 CKT 1 / COLLI;2M 345 COLLI; 765 TRIP BRANCH FROM BUS 275168 TO BUS 270697 CKT 1 / COLLI;2M 345 COLLI; R 345 TRIP BRANCH FROM BUS 275168 TO BUS 275268 CKT 1 / COLLI;2M 345 COLLI;2C 33 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 END
112-65-BT2-3__	CONTINGENCY '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
112-65-BT5-6__	CONTINGENCY '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
2978_C2_A	CONTINGENCY '2978_C2_A' OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTO; 765 1 END
345-L19601_B-S+_345-L9803__R-S	CONTINGENCY '345-L19601_B-S+_345-L9803__R-S' TRIP BRANCH FROM BUS 270790 TO BUS 270770 CKT 1 / KATYD; B 345 GOODI;4B 345 TRIP BRANCH FROM BUS 270769 TO BUS 270891 CKT 1 / GOODI;2R 345 SCULL; R 345 END

Generator Deliverability

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

No violations were found.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

Table 2: Multiple Facility Contingency												
Item #	Contingency		Overloaded Element	Bus			Loading		Rating		MW Contribution	Appendix #
	Type	Name		From	To	Ckt	Initial	Final	Type	MVA		
1a	LFFB	2978_C2_A	BURNH; B-17SHEFLD 345 kV line	270674	255111	1	99.96	100.04	ER	1374	10.55	1

Item 1a. (CE - MISO NIPS) The BURNH; B-17SHEFLD 345 kV line (from bus 270674 to bus 255111 ckt 1) loads from 99.96% to 100.04% (**DC power flow**) of its emergency rating (1374 MVA) for the line fault with failed breaker contingency outage of '2978_C2_A'. This project contributes approximately 10.55 MW to the thermal violation.

CONTINGENCY '2978_C2_A'

OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1 / 243206

05DUMONT 765 243207 05GRNTWN 765 1

OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206

05DUMONT 765 270644 WILTO; 765 1

END

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

Short Circuit

(Summary of impacted circuit breakers)

PJM has completed the short circuit analysis of the Y3-035 queue project **Mole Creek 345kV**. One option was considered during this study: the option was a direct connection Mole Creek substation. PJM analysis found **no new breakers** to be over-duty in the ComEd transmission area.

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)

Table 3: Contribution to Previously Identified Overloads

Item #	Contingency		Overloaded Element	Bus			Loading		Rating		MW Contribution	Appendix #
	Type	Name		From	To	Ckt	Initial	Final	Type	MVA		
2a	DCT L	345-L19601_B-S+_345-L9803_R-S	KATYD; B-DRESD; B 345 kV line	270790	270716	1	109.7	113	ER	1768	58.47	2
2b	LFFB	112-65-BT5-6__	WILTO; 765/345 kV transformer	275232	270644	1	133.08	133.17	ER	1601	16.29	3
2c	LFFB	112-65-BT2-3__	WILTO; 765/345 kV transformer	275233	270644	1	135.77	135.87	ER	1601	16.63	4
2d	LFFB	112-65-BT5-6__	WILTO; B-WILTO;3M 345 kV line	270926	275232	1	148.07	148.17	ER	1601	16.29	5
2e	LFFB	112-65-BT2-3__	WILTO; R-WILTO;4M 345 kV line	270927	275233	1	151.06	151.16	ER	1601	16.63	6
2f	LFFB	023-65-BT4-5__	17STLWEL-05DUMONT 345 kV line	255113	243219	1	165.44	165.56	ER	1409	17.56	7
2g	LFFB	023-65-BT2-3__	17STLWEL-05DUMONT 345 kV line	255113	243219	1	165.7	165.82	ER	1409	17.57	8
2h	LFFB	2978_C2_A	17STLWEL-05DUMONT 345 kV line	255113	243219	1	169.83	169.94	ER	1409	16.82	9

Item 2a. (CE - CE) The KATYD; B-DRESD; B 345 kV line (from bus 270790 to bus 270716 ckt 1) loads from 109.7% to 113.0% (**DC power flow**) of its emergency rating (1768 MVA) for the tower line contingency outage of '345-L19601_B-S+_345-L9803__R-S'. This project contributes approximately 58.47 MW to the thermal violation.

CONTINGENCY '345-L19601_B-S+_345-L9803__R-S'
TRIP BRANCH FROM BUS 270790 TO BUS 270770 CKT 1 / KATYD; B 345
GOODI;4B 345
TRIP BRANCH FROM BUS 270769 TO BUS 270891 CKT 1 / GOODI;2R 345
SCULL; R 345
END

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

Item 2b. (CE - CE) The WILTO; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 133.08% to 133.17% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT5-6__'. This project contributes approximately 16.29 MW to the thermal violation.

CONTINGENCY '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

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

Item 2c. (CE - CE) The WILTO; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 135.77% to 135.87% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT2-3__'. This project contributes approximately 16.63 MW to the thermal violation.

CONTINGENCY '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

Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

Item 2d. (CE - CE) The WILTO; B-WILTO;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 148.07% to 148.17% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT5-6__'. This project contributes approximately 16.29 MW to the thermal violation.

CONTINGENCY '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

Please refer to Appendix 5 for a table containing the generators having contribution to this flowgate.

Item 2e. (CE - CE) The WILTO; R-WILTO;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 151.06% to 151.16% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT2-3__'. This project contributes approximately 16.63 MW to the thermal violation.

CONTINGENCY '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

Please refer to Appendix 6 for a table containing the generators having contribution to this flowgate.

Item 2f. (MISO NIPS - AEP) The 17STLWEL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 165.44% to 165.56% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '023-65-BT4-5__'. This project contributes approximately 17.56 MW to the thermal violation.

CONTINGENCY '023-65-BT4-5__'

TRIP BRANCH FROM BUS 275168 TO BUS 270607 CKT 1 / COLLI;2M 345
COLLI; 765

TRIP BRANCH FROM BUS 275168 TO BUS 270697 CKT 1 / COLLI;2M 345
COLLI; R 345

TRIP BRANCH FROM BUS 275168 TO BUS 275268 CKT 1 / COLLI;2M 345
COLLI;2C 33

TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765
05DUMONT 765

END

Please refer to Appendix 7 for a table containing the generators having contribution to this flowgate.

Item 2g. (MISO NIPS - AEP) The 17STLWEL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 165.7% to 165.82% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '023-65-BT2-3__'. This project contributes approximately 17.57 MW to the thermal violation.

CONTINGENCY '023-65-BT2-3__'

TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765
05DUMONT 765

TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1 / COLLI; 765
PLANO; 765

END

Please refer to Appendix 8 for a table containing the generators having contribution to this flowgate.

Item 2h. (MISO NIPS - AEP) The 17STLWEL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 169.83% to 169.94% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '2978_C2_A'. This project contributes approximately 16.82 MW to the thermal violation.

CONTINGENCY '2978_C2_A'

OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1 / 243206
05DUMONT 765 243207 05GRNTWN 765 1

OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206
05DUMONT 765 270644 WILTO; 765 1

END

Please refer to Appendix 9 for a table containing the generators having contribution to this flowgate.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, I.e. “Network Impacts”, initially caused by the addition of this project’s generation.)

For Item 1a, the overload of the BURNH; B-17SHEFLD 345 kV line can be relieved by the following:

ComEd: No ComEd upgrades required. This violation will be further analyzed in the SIS phase.

NIPSCO: The limiting facility is owned by NIPSCO. This violation will be further analyzed in the SIS phase.

Contribution to Previously Identified System Reinforcements

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

For Item 2a, the overload of the KATYD; B-DRESD; B 345 kV line can be relieved by reconductoring and increasing the thermal rating of the approximately 32 mile long line 1202 (formerly line 0302). The total estimated cost to perform this work is **\$26,000,000** (PJM Network Upgrade# N1710) and assumes that reconductoring of the entire 32 miles is required to increase the thermal rating. It will take approximately **24 to 36 months** to complete this work.

For Items 2b, 2c, 2d, and 2e, the overloads of WILTO; 765/345 kV transformer, WILTO; B-WILTO;3M 345 kV line and WILTO; R-WILTO;4M 345 kV line can be relieved by installing two new 345 kV bus tie circuit breakers and moving line L11216 to bus 8. The total estimated cost is **\$15,000,000** and will take approximately **18 to 24 months** to complete this work.

For Items 2f, 2g, and 2h, the overloads of the 17STLWEL-05DUMONT 345 kV line can be relieved by the following:

A sag check will be required for the ACSR 954 conductor section 1 to determine if the line section can be operated above its emergency rating of 1409 MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 8.5 mile section of line would need to be rebuilt. The total estimated cost (2013 Dollars) for the sag study is **\$34,000**.

Delivery of Energy Portion of Interconnection Request

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.

As a result of the aggregate energy resources in the area, no violations were identified.