Addendum for *MISO Affected System Impact Study SPP DISIS-2016-002 Draft*

September 14, 2020

This addendum contains updated study results for the report entitled Affected System Impact Study SPP DISIS-2016-002 performed on MISO's behalf by MEPPI dated June 2019. Results have been updated to reflect Network Upgrade (NU) changes after the withdrawal of Study Units (GEN-2016-096, GEN-2016-164, GEN-2016-165 and GEN-2016-166) and addition of Network Upgrades identified in SPP DISIS-2016-002 and confirmed by SPP on August 14th 2020.

1.1 Study Projects

Table 1 provides list of study projects after withdrawals in DISIS-2016-002 cycle.

Table 1: Active Study Projects

Queue number	Capacity (MW)	Service	Fuel Type	Area	Point of Interconnection
GEN-2016-036	44.6	ER	Wind	WAPA	Granite Falls 115kV
GEN-2016-074	200	ER/NR	Wind	NPPD	Sweetwater 345kV
GEN-2016-087	98.9	ER	Wind	WAPA	Bismark - Glenham 230kV line
GEN-2016-088	151.2	ER/NR	Wind	KCPL	Ketchem (Gen-2015-005 Tap) 345kV
GEN-2016-092	175	ER/NR	Wind	WAPA	Tap Leland Olds -Ft Thompson 345kV
GEN-2016-094	200	ER/NR	Wind	WAPA	Tap Ft Thompson - Oahe 230kV
GEN-2016-106	400	ER	Wind	NPPD	Gentleman Substation 345kV
GEN-2016-110	152	ER	Wind	BEPC	Tap Laramie - Stegall 345kV
GEN-2016-115	300	ER	Wind	KCPL	Holt County 345kV
GEN-2016-130	202	ER	Wind	BEPC	Leland Olds 345kV
GEN-2016-147	44.44	ER	Solar	WAPA	Sidney 115kV
GEN-2016-151	202	ER	Wind	WAPA	Tande 345kV

Table 2 Provides list of withdrawn projects (included in original MISO performed Affected System Studies)

Table 2: Withdrawn Study projects

Queue number	Capacity (MW)	Service	Fuel Type	Area	Proposed Point of Interconnection
GEN-2016-164	7.92	ER	Wind	BEPC	Groton 115kV
GEN-2016-096	227.7	ER	Wind	NPPD	Pauline - Moore 345kV
GEN-2016-165	202	ER	Wind	WAPA/NPPD	Fort Thompson - Grand Island 345kV
GEN-2016-166	35	ER/NR	Solar	AEP	Prairie Grove 69kV

1.2 Model Updates

With the withdrawal of units mentioned in Table *2*, the original study models were updated with the latest known information. In addition to the SPP queue withdrawal, the model was updated with the withdrawal of the J528, J598 MISO queue withdrawals along with the network upgrades that were no longer required as documented in the addendums for February 2016 and August 2016 study report addendums. Also, some corrections were made to the voltage schedule of MISO queue study units to reflect current information and improve the initial conditions of the power flow model. SPP DISIS-2016-002 network upgrades were modeled. For this addendum, MISO is only utilizing the MISO SH90 cases that were originally developed by MEPPI.

DPP 2016 February West SIS Addendum

https://cdn.misoenergy.org/GI_DPP_2016_FEB_West_Final_SIS_Addendum_Public315940.pdf

DPP 2016 February West SIS Second Addendum

https://cdn.misoenergy.org/GI%20DPP%202016%20FEB%20West%20Area%20SIS%20Second%20Addendum%20Public%20Final429588.pdf

DPP 2016 August West SIS Addendum

https://cdn.misoenergy.org/GI%20DPP%202016%20AUG%20West%20Area%20Restudy%20SIS%20Addendum%20Public429301.pdf

Table 3: Voltage Schedule Update

Voltage Schedule Updates	
Project	**Voltage (pu)**
J460	1.0261

Voltage Schedule Updates	
J432	1.0261
J488	1.03
J526	1.03
J523	1.0248
J302	1.03
J512	1.0261
J504	1.031

1.3 Results

The original affected system study performed by MEPPI identified the following network upgrades in Table 4.

Table 4: Original Network Upgrades Identified

Constraint	Transmission Owner	Mitigation Required	Cost Estimate
Min Valley to Granite Falls 115kV line	XEL/WAPA	Structure replacements	$500,000
Low voltages near Black Hawk 345kV and voltages near Waterloo, Iowa	MEC	Install a 150 MVAr SVC or STATCOM at Black Hawk 345kV	$50,000,000
Low voltages near Montezuma 345kV and J530 POI	MEC	Install a 200 MVAr SVC or STATCOM at Montezuma 345kV	$60,000,000
Low voltages at various OTP buses	OTP	Install three 20 MVAr capacitor banks at Wahpeton 115kV	$3,000,000
Low voltages at various OTP buses	OTP	Install a 20 MVAr capacitor bank at Hensel 69kV	$1,000,000

Constraint	Transmission Owner	Mitigation Required	Cost Estimate
Low voltages near Lyon County 115kV	OTP	Install 200 MVAr capacitor banks at Lyon County 115kV	$2,000,000
Low voltages near Big Sand 69kV	DPC	Install 2 x 7.5 MVAr capacitor banks at Big Sand 69kV	$650,000

The thermal analysis shows that there are no thermal constraints for the DISIS 2016-002 cluster to mitigate. The voltage analysis did identify voltage constraints that required a mitigation plan. *Table 5* documents the voltage mitigations that were required on MISO's system to integrate the DISIS 2016-002 cluster. Appendix B contains all identified voltage constraint results.

Table 5: Voltage Network Upgrades Identified

Constraint	Transmission Owner	Mitigation Required	Cost Estimate
Low voltages near Black Hawk 345kV Substation	MEC	Install a 150 MVAr SVC or STATCOM at Black Hawk 345kV	$50,000,000
Low voltages near Montezuma 345 kV Substation	MEC	Install a 150 MVAr Capacitor at Montezuma 345 kV	$5,000,000
Low Voltages near Arbor Hill and Beaver Creek 345 kV Substations	MEC	Install a 100 MVAr Capacitor at Grimes 345 kV	$5,000,000
Low Voltage Charles City South 69 kV Substation	MEC	Install a 25 MVAr Capacitor at Floyd 161 kV	$2,000,000

Constraint	Transmission Owner	Mitigation Required	Cost Estimate
Low voltages near Wahpeton	OTP	Install two 20 MVAr capacitor banks at Wahpeton 115kV	$3,000,000
Low voltages near Big Sand 69kV	DPC	Install two 7.5 MVAr capacitor banks at Big Sand 69kV	$650,000

With all the network upgraded identified as voltage constraints. Section 6.1.1.1.10.2 of the MISO BPM-015 was used to determine cost allocation for voltage constraints. BPM-015 is available on the MISO public website in the Generation Interconnection section. A link to directly download the latest BPM is provided below. The allocated costs for each project are document in *Table 6*. Detailed calculations for cost allocation are included in Appendix C.

https://cdn.misoenergy.org/BPM%20015%20-%20Generation%20Interconnection49574.zip

Table 6: Cost Allocation

Project	Black Hawk SVC	Montezuma Capacitor	Grimes Capacitor	Floyd Capacitor	Big Sand Capacitors	Wahpeton Capacitors	Total
2016-036	$1,357,827	$100,000	$0	$58,309	$24,164	$0	**$1,540,300**
2016-074	$4,552,716	$500,000	$537,849	$192,420	$50,743	$173,913	**$6,007,641**
2016-087	$2,476,038	$208,333	$239,044	$104,956	$41,078	$313,043	**$3,382,493**
2016-088	$2,715,655	$491,667	$278,884	$110,787	$28,996	$78,261	**$3,704,250**
2016-092	$4,392,971	$391,667	$458,167	$192,420	$67,658	$347,826	**$5,850,709**
2016-094	$4,952,077	$441,667	$537,849	$221,574	$72,491	$382,609	**$6,608,266**
2016-106	$8,945,687	$891,667	$976,096	$355,685	$99,071	$317,391	**$11,585,596**
2016-110	$3,354,633	$333,333	$338,645	$122,449	$36,245	$117,391	**$4,302,697**
2016-115	$6,629,393	$908,333	$737,052	$256,560	$62,825	$126,087	**$8,720,250**
2016-130	$4,872,204	$375,000	$458,167	$198,251	$84,572	$613,043	**$6,601,239**
2016-147	$1,038,339	$0	$0	$0	$0	$0	**$1,038,339**
2016-151	$4,712,460	$358,333	$438,247	$186,589	$82,156	$530,435	**$6,308,220**
Total	**$50,000,000**	**$5,000,000**	**$5,000,000**	**$2,000,000**	**$650,000**	**$3,000,000**	**$65,650,000**

1.4 Conclusion

With the withdrawal of MISO and SPP queued units, the changes to the network upgrades assigned to DISIS-2016-002 have been re-evaluated. The updated network upgrades have been identified and cost allocated in this addendum. All estimates in this addendum are planning level estimates. Upon the conclusion of the DISIS-2016-002 study cycle, Interconnection customers are expected to work with the affected MISO transmission owners to perform the required facility studies. Negotiation of facility construction agreements will need to be done once the interconnection customer executes a SPP interconnection agreement.

Appendix A Voltage Results

[REDACTED]

Appendix B Voltage Cost Allocation

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