

**Addendum for MISO DPP-2015-FEB-
West**

Definitive Planning Phase

PJM Affected Systems

February 28, 2017

This addendum contains updated study results for the report entitled *MISO DPP 2015 February West Area* dated July 16, 2016 and report addendum entitled *Addendum for MISO DPP-2015-FEB-West Definitive Planning Phase* dated October 4, 2016. The PJM Affected Systems analysis has been updated due to changes in both the PJM and MISO queues that occurred after the initial study.

Table 1 illustrates the cost comparison of the Affected Systems upgrade changes from the updated PJM report dated February 6, 2017 and subsequent report dated September 13, 2016 for projects in the Western Region.

Table 1: PJM Upgrade Cost Comparison

Project	Total PJM NU Cost Per Impacted Project		Cost Differential (Updated Cost - Originally Cost)
	Allocated Cost (9/13/2016)	Updated Allocated Cost (2/6/2017)	
G736	\$18,000,000	\$0	(\$18,000,000)
J299	\$0	\$0	\$0
J385	\$0	\$0	\$0
J391	\$0	\$0	\$0
J400	\$0	\$0	\$0
J405	\$0	\$0	\$0
J407	\$2,183,000	\$0	(\$2,183,000)
J411	\$8,333,000	\$19,000,000	\$10,667,000
J416	\$0	\$0	\$0
J426	\$0	\$0	\$0

1.1 Project Changes

DPP-2015-FEB-West area Projects J407, J411 & J416 were previously contingent upon upgrades to mitigate overloads on the Cordova – Nelson 345 kV line, Quad Cities – EES H471 345 kV line and the EES H471 – Nelson 345 kV line. PJM baseline upgrades B2692.1 and B2692.2 were previously required to mitigate the identified overloads. These projects are no longer contingent upon these projects being constructed.

DPP-2015-FEB-West area project J411 was previously responsible for upgrades to mitigate overloads on the Stillwell – Dumont 345 kV line. After the PJM retool MISO ATC project J390 is solely responsible for this upgrade.

DPP-2015-FEB-West area projects J407 & J411 were previously responsible for upgrades to mitigate overloads on the WILTON ; B-WILTON ;3M 345 kV line. This upgrade is no longer required.

DPP-2015-FEB-West area project G736 was previously responsible for upgrades to mitigate the Benton – T094 345 kV line. This upgrade cost responsibility has been shifted to MISO project J411. The J411 estimated cost allocation is \$19,000,000.

Appendix A: PJM Affected Systems Study Report

Impacts of MISO DPP-2015-February-August

Projects on PJM Facilities

1. MISO generators studied:

2015 February DPP:

MISO Project	POI	Interconnection	Summer	Capacity MW	Energy-Only MW	Fuel Type
		ServiceType	Max Output (MFO)			
G736	Big Stone South 230kV Substation	NRIS	200	200	0	Wind
J299	Wilmarth Substation: MEC-CT1 15 kV	ERIS	73	0	73	Gas
J301	Rapson 345 kV	NRIS	101	101	0	Wind
J308	Rapson - Banner 345 kV line	NRIS	301	301	0	Wind
J319	ANO-Pleasant Hill 500 kV line	NRIS	500	500	0	HVDC Line
J321	Rapson - Banner 345 kV line	NRIS	151.2	151.2	0	Wind
J384	2346 Clearview Road, Cambridge: CHA 138 kV	NRIS	21	21	0	Gas
J385	Chisago 7 115 kV	NRIS	100	100	0	Solar
J390	Rockdale – Paddock 345 kV line	NRIS	702	702	0	Gas
J391	MMU's N 7th Street 115 kV substation	NRIS	50	50	0	Gas
J392	Livingston to Stover 138 kV line: AlbaJ 138 kV	NRIS	434.3	434.3	0	Gas
J395	Section 34 Township 3N Range 2E: HLM - DAR 138 kV line	ERIS	98	0	98	Wind
J400	Lyon County 115kV Substation	NRIS	62.5	62.5	0	Solar
J401	Stout South Substation 138 kV	NRIS	20	20	0	Battery
J405	Lewis & Clark Jct substation: Lewis 115 kV	NRIS	40	40	0	Gas
J407	Glenworth 161 kV	NRIS	200	200	0	Wind
J411	Lehigh - Raun 345 kV line	NRIS	300	300	0	Wind
J416	Emery - Blackhawk 345 kV line	NRIS	200	200	0	Wind
J419	Milan 120 kV	NRIS	100	100	0	Solar
J422	Greenwood Energy Center 26 kV	NRIS Only	30	30	0	Gas
J426	Chanarambie substation 35.4 kV	NRIS	100	100	0	Wind
J431	Goodland 69 kV	NRIS Only	106	106	0	Wind

2015 August DPP:

MISO Project	POI	Interconnection ServiceType	Summer Max Output (MFO)	Capacity MW	Energy-Only MW	FuelType
G934	METC Nelson Road 345kV substation	NRIS	150	150	0	Wind
J041	Wellsburg 161 kV Substation	NRIS	90	90	0	Wind
J264	Bingham - Cornell 138 kV	NRIS	120	120	0	Wind
J291	PPI Aley 138kV Substation	NRIS	42	42	0	Gas
J298	Dysart 161 kV	NRIS	300.9	300.9	0	Wind
J396	Entergy Little Gypsy 230kV Power Station	NRIS	904	904	0	Gas
J399	Black Dog 115 kV substation	NRIS	214	214	0	Gas
J412	LeHigh - Raun 345 kV line	NRIS	200	200	0	Wind
J429	Big Hill 138 kV substation	NRIS	100	100	0	Wind
J436	Big Stone South 345/230 kV sub interconnecting at 345 kV	ERIS	150	0	150	Wind
J437	Big Stone South 345/230 kV sub interconnecting at 345 kV	ERIS	150	0	150	Wind
J438	Poweshiek-Parnell 161 kV line	NRIS	170.2	170.2	0	Wind
J440	Consumers DIGG 230 kV substation	NRIS Only	52	52	0	Gas
J442	Big Stone substation via a radial 230 kV line	NRIS	200	200	0	Wind
J443	Greely Tap 69kV	NRIS Only	41	41	0	Wind
J449	Pioneer Prairie I substation: Mitchell Co 345kV	NRIS/ERIS	202	40	162	Wind
J453	Duke Edwardsport 6951 69 kV line	ERIS	17.25	0	17.25	Solar
J455	Webster-Burt 345 kV line	ERIS	300	0	300	Wind
J466	Stein 345 kV Substation	NRIS	30	30	0	Co-Gen
J469	Consumers Grayling Generation 46 kV Substation	External NRIS	1.8	1.8	0	Wood

2. Summer Peak Analysis

- Model used – PJM AA1 Queue SIS 2018 Summer Peak case. All Active PJM queue projects modeled through the AA1 Queue along with all previously studied MISO DPP projects (studied through 2014 DPP). The MISO 2015 February and August DPP generators being studied were added to the model.
- Contingencies used – All PJM category B (single) and C contingencies (tower, bus fault, fault with stuck breaker)
- Monitored areas – All PJM areas
- Analysis type – PJM Generation Deliverability Test
- MISO ERIS Projects were modeled as PJM Energy-Only projects.
- MISO NRIS Projects were modeled as PJM Capacity projects.
- Generators were scaled to their respective capacity portions for base case (N-0) and all contingencies.
- Generators were scaled to their respective summer energy-only capabilities for category C contingencies only.
- MISO generation sunk to MISO
- PJM generation sunk to PJM

3. Summer Peak Results :

1. (MISO – AEP) The 17STILLWELL-05DUMONT 345 kV line (255113-243219 ckt 1) loads from 97.73% to 110.97% (AC power flow) of its emergency rating (1409 MVA) for the stuck breaker contingency outage of '2978_C2_A'.

CONTINGENCY '2978_C2_A'

OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1 / 243206
05DUMONT 765 907040 X1-020 TAP 765 1

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

END

2. (MISO – AEP) The 17STILLWELL-05DUMONT 345 kV line (255113-243219 ckt 1) loads from 89.06% to 102.51% (AC power flow) of its emergency rating (1409 MVA) for the stuck breaker contingency outage of '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

3. (MISO – AEP) The 17STILLWELL-05DUMONT 345 kV line (255113-243219 ckt 1) loads from 88.94% to 102.41% (AC power flow) of its emergency rating (1409 MVA) for the stuck breaker contingency outage of '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

4. Light Load analysis

- Model used – PJM AA1 Queue SIS 2018 Light Load case. All Active PJM queue projects modeled through the AA1 Queue along with all previously studied MISO DPP projects (studied through 2014 DPP). The MISO 2015 February and August DPP generators being studied were added to the model.
- Contingencies used – All PJM category B (single) and C contingencies (tower, bus fault, fault with stuck breaker)
- Monitored areas – All PJM areas
- Analysis type – PJM Generation Deliverability Test
- Analysis type – Light Load Generation Deliverability
 - All wind generators were scaled to 80% of their respective total capabilities for base case, category B, and category C events
 - The coal generator was scaled to 45% of its respective total capabilities for base case, category B, and category C events
- MISO generation sunk to MISO
- PJM generation sunk to PJM

5. Light Load Results

1. (AEP - AEP) The 05BENTON ; T-094 345 kV line (from bus 243212 to bus 247502 ckt 1) loads from 97.76% to 106.18% (AC power flow) of its normal rating (1409 MVA) for the single line contingency outage of '7023_B2_TOR8101690'.

CONTINGENCY '7023_B2_TOR8101690'

OPEN BRANCH FROM BUS 243215 TO BUS 247502 CKT 2 / 243215 05COOK 345
247502 T-094 345 2

END

6. Required System Upgrades & Cost Estimates/Allocations:

1. To relieve the Stillwell – Dumont 345 kV line overloads:
 - a. The MISO 2015 February DPP queue projects drive the loading above 1409 MVA SE. The upgrade is a sag study which has already been completed by AEP. The sag study results show work will include the replacement of tower 20 with a custom steel pole, replacement of tower 24 with a custom H-frame and the removal of swing angle brackets on 2 structures. Cost estimate is \$1.613M The new expected AEP-end SE rating is to be 1718 MVA SE limited by a Dumont wavetrapp and possibly the conductor.

The following MISO 2015 DPP Projects contribute to these constraints: J384, J395, G736, J400, J299, J385, J390, J391, J407, J426, J416, J443, J449, J041, J298, J436, J442.

These queue contributors are listed in queue order based on each project's M2 Date. This queue order was proposed and approved by MISO.

J390 is responsible for this cost as they are the project who causes the overload on the Stillwell-Dumont 345 kV line. The projects that contribute and are queued after J390 do not meet PJM cost allocation rules and do not receive any cost allocation at this time.

As changes to the PJM Interconnection Process occur (such as PJM or MISO projects withdrawing from the queue), the driver queue project can change and other MISO and/or PJM queue project(s) could receive cost allocation towards this upgrade going forward.

2. To relieve the 05BENTON-T-094 345 kV line overload:

Reconductor or rebuild (depending on the existing structures) the portions of 345 kV lines between the Benton Harbor and Sagreto 345 kV substations. The estimated cost will approximately be \$18,000,000 for the ACSR 954 45/7 Rail Conductor Section 1 and \$1,000,000 for the ACSR/TW 1158.4 Type 13 Hudson Conductor Section 2. PJM Network Upgrade N5106. Total cost estimate is \$19M.

The following MISO 2015 DPP Projects contribute to this overload: J395, G736, J407, J411, J426, J416, J443, J454, J449, J455, J041, J298, J412, J436, J437, J438, J442.

These queue contributors are listed in queue order based on each project's M2 Date. This queue order was proposed and approved by MISO.

MISO DPP 2015 project J411 is responsible for this cost as they are the project who causes the overload on the Benton – T-094 345 kV line. The projects that contribute and are queued after J411 do not meet PJM cost allocation rules and do not receive any cost allocation at this time.

As changes to the PJM Interconnection Process occur (such as PJM or MISO projects withdrawing from the queue), the driver queue project can change and other MISO and/or PJM queue project(s) could receive cost allocation towards this upgrade going forward.