#U4-011– Pontiac – Brokaw #1 345kV
Generation Interconnection

Revenue Metering and SCADA Requirements

For PJM: IC 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 Sections 24.1 and 24.2.

For ComEd: IC will be required to 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)".

Option 1: Pontiac Red – Brokaw Tap 345kV

Direct Connection Cost Estimate

The total preliminary estimate for Direct Connection work performed by ComEd is given in the following table:

Description	**Total Cost**
Three 345kV breaker Interconnection Substation Pleasant Hill TSS91 (assuming ComEd engineer, procure & build the substation)	**$15,000,000**
345kV transmission line tie-in (By ComEd)	**$ 2,000,000**
Total	**$17,000,000**

Non-Direct Connection Cost Estimate

The total preliminary estimate for Non-Direct Connection work performed by ComEd is given in the following table:

Description	**Total Cost**
Remote-end relay upgrade (By ComEd)	**$ 1,000,000**

Network Impacts

The queue U4-011 project was studied as a 200MW (26MW Capacity) injection into ComEd's system. The Point of Interconnection was modeled as a tap of the Pontiac Red – Brokaw Tap 345kV line. Project U4-011 was evaluated for compliance with reliability criteria for summer peak conditions in 2013.

IN THE DELIVERY OF ENERGY PORTION OF INTERCONNECTION REQUEST SECTION THERE ARE SEVERAL SITUATIONS THAT WILL LIKELY CAUSE CURTAILMENT OF THIS PROJECT. SOME MAY LIMIT THE AGGREGATE TOTAL OF THE ENERGY OUTPUT OF THIS PROJECT AND ADJACENT GENERATING FACILITIES WELL BELOW THEIR FULL ENERGY OUTPUT ON A FREQUENT, IF NOT CONTINUOUS, BASIS. FACTORS THAT CAN AFFECT THE AMOUNT OF CURTAILMENT ARE SEASONAL VARIATIONS IN LINE RATINGS, ACTUAL LOAD FLOWS, AND ACTUAL DISPATCH OF OTHER LOCAL GENERATION. UNDER LIGHT LOAD CONDITIONS FOR WIND FARMS, CURTAILMENT MAY BE EVEN MORE SEVERE. PLEASE NOTE THAT ANY REQUIRED UPGRADES LISTED BELOW WILL NOT ELIMINATE THIS CONGESTION. SEE THIS SECTION AT THE END OF THE REPORT FOR FURTHER DETAILS.

Potential network impacts were as follows:

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

No problems were identified.

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.)

No problems were identified.

Short Circuit
(Summary of impacted circuit breakers)

To be determined in the System Impact Study.

Contribution to Previously Identified Overloads

(U4-011 contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Table 1 - Contribution to Previously Identified Overloads								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
1a	U4-011	15.4	U4-011 to Pontiac MidPoint 345kV line 8001	101.3%	102.3%	Emergency	1441	SPS at Kincaid with outage on Kincaid to Latham 345kV line 2102 also trips Kincaid to Pawnee West(Ameren/CIPS) 345kV line 2106 ('SPS-2102&2106_U2-058')

Steady-State Voltage Requirements

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

To be determined in the System Impact Study.

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

To be determined in the System Impact Study.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

No new system requirements were identified.

Contribution to Previously Identified 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)

In Item 1a from the Contribution to Previously Identified Overloads section, the overload of U4-011 to Pontiac MidPoint 345kV line 8001 is caused by the outage of SPS at Kincaid with outage on Kincaid to Latham 345kV line 2102 also trips Kincaid to Pawnee West(Ameren/CIPS) 345kV line 2106. This overload can be relieved by upgrading the current transformers at Relay Point #4 at Brokaw. The cost of this upgrade is estimated to be **$750,000**. Project U4-011 will have a cost allocation to this upgrade. Cost allocations for this reinforcement will be assigned in the System Impact Study.

Potential Issues

In the previous queue, multiple projects were studied with more than one option. The U queue was studied with the primary Point of Interconnection (POI) from the prior queue. U queue primary POI selections were studied with only other U queue primary POI selections and the prior queue constraints listed above. U queue secondary POI selections were studied with only other U queue secondary POI selections and the prior queue constraints listed above. Depending

on which POI selection the prior queue projects choose, results may significantly change between the Feasibility and Impact Studies.

Impacts on the MISO member transmission systems are not included in this analysis, but they will be included in the Impact Study, which may reveal upgrades needed in the MISO system not identified in this Feasibility Study.

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, the following violations were identified:

Table 2 - Delivery of Energy Portion of Interconnection Request

Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
2a	U4-011	87.5	Loretto (O51) Tap to Wilton Center 345kV line 8012	233.8%	240.6%	Emergency	1280	R78 to Dresden Red 345kV line 1214 ('345-L1214__-S_WITH_O24_R78B')
2b	U4-011	87.5	Pontiac MidPoint to Loretto (O51) Tap 345kV line 8012	212.3%	219.6%	Emergency	1201	R78 to Dresden Red 345kV line 1214 ('345-L1214__-S_WITH_O24_R78B')
2c	U4-011	20.7	Wilton Center to Blue Island Red 345kV line 11614	180.5%	181.9%	Emergency	1441	Wilton Center to Dumont 765kV line 11215 ('05DUMONT 765 - WILTO; 765 - 1')
2d	U4-011	87.6	R78 to Dresden Red 345kV line 1214	169.1%	174.1%	Emergency	1739	Loretto (O51) to Wilton Center 345kV line 11212 ('O51_SINGLE_B')
2e	U4-011	87.6	Pontiac MidPoint to R78 Tap 345kV line 8014	159.2%	164.2%	Emergency	1739	Loretto (O51) to Wilton Center 345kV line 11212 ('345-L11212___-S_WITH_O51B')
2f	U4-011	48.8	Dresden to Elwood Red 345kV line 1222	154.0%	157.3%	Emergency	1479	Dresden to Electric Junction Red 345kV line 1223 ('345-L1223T_R-S')
2g	U4-011	61.9	Blue Mound to Pontiac MidPoint 345kV line 8002	141.9%	146.0%	Emergency	1528	Lanesville to Pontiac MidPoint 345kV line 8001 ('345-L8001_S_U4-011B')
2h	U4-011	62.4	Latham to Blue Mound 345kV line 2102	116.0%	120.6%	Emergency	1334	Lanesville to Pontiac MidPoint 345kV line 8001 ('345-L8001_S_U4-011B')
2i	U4-011	118.8	U4-011 to Pontiac MidPoint 345kV line 8001	104.8%	113.0%	Emergency	1441	SPS at Kincaid with outage on Kincaid to Latham 345kV line 2102 also trips Kincaid to Pawnee West(Ameren/CIPS) 345kV line 2106 ('SPS-2102&2106_U2-058')

Option 2: Pontiac Red 345kV

Facilities to Accommodate the Interconnection

Non-Direct Connection Cost Estimate

The total preliminary estimate for Non-Direct Connection work performed by ComEd is given in the following table:

Description	Total Cost
Upgrade metering, communication and SCADA links (By ComEd)	**$ 500,000**

Network Impacts

A sensitivity study was done for the queue U4-011 project as a 200MW (26MW Capacity) injection into ComEd's system. The Point of Interconnection was modeled as a tap of the Pontiac Midpoint substation. Project U4-011 was evaluated for compliance with reliability criteria for summer peak conditions in 2013. Potential network impacts were as follows:

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

No problems were identified.

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.)

No problems were identified.

Short Circuit
(Summary of impacted circuit breakers)

To be determined in the System Impact Study.

Contribution to Previously Identified Overloads

(U4-011 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	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
3a	U4-011	64.0	Wilton Center to Dumont 765kV line 11215	107.0%	108.1%	Applicable Load Dump Rating	5906	Tower outage of Wilton Center to Blue Island Blue 345kV line 11613 and Wilton Center to Blue Island Red 345kV line 11614 ('345-L11613AB-S_+_345-L11614AR-S')

Steady-State Voltage Requirements

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

To be determined in the System Impact Study.

Stability and Reactive Power Requirement for Low Voltage Ride Through

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

To be determined in the System Impact Study.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

No new system requirements were identified.

Contribution to Previously Identified 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)

In Item 3a from the Contribution to Previously Identified Overloads section, the overload of Wilton Center to Dumont 765kV line 11215 is caused by the tower outage of Wilton Center to Blue Island Blue 345kV line 11613 and Wilton Center to Blue Island Red 345kV line 11614. If this option is chosen, the reinforcements and costs will be supplied during the System Impact Study. Project U4-011 will have a cost allocation to this upgrade. Cost allocations for this reinforcement will be assigned in the System Impact Study.

Potential Issues

In the previous queue, multiple projects were studied with more than one option. The U queue was studied with the primary Point of Interconnection (POI) from the prior queue. U queue primary POI selections were studied with only other U queue primary POI selections and the prior queue constraints listed above. U queue secondary POI selections were studied with only other U queue secondary POI selections and the prior queue constraints listed above. Depending

on which POI selection the prior queue projects choose, results may significantly change between the Feasibility and Impact Studies.

Impacts on the MISO member transmission systems are not included in this analysis, but they will be included in the Impact Study, which may reveal upgrades needed in the MISO system not identified in this Feasibility Study.

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, the following violations were identified:

Table 4 - Delivery of Energy Portion of Interconnection Request

Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
4a	U4-011	99.7	Loretto (O51) Tap to Wilton Center 345kV line 8012	230.9%	238.7%	Emergency	1280	R78 to Dresden Red 345kV line 1214 ('345-L1214__-S_WITH_O24_R78B')
4b	U4-011	99.7	Pontiac MidPoint to Loretto (O51) Tap 345kV line 8012	209.2%	217.5%	Emergency	1201	R78 to Dresden Red 345kV line 1214 ('345-L1214__-S_WITH_O24_R78B')
4c	U4-011	23.4	Wilton Center to Blue Island Red 345kV line 11614	180.5%	182.1%	Emergency	1441	Wilton Center to Dumont 765kV line 11215 ('05DUMONT 765 - WILTO; 765 - 1')
4d	U4-011	100.0	R78 to Dresden Red 345kV line 1214	167.0%	172.7%	Emergency	1739	Loretto (O51) to Wilton Center 345kV line 11212 ('O51_SINGLE_B')
4e	U4-011	100.0	Pontiac MidPoint to R78 Tap 345kV line 8014	157.1%	162.8%	Emergency	1739	Loretto (O51) to Wilton Center 345kV line 11212 ('O51_SINGLE_B')
4f	U4-011	20.8	Wilton Center to Blue Island Blue 345kV line 11613	166.1%	167.5%	Emergency	1441	Wilton Center to Dumont 765kV line 11215 ('05DUMONT 765 - WILTO; 765 - 1')
4g	U4-011	56.0	Dresden to Elwood Red 345kV line 1222	152.6%	156.4%	Emergency	1479	Dresden to Electric Junction Red 345kV line 1223 ('345-L1223T_R-S')