

**#U2-058 – Kincaid 345kV
Generation Interconnection**

Option 1:

Connection Cost Estimate

Site Location	Material	Labor	Cost Estimate Total
TSS 887 Sangchris Lake Station Construction Oversight	\$8,000	\$327,000	\$335,000
TSS 887 Sangchris Lake Station Testing & Commissioning	\$0	\$135,000	\$135,000
TSS 887 Sangchris Lake Station T-Line Tie	\$1,100,000	\$900,000	\$2,000,000
TSS 887 Sangchris Lake Station Comm. Work	\$1,200,000	\$4,800,000	\$6,000,000
TSS 987 Sangchris Lake Station Misc. Network	\$11,000	\$586,000	\$597,000
Station 21 Kincaid Relay Upgrade	\$150,000	\$150,000	\$300,000
TSS178 Blue Mound Relay Upgrade	\$150,000	\$150,000	\$300,000
TOTAL COST	\$2,614,000	\$7,048,000	\$9,662,000

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 138 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 queue U2-058 project was studied as a 500MW (65MW Capacity) injection into ComEd’s system. The project was modeled at a tap of the Kincaid Blue – Latham Tap 345kV line 2102. Project U2-058 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)

Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
1a	U2-058	23.6	Blue Mound to Pontiac MidPoint 345kV line 8002	98.7%	100.3%	Emergency	1528	Kincaid to Pontiac MidPoint 345kV line 8001
1b	U2-058	33.0	Kincaid to Lanesville(Ameren) 345kV line 2101	99.7%	101.9%	Emergency	1528	SPS at Kincaid with outage on Kincaid to Latham 345kV line 2102 also trips Kincaid to Pawnee West(Ameren/CIPS) 345kV line 2106
1c	U2-058	18.7	Brokaw to Pontiac MidPoint 345kV line 8001	99.9%	101.2%	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

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

(U2-058 contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
2a	U2-058	21.4	Loretto (O51) to Wilton Center 345kV line 11212	123.4%	125.1%	Emergency	1280	R78 to Dresden Red 345kV line 1214
2b	U2-058	21.4	Pontiac MidPoint to Loretto (O51) 345kV line 8012	124.3%	126.1%	Emergency	1201	R78 to Dresden Red 345kV line 1214
2c	U2-058	39.8	U2-058 to Latham 345kV line 2102	104.6%	107.6%	Emergency	1334	Kincaid to Lanesville(Ameren) 345kV line 2101
2d	U2-058	23.8	Latham to Blue Mound 345kV line 2102	108.1%	109.9%	Emergency	1334	Kincaid to Poniac MidPoint 345kV line 8001

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)

1. In Item 1a of the Generator Deliverability Impacts, the overload of Blue Mound to Pontiac MidPoint 345kV line 8002 is caused by the outage of Kincaid to Pontiac MidPoint 345kV line 8001. This overload can be relieved TSS 80 Pontiac MidPoint. The cost of this upgrade is estimated to be **\$3,000,000**. This reinforcement will be reviewed again in the System Impact Study.
2. In Item 1b of the Generator Deliverability Impacts, the overload of Kincaid to Lanesville(Ameren) 345kV line 2101 is caused by a 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 two 345kV bus tie circuit breakers (1-2 and 2-3) at Station 21 Kincaid. The cost of this upgrade is estimated to be **\$3,000,000**. This reinforcement will be reviewed again in the System Impact Study.
3. In Item 1c of the Generator Deliverability Impacts, the overload of Brokaw to Pontiac MidPoint 345kV line 8001 is caused by a 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**. This reinforcement will be reviewed again in the System Impact Study.

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)

1. In Item 2a of the Contribution to Previously Identified Overloads, the overload of Loretto (O51) to Wilton Center 345kV line 11212 is caused by an outage of the R78 to Dresden 345kV line 1214. This overload was first caused by queue project S28. This overload can be relieved by reconductoring 38.1 miles of 345kV line 11212. The cost of this upgrade is estimated to be **\$32,000,000**. Project U2-058 will have a cost allocation to this upgrade. Cost allocations for this reinforcement will be assigned in the System Impact Study.

2. In Item 2b of the Contribution to Previously Identified Overloads, the overload of Pontiac MidPoint to Loretto (O51) 345kV line 8012 is caused by an outage of the R78 to Dresden 345kV line 1214. This overload was first caused by queue project T105. This overload can be relieved by reconductoring 11.3 miles of 345kV line 8012. The cost of this upgrade is estimated to be **\$9,000,000**. Project U2-058 will have a cost allocation to this upgrade. Cost allocations for this reinforcement will be assigned in the System Impact Study.
3. In Item 2c of the Contribution to Previously Identified Overloads, the overload of U2-058 to Latham 345kV line 2102 is caused by an outage of the Kincaid to Lanesville(Ameren) 345kV line 2101. This overload can be relieved by reconductoring 740 feet of the 345kV line 2102 at Relay Point #2 at Latham. The cost of this upgrade is estimated to be **\$250,000**. Project U2-058 will have a cost allocation to this upgrade. Cost allocations for this reinforcement will be assigned in the System Impact Study.
4. In Item 2d of the Contribution to Previously Identified Overloads, the overload of Latham to Blue Mound 345kV line 2102 is caused by an outage of the Kincaid to Pontiac MidPoint 345kV line 8001. This overload can be relieved by reconductoring 210 feet of the 345kV line 2102 at Relay Point #2 at Latham. The cost of this upgrade is estimated to be **\$250,000**. Project U2-058 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.

A transient stability study for #U2-058 will be conducted as part of the System Impact Study, which may reveal upgrades not identified in this Feasibility Study. Power factor requirements will also be analyzed during the System Impact 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 3 - Delivery of Energy Portion of Interconnection Request								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
3a	U2-058	164.7	Loretto (O51) Tap to Wilton Center 345kV line 8012	212.9%	225.8%	Emergency	1280	R78 to Dresden Red 345kV line 1214
3b	U2-058	164.7	Pontiac MidPoint to Loretto (O51) Tap 345kV line 8012	190.0%	203.8%	Emergency	1201	R78 to Dresden Red 345kV line 1214
3c	U2-058	163.9	R78 to Dresden Red 345kV line 1214	153.7%	163.2%	Emergency	1739	Loretto (O51) to Wilton Center 345kV line 11212
3d	U2-058	163.9	Pontiac MidPoint to R78 Tap 345kV line 8014	143.8%	153.2%	Emergency	1739	Loretto (O51) to Wilton Center 345kV line 11212
3e	U2-058	90.1	Dresden to Elwood Red 345kV line 1222	144.0%	150.1%	Emergency	1479	Dresden to Electric Junction Red 345kV line 1223
3f	U2-058	181.8	Blue Mound to Pontiac MidPoint 345kV line 8002	120.5%	132.4%	Emergency	1528	Kincaid to Pontiac MidPoint 345kV line 8001
3g	U2-058	306.2	U2-058 to Latham 345kV line 2102	101.3%	124.3%	Emergency	1334	Kincaid to Lanesville(Ameren) 345kV line 2101
3h	U2-058	183.2	Latham to Blue Mound 345kV line 2102	102.0%	115.7%	Emergency	1334	Kincaid to Pontiac MidPoint 345kV line 8001
3i	U2-058	253.9	Kincaid to Lanesville(Ameren) 345kV line 2101	97.0%	113.6%	Emergency	1528	SPS at Kincaid with outage on Kincaid to Latham 345kV line 2102 also trips Kincaid to Pawnee West(Ameren/CIPS) 345kV line 2106
3j	U2-058	143.7	Brokaw to Pontiac MidPoint 345kV line 8001	94.7%	104.7%	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

Option 2:

Connection Cost Estimate

Site Location	Material	Labor	Cost Estimate Total
TSS 887 Bear Creek Station Construction Oversight	\$8,000	\$327,000	\$335,000
TSS 887 Sangchris Lake Station Testing & Commissioning	\$0	\$135,000	\$135,000
TSS 887 Bear Creek Station T-Line Tie	\$1,100,000	\$900,000	\$2,000,000
TSS 887 Bear Creek Station Comm. Work	\$1,200,000	\$4,800,000	\$6,000,000
TSS 987 Bear Creek Station Misc. Network	\$11,000	\$586,000	\$597,000
Station 21 Kincaid Relay Upgrade	\$150,000	\$150,000	\$300,000
TSS178 Blue Mound Relay Upgrade	\$150,000	\$150,000	\$300,000
TOTAL COST	\$2,614,000	\$7,048,000	\$9,662,000

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 138 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 queue U2-058 project was studied as a 500MW (65MW Capacity) injection into ComEd's system. The project was modeled at a tap of the Kincaid Red – North Pana 345kV line 2105. Project U2-058 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

(U2-058 contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Table 4 - Contribution to Previously Identified Overloads								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
4a	U2-058	16.7	Pontiac MidPoint to Loretto (O51) 345kV line 8012	124.3%	125.7%	Emergency	1201	R78 to Dresden Red 345kV line 1214
4b	U2-058	25.8	Kincaid to Latham Tap Blue 345kV line 2102	104.5%	106.4%	Emergency	1334	Kincaid to Lanesville(Ameren) 345kV line 2101
4c	U2-058	17.6	Latham Tap to Blue Mound Blue 345kV line 2102	108.08%	109.40%	Emergency	1334	Kincaid to Poniac MidPoint 345kV line 8001

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)

1. In Item 4a of the Contribution to Previously Identified Overloads, the overload of Pontiac MidPoint to Loretto (O51) 345kV line 8012 is caused by an outage of the R78 to Dresden 345kV line 1214. This overload was first caused by queue project T105. This overload can be relieved by reconductoring 11.3 miles of 345kV line 8012. The cost of this upgrade is estimated to be **\$9,000,000**. Project U2-058 will have a cost allocation to this upgrade. Cost allocations for this reinforcement will be assigned in the System Impact Study.
2. In Item 4b of the Contribution to Previously Identified Overloads, the overload of U2-058 to Latham 345kV line 2102 is caused by an outage of the Kincaid to Lanesville(Ameren) 345kV line 2101. This overload can be relieved by reconductoring 740 feet of the 345kV line 2102 at Relay Point #2 at Latham. The cost of this upgrade is estimated to be **\$250,000**. Project U2-058 will have a cost allocation to this upgrade. Cost allocations for this reinforcement will be assigned in the System Impact Study.
3. In Item 4c of the Contribution to Previously Identified Overloads, the overload of Latham to Blue Mound 345kV line 2102 is caused by an outage of the Kincaid to Pontiac MidPoint 345kV line 8001. This overload can be relieved by reconductoring 210 feet of the 345kV line 2102 at Relay Point #2 at Latham. The cost of this upgrade is estimated to be **\$250,000**. Project U2-058 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 from the prior queue. Depending on which option 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 5 - Delivery of Energy Portion of Interconnection Request								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
5a	U2-058	128.4	Loretto (O51) Tap to Wilton Center 345kV line 8012	212.9%	222.9%	Emergency	1280	R78 to Dresden Red 345kV line 1214
5b	U2-058	128.4	Pontiac MidPoint to Loretto (O51) Tap 345kV line 8012	190.0%	200.7%	Emergency	1201	R78 to Dresden Red 345kV line 1214
5c	U2-058	127.5	R78 to Dresden Red 345kV line 1214	153.7%	161.1%	Emergency	1739	Loretto (O51) to Wilton Center 345kV line 11212
5d	U2-058	127.5	Pontiac MidPoint to R78 Tap 345kV line 8014	143.8%	151.1%	Emergency	1739	Loretto (O51) to Wilton Center 345kV line 11212
5e	U2-058	69.4	Dresden to Elwood Red 345kV line 1222	144.0%	148.7%	Emergency	1479	Dresden to Electric Junction Red 345kV line 1223
5f	U2-058	133.7	Blue Mound to Pontiac MidPoint 345kV line 8002	120.4%	129.1%	Emergency	1528	Kincaid to Pontiac MidPoint 345kV line 8001
5g	U2-058	198.2	Kincaid to Latham 345kV line 2102	101.2%	116.0%	Emergency	1334	Kincaid to Lanesville(Ameren) 345kV line 2101
5h	U2-058	135.1	Latham to Blue Mound 345kV line 2102	102.0%	112.1%	Emergency	1334	Kincaid to Pontiac MidPoint 345kV line 8001