#U1-049 – Kankakee 138kV
Generation Interconnection

Option 1:

The U1-049 project was studied as a 100MW Energy (13MW Capacity) injection at the 138kV Kankakee TSS157 substation.

Cost Estimate

The Kensington Ave. substation will be energized before U1-049 is allowed to interconnect. ComEd will engineer, design, procure materials, and construct the proposed interconnection work for the ComEd side of the Point of Interconnection. The estimated cost to complete the above mentioned work is **$2,100,000**. This is an Order-of-Magnitude estimate and the Interconnection Customer is responsible for the actual costs.

ComEd will take approximately 18-24 months to complete this work after the Interconnection Customer executes an Interconnection Service Agreement (ISA) and provides that appropriate funds.

The Interconnection Customer is responsible for all engineering, design, procurement, testing, and construction of all equipment on the Interconnection Customer's side of the Point of Interconnection.

Risks Associated with the Interconnection

The proposed Kensington Ave. substation will be connected to the TSS 86 Davis Creek 345/138kV substation through two 138kV (13 miles long) lines.

Projects S36, S37, and T120 are ahead of the U1-049 project in the PJM Queue with a planned interconnection into the Kensington Ave. substation. The total energy output of these three wind farms is 600MW. The U1-049 project proposes to connect an additional 100MW to this same Point of Interconnection (POI).

After the S36, S37, T120, and U1-049 wind farms are connected to the Kensington Ave. substation, PJM operating restrictions would limit the total output of the four wind farms less local loads fed out of the TSS 157 Kankakee substation at or below the lower of the long term emergency ratings of the two 138kV lines to TSS 86 Davis Creek (317MVA in the summer). That is to say, the system will be operated in such a way that under normal conditions (both lines in), the four wind farms would be dispatched to prevent either line from exceeding its long term emergency rating upon the loss of the other.

If any subsequent queue projects choose to connect at the Kensington Ave. substation, the output of all the interconnected projects would have their combined output limited as described above.

Merchant upgrades to the transmission system can be requested to increase the load carrying capability of the transmission system. However, no request has been received. Please note that any Merchant upgrade cannot be reserved for the sole use of the requester. Furthermore, the maximum 138kV rating achievable on the ComEd system using standard conductors is 449MVA. Therefore, upgrading the 138kV line by reconductoring will still not provide adequate transmission line capacity to enable all of the energy from these projects to be delivered.

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 U1-049 project was studied as a 100MW (13MW Capacity) injection into ComEd's system at the Kankakee Red 138kV substation. Project U1-049 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.)

Table 1 - Multiple Facility Contingency Impacts

Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
1a	U1-049	11.9	Davis Creek to Manteno Red 138kV line 0902	97.6%	102.4%	Applicable Load Dump Rating	244	Tower outage of Braidwood to East Frankfort Blue 345kV line 2001 and Braidwood to East Frankfort Red 345kV line 2003
1b	U1-049	100.0	Kankakee Red Tap to Kankakee portion of the Davis Creek - Kankakee - Bradley Red 138kV line 8603	93.8%	111.3%	Applicable Load Dump Rating	573	Tower outage of Braidwood to Davis Creek Red 345kV line 2004 and Kankakee to Davis Creek Blue 138kV line 8605

Short Circuit

(Summary of impacted circuit breakers)

To be determined in the System Impact Study.

Contribution to Previously Identified Overloads

(U1-049 contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Table 2 - Contribution to Previously Identified Overloads

Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
2a	U1-049	46.4	Kankakee to Bradley 138kV line 8603	141.4%	156.1%	Applicable Load Dump Rating	316	Tower outage of Kankakee to Davis Creek Blue 138kV line 8605 and Wilmington to Davis Creek 138kV line 8607

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 from Multiple Facility Contingency, the overload of Davis Creek to Manteno 138kV line 0902 is caused by a tower outage of the Braidwood to East Frankfort 345kV lines 2001 and 2003. This overload can be relieved by upgrading relays at TSS 86 Davis Creek in order to increase the forward relay trip setting of the 138kV line 0902. The cost of this upgrade is estimated to be **$750,000**. This reinforcement will be reviewed again in the System Impact Study.

2. In Item 1b from Contribution to Previously Identified Overloads, the overload of the Kankakee Red Tap to Kankakee portion of the Davis Creek-Kankakee-Bradley 138kV line 8603 is caused by a tower outage of Braidwood to Davis Creek 345kV 2004 and 8605 lines. This violation will never materialize in real time, because a tower outage study was performed at 100% energy output. Whereas in real time operation, the total energy flow on the two 138kV lines would not be allowed to exceed its N-1 rating of 317 MW. When a tower outage study was performed at 317 MW, no violation was found. Since this will be limited in real time, no mitigation is required for this overload.

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 2a from Contribution to Previously Identified Overloads, the overload of the Kankakee to Bradley 138kV line 8603 is caused by a tower outage of Kankakee to Davis Creek 138kV line 8605 and Wilmington to Davis Creek 138kV line 8607. The overload can be relieved by replacing the 0.14 miles of conductor between the tap and Bradley with conductor having an applicable load dump rating of 455 MVA. The cost of this upgrade is estimated to be **$150,000**. Cost allocations will be assigned during 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 3 - Delivery of Energy Portion of Interconnection Request

Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
3a	U1-049	100.0	Kankakee Tap to Kankakee portion of the Davis Creek - Nucor Steel - Kankakee - Bradley Blue 138kV line 8605	119.8%	142.0%	Emergency	449	Kankakee Red Tap to Davis Creek Red 138kV line 8603
3b	U1-049	100.0	Kankakee Tap to Davis Creek Red 138kV line 8603	88.8%	117.5%	Emergency	349	Kankakee to Davis Creek Blue 138kV line 8605
3c	U1-049	100.0	Kankakee to Davis Creek Blue 138kV line 8605	98.2%	129.7%	Emergency	317	Kankakee Red Tap to Davis Creek Red 138kV line 8603

Option 2:

The U1-049 project is 100MW Energy (13MW Capacity) wind farm that will be connecting to the 345kV TSS 86 Davis Creek substation. However, PJM has not yet evaluated this interconnection.

Cost Estimate

ComEd will engineer, design, procure materials, and construct the proposed interconnection work for the ComEd side of the Point of Interconnection. The estimated cost to complete the above mentioned work is **$5,000,000**. This is an Order-of-Magnitude estimate and the Interconnection Customer is responsible for the actual costs.

ComEd will take approximately 18-24 months to complete this work after the Interconnection Customer executes an Interconnection Service Agreement (ISA) and provides that appropriate funds.

The Interconnection Customer is responsible for all engineering, design, procurement, testing, and construction of all equipment on the Interconnection Customer's side of the Point of Interconnection.

If chosen, this option would be studied in detail during the System Impact Study phase.

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 IC'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 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)".