#T106 – Lee County Energy 138kV
Generation Interconnection

Network Impacts

The T106 project was studied as a 140 MW Energy (28 MW Capacity) injection into TSS 937 Lee County Energy Center 345kV substation in the ComEd area. Project T106 was evaluated for compliance with reliability criteria for summer peak conditions in 2012.

The results of this study and others performed for earlier queued projects indicate that the installation of all of these projects cannot be accommodated by the ComEd transmission system without the addition of major extra high voltage (EHV) reinforcements. The T106 project has contributions toward many of the same violations that were initially caused by earlier projects in the R and T queues. Upgrades required by these earlier queued projects included four new 345kV lines and the addition of a 765kV "backbone" transmission system with additional ties to the transmission system east of ComEd. These large upgrades may have costs in the billions of dollars and the T106 project may have some cost allocation to them. Subsequent studies may indicate a different set of upgrades that this project may be assessed and will depend on whether earlier queued projects withdraw.

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

(T106 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		Contingent Element
				From	To	Type	MVA	
1a	T106	29.8	Byron to Cherry Valley Blue 345kV line #0621	187.90%	189.40%	Applicable Load Dump Rating	2024	Byron to Cherry Valley Red 345kV line #0622 & Cherry Valley to Dixon 138kV line #15621
1b	T106	43.3	Byron to Wempletown 345kV line #0624	256.20%	258.10%	Applicable Load Dump Rating	2277	Byron to Cherry Valley Red 345kV line #0622 & Byron to Cherry Valley Blue 345kV line #0621
1c	T106	93.8	Nelson to Lee County 345kV line #15501	230.80%	235.40%	Applicable Load Dump Rating	2024	Cherry Valley to Silver Lake 345kV line #15616 & Cherry Valley – W DeKalb – Glidden 138kV line #15627
1d	T106	40.1	Nelson to P20 345kV line #15502	186.60%	189.20%	Applicable Load Dump Rating	1572	Cherry Valley to Silver Lake 345kV line #15616 & Cherry Valley – W DeKalb – Glidden 138kV line #15627
1e	T106	40.1	P20 to Electric Junction 345kV line #18402	191.50%	194.10%	Applicable Load Dump Rating	1572	Cherry Valley to Silver Lake 345kV line #15616 & Cherry Valley – W DeKalb – Glidden 138kV line #15627
1f	T106	6	Wempletown 345/138kV transformer #84	210.30%	211.30%	Applicable Load Dump Rating	610	Byron to Cherry Valley Red 345kV line #0622 & Byron to Cherry Valley Blue 345kV line #0621
1g	T106	7.3	E Rockford Tap to Alpine Tap portion of the Cherry Valley – E Rockford – Alpine – Belvidere 138kV line #15623	104.00%	104.80%	Applicable Load Dump Rating	959	Cherry Valley to Silver Lake 345kV line #15616 & Cherry Valley – W DeKalb – Glidden 138kV line #15627
1h	T106	7.6	Alpine Tap to Belvidere portion of the Cherry Valley – E Rockford – Alpine – Belvidere 138kV line #15623	178.50%	179.90%	Applicable Load Dump Rating	544	Cherry Valley to Silver Lake 345kV line #15616 & Cherry Valley – W DeKalb – Glidden 138kV line #15627
1i	T106	7.6	Belvidere to Marengo Red Tap portion of Belvidere – Marengo – Pleasant Valley Red 138kV line #12204	164.30%	165.70%	Applicable Load Dump Rating	544	Cherry Valley to Silver Lake 345kV line #15616 & Cherry Valley – W DeKalb – Glidden 138kV line #15627

Table 1 - Contribution to Previously Identified Overloads(Continued)								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingent Element
				From	To	Type	MVA	
1j	T106	9	Marengo Red Tap to Pleasant Valley portion of Belvidere – Marengo – Pleasant Valley Red 138kV line #12204	298.70%	301.10%	Applicable Load Dump Rating	388	Cherry Valley to Silver Lake 345kV line #15616 & Cherry Valley – W DeKalb – Glidden 138kV line #15627
1k	T106	8	Belvidere to Marengo Tap Blue portion of Belvidere – Marengo - Woodstock 138kV line #12205	221.40%	223.10%	Applicable Load Dump Rating	473	Cherry Valley to Silver Lake 345kV line #15616 & Cherry Valley – W DeKalb – Glidden 138kV line #15627
1l	T106	6.6	Marengo Tap to Woodstock Blue portion of Belvidere – Marengo - Woodstock 138kV line #12205	255.10%	257.30%	Applicable Load Dump Rating	300	Cherry Valley to Silver Lake 345kV line #15616 & Cherry Valley – W DeKalb – Glidden 138kV line #15627
1m	T106	6.6	Woodstock to Pleasant Valley Blue 138kV line #14106	194.80%	196.80%	Applicable Load Dump Rating	345	Cherry Valley to Silver Lake 345kV line #15616 & Cherry Valley – W DeKalb – Glidden 138kV line #15627
1n	T106	6.1	Cherry Valley to B465 (Daimler Chrysler) portion of the Cherry Valley – B465 – Belvidere Blue 138kV line #15624	152.70%	153.90%	Applicable Load Dump Rating	511	Cherry Valley to Silver Lake 345kV line #15616 & Cherry Valley – W DeKalb – Glidden 138kV line #15627
1o	T106	6.1	B465 (Daimler Chrysler) to Belvidere portion of the Cherry Valley – B465 – Belvidere Blue 138kV line #15624	141.10%	142.20%	Applicable Load Dump Rating	544	Cherry Valley to Silver Lake 345kV line #15616 & Cherry Valley – W DeKalb – Glidden 138kV line #15627
1p	T106	6.9	Waterman to Sandwich 138kV line #11301	115.40%	116.60%	Applicable Load Dump Rating	588	Electric Junction - N Aurora - Sugar Grove - Waterman - Glidden 138kV line #11106 & P20 to Electric Junction 345kV line #18402
1q	T106	6.9	Sandwich to Plano 138kV line #14302	113.50%	114.80%	Applicable Load Dump Rating	537	Electric Junction - N Aurora - Sugar Grove - Waterman - Glidden 138kV line #11106 & P20 to Electric Junction 345kV line #18402

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)

Previous projects in the PJM Queue have established the need for two 345 kV lines from Byron to Wayne and a second Byron to Nelson 345 kV line to satisfy ComEd's transient stability criteria.

Summary of Required Upgrades to Satisfy Stability Criteria

1. First 345kV transmission line between Byron and Wayne (56 miles). This line is required to mitigate transient stability criteria violations initially caused by the R16 project. The T106 project may have a cost allocation to this upgrade. The cost estimate for this upgrade is $**250,000,000**. (PJM Network Upgrade# N**1606**).

2. Second 345kV transmission line between Byron and Wayne (56 miles). This line is required to mitigate transient stability criteria violations initially caused by the R33 project. The T106 project may have a cost allocation to this upgrade. The cost estimate for this upgrade is $**50,000,000** (PJM Network Upgrade# N**1638**).

3. A new 345kV transmission line between Byron and Nelson (33 miles). This line is required to mitigate transient stability criteria violations initially caused by the R33 project. The T106 project may have a cost allocation to this upgrade. The cost estimate for this upgrade is $**125,000,000** (PJM Network Upgrade# N**1639**).

In addition a new 31-mile 345 kV Cherry Valley to Pleasant Valley line is proposed. One 345kV breaker at Cherry Valley substation and a three-breaker 345kV ring bus at Pleasant Valley will be required to terminate the proposed line. This line will provide a second 345 kV path between Cherry Valley and Silver Lake. The estimated costs for these facilities are $**97,000,000**. The T106 project may have a cost allocation for this upgrade.

The projects that mitigate the thermal violations are described below:
These 345 kV additions address the 345 kV overloads resulting from project T32 and prior PJM queue projects listed in Table 1 (Items 1a, 1b, 1c, 1d, 1e, and 1f). The 345 kV additions also reduce the base flows on the 138 kV facilities in the Belvidere – Marengo – Woodstock – Pleasant Valley – Crystal Lake corridor. A preliminary investigation shows that these reductions in flows appear to eliminate the 138 kV overloads listed in Table 1 (Items 1g, 1h, 1i, 1j, 1k, 1l, 1m, 1n, 1o, 1p, and 1q).

Other projects in the T-Queue prior to T106 demonstrate the need for long lead time facilities including a 765 kV "backbone" transmission system tying the Byron area to the transmission system east of ComEd. While project T106 may have some contributions to the need for this 765 kV "backbone", it may be possible to place T106 in service prior to construction of the 765 kV "backbone". With the addition of the four 345 kV lines listed above sufficient 138 kV capacity may be available to add project T106.

The cost of all of the upgrades mentioned above could be in the range of billions of dollars.

Additional studies will be performed during the System Impact and Facilities Studies to determine the ability to add project T106 after the four 345 kV lines are installed and prior to the installation of the 765 kV "backbone". These studies will also develop the optimum plan to address these issues. Studies will also be performed regarding cost allocation among the various projects.

Potential Issues

Since this analysis has been completed, the R59 project has been withdrawn from the PJM queue. This may have an impact on the T106 project's upgrades and cost responsibilities.

The Byron/Nelson area of the ComEd transmission system has historically been limited by transient and dynamic stability concerns and previous studies for new generator interconnections have identified severe limitations. Stability studies for this project will be performed during the System Impact Study. It is possible that significant cost contributions may be required of this project for new or previously identified stability upgrades.

The impacts on the AEP system due to the expansion of the 765kV system in ComEd and the new 765kV tie lines to AEP have not been studied. Additional system reinforcements may be required due to Project T106 and these line additions.

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		Contingent Element
				From	To	Type	MVA	
2a	T106	56.7	Cherry Valley to Silver Lake 345kV line #15616	284.90%	288.60%	Emergency	1530	Nelson to Lee County 345kV line #15501
2b	T106	29.4	Byron to Cherry Valley Blue 345kV line #0621	247.50%	249.50%	Emergency	1530	Byron to Cherry Valley Red 345kV line #0622
2c	T106	49	Byron to Cherry Valley Red 345kV line #0622	236.10%	239.30%	Emergency	1530	Nelson to Lee County 345kV line #15501
2d	T106	44.8	Byron to Wempletown 345kV line #0624	200.70%	203.30%	Emergency	1739	Nelson to Lee County 345kV line #15501
2e	T106	25.5	Silver Lake to Libertyville Red 345kV line #13821	135.40%	137.10%	Emergency	1530	Nelson to Lee County 345kV line #15501
2f	T106	14.9	Wempletown to T92T93 Red 345kV line #17102	182.60%	183.70%	Emergency	1341	Wempletown to T92T93 Blue 345kV line #17101
2g	T106	14.6	T92T93 to Paddock Red 345kV line #17102	178.10%	179.20%	Emergency	1341	T92T93 to Rockdale Blue 345kV line #17101
2h	T106	10.7	T92T93 to Rockdale Blue 345kV line #17101	168.00%	168.90%	Emergency	1214	T92T93 to Paddock Red 345kV line #17102
2i	T106	91.4	Nelson to Lee County 345kV line #15501	286.80%	292.70%	Emergency	1530	Cherry Valley to Silver Lake 345kV line #15616
2j	T106	39	Nelson to P20 345kV line #15502	228.60%	231.70%	Emergency	1234	Cherry Valley to Silver Lake 345kV line #15616
2k	T106	39	P20 to Electric Junction 345kV line #18402	234.80%	237.90%	Emergency	1234	Cherry Valley to Silver Lake 345kV line #15616
2l	T106	10.5	Zion to Pleasant Prairie Red 345kV line #2221	135.90%	136.80%	Emergency	1096	Cherry Valley to Silver Lake 345kV line #15616
2m	T106	10.7	Cherry Valley 345/138kV transformer #81	173.30%	175.60%	Emergency	465	Nelson to Lee County 345kV line #15501
2n	T106	11.2	Cherry Valley 345/138kV transformer #83	175.20%	177.50%	Emergency	480	Nelson to Lee County 345kV line #15501

Table 2 - Contribution to Previously Identified Overloads(Continued)								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingent Element
				From	To	Type	MVA	
2o	T106	7	Wempletown 345/138kV transformer #84	119.30%	120.80%	Emergency	480	Nelson to Lee County 345kV line #15501
2p	T106	6.9	Belvidere to Marengo Red Tap portion of Belvidere – Marengo – Pleasant Valley Red 138kV line #12204	186.40%	188.00%	Emergency	430	Cherry Valley to Silver Lake 345kV line #15616
2q	T106	8.3	Marengo Red Tap to Pleasant Valley portion of Belvidere – Marengo – Pleasant Valley Red 138kV line #12204	319.90%	322.80%	Emergency	293	Cherry Valley to Silver Lake 345kV line #15616
2r	T106	7.6	Belvidere to Marengo Tap Blue portion of Belvidere – Marengo - Woodstock 138kV line #12205	225.50%	227.30%	Emergency	430	Cherry Valley to Silver Lake 345kV line #15616
2s	T106	6.1	Marengo Tap to Woodstock Blue portion of Belvidere to Woodstock 138kV line #12205	265.00%	267.40%	Emergency	261	Cherry Valley to Silver Lake 345kV line #15616
2t	T106	6.1	Woodstock to Pleasant Valley Blue 138kV line #14106	229.40%	231.70%	Emergency	261	Cherry Valley to Silver Lake 345kV line #15616
2u	T106	6.5	Cherry Valley to E Rockford tap portion of the Cherry Valley – E Rockford – Alpine – Belvidere 138kV line #15623	155.10%	156.20%	Emergency	599	Cherry Valley to Silver Lake 345kV line #15616
2v	T106	6.5	E Rockford tap to Alpine tap portion of Cherry Valley – E Rockford – Alpine – Belvidere 138kV line #15623	129.90%	130.90%	Emergency	690	Cherry Valley to Silver Lake 345kV line #15616
2w	T106	6.9	Alpine tap to Belvidere Red portion of Cherry Valley – E Rockford – Alpine – Belvidere 138kV line #15623	207.60%	209.30%	Emergency	423	Cherry Valley to Silver Lake 345kV line #15616
2x	T106	8.6	Cherry Valley to W DeKalb tap portion of Cherry Valley – W DeKalb – Glidden 138kV line #15627	180.10%	182.70%	Emergency	338	Nelson to Lee County 345kV line #15501
2y	T106	6.9	Waterman 138kV bus tie 2-3	362.90%	366.10%	Emergency	215	P20 to Electric Junction 345kV line #18402
2z	T106	8.6	W DeKalb tap to Glidden portion of Cherry Valley – W DeKalb – Glidden 138kV line #15627	242.10%	245.80%	Emergency	235	Nelson to Lee County 345kV line #15501
2aa	T106	7.3	Cherry Valley to Stillman Valley tap portion of the Cherry Valley - Stillman Valley - O68/R54 138kV line #15621	125.60%	127.80%	Emergency	337	Nelson to Lee County 345kV line #15501
2ab	T106	6.1	Nelson to Nelson Tap portion of the Nelson-Dixon-Schauff Rd 138kV line #15508	116.70%	118.90%	Emergency	280	Nelson to Rock Falls 138kV line #15509
2ac	T106	7.3	Dixon to R65/O68 138kV line #10721	304.30%	308.30%	Emergency	182	Nelson to Lee County 345kV line #15501