Table L-6: MAPP Significantly Affected Facilities (SAF) and their Highest Loadings in 2017 SH Scenario

Generator	Constraint	Rating	Owner	Worst Loading		Cont Type	Mitigation	Cost ($)
				(MVA)	(%)			
J285	Twin Church-Sioux City 230 kV	320.0	WAPA NPPD	469.8	146.8	B	Constraint was identified in DPP 2012 Aug study. Build a second 25 miles line with sub expansion (NPPD owned, $30M). MAPP (WAPA) portion of the upgrade cost is $0	$0
J316	Aberdeen Jct-Aberdeen Siebrecht 115 kV	128.0	NWPS	139.5	109.0	C	Reconductor the 45 miles of 115 kV from Ellendale – Aberdeen Jct. – Aberdeen Siebrecht with “Hawk” equivalent 477 ACSS, HS285, high temp. conductor, for a cost of approximately $4.9 million.	Included in MISO mitigation cost
J316	Aberdeen Jct-Ellendale 115 kV	128.0	NWPS MDU	170.9	133.5	C	Reconductor the 45 miles of 115 kV from Ellendale – Aberdeen Jct. – Aberdeen Siebrecht with “Hawk” equivalent 477 ACSS, HS285, high temp. conductor, for a cost of approximately $4.9 million.	Included in MISO mitigation cost

L.5 2017 Stability Analysis Results

L.5.1 2017 Stability Analysis Results

Tripping of Some Wind Farms by Frequency Protection

Several wind farms were tripped by their frequency protection during simulation of some 3PH disturbances (Table L-7). These wind turbines used default protection settings shown in Table L-8 (<56.5 Hz or >62.5 Hz with a 20 millisecond time delay).

During the simulation, PSS®E calculates frequency from the change in bus voltage angle. The spike in frequency during the simulation is due to the change in the bus voltage angle when the fault is applied. In reality, frequency will not change instantaneously during a fault. The simulation was repeated with the instantaneous frequency protection disabled. Aside from the frequency spike, frequency is around 60 Hz and the frequency protection will not operate. Also, no stability violations were identified with these disturbances.

Frequency protection operates due to frequency spikes that result from the method used to calculate instantaneous bus frequency in the simulation. In reality, frequency can not change instantaneously, so no mitigation plan is required by the West Area DPP projects for frequency protection operation.

Table L-7: Tripping of Some Wind Farms by Frequency Protection

Disturbance Name	Description	2017 Results
0754_w_mec__b2__cmvp_sheldon__burt_____fr	3ph fault; generic clearing; on Obrien Co-Kossuth; at Obrien Co 345 kV	WTGs at bus 635408 and 635409 are tripped by frequency protection during the fault.
0760_w_mec__c3__ia-n4-1c3_at_raun-sioux_city	3PH fault at Raun on Raun-Sioux City 345 kV line; prior outage of Obrien-Lakefield 345 kV line	WTGs at bus 635408 and 635409 are tripped by frequency protection during the fault.
0762_w_mec__c3__ia-ws4-1c3_at_cbec-fallow	3ph fault at Council Bluffs on Council Bluffs-Fallow 345 kV line; Prior outage of Rolling Hills-Madison Co 345 kV line	WTGs at bus 635102, 635104 and 635106 are tripped by frequency protection during the fault.
Obrien_3ph_Lakefield_345	3PH fault on Obrien to Lakefield 345 kV line; Cleared at 4 cycles	WTGs at bus 635408, 635409 are tripped by frequency protection during the fault.
Obrien_3ph_KOS South_345	3PH fault on Obrien to Kossuth 345 kV line; Cleared at 4 cycles	WTGs at bus 635408, 635409 are tripped by frequency protection during the fault.
Obrien_3ph_Highland_345	3PH fault on Obrien to Highland 345 kV line; Cleared at 4 cycles	WTGs at bus 635408, 635409 are tripped by frequency protection during the fault.
MCKSBRG_3ph_Creston_161	3PH fault on MCKSBRG to Creston 161 kV line; Cleared at 6 cycles	WTGs at bus 635648 (J289) is tripped by frequency protection during the fault.
MCKSBRG_3ph_Winterset_161	3PH fault on MCKSBRG to Winterset 161 kV line; Cleared at 6 cycles	WTGs at bus 635648 (J289) is tripped by frequency protection during the fault.

Table L-8: Turbine Frequency Protection

Frequency	Time Limit
> 62.5 Hz	20 ms
< 56.5 Hz	20 ms

Instability of Big Stone Generator

Disturbance ‘BigStone_BusDiff-Fault’ is a 3PH fault at the Big Stone 230 kV bus with bus differentional protection failure (fault was cleared after 96 cycles). Instability of Big Stone generator was identified during the fault in both study case and benchmark case (Table L-9). If out of step protection is modeled, the Big Stone generator will be tripped by the out of step protection based on its actual relay settings. With tripping of the Big Stone generator, no other stability violations were identified with this disturbance.

No mitigation plan is required by the West Area DPP projects for instability of the Big Stone generator.

Table L-9: Instability of Big Stone Generator

Disturbance Name	Description	NERC Cat.	2017 Results
BigStone_BusDiff-Fault	3PH fault at Big Stone 230 kV bus; Bus differential relay failure; Trip Big Stone-Browns Valley-Hankinson 230 kV, Big Stone-HWY12-Ortonville 230 kV at 26 cycles; Trip Big Stone-Blair 230 kV, Big Stone-Mariett-Burr 230 kV, Canby-Burr 230 kV, Big Stone xfmr, and clear the fault at 96 cycles	D4	Big Stone unit (620315) is unstable in both study and benchmark cases. No other stability violations are identified after Big Stone unit is tripped by out of step protection.

Tripping of J320 by Loss of Excitation Relay

Steam turbine generation unit (bus #: 600067) of combined cycle plant (J320 is 55 MW expansion) at High Bridge 115 kV substation was tripped by the Loss of Excitation (LOEX) relay during simulation of some 3PH disturbances (Table L-10).

Table L-10: Tripping of High Bridge Units by LOEX Relay

Disturbance Name	Description	2017 Results
0878_w_xel__b2__highbridge-merriumpark	3ph fault at High Bridge on High Bridge-Merrium Park 115 kV line; trip High Bridge-Merrium Park 115 kV line	Machine at bus 600067 (J320) is tripped by the loss of excitation Model. The LOEX model parameter may need to be reset. Not tripped in benchmark case.
HighBridge_3ph_Shepard_115	3PH fault on High Bridge to Shepard 115 kV line; Cleared at 6 cycles	Machine at bus 600067 (J320) is tripped by the loss of excitation Model. The LOEX model parameter may need to be reset. Not tripped in benchmark case.
HighBridge_3ph_DaytonBluff_115	3PH fault on High Bridge to Dayton's Bluff 115 kV line; Cleared at 6 cycles	Machine at bus 600067 (J320) is tripped by the loss of excitation Model. The LOEX model parameter may need to be reset. Not tripped in benchmark case.

Under several 3PH local faults in Table L-10, the generator apparent impedance was still within the LOEX relay operational zone after the 3PH fault was cleared. This was the reason why the generator was tripped by the LOEX relay. With the same three 3PH faults listed in Table L-10, the High Bridge steam turbine unit was not tripped in the benchmark case but the non-operational margin was very low (Figure L-1).

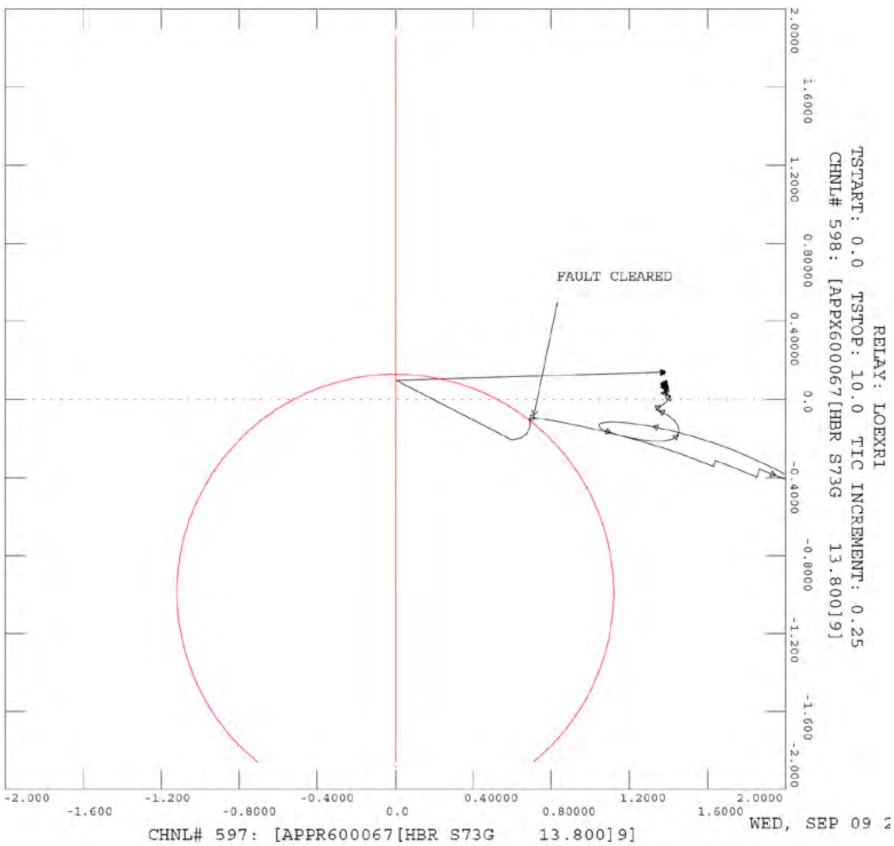

Figure L-1: High Bridge Steam Turbine Unit (600067) Apparent Impedance in the Benchmark Case for 3PH Fault '0878_w_xel__b2__highbridge-merriumpark'

Original parameters of the High Bridge steam turbine generator LOEX relay are listed in Table L-11. Xcel Energy confirmed that the parameter D1 should be -1.27 (-(Xd'+R1)/2=-1.27) instead of -0.99.

With the High Bridge steam turbine generator LOEX relay set at the correct parameters, the disturbances in Table L-10 were simulated again and no stability violations were identified.

Table L-11: LOEX Relay Original Parameters for High Bridge Steam Turbine Generator

Parameter	Value	Note
T1, zone 1 operating time (cycles)	12.00	
R1, zone 1 reach (diameter in pu)	2.24	Generator Xd=2.24, Xd'=0.3
A1, zone 1 centerline angle (degrees)	90.00	
D1, zone 1 center distance (pu)	-0.99	

Tripping of J316 Wind Farm by Turbine High Voltage Protection

J316 wind farm was tripped by the turbine high voltage protection during post-fault period in simulation of some local disturbances (Table L-12). The J316 wind turbines are GE 1.7-100 MW Type 3 turbines with local (terminal) high voltage protection default settings shown in Table L-13 (>1.15 pu with 0.1 second time delay).

Table L-12: Tripping of J316 Wind Farm by Turbine High Voltage Protection

Disturbance Name	Description	2017 Results
J316_3ph_Tatanka-POI_230	3PH fault on J316 Sub to Tatanka POI 230 kV line; Cleared at 5 cycles	J316 is tripped by the turbine high voltage protection (> 1.15 pu for over 0.1 second) after the fault is cleared.
J316_SLG_Tatanka-POI_230	SLG fault at J316 Sub on J316 Sub-Tatanka POI 230 kV; delayed clear J316 Sub-Tatanka POI 230 kV	J316 is tripped by the turbine high voltage protection (> 1.15 pu for over 0.1 second) after the fault is cleared.
J316_3ph_Ellendale_230	3PH fault on J316 Sub to Ellendale 230 kV line; Cleared at 5 cycles	J316 is tripped by the turbine high voltage protection (> 1.15 pu for over 0.1 second) after the fault is cleared.

Table L-13: Turbine High Voltage Default Protection

Terminal Voltage	Time Limit (second)
>1.15 pu	0.1
1.1<V≤1.15 pu	1.0

Under the fault disturbances listed in Table L-12, the J316 terminal voltage is shown in Figure L-2. The J316 terminal voltage is between 1.175 and 1.2 pu for more than 0.1 second but less than 0.12 second, so the turbine high voltage default protection (> 1.15 pu for over 0.1 second) trips the J316 wind farm.

It is verified[3] that the actual GE 1.7-100 type 3 turbine has the High Voltage Ride Through (HVRT) capability listed in Table L-14. The actual turbine will not be tripped if the terminal voltage is between 1.175 and 1.2 pu for less than 0.2 second. The J316 terminal voltage is between 1.175 and 1.2 pu for less than 0.12 second under the disturbances in Table L-12, therefore the J316 wind turbine will not be tripped under these three disturbances.

With the J316 turbine high voltage protection set at the correct value (Table L-14), the disturbances in Table L-12 were simulated again. J316 was not tripped, and no transient voltage violation or other stability violations were identified.

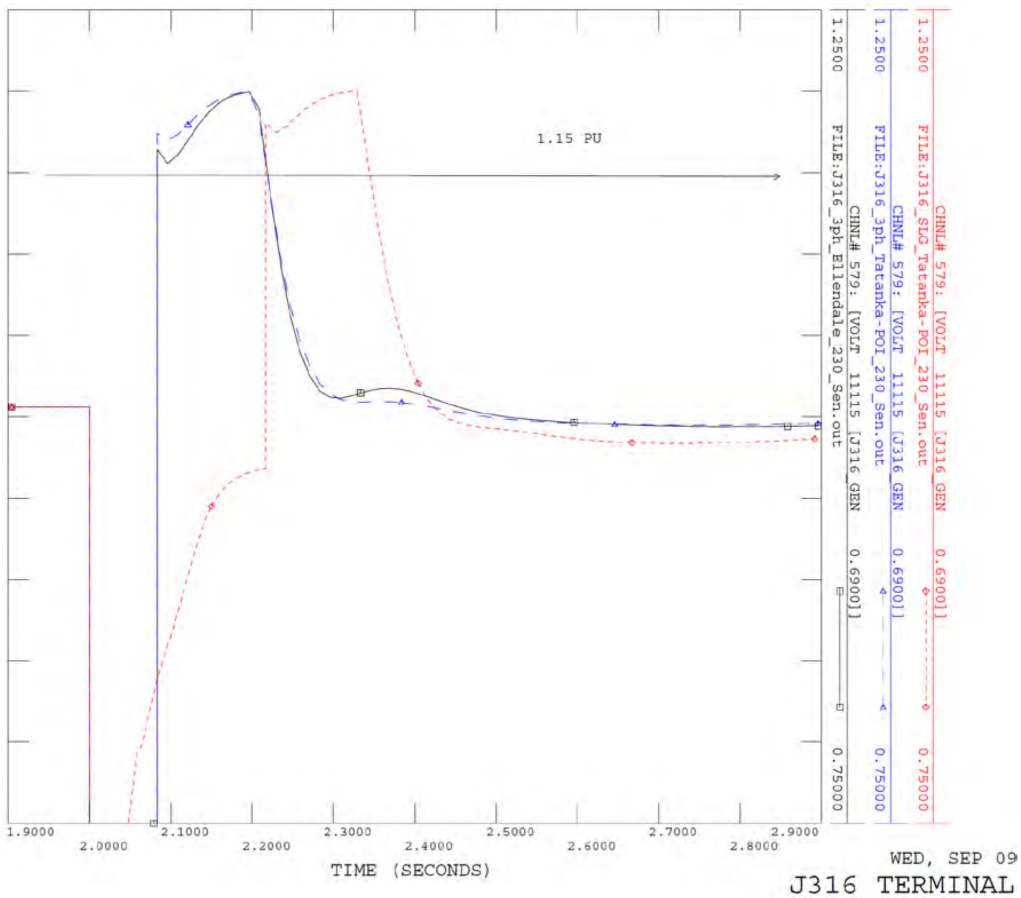

Figure L-2: J316 Terminal Voltage under Three Disturbances in Table L-12

Note 1: Voltage with black trace is J316 terminal voltage under the disturbance 'J316_3ph_Ellendale_230'.
Note 2: Voltage with blue trace is J316 terminal voltage under the disturbance 'J316_3ph_Tatanka-POI_230'.
Note 3: Voltage with red trace is J316 terminal voltage under the disturbance 'J316_SLG_Tatanka-POI_230'.

[3] "Technical Documentation Wind Turbine Generator Systems 1.x Series - 50 Hz and 60 Hz," GE Power & Water, 2014.

Table L-14: GE 1.7-100 Turbine High Voltage Ride Through (HVRT) Capability

Dynamic Voltage Range (%)	Time (s) HVRT
100 – 110	Continuous
110 – 115	1
115 – 117.5	0.5
117.5 – 120	0.2
120 - 130	0.1

L.5.2 Network Upgrades Identified in Stability Analysis for 2017 Scenario

No additional Network Upgrades are required in stability analysis for the 2017 scenario.

L.6 2017 Deliverability Study Results

L.6.1 J285

J285 Deliverable (NRIS) Amount in Near Term Case: (Conditional on ERIS upgrades and case assumptions)	250 MW (100%)

L.6.2 J289

J289 Deliverable (NRIS) Amount in Near Term Case: (Conditional on ERIS upgrades and case assumptions)	0 MW (0%)						
Next Upgrade for Higher NRIS Level (cumulative) (i.e. All upgrades must be made for 100% NRIS)	**Level of Service Attainable**	**Distribution Factor**	**Constraint in ERIS Analysis?**	**Projects Associated With ERIS Constraint**	**Projects Associated With NRIS Constraint**	**Upgrade Cost Allocated to Project**	**Total Cost of Upgrade**
Ottumwa–Wapello 161 kV #1	20.0 MW (100.0%)	5.92%	No		J289, J329, J344	Not Available	Not Available

L.6.3 J316

J316 Deliverable (NRIS) Amount in Near Term Case: (Conditional on ERIS upgrades and case assumptions)	**0 MW (0%)**						
Next Upgrade for Higher NRIS Level (cumulative) (i.e. All upgrades must be made for 100% NRIS)	**Level of Service Attainable**	**Distribution Factor**	**Constraint in ERIS Analysis?**	**Projects Associated With ERIS Constraint**	**Projects Associated With NRIS Constraint**	**Upgrade Cost Allocated to Project**	**Total Cost of Upgrade**
Mandan–Ward 230 kV	13.7 MW (9.1%)	29.35%	No		J316	Not Available	Not Available
Jamestown-Buffalo 345 kV	13.7 MW (9.1%)	12.73%	No		J316	Not Available	Not Available
Square Butte-Stanton 230 kV	14.1 MW (9.4%)	6.74%	No		J316	Not Available	Not Available
Oakes-Forman 230 kV	19.4 MW (12.9%)	55.73%	Yes	J316	J316	Not Available	Not Available
J316 Sub-Ellendale 230 kV	43.2 MW (28.8%)	63.05%	No		J316	Not Available	Not Available
Heskett–Mandan 115 kV	49.2 MW (32.8%)	21.89%	No		J316	Not Available	Not Available
Aberdeen Jct-Ellendale 115 kV	100.1 MW (66.7%)	30.92%	Yes	J316	J316	Not Available	Not Available
Forman 115-230-41.6 kV xfmr	112.9 MW (75.3%)	25.40%	Yes	J316	J316	Not Available	Not Available
Ellendale-Oakes 230 kV	126.0 MW (84.0%)	56.94%	No		J316	Not Available	Not Available
Merricourt-Ellendale 230 kV	138.4 MW (92.3%)	55.58%	No		J316	Not Available	Not Available
Merricourt-Wishek 230 kV	141.1 MW (94.1%)	69.02%	No		J316	Not Available	Not Available
Forman-Forman 115 kV	145.4 MW (96.9%)	25.40%	No		J316	Not Available	Not Available
Tatanka-Merricourt 230 kV	148.5 MW (99.0%)	99.94%	No		J316	Not Available	Not Available
Buffalo–Bison 345 kV	149.3 MW (99.5%)	12.33%	No		J316	Not Available	Not Available
Forman-Hankinson 230 kV	150.0 MW (100.0%)	42.64%	No		J316	Not Available	Not Available

L.6.4 J329

J329 Deliverable (NRIS) Amount in Near Term Case: (Conditional on ERIS upgrades and case assumptions)	12.5 MW (22.7%)						
Next Upgrade for Higher NRIS Level (cumulative) (i.e. All upgrades must be made for 100% NRIS)	**Level of Service Attainable**	**Distribution Factor**	**Constraint in ERIS Analysis?**	**Projects Associated With ERIS Constraint**	**Projects Associated With NRIS Constraint**	**Upgrade Cost Allocated to Project**	**Total Cost of Upgrade**
Ottumwa–Wapello 161 kV #1	55.0 MW (100.0%)	19.37%	No		J289, J329, J344	Not Available	Not Available

L.6.5 J343

J343 Deliverable (NRIS) Amount in Near Term Case: (Conditional on ERIS upgrades and case assumptions)	150 MW (100%)

L.6.6 J344

J344 Deliverable (NRIS) Amount in Near Term Case: (Conditional on ERIS upgrades and case assumptions)	38.4 MW (22.7%)						
Next Upgrade for Higher NRIS Level (cumulative) (i.e. All upgrades must be made for 100% NRIS)	**Level of Service Attainable**	**Distribution Factor**	**Constraint in ERIS Analysis?**	**Projects Associated With ERIS Constraint**	**Projects Associated With NRIS Constraint**	**Upgrade Cost Allocated to Project**	**Total Cost of Upgrade**
Ottumwa–Wapello 161 kV #1	169.0 MW (100.0%)	21.83%	No		J289, J329, J344	Not Available	Not Available

L.6.7 J382

J382 Deliverable (NRIS) Amount in Near Term Case: (Conditional on ERIS upgrades and case assumptions)	48.3 MW (100%)

L.7 Cost Allocation for 2017 Scenario

L.7.1 ERIS Network Upgrades for 2017 Scenario

Table L-15: Network Upgrades in MISO Steady-State Analysis for 2017 Scenario

Constraint	Mitigation	Owner	Cost ($)
J344 Sub-Beacon 161 kV	MEC - Beacon terminal requires replacement of line drops to achieve an acceptable Ring Closed rating: $25k; ITCM - Not loss of a single element: Mitigation not required	MEC ITCM	$25,000
Maryville-Clarinda 161 kV	MidAmerican's section is clearance and terminal limited. Structure replacements and terminal equipment replacements with an estimated cost of $225k would provide a rating of 199 MVA for MidAmerican's section.	MEC GMO	$225,000
Forman 230-115-41.6 kV xfmr	Requires additional transformer capacity. Replace existing 230/115/41.6 kV transformer with a larger unit.	OTP	$2,000,000
Oakes-Forman 230 kV	Line is clearance limited (sag rate 305 MVA). Will be required to do a phase raiser on one structure to allow adequated clearance. Fixing this one structure will allow the line to be rated at 330 MVA.	OTP	$20,000
Wapello-Apanoose 161 kV	Sag mitigation required - planning level estimate is $720k	ITCM	$720,000
Clarinda-Brooks 161 kV	MidAmerican's rating is clearance and terminal limited. Structure replacements and terminal equipment replacements with an estimated cost of $225k would provide a rating of 185 MVA.	MEC	$225,000
Aberdeen Jct- Aberdeen Siebrecht 115 kV	Reconductor the 45 miles of 115 kV from Ellendale – Aberdeen Jct. – Aberdeen Siebrecht with “Hawk” equivalent 477 ACSS, HS285, high temp. conductor, for a cost of approximately $4.9 million.	NWPS	Included in Aberdeen Jct-Ellendale 115 kV
Aberdeen Jct-Ellendale 115 kV	MDU - Upgrade Ellendale Terminal (wave trap, bus & CT): $70k; NWPS - Reconductor the 45 miles of 115 kV from Ellendale – Aberdeen Jct. – Aberdeen Siebrecht with “Hawk” equivalent 477 ACSS, HS285, high temp. conductor, for a cost of approximately $4.9 million.	NWPS MDU	$4,970,000

Table L-16: Additional Network Upgrades in MAPP SAF Analysis for 2017 Scenario

Constraint	Mitigation	Owner	Cost ($)
Twin Church-Sioux City 230 kV	Constraint was identified in DPP 2012 Aug study. Build a second 25 miles line with sub expansion (NPPD owned, $30M). MAPP (WAPA) portion of the upgrade cost is $0	WAPA NPPD	$0

Table L-17: PJM Network Upgrades for 2017 Scenario

Constraint	Mitigation	Owner	Cost ($)
Cordova–Nelson 345 kV line	Existing PJM baseline upgrades B2692.1 & B2692.2 are planned to be put into service by summer 2019. B2692.1 & B2692.2 will upgrade the Cordova - Nelson 345 kV line. The new line ratings will be 1679 / 2058 / 2280 MVA (SN/SE/SLD)	PJM	Existing PJM baseline upgrades
Quad Cities–ESS H471 345 kV line	Existing PJM baseline upgrades B2692.1 & B2692.2 are planned to be put into service by summer 2019. B2692.1 & B2692.2 will upgrade the Quad Cities – ESS H471 345 kV line. The new line ratings will be 1679/2011/2280 MVA (SN/SE/SLD)	PJM	Existing PJM baseline upgrades
ESS H471–Nelson 345 kV line	Existing PJM baseline upgrades B2692.1 & B2692.2 are planned to be put into service by summer 2019. B2692.1 & B2692.2 will upgrade the ESS H471 - Nelson 345 kV line. The new line ratings will be 1679/2011/2280 MVA (SN/SE/SLD)	PJM	Existing PJM baseline upgrades

Note 1: All the three constraints will be mitigated by existing PJM baseline upgrades B2692.1 & B2692.2, which are planned to be in service by summer 2019.

Note 2: Two projects J285 and J344 in the MISO DPP 2014 Cycle contribute loading to these three overloads. These projects can wait until B2692.1 & B2692.2 are placed into service or the projects can pay an advancement cost to place B2692.1 & B2692.2 into service earlier, if feasible per ComEd.

Table L-18: SPP Network Upgrades for 2017 Scenario

Thermal Constraint	Mitigation	Owner	DPP Cost ($)
No Constraints[1]			$0

Note 1: For Network Resource Interconnection Service (NRIS), NRIS constraints must be mitigated by the delay of NRIS until such time that the Nebraska City – Sibley 345kV can be place in service in 2017.

Table L-19: Network Upgrades in Voltage Stability Analysis for 2017 Scenario

Constraint	Owner	Mitigation	Cost ($)
No Constraints			$0

Table L-20: Additional Network Upgrades in Transient Stability Analysis for 2017 Scenario

Constraint	Owner	Mitigation	Cost ($)
No Constraints			

Table L-21: Shared Network Upgrade for 2017 Scenario

Network Upgrades	Original Driver for the Project	Total Network Upgrade Cost	J289 Cost Responsibility	J344 Cost Responsibility
J274 POI-Creston 161 kV	J274	$175,000	$32,953	$0
Jasper-Newton 161 kV	J233	$50,000	$0	$8,771

L.7.2 Cost Allocation in 2017 Scenario

Assuming all generating facilities in the DPP 2014 August West Area group advance, a summary of the costs for total NUs (NUs for ERIS, NRIS, and Interconnection Facilities) allocated to each generating facility is listed in Table L-22 for 2017 scenario.

Table L-22: Summary of Total NU Costs Allocated to Each Generation Project for 2017 Scenario

Project	Max Output (MW)	Total Cost of NU per Project ($)	$/MW	Share %
J285	250	$2,844,000	$11,376	9.76%
J289	20	$3,337,953	$166,898	11.46%
J316	150	$12,916,800	$86,112	44.34%
J320	55	$0	$0	0.00%
J329	55	$1,054,450	$19,172	3.62%
J343	150	$2,990,000	$19,933	10.26%
J344	169	$5,991,311	$35,452	20.56%
J382	48.3	$0	$0	0.00%
Total/Average	**897.3**	**$29,134,514**	**$42,368**	**100.00%**

Addendum for *MISO DPP 2014 August West Area Restudy*

May 11, 2016

This addendum contains updated study results for the report entitled *MISO DPP 2014 August West Area Restudy* and dated December 22, 2015. Results have been updated to reflect Network Upgrade (NU) changes after the withdrawal of generation project G359 (150 MW).

Table E-1 is Network Upgrade (NU) cost comparison (excluding TOIFs and Interconnection Facilities) between the allocated cost in the original report dated December 22, 2015 and the updated allocated cost in 2024 scenario.

Table E-1: Total Network Upgrade Cost (excluding TOIFs and Interconnection Facilities) Per Project Comparison in 2024 Scenario

Project	Total NU Cost Per Project for Actual NRIS Elections for each Project		Cost Differential (Updated Cost - Originally Cost)
	Allocated Cost (12/22/2015)	Updated Allocated Cost	
J285	$0	$0	$0
J289	$332,953	$332,953	$0
J316	$34,125,000	$19,000,000	($15,125,000)
J320	$0	$0	$0
J329	$0	$0	$0
J343	$295,000	$295,000	$0
J344	$333,771	$333,771	$0
J382	$0	$0	$0

1.1 *Study Background*

The G359 prior queued generation project was modeled in the original 2014 August West Area DPP Group Study completed on December 22, 2015. This prior queued generation project has been withdrawn.

Table 1: J359 Prior Queued Generation Project Withdrawn

MISO Project #	Service Type	TO	County, State	Point Of Interconnection	Fuel Type	Max Output (MW)
G359	ER	MDU	Dickey, ND	Ellendale 230 kV	Wind	150

Due to withdrawal of the G359 prior queued generation project, a sensitivity study has been performed by turning off the withdrawn generation project.

1.2 Steady State Contingency Analysis

1.2.1 Model Updating

The original DPP 2014 August West Area study cases were updated as follows:

- Remove the prior queued generating facility G359 from both the benchmark and study cases. Generation in the MISO market was scaled up in proportion to Pmax – Pgen.
- The power flow cases were solved with transformer tap adjustment enabled, area interchange disabled, phase shifter adjustment enabled and switched shunt adjustment enabled.

1.2.2 2024 Scenario Contingency Analysis Thermal Results

AC contingency analyses were performed on the updated 2024 models.

2024 Summer Shoulder

Table 2 lists the thermal constraint changes for 2024 summer shoulder in the restudy model compared with the original DPP study results. Detailed ACCC restudy results for the 2024 summer shoulder scenario are in the workbook "G359-Restudy_2024SH_Thermal_MISO_160506.xlsx". Thermal constraint changes are listed below:

- The J316 Sub – Ellendale 230 kV line is no longer a constraint.

Table 2: Thermal Constraint Changes in the 2024 Summer Shoulder Scenario

Facility	Original DPP	G359 Restudy
J316 Sub-Ellendale 230 kV	Constraint	Not a Constraint

2024 Summer Peak

There are no thermal constraint changes for 2024 summer peak.

1.2.3 SAF Analysis for Non-MISO MAPP Companies in 2024 Scenario

Significantly Affected Facilities (SAF) were screened for affected non-MISO MAPP companies (WAPA, MPC, BEPC, CIPCO, CBPC). AC contingency analysis was restudied for the SAF analysis, using the updated 2024 models.

2024 Summer Shoulder

There are no thermal violation (SAF) changes in the 2024 restudy models compared with the original DPP study results. Detailed SAF restudy results for the 2024 summer shoulder scenario are in the workbook "G359-Restudy_2024SH_Thermal_MAPP-SAF_160506.xlsx".

2024 Summer Peak

There are no thermal violation (SAF) changes for 2024 summer peak.

1.3 Deliverability Study

Detailed deliverability restudy results for the 2024 scenario are in the workbook "MISO-DPP-2014-AUG-West-NR_G359_withdrawn_2016-05-09.xlsx". Changes of NRIS levels and deliverability constraint s are listed in Table 3.

Table 3: Changes of NRIS Levels and Deliverability Constraints in the 2024 Scenario

Generation Proj	Original DPP		G359 Restudy	
	NR Deliverable (MW)	Constraints	NR Deliverable (MW)	Constraints
J285	250.0	None	250.0	None
J289	20.0	None	20.0	None
J316	0.0	Mandan–Ward 230 kV J316 Sub-Ellendale 230 kV Heskett - Mandan 115 kV Merricourt - Ellendale 230 kV	0.0	Mandan–Ward 230 kV (0 MW) J316 Sub-Ellendale 230 kV (117.8 MW)[1]
J329	55.0	None	55.0	None
J343	150.0	None	150.0	None
J344	169.0	None	169.0	None
J382	48.3	None	48.3	None

Note 1: The J316 Sub-Ellendale 230 kV is no longer an ERIS constraint. But this is a NRIS constraint identified in the deliverability study.

1.4 Cost Allocation

The revised per project cost summary of generation projects for 2024 scenario is listed below:

1.4.1 J285 Summary

Network Upgrade	Cost	J285
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

1.4.2 J289 Summary

Network Upgrade	Total Cost	J289
630388 WINCOR 8 69.0 630389 WINMUNI8 69.0 1	$300,000	$300,000
J274 POI-Creston 161 kV	$175,000	$32,953

Network Upgrade	Total Cost	J289
Total Cost Per Project for Actual NRIS Elections for each Project		**$332,953**

1.4.3 J316 Summary

Network Upgrade	Cost	J316
11117 J316_SUB 230 661098 ELLENDLMVP4 230 1[1]	$12,000,000	$12,000,000
661053 MANDAN 4 230 652296 WARD 4 230 1	$7,000,000	$7,000,000
Total Cost Per Project for Actual NRIS Elections for each Project		**$19,000,000**

Note 1: The J316 Sub-Ellendale 230 kV is no longer an ERIS constraint. But this is a NRIS constraint identified in the deliverability study.

1.4.4 J320 Summary

Network Upgrade	Total Cost	J320
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

1.4.5 J329 Summary

Network Upgrade	Cost	J329
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

1.4.6 J343 Summary

Network Upgrade	Cost	J343
541251 MARYVLE5 161 635034 CLRNDA 5 161 1	$225,000	$225,000
635034 CLRNDA 5 161 635037 BROOKS 5 161 1	$70,000	$70,000
Total Cost Per Project for Actual NRIS Elections for each Project		**$295,000**

1.4.7 J344 Summary

Network Upgrade	Cost	J344
11128 J344_SUB 161 635870 BEACON 5 161 1	$325,000	$325,000
Jasper-Newton 161 kV	$50,000	$8,771
Total Cost Per Project for Actual NRIS Elections for each Project		**$333,771**

1.4.8 J382 Summary

Network Upgrade	Cost	J382
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

Appendix A: 2017 Restudy Results

Table A-1 is a Network Upgrade (NU) cost comparison (excluding TOIFs and Interconnection Facilities) between the originally allocated cost and the updated allocated cost in 2017 scenario.

Table A-1: Total Network Upgrade Cost (excluding TOIFs and Interconnection Facilities) Per Project Comparison in 2017 Scenario

Project	Total NU Cost Per Project for Actual NRIS Elections for each Project		Cost Differential (Updated Cost - Originally Cost)
	Originally Allocated Cost	Updated Allocated Cost	
J285	$0	$0	$0
J289	$32,953	$32,953	$0
J316	$6,990,000	$4,970,000	($2,020,000)
J320	$0	$0	$0
J329	$0	$0	$0
J343	$450,000	$450,000	$0
J344	$753,771	$753,771	$0
J382	$0	$0	$0

Table A-2 lists the thermal constraint changes in the restudy model compared with the original DPP study results. Detailed ACCC restudy results for the 2017 summer shoulder scenario are in the workbook “G359-Restudy_2017SH_Thermal_MISO.xlsx”.

- The Forman 230-115-41.6 kV transformer is no longer a constraint.
- The Oakes – Forman 230 kV line is no longer a constraint.
- The Aberdeen Jct - Aberdeen Siebrecht 115 kV line is no longer a constraint.

Table A-2: Thermal Constraint Changes in the 2017 Summer Shoulder Scenario

Facility	Original DPP	G359 Restudy
Forman 230-115-41.6 kV xfmr	Constraint	Not a Constraint
Oakes-Forman 230 kV	Constraint	Not a Constraint
Aberdeen Jct-Aberdeen Siebrecht 115 kV	Constraint	Not a Constraint

There are no thermal violation changes for non-MISO MAPP companies (SAF) in the 2017 restudy models compared with the original DPP study results. Detailed SAF restudy results for the 2017 summer shoulder scenario are in the workbook “G359-Restudy_2017SH_Thermal_MAPP-SAF_160506.xlsx”.

There are no thermal constraint changes for 2017 summer peak.

Detailed deliverability restudy results for the 2017 scenario are in the workbook "MISO-DPP-2014-AUG-West-NR_G359_withdrawn_2016-05-09.xlsx". Changes of NRIS levels and deliverability constraint s are listed in Table A-3.

Table A-3: Changes of NRIS Levels and Deliverability Constraints in the 2017 Scenario

Generation Proj	Original DPP		G359 Restudy	
	NR Deliverable (MW)	Constraints	NR Deliverable (MW)	Constraints
J285	250.0	None	79.5	Dickenson Co-Triboji 161 kV
J289	0.0	Ottumwa–Wapello 161 kV #1	0.0	Ottumwa–Wapello 161 kV #1
J316	0.0	Various	0.0	Various
J329	12.5	Ottumwa–Wapello 161 kV #1	12.9	Ottumwa–Wapello 161 kV #1
J343	150.0	None	150.0	None
J344	38.4	Ottumwa–Wapello 161 kV #1	35.6	Ottumwa–Wapello 161 kV #1
J382	48.3	None	48.3	None

The revised per project cost summary of generation projects for 2017 scenario is listed below.

J285 Summary

Network Upgrade	Cost	J285
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

J289 Summary

Network Upgrade	Total Cost	J289
J274 POI-Creston 161 kV	$175,000	$32,953
Total Cost Per Project for Actual NRIS Elections for each Project		**$32,953**

J316 Summary

Network Upgrade	Total Cost	J316
660000 ABDNJCT7 115 661027 ELLENDL7 115 1	$4,970,000	$4,970,000
Total Cost Per Project for Actual NRIS Elections for each Project		**$4,970,000**

J320 Summary

Network Upgrade	Total Cost	J320
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

J329 Summary

Network Upgrade	Cost	J329
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

J343 Summary

Network Upgrade	Cost	J343
541251 MARYVLE5 161 635034 CLRNDA 5 161 1	$225,000	$225,000
635034 CLRNDA 5 161 635037 BROOKS 5 161 1	$225,000	$225,000
Total Cost Per Project for Actual NRIS Elections for each Project		**$450,000**

J344 Summary

Network Upgrade	Cost	J344
11128 J344_SUB 161 635870 BEACON 5 161 1	$25,000	$25,000
631110 WAPELLO5 161 631112 APANOSE5 161 1	$720,000	$720,000
Jasper-Newton 161 kV	$50,000	$8,771
Total Cost Per Project for Actual NRIS Elections for each Project		**$753,771**

J382 Summary

Network Upgrade	Cost	J382
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED
***DOCUMENT IS TRADE SECRET IN ITS ENTIRETY**

Docket No. E002/M-16-777
DOC Information Request No. 1
Attachment A3

MISO Project J316
Phase II Network Upgrade Facilities Study, North Dakota

GENERATOR INTERCONNECTION AGREEMENT (GIA)

Project No. J316

THIS GENERATOR INTERCONNECTION AGREEMENT ("GIA") is made and entered into this 30TH day of AUGUST 2016, by and between **Foxtail Wind, LLC**, a limited liability company organized and existing under the laws of the State of Delaware ("Interconnection Customer" with a Generating Facility), and **Montana-Dakota Utilities Company**, A Division of MDU Resources Group, Inc., a corporation organized and existing under the laws of the State of Delaware ("Transmission Owner"), and the **Midcontinent Independent System Operator, Inc**., a non-profit, non-stock corporation organized and existing under the laws of the State of Delaware ("Transmission Provider"). Interconnection Customer, Transmission Owner and Transmission Provider each may be referred to as a "Party," or collectively as the "Parties."

RECITALS

WHEREAS, Transmission Provider has functional control of the operations of the Transmission System, as defined herein, and is responsible for providing Transmission Service and Interconnection Service on the transmission facilities under its control; and

WHEREAS, Interconnection Customer intends to own, lease and/or control and operate the Generating Facility identified in Appendix A to this GIA; and

WHEREAS, Transmission Owner owns or operates the Transmission System, whose operations are subject to the functional control of Transmission Provider, to which Interconnection Customer desires to connect the Generating Facility, and may therefore be required to construct certain Interconnection Facilities and Network Upgrades, as set forth in this GIA; and

WHEREAS, Interconnection Customer, Transmission Owner and Transmission Provider have agreed to enter into this GIA, and where applicable subject to Appendix H for a provisional GIA, for the purpose of interconnecting the Generating Facility with the Transmission System;

NOW, THEREFORE, in consideration of and subject to the mutual covenants contained herein, it is agreed:

ARTICLE 1. DEFINITIONS

When used in this GIA, terms with initial capitalization that are not defined in Article 1 shall have the meanings specified in the Article in which they are used. Those capitalized terms used in this GIA that are not otherwise defined in this GIA have the meaning set forth in the Tariff.

Adverse System Impact shall mean the negative effects due to technical or operational limits on conductors or equipment being exceeded that may compromise the safety and reliability of the electric system.

Affected System shall mean an electric transmission or distribution system or the electric system associated with an existing generating facility or of a higher queued Generating Facility, which is an electric system other than the Transmission Owner's Transmission System that is affected by the Interconnection Request. An Affected System may or may not be subject to FERC jurisdiction.

Affected System Operator shall mean the entity that operates an Affected System.

Affiliate shall mean, with respect to a corporation, partnership or other entity, each such other corporation, partnership or other entity that directly or indirectly, through one or more intermediaries, controls, is controlled by, or is under common control with, such corporation, partnership or other entity.

Ancillary Services shall mean those services that are necessary to support the transmission of capacity and energy from resources to loads while maintaining reliable operation of the Transmission System in accordance with Good Utility Practice.

Applicable Laws and Regulations shall mean all duly promulgated applicable federal, state and local laws, regulations, rules, ordinances, codes, decrees, judgments, directives, or judicial or administrative orders, permits and other duly authorized actions of any Governmental Authority having jurisdiction over the Parties, their respective facilities and/or the respective services they provide.

Applicable Reliability Council shall mean the Regional Entity of NERC applicable to the Local Balancing Authority of the Transmission System to which the Generating Facility is directly interconnected.

Applicable Reliability Standards shall mean Reliability Standards approved by the Federal Energy Regulatory Commission (FERC) under section 215 of the Federal Power Act, as applicable.

Base Case shall mean the base case power flow, short circuit, and stability databases used for the Interconnection Studies by Transmission Provider or Interconnection Customer.

Breach shall mean the failure of a Party to perform or observe any material term or condition of this GIA.

Breaching Party shall mean a Party that is in Breach of this GIA.

Business Day shall mean Monday through Friday, excluding Federal Holidays.

Calendar Day shall mean any day including Saturday, Sunday or a Federal Holiday.

Commercial Operation shall mean the status of a Generating Facility that has commenced generating electricity for sale, excluding electricity generated during Trial Operation.

Commercial Operation Date (COD) of a unit shall mean the date on which the Generating Facility commences Commercial Operation as agreed to by the Parties pursuant to Appendix E to this GIA.

Common Use Upgrade (CUU) shall mean an Interconnection Facility, Network Upgrade, System Protection Facility, or any other classified addition, alteration, or improvement on the Transmission System or the transmission system of an Affected System, not classified under Attachment FF as a Baseline Reliability Project, Market Efficiency Project, or Multi-Value Project, that is needed for the interconnection of multiple Interconnection Customers' Generating Facilities and which is the shared responsibility of such Interconnection Customers.

Confidential Information shall mean any proprietary or commercially or competitively sensitive information, trade secret or information regarding a plan, specification, pattern, procedure, design, device, list, concept, policy or compilation relating to the present or planned business of a Party, or any other information as specified in Article 22, which is designated as confidential by the Party supplying the information, whether conveyed orally, electronically, in writing, through inspection, or otherwise, that is received by another Party.

Default shall mean the failure of a Breaching Party to cure its Breach in accordance with Article 17 of this GIA.

Definitive Planning Phase Queue Position shall mean the order of a valid Interconnection Request, relative to all other pending valid Interconnection Requests, in the Definitive Planning Phase. The Definitive Planning Phase Queue Position is established based upon the date Interconnection Customer satisfies all of the requirements of Section 8.2 to enter the Definitive Planning Phase.

Demonstrated Capability shall mean the continuous net real power output that the Generating Facility is required to demonstrate in compliance with Applicable Reliability Standards.

Dispute Resolution shall mean the procedure for resolution of a dispute between or among the Parties in which they will first attempt to resolve the dispute on an informal basis.

Distribution System shall mean the Transmission Owner's facilities and equipment, or the Distribution System of another party that is interconnected with the Transmission Owner's Transmission System, if any, connected to the Transmission System, over which facilities Transmission Service or Wholesale Distribution Service under the Tariff is available at the time Interconnection Customer has requested interconnection of a Generating Facility for the purpose of either transmitting electric energy in interstate commerce or selling electric energy at wholesale in interstate commerce and which are used to transmit electricity to ultimate usage points such as homes and industries directly from nearby generators or from interchanges with higher voltage transmission networks which transport bulk power over longer distances. The voltage levels at which distribution systems operate differ among Local Balancing Authorities and other entities owning distribution facilities interconnected to the Transmission System.

Distribution Upgrades shall mean the additions, modifications, and upgrades to the Distribution System at or beyond the Point of Interconnection to facilitate interconnection of the Generating Facility and render the delivery service necessary to affect Interconnection Customer's wholesale sale of electricity in interstate commerce. Distribution Upgrades do not include Interconnection Facilities.

Effective Date shall mean the date on which this GIA becomes effective upon execution by the Parties subject to acceptance by the Commission, or if filed unexecuted, upon the date specified by the Commission.

Emergency Condition shall mean a condition or situation: (1) that in the reasonable judgment of the Party making the claim is imminently likely to endanger, or is contributing to the endangerment of, life, property, or public health and safety; or (2) that, in the case of either Transmission Provider or Transmission Owner, is imminently likely (as determined in a non-discriminatory manner) to cause a material adverse effect on the security of, or damage to the Transmission System, Transmission Owner's Interconnection Facilities or the electric systems of others to which the Transmission System is directly connected; or (3) that, in the case of Interconnection Customer, is imminently likely (as determined in a non-discriminatory manner) to cause a material adverse effect on the security of, or damage to, the Generating Facility or Interconnection Customer's Interconnection Facilities. System restoration and blackstart shall be considered Emergency Conditions; provided that Interconnection Customer is not obligated by this GIA to possess blackstart capability. Any condition or situation that results from lack of sufficient generating capacity to meet load requirements or that results solely from economic conditions shall not constitute an Emergency Condition, unless one of the enumerated conditions or situations identified in this definition also exists.

Energy Displacement Agreement shall mean an agreement between an Interconnection Customer with an existing generating facility on the Transmission Provider's Transmission System and an Interconnection Customer with a proposed Generating Facility seeking to interconnect with Net Zero Interconnection Service. The Energy Displacement Agreement specifies the term of operation, the Generating Facility Interconnection Service limit, and the mode of operation for energy production (common or singular operation).

Energy Resource Interconnection Service (ER Interconnection Service) shall mean an Interconnection Service that allows Interconnection Customer to connect its Generating Facility to the Transmission System or Distribution System, as applicable, to be eligible to deliver the Generating Facility's electric output using the existing firm or non-firm capacity of the Transmission System on an as available basis. Energy Resource Interconnection Service does not convey transmission service.

Engineering & Procurement (E&P) Agreement shall mean an agreement that authorizes Transmission Owner to begin engineering and procurement of long lead-time items necessary for the establishment of the interconnection in order to advance the implementation of the Interconnection Request.

Environmental Law shall mean Applicable Laws or Regulations relating to pollution or protection of the environment or natural resources.

Federal Holiday shall mean a Federal Reserve Bank holiday for a Party that has its principal place of business in the United States and a Canadian Federal or Provincial banking holiday for a Party that has its principal place of business located in Canada.

Federal Power Act shall mean the Federal Power Act, as amended, 16 U.S.C. §§ 791a *et seq*.

FERC shall mean the Federal Energy Regulatory Commission, also known as Commission, or its successor.

Force Majeure shall mean any act of God, labor disturbance, act of the public enemy, war, insurrection, riot, fire, storm or flood, explosion, breakage or accident to machinery or equipment, any order, regulation or restriction imposed by governmental, military or lawfully established civilian authorities, or any other cause beyond a Party's control. A Force Majeure event does not include an act of negligence or intentional wrongdoing by the Party claiming Force Majeure.

Generating Facility shall mean Interconnection Customer's device(s) for the production and/or storage for later injection of electricity identified in the Interconnection Request, but shall not include the Interconnection Customer's Interconnection Facilities.

Generating Facility Capacity shall mean the net capacity of the Generating Facility and the aggregate net capacity of the Generating Facility where it includes multiple energy production devices.

Generator Interconnection Agreement (GIA) shall mean the form of interconnection agreement, set forth herein.

Generator Interconnection Procedures (GIP) shall mean the interconnection procedures set forth in Attachment X of the Tariff.

Generator Upgrades shall mean the additions, modifications, and upgrades to the electric system of an existing generating facility or of a higher queued Generating Facility at or beyond the Point of Interconnection to facilitate interconnection of the Generating Facility and render the Transmission Service necessary to affect Interconnection Customer's wholesale sale of electricity in interstate commerce.

Good Utility Practice shall mean any of the practices, methods and acts engaged in or approved by a significant portion of the electric industry during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather to be acceptable practices, methods, or acts generally accepted in the region.

Governmental Authority shall mean any federal, state, local or other governmental regulatory or administrative agency, court, commission, department, board, or other governmental subdivision, legislature, rulemaking board, tribunal, or other governmental authority having jurisdiction over the Parties, their respective facilities, or the respective services they provide, and exercising or entitled to exercise any administrative, executive, police, or taxing authority or power; provided, however, that such term does not include Interconnection Customer, Transmission Provider, Transmission Owner, or any Affiliate thereof.

Group Study(ies) shall mean the process whereby more than one Interconnection Request is studied together, instead of serially, for the purpose of conducting one or more of the required Studies.

Hazardous Substances shall mean any chemicals, materials or substances defined as or included in the definition of "hazardous substances," "hazardous wastes," "hazardous materials," "hazardous constituents," "restricted hazardous materials," "extremely hazardous substances," "toxic substances," "radioactive substances," "contaminants," "pollutants," "toxic pollutants" or words of similar meaning and regulatory effect under any applicable Environmental Law, or any other chemical, material or substance, exposure to which is prohibited, limited or regulated by any applicable Environmental Law.

HVDC Facilities shall mean the high voltage direct current transmission facilities, including associated alternating current facilities, if any, that are subject to Section 27A of the Tariff and that are specifically identified in (i) any Agency Agreement pertaining to such facilities between Transmission Provider and Transmission Owner that owns or operates such facilities, or (ii) in any other arrangement that permits or will permit Transmission Provider to provide HVDC Service over such facilities as set forth in Section 27A of the Tariff.

HVDC Service shall mean Firm and Non-Firm Point-To-Point Transmission Service provided by Transmission Provider on HVDC Facilities pursuant to Section 27A of the Tariff.

Initial Queue Position shall mean the order of a valid Interconnection Request, relative to all other pending valid Interconnection Requests. The Initial Queue Position is established based upon the date and time of receipt of the valid Interconnection Request by Transmission Provider.

Initial Synchronization Date shall mean the date upon which the Generating Facility is initially synchronized and upon which Trial Operation begins.

In-Service Date (ISD) shall mean the date upon which Interconnection Customer reasonably expects it will be ready to begin use of the Transmission Owner's Interconnection Facilities to obtain backfeed power.

Interconnection Customer shall mean any entity, including Transmission Provider, Transmission Owner or any of the Affiliates or subsidiaries of either, that proposes to interconnect its Generating Facility with the Transmission System.

Interconnection Customer's Interconnection Facilities (ICIF) shall mean all facilities and equipment, as identified in Appendix A of this GIA, that are located between the Generating Facility and the Point of Change of Ownership, including any modification, addition, or upgrades to such facilities and equipment necessary to physically and electrically interconnect the Generating Facility to the Transmission System or Distribution System, as applicable. Interconnection Customer's Interconnection Facilities are sole use facilities.

Interconnection Facilities shall mean the Transmission Owner's Interconnection Facilities and the Interconnection Customer's Interconnection Facilities. Collectively, Interconnection Facilities include all facilities and equipment between the Generating Facility and the Point of Interconnection, including any modification, additions or upgrades that are necessary to physically and electrically interconnect the Generating Facility to the Transmission System. Interconnection Facilities shall not include Distribution Upgrades, Generator Upgrades, Stand Alone Network Upgrades or Network Upgrades.

Interconnection Facilities Study shall mean a study conducted by Transmission Provider, or its agent, for Interconnection Customer to determine a list of facilities (including Transmission Owner's Interconnection Facilities, System Protection Facilities, and if such upgrades have been determined, Network Upgrades, Distribution Upgrades, Generator Upgrades, Common Use Upgrades, and upgrades on Affected Systems, as identified in the Interconnection System Impact Study), the cost of those facilities, and the time required to interconnect the Generating Facility with the Transmission System.

Interconnection Facilities Study Agreement shall mean the form of agreement contained in Appendix 4 of the Generator Interconnection Procedures for conducting the Interconnection Facilities Study.

Interconnection Feasibility Study shall mean a preliminary evaluation of the system impact of interconnecting the Generating Facility to the Transmission System.

Interconnection Request shall mean an Interconnection Customer's request, in the form of Appendix 1 to the Generator Interconnection Procedures, to interconnect a new Generating Facility, or to increase the capacity of, or make a Material Modification to the operating characteristics of, an existing Generating Facility that is interconnected with the Transmission System.

Interconnection Service shall mean the service provided by Transmission Provider associated with interconnecting the Generating Facility to the Transmission System and enabling it to receive electric energy and capacity from the Generating Facility at the Point of Interconnection, pursuant to the terms of this GIA and, if applicable, the Tariff.

Interconnection Study (or Study) shall mean any of the studies described in the Generator Interconnection Procedures.

Interconnection Study Agreement shall mean the form of agreement contained in Attachment B to Appendix 1 of the Generator Interconnection procedures for conducting all studies required by the Generator Interconnection Procedures.

Interconnection System Impact Study shall mean an engineering study that evaluates the impact of the proposed interconnection on the safety and reliability of Transmission System and, if applicable, an Affected System. The study shall identify and detail the system impacts that would result if the Generating Facility were interconnected without project modifications or system modifications, focusing on the Adverse System Impacts identified in the Interconnection Feasibility Study, or to study potential impacts, including but not limited to those identified in the Scoping Meeting as described in the Generator Interconnection Procedures.

IRS shall mean the Internal Revenue Service.

Local Balancing Authority shall mean an operational entity or a Joint Registration Organization which is (i) responsible for compliance with the subset of NERC Balancing Authority Reliability Standards defined in the Balancing Authority Agreement for their local area within the MISO Balancing Authority Area, (ii) a Party to Balancing Authority Agreement, excluding the MISO, and (iii) provided in the Balancing Authority Agreement.

Loss shall mean any and all damages, losses, claims, including claims and actions relating to injury to or death of any person or damage to property, demand, suits, recoveries, costs and expenses, court costs, attorney fees, and all other obligations by or to third parties, arising out of or resulting from the other Party's performance, or non-performance of its obligations under this GIA on behalf of the indemnifying Party, except in cases of gross negligence or intentional wrongdoing, by the indemnified party.

Material Modification shall mean those modifications that have a material impact on the cost or timing of any Interconnection Request with a later queue priority date.

Metering Equipment shall mean all metering equipment installed or to be installed at the Generating Facility pursuant to this GIA at the metering points, including but not limited to instrument transformers, MWh-meters, data acquisition equipment, transducers, remote terminal unit, communications equipment, phone lines, and fiber optics.

Monitoring and Consent Agreement shall mean an agreement that defines the terms and conditions applicable to a Generating Facility acquiring Net Zero Interconnection Service. The Monitoring and Consent Agreement will list the roles and responsibilities of an Interconnection Customer seeking to interconnect with Net Zero Interconnection Service and Transmission Owner to maintain the total output of the Generating Facility inside the parameters delineated in the GIA.

NERC shall mean the North American Electric Reliability Corporation or its successor organization.

Net Zero Interconnection Service shall mean a form of ER Interconnection Service that allows Interconnection Customer to alter the characteristics of an existing generating facility, with the consent of the existing generating facility, at the same POI such that the Interconnection Service limit remains the same.

Network Customer shall have that meaning as provided in the Tariff.

Network Resource shall mean any designated generating resource owned, purchased, or leased by a Network Customer under the Tariff. Network Resources do not include any resource, or any portion thereof, that is committed for sale to third parties or otherwise cannot be called upon to meet the Network Customer's Network Load on a non-interruptible basis.

Network Resource Interconnection Service (NR Interconnection Service) shall mean an Interconnection Service that allows Interconnection Customer to integrate its Generating Facility with the Transmission System in the same manner as for any Generating Facility being designated as a Network Resource. Network Resource Interconnection Service does not convey transmission service. Network Resource Interconnection Service shall include any network resource interconnection service established under an agreement with, or the tariff of, a Transmission Owner prior to integration into MISO, that is determined to be deliverable through the integration deliverability study process.

Network Upgrades shall mean the additions, modifications, and upgrades to the Transmission System required at or beyond the point at which the Interconnection Facilities connect to the Transmission System or Distribution System, as applicable, to accommodate the interconnection of the Generating Facility to the Transmission System. Network Upgrade shall not include any HVDC Facility Upgrades.

Notice of Dispute shall mean a written notice of a dispute or claim that arises out of or in connection with this GIA or its performance.

Operating Horizon Study shall mean an Interconnection System Impact Study that includes in service transmission and generation for an identified timeframe to determine either the available injection capacity of an Interconnection Request or Interconnection Facilities and/or Transmission System changes required for the requested Interconnection Service**.**

Optional Interconnection Study shall mean a sensitivity analysis based on assumptions specified by Interconnection Customer in the Optional Interconnection Study Agreement.

Optional Interconnection Study Agreement shall mean the form of agreement contained in Appendix 5 of the Generator Interconnection Procedures for conducting the Optional Interconnection Study.

Party or Parties shall mean Transmission Provider, Transmission Owner, Interconnection Customer, or any combination of the above.

Planning Horizon Study shall mean an Interconnection System Impact Study that includes a future year study to determine either the available injection capacity of an Interconnection Request or Interconnection Facilities and/or Transmission System changes required for the requested Interconnection Service.

Point of Change of Ownership (PCO) shall mean the point, as set forth in Appendix A to the Generator Interconnection Agreement, where the Interconnection Customer's Interconnection Facilities connect to the Transmission Owner's Interconnection Facilities.

Point of Interconnection (POI) shall mean the point, as set forth in Appendix A of the GIA, where the Interconnection Facilities connect to the Transmission System.

Reasonable Efforts shall have that meaning as provided in the Tariff.

Regular Generator Interconnection System Impact Study is an option in the System Planning Analysis Phase where a study is performed under the same assumptions used in Section 8 of this GIP.

Scoping Meeting shall mean the meeting between representatives of Interconnection Customer, Transmission Owner, Affected System Operator(s) and Transmission Provider conducted for the purpose of discussing alternative interconnection options, to exchange information including any transmission data and earlier study evaluations that would be reasonably expected to impact such interconnection options, to analyze such information, and to determine the potential feasible Points of Interconnection.

Shared Network Upgrade shall mean a Network Upgrade or Common Use Upgrade that is funded by an Interconnection Customer(s) and also benefits other Interconnection Customer(s) that are later identified as beneficiaries.

Site Control shall mean documentation reasonably demonstrating: (1) ownership of, a leasehold interest in, or a right to develop a site for the purpose of constructing the Generating Facility and when applicable (i.e. when Interconnection Customer is providing the site for the TOIFs and Network Upgrades at the POI) the Interconnection Facilities, and; (2) an option to purchase or acquire a leasehold site for such purpose; or (3) an exclusivity or other business relationship between Interconnection Customer and the entity having the right to sell, lease or grant Interconnection Customer the right to possess or occupy a site for such purpose. Such documentation must include a reasonable determination of sufficient land area to support the size and type of Generating Facility proposed. Such documentation must include a reasonable determination of sufficient land area to support the size and type of Generating Facility proposed.

Small Generating Facility shall mean a Generating Facility that has an aggregate net Generating Facility Capacity of no more than five MW and meets the requirements of Section 14 and Appendix 3 of the GIP.

Special Protection System (SPS) shall mean an automatic protection system or remedial action scheme designed to detect abnormal or predetermined system conditions, and take corrective actions other than and/or in addition to the isolation of faulted components, to maintain system reliability. Such action may include changes in demand (MW and MVar), energy (MWh and MVarh), or system configuration to maintain system stability, acceptable voltage, or power flows. An SPS does not include (a) underfrequency or undervoltage load shedding, (b) fault conditions that must be isolated, (c) out-of-step relaying not designed as an integral part of an SPS, or (d) Transmission Control Devices.

Stand Alone Network Upgrades shall mean Network Upgrades that an Interconnection Customer may construct without affecting day-to-day operations of the Transmission System during their construction. Transmission Provider, Transmission Owner and Interconnection Customer must agree as to what constitutes Stand Alone Network Upgrades and identify them in Appendix A to this GIA.

System Protection Facilities shall mean the equipment, including necessary protection signal communications equipment, required to protect (1) the Transmission System or other delivery systems or other generating systems from faults or other electrical disturbances occurring at the Generating Facility and (2) the Generating Facility from faults or other electrical system disturbances occurring on the Transmission System or on other delivery systems or other generating systems to which the Transmission System is directly connected.

Tariff shall mean the Transmission Provider's Tariff through which open access transmission service and Interconnection Service are offered, as filed with the Commission, and as amended or supplemented from time to time, or any successor tariff.

Transmission Control Devices shall mean a generally accepted transmission device that is planned and designed to provide dynamic control of electric system quantities, and are usually employed as solutions to specific system performance issues. Examples of such devices include fast valving, high response exciters, high voltage DC links, active or real power flow control and reactive compensation devices using power electronics (*e.g.*, unified power flow controllers), static var compensators, thyristor controlled series capacitors, braking resistors, and in some cases mechanically-switched capacitors and reactors. In general, such systems are not considered to be Special Protection Systems.

Transmission Owner shall mean that Transmission Owner as defined in the Tariff, which includes an entity that owns, leases or otherwise possesses an interest in the portion of the Transmission System at which Interconnection Customer proposes to interconnect or otherwise integrate the operation of the Generating Facility. Transmission Owner should be read to include any Independent Transmission Company that manages the transmission facilities of Transmission Owner and shall include, as applicable, the owner and/or operator of distribution facilities interconnected to the Transmission System, over which facilities transmission service or Wholesale Distribution Service under the Tariff is available at the time Interconnection Customer requests Interconnection Service and to which Interconnection Customer has requested interconnection of a Generating Facility for the purpose of either transmitting electric energy in interstate commerce or selling electric energy at wholesale in interstate commerce.

Transmission Provider shall mean the Midcontinent Independent System Operator, Inc. (“MISO”), the Regional Transmission Organization that controls or operates the transmission facilities of its transmission-owning members used for the transmission of electricity in interstate commerce and provides transmission service under the Tariff.

Transmission Owner’s Interconnection Facilities (TOIF) shall mean all facilities and equipment owned by Transmission Owner from the Point of Change of Ownership to the Point of Interconnection as identified in Appendix A to this GIA, including any modifications, additions or upgrades to such facilities and equipment. Transmission Owner’s Interconnection Facilities are sole use facilities and shall not include Distribution Upgrades, Generator Upgrades, Stand Alone Network Upgrades or Network Upgrades.

Transmission System shall mean the facilities owned by Transmission Owner and controlled or operated by Transmission Provider or Transmission Owner that are used to provide Transmission Service (including HVDC Service) or Wholesale Distribution Service under the Tariff.

Trial Operation shall mean the period during which Interconnection Customer is engaged in on-site test operations and commissioning of the Generating Facility prior to Commercial Operation.

Variable Energy Resource shall mean a device for the production of electricity that is characterized by an energy source that: (1) is renewable; (2) cannot be stored by the facility owner or operator; and (3) has variability that is beyond the control of the facility owner or operator.

Wholesale Distribution Service shall have that meaning as provided in the Tariff. Wherever the term “transmission delivery service” is used, Wholesale Distribution Service shall also be implied.

ARTICLE 2. EFFECTIVE DATE, TERM AND TERMINATION

2.1 **Effective Date**. This GIA shall become effective upon execution by the Parties subject to acceptance by FERC (if applicable), or if filed unexecuted, upon the date specified by FERC. Transmission Provider shall promptly file this GIA with FERC upon execution in accordance with Article 3.1, if required.

2.2 **Term of Agreement**. Subject to the provisions of Article 2.3, this GIA shall remain in effect for a period of thirty (30) years from the Effective Date and shall be automatically renewed for each successive one-year period thereafter on the anniversary of the Effective Date.

2.3 **Termination Procedures.** This GIA may be terminated as follows:

2.3.1 **Written Notice.** This GIA may be terminated by Interconnection Customer after giving Transmission Provider and Transmission Owner ninety (90) Calendar Days advance written notice or by Transmission Provider if the Generating Facility or a portion of the Generating Facility fails to achieve Commercial Operation for three (3) consecutive years following the Commercial Operation Date, or has ceased Commercial Operation for three (3) consecutive years, beginning with the last date of Commercial Operation for the Generating Facility, after giving Interconnection Customer ninety (90) Calendar Days advance written notice. Where only a portion of the Generating Facility fails to achieve Commercial Operation for three (3) consecutive years following the Commercial Operation Date, Transmission Provider may only terminate that portion of the GIA. The Generating Facility will not be deemed to have ceased Commercial Operation for purposes of this Article 2.3.1 if Interconnection Customer can document that it has taken other significant steps to maintain or restore operational readiness of the Generating Facility for the purpose of returning the Generating Facility to Commercial Operation as soon as possible.

2.3.1.1 **Net Zero Interconnection Service.** Where this GIA provides for Net Zero Interconnection Service and the Energy Displacement Agreement or the Monitoring and Consent Agreement required for Net Zero Interconnection Service are no longer in effect, Interconnection Customer shall immediately cease Commercial Operation of the Generating Facility and this GIA shall be deemed terminated.

2.3.2 **Default.** Any Party may terminate this GIA in accordance with Article 17.

2.3.3 Notwithstanding Articles 2.3.1 and 2.3.2, no termination shall become effective until the Parties have complied with all Applicable Laws and Regulations applicable to such termination, including the filing with FERC of a notice of termination of this GIA, if required, which notice has been accepted for filing by FERC.

2.4 Termination Costs. If a Party elects to terminate this GIA pursuant to Article 2.3 above, each Party shall pay all costs incurred for which that Party is responsible (including any cancellation costs relating to orders or contracts for Interconnection Facilities, applicable upgrades, and related equipment) or charges assessed by the other Parties, as of the date of the other Parties' receipt of such notice of termination, under this GIA. In the event of termination by a Party, the Parties shall use commercially Reasonable Efforts to mitigate the costs, damages and charges arising as a consequence of termination. Upon termination of this GIA, unless otherwise ordered or approved by FERC:

2.4.1 With respect to any portion of the Transmission Owner's Interconnection Facilities, Network Upgrades, System Protection Facilities, Distribution Upgrades, Generator Upgrades, and if so determined and made a part of this GIA, upgrades on Affected Systems, that have not yet been constructed or installed, Transmission Owner shall to the extent possible and to the extent of Interconnection Customer's written notice under Article 2.3.1, cancel any pending orders of, or return, any materials or equipment for, or contracts for construction of, such facilities; provided that in the event Interconnection Customer elects not to authorize such cancellation, Interconnection Customer shall assume all payment obligations with respect to such materials, equipment, and contracts, and Transmission Owner shall deliver such material and equipment, and, if necessary, assign such contracts, to Interconnection Customer as soon as practicable, at Interconnection Customer's expense. To the extent that Interconnection Customer has already paid Transmission Owner for any or all such costs of materials or equipment not taken by Interconnection Customer, Transmission Owner shall promptly refund such amounts to Interconnection Customer, less any costs, including penalties incurred by Transmission Owner to cancel any pending orders of or return such materials, equipment, or contracts.

If an Interconnection Customer terminates this GIA, it shall be responsible for all costs incurred in association with that Interconnection Customer's interconnection, including any cancellation costs relating to orders or contracts for Interconnection Facilities and equipment, and other expenses including any upgrades or related equipment for which Transmission Owner has incurred expenses and has not been reimbursed by Interconnection Customer.

2.4.2 Transmission Owner may, at its option, retain any portion of such materials, equipment, or facilities that Interconnection Customer chooses not to accept delivery of, in which case Transmission Owner shall be responsible for all costs associated with procuring such materials, equipment, or facilities. If Transmission Owner does not so elect, then Interconnection Customer shall be responsible for such costs.

2.4.3 With respect to any portion of the Interconnection Facilities, and any other facilities already installed or constructed pursuant to the terms of this GIA, Interconnection Customer shall be responsible for all costs associated with the removal, relocation, reconfiguration or other disposition or retirement of such materials, equipment, or facilities, and such other expenses actually incurred by Transmission Owner necessary to return the Transmission, Distribution or Generator System, as applicable, to safe and reliable operation.

2.5 **Disconnection**. Upon termination of this GIA, the Parties will take all appropriate steps to disconnect the Generating Facility from the Transmission or Distribution System, as applicable. All costs required to effectuate such disconnection shall be borne by the terminating Party, unless such termination resulted from the non-terminating Party's Default of this GIA or such non-terminating Party otherwise is responsible for these costs under this GIA.

2.6 **Survival.** This GIA shall continue in effect after termination to the extent necessary to provide for final billings and payments and for costs incurred hereunder, including billings and payments pursuant to this GIA; to permit the determination and enforcement of liability and indemnification obligations arising from acts or events that occurred while this GIA was in effect; and to permit each Party to have access to the lands of the other Party pursuant to this GIA or other applicable agreements, to disconnect, remove or salvage its own facilities and equipment.

ARTICLE 3. REGULATORY FILINGS

3.1 **Filing.** Transmission Provider shall file this GIA (and any amendment hereto) with the appropriate Governmental Authority, if required. A Party may request that any information so provided be subject to the confidentiality provisions of Article 22. If that Party has executed this GIA, or any amendment thereto, the Party shall reasonably cooperate with Transmission Provider with respect to such filing and to provide any information reasonably requested by Transmission Provider needed to comply with applicable regulatory requirements.

ARTICLE 4. SCOPE OF SERVICE

4.1 **Interconnection Product Options**. Interconnection Customer has selected the following (checked) type of Interconnection Service:

Check: ____ NZ or ____ ER and/or _X_ NR (See Appendix A for details)

4.1.1 **Energy Resource Interconnection Service (ER Interconnection Service).**

4.1.1.1 **The Product.** ER Interconnection Service allows Interconnection Customer to connect the Generating Facility to the Transmission or Distribution System, as applicable, and be eligible to deliver the Generating Facility's output using the existing firm or non-firm capacity of the Transmission System on an "as available" basis. To the extent Interconnection Customer wants to receive ER Interconnection Service, Transmission Owner shall construct facilities consistent with the studies identified in Appendix A.

An Interconnection Customer seeking ER Interconnection Service for new or added capacity at a Generating Facility may be granted conditional ER Interconnection Service status to the extent there is such capacity available on the Transmission System to accommodate the Interconnection Customer's Generating Facility. At the request of Interconnection Customer, conditional ER Interconnection Service status may be granted subject to the system being able to accommodate the interconnection without upgrades, until such time as a higher queued project(s) with a later service date affecting the same common elements is placed into service. The conditional ER Interconnection Service shall be terminated in the event Interconnection Customer fails to fund the necessary studies and the Network Upgrades necessary to grant the Interconnection Customer's ER Interconnection Service upon the completion of higher queued projects involving the same common elements.

4.1.1.2 Transmission Delivery Service Implications. Under ER Interconnection Service, Interconnection Customer will be eligible to inject power from the Generating Facility into and deliver power across the Transmission System on an "as available" basis up to the amount of MW identified in the applicable stability and steady state studies to the extent the upgrades initially required to qualify for ER Interconnection Service have been constructed. After that date FERC makes effective the MISO's Energy Market Tariff filed in Docket No. ER04-691-000, Interconnection Customer may place a bid to sell into the market up to the maximum identified Generating Facility output, subject to any conditions specified in the Interconnection Service approval, and the Generating Facility will be dispatched to the extent the Interconnection Customer's bid clears. In all other instances, no transmission or other delivery service from the Generating Facility is assured, but Interconnection Customer may obtain Point-To-Point Transmission Service, Network Integration Transmission Service or be used for secondary network transmission service, pursuant to the Tariff, up to the maximum output identified in the stability and steady state studies. In those instances, in order for Interconnection Customer to obtain the right to deliver or inject energy beyond the Point of Interconnection or to improve its ability to do so, transmission delivery service must be obtained pursuant to the provisions of the Tariff. The Interconnection Customer's ability to inject its Generating Facility output beyond the Point of Interconnection, therefore, will depend on the existing capacity of the Transmission or Distribution System as applicable, at such time as a Transmission Service request is made that would accommodate such delivery. The provision of Firm Point-To-Point Transmission Service or

Network Integration Transmission Service may require the construction of additional Network or Distribution Upgrades.

4.1.2 Network Resource Interconnection Service (NR Interconnection Service).

4.1.2.1 The Product. Transmission Provider must conduct the necessary studies and Transmission Owner shall construct the facilities identified in Appendix A of this GIA, subject to the approval of Governmental Authorities, needed to integrate the Generating Facility in the same manner as for any Generating Facility being designated as a Network Resource.

4.1.2.2 Transmission Delivery Service Implications. NR Interconnection Service allows the Generating Facility to be designated by any Network Customer under the Tariff on the Transmission System as a Network Resource, up to the Generating Facility's full output, on the same basis as existing Network Resources that are interconnected to the Transmission or Distribution System, as applicable, and to be studied as a Network Resource on the assumption that such a designation will occur. Although NR Interconnection Service does not convey a reservation of Transmission Service, any Network Customer can utilize Network Integration Transmission Service under the Tariff to obtain delivery of energy from the Generating Facility in the same manner as it accesses Network Resources. A Generating Facility receiving NR Interconnection Service may also be used to provide Ancillary Services after technical studies and/or periodic analyses are performed with respect to the Generating Facility’s ability to provide any applicable Ancillary Services, provided that such studies and analyses have been or would be required in connection with the provision of such Ancillary Services by any existing Network Resource. However, if the Generating Facility has not been designated as a Network Resource by any Network Customer, it cannot be required to provide Ancillary Services except to the extent such requirements extend to all generating facilities that are similarly situated. The provision of Network Integration Transmission Service or Firm Point-To-Point Transmission Service may require additional studies and the construction of additional upgrades. Because such studies and upgrades would be associated with a request for delivery service under the Tariff, cost responsibility for the studies and upgrades would be in accordance with FERC’s policy for pricing transmission delivery services.

NR Interconnection Service does not necessarily provide Interconnection Customer with the capability to physically deliver the output of its Generating Facility to any particular load on the Transmission System without incurring congestion costs. In the event of transmission or distribution constraints on the Transmission or Distribution System, as applicable, the Generating Facility shall be subject to the applicable congestion management procedures in the Transmission System in the same manner as Network Resources.

There is no requirement either at the time of study or interconnection, or at any point in the future, that the Generating Facility be designated as a Network Resource by a Network Customer or that Interconnection Customer identify a specific buyer (or sink). To the extent a Network Customer does designate the Generating Facility as a Network Resource, it must do so pursuant to the Tariff.

Once an Interconnection Customer satisfies the requirements for obtaining NR Interconnection Service, any future Transmission Service request for delivery from the Generating Facility within the Transmission System of any amount of capacity and/or energy, up to the amount initially studied, will not require that any additional studies be performed or that any further upgrades associated with such Generating Facility be undertaken, regardless of whether such Generating Facility is ever designated by a Network Customer as a Network Resource and regardless of changes in ownership of the Generating Facility. To the extent Interconnection Customer enters into an arrangement for long term Transmission Service for deliveries from the Generating Facility to customers other than the studied Network Customers, or for any Point-To-Point Transmission Service, such request may require additional studies and upgrades in order for Transmission Provider to grant such request. However, the reduction or elimination of congestion or redispatch costs may require additional studies and the construction of additional upgrades.

To the extent Interconnection Customer enters into an arrangement for long term Transmission Service for deliveries from the Generating Facility outside the Transmission System, such request may require additional studies and upgrades in order for Transmission Provider to grant such request.

4.1.2.3 Conditional NR Interconnection Service. An Interconnection Customer seeking NR Interconnection Service for new or added capacity at a Generating Facility may be granted conditional NR Interconnection Service status to the extent there is such capacity available on the Transmission System to accommodate the Interconnection Customer's Generating Facility. At the request of Interconnection Customer, conditional NR Interconnection Service status may be granted subject to the system being able to accommodate the interconnection without upgrades, until such time as higher queued project(s) with a later service date affecting the same common elements is placed into service. The conditional NR Interconnection Service status may be converted to ER Interconnection Service if either of the following occurs:

1) Interconnection Customer fails to fund necessary studies and Network Upgrades required to allow the Interconnection Customer's Generating Facility to receive NR Interconnection Service upon the completion of higher queued projects involving the same common elements; or

2) The higher queued project(s) or planned and required Network Upgrades are placed in service and the Network Upgrades required to provide NR Interconnection Service status to the Interconnection Customer's Generating Facility are not in service.

In the event Interconnection Customer fails to fund the necessary studies and Network Upgrades for NR Interconnection Service, the Interconnection Customer's conditional NR Interconnection Service status shall be converted to ER Interconnection Service status unless Interconnection Customer makes a new Interconnection Request. Such new Interconnection Request shall be evaluated in accordance with the GIP and its new queue position.

Some or all of the conditional NR Interconnection Service status may be temporarily revoked if the Network Upgrades are not in service when the higher queued project(s) are placed in service. The availability of conditional NR Interconnection Service status will be determined by Transmission Provider's studies. Upon funding and completion of the Network Upgrades required to establish the Generating Facility's NR Interconnection Service status, the Generating Facility will be granted NR Interconnection Service status.

The Parties agree that the portion of the Generating Facility classified as NR Interconnection Service is the first portion of the output of the combined output of all the units at the Generating Facility except in circumstances where Interconnection Customer otherwise elects this GIA, as amended, to allocate that portion to the output of specific unit(s) at the Generating Facility, the total of which will not exceed the output eligible for NR Interconnection Service as shown by the additional studies. To the extent Interconnection Customer desires to obtain NR Interconnection Service for any portion of the Generating Facility in addition to that supported by such additional studies, Interconnection Customer will be required to request such additional NR Interconnection Service through a separate Interconnection Request in accordance with the GIP.

4.1.3 Net Zero Interconnection Service (NZ Interconnection Service).

4.1.3.1 The Product. Net Zero Interconnection Service is restricted ER Interconnection Service that allows an Interconnection Customer to increase the gross generating capability at the same Point of Interconnection of an existing generating facility without increasing the existing Interconnection Service limit at that Point of Interconnection.

4.1.3.2 Transmission Delivery Service Implications. Net Zero Interconnection Service does not convey any right to deliver electricity to any specific customer or Point of Delivery.

4.2 Provision of Service. Transmission Provider shall provide Interconnection Service for the Generating Facility at the Point of Interconnection.

4.3 Performance Standards. Each Party shall perform all of its obligations under this GIA in accordance with Applicable Laws and Regulations, Applicable Reliability Standards, and Good Utility Practice. To the extent a Party is required or prevented or limited in taking any action by such regulations and standards, or if the obligations of any Party may become limited by a change in Applicable Laws and Regulations, Applicable Reliability Standards, and Good Utility Practice after the execution of this GIA, that Party shall not be deemed to be in Breach of this GIA for its compliance therewith. The Party so limited shall notify the other Parties whereupon Transmission Provider shall amend this GIA in concurrence with the other Parties and submit the amendment to the Commission for approval.

4.4 No Transmission Delivery Service. The execution of this GIA does not constitute a request for, or the provision of, any transmission delivery service under the Tariff, and does not convey any right to deliver electricity to any specific customer or Point of Delivery.

4.5 Interconnection Customer Provided Services. The services provided by Interconnection Customer under this GIA are set forth in Article 9.6 and Article 13.4.1. Interconnection Customer shall be paid for such services in accordance with Article 11.6.

ARTICLE 5. INTERCONNECTION FACILITIES ENGINEERING, PROCUREMENT, AND CONSTRUCTION

5.1 Options. Unless otherwise mutually agreed to between the Parties, Interconnection Customer shall select: 1) the In-Service Date, Initial Synchronization Date, and Commercial Operation Date based on a reasonable construction schedule that will allow sufficient time for design, construction, equipment procurement, and permit acquisition of Transmission System equipment or right-of-way; and 2) either Standard Option or Alternate Option set forth below for completion of the Transmission Owner's Interconnection Facilities, Network Upgrades, System Protection Facilities, Distribution

Upgrades and Generator Upgrades, as applicable, and set forth in Appendix A, and such dates and selected option shall be set forth in Appendix B. The dates and selected option shall be subject to the acceptance of Transmission Owner taking into account the type of construction to be employed and the regulatory requirements of Governmental Authority, and does not convey any right to deliver electricity to any specific customer or Point of Delivery, including the need to obtain permits or other authorizations for construction of the Interconnection Facilities, Network Upgrades, System Protection Facilities, Distribution Upgrades, Generator Upgrades, the Generating Facility and Stand-Alone Network Upgrades.

5.1.1 Standard Option. Transmission Owner shall design, procure, and construct the Transmission Owner's Interconnection Facilities, Network Upgrades, System Protection Facilities, Distribution Upgrades, and Generator Upgrades using Reasonable Efforts to complete the Transmission Owner's Interconnection Facilities, Network Upgrades, System Protection Facilities, Distribution Upgrades and Generator Upgrades by the dates set forth in Appendix B, Milestones, subject to the receipt of all approvals required from Governmental Authorities and the receipt of all land rights necessary to commence construction of such facilities, and such other permits or authorizations as may be required. Transmission Provider or Transmission Owner shall not be required to undertake any action which is inconsistent with its standard safety practices, its material and equipment specifications, its design criteria and construction procedures, its labor agreements, Applicable Laws and Regulations and Good Utility Practice. In the event Transmission Owner reasonably expects that it will not be able to complete the Transmission Owner's Interconnection Facilities, Network Upgrades, System Protection Facilities, Distribution Upgrades and Generator Upgrades by the specified dates, Transmission Owner shall promptly provide written notice to Interconnection Customer and Transmission Provider and shall undertake Reasonable Efforts to meet the earliest dates thereafter.

5.1.2 Alternate Option. If the dates designated by Interconnection Customer are acceptable to Transmission Provider and Transmission Owner, Transmission Provider shall so notify Interconnection Customer within thirty (30) Calendar Days, and Transmission Owner shall assume responsibility for the design, procurement and construction of the Transmission Owner's Interconnection Facilities by the designated dates.

If Transmission Owner subsequently fails to complete the Transmission Owner's Interconnection Facilities by the In-Service Date, to the extent necessary to provide back feed power; or fails to complete Network Upgrades by the Initial Synchronization Date to the extent necessary to allow for Trial Operation at full power output, unless other arrangements are made by the Parties for such Trial Operation; or fails to complete the Network Upgrades by the Commercial Operation Date, as such dates are reflected in Appendix B, Milestones; Transmission Owner shall pay Interconnection Customer liquidated damages in accordance with Article 5.3, Liquidated Damages, provided, however, the dates designated by Interconnection Customer shall be extended day for day for each Calendar Day that Transmission Provider refuses to grant clearances to install equipment.

Transmission Owner and Interconnection Customer may adopt an incentive payment schedule that is mutually agreeable to encourage Transmission Owner to meet specified accelerated dates. Such payment by Interconnection Customer is not subject to refund.

5.1.3 Option to Build. If the dates designated by Interconnection Customer are not acceptable to Transmission Owner to complete the Transmission Owner's Interconnection Facilities or Stand Alone Network Upgrades, Transmission Provider shall so notify Interconnection Customer within thirty (30) Calendar Days, and unless the Parties agree otherwise, Interconnection Customer shall have the option to assume responsibility for the design, procurement and construction of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades by the dates originally designated by Interconnection Customer under Article 5.1.2. The Parties must agree as to what constitutes Stand Alone Network Upgrades and identify such Stand Alone Network Upgrades in Appendix A. Except for Stand Alone Network Upgrades, Interconnection Customer shall have no right to construct Network Upgrades under this option.

5.1.4 Negotiated Option. If Interconnection Customer elects not to exercise its option under Article 5.1.3, Option to Build, Interconnection Customer shall so notify Transmission Provider and Transmission Owner within thirty (30) Calendar Days, and the Parties shall in good faith attempt to negotiate terms and conditions (including revision of the specified dates and liquidated damages, the provision of incentives or the procurement and construction of a portion of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades by Interconnection Customer) pursuant to which Transmission Owner is responsible for the design, procurement and construction of the Transmission Owner's Interconnection Facilities and Network Upgrades. If the Parties are unable to reach agreement on such terms and conditions, Transmission Owner shall assume responsibility for the design, procurement and construction of the Transmission Owner's Interconnection Facilities and Network Upgrades pursuant to 5.1.1, Standard Option.

Transmission Owner and Interconnection Customer may adopt an incentive payment schedule that is mutually agreeable to encourage Transmission Owner to meet specified accelerated dates. Such payment by Interconnection Customer is not subject to refund.

5.2 General Conditions Applicable to Option to Build. If Interconnection Customer assumes responsibility for the design, procurement and construction of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades after receipt of all required approvals from Governmental Authorities necessary to commence construction,

(1) Interconnection Customer shall engineer, procure equipment, and construct the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades (or portions thereof) using Good Utility Practice and using standards and specifications provided in advance by Transmission Owner, or as required by any Governmental Authority;

(2) Interconnection Customer's engineering, procurement and construction of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades shall comply with all requirements of law or Governmental Authority to which Transmission Owner would be subject in the engineering, procurement or construction of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades;

(3) Transmission Provider, at Transmission Provider's option, and Transmission Owner shall be entitled to review and approve the engineering design, equipment acceptance tests(including witnessing of acceptance tests), and the construction (including monitoring of construction) of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades, and shall have the right to reject any design, procurement, construction or acceptance test of any equipment that does not meet the standards and specifications of Transmission Provider, Transmission Owner and any Governmental Authority;

(4) prior to commencement of construction, Interconnection Customer shall provide to Transmission Provider and Transmission Owner a schedule for construction of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades, and shall promptly respond to requests for information from Transmission Provider and Transmission Owner;

(5) at any time during construction, Transmission Provider and Transmission Owner shall have unrestricted access to the construction site for the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades and to conduct inspections of the same;

(6) at any time during construction, should any phase of the engineering, equipment procurement, or construction of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades not meet the standards and specifications provided by Transmission Owner, Interconnection Customer shall be obligated to remedy deficiencies in that portion of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades to meet the standards and specifications provided by Transmission Provider and Transmission Owner;

(7) Interconnection Customer shall indemnify Transmission Provider and Transmission Owner for claims arising from the Interconnection Customer's construction of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades under the terms and procedures applicable to Article 18.1, Indemnity;

(8) Interconnection Customer shall transfer control of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades to Transmission Owner;

(9) Unless Parties otherwise agree, Interconnection Customer shall transfer ownership of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades to Transmission Owner;

(10) Transmission Provider, at Transmission Provider's option, and Transmission Owner shall approve and accept for operation and maintenance the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades to the extent engineered, procured, and constructed in accordance with this Article 5.2 only if the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades meet the standards and specifications of Transmission Provider, Transmission Owner and any Governmental Authority.

(11) Interconnection Customer shall deliver to Transmission Owner "as-built" drawings, information, and any other documents that are reasonably required by Transmission Owner to assure that the Interconnection Facilities and Stand-Alone Network Upgrades are built to the standards and specifications required by Transmission Owner.

5.3 **Liquidated Damages**. The actual damages to Interconnection Customer, in the event the Transmission Owner's Interconnection Facilities or Network Upgrades are not completed by the dates designated by Interconnection Customer and accepted by Transmission Provider and Transmission Owner pursuant to subparagraphs 5.1.2 or 5.1.4, above, may include Interconnection Customer's fixed operation and maintenance costs and lost opportunity costs. Such actual damages are uncertain and impossible to determine at this time. Because of such uncertainty, any liquidated damages paid by Transmission Owner to Interconnection Customer in the event that Transmission Owner does not complete any portion of the Transmission Owner's Interconnection Facilities or Network Upgrades by the applicable dates, shall be an amount equal to ½ of 1 percent per day of the actual cost of the Transmission Owner's Interconnection Facilities and Network Upgrades, in the aggregate, for which Transmission Owner has assumed responsibility to design, procure and construct.

However, in no event shall the total liquidated damages exceed 20 percent of the actual cost of the Transmission Owner's Interconnection Facilities and Network Upgrades for which Transmission Owner has assumed responsibility to design, procure, and construct. The foregoing payments will be made by Transmission Owner to Interconnection

Customer as just compensation for the damages caused to Interconnection Customer, which actual damages are uncertain and impossible to determine at this time, and as reasonable liquidated damages, but not as a penalty or a method to secure performance of this GIA. Liquidated damages, when the Parties agree to them, are the exclusive remedy for the Transmission Owner's failure to meet its schedule.

No liquidated damages shall be paid to Interconnection Customer if: (1) Interconnection Customer is not ready to commence use of the Transmission Owner's Interconnection Facilities or Network Upgrades to take the delivery of power for the Generating Facility's Trial Operation or to export power from the Generating Facility on the specified dates, unless Interconnection Customer would have been able to commence use of the Transmission Owner's Interconnection Facilities or Network Upgrades to take the delivery of power for Generating Facility's Trial Operation or to export power from the Generating Facility, but for Transmission Owner's delay; (2) the Transmission Owner's failure to meet the specified dates is the result of the action or inaction of Transmission Provider, Interconnection Customer or any other earlier queued Interconnection Customer who has entered into an earlier GIA with Transmission Provider and/or a Transmission Owner or with an Affected System Operator, or any cause beyond Transmission Owner's reasonable control or reasonable ability to cure;
(3) Interconnection Customer has assumed responsibility for the design, procurement and construction of the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades; (4) the delay is due to the inability of Transmission Owner to obtain all required approvals from Governmental Authorities in a timely manner for the construction of any element of the Interconnection Facilities, Network Upgrades or Stand Alone Network Upgrades, or any other permit or authorization required, or any land rights or other private authorizations that may be required, and Transmission Owner has exercised Reasonable Efforts in procuring such approvals, permits, rights or authorizations; or (5) the Parties have otherwise agreed.

5.4 Power System Stabilizers. Interconnection Customer shall procure, install, maintain and operate power system stabilizers in accordance with the guidelines and procedures established by the Applicable Reliability Council. Transmission Provider and Transmission Owner reserve the right to reasonably establish minimum acceptable settings for any installed power system stabilizers, subject to the design and operating limitations of the Generating Facility. If the Generating Facility's power system stabilizers are removed from service or are not capable of automatic operation, Interconnection Customer shall immediately notify the Transmission Provider's system operator, or its designated representative. The requirements of this paragraph shall not apply to induction generators.

5.5 Equipment Procurement. If responsibility for construction of the Transmission Owner's Interconnection Facilities, Network Upgrades and/or Distribution Upgrades is to be borne by Transmission Owner, then Transmission Owner shall commence design of the Transmission Owner's Interconnection Facilities, Network Upgrades and/or Distribution Upgrades, and procure necessary equipment as soon as practicable after all of the following conditions are satisfied, unless the Parties otherwise agree in writing:

5.5.1 Transmission Provider has completed the Interconnection Facilities Study pursuant to the Interconnection Facilities Study Agreement; and

5.5.2 Interconnection Customer has provided security to Transmission Owner in accordance with Article 11.5 by the dates specified in Appendix B, Milestones.

5.6 **Construction Commencement.** Transmission Owner shall commence construction of the Transmission Owner's Interconnection Facilities, Network Upgrades, Transmission Owner's System Protection Facilities, Distribution Upgrades, and Generator Upgrades for which it is responsible as soon as practicable after the following additional conditions are satisfied:

5.6.1 Approval of the appropriate Governmental Authority has been obtained for any facilities requiring regulatory approval; and

5.6.2 Where applicable, Interconnection Customer has provided security to Transmission Owner in accordance with Article 11.5 by the dates specified in Appendix B, Milestones.

5.7 **Work Progress**. Transmission Owner and Interconnection Customer will keep each other and Transmission Provider advised periodically as to the progress of their respective design, procurement and construction efforts. Either Transmission Owner or Interconnection Customer may, at any time, request a progress report from the other, with a copy to be provided to the other Parties. If, at any time, Interconnection Customer determines that the completion of the Transmission Owner's Interconnection Facilities, Network Upgrades, or Transmission Owner's System Protection Facilities will not be required until after the specified In-Service Date, Interconnection Customer will provide written notice to Transmission Provider and Transmission Owner of such later date upon which the completion of the Transmission Owner's Interconnection Facilities, Network Upgrades or Transmission Owner's System Protection Facilities will be required. Transmission Owner may delay the In-Service Date of its facilities accordingly.

5.8 **Information Exchange**. As soon as reasonably practicable after the Effective Date, the Parties shall exchange information regarding the design and compatibility of the Interconnection Facilities and compatibility of the Interconnection Facilities with the Transmission System or Distribution System, as applicable, and shall work diligently and in good faith to make any necessary design changes.

5.9 **Limited Operation.** If any of the Transmission Owner's Interconnection Facilities, Network Upgrades, or Transmission Owner's System Protection Facilities, Distribution Upgrades or Generator Upgrades are not reasonably expected to be completed prior to the Commercial Operation Date of the Generating Facility, Transmission Provider shall, upon the request and at the expense of Interconnection Customer, perform operating studies on a timely basis to determine the extent to which the Generating Facility and the Interconnection Customer's Interconnection Facilities may operate prior to the completion of the Transmission Owner's Interconnection Facilities, Network Upgrades, Transmission Owner's System Protection Facilities, Distribution Upgrades or Generator Upgrades consistent with Applicable Laws and Regulations, Applicable Reliability Standards, Good Utility Practice, and this GIA. Transmission Provider and Transmission Owner shall permit Interconnection Customer to operate the Generating Facility and the Interconnection Customer's Interconnection Facilities in accordance with the results of such studies; provided, however, such studies reveal that such operation may occur without detriment to the Transmission System as then configured and in accordance with the safety requirements of Transmission Owner and any Governmental Authority.

The maximum permissible output of the Generating Facility will be updated on a quarterly basis if the Network Upgrades necessary for the interconnection of the Generating Facility pursuant to this GIA are not in service within six (6) months following the Commercial Operation Date of the Generating Facility as specified in Appendix B of this GIA. These quarterly studies will be performed using the same methodology set forth in Section 11.5 of the GIP. These quarterly updates will end when all Network Upgrades necessary for the interconnection of the Generating Facility pursuant to this GIA are in service.

5.10 Interconnection Customer's Interconnection Facilities. Interconnection Customer shall, at its expense, design, procure, construct, own and install the ICIF, as set forth in Appendix A.

5.10.1 Interconnection Customer's Interconnection Facility Specifications. Interconnection Customer shall submit initial design and specifications for the ICIF, including Interconnection Customer's System Protection Facilities, to Transmission Provider and Transmission Owner at least one hundred eighty (180) Calendar Days prior to the Initial Synchronization Date; and final design and specifications for review and comment at least ninety (90) Calendar Days prior to the Initial Synchronization Date. Transmission Provider at Transmission Provider's option, and Transmission Owner shall review such specifications to ensure that the ICIF are compatible with their respective technical specifications, operational control, and safety requirements and comment on such design and specifications within thirty (30) Calendar Days of Interconnection Customer's submission. All specifications provided hereunder shall be deemed confidential.

5.10.2 Transmission Provider's and Transmission Owner's Review. Transmission Provider's and Transmission Owner's review of Interconnection Customer's final specifications shall not be construed as confirming, endorsing, or providing a warranty as to the design, fitness, safety, durability or reliability of the Generating Facility, or the ICIF. Interconnection Customer shall make such changes to the ICIF as may reasonably be required by Transmission Provider and Transmission Owner, in accordance with Good Utility Practice, to ensure that the ICIF are compatible with the technical specifications, operational control and safety requirements of Transmission Provider and Transmission Owner.

5.10.3 ICIF Construction. The ICIF shall be designed and constructed in accordance with Good Utility Practice. Within one hundred twenty (120) Calendar Days after the Commercial Operation Date, unless the Parties agree on another mutually acceptable deadline, Interconnection Customer shall deliver to Transmission Provider and Transmission Owner "as-built" drawings, information and documents for the ICIF, such as: a one-line diagram, a site plan showing the Generating Facility and the ICIF, plan and elevation drawings showing the layout of the ICIF, a relay functional diagram, relaying AC and DC schematic wiring diagrams and relay settings for all facilities associated with the Interconnection Customer's step-up transformers, the facilities connecting the Generating Facility to the step-up transformers and the ICIF, and the impedances (determined by factory tests) for the associated step-up transformers and the Generating Facility. Interconnection Customer shall provide Transmission Provider and Transmission Owner with Interconnection Customer's specifications for the excitation system, automatic voltage regulator, Generating Facility control and protection settings, transformer tap settings, and communications, if applicable.

5.11 Transmission Owner's Interconnection Facilities Construction. The Transmission Owner's Interconnection Facilities shall be designed and constructed in accordance with Good Utility Practice. Upon request, within one hundred twenty (120) Calendar Days after the Commercial Operation Date, unless the Parties agree on another mutually acceptable deadline, Transmission Owner shall deliver to Transmission Provider (if requested) and Interconnection Customer the "as-built" drawings, information and documents for the Transmission Owner's Interconnection Facilities specified in Appendix C to this GIA.

Such drawings, information and documents shall be deemed Confidential Information.

Upon completion, the Transmission Owner's Interconnection Facilities and Stand Alone Network Upgrades shall be under the control of Transmission Provider or its designated representative.

5.12 Access Rights. Upon reasonable notice by a Party, and subject to any required or necessary regulatory approvals, a Party ("Granting Party") shall furnish *at no cost* to the other Party ("Access Party") any rights of use, licenses, rights of way and easements with respect to lands owned or controlled by the Granting Party, its agents (if allowed under the applicable agency agreement), or any Affiliate, that are necessary to enable the Access Party to obtain ingress and egress to construct, operate, maintain, repair, test (or witness testing), inspect, replace or remove facilities and equipment to: (i) interconnect the Generating Facility with the Transmission System; (ii) operate and maintain the Generating Facility, the Interconnection Facilities and the Transmission System; and (iii) disconnect or remove the Access Party's facilities and equipment upon termination of this GIA. In exercising such licenses, rights of way and easements, the Access Party shall not unreasonably disrupt or interfere with normal operation of the Granting Party's business and shall adhere to the safety rules and procedures established in advance, as may be changed from time to time, by the Granting Party and provided to the Access Party.

5.13 **Lands of Other Property Owners**. If any part of the Transmission Owner's Interconnection Facilities, Network Upgrades, and/or Distribution Upgrades is to be installed on property owned by persons other than Interconnection Customer or Transmission Owner, Transmission Owner shall at Interconnection Customer's expense use efforts, similar in nature and extent to those that it typically undertakes on its own behalf or on behalf of its Affiliates, including use of its eminent domain authority to the extent permitted and consistent with Applicable Laws and Regulations and, to the extent consistent with such Applicable Laws and Regulations, to procure from such persons any rights of use, licenses, rights of way and easements that are necessary to construct, operate, maintain, test, inspect, replace or remove the Transmission Owner's Interconnection Facilities, Network Upgrades and/or Distribution Upgrades upon such property.

5.14 **Permits.** Transmission Provider or Transmission Owner and Interconnection Customer shall cooperate with each other in good faith in obtaining all permits, licenses and authorizations that are necessary to accomplish the interconnection in compliance with Applicable Laws and Regulations. With respect to this paragraph, Transmission Owner shall provide permitting assistance to Interconnection Customer comparable to that provided to the Transmission Owner’s own, or an Affiliate’s, generation to the extent that Transmission Owner or its Affiliate owns generation.

5.15 **Early Construction of Base Case Facilities.** (Includes facilities required for all queued projects with interconnection agreements).Interconnection Customer may request Transmission Owner to construct, and Transmission Owner shall construct, using Reasonable Efforts to accommodate Interconnection Customer's In-Service Date, all or any portion of any Network Upgrades, Transmission Owner’s System Protection Facilities or Distribution Upgrades required for Interconnection Customer to be interconnected to the Transmission or Distribution System, as applicable, which are included in the Base Case of the Interconnection Facilities Study for Interconnection Customer, and which also are required to be constructed for another Interconnection Customer with a prior GIA, but where such construction is not scheduled to be completed in time to achieve Interconnection Customer's In-Service Date. Any such Network Upgrades, System Protection Facilities or Distribution Upgrades are included in the facilities to be constructed and as set forth in Appendix A to this GIA to the extent they are reasonably known.

5.16 **Suspension.**

5.16.1 **Interconnection Customer’s Right to Suspend for Force Majeure Event; Obligations.** Provided that such suspension is permissible under the authorizations, permits or approvals granted for the construction of such Interconnection Facilities, Network Upgrades or Stand Alone Network Upgrades, Interconnection Customer will not suspend unless a Force Majeure event occurs.

Interconnection Customer must provide written notice of its request for suspension to Transmission Provider and Transmission Owner, and provide a description of the Force Majeure event that is acceptable to Transmission Provider. Suspension will only apply to Interconnection Customer milestones and Interconnection Facilities described in the Appendices of this GIA. Prior to suspension, Interconnection Customer must also provide security acceptable to Transmission Owner, equivalent to the higher of $5 million or the total cost of all Network Upgrades, Transmission Owner's System Protection Facilities, and Distribution Upgrades listed in Appendix A of this GIA. Network Upgrades and Transmission Owner's Interconnection Facilities will be constructed on the schedule described in the Appendices of this GIA unless: (1) construction is prevented by the order of a Governmental Authority; (2) the Network Upgrades are not needed by any other project; or (3) Transmission Owner or Transmission Provider determines that a Force Majeure event prevents construction. In the event of (1), (2), or (3) security shall be released upon the determination that the Network Upgrades will no longer be constructed.

If suspension occurs, the Transmission or Distribution System, as applicable, shall be left in a safe and reliable condition in accordance with Good Utility Practice and the Transmission Provider's and Transmission Owner's safety and reliability criteria. In such event, Interconnection Customer shall be responsible for all reasonable and necessary costs which Transmission Provider and Transmission Owner (i) have incurred pursuant to this GIA prior to the suspension and (ii) incur in suspending such work, including any costs incurred to perform such work as may be necessary to ensure the safety of persons and property and the integrity of the Transmission or Distribution System, as applicable, during such suspension and, if applicable, any costs incurred in connection with the cancellation or suspension of material, equipment and labor contracts which Transmission Provider and Transmission Owner cannot reasonably avoid; provided, however, that prior to canceling or suspending any such material, equipment or labor contract, Transmission Provider and Transmission Owner shall obtain Interconnection Customer's authorization to do so.

Transmission Provider and Transmission Owner shall each invoice Interconnection Customer for such costs pursuant to Article 12 and shall use Reasonable Efforts to minimize its costs. In the event Interconnection Customer suspends work by Transmission Owner required under this GIA pursuant to this Article 5.16, and has not requested Transmission Owner to recommence the work required under this GIA on or before the expiration of three (3) years following commencement of such suspension, this GIA shall be deemed terminated. The three-year period shall begin on the date the suspension is requested, or the date of the written notice to Transmission Provider, if no effective date is specified.

5.16.2 Effect of Missed Interconnection Customer Milestones. If Interconnection Customer fails to provide notice of suspension pursuant to Article 5.16, and Interconnection Customer fails to fulfill or complete any Interconnection

Customer Milestone provided in Appendix B (“Milestone”), this constitutes a Breach under this GIA. Depending upon the consequences of the Breach and effectiveness of the cure pursuant to Article 17, the Transmission Owners’ Milestones may be revised, following consultation with Interconnection Customer, consistent with Reasonable Efforts, and in consideration of all relevant circumstances. Parties shall employ Reasonable Efforts to maintain their remaining respective Milestones.

5.16.3 **Effect of Suspension; Parties Obligations.** In the event that Interconnection Customer suspends work pursuant to this Article 5.16, no construction duration, timelines and schedules set forth in Appendix B shall be suspended during the period of suspension unless ordered by a Governmental Authority, with such order being the Force Majeure event causing the suspension. Should Interconnection Customer request that work be recommenced, Transmission Owner shall be obligated to proceed with Reasonable Efforts and in consideration of all relevant circumstances including regional outage schedules, construction availability and material procurement in performing the work as described in Appendix A and Appendix B. Transmission Owner will provide Interconnection Customer with a revised schedule for the design, procurement, construction, installation and testing of the Transmission Owner’s Interconnection Facilities and Network Upgrades. Upon any suspension by Interconnection Customer pursuant to Article 5.16, Interconnection Customer shall be responsible for only those costs specified in this Article 5.16.

5.17 Taxes.

5.17.1 **Interconnection Customer Payments Not Taxable.** The Parties intend that all payments or property transfers made by Interconnection Customer to Transmission Owner for the installation of the Transmission Owner’s Interconnection Facilities, Network Upgrades, Transmission Owner’s System Protection Facilities, Distribution Upgrades and Generator Upgrades shall be non-taxable, either as contributions to capital, or as an advance, in accordance with the Internal Revenue Code and any applicable state income tax laws and shall not be taxable as contributions in aid of construction or otherwise under the Internal Revenue Code and any applicable state income tax laws. To the extent that Transmission Owner is a limited liability company and not a corporation, and has elected to be taxed as a partnership, then the following shall apply: Transmission Owner represents, and the Parties acknowledge, that Transmission Owner is a limited liability company and is treated as a partnership for federal income tax purposes. Any payment made by Interconnection Customer to Transmission Owner for Network Upgrades is to be treated as an up front payment in accordance with Rev Proc 2005-35. It is anticipated by the parties that any amounts paid by Interconnection Customer to Transmission Owner for Network Upgrades will be reimbursed to Interconnection Customer in accordance with the terms of this GIA, provided Interconnection Customer fulfills its obligations under this GIA.

5.17.2 Representations and Covenants. In accordance with IRS Notice 2001-82 and IRS Notice 88-129, Interconnection Customer represents and covenants that (i) ownership of the electricity generated at the Generating Facility will pass to another party prior to the transmission of the electricity on the Transmission System, (ii) for income tax purposes, the amount of any payments and the cost of any property transferred to Transmission Owner for the Transmission Owner's Interconnection Facilities will be capitalized by Interconnection Customer as an intangible asset and recovered using the straight-line method over a useful life of twenty (20) years, and (iii) any portion of the Transmission Owner's Interconnection Facilities that is a "dual-use intertie," within the meaning of IRS Notice 88-129, is reasonably expected to carry only a de minimis amount of electricity in the direction of the Generating Facility. For this purpose, "de minimis amount" means no more than 5 percent of the total power flows in both directions, calculated in accordance with the "5 percent test" set forth in IRS Notice 88-129. This is not intended to be an exclusive list of the relevant conditions that must be met to conform to IRS requirements for non-taxable treatment.

At Transmission Owner's request, Interconnection Customer shall provide Transmission Owner with a report from an independent engineer confirming its representation in clause (iii), above, with a copy to Transmission Provider. Transmission Owner represents and covenants that the cost of the Transmission Owner's Interconnection Facilities paid for by Interconnection Customer will have no net effect on the base upon which rates are determined.

5.17.3 Indemnification for the Cost Consequences of Current Tax Liability Upon Transmission Owner. Notwithstanding Article 5.17.1 and to the extent permitted by law, Interconnection Customer shall protect, indemnify and hold harmless Transmission Owner from the cost consequences of any tax liability imposed against Transmission Owner as the result of payments or property transfers made by Interconnection Customer to Transmission Owner under this GIA for Interconnection Facilities, as well as any interest and penalties, other than interest and penalties attributable to any delay caused by Transmission Owner.

Transmission Owner shall not include a gross-up for the cost consequences of any current tax liability in the amounts it charges Interconnection Customer under this GIA unless (i) Transmission Owner has determined, in good faith, that the payments or property transfers made by Interconnection Customer to Transmission Owner should be reported as income subject to taxation or (ii) any Governmental Authority directs Transmission Owner to report payments or property as income subject to taxation; provided, however, that Transmission Owner may require Interconnection Customer to provide security for Interconnection Facilities, in a form reasonably acceptable to Transmission Owner (such as a parental guarantee or a letter of credit), in an amount equal to the cost consequences or any current tax liability under this Article 5.17.

Interconnection Customer shall reimburse Transmission Owner for such costs on a fully grossed-up basis, in accordance with Article 5.17.4, within thirty (30) Calendar Days of receiving written notification from Transmission Owner of the amount due, including detail about how the amount was calculated.

The indemnification obligation shall terminate at the earlier of (1) the expiration of the ten-year testing period and the applicable statute of limitation, as it may be extended by Transmission Owner upon request of the IRS, to keep these years open for audit or adjustment, or (2) the occurrence of a subsequent taxable event and the payment of any related indemnification obligations as contemplated by this Article 5.17.

5.17.4 Tax Gross-Up Amount. Interconnection Customer's liability for the cost consequences of any current tax liability under this Article 5.17 shall be calculated on a fully grossed-up basis. Except as may otherwise be agreed to by the parties, this means that Interconnection Customer will pay Transmission Owner, in addition to the amount paid for the Interconnection Facilities, Network Upgrades, Transmission Owner’s System Protection Facilities, and/or Distribution Upgrades, an amount equal to (1) the current taxes imposed on Transmission Owner (“Current Taxes”) on the excess of (a) the gross income realized by Transmission Owner as a result of payments or property transfers made by Interconnection Customer to Transmission Owner under this GIA (without regard to any payments under this Article 5.17) (the “Gross Income Amount”) over (b) the present value of future tax deductions for depreciation that will be available as a result of such payments or property transfers (the “Present Value Depreciation Amount”), plus (2) an additional amount sufficient to permit Transmission Owner to receive and retain, after the payment of all Current Taxes, an amount equal to the net amount described in clause (1).

For this purpose, (i) Current Taxes shall be computed based on Transmission Owner’s composite federal and state tax rates at the time the payments or property transfers are received and Transmission Owner will be treated as being subject to tax at the highest marginal rates in effect at that time (the “Current Tax Rate”), and (ii) the Present Value Depreciation Amount shall be computed by discounting Transmission Owner’s anticipated tax depreciation deductions as a result of such payments or property transfers by Transmission Owner’s current weighted average cost of capital. Thus, the formula for calculating Interconnection Customer's liability to Transmission Owner pursuant to this Article 5.17.4 can be expressed as follows: (Current Tax Rate x (Gross Income Amount – Present Value of Tax Depreciation))/(1-Current Tax Rate). Interconnection Customer's estimated tax liability in the event taxes are imposed shall be stated in Appendix A, Interconnection Facilities, Network Upgrades and Distribution Upgrades.

5.17.5 **Private Letter Ruling or Change or Clarification of Law.** At Interconnection Customer's request and expense, Transmission Owner shall file with the IRS a request for a private letter ruling as to whether any property transferred or sums paid, or to be paid, by Interconnection Customer to Transmission Owner under this GIA are subject to federal income taxation. Interconnection Customer will prepare the initial draft of the request for a private letter ruling, and will certify under penalties of perjury that all facts represented in such request are true and accurate to the best of Interconnection Customer's knowledge. Transmission Owner and Interconnection Customer shall cooperate in good faith with respect to the submission of such request.

Transmission Owner shall keep Interconnection Customer fully informed of the status of such request for a private letter ruling and shall execute either a privacy act waiver or a limited power of attorney, in a form acceptable to the IRS, that authorizes Interconnection Customer to participate in all discussions with the IRS regarding such request for a private letter ruling. Transmission Owner shall allow Interconnection Customer to attend all meetings with IRS officials about the request and shall permit Interconnection Customer to prepare the initial drafts of any follow-up letters in connection with the request.

5.17.6 **Subsequent Taxable Events.** If, within 10 years from the date on which the relevant Transmission Owner's Interconnection Facilities are placed in service, (i) Interconnection Customer breaches the covenant contained in Article 5.17.2, (ii) a "disqualification event" occurs within the meaning of IRS Notice 88-129, or (iii) this GIA terminates and Transmission Owner retains ownership of the Interconnection Facilities, Network Upgrades, Transmission Owner's System Protection Facilities, and/or Distribution Upgrades, Interconnection Customer shall pay a tax gross-up for the cost consequences of any current tax liability imposed on Transmission Owner, calculated using the methodology described in Article 5.17.4 and in accordance with IRS Notice 90-60.

5.17.7 **Contests.** In the event any Governmental Authority determines that Transmission Owner's receipt of payments or property constitutes income that is subject to taxation, Transmission Owner shall notify Interconnection Customer, in writing, within thirty (30) Calendar Days of receiving notification of such determination by a Governmental Authority. Upon the timely written request by Interconnection Customer and at Interconnection Customer's sole expense, Transmission Owner may appeal, protest, seek abatement of, or otherwise oppose such determination. Upon Interconnection Customer's written request and sole expense, Transmission Owner shall file a claim for refund with respect to any taxes paid under this Article 5.17, whether or not it has received such a determination. Transmission Owner reserves the right to make all decisions with regard to the prosecution of such appeal, protest, abatement or other contest, including the selection of counsel and compromise or settlement of the claim, but Transmission Owner shall keep Interconnection Customer informed, shall consider in good faith suggestions from Interconnection

Customer about the conduct of the contest, and shall reasonably permit Interconnection Customer or an Interconnection Customer representative to attend contest proceedings.

Interconnection Customer shall pay to Transmission Owner on a periodic basis, as invoiced by Transmission Owner, Transmission Owner's documented reasonable costs of prosecuting such appeal, protest, abatement or other contest. At any time during the contest, Transmission Owner may agree to a settlement either with Interconnection Customer's consent or after obtaining written advice from nationally-recognized tax counsel, selected by Transmission Owner, but reasonably acceptable to Interconnection Customer, that the proposed settlement represents a reasonable settlement given the hazards of litigation. Interconnection Customer's obligation shall be based on the amount of the settlement agreed to by Interconnection Customer, or if a higher amount, so much of the settlement that is supported by the written advice from nationally-recognized tax counsel selected under the terms of the preceding sentence. The settlement amount shall be calculated on a fully grossed-up basis to cover any related cost consequences of the current tax liability. Any settlement without Interconnection Customer's consent or such written advice will relieve Interconnection Customer from any obligation to indemnify Transmission Owner for the tax at issue in the contest.

5.17.8 **Refund.** In the event that (a) a private letter ruling is issued to Transmission Owner which holds that any amount paid or the value of any property transferred by Interconnection Customer to Transmission Owner under the terms of this GIA is not subject to federal income taxation, (b) any legislative change or administrative announcement, notice, ruling or other determination makes it reasonably clear to Transmission Owner in good faith that any amount paid or the value of any property transferred by Interconnection Customer to Transmission Owner under the terms of this GIA is not taxable to Transmission Owner, (c) any abatement, appeal, protest, or other contest results in a determination that any payments or transfers made by Interconnection Customer to Transmission Owner are not subject to federal income tax, or (d) if Transmission Owner receives a refund from any taxing authority for any overpayment of tax attributable to any payment or property transfer made by Interconnection Customer to Transmission Owner pursuant to this GIA, Transmission Owner shall promptly refund to Interconnection Customer the following:

(i) any payment made by Interconnection Customer under this Article 5.17 for taxes that is attributable to the amount determined to be non-taxable, together with interest thereon,

(ii) interest on any amounts paid by Interconnection Customer to Transmission Owner for such taxes which Transmission Owner did not submit to the taxing authority, calculated in accordance with the methodology set forth in 18 C.F.R. Section 35.19a(a)(2)(iii) from the date payment was made by Interconnection Customer to the date Transmission Owner refunds such payment to Interconnection Customer, and

(iii) with respect to any such taxes paid by Transmission Owner, any refund or credit Transmission Owner receives or to which it may be entitled from any Governmental Authority, interest (or that portion thereof attributable to the payment described in clause (i), above) owed to Transmission Owner for such overpayment of taxes (including any reduction in interest otherwise payable by Transmission Owner to any Governmental Authority resulting from an offset or credit); provided, however, that Transmission Owner will remit such amount promptly to Interconnection Customer only after and to the extent that Transmission Owner has received a tax refund, credit or offset from any Governmental Authority for any applicable overpayment of income tax related to the Transmission Owner's Interconnection Facilities.

The intent of this provision is to leave both parties, to the extent practicable, in the event that no taxes are due with respect to any payment for Interconnection Facilities and Network Upgrades hereunder, in the same position they would have been in had no such tax payments been made.

5.17.9 Taxes Other Than Income Taxes. Upon the timely request by Interconnection Customer, and at Interconnection Customer's sole expense, Transmission Owner shall appeal, protest, seek abatement of, or otherwise contest any tax (other than federal or state income tax) asserted or assessed against Transmission Owner for which Interconnection Customer may be required to reimburse Transmission Owner under the terms of this GIA. Interconnection Customer shall pay to Transmission Owner on a periodic basis, as invoiced by Transmission Owner, Transmission Owner's documented reasonable costs of prosecuting such appeal, protest, abatement, or other contest. Interconnection Customer and Transmission Owner shall cooperate in good faith with respect to any such contest. Unless the payment of such taxes is a prerequisite to an appeal or abatement or cannot be deferred, no amount shall be payable by Interconnection Customer to Transmission Owner for such taxes until they are assessed by a final, non-appealable order by any court or agency of competent jurisdiction. In the event that a tax payment is withheld and ultimately due and payable after appeal, Interconnection Customer will be responsible for all taxes, interest and penalties, other than penalties attributable to any delay caused by Transmission Owner.

5.18 Tax Status. Each Party shall cooperate with the other Parties to maintain each Party's tax status. Nothing in this GIA is intended to adversely affect any Party's tax-exempt status with respect to the issuance of bonds including, but not limited to, Local Furnishing Bonds.

5.19 Modification.

5.19.1 General. Either Party may undertake modifications to its facilities. If a Party plans to undertake a modification that reasonably may be expected to affect another Party's facilities, that Party shall provide to the other Parties sufficient information regarding such modification so that the other Parties may evaluate the potential impact of such modification prior to commencement of the work. Such information shall be deemed to be Confidential Information hereunder and shall include information concerning the timing of such modifications and whether such modifications are expected to interrupt the flow of electricity from the Generating Facility. The Party desiring to perform such work shall provide the relevant drawings, plans, and specifications to the other Parties at least ninety (90) Calendar Days in advance of the commencement of the work or such shorter period upon which the Parties may agree, which agreement shall not unreasonably be withheld, conditioned or delayed.

In the case of Generating Facility modifications that do not require Interconnection Customer to submit an Interconnection Request, Transmission Provider shall provide, within thirty (30) Calendar Days (or such other time as the Parties may agree), an estimate of any additional modifications to the Transmission or Distribution System as applicable, Transmission Owner’s Interconnection Facilities, Network Upgrades, Transmission Owner’s System Protection Facilities, and/or Distribution Upgrades necessitated by such Interconnection Customer modification and a good faith estimate of the costs thereof which shall be the responsibility of Interconnection Customer.

5.19.2 Standards. Any additions, modifications, or replacements made to a Party’s facilities shall be designed, constructed and operated in accordance with this GIA and Good Utility Practice.

5.19.3 Modification Costs. Interconnection Customer shall not be directly assigned the costs of any additions, modifications, or replacements that Transmission Owner makes to the Transmission Owner’s Interconnection Facilities, Network Upgrades, Transmission Owner’s System Protection Facilities, Distribution Upgrades, or the Transmission or Distribution System, as applicable, to facilitate the interconnection of a third party to the Transmission Owner’s Interconnection Facilities or the Transmission or Distribution System, as applicable, or to provide transmission service to a third party under the Tariff. Interconnection Customer shall be responsible for the costs of any additions, modifications, or replacements to the Interconnection Customer’s Interconnection Facilities that may be necessary to maintain or upgrade such Interconnection Customer’s Interconnection Facilities consistent with Applicable Laws and Regulations, Applicable Reliability Standards or Good Utility Practice.

ARTICLE 6. TESTING AND INSPECTION

6.1 Pre-Commercial Operation Date Testing and Modifications. Prior to the Commercial Operation Date, Transmission Owner shall test the Transmission Owner's Interconnection Facilities, Network Upgrades, Transmission Owner's System Protection Facilities and Distribution Upgrades, and Interconnection Customer shall test each electric production device at the Generating Facility, Interconnection Customer's System Protection Facilities and the Interconnection Customer's Interconnection Facilities to ensure their safe and reliable operation. Similar testing may be required after initial operation. Transmission Owner and Interconnection Customer shall make any modifications to their respective facilities that are found to be necessary as a result of such testing. Interconnection Customer shall bear the cost of all such testing and modifications. Interconnection Customer shall generate test energy at the Generating Facility only if it has arranged for the delivery of such test energy.

6.2 Post-Commercial Operation Date Testing and Modifications. Each Party shall at its own expense perform routine inspection and testing of its facilities and equipment in accordance with Good Utility Practice as may be necessary to ensure the continued interconnection of the Generating Facility with the Transmission or Distribution System, as applicable, in a safe and reliable manner. Each Party shall have the right, upon advance written notice, to require reasonable additional testing of the Interconnection Facilities, at the requesting Party's expense, as may be in accordance with Good Utility Practice.

6.3 Right to Observe Testing. Each Party shall notify the other Parties in advance of its performance of tests of its Interconnection Facilities. The other Parties shall each have the right, at its own expense, to observe such testing.

6.4 Right to Inspect. Each Party shall have the right, but shall have no obligation to: (i) observe Transmission Owner's and Interconnection Customer's tests and/or inspection of any of their respective System Protection Facilities and other protective equipment, including power system stabilizers; (ii) review the settings of the System Protection Facilities and other protective equipment; and (iii) review the maintenance records relative to the Interconnection Facilities, the System Protection Facilities and other protective equipment. A Party may exercise these rights from time to time as it deems necessary upon reasonable notice to the other Parties. The exercise or non-exercise by a Party of any such rights shall not be construed as an endorsement or confirmation of any element or condition of the Interconnection Facilities or the System Protection Facilities or other protective equipment or the operation thereof, or as a warranty as to the fitness, safety, desirability, or reliability of same. Any information that a Party obtains through the exercise of any of its rights under this Article 6.4 shall be deemed to be Confidential Information and treated pursuant to Article 22 of this GIA.

ARTICLE 7. METERING

7.1 **General.** Each Party shall comply with the Applicable Reliability Council requirements. Unless otherwise agreed by the Parties, Transmission Owner, at its election, or otherwise Interconnection Customer, shall install Metering Equipment (the "Metering Party") at the Point of Interconnection prior to any operation of the Generating Facility and Transmission Owner, at its election, or otherwise Interconnection Customer shall own, operate, test and maintain such Metering Equipment. Power flows to and from the Generating Facility shall be measured at or, at the Metering Party's option, compensated to, the Point of Interconnection. The Metering Party shall provide metering quantities, in analog and/or digital form, to the other Parties upon request. Interconnection Customer shall bear all reasonable documented costs associated with the purchase, installation, operation, testing and maintenance of the Metering Equipment.

7.2 **Check Meters.** Interconnection Customer, at its option and expense, may install and operate, on its premises and on its side of the Point of Interconnection, one or more check meters to check the Metering Equipment owned by the Metering Party. Such check meters shall be for check purposes only and shall not be used for the measurement of power flows for purposes of this GIA, except as provided in Article 7.4 below. The check meters shall be subject at all reasonable times to inspection and examination by Transmission Provider, Transmission Owner or their designees. The installation, operation and maintenance thereof shall be performed entirely by Interconnection Customer in accordance with Good Utility Practice.

7.3 **Standards**. The Metering Party shall install, calibrate, and test revenue quality Metering Equipment in accordance with applicable ANSI standards.

7.4 **Testing of Metering Equipment**. The Metering Party shall inspect and test Metering Equipment upon installation and at least once every two (2) years thereafter. If requested to do so by a Party, the Metering Party shall, at the requesting Party's expense, inspect or test Metering Equipment more frequently than every two (2) years. The Metering Party shall give reasonable notice to the other Parties of the time when any inspection or test shall take place, and the other Parties may have representatives present at the test or inspection. If at any time Metering Equipment is found to be inaccurate or defective, it shall be adjusted, repaired or replaced at Interconnection Customer's expense, in order to provide accurate metering, unless the inaccuracy or defect is due to the Metering Party's failure to maintain, then the Metering Party shall pay. If Metering Equipment fails to register, or if the measurement made by Metering Equipment during a test varies by more than two percent (2%) from the measurement made by the standard meter used in the test, the Metering Party shall adjust the measurements by correcting all measurements for the period during which Metering Equipment was in error by using Interconnection Customer's check meters, if installed. If no such check meters are installed or if the period cannot be reasonably ascertained, the adjustment shall be for the period immediately preceding the test of the Metering Equipment equal to one-half the time from the date of the previous test of the Metering Equipment.

7.5 **Metering Data**. At Interconnection Customer's expense, the metered data shall be telemetered to one or more locations designated by Transmission Provider and Transmission Owner and one or more locations designated by Interconnection Customer. Such telemetered data shall be used, under normal operating conditions, as the official measurement of the amount of energy delivered from the Generating Facility to the Point of Interconnection.

ARTICLE 8. COMMUNICATIONS

8.1 **Interconnection Customer Obligations**. Interconnection Customer shall maintain satisfactory operating communications with Transmission Provider's Transmission System dispatcher or representative designated by Transmission Provider. Interconnection Customer shall provide standard voice line, dedicated voice line and facsimile communications at its Generating Facility control room or central dispatch facility through use of either the public telephone system, or a voice communications system that does not rely on the public telephone system. Interconnection Customer shall also provide the dedicated data circuit(s) necessary to provide Interconnection Customer data to Transmission Provider as set forth in Appendix D, Security Arrangements Details. The data circuit(s) shall extend from the Generating Facility to the location(s) specified by Transmission Provider. Any required maintenance of such communications equipment shall be performed by and at the cost of Interconnection Customer. Operational communications shall be activated and maintained under, but not be limited to, the following events: system paralleling or separation, scheduled and unscheduled shutdowns, equipment clearances, and hourly and daily load data.

Unless the Generating Facility is an Intermittent Resource not relying on wind as a fuel source, Interconnection Customer shall install communication and control equipment such that the Generating Facility can receive and respond to the appropriate dispatch signals while operating under the Tariff. Where applicable, the requirements of the communication and control equipment will be enumerated in Appendix C to this GIA.

8.2 **Remote Terminal Unit (RTU)**. Prior to the Initial Synchronization Date of the Generating Facility, a remote terminal unit, or equivalent data collection and transfer equipment acceptable to both Parties, shall be installed by Interconnection Customer, or by Transmission Owner at Interconnection Customer's expense, to gather accumulated and instantaneous data to be telemetered to the location(s) designated by Transmission Owner and Transmission Provider through use of a dedicated point-to-point data circuit(s) as indicated in Article 8.1. The communication protocol for the data circuit(s) shall be specified by Transmission Owner and Transmission Provider. Instantaneous bi-directional analog real power and reactive power flow information must be telemetered directly to the location(s) specified by Transmission Provider and Transmission Owner.

Each Party will promptly advise the other Parties if it detects or otherwise learns of any metering, telemetry or communications equipment errors or malfunctions that require the attention and/or correction. The Party owning such equipment shall correct such error or malfunction as soon as reasonably feasible.

8.3 No Annexation. Any and all equipment placed on the premises of a Party shall be and remain the property of the Party providing such equipment regardless of the mode and manner of annexation or attachment to real property, unless otherwise mutually agreed by the Parties.

8.4 Provision of Data from a Variable Energy Resource. The Interconnection Customer whose Generating Facility is a Variable Energy Resource shall provide meteorological and forced outage data to the Transmission Provider to the extent necessary for the Transmission Provider's development and deployment of power production forecasts for that class of Variable Energy Resources. The Interconnection Customer with a Variable Energy Resource having wind as the energy source will, upon request by the Transmission Provider, be required to provide the Transmission Provider with site-specific meteorological data including: temperature, wind speed, wind direction, and atmospheric pressure. The Interconnection Customer with a Variable Energy Resource having solar as the energy source will, upon request by the Transmission Provider, be required to provide the Transmission Provider with site-specific meteorological data including: temperature, atmospheric pressure, and irradiance. The Transmission Provider and Interconnection Customer whose Generating Facility is a Variable Energy Resource shall mutually agree to any additional meteorological data that are required for the development and deployment of a power production forecast. The Interconnection Customer whose Generating Facility is a Variable Energy Resource also shall submit data to the Transmission Provider regarding all forced outages to the extent necessary for the Transmission Provider's development and deployment of power production forecasts for that class of Variable Energy Resources. The exact specifications of the meteorological and forced outage data to be provided by the Interconnection Customer to the Transmission Provider, including the frequency and timing of data submittals, shall be made taking into account the size and configuration of the Variable Energy Resource, its characteristics, location, and its importance in maintaining generation resource adequacy and transmission system reliability in its area. All requirements for meteorological and forced outage data must be commensurate with the power production forecasting employed by the Transmission Provider. Data requirements for meteorological and forced outage data will be negotiated by the Transmission Provider and the Interconnection Customer, and will be set forth in Appendix C, Interconnection Details, of this GIA.

ARTICLE 9. OPERATIONS

9.1 General. Each Party shall comply with the Applicable Reliability Council requirements. Each Party shall provide to any Party all information that may reasonably be required by that Party to comply with Applicable Laws and Regulations and Applicable Reliability Standards.

9.2 **Local Balancing Authority Notification**. At least three (3) months before Initial Synchronization Date, Interconnection Customer shall notify Transmission Provider and Transmission Owner in writing of the Local Balancing Authority in which the Generating Facility will be located. If Interconnection Customer elects to locate the Generating Facility through dynamic metering/scheduling in a Local Balancing Authority other than the Local Balancing Authority in which the Generating Facility is physically located, and if permitted to do so by the relevant transmission tariffs, all necessary arrangements, including but not limited to those set forth in Article 7 and Article 8 of this GIA, and remote Local Balancing Authority generator interchange agreements, if applicable, and the appropriate measures under such agreements, shall be executed and implemented prior to the placement of the Generating Facility in the other Local Balancing Authority.

9.3 **Transmission Provider and Transmission Owner Obligations**. Transmission Provider shall cause the Transmission System and the Transmission Owner’s Interconnection Facilities to be operated, maintained and controlled in a safe and reliable manner in accordance with this GIA. Transmission Provider, or its designee, may provide operating instructions to Interconnection Customer consistent with this GIA and the Tariff and, if applicable, Transmission Owner’s operating protocols and procedures as they may change from time to time. Transmission Provider will consider changes to its operating protocols and procedures proposed by Interconnection Customer.

9.4 **Interconnection Customer Obligations**. Interconnection Customer shall at its own expense operate, maintain and control the Generating Facility and the Interconnection Customer’s Interconnection Facilities in a safe and reliable manner and in accordance with this GIA. The Generating Facility must be operated in accordance with the operating limits, if any, in the Interconnection Facilities Study and specified in Appendix C of this GIA. Interconnection Customer shall operate the Generating Facility and the Interconnection Customer’s Interconnection Facilities in accordance with all applicable requirements of Transmission Provider or its designated Local Balancing Authority Operator of which the Generating Facility is part, as such requirements are set forth in Appendix C, Interconnection Details, of this GIA. Appendix C, Interconnection Details, will be modified to reflect changes to the requirements as they may change from time to time. Any Party may request that a Party provide copies of the requirements set forth in Appendix C, Interconnection Details, of this GIA.

9.5 **Start-Up and Synchronization.** Consistent with the Parties’ mutually acceptable procedures, Interconnection Customer is responsible for the proper synchronization of the Generating Facility to the Transmission or Distribution System, as applicable.

9.6 **Reactive Power.**

9.6.1 **Power Factor Design Criteria.** Interconnection Customer shall design the Generating Facility to be capable of maintaining a composite power delivery at continuous rated power output at the Point of Interconnection at all power factors over 0.95 leading to 0.95 lagging, unless Transmission Provider has established different requirements that apply to all generators in the Local

Balancing Authority on a comparable basis. The applicable Local Balancing Authority power factor requirements are listed on the Transmission Provider's website at

https://www.misoenergy.org/Library/Repository/Study/Generator%20Interconnection/Reactive%20Generator%20Requirements.pdf

and may be referenced in the Appendices to this GIA. The Generating Facility shall be capable of continuous dynamic operation throughout the power factor design range as measured at the Point of Interconnection. Such operation shall account for the net effect of all energy production devices on the Interconnection Customer's side of the Point of Interconnection. Unless demonstrated by study as indicated in Appendix C, the requirements of this Article 9.6.1 shall not apply to wind generators.

9.6.2 Voltage Schedules. Once Interconnection Customer has synchronized the Generating Facility with the Transmission System, Transmission Provider shall require Interconnection Customer to operate the Generating Facility to produce or absorb reactive power within the design limitations of the Generating Facility set forth in Article 9.6.1 (Power Factor Design Criteria), to maintain the output voltage or power factor at the Point of Interconnection as specified by Transmission Provider. Transmission Provider's voltage schedules shall treat all sources of reactive power in the Local Balancing Authority in an equitable and not unduly discriminatory manner. Transmission Provider shall exercise Reasonable Efforts to provide Interconnection Customer with such schedules at least one (1) Calendar Day in advance, and may make changes to such schedules as necessary to maintain the reliability of the Transmission or Distribution System as applicable. Interconnection Customer shall operate the Generating Facility to maintain the specified output voltage or power factor at the Point of Interconnection within the design limitations of the Generating Facility set forth in Article 9.6.1 (Power Factor Design Criteria). If Interconnection Customer is unable to maintain the specified voltage or power factor, it shall promptly notify Transmission Provider's system operator, or its designated representative.

9.6.2.1 Governors and Regulators. Whenever the Generating Facility is operated in parallel with the Transmission or Distribution System as applicable and the speed governors (if installed on the generating unit pursuant to Good Utility Practice) and voltage regulators are capable of operation, Interconnection Customer shall operate the Generating Facility with its speed governors and voltage regulators in automatic operation. If the Generating Facility's speed governors and voltage regulators are not capable of such automatic operation, Interconnection Customer shall immediately notify Transmission Provider's system operator, or its designated representative, and ensure that such Generating Facility's reactive power production or absorption (measured in

MVARs) are within the design capability of the Generating Facility's generating unit(s) and steady state stability limits. Interconnection Customer shall not cause its Generating Facility to disconnect automatically or instantaneously from the Transmission or Distribution System, as applicable, or trip any generating unit comprising the Generating Facility for an under or over frequency condition unless the abnormal frequency condition persists for a time period beyond the limits set forth in ANSI/IEEE Standard C37.106, or such other standard as applied to other generators in the Local Balancing Authority on a comparable basis.

9.6.3 Payment for Reactive Power. Payments for reactive power shall be pursuant to any tariff or rate schedule filed by Transmission Provider and approved by the FERC.

9.7 Outages and Interruptions.

9.7.1 Outages.

9.7.1.1 Outage Authority and Coordination. Interconnection Customer and Transmission Owner may each in accordance with Good Utility Practice in coordination with the other Party and Transmission Provider remove from service any of its respective Interconnection Facilities, System Protection Facilities, Network Upgrades, System Protection Facilities or Distribution Upgrades that may impact the other Party's facilities as necessary to perform maintenance or testing or to install or replace equipment. Absent an Emergency Condition, the Party scheduling a removal of such facility(ies) from service will use Reasonable Efforts to notify one another and schedule such removal on a date and time mutually acceptable to the Parties. In all circumstances, any Party planning to remove such facility(ies) from service shall use Reasonable Efforts to minimize the effect on the other Parties of such removal.

9.7.1.2 Outage Schedules. Transmission Provider shall post scheduled outages of transmission facilities on the OASIS. Interconnection Customer shall submit its planned maintenance schedules for the Generating Facility to Transmission Provider and Transmission Owner for a minimum of a rolling twenty-four (24) month period in accordance with the Transmission Provider's procedures. Interconnection Customer shall update its planned maintenance schedules as necessary. Transmission Provider may request Interconnection Customer to reschedule its maintenance as necessary to maintain the reliability of the Transmission System; provided, however, adequacy of generation supply shall not be a criterion in determining Transmission System reliability.
Transmission Provider shall compensate, pursuant to applicable Transmission Provider tariff or rate schedule, Interconnection Customer for any additional direct costs that Interconnection Customer incurs as a

result of having to reschedule maintenance, including any additional overtime, breaking of maintenance contracts or other costs above and beyond the cost Interconnection Customer would have incurred absent the Transmission Provider's request to reschedule maintenance. Interconnection Customer will not be eligible to receive compensation, if during the twelve (12) months prior to the date of the scheduled maintenance, Interconnection Customer had modified its schedule of maintenance activities.

Costs shall be determined by negotiation between Transmission Provider and Interconnection Customer prior to implementation of the voluntary change in outage schedules, or if such request is made by or on behalf of a Transmission Customer requesting firm service, costs and recovery of costs shall be determined through a bilateral agreement between the Transmission Customer and Interconnection Customer. Voluntary changes to outage schedules under this Article 9.7.1.2 are separate from actions and compensation required under Article 13 and for which costs are recovered in accordance with Transmission Provider's applicable tariff or rate schedule.

9.7.1.3 Outage Restoration. If an outage on either the Interconnection Customer's or Transmission Owner's Interconnection Facilities, Network Upgrades, System Protection Facilities or Distribution Upgrades adversely affects a Party's operations or facilities, the Party that owns or controls the facility that is out of service shall use Reasonable Efforts to promptly restore such facility(ies) to a normal operating condition consistent with the nature of the outage. The Party that owns or controls the facility that is out of service shall provide the other Parties, to the extent such information is known, information on the nature of the Emergency Condition, an estimated time of restoration, and any corrective actions required. Initial verbal notice shall be followed up as soon as practicable with written notice to the other Parties explaining the nature of the outage.

9.7.2 Interruption of Service. If required by Good Utility Practice to do so, Transmission Provider may require Interconnection Customer to interrupt or reduce deliveries of electricity if such delivery of electricity could adversely affect Transmission Provider's ability to perform such activities as are necessary to safely and reliably operate and maintain the Transmission System. The following provisions shall apply to any interruption or reduction permitted under this Article 9.7.2:

9.7.2.1 The interruption or reduction shall continue only for so long as reasonably necessary under Good Utility Practice;

9.7.2.2 Any such interruption or reduction shall be made on an equitable, non-discriminatory basis with respect to all generating facilities directly connected to the Transmission or Distribution System, as applicable;

9.7.2.3 When the interruption or reduction must be made under circumstances which do not allow for advance notice, Transmission Provider shall notify Interconnection Customer by telephone as soon as practicable of the reasons for the curtailment, interruption, or reduction, and, if known, its expected duration. Telephone notification shall be followed by written notification as soon as practicable;

9.7.2.4 Except during the existence of an Emergency Condition, when the interruption or reduction can be scheduled without advance notice, Transmission Provider shall notify Interconnection Customer in advance regarding the timing of such scheduling and further notify Interconnection Customer of the expected duration. Transmission Provider shall coordinate with Interconnection Customer using Good Utility Practice to schedule the interruption or reduction during periods of least impact to Interconnection Customer, Transmission Owner and Transmission Provider;

9.7.2.5 The Parties shall cooperate and coordinate with each other to the extent necessary in order to restore the Generating Facility, Interconnection Facilities, and the Transmission or Distribution System, as applicable to their normal operating state, consistent with system conditions and Good Utility Practice.

9.7.3 Under-Frequency and Over Frequency Conditions. The Transmission System is designed to automatically activate a load-shed program as required by the Applicable Reliability Council in the event of an under-frequency system disturbance. Interconnection Customer shall implement under-frequency and over-frequency relay set points for the Generating Facility as required by the Applicable Reliability Council to ensure “ride through” capability of the Transmission System. Generating Facility response to frequency deviations of pre-determined magnitudes, both under-frequency and over-frequency deviations, shall be studied and coordinated with Transmission Provider in accordance with Good Utility Practice. The term "ride through" as used herein shall mean the ability of a Generating Facility to stay connected to and synchronized with the Transmission System during system disturbances within a range of under-frequency and over-frequency conditions, in accordance with Good Utility Practice.

9.7.4 **System Protection and Other Control Requirements**.

9.7.4.1 System Protection Facilities. Interconnection Customer shall, at its expense, install, operate and maintain its System Protection Facilities as a part of the Generating Facility or the Interconnection Customer's Interconnection Facilities. Transmission Owner shall install at Interconnection Customer's expense any Transmission Owner's System Protection Facilities that may be required on the Transmission Owner's Interconnection Facilities or the Transmission Owner's transmission or distribution facilities as a result of the interconnection of the Generating Facility and the Interconnection Customer's Interconnection Facilities.

9.7.4.2 Interconnection Customer's and Transmission Owner's System Protection Facilities shall be designed and coordinated with Affected Systems in accordance with Good Utility Practice.

9.7.4.3 Each Party shall be responsible for protection of its facilities consistent with Good Utility Practice.

9.7.4.4 Each Party's protective relay design shall incorporate the necessary test switches to perform the tests required in Article 6. The required test switches will be placed such that they allow operation of lockout relays while preventing breaker failure schemes from operating and causing unnecessary breaker operations and/or the tripping of the Generating Facility.

9.7.4.5 Each Party will test, operate and maintain their respective System Protection Facilities in accordance with Good Utility Practice.

9.7.4.6 Prior to the In-Service Date, and again prior to the Commercial Operation Date, Interconnection Customer or Transmission Owner, or their respective agents, shall perform a complete calibration test and functional trip test of the System Protection Facilities. At intervals suggested by Good Utility Practice and following any apparent malfunction of the System Protection Facilities, Interconnection Customer or Transmission Owner shall each perform both calibration and functional trip tests of their respective System Protection Facilities. These tests do not require the tripping of any in-service generating unit. These tests do, however, require that all protective relays and lockout contacts be activated.

9.7.5 **Requirements for Protection.** In compliance with Good Utility Practice, Interconnection Customer shall provide, install, own, and maintain relays, circuit breakers and all other devices necessary to remove any fault contribution of the Generating Facility to any short circuit occurring on the Transmission or Distribution System, as applicable, not otherwise isolated by Transmission Owner's equipment, such that the removal of the fault contribution shall be coordinated with the protective requirements of the Transmission or Distribution System, as applicable. Such protective equipment shall include, without limitation, a disconnecting device or switch with load-interrupting capability located between the Generating Facility and the Transmission or Distribution System, as applicable, at a site selected upon mutual agreement (not to be unreasonably withheld, conditioned or delayed) of the Parties. Interconnection Customer shall be responsible for protection of the Generating Facility and Interconnection Customer's other equipment from such conditions as negative sequence currents, over- or under-frequency, sudden load rejection, over- or under-voltage, and generator loss-of-field. Interconnection Customer shall be solely responsible to disconnect the Generating Facility and Interconnection Customer's other equipment if conditions on the Transmission or Distribution System, as applicable, could adversely affect the Generating Facility.

9.7.6 **Power Quality.** Neither Party's facilities shall cause excessive voltage flicker nor introduce excessive distortion to the sinusoidal voltage or current waves as defined by ANSI Standard C84.1-1989, in accordance with IEEE Standard 519, or any applicable superseding electric industry standard. In the event of a conflict between ANSI Standard C84.1-1989, and any applicable superseding electric industry standard, the applicable superseding electric industry standard shall control.

9.8 **Switching and Tagging Rules. P**rior to the Initial Synchronization Date, each Party shall provide the other Parties a copy of its switching and tagging rules that are applicable to the other Parties' activities. Such switching and tagging rules shall be developed on a non-discriminatory basis. The Parties shall comply with applicable switching and tagging rules, as amended from time to time, in obtaining clearances for work or for switching operations on equipment.

9.9 **Use of Interconnection Facilities by Other Parties**.

9.9.1 Purpose of Interconnection Facilities. Except as may be required by Applicable Laws and Regulations, or as otherwise agreed to among the Parties, the Interconnection Facilities shall be constructed for the sole purpose of interconnecting the Generating Facility to the Transmission or Distribution System, as applicable, and shall be used for no other purpose.

9.9.2 Other Users. If required by Applicable Laws and Regulations or if the Parties mutually agree, such agreement not to be unreasonably withheld or delayed, to allow one or more Parties to use the Transmission Owner's Interconnection Facilities, or any part thereof, Interconnection Customer will be entitled to compensation for the capital expenses it incurred in connection with the Interconnection Facilities based upon the pro rata use of the Interconnection Facilities by Transmission Owner, all non-Party users, and Interconnection Customer, in accordance with Applicable Laws and Regulations or upon some other mutually-agreed upon methodology. In addition, cost responsibility for ongoing costs, including operation and maintenance costs associated with the Interconnection Facilities, will be allocated between Interconnection Customer and any non-Party users based upon the pro rata use of the Interconnection

Facilities by Transmission Owner, all non-Party users, and Interconnection Customer, in accordance with Applicable Laws and Regulations or upon some other mutually agreed upon methodology. If the issue of such compensation or allocation cannot be resolved through such negotiations, it shall be submitted to Dispute Resolution pursuant to Section 12 of the Tariff.

9.10 Disturbance Analysis Data Exchange. The Parties will cooperate with one another in the analysis of disturbances to either the Generating Facility or the Transmission System by gathering and providing access to any information relating to any disturbance, including information from oscillography, protective relay targets, breaker operations and sequence of events records, and any disturbance information required by Good Utility Practice.

ARTICLE 10. MAINTENANCE

10.1 Transmission Owner Obligations. Transmission Owner shall maintain the Transmission Owner's Interconnection Facilities in a safe and reliable manner and in accordance with this GIA and all Applicable Laws and Regulations.

10.2 Interconnection Customer Obligations. Interconnection Customer shall maintain the Generating Facility and the Interconnection Customer's Interconnection Facilities in a safe and reliable manner and in accordance with this GIA and all Applicable Laws and Regulations.

10.3 Coordination. The Parties shall confer regularly to coordinate the planning, scheduling and performance of preventive and corrective maintenance on the Generating Facility and the Interconnection Facilities.

10.4 Secondary Systems. Each Party shall cooperate with the other in the inspection, maintenance, and testing of control or power circuits that operate below 600 volts, AC or DC, including, but not limited to, any hardware, control or protective devices, cables, conductors, electric raceways, secondary equipment panels, transducers, batteries, chargers, and voltage and current transformers that directly affect the operation of a Party's facilities and equipment which may reasonably be expected to impact another Party. Each Party shall provide advance notice to the other Parties before undertaking any work on such circuits, especially on electrical circuits involving circuit breaker trip and close contacts, current transformers, or potential transformers.

10.5 Operating and Maintenance Expenses. Subject to the provisions herein addressing the use of facilities by others, and except for operations and maintenance expenses associated with modifications made for providing Interconnection Service or Transmission Service to a non-
Party and such non-Party pays for such expenses, Interconnection Customer shall be responsible for all reasonable expenses including overheads, associated with:
(1) owning, operating, maintaining, repairing, and replacing Interconnection Customer's

Interconnection Facilities; and (2) operation, maintenance, repair and replacement of Transmission Owner's Interconnection Facilities to the extent required by Transmission Owner on a comparable basis.

ARTICLE 11. PERFORMANCE OBLIGATION

11.1 Interconnection Customer's Interconnection Facilities. Interconnection Customer shall design, procure, construct, install, own and/or control the Interconnection Customer's Interconnection Facilities described in Appendix A at its sole expense.

11.2 Transmission Owner's Interconnection Facilities. Transmission Owner shall design, procure, construct, install, own and/or control the Transmission Owner's Interconnection Facilities described in Appendix A at the sole expense of Interconnection Customer.

11.3 Network Upgrades, System Protection Facilities and Distribution Upgrades. Transmission Owner shall design, procure, construct, install, and own the Network Upgrades, Transmission Owner's System Protection Facilities and Distribution Upgrades described in Appendix A. Interconnection Customer shall be responsible for all costs related to Distribution Upgrades and/or Generator Upgrades. Transmission Owner shall provide Transmission Provider and Interconnection Customer with written notice pursuant to Article 15 that Transmission Owner elects to fund the capital for the Network Upgrades and Transmission Owner's System Protection Facilities, which election shall only be available upon mutual agreement of Interconnection Customer and Transmission Owner; otherwise, such facilities, if any, shall be solely funded by Interconnection Customer.

11.3.1 Contingencies Affecting Network Upgrades, System Protection Facilities and Distribution Upgrades**.** Network Upgrades, System Protection Facilities and Distribution Upgrades that are required to accommodate the Generating Facility may be modified because (1) a higher queued interconnection request withdrew or was deemed to have withdrawn, (2) the interconnection agreement associated with a higher queued interconnection request was terminated prior to the project's In-Service Date, (3) the Commercial Operation Date for a higher queued interconnection request is delayed, or the project itself is delayed (including due to suspension) such that facilities required to accommodate lower queued projects or the project itself may be altered, (4) the queue position is reinstated for a higher-queued interconnection request whose queue position was subject to dispute resolution, (5) changes occur in Transmission Provider or Transmission Owner equipment design standards or reliability criteria giving rise to the need for restudy, (6) the facilities required to accommodate a higher queued Interconnection Request were modified constituting a Material Modification pursuant to Section 4.4 of the GIP, (7) a GIA with an effective date prior to this GIA is terminated, or (8) when ordered to restudy by FERC. The higher queued Interconnection Requests that could impact the Network Upgrades, System Protection Facilities and Distribution Upgrades required to accommodate the

Generating Facility, and possible Modifications that may result from the above listed events affecting the higher queued Interconnection Requests, to the extent such modifications are reasonably known and can be determined, and estimates of the costs associated with such required Network Upgrades, System Protection Facilities and Distribution Upgrades, are provided in Appendix A.

11.3.2 Agreement to Restudy**.** Interconnection Customer agrees to enter into an Interconnection Study Agreement, if at any time before the Network Upgrades, System Protection Facilities and/or Distribution Upgrades associated with higher queued Interconnection Requests with GIA in effect prior to this GIA are completed, Transmission Provider determines restudy is required because one of the contingencies in Article 11.3.1 occurred, and provides notice to Interconnection Customer. Any restudy shall be performed, as applicable, in accordance with Sections 6.3, 7.4 and 8.5 of the GIP. The Parties agree to amend Appendix A to this GIA in accordance with Article 30.10 to reflect the results of any restudy required under this Article 11.3.2.

11.3.3 **Agreement to Fund Shared Network Upgrades.** Interconnection Customer agrees to fund Shared Network Upgrades, as determined by Transmission Provider. Where applicable, payments to fund Shared Network Upgrade(s) that are made to Transmission Provider by Interconnection Customer will be disbursed by Transmission Provider to the appropriate entities that funded the Shared Network Upgrades in accordance with Attachment X and Attachment FF of the Tariff. In the event that Interconnection Customer fails to meet its obligation to fund Shared Network Upgrades, Transmission Owner and Transmission Provider shall not be responsible for the Interconnection Customer's funding obligation.

11.4 **Transmission Credits**.

11.4.1 Repayment of Amounts Advanced for Network Upgrades. Interconnection Customer shall be entitled to a cash repayment by Transmission Owner(s) and the Affected System Owner(s) that own the Network Upgrades, of the amount paid respectively to Transmission Owner and Affected System Operator, if any, for the Network Upgrades, as provided under Attachment FF of this Tariff and including any tax gross-up or other tax-related payments associated with the repayable portion of the Network Upgrades, and not repaid to Interconnection Customer pursuant to Article 5.17.8 or otherwise, to be paid to Interconnection Customer on a dollar-for-dollar basis for the non-usage sensitive portion of transmission charges, as payments are made under the Tariff and Affected System's Tariff for Transmission Services with respect to the Generating Facility. Any repayment shall include interest calculated in accordance with the methodology set forth in FERC's regulations at 18 C.F.R. § 35.19 (a)(2)(iii) from the date of any payment for Network Upgrades through the date on which Interconnection Customer receives a repayment of such payment pursuant to this subparagraph. Interest shall not accrue during periods in which

Interconnection Customer has suspended construction pursuant to Article 11 or the Network Upgrades have been determined not to be needed pursuant to this Article 11.4.1. Interconnection Customer may assign such repayment rights to any person.

If the Generating Facility is designated a Network Resource under the Tariff, or if there are otherwise no incremental payments for Transmission Service resulting from the use of the Generating Facility by Transmission Customer, and in the absence of another mutually agreeable payment schedule any repayments provided under Attachment FF shall be established equal to the applicable rate for Firm Point-To-Point Transmission Service for the pricing zone where the Network Load is located multiplied by the portion of the demonstrated output of the Generating Facility designated as a Network Resource by the Network Customer(s) or in the absence of such designation, equal to the monthly firm single system-wide rate defined under Schedule 7 of the Tariff multiplied by the portion of the demonstrated output of the Generating Facility under contract to Network Customer(s) and consistent with studies pursuant to Section 3.2.2.2 of the GIP.

Notwithstanding the foregoing, as applicable and consistent with the provisions of Attachment FF of this Tariff, Interconnection Customer, Transmission Provider, Transmission Owner, and Affected System Operator may adopt any alternative payment schedule that is mutually agreeable so long as Transmission Owner and Affected System Operator take one of the following actions no later than five (5) years from the Commercial Operation Date: (1) return to Interconnection Customer any amounts advanced for Network Upgrades not previously repaid, or (2) declare in writing that Transmission Owner or Affected System Operator will continue to provide payments to Interconnection Customer on a dollar-for-dollar basis for the non-usage sensitive portion of transmission charges, or develop an alternative schedule that is mutually agreeable and provides for the return of all amounts advanced for Network Upgrades not previously repaid; however, full reimbursement shall not extend beyond twenty (20) years from the Commercial Operation Date.

If the Generating Facility is installed in phases, the amount eligible for refund as each phase achieves Commercial Operation will be reduced by the proportional amount of generation capacity not yet installed. However, all facilities in Appendix A other than the Generating Facility shall be built without consideration for the phasing of the Generating Facility as though the entire Generating Facility will be placed in Commercial Operation for the full output or increased output of the Generating Facility constructed by Interconnection Customer under this GIA.

If the Generating Facility fails to achieve Commercial Operation, but it or another generating facility is later constructed and makes use of the Network Upgrades, Transmission Owner and Affected System Operator shall at that time reimburse Interconnection Customer for the remaining applicable amounts that may be refundable pursuant to Attachment FF of this Tariff that were advanced for the Network Upgrades on their respective systems as described above. Before any such reimbursement can occur, Interconnection Customer, or the entity that ultimately constructs the Generating Facility, if different, is responsible for identifying the entity to which the reimbursement must be made.

11.4.2 Special Provisions for Transmission Provider as an Affected System to be covered under Separate Agreements. When the Transmission Owner's Transmission or Distribution System (including for this Article 11.4.2 independent distribution systems connected to the Transmission System) is an Affected System for an interconnection in another electric system, Transmission Provider will coordinate the performance of Interconnection Studies with the other system. Transmission Provider will determine if any Network Upgrades or Distribution Upgrades, which may be required on the Transmission System as a result of the interconnection, would not have been needed but for the interconnection. Unless Transmission Owner provides, under the interconnection agreement between Interconnection Customer and the other system, for the repayment of amounts advanced to Transmission Provider or an impacted Transmission Owner for Network Upgrades, Interconnection Customer, Transmission Provider, and the impacted Transmission Owner(s) shall enter into an agreement that provides for such repayment by Transmission Owner(s) as directed by Transmission Provider. The agreement shall specify the terms governing payments to be made by Interconnection Customer to the Affected System Operator as well as the payment of refunds by the Affected System Operator.

11.4.3 Notwithstanding any other provision of this GIA, nothing herein shall be construed as relinquishing or foreclosing any rights, including but not limited to firm transmission rights, capacity rights, transmission congestion rights, or transmission credits, that Interconnection Customer, shall be entitled to, now or in the future under any other agreement or tariff as a result of, or otherwise associated with, the transmission capacity, if any, created by the Network Upgrades, including the right to obtain cash reimbursement or transmission credits for transmission service that is not associated with the Generating Facility.

11.5 **Initial Payment.** Interconnection Customer shall elect (and provide its election to the Transmission Provider within five days of the commencement of negotiation of the GIA pursuant to Section 11.2 of the GIP) to make either 1) an initial payment equal to twenty (20) percent of the total cost of Network Upgrades, Transmission Owner Interconnection Facilities, Transmission Owner’s System Protection Facilities, Distribution Upgrades and/or Generator Upgrades (if the In-Service Date is less than or equal to five (5) years of the initial payment date); or 2) an initial payment equal to ten (10) percent of the total cost of Network Upgrades, Transmission Owner Interconnection Facilities, Transmission Owner’s System Protection Facilities, Distribution Upgrades and/or Generator Upgrades (if the In-Service Date exceeds the initial payment date by more than five (5) years); or 3) the total cost of Network Upgrades, Transmission Owner Interconnection Facilities, Transmission Owner's System Protection Facilities, Distribution Upgrades and/or Generator Upgrades in the form of security pursuant to Article 11.6. The initial payment shall be provided to Transmission Owner by Interconnection Customer pursuant to this Article 11.5 within the later of a) thirty (30) days of the execution of the GIA by all Parties, or b) thirty (30) days of acceptance by FERC if the GIA is filed unexecuted and the payment is being protested by Interconnection Customer, or c) thirty (30) days of the filing if the GIA is filed unexecuted and the initial payment is not being protested by Interconnection Customer.

11.6 **Provision of Security**. Unless otherwise provided in Appendix B, at least thirty (30) Calendar Days prior to the commencement of the design, procurement, installation, or construction of a discrete portion of an element, not otherwise funded under Article 11.5, of the Transmission Owner's Interconnection Facilities, Transmission Owner's System Protection Facilities, Network Upgrades, Distribution Upgrades or Stand-Alone Network Upgrades, or at the request of Transmission Owner if regulatory approvals are required for the construction of such facilities, Interconnection Customer shall provide Transmission Owner, at Interconnection Customer's selection, a guarantee, a surety bond, letter of credit or other form of security that is reasonably acceptable to Transmission Owner and is consistent with the Uniform Commercial Code of the jurisdiction identified in Article 14.2.1. Such security for payment shall be in an amount sufficient to cover the applicable costs and cost commitments, in addition to those funded under Article 11.5, required of the Party responsible for building the facilities pursuant to the construction schedule developed in Appendix B for designing, engineering, seeking regulatory approval from any Governmental Authority, constructing, procuring and installing the applicable portion of the Transmission Owner's Interconnection Facilities, Transmission Owner's System Protection Facilities, Network Upgrades, Distribution Upgrades or Stand-Alone Network Upgrades and shall be reduced on a dollar-for-dollar basis for payments made to Transmission Owner for these purposes.

In addition:

11.6.1 The guarantee must be made by an entity that meets the creditworthiness requirements of Transmission Owner, and contain terms and conditions that guarantee payment of any amount that may be due from Interconnection Customer, up to an agreed-to maximum amount.

11.6.2 The letter of credit must be issued by a financial institution reasonably acceptable to Transmission Owner and must specify a reasonable expiration date.

11.6.3 The surety bond must be issued by an insurer reasonably acceptable to Transmission Owner and must specify a reasonable expiration date.

11.6.4 If the Shared Network Upgrade is not in service, Interconnection Customer will provide, as applicable, an Irrevocable Letter of Credit to fund any Shared Network Upgrade pursuant to Attachment FF of the Tariff. The Irrevocable Letter of Credit shall be in an amount sufficient to cover the Interconnection Customer's share of the applicable costs and cost commitments associated with the Shared Network Upgrades. Transmission Provider may periodically adjust the Interconnection Customer's share of the applicable costs and cost commitment of Shared Network Upgrades and may require Interconnection Customer to adjust the amount of the Irrevocable Letter of Credit accordingly.

11.7 **Interconnection Customer Compensation.** If Transmission Provider requests or directs Interconnection Customer to provide a service pursuant to Article 13.4 of this GIA, Transmission Provider shall compensate Interconnection Customer in accordance with any tariff or rate schedule filed by Transmission Provider and approved by the FERC.

ARTICLE 12. INVOICE

12.1 **General.** Each Party shall submit to the other Party, on a monthly basis, invoices of amounts due, if any, for the preceding month. Each invoice shall state the month to which the invoice applies and fully describe the services and equipment provided. The Parties may discharge mutual debts and payment obligations due and owing to each other on the same date through netting, in which case all amounts a Party owes to the other Party under this GIA, including interest payments or credits, shall be netted so that only the net amount remaining due shall be paid by the owing Party.

12.2 **Final Invoice**. Within six (6) months after completion of the construction of the Transmission Owner's Interconnection Facilities, Transmission Owner's System Protection Facilities, Distribution Upgrades and the Network Upgrades, Transmission Owner shall provide an invoice of the final cost of the construction of the Transmission Owner's Interconnection Facilities, Transmission Owner's System Protection Facilities, Distribution Upgrades and the Network Upgrades and shall set forth such costs in sufficient detail to enable Interconnection Customer to compare the actual costs with the estimates and to ascertain deviations, if any, from the cost estimates. Transmission Owner shall refund, with interest (calculated in accordance with 18 C.F.R. Section 35.19a(a)(2)(iii), to Interconnection Customer any amount by which the actual payment by Interconnection Customer for estimated costs exceeds the actual costs of construction within thirty (30) Calendar Days of the issuance of such final construction invoice.

12.3 **Payment**. Invoices shall be rendered to the paying Party at the address specified in Appendix F. The Party receiving the invoice shall pay the invoice within thirty (30) Calendar Days of receipt. All payments shall be made in immediately available funds payable to the other Party, or by wire transfer to a bank named and account designated by the invoicing Party. Payment of invoices by a Party will not constitute a waiver of any rights or claims that Party may have under this GIA.

12.4 **Disputes**. In the event of a billing dispute among the Parties, Transmission Provider shall continue to provide Interconnection Service under this GIA as long as Interconnection Customer: (i) continues to make all payments not in dispute; and (ii) pays to Transmission Provider or Transmission Owner or into an independent escrow account the portion of the invoice in dispute, pending resolution of such dispute. If Interconnection Customer fails to meet these two requirements for continuation of service, then Transmission Provider may or, at Transmission Owner's request upon Interconnection Customer's failure to pay, Transmission Owner, shall provide notice to Interconnection Customer of a Default pursuant to Article 17. Within thirty (30) Calendar Days after the resolution of the dispute, the Party that owes money to another Party shall pay the amount due with interest calculated in accord with the methodology set forth in 18 C.F.R. § 35.19a(a)(2)(iii).

ARTICLE 13. EMERGENCIES

13.1 **Obligations.** Each Party shall comply with the Emergency Condition procedures of Transmission Provider, NERC, the Applicable Reliability Council, and Applicable Laws and Regulations.

13.2 **Notice.** Transmission Provider or Transmission Owner shall notify the other Parties promptly when it becomes aware of an Emergency Condition that affects the Transmission Owner's Interconnection Facilities or the Transmission or Distribution System, as applicable, that may reasonably be expected to affect Interconnection Customer's operation of the Generating Facility or the Interconnection Customer's Interconnection Facilities.

Interconnection Customer shall notify Transmission Provider and Transmission Owner, which includes by definition if applicable, the operator of a Distribution System, promptly when it becomes aware of an Emergency Condition that affects the Generating Facility or the Interconnection Customer's Interconnection Facilities that may reasonably be expected to affect the Transmission or Distribution System, as applicable, or the Transmission Owner's Interconnection Facilities.

To the extent information is known, the notification shall describe the Emergency Condition, the extent of the damage or deficiency, the expected effect on the operation of Interconnection Customer's or Transmission Provider's or Transmission Owner's facilities and operations, its anticipated duration and the corrective action taken and/or to be taken. The initial notice shall be followed as soon as practicable with written notice.

13.3 **Immediate Action**. Unless, in a Party's reasonable judgment, immediate action is required, the Party exercising such judgment shall notify and obtain the consent of the other Parties, such consent to not be unreasonably withheld, prior to performing any manual switching operations at the Generating Facility or the Interconnection Customer's Interconnection Facilities in response to an Emergency Condition either declared by

Transmission Provider or otherwise regarding the Transmission or Distribution System, as applicable.

13.4 Transmission Provider and Transmission Owner Authority.

13.4.1 **General**. Transmission Provider or Transmission Owner may take whatever actions or inactions with regard to the Transmission System or the Transmission Owner's Interconnection Facilities it deems necessary during an Emergency Condition in order to (i) preserve public health and safety, (ii) preserve the reliability of the Transmission System or the Transmission Owner's Interconnection Facilities, (iii) limit or prevent damage, and (iv) expedite restoration of service.

Transmission Provider or Transmission Owner shall use Reasonable Efforts to minimize the effect of such actions or inactions on the Generating Facility or the Interconnection Customer's Interconnection Facilities. Transmission Provider or Transmission Owner may, on the basis of technical considerations, require the Generating Facility to mitigate an Emergency Condition by taking actions necessary and limited in scope to remedy the Emergency Condition, including, but not limited to, directing Interconnection Customer to shut-down, start-up, increase or decrease the real or reactive power output of the Generating Facility; implementing a reduction or disconnection pursuant to Article 13.4.2; directing Interconnection Customer to assist with blackstart (if available) or restoration efforts; or altering the outage schedules of the Generating Facility and the Interconnection Customer's Interconnection Facilities. Interconnection Customer shall comply with all of Transmission Provider's or Transmission Owner's operating instructions concerning Generating Facility real power and reactive power output within the manufacturer's design limitations of the Generating Facility's equipment that is in service and physically available for operation at the time, in compliance with Applicable Laws and Regulations.

13.4.2 Reduction and Disconnection. Transmission Provider or Transmission Owner may reduce Interconnection Service or disconnect the Generating Facility or the Interconnection Customer's Interconnection Facilities, when such reduction or disconnection is necessary under Good Utility Practice due to Emergency Conditions. These rights are separate and distinct from any right of curtailment of Transmission Provider pursuant to the Tariff. When Transmission Provider can schedule the reduction or disconnection in advance, Transmission Provider shall notify Interconnection Customer of the reasons, timing and expected duration of the reduction or disconnection. Transmission Provider shall coordinate with Interconnection Customer and Transmission Owner using Good Utility Practice to schedule the reduction or disconnection during periods of least impact to Interconnection Customer, Transmission Owner and Transmission Provider. Any reduction or disconnection shall continue only for so long as reasonably necessary pursuant to Good Utility Practice. The Parties shall cooperate with each other to restore the Generating Facility, the

Interconnection Facilities, and the Transmission System to their normal operating state as soon as practicable consistent with Good Utility Practice.

13.5 Interconnection Customer Authority. Consistent with Good Utility Practice and this GIA and the GIP, Interconnection Customer may take whatever actions or inactions with regard to the Generating Facility or the Interconnection Customer's Interconnection Facilities during an Emergency Condition in order to (i) preserve public health and safety, (ii) preserve the reliability of the Generating Facility or the Interconnection Customer's Interconnection Facilities, (iii) limit or prevent damage, and (iv) expedite restoration of service. Interconnection Customer shall use Reasonable Efforts to minimize the effect of such actions or inactions on the Transmission System and the Transmission Owner's Interconnection Facilities. Transmission Provider and Transmission Owner shall use Reasonable Efforts to assist Interconnection Customer in such actions.

13.6 Limited Liability. Except as otherwise provided in Article 11.6 of this GIA, no Party shall be liable to any other for any action it takes in responding to an Emergency Condition so long as such action is made in good faith and is consistent with Good Utility Practice.

13.7 Audit. In accordance with Article 25.3, any Party may audit the performance of another Party when that Party declared an Emergency Condition.

ARTICLE 14. REGULATORY REQUIREMENTS AND GOVERNING LAW

14.1 Regulatory Requirements. Each Party's obligations under this GIA shall be subject to its receipt of any required approval or certificate from one or more Governmental Authorities in the form and substance satisfactory to the applying Party, or the Party making any required filings with, or providing notice to, such Governmental Authorities, and the expiration of any time period associated therewith. Each Party shall in good faith seek, and if necessary assist the other Party and use its Reasonable Efforts to obtain such other approvals. Nothing in this GIA shall require Interconnection Customer to take any action that could result in its inability to obtain, or its loss of, status or exemption under the Federal Power Act, the Public Utility Holding Company Act of 2005, as amended, or the Public Utility Regulatory Policies Act of 1978.

14.2 Governing Law.

14.2.1 The validity, interpretation and performance of this GIA and each of its provisions shall be governed by the laws of the state where the Point of Interconnection is located, without regard to its conflicts of law principles.

14.2.2 This GIA is subject to all Applicable Laws and Regulations.

14.2.3 Each Party expressly reserves the right to seek changes in, appeal, or otherwise contest any laws, orders, rules, or regulations of a Governmental Authority.

ARTICLE 15. NOTICES

15.1 **General.** Unless otherwise provided in this GIA, any notice, demand or request required or permitted to be given by any Party to the other Parties and any instrument required or permitted to be tendered or delivered by a Party in writing to the other Parties shall be effective when delivered and may be so given, tendered or delivered, by recognized national courier, or by depositing the same with the United States Postal Service with postage prepaid, for delivery by certified or registered mail, addressed to the Party, or personally delivered to the Party, at the address set out in Appendix F, Addresses for Delivery of Notices and Billings.

Either Party may change the notice information in this GIA by giving five (5) Business Days written notice prior to the effective date of the change.

15.2 **Billings and Payments**. Billings and payments shall be sent to the addresses set out in Appendix F.

15.3 **Alternative Forms of Notice**. Any notice or request required or permitted to be given by any Party to the other and not required by this GIA to be given in writing may be so given by telephone, facsimile or email to the telephone numbers and email addresses set out in Appendix F.

15.4 **Operations and Maintenance Notice**. Each Party shall notify the other Parties in writing of the identity of the person(s) that it designates as the point(s) of contact with respect to the implementation of Articles 9 and 10.

ARTICLE 16. FORCE MAJEURE

16.1 **Force Majeure.**

16.1.1 Economic hardship is not considered a Force Majeure event.

16.1.2 A Party shall not be considered to be in Default with respect to any obligation hereunder, (including obligations under Article 4 and 5), other than the obligation to pay money when due, if prevented from fulfilling such obligation by Force Majeure. A Party unable to fulfill any obligation hereunder (other than an obligation to pay money when due) by reason of Force Majeure shall give notice and the full particulars of such Force Majeure to the other Parties in writing or by telephone as soon as reasonably possible after the occurrence of the cause relied upon. Telephone, facsimile or email notices given pursuant to this Article shall be confirmed in writing as soon as reasonably possible and shall specifically state full particulars of the Force Majeure, the time and date when the Force Majeure occurred and when the Force Majeure is reasonably expected to cease. The Party affected shall exercise Reasonable Efforts to remove such disability with reasonable dispatch, but shall not be required to accede or agree to any provision not satisfactory to it in order to settle and terminate a strike or other labor disturbance.

ARTICLE 17. DEFAULT

17.1 Default

17.1.1 General. No Default shall exist where such failure to discharge an obligation (other than the payment of money) is the result of Force Majeure as defined in this GIA or the result of an act or omission of another Party. Upon a Breach, the non-Breaching Party or Parties shall give written notice of such Breach to the Breaching Party with a copy to the other Party if one Party gives notice of such Breach. Except as provided in Article 17.1.2, the Breaching Party shall have thirty (30) Calendar Days from receipt of the Breach notice within which to cure such Breach; provided however, if such Breach is not capable of cure within thirty (30) Calendar Days, the Breaching Party shall commence such cure within thirty (30) Calendar Days after notice and continuously and diligently complete such cure within ninety (90) Calendar Days from receipt of the Breach notice; and, if cured within such time, the Breach specified in such notice shall cease to exist.

17.1.2 Termination. If a Breach is not cured as provided in this Article, or if a Breach is not capable of being cured within the period provided for herein, the non-Breaching Party or Parties shall terminate this GIA, subject to Article 2.3.2 of this GIA, by written notice to the Breaching Party, with a copy to the other Party if one Party gives notice of termination, and be relieved of any further obligation hereunder and, whether or not that Party(ies) terminates this GIA, to recover from the Breaching Party all amounts due hereunder, plus all other damages and remedies to which it is (they are) entitled at law or in equity. The provisions of this Article will survive termination of this GIA.

ARTICLE 18. LIMITATION OF LIABILITY, INDEMNITY, CONSEQUENTIAL DAMAGES AND INSURANCE

18.1 Limitation of Liability. A Party shall not be liable to another Party or to any third party or other person for any damages arising out of actions under this GIA, including, but not limited to, any act or omission that results in an interruption, deficiency or imperfection of Interconnection Service, except as provided in this Tariff. The provisions set forth in the Tariff shall be additionally applicable to any Party acting in good faith to implement or comply with its obligations under this GIA, regardless of whether the obligation is preceded by a specific directive.

18.2 **Indemnity.** To the extent permitted by law, an Indemnifying Party shall at all times indemnify, defend and hold the other Parties harmless from Loss.

18.2.1 Indemnified Party. If an Indemnified Party is entitled to indemnification under this Article 18 as a result of a claim by a non-Party, and the Indemnifying Party fails, after notice and reasonable opportunity to proceed under Article 18.2, to assume the defense of such claim, such Indemnified Party may at the expense of the Indemnifying Party contest, settle or consent to the entry of any judgment with respect to, or pay in full, such claim.

18.2.2 Indemnifying Party. If an Indemnifying Party is obligated to indemnify and hold any Indemnified Party harmless under this Article 18, the amount owing to the Indemnified Party shall be the amount of such Indemnified Party's actual Loss, net of any insurance or other recovery.

18.2.3 Indemnity Procedures. Promptly after receipt by an Indemnified Party of any claim or notice of the commencement of any action or administrative or legal proceeding or investigation as to which the indemnity provided for in Article 18.2 may apply, the Indemnified Party shall notify the Indemnifying Party of such fact. Any failure of or delay in such notification shall not affect a Party's indemnification obligation unless such failure or delay is materially prejudicial to the Indemnifying Party.

The Indemnifying Party shall have the right to assume the defense thereof with counsel designated by such Indemnifying Party and reasonably satisfactory to the Indemnified Party. If the defendants in any such action include one or more Indemnified Parties and the Indemnifying Party and if the Indemnified Party reasonably concludes that there may be legal defenses available to it and/or other Indemnified Parties which are different from or additional to those available to the Indemnifying Party, the Indemnified Party shall have the right to select separate counsel to assert such legal defenses and to otherwise participate in the defense of such action on its own behalf. In such instances, the Indemnifying Party shall only be required to pay the fees and expenses of one additional attorney to represent an Indemnified Party or Indemnified Parties having such differing or additional legal defenses.

The Indemnified Party shall be entitled, at its expense, to participate in any such action, suit or proceeding, the defense of which has been assumed by the Indemnifying Party. Notwithstanding the foregoing, the Indemnifying Party (i) shall not be entitled to assume and control the defense of any such action, suit or proceedings if and to the extent that, in the opinion of the Indemnified Party and its counsel, such action, suit or proceeding involves the potential imposition of criminal liability on the Indemnified Party, or there exists a conflict or adversity of interest between the Indemnified Party and the Indemnifying Party, in such event the Indemnifying Party shall pay the reasonable expenses of the Indemnified Party, and (ii) shall not settle or consent to the entry of any judgment in any action, suit or proceeding without the consent of the Indemnified Party, which shall not be reasonably withheld, conditioned or delayed.

18.3 Consequential Damages. Other than the Liquidated Damages heretofore described, in no event shall either Party be liable under any provision of this GIA for any losses, damages, costs or expenses for any special, indirect, incidental, consequential, or punitive damages, including but not limited to loss of profit or revenue, loss of the use of equipment, cost of capital, cost of temporary equipment or services, whether based in whole or in part in contract, in tort, including negligence, strict liability, or any other theory of liability; provided; however, that damages for which a Party may be liable to the other Party under another agreement will not be considered to be special, indirect, incidental, or consequential damages hereunder.

18.4 Insurance. Transmission Owner and Interconnection Customer shall, at their own expense, maintain in force throughout the period of this GIA pursuant to 18.4.9, and until released by the other Party, the following minimum insurance coverages, with insurers authorized to do business or an approved surplus lines carrier in the state where the Point of Interconnection is located:

18.4.1 Employers' Liability and Workers' Compensation Insurance providing statutory benefits in accordance with the laws and regulations of the state in which the Point of Interconnection is located.

18.4.2 Commercial General Liability Insurance including premises and operations, personal injury, broad form property damage, broad form blanket contractual liability coverage (including coverage for the contractual indemnification) products and completed operations coverage, coverage for explosion, collapse and underground hazards, independent contractors coverage, coverage for pollution to the extent normally available and punitive damages to the extent normally available and a cross liability endorsement, with minimum limits of One Million Dollars ($1,000,000) per occurrence/One Million Dollars ($1,000,000) aggregate combined single limit for personal injury, bodily injury, including death and property damage.

18.4.3 Comprehensive Automobile Liability Insurance, for coverage of owned and non-owned and hired vehicles, trailers or semi-trailers licensed for travel on public roads, with a minimum combined single limit of One Million Dollars ($1,000,000) each occurrence for bodily injury, including death, and property damage.

18.4.4 Excess Public Liability Insurance over and above the Employer’s Liability, Commercial General Liability and Comprehensive Automobile Liability

Insurance coverage, with a minimum combined single limit of Twenty Million Dollars ($20,000,000) per occurrence/Twenty Million Dollars ($20,000,000) aggregate.

18.4.5 The Commercial General Liability Insurance, Comprehensive Automobile Insurance and Excess Public Liability Insurance policies shall name the other Parties, their parents, associated and Affiliate companies and their respective directors, officers, agents, servants and employees ("Other Party Group") as additional insured. All policies shall contain provisions whereby the insurers waive all rights of subrogation in accordance with the provisions of this GIA against the Other Party Groups and provide thirty (30) Calendar Days' advance written notice to the Other Party Groups prior to anniversary date of cancellation or any material change in coverage or condition.

18.4.6 The Commercial General Liability Insurance, Comprehensive Automobile Liability Insurance and Excess Public Liability Insurance policies shall contain provisions that specify that the policies are primary and shall apply to such extent without consideration for other policies separately carried and shall state that each insured is provided coverage as though a separate policy had been issued to each, except the insurer's liability shall not be increased beyond the amount for which the insurer would have been liable had only one insured been covered. Each Party shall be responsible for its respective deductibles or retentions.

18.4.7 The Commercial General Liability Insurance, Comprehensive Automobile Liability Insurance and Excess Public Liability Insurance policies, if written on a Claims First Made Basis, shall be maintained in full force and effect for two (2) years after termination of this GIA, which coverage may be in the form of tail coverage or extended reporting period coverage if agreed by Transmission Owner and Interconnection Customer.

18.4.8 The requirements contained herein as to the types and limits of all insurance to be maintained by Transmission Owner and Interconnection Customer are not intended to and shall not in any manner, limit or qualify the liabilities and obligations assumed by Transmission Owner and Interconnection Customer under this GIA.

18.4.9 As of the date set forth in Appendix B, Milestones, and as soon as practicable after the end of each fiscal year or at the renewal of the insurance policy and in any event within ninety (90) Calendar Days thereafter, Interconnection Customer and Transmission Owner shall provide the other Party with certification of all insurance required in this GIA, executed by each insurer or by an authorized representative of each insurer.

18.4.10 Notwithstanding the foregoing, Transmission Owner or Interconnection Customer may self-insure to meet the minimum insurance requirements of

Articles 18.4.1 through 18.4.8, to the extent it maintains a self-insurance program; provided that, Transmission Owner's or Interconnection Customer's senior secured debt is rated at investment grade, or better, by Standard & Poor's and that its self-insurance program meets minimum insurance requirements under Articles 18.4.1 through 18.4.8. For any period of time that a Transmission Owner's or Interconnection Customer's senior secured debt is unrated by Standard & Poor's or is rated at less than investment grade by Standard & Poor's, such Party shall comply with the insurance requirements applicable to it under Articles 18.4.1 through 18.4.9. In the event that Transmission Owner or Interconnection Customer is permitted to self-insure pursuant to this article, it shall notify the other Party that it meets the requirements to self-insure and that its self-insurance program meets the minimum insurance requirements in a manner consistent with that specified in Article 18.4.9.

18.4.11 Transmission Owner and Interconnection Customer agree to report to each other in writing as soon as practical all accidents or occurrences resulting in injuries to any person, including death, and any property damage arising out of this GIA.

ARTICLE 19. ASSIGNMENT

19.1 Assignment. This GIA may be assigned by any Party only with the written consent of the other Parties; provided that a Party may assign this GIA without the consent of the other Parties to any Affiliate of the assigning Party with an equal or greater credit rating and with the legal authority and operational ability to satisfy the obligations of the assigning Party under this GIA; and provided further that Interconnection Customer shall have the right to assign this GIA, without the consent of either Transmission Provider or Transmission Owner, for collateral security purposes to aid in providing financing for the Generating Facility, provided that Interconnection Customer will promptly notify Transmission Provider of any such assignment. Any financing arrangement entered into by Interconnection Customer pursuant to this Article will provide that prior to or upon the exercise of the secured party's , trustee's or mortgagee's assignment rights pursuant to said arrangement, the secured creditor, the trustee or mortgagee will notify Transmission Provider of the date and particulars of any such exercise of assignment right(s), including providing Transmission Provider and Transmission Owner with proof that it meets the requirements of Article 11.5 and 18.4. Any attempted assignment that violates this Article is void and ineffective. Any assignment under this GIA shall not relieve a Party of its obligations, nor shall a Party's obligations be enlarged, in whole or in part, by reason thereof. Where required, consent to assignment will not be unreasonably withheld, conditioned or delayed.

ARTICLE 20. SEVERABILITY

20.1 Severability. If any provision in this GIA is finally determined to be invalid, void or unenforceable by any court or other Governmental Authority having jurisdiction, such determination shall not invalidate, void or make unenforceable any other provision, agreement or covenant of this GIA; provided that if Interconnection Customer (or any non-Party, but only if such non-Party is not acting at the direction of either Transmission Provider or Transmission Owner) seeks and obtains such a final determination with respect to any provision of the Alternate Option (Article 5.1.2), or the Negotiated Option (Article 5.1.4), then none of these provisions shall thereafter have any force or effect and the Parties' rights and obligations shall be governed solely by the Standard Option (Article 5.1.1).

ARTICLE 21. COMPARABILITY

21.1 Comparability. The Parties will comply with all applicable comparability and code of conduct laws, rules and regulations including such laws, rules and regulations of Governmental Authorities establishing standards of conduct, as amended from time to time.

ARTICLE 22. CONFIDENTIALITY

22.1 Confidentiality. Confidential Information shall include, without limitation, all information relating to a Party's technology, research and development, business affairs, and pricing, and any information supplied by a Party to another Party prior to the execution of this GIA.

Information is Confidential Information only if it is clearly designated or marked in writing as confidential on the face of the document, or, if the information is conveyed orally or by inspection, if the Party providing the information orally informs the Party receiving the information that the information is confidential. The Parties shall maintain as confidential any information that is provided and identified by a Party as Critical Energy Infrastructure Information (CEII), as that term is defined in 18 C.F.R. Section 388.113(c). Such confidentiality will be maintained in accordance with this Article 22.

If requested by the receiving Party, the disclosing Party shall provide in writing, the basis for asserting that the information referred to in this Article warrants confidential treatment, and the requesting Party may disclose such writing to the appropriate Governmental Authority. Each Party shall be responsible for the costs associated with affording confidential treatment to its information.

22.1.1 Term**.** During the term of this GIA, and for a period of three (3) years after the expiration or termination of this GIA, except as otherwise provided in this

Article 22 or with regard to CEII, each Party shall hold in confidence and shall not disclose to any person Confidential Information. CEII shall be treated in accordance with Commission policy and regulations.

22.1.2 Scope. Confidential Information shall not include information that the receiving Party can demonstrate: (1) is generally available to the public other than as a result of a disclosure by the receiving Party; (2) was in the lawful possession of the receiving Party on a non-confidential basis before receiving it from the disclosing Party; (3) was supplied to the receiving Party without restriction by a non-Party, who, to the knowledge of the receiving Party after due inquiry, was under no obligation to the disclosing Party to keep such information confidential; (4) was independently developed by the receiving Party without reference to Confidential Information of the disclosing Party; (5) is, or becomes, publicly known, through no wrongful act or omission of the receiving Party or Breach of this GIA; or (6) is required, in accordance with Article 22.1.7 of this GIA, Order of Disclosure, to be disclosed by any Governmental Authority or is otherwise required to be disclosed by law or subpoena, or is necessary in any legal proceeding establishing rights and obligations under this GIA. Information designated as Confidential Information will no longer be deemed confidential if the Party that designated the information as confidential notifies the receiving Party that it no longer is confidential.

22.1.3 Release of Confidential Information. No Party shall release or disclose Confidential Information to any other person, except to its Affiliates (limited by the Standards of Conduct requirements), subcontractors, employees, agents, consultants, or to non-parties who may be or are considering providing financing to or equity participation with Interconnection Customer, or to potential purchasers or assignees of Interconnection Customer, on a need-to-know basis in connection with this GIA, unless such person has first been advised of the confidentiality provisions of this Article 22 and has agreed to comply with such provisions. Notwithstanding the foregoing, a Party providing Confidential Information to any person shall remain primarily responsible for any release of Confidential Information in contravention of this Article 22.

22.1.4 Rights. Each Party retains all rights, title, and interest in the Confidential Information that it discloses to the receiving Party. The disclosure by a Party to the receiving Party of Confidential Information shall not be deemed a waiver by the disclosing Party or any other person or entity of the right to protect the Confidential Information from public disclosure.

22.1.5 No Warranties. By providing Confidential Information, no Party makes any warranties or representations as to its accuracy or completeness. In addition, by supplying Confidential Information, no Party obligates itself to provide any particular information or Confidential Information to another Party nor to enter into any further agreements or proceed with any other relationship or joint venture.

22.1.6 Standard of Care. Each Party shall use at least the same standard of care to protect Confidential Information it receives as it uses to protect its own Confidential Information from unauthorized disclosure, publication or dissemination. Each Party may use Confidential Information solely to fulfill its obligations to another Party under this GIA or its regulatory requirements.

22.1.7 Order of Disclosure. If a court or a Government Authority or entity with the right, power, and apparent authority to do so requests or requires any Party, by subpoena, oral deposition, interrogatories, requests for production of documents, administrative order, or otherwise, to disclose Confidential Information, that Party shall provide the disclosing Party with prompt notice of such request(s) or requirement(s) so that the disclosing Party may seek an appropriate protective order or waive compliance with the terms of this GIA. Notwithstanding the absence of a protective order or waiver, the Party may disclose such Confidential Information which, in the opinion of its counsel, the Party is legally compelled to disclose. Each Party will use Reasonable Efforts to obtain reliable assurance that confidential treatment will be accorded any Confidential Information so furnished.

22.1.8 Termination of Agreement. Upon termination of this GIA for any reason, each Party shall, within ten (10) Calendar Days of receipt of a written request from another Party, use Reasonable Efforts to destroy, erase, or delete (with such destruction, erasure, and deletion certified in writing to the requesting Party) or return to the requesting Party, without retaining copies thereof, any and all written or electronic Confidential Information received from the requesting Party, except that each Party may keep one copy for archival purposes, provided that the obligation to treat it as Confidential Information in accordance with this Article 22 shall survive such termination.

22.1.9 Remedies**.** The Parties agree that monetary damages would be inadequate to compensate a Party for another Party's Breach of its obligations under this Article 22. Each Party accordingly agrees that the disclosing Party shall be entitled to equitable relief, by way of injunction or otherwise, if the receiving Party Breaches or threatens to Breach its obligations under this Article 22, which equitable relief shall be granted without bond or proof of damages, and the Breaching Party shall not plead in defense that there would be an adequate remedy at law. Such remedy shall not be deemed an exclusive remedy for the Breach of this Article 22, but shall be in addition to all other remedies available at law or in equity. The Parties further acknowledge and agree that the covenants contained herein are necessary for the protection of legitimate business interests and are reasonable in scope. No Party, however, shall be liable for indirect, incidental, or consequential or punitive damages of any nature or kind resulting from or arising in connection with this Article 22.

22.1.10 Disclosure to FERC, Its Staff or a State**.** Notwithstanding anything in this Article 22 to the contrary, and pursuant to 18 CFR § 1b.20, if FERC or its staff, during the course of an investigation or otherwise, requests information from a Party that is otherwise required to be maintained in confidence pursuant to this GIA, the Party shall provide the requested information to FERC or its staff, within the time provided for in the request for information. In providing the information to FERC or its staff, the Party must, consistent with 18 CFR § 388.112, request that the information be treated as confidential and non-public by FERC and its staff and that the information be withheld from public disclosure. Parties are prohibited from notifying the other Parties to this GIA prior to the release of the Confidential Information to FERC or its staff. The Party shall notify the other Parties to this GIA when it is notified by FERC or its staff that a request to release Confidential Information has been received by FERC, at which time any of the Parties may respond before such information would be made public, pursuant to 18 CFR § 388.112. Requests from a state regulatory body conducting a confidential investigation shall be treated in a similar manner if consistent with the applicable state rules and regulations.

22.1.11 Subject to the exception in Article 22.1.10, any information that a disclosing Party claims is competitively sensitive, commercial or financial information under this GIA shall not be disclosed by the receiving Party to any person not employed or retained by the receiving Party, except to the extent disclosure is (i) required by law; (ii) reasonably deemed by the receiving Party to be required to be disclosed in connection with a dispute between or among the Parties, or the defense of litigation or dispute; (iii) otherwise permitted by consent of the disclosing Party, such consent not to be unreasonably withheld; or (iv) necessary to fulfill its obligations under this GIA or as the Regional Transmission Organization or a Local Balancing Authority operator including disclosing the Confidential Information to a regional or national reliability organization. The Party asserting confidentiality shall notify the receiving Party in writing of the information that Party claims is confidential. Prior to any disclosures of that Party's Confidential Information under this subparagraph, or if any non-Party or Governmental Authority makes any request or demand for any of the information described in this subparagraph, the Party who received the Confidential Information from the disclosing Party agrees to promptly notify the disclosing Party in writing and agrees to assert confidentiality and cooperate with the disclosing Party in seeking to protect the Confidential Information from public disclosure by confidentiality agreement, protective order or other reasonable measures.

ARTICLE 23. ENVIRONMENTAL RELEASES

23.1 Each Party shall notify the other Parties, first orally and then in writing, of the release of any Hazardous Substances, any asbestos or lead abatement activities, or any type of remediation activities related to the Generating Facility or the Interconnection Facilities, each of which may reasonably be expected to affect another Party. The notifying Party shall: (i) provide the notice as soon as practicable, provided such Party makes a good faith effort to provide the notice no later than twenty-four hours after such Party becomes aware of the occurrence; and (ii) promptly furnish to the other Parties copies of any publicly available reports filed with any Governmental Authorities addressing such events.

ARTICLE 24. INFORMATION REQUIREMENTS

24.1 Information Acquisition. Transmission Provider, Transmission Owner and Interconnection Customer shall submit specific information regarding the electrical characteristics of their respective facilities to each other as described below and in accordance with Applicable Reliability Standards.

24.2 Information Submission by Transmission Provider and Transmission Owner The initial information submission by Transmission Provider to Interconnection Customer, with copy provided to Transmission Owner, shall occur no later than one hundred eighty (180) Calendar Days prior to Trial Operation and shall include Transmission or Distribution System information, as applicable and available, necessary to allow Interconnection Customer to select equipment and meet any system protection and stability requirements, unless otherwise mutually agreed to by the Parties. On a monthly basis, Transmission Owner shall provide Interconnection Customer a status report on the construction and installation of Transmission Owner's Interconnection Facilities, Transmission Owner's System Protection Facilities, Distribution Upgrades and Network Upgrades, including, but not limited to, the following information: (1) progress to date; (2) a description of the activities since the last report (3) a description of the action items for the next period; and (4) the delivery status of equipment ordered.

24.3 Updated Information Submission by Interconnection Customer. The updated information submission by Interconnection Customer to Transmission Provider, with copy to Transmission Owner, including manufacturer information, shall occur no later than one hundred eighty (180) Calendar Days prior to the Trial Operation. Interconnection Customer shall submit to Transmission Provider and Transmission Owner a completed copy of the Generating Facility data requirements contained in Appendix 1 to the GIP. It shall also include any additional information provided to Transmission Provider for the Interconnection Feasibility Study and Interconnection Facilities Study. Information in this submission shall be the most current Generating Facility design or expected performance data. Information submitted for stability models shall be compatible with Transmission Provider standard models. If there is no compatible model, Interconnection Customer will work with a consultant mutually agreed to by Transmission Provider and Interconnection Customer to develop and supply a standard model and associated information.

If the Interconnection Customer's data is materially different from what was originally provided to Transmission Provider pursuant to the Interconnection Study Agreement between Transmission Provider and Interconnection Customer, then Transmission Provider will conduct appropriate studies to determine the impact on the Transmission

System based on the actual data submitted pursuant to this Article 24.3. Interconnection Customer shall not begin Trial Operation until such studies are completed.

24.4 Information Supplementation. Prior to the Commercial Operation Date, the Parties shall supplement their information submissions described above in this Article 24 with any and all "as-built" Generating Facility information or "as-tested" performance information that differs from the initial submissions or, alternatively, written confirmation that no such differences exist. Interconnection Customer shall conduct tests on the Generating Facility as required by Good Utility Practice, such as an open circuit "step voltage" test on the Generating Facility to verify proper operation of the Generating Facility's automatic voltage regulator.

Unless otherwise agreed, the test conditions shall include: (1) Generating Facility at synchronous speed; (2) automatic voltage regulator on and in voltage control mode; and (3) a five percent (5 %) change in Generating Facility terminal voltage initiated by a change in the voltage regulators reference voltage. Interconnection Customer shall provide validated test recordings showing the responses in Generating Facility terminal and field voltages. In the event that direct recordings of these voltages is impractical, recordings of other voltages or currents that mirror the response of the Generating Facility's terminal or field voltage are acceptable if information necessary to translate these alternate quantities to actual Generating Facility terminal or field voltages is provided. Generating Facility testing shall be conducted and results provided to Transmission Provider and Transmission Owner for each individual generating unit in a station.

Subsequent to the Operation Date, Interconnection Customer shall provide Transmission Provider and Transmission Owner any information changes due to equipment replacement, repair, or adjustment. Transmission Owner shall provide Interconnection Customer, with copy to Transmission Provider, any information changes due to equipment replacement, repair or adjustment in the directly connected substation or any adjacent Transmission Owner substation that may affect the Interconnection Customer's Interconnection Facilities equipment ratings, protection or operating requirements. The Parties shall provide such information no later than thirty (30) Calendar Days after the date of the equipment replacement, repair or adjustment.

ARTICLE 25. INFORMATION ACCESS AND AUDIT RIGHTS

25.1 Information Access. Each Party (the "disclosing Party") shall make available to the other Parties information that is in the possession of the disclosing Party and is necessary in order for the other Parties to: (i) verify the costs incurred by the disclosing Party for which another Party is responsible under this GIA; and (ii) carry out its obligations and responsibilities under this GIA. The Parties shall not use such information for purposes other than those set forth in this Article 25.1 and to enforce their rights under this GIA.

25.2 Reporting of Non-Force Majeure Events. A Party (the "notifying Party") shall notify the other Parties when the notifying Party becomes aware of its inability to comply with the provisions of this GIA for a reason other than a Force Majeure event. The Parties agree to cooperate with each other and provide necessary information regarding such inability to comply, including the date, duration, reason for the inability to comply, and corrective actions taken or planned to be taken with respect to such inability to comply. Notwithstanding the foregoing, notification, cooperation or information provided under this Article shall not entitle any Party receiving such notification to allege a cause for anticipatory breach of this GIA.

25.3 Audit Rights. Subject to the requirements of confidentiality under Article 22 of this GIA, each Party shall have the right, during normal business hours, and upon prior reasonable notice to the other Parties, to audit at its own expense the other Parties' accounts and records pertaining to the Parties' performance or the Parties' satisfaction of obligations under this GIA. Such audit rights shall include audits of the other Parties' costs, calculation of invoiced amounts, the Transmission Provider's efforts to allocate responsibility for the provision of reactive support to the Transmission or Distribution System, as applicable, the Transmission Provider's efforts to allocate responsibility for interruption or reduction of generation, and each Party's actions in an Emergency Condition. Any audit authorized by this Article shall be performed at the offices where such accounts and records are maintained and shall be limited to those portions of such accounts and records that relate to each Party's performance and satisfaction of obligations under this GIA. Each Party shall keep such accounts and records for a period equivalent to the audit rights periods described in Article 25.4.

25.4 Audit Rights Periods.

25.4.1 Audit Rights Period for Construction-Related Accounts and Records. Accounts and records related to the design, engineering, procurement, and construction of the Transmission Owner's Interconnection Facilities, Transmission Owner's System Protection Facilities, Distribution Upgrades and Network Upgrades shall be subject to audit for a period of twenty-four months following Transmission Owner's issuance of a final invoice in accordance with Article 12.2.

25.4.2 Audit Rights Period for All Other Accounts and Records. Accounts and records related to a Party's performance or satisfaction of all obligations under this GIA other than those described in Article 25.4.1 shall be subject to audit as follows: (i) for an audit relating to cost obligations, the applicable audit rights period shall be twenty-four (24) months after the auditing Party's receipt of an invoice giving rise to such cost obligations; and (ii) for an audit relating to all other obligations, the applicable audit rights period shall be twenty-four (24) months after the event for which the audit is sought.

25.5 Audit Results. If an audit by a Party determines that an overpayment or an underpayment has occurred, a notice of such overpayment or underpayment shall be given to the Party or from whom the overpayment or underpayment is owed together with those records from the audit which support such determination.

ARTICLE 26. SUBCONTRACTORS

26.1 General. Nothing in this GIA shall prevent a Party from utilizing the services of any subcontractor as it deems appropriate to perform its obligations under this GIA; provided, however, that each Party shall require its subcontractors to comply with all applicable terms and conditions of this GIA in providing such services and each Party shall remain primarily liable to the other Parties for the performance of such subcontractor.

26.2 Responsibility of Principal. The creation of any subcontract relationship shall not relieve the hiring Party of any of its obligations under this GIA. The hiring Party shall be fully responsible to the other Parties for the acts or omissions of any subcontractor the hiring Party hires as if no subcontract had been made; provided, however, that in no event shall Transmission Provider or Transmission Owner be liable for the actions or inactions of Interconnection Customer or its subcontractors with respect to obligations of Interconnection Customer under Article 5 of this GIA. Any applicable obligation imposed by this GIA upon the hiring Party shall be equally binding upon, and shall be construed as having application to, any subcontractor of such Party.

26.3 No Limitation by Insurance. The obligations under this Article 26 will not be limited in any way by any limitation of subcontractor's insurance.

ARTICLE 27. DISPUTES

27.1 Submission. In the event any Party has a dispute, or asserts a claim, that arises out of or in connection with this GIA or its performance, such Party (the "disputing Party") shall provide the other Parties with written notice of the dispute or claim ("Notice of Dispute"). Such dispute or claim shall be referred to a designated senior representative of each Party for resolution on an informal basis as promptly as practicable after receipt of the Notice of Dispute by the non-disputing Parties. In the event the designated representatives are unable to resolve the claim or dispute through unassisted or assisted negotiations within thirty (30) Calendar Days of the non-disputing Parties' receipt of the Notice of Dispute, such claim or dispute shall be submitted for resolution in accordance with the dispute resolution procedures of the Tariff.

ARTICLE 28. REPRESENTATIONS, WARRANTIES AND COVENANTS

28.1 General. Each Party makes the following representations, warranties and covenants:

28.1.1 Good Standing. Such Party is duly organized, validly existing and in good standing under the laws of the state in which it is organized, formed, or incorporated, as applicable; that it is qualified to do business in the state or states in which the Generating Facility, Interconnection Facilities and Network Upgrades owned by such Party, as applicable, are located; and that it has the corporate power and authority to own its properties, to carry on its business as now being conducted and to enter into this GIA and carry out the transactions contemplated hereby and perform and carry out all covenants and obligations on its part to be performed under and pursuant to this GIA.

28.1.2 Authority**.** Such Party has the right, power and authority to enter into this GIA, to become a Party hereto and to perform its obligations hereunder. This GIA is a legal, valid and binding obligation of such Party, enforceable against such Party in accordance with its terms, except as the enforceability thereof may be limited by applicable bankruptcy, insolvency, reorganization or other similar laws affecting creditors' rights generally and by general equitable principles (regardless of whether enforceability is sought in a proceeding in equity or at law).

28.1.3 No Conflict. The execution, delivery and performance of this GIA does not violate or conflict with the organizational or formation documents, or bylaws or operating agreement, of such Party, or any judgment, license, permit, order, material agreement or instrument applicable to or binding upon such Party or any of its assets.

28.1.4 Consent and Approval. Such Party has sought or obtained, or, in accordance with this GIA will seek or obtain, each consent, approval, authorization, order, or acceptance by any Governmental Authority in connection with the execution, delivery and performance of this GIA, and it will provide to any Governmental Authority notice of any actions under this GIA that are required by Applicable Laws and Regulations.

ARTICLE 29. {RESERVED}

ARTICLE 30. MISCELLANEOUS

30.1 **Binding Effect.** This GIA and the rights and obligations hereof, shall be binding upon and shall inure to the benefit of the successors and assigns of the Parties hereto.

30.1.1 Reversion. If offered pursuant to an Agency Agreement under which this GIA is executed by Transmission Provider as agent for the relevant Transmission Owner, in the event that the relevant Agency Agreement terminates, any HVDC Service offered by Transmission Provider under this GIA shall revert to the relevant Transmission Owner and Transmission Provider shall be released from all obligations and responsibilities under this GIA.

30.2 **Conflicts.** In the event of a conflict between the body of this GIA and any attachment, appendices or exhibits hereto, the terms and provisions of the body of this GIA shall prevail and be deemed the final intent of the Parties.

30.3 **Rules of Interpretation**. This GIA, unless a clear contrary intention appears, shall be construed and interpreted as follows: (1) the singular number includes the plural number and vice versa; (2) reference to any person includes such person's successors and assigns but, in the case of a Party, only if such successors and assigns are permitted by this GIA, and reference to a person in a particular capacity excludes such person in any other capacity or individually; (3) reference to any agreement (including this GIA), document, instrument or tariff means such agreement, document, instrument, or tariff as amended or modified and in effect from time to time in accordance with the terms thereof and, if applicable, the terms hereof; (4) reference to any Applicable Laws and Regulations means such Applicable Laws and Regulations as amended, modified, codified, or reenacted, in whole or in part, and in effect from time to time, including, if applicable, rules and regulations promulgated thereunder; (5) unless expressly stated otherwise, reference to any Article, Section or Appendix means such Article of this GIA or such Appendix to this GIA, or such Section to the GIP or such Appendix to the GIP, as the case may be; (6) "hereunder", "hereof", "herein", "hereto" and words of similar import shall be deemed references to this GIA as a whole and not to any particular Article or other provision hereof or thereof; (7) "including" (and with correlative meaning "include") means including without limiting the generality of any description preceding such term; and (8) relative to the determination of any period of time, "from" means "from and including", "to" means "to but excluding" and "through" means "through and including".

30.4 **Entire Agreement.** This GIA, including all Appendices and attachments hereto, constitutes the entire agreement between the Parties with reference to the subject matter hereof, and supersedes all prior and contemporaneous understandings or agreements, oral or written, between the Parties with respect to the subject matter of this GIA. There are no other agreements, representations, warranties, or covenants, which constitute any part of the consideration for, or any condition to, any Party's compliance with its obligations under this GIA.

30.5 **No Third Party Beneficiaries.** This GIA is not intended to and does not create rights, remedies, or benefits of any character whatsoever in favor of any persons, corporations, associations, or entities other than the Parties, and the obligations herein assumed are solely for the use and benefit of the Parties, their successors in interest and, where permitted, their assigns.

30.6 **Waiver.** The failure of a Party to this GIA to insist, on any occasion, upon strict performance of any provision of this GIA will not be considered a waiver of any obligation, right, or duty of, or imposed upon, such Party.

Any waiver at any time by any Party of its rights with respect to this GIA shall not be deemed a continuing waiver or a waiver with respect to any other failure to comply with any other obligation, right, duty of this GIA. Termination or Default of this GIA for any reason by Interconnection Customer shall not constitute a waiver of the Interconnection Customer's legal rights to obtain Interconnection Service from Transmission Provider. Any waiver of this GIA shall, if requested, be provided in writing.

30.7 Headings. The descriptive headings of the various Articles of this GIA have been inserted for convenience of reference only and are of no significance in the interpretation or construction of this GIA.

30.8 Multiple Counterparts. This GIA may be executed in two or more counterparts, each of which is deemed an original but all constitute one and the same instrument.

30.9 Amendment. The Parties may by mutual agreement amend this GIA by a written instrument duly executed by all of the Parties.

30.10 Modification by the Parties. The Parties may by mutual agreement amend the Appendices to this GIA by a written instrument duly executed by all of the Parties. Such amendment shall become effective and a part of this GIA upon satisfaction of all Applicable Laws and Regulations.

30.11 Reservation of Rights. Transmission Provider shall have the right to make a unilateral filing with FERC to modify this GIA with respect to any rates, terms and conditions, charges, classifications of service, rule or regulation under Section 205 or any other applicable provision of the Federal Power Act and FERC’s rules and regulations thereunder, and Transmission Owner and Interconnection Customer shall have the right to make a unilateral filing with FERC to modify this GIA pursuant to Section 206 or any other applicable provision of the Federal Power Act and FERC’s rules and regulations thereunder; provided that each Party shall have the right to protest any such filing and to participate fully in any proceeding before FERC in which such modifications may be considered. Nothing in this GIA shall limit the rights of the Parties or of FERC under Sections 205 or 206 of the Federal Power Act and FERC’s rules and regulations thereunder, except to the extent that the Parties otherwise mutually agree as provided herein.

30.12 No Partnership. This GIA shall not be interpreted or construed to create an association, joint venture, agency relationship, or partnership among or between the Parties or to impose any partnership obligation or partnership liability upon any Party. No Party shall have any right, power or authority to enter into any agreement or undertaking for, or act on behalf of, or to act as or be an agent or representative of, or to otherwise bind, the other Parties.

IN WITNESS WHEREOF, the Parties have executed this GIA in multiple originals; each of which shall constitute and be an original GIA among the Parties.

Midcontinent Independent System Operator, Inc.

By: Jennifer Curran 8/30/16 DW

Name: **JENNIFER CURRAN**

Title: **Vice President**
System Planning & Seams Coordination

Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc.

By:

Name: JAY SKABO

Title: Vice President - Electric Supply

Foxtail Wind, LLC

By:

Name: John DiDonato

Title: Vice President

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

APPENDICES TO GIA

Appendix A
To GIA

Interconnection Facilities, System Protection Facilities, Distribution Upgrades, Generator Upgrades and Network Upgrades

1. Description of Generating Facility:

Interconnection Customer shall install a 165 MVA facility, rated at 150 MW gross and 150 MW net, with all studies performed at or below these outputs. The Generating Facility is composed of eighty-nine (89) GE 1.7 MW wind turbines. The Interconnection Service provided under this agreement is 150 MW of Conditional ERIS that will become 150 MW of ERIS and/or NRIS where NRIS cannot exceed 150 MW once all Network Upgrades are in service, including those in Exhibit A10.

Interconnection Customer shall install a switchyard with the appropriate protection equipment coordinated per Appendix C to this GIA. The Switchyard shall contain one generator step-up transformer, one circuit breaker connected in series fashion, see Exhibit A1-1.

2. Interconnection Facilities:

(a) Point of Interconnection. The Point of Interconnection shall be at the point where the Generating Facility tap takes off from the 230kV bus at Transmission Owners new Foxtail Substation. The Point of Change of Ownership shall be the dead end structure inside the new Foxtail substation on the Interconnection Customer line terminal.

(b) Interconnection Facilities (including metering equipment) to be constructed by Interconnection Customer. Interconnection Customer shall construct the Interconnection Customer Interconnection Facilities

- One 102/136/170 MVA, 230kV/34.5kV Transformer
- One 230kV Breaker
- One 230kV group operated disconnect switch
- 250 feet 795 kcmil overhead transmission line

(c) Transmission Owner Interconnection Facilities (including metering equipment) to be constructed by Transmission Owner. Transmission Owner's Interconnection Facilities shall include:
- One (1) 230 kV line termination structure
- One (1) 230 kV group operated disconnect switch
- Three (3) 230 kV metering accuracy class current transformers
- Three (3) 230 kV metering accuracy class voltage transformers
- Three (3) 152 kV MCOV surge arresters

- Energy interchange metering facilities with "received" and "delivered" kWH and kVarH registration, outputs will be KYZ and +/- 1 mA DC current, accuracy of <0.1%, modem output to be read remotely
- 230 kV bus work from the Point of Interconnection to the Point of Change of Ownership

These facilities are estimated to cost $**775,500** in 2015 dollars and are detailed in Exhibits A5 and A6.

3. Network Upgrades:

(a) Stand-Alone Network Upgrades to be installed by Transmission Owner:
Transmission Owner will build a new interconnection substation which includes:
- Three (3) 230 kV 2000 amp dead tank gas circuit breakers
- Two (2) 230 kV line termination structures
- Six (6) 230 kV group operated disconnect switches
- Two (2) 230 kV group operated disconnect switches with interlocking ground switch
- Six (6) 230 kV voltage transformers
- Six (6) 152 kV MCOV surge arresters
- Associated 230 kV bus work, steel structures, grounding, conduit, foundations
- Control hut with interior equipment: AC and DC distribution systems, communications system, and six switchboard panels containing protective relaying and controls required to support the circuit breakers and the system protection functions.

Estimated cost - **$4,876,300** in 2015 dollars and are detailed in Exhibits A5 and A6.

(b) Network Upgrades to be installed by Transmission Owner.

1. Transmission Owner will split the Tatanka to Ellendale 230 kV line, build tap lines, and terminate each line section in the Foxtail Substation.

   Estimated cost is **$275,000** in 2015 dollars. See Exhibits A5 and A6 for details.

2. Transmission Owner will uprate the Foxtail to Ellendale 230kV line to a minimum rating of 417 MVA. Transmission Owner will install 18.0 miles of 795 ACSS.

   Estimated cost is **$2,865,000** in 2016 dollars. See Exhibits A5 and A6 for details.

(c) Shared Network Upgrade(s) to be funded by Interconnection Customer.
None

4. System Protection Facilities

(a) System Protection Facilities not listed in Section 2 or 3 to be constructed by Interconnection Customer. None

(b) System Protection Facilities not listed in 2 or 3 to be constructed by Transmission Owner.

- Revise protection scheme and reset dual primary relay systems on the 230 kV Ellendale line at the Tatanka Substation
- Revise protection scheme and reset dual primary relay systems on the 230 kV Tatanka line at the Ellendale Substation

Estimated cost - **$47,300** in 2015 dollars

5. Distribution Upgrades:

(a) None

6. Contingency List: See Exhibit A10

7. Affected System Upgrades List
WAPA: The Ward-Mandan 230 kV line will need to be uprated to a minimum 458 MVA rating. Interconnection Customer is responsible for coordinating with WAPA for this work.

8. Exhibits – The following exhibits are included:

A1. Interconnection Customer One-Line and Site Map
A1-1: Interconnection Customer One-Line Diagram
A1-2: Interconnection Project Site Map

A2. Transmission Owner One-Line and System Map
A2-1: Transmission Owner Single Line Drawing for new J316 Interconnection Substation
A2-2: Transmission Owner's Network Upgrade map

A3. Transmission Owners Station Key Plans

A4. Reserved

A5. Facilities to be Constructed by Transmission Owner

A6. Detailed Costs of Facilities to be Constructed by Transmission Owner
A6-1: Transmission Owner Interconnection Facilities
A6-2: Transmission Owner Network Upgrades

A7. Network Upgrades to be Constructed by Interconnection Customer

A8. Transmission Owner's Interconnection Facilities to be Constructed by Interconnection Customer

A9. Facilities Subject to Transmission Owner Reimbursement

A10. Contingent Facilities

A11. Interconnection Customer Milestones

A12. Construction and Coordination Schedules

A13. Permits, Licenses, Regulatory Approvals and Authorization

A14. Interconnection Guidelines

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Exhibit A1-1
Interconnection Customer Single Line Drawing

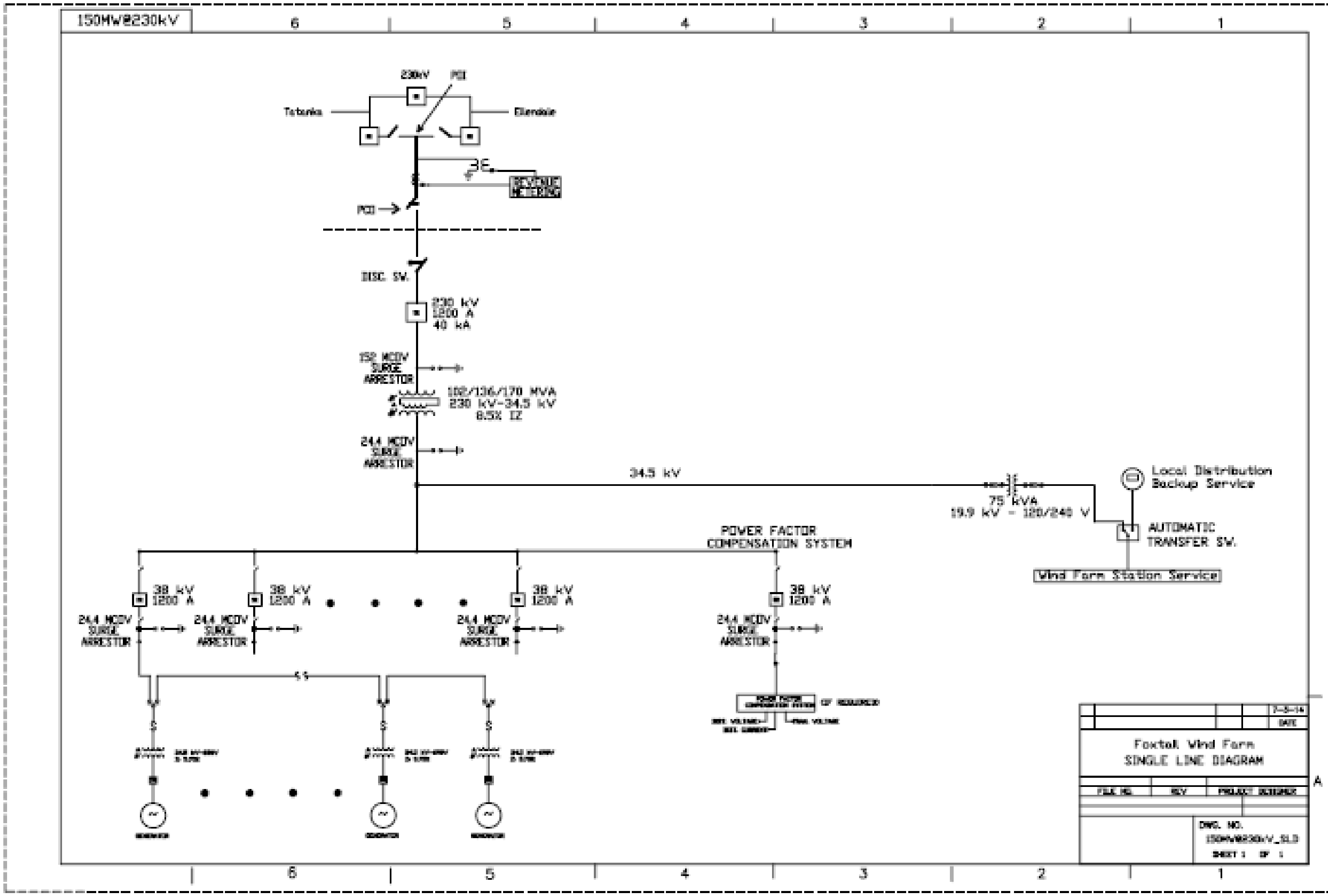


Exhibit A1-2
Interconnection Customer Site Map

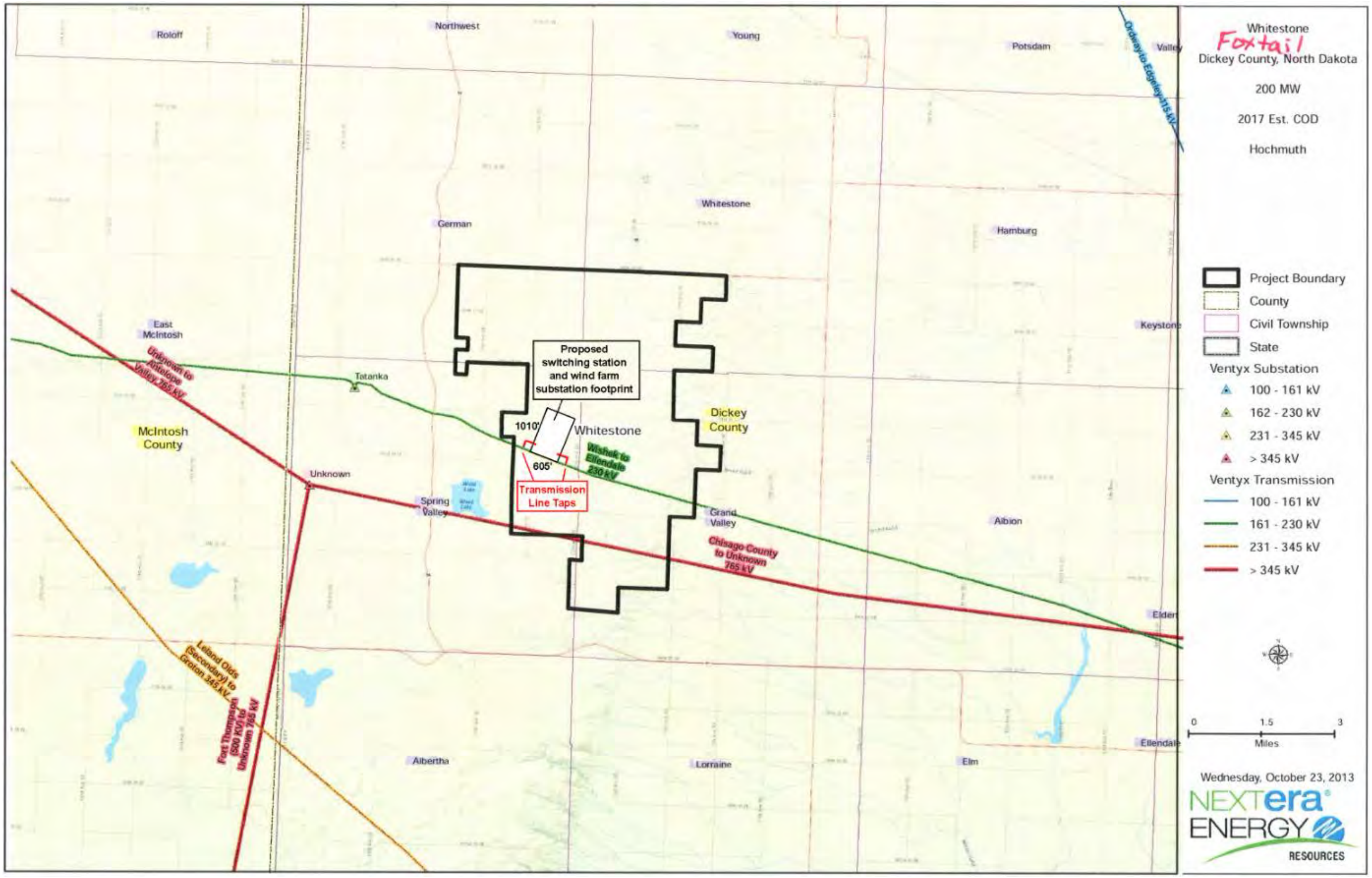
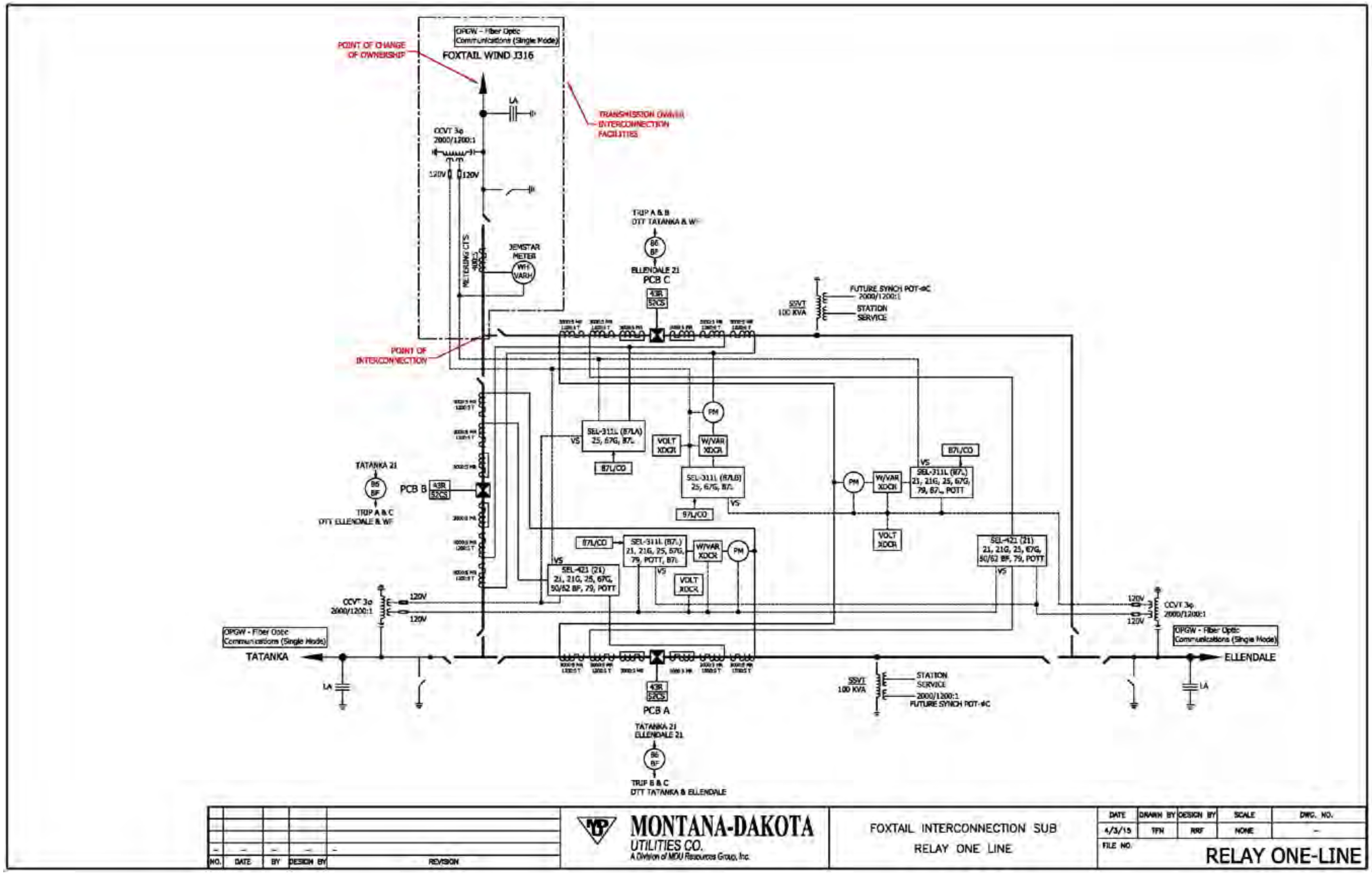


Exhibit A2 -1
Transmission Owner Single Line Drawing for new Foxtail Substation



PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Exhibit A2 -2
Transmission Owner Network Upgrade Drawings

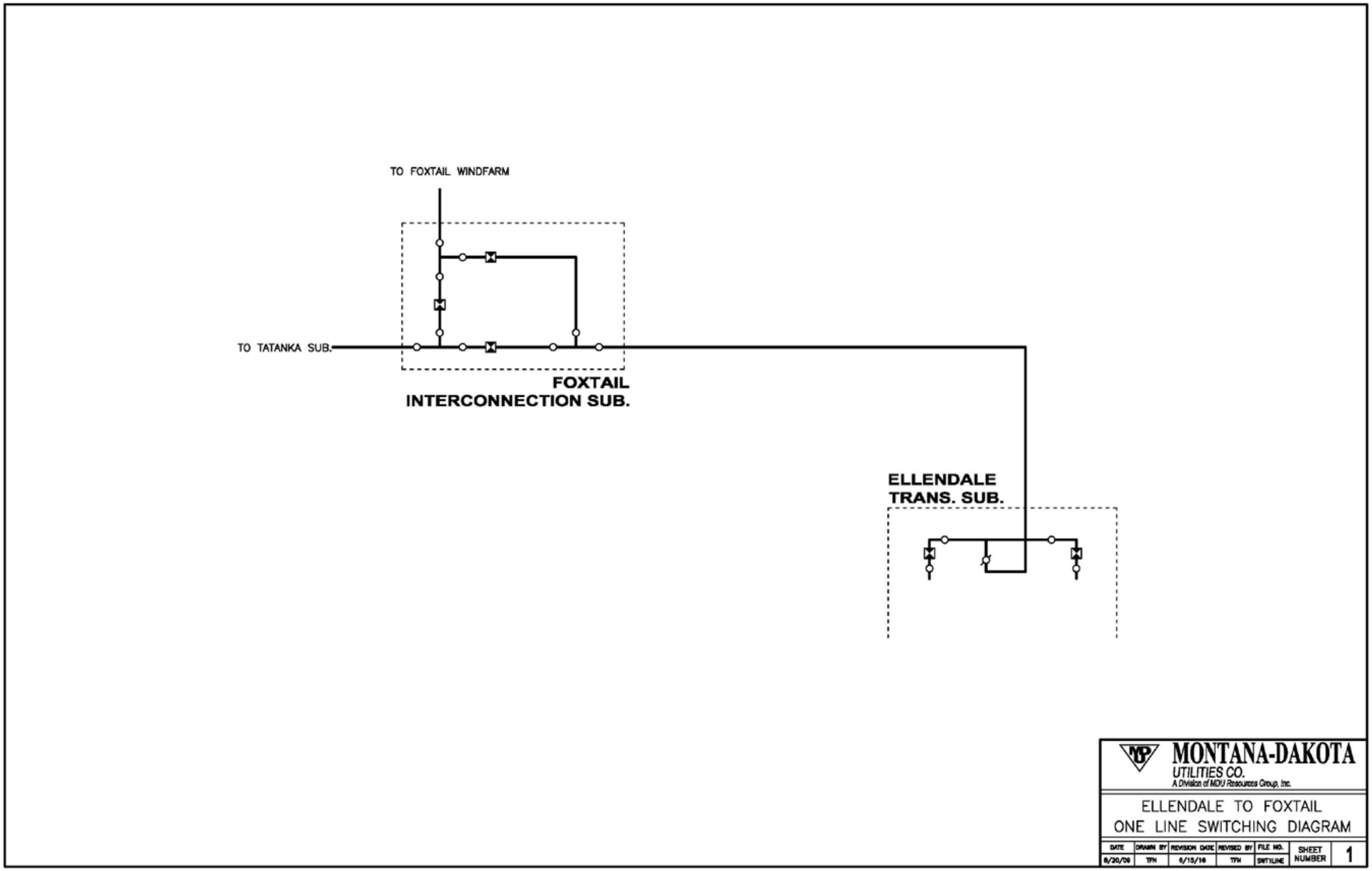


Exhibit A3
Transmission Owners Station Key Plans

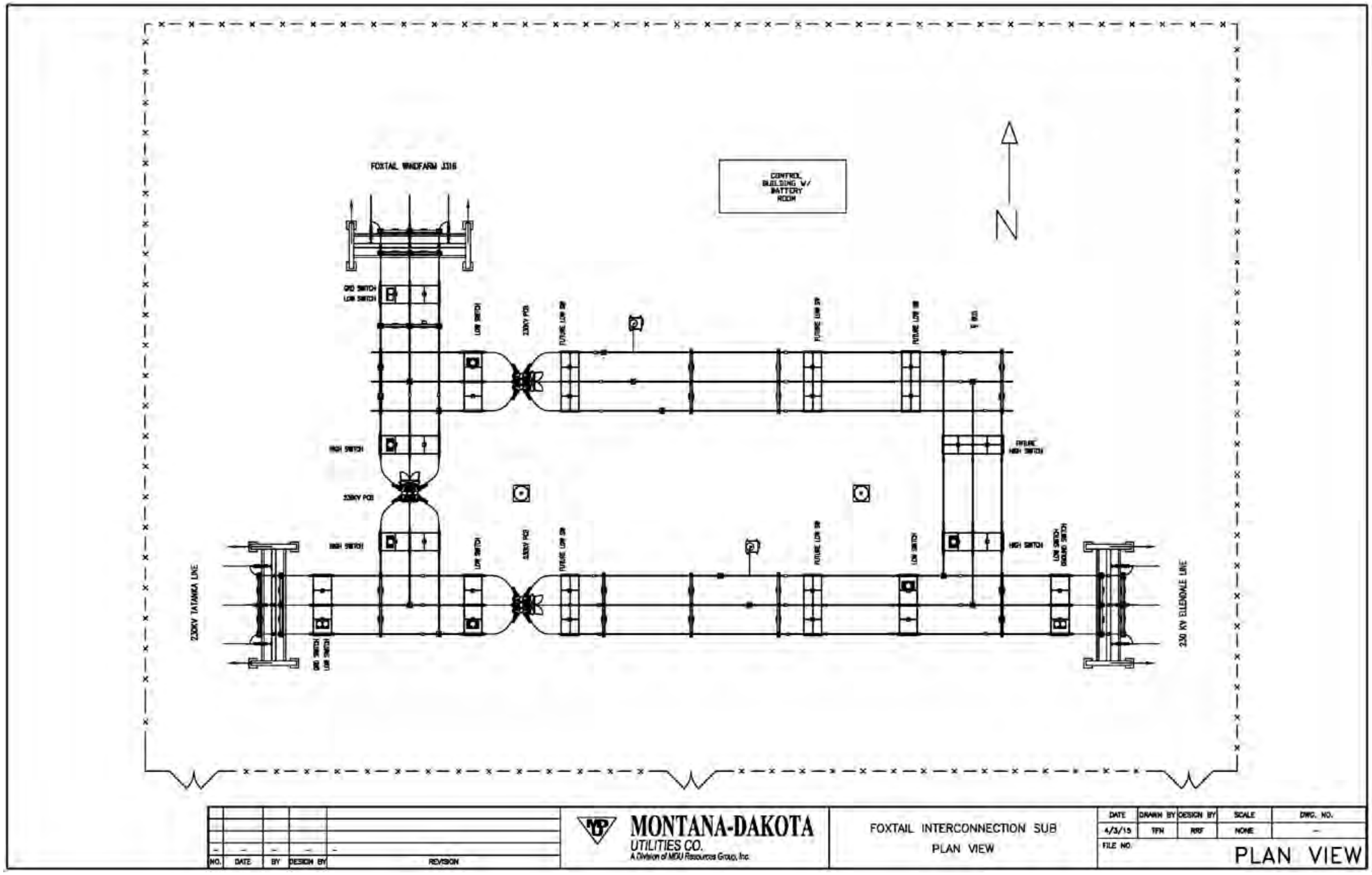


Exhibit A4
Transmission Line Plan and Profile
{Reserved}

Exhibit A5
Facilities to be constructed by Transmission Owner

Upgrade Type	Facilities to be Constructed	Estimate
Stand Alone Network Upgrade	Foxtail Substation	$4,876,300
Network Upgrade	Transmission Line Taps to Interconnection substation	$275,000
Network Upgrade	Foxtail to Ellendale 230kV Transmission Line conductor upgrade	$2,865,000
System Protection Facilities	Tatanka and Ellendale Substation	$47,300
Transmission Owner Interconnection Facilities	Foxtail Interconnection 230kV Terminal	$775,000
	Total	**$8,838,600**

Exhibit A6-1
Details of Facilities to be constructed by Transmission Owner

Exhibit A6-1 Stand Alone Network Upgrades Foxtail Substation		
Description	Quantity	Amount
230 kV Circuit Breaker	3 Each	$368,500
Group Operated Disconnect Switches	8 Each	$222,200
Voltage Transformers	6 Each	$132,000
Surge Arresters 152 kV MCOV	6 Each	$113,300
Steel Structures & Bus Work	Lot	$503,800
Grounding, Conduit, Fence	Lot	$123,200
Site Preparation & Foundations	Lot	$283,800
Control Hut and Interior Equipment	Lot	$426,800
Protective Relays & Control Equipment	Lot	$264,000
Engineering Design & Checkout	Lot	$664,400
Construction Labor	Lot	$1,449,800
Transportation & Equipment	Lot	$104,500
Overhead	Lot	$220,000
Total		$4,876,300

Exhibit A6-2
Details of Facilities to be constructed by Transmission Owner

Exhibit A6-2 Non-Stand Alone Network Upgrades Foxtail Substation Line Taps		
Description	Quantity	Amount
Line Relocation Material	Lot	$138,600
Engineering Design	Lot	$18,700
Construction Labor	Lot	$60,500
Transportation & Equipment	Lot	$26,400
Overhead	Lot	$30,800
Total		$275,000

Exhibit A6-3
Details of Facilities to be constructed by Transmission Owner

Exhibit A6-3 Transmission Owner Interconnection Facilities Foxtail Interconnect 230 kV Terminal		
Description	Quantity	Amount
Group Operated Disconnect Switch	1 Each	$47,300
Instrument Transformers – Metering Accuracy	6 Each	$148,500
Surge Arresters 152 kV MCOV	3 Each	$55,000
Steel Structures & Bus Work	Lot	$89,100
Foundations, Grounding & Conduit	Lot	$23,100
Metering & Control Equipment	Lot	$16,500
Engineering Design & Checkout	Lot	$35,200
Construction Labor	Lot	$217,800
Transportation & Equipment	Lot	$13,200
Overhead	Lot	$129,800
Total		$775,500

Exhibit A6-4
Details of Facilities to be constructed by Transmission Owner

Exhibit A6-4 System Protection Upgrades Tatanka and Ellendale Substation Relays		
Description	Quantity	Amount
Engineering Design & Checkout	Lot	$30,800
Construction Labor	Lot	$8,800
Overhead	Lot	$7,700
Total		$47,300

Exhibit A6-5
Details of Facilities to be constructed by Transmission Owner

Exhibit A6-5 Non-Stand Alone Network Upgrades Foxtail to Ellendale 230 kV Line Reconductor		
Description	Quantity	Amount
Conductor and Hardware	Lot	$1,514,000
Engineering Design	Lot	$126,000
Construction Labor	Lot	$885,000
Transportation & Equipment	Lot	$70,000
Overhead	Lot	$270,000
Total		$2,865,000

Exhibit A7
Network Upgrades to be Constructed by Interconnection Customer

There are no Network Upgrades to be constructed by the Interconnection Customer.

Exhibit A8
Transmission Owner's Interconnection Facilities to be Constructed by Interconnection Customer

There are no Transmission Owner Interconnection Facilities to be constructed by the Interconnection Customer.

Exhibit A9
Facilities Subject to Transmission Owner ATTACHMENT FF Reimbursement

Interconnection Customer funding of Transmission Owner Interconnection Facilities costs and System Protection Facilities costs are not eligible for reimbursement.

Interconnection Customer funding of Transmission Owner Network Upgrade costs are eligible for reimbursement. Transmission Owner Network Upgrades costs are estimated at **$8,016,600** (See Exhibit A5).

In accordance with current Attachment FF, none of these Network Upgrades will be reimbursed.

If the Interconnection Customer fails to achieve Commercial Operation of the Generating Facility by the Commercial Operation Date indicated in the Appendix B Milestones of the GIA for reasons other than Transmission Owner delay of the In Service Date, interest due to Interconnection Customer under Article 11.4 of the GIA for funding of Network Upgrade costs will not accrue for dates beyond that Commercial Operation Date.

Exhibit A10 – Contingent Facilities

Higher queue and/or same DPP group study Interconnection Requests that may create Contingencies pursuant to Article 11.3.1 are listed in Table 2 below. Table 1 describes MTEP Projects modeled in the studies that yielded the ERIS and NRIS described in Appendix A of this GIA and is not related to Article 11.3.1, i.e., does not describe projects associated with a higher queued and/or same DPP group study Interconnection Request. Nevertheless, if the MTEP projects are not completed or significantly modified the incremental NRIS allowed will be zero until such time as the Interconnection Customer funds a study to determine the applicable NRIS level that results due to the changes in Table 1.

The list of higher-queued and/or same DPP group study projects in Table 2, not yet in service, as well as other generation projects, upgrades and MTEP Projects listed in the Exhibit A10, were included in the interconnection study for queue project J316. However, a project's, upgrades, or MTEP Project's inclusion in the System Impact Study does not necessarily mean that these facilities would be contingencies for the Interconnection Customer's Generating Facility. Restudies involving the generation projects listed in this Exhibit A10, will be pursuant to Article 11.3.2 which may affect the Interconnection Customer's upgrade responsibilities under this GIA.

MTEP Assumptions and Competing Generation and Dispatch Assumptions

MISO generating facilities listed in Table 2 were dispatched to generation in the MISO market

Table 1 Transmission Assumptions

MTEP ID	Facility	Description	Expected Completion Date	Status
2248	Proposed MVP Portfolio 1 - Zachary - Ottumwa 345	Zachary Substation - New 560 MVA, 345/161 kV Transformer. New 71 mile 345 kV line from Zachary to Ottumwa with 3000 A summer emergency capability	11/15/2018	Under Construction
3127	Proposed MVP Portfolio 1: N LaCrosse-N Madison-Cardinal-Eden-Hickory Creek 345 kV (Only North Lacrosse – North Madison Required)	Construct N LaCrosse-N Madison-Cardinal 345 kV & Hickory Creek-Eden-Cardinal 345 kV line. Install Eden transformer	12/31/2018	Under Construction
3205	Proposed MVP Portfolio 1: Lakefield Jct. - Winnebago - Winco - Kossuth County & Obrien County - Kossuth County - Webster 345 kV line	New 345 kV line from Lakefield Junction to Kossuth County via Winnebago and Winco and a new 345 kV line from Obrien County to Webster via Kossuth County. Includes 161 kV rebuild as underbuild along portions of the route.	12/31/2016	Under Construction

MTEP ID	Facility	Description	Expected Completion Date	Status
3473	Sioux Falls 115 kV Phase 1	This project re-constructs 10 miles of existing 69 kV line in Sioux Falls, SD to 115 kV; 6 miles of the new line will be double circuit with existing 69 kV	3/30/2016	Under Construction
SPP	Nebraska – Sibley 345 kV line	Construct Nebraska – Sibley 345 kV line	12/31/2016	Under Construction

Table 2 MISO Higher Queued / Similar Queued Interconnection Projects

MISO Higher Queued Project #	Service Type	TO	County, State	Point Of Interconnection	Pmax (MW)	Fuel Type	Status
G549	NR	GRE	Pope, MN	Next to Williams Substation (69 kV)	20	Wind	Under Construction
G620	ER	XEL (NSP)	Goodhue, MN	Kenyon - Dodge 69 kV	19	Wind	Under Construction
G621	NR	XEL (NSP)	Pipestone, MN	Golf - Wookstock 34.5 kV	20	Wind	Under Construction
G667	ER	ITC Midwest	Jackson, MN	Round Lake Tap 69 kV Substation	13	Wind	Under Construction
G826	NR	XEL (NSP)	Jackson, MN	Lakefield Generation SW – Lakefield Junction 345 kv	200	Wind	Under Construction
G830	NR	GRE	McHenry, ND	McHenry Substation	99	Wind	Under Construction
G858	NR	XEL (NSP)	Stearns, MN	Black Oak 69 kV Substation	38	Wind	Under Construction
H071	NR	XEL (NSP)	Stearns, MN	Black Oak 69 kV Substation	40	Wind	Under Construction
H081	ER	XEL (NSP)	Lyon, MN	Brookings – Lyon County 345 kV	201	Wind	Under Construction
J196	NR	AMRN	Vermillion, IL	Vermillion 138 kV Substation	50	Wind	Under Construction
J233	NR	ITCM	Marshall, IA	Marshalltown 161 kV Substation	635	Gas	Under Construction
J238	NR	IPL	Morgan, IN	138kV at existing Eagle Valley Power Plant	725	Gas	Under Construction
J241	NR	ATC	Dickinson, WI	Existing Twin Falls	3.7	Hydro	Under Construction

MISO Higher Queued Project #	Service Type	TO	County, State	Point Of Interconnection	Pmax (MW)	Fuel Type	Status
J226	NR	METC	Mason, MI	Ludington Substation	70	Hydro	Under Construction
J227	NR	METC	Mason, MI	Ludington Substation	70	Hydro	Under Construction
J228	NR	METC	Mason, MI	Ludington Substation	70	Hydro	Under Construction
J230	NR	METC	Mason, MI	Ludington Substation	70	Hydro	Under Construction
J231	NR	METC	Mason, MI	Ludington Substation	70	Hydro	Under Construction
J262	NR	OTP	Stutsman, ND	Jamestown 115/345 kV Substation	100	Wind	Under Construction
J263	NR	OTP	Stutsman, ND	Jamestown 115/345 kV Substation	100	Wind	Under Construction
J327	NR	ITC	Huron, MI	Rapson 120 kV Substation	150	Wind	Under Construction
J340	NR	ITC	Huron, MI	Grassmere 345 kV Substation	100	Wind	Under Construction
J354	NR	ITC	Huron, MI	Grassmere, 345 kV Substation	52	Wind	Under Construction
J285	NR	MEC	O’Brien, IA	Obrien County 345kV sub	250	Wind	DPP-2014-AUG-West
J329	NR	CFU	Marion, IA	Pella West sub	55	Hydro	DPP-2014-AUG-West
J344	NR	ITC-M	Mahaska, IA	Poweshiek – Oskaloosa 161kV	169	Wind	DPP-2014-AUG-West

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Exhibit A11
Interconnection Customer Milestones
See Appendix B for actual dates

The Interconnection Customer has indicated that an In Service Date of 9/15/17and a Commercial Operation Date of 12/15/17are desired.

See Appendix B for the specific project schedule of Transmission Owner and Interconnection Customer Milestones in this GIA.

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Exhibit A12
Construction and Coordination Schedules
(See Appendix B for actual schedule)

Transmission Owner estimates that approximately 18 months from the Effective Date of the GIA will be required to complete construction of the Interconnection Facilities and Network Upgrades necessary for the interconnection of project J316. Transmission Owner will use Reasonable Efforts to achieve the Interconnection Customer's requested In Service Date of 9/15/17for Transmission Owner Interconnection Facilities. The project schedule will be contingent upon operating constraints, conflicting project schedules, and resource availability. Coordination of outages will be subject to further study.

A project schedule will be established as part of the Transmission Owner and Interconnection Customer Milestones in Appendix B.

Exhibit A13
Permits, Licenses, Regulatory Approvals and Authorization

Agency	Type of Approval	Need
State of North Dakota		
Public Services Commission	Certificate of Public Convenience and Necessity	PSC Requirement
Department of Health	NPDES Permit: General Construction Strom Water	Required for disturbance of over 1 acre of land. Must prepare a Storm Water Pollution Prevention Plan (SWPPP).

- **These permits will be acquired by the Transmission Owner.**

Exhibit A14
Interconnection and Operating Guidelines

Transmission Owner's requirements for generation, transmission, and end-user facility interconnections are available at the following link:
http://www.montana-dakota.com/rates-and-services/interconnection-requirements

Appendix B
To GIA

Milestones

1. **Selected Option pursuant to Article 5.1:** The Parties acknowledge that Section 30.2 provides that conflicts between the Appendices and the body of the GIA are to be resolved in favor of the body of the GIA. The Parties acknowledge that the items set forth below are intended to explain the provisions of the GIA and to set forth the specific agreement of the Interconnection Customer and Transmission Owner relating to certain aspects of the Agreement that are not resolved by the terms of the GIA. The specific items set forth below are not intended to be in conflict with the provisions of the GIA.

   Interconnection Customer selects the Standard Option as described in Article 5.1.1. Articles 5.1.2, 5.1.4 and 5.3 shall not apply to this GIA. If it is asserted that any element of the items set forth above are in conflict with the terms of the GIA, then any Party to this GIA may exercise its Section 205 or 206 rights under the Federal Power Act to resolve such conflict and the terms of the GIA shall not be deemed to be controlling until any such proceeding commenced has been resolved by a final, non-appealable order.

2. **Milestones:** The description and date entries listed in the following tables are provided establishing their applicable Milestones consistent with the provisions of this GIA.

   A. Interconnection Customer Milestones

No.	**Description**	**Date**
1a.	Provide initial payment of **$1,767,720** (20% of the cost of TOIFs and Network Upgrades and System Protection Facilities) to Transmission Owner or see Milestone 1b (GIA 11.5)	30 Calendar Days after Effective Date
1b.	Provide security, *i.e.*, a guarantee, surety bond, letter of credit or other reasonably acceptable form of security to Transmission Owner in the amount of **$8,838,600** (GIA 11.6).	N/A
2.	Provide Certificate of Insurance (GIA 18.4.9).	The earlier of the construction work commencement date or the milestone date; thereafter, within 90 Calendar Days of end of fiscal year or insurance renewal date.
3.	i) Provide to Transmission Provider (a) reasonable evidence of continued Site Control or (b) post $250,000 non-refundable additional security. ii) Provide evidence of one or more of the following	Within 15 Business Days of Effective Date. Within 180 Calendar Days

	milestones being achieved: (1) execution of contract for (a) fuel supply or transport; (b) cooling water supply; (c) engineering procurement of major equipment or construction; (d) execution of a contract for the sale of electric energy or capacity from the Generating Facility, or a statement signed by an officer or authorized agent of Interconnection Customer attesting that the Generating Facility is included in an applicable state resource adequacy plan; or other information that Transmission Provider deems to be reasonable evidence that the Generating Facility will qualify as a designated network resource; or (2) documentation of application for state or local air, water, land, or federal nuclear or hydroelectric permits and that the application is proceeding per regulations (GIP 11.3).	of Effective Date.
4a	Provide one cash payment in the amount of $4,234,880 to Transmission Owner to commence detailed design, equipment procurement and construction for Interconnection and Network Facilities (GIA 5.5 and 5.6).	11/15/2016
4b	Provide one cash payment in the amount of $2,836,000 to Transmission Owner for construction activities for Transmission Owner Interconnection Facilities and Network Upgrades (GIA 5.5 and 5.6).	03/15/2017
5.	Pre-construction meeting.	As may be agreed to by the Parties.
6.	Provide initial design and specifications for Interconnection Customer's Interconnection Facilities to Transmission Owner and Transmission Provider for comment (GIA 5.10.1).) Provide the following information to the Transmission Owner: • One line diagram • Interconnection transmission line impedance, conductor type and length from POI to station transformer • Station transformer nameplate and test report • Collector system equivalent impedance • Pad mount turbine transformer nameplate and test report (verify if there is one per turbine or shared) • Generator nameplate and data sheets • Generator PSSE dynamics model raw data file (*.dyr format; contact Transmission Owner for	180 Calendar Days prior to initial synchronization date.

	required PSSE version) • Generator site reactive power compensation (i.e. cap bank)	
7.	Provide final design and specifications for Interconnection Customer's Interconnection Facilities to Transmission Owner and Transmission Provider for comment (GIA 5.10.1). Provide the following information to the Transmission Owner: • One line diagram • Interconnection transmission line impedance, conductor type and length from POI to station transformer • Station transformer nameplate and test report • Collector system equivalent impedance • Pad mount turbine transformer nameplate and test report (verify if there is one per turbine or shared) • Generator nameplate and data sheets • Generator PSSE dynamics model raw data file (*.dyr format; contact Transmission Owner for required PSSE version) • Generator site reactive power compensation (i.e. cap bank)	90 Calendar Days prior to initial synchronization date.
8.	Reserved	reserved
9.	Deliver to Transmission Owner and Transmission Provider "as built" drawings, information and documents regarding Interconnection Customer's Interconnection Facilities (GIA 5.10.3). Provide the following information to the Transmission Owner: • One line diagram • Interconnection transmission line impedance, conductor type and length from POI to station transformer • Station transformer nameplate and test report • Collector system equivalent impedance • Pad mount turbine transformer nameplate and test report (verify if there is one per turbine or shared) • Generator nameplate and data sheets • Generator PSSE dynamics model raw data file (*.dyr format; contact Transmission Owner for required PSSE version)	Within 120 Calendar Days of Commercial Operation Date if requested.

	• Generator site reactive power compensation (i.e. cap bank)	
10.	Notify Transmission Provider and Transmission Owner in writing of Local Balancing Authority where Generating Facility is located (GIA 9.2).	Three months prior to Initial Synchronization Date.
11.	Pre-energization meeting.	As agreed upon by the Transmission Owner and Interconnection Customer
12.	Initial Synchronization Date.	9/15/17
13.	Commercial Operation Date	12/15/17
14.	Interconnection Customer shall provide the Parties with notice on the status of the Generating Facility, including COD, under Article 15 of this GIA and shall also send such notice by email to ResourceIntegration@misoenergy.org. Notification shall include Interconnection Customer's name, and as applicable Market Participant(s) name(s), and project number.	**At least six (6) months before the earlier of either the Generating Facility COD or commencement of testing.**
15.	Interconnection Customer shall provide notice to the Parties of a test plan in advance of conducting tests for the Generating Facility. The notice shall be in the form below and should be provided under Article 15 of this GIA, and a copy of such notice should be emailed to ResourceIntegration@misoenergy.org.	At least five (5) Business Days prior to the first testing date.

B. Transmission Owner Milestones

No.	Description	Date
0.	Transmission Owner to insert Network Upgrade information into Transmission Provider's MTEP database and Model on Demand	Within 30 Calendar Days of Effective Date
1.	Provide Certificate of Insurance (GIA 18.4.9)	The earlier of the construction work commencement date or the milestone date; within 90 days of end of fiscal year or insurance renewal date
2.	Transmission Owner to commence preliminary design, permitting, and engineering of Transmission Owner Interconnection Facilities and Network Upgrades.	Upon receipt of payment per Interconnection Customer Milestone #1A Table A
3.	Transmission Owner to commence detailed design, engineering, and equipment procurement for Transmission Owner Interconnection Facilities and Network Upgrades.	Upon receipt of payment per Interconnection Customer Milestone #4a Table A
4.	Transmission Owner to commence construction activities for Transmission Owner Interconnection Facilities and Network Upgrades.	Upon receipt of payments per Interconnection Customer Milestone #4b Table A
5.	In Service Date of Interconnection Facilities and Network Upgrades	12/15/2017
6.	Comment on Interconnection Customer's final design and generator specifications	30 days after submittal by the Interconnection Customer
7.	Deliver to Interconnection Customer and Transmission Provider "as built" drawing, information, and documents regarding Transmission Owner Interconnection Facilities. (GIA 5.11)	Within 120 days after the Commercial Operation Date if requested.
8.	Provide final accounting of actual costs and Interconnection Customer final cost invoices (GIA 12.2 et seq.) related to facilities in Tables A1.	Within 180 days of actual In Service Date (of Interconnection Customer Facilities Table A1) or actual Commercial Operation Date.
9.	Refund any overpayment of estimated cost (GIA 12.3 et seq.)	Within 30 days of final invoice

.

C. Affected System Owner Milestones

<u>WAPA:</u> The Ward-Mandan 230 kV line will need to be uprated to a minimum 458 MVA rating. Interconnection Customer is responsible for coordinating with WAPA for this work.

D. Transmission Provider Milestones

No.	**Description**	**Date**
1	Update Operating Guideline Limit as applicable during Conditional Interconnection Service	Quarterly update on a rolling 12 month basis
2.	Unconditional Service requires completion of MTEP Contingent Facilities listed in Exhibit A10 and Affected System upgrades	TP to provide Notice to the Parties

Appendix B-1
To GIA

Pre-Certification Generation Test Notification Form

The following form would need to be submitted to MISO Real Time Operations at least five (5) Business Days prior to the first date of testing.

Project Number:

Project Name:

Point of Interconnection:

Dispatcher Contact Information:

Date	**Start Time (in EST)**	**End Time (in EST)**	**Expected MW Output**	**Expected MVAR Output (Only needed if beyond normal power factor)**

Appendix C
To GIA

Interconnection Details

This Appendix C is a part of this GIA among Interconnection Customer, Transmission Owner and Transmission Provider.

1. Transmission Owner shall provide the following "as-built" drawings, information and documents regarding the Transmission Owner's Interconnection Facilities pursuant to Article 5.11 of this GIA:

2. The unique requirements of each generation interconnection will dictate the establishment of mutually agreeable Interconnection and/or Operating Guidelines that further define the requirements of this GIA. The Interconnection and/or Operating Guidelines applicable to this GIA consist of the following information. Additional detail may be provided through attachment to this Appendix C or through electronic means via the web address specified.

   http://www.montana-dakota.com/rates-and-services/interconnection-requirements

   (a) System Protection Facilities;
   (b) Communication requirements;
   (c) Metering requirements;
   (d) Grounding requirements;
   (e) Transmission Line and Substation Connection configurations;
   (f) Unit Stability requirements;
   (g) Equipment ratings;
   (h) Short Circuit requirements;
   (i) Synchronizing requirements;
   (j) Generation and Operation Control requirements;
   (k) Data provisions;
   (l) Energization inspection and testing requirements;

3. No further requirements pursuant to GIA article 8.4

Appendix D
To GIA

Security Arrangements Details

Infrastructure security of Transmission or Distribution System equipment and operations, as applicable, and control hardware and software is essential to ensure day-to-day Transmission and Distribution System reliability and operational security. The Commission will expect all Transmission Providers, market participants, and Interconnection Customers interconnected to the Transmission or Distribution System, as applicable, to comply with the recommendations provided by Governmental Authorities regarding Critical Energy Infrastructure Information ("CEII") as that term is defined in 18 C.F.R. Section 388.113(c) and best practice recommendations from the electric reliability authority. All public utilities will be expected to meet basic standards for system infrastructure and operational security, including physical, operational, and cyber-security practices.

Appendix E
To GIA

Commercial Operation Date

This Appendix E is a part of this GIA between Transmission Provider, Transmission Owner and Interconnection Customer.

[Date]

Midcontinent Independent System Operator, Inc.
Attn: Director, Transmission Access Planning
P.O. Box 4202
Carmel, IN 46082-4202

for overnight deliveries:
720 City Center Drive
Carmel, IN 46032

Re: _____________ Generating Facility

Dear _______________:

On **[Date] [Interconnection Customer]** has completed Trial Operation of Unit No. ___. This letter confirms that **[Interconnection Customer]** commenced commercial operation of Unit No. ___ at the Generating Facility, effective as of **[Date plus one Calendar Day]**.

Thank you.

[Signature]

[Interconnection Customer Representative]

cc: Transmission Owner

Appendix F
To GIA

Addresses for Delivery of Notices and Billings

Notices:

Transmission Provider:

USPS mailing address:
MISO
Attn: Director, Transmission Access Planning
P.O. Box 4202
Carmel, IN 46082-4202

For overnight deliveries:
MISO
Attn: Director, Transmission Access Planning
720 City Center Drive
Carmel, IN 46032

Transmission Owner:

Montana-Dakota Utilities Co.
Vice President, Electric Supply
400 North Fourth Street
Bismarck, ND 58501

Interconnection Customer:

Foxtail Wind, LLC
Vice President, Business Management MidWest
700 Universe Blvd
Juno Beach, FL 33408
561-691-7887 (tel)
561-304-5161 (fax)

Billings and Payments:

Transmission Provider:

USPS mailing address:
MISO
Attn: Director, Transmission Access Planning
P.O. Box 4202
Carmel, IN 46082-4202

For overnight deliveries:
MISO
Attn: Director, Transmission Access Planning
720 City Center Drive
Carmel, IN 46032

Transmission Owner:

Montana-Dakota Utilities Co.
Vice President, Electric Supply
400 North Fourth Street
Bismarck, ND 58501

Interconnection Customer:

Foxtail Wind, LLC
Vice President, Business Management MidWest
700 Universe Blvd
Juno Beach, FL 33408
561-691-7887 (tel)

Alternative Forms of Delivery of Notices (telephone, facsimile or email):

Transmission Provider:
Phone: (317)249-5700
Email: misotap@misoenergy.org or
MISOTransmissionAccessPlanning@misoenergy.org

Transmission Owner:

Phone: (701) 222-7722
Email: jay.skabo@mdu.com

Interconnection Customer:

Foxtail Wind, LLC
Vice President, Business Management MidWest
700 Universe Blvd
Juno Beach, FL 33408
561-691-7887 (tel)
561-304-5161 (fax)

APPENDIX G

INTERCONNECTION REQUIREMENTS FOR A WIND GENERATING PLANT

Appendix G sets forth requirements and provisions specific to a wind generating plant. All other requirements of this GIA continue to apply to wind generating plant interconnections.

A. Technical Standards Applicable to a Wind Generating Plant

i. Low Voltage Ride-Through (LVRT) Capability

A wind generating plant shall be able to remain online during voltage disturbances up to the time periods and associated voltage levels set forth in the standard below.

1. Wind generating plants are required to remain in-service during three-phase faults with normal clearing (which is a time period of approximately 4-9 cycles) and single line to ground faults with delayed clearing, and subsequent post-fault voltage recovery to prefault voltage unless clearing the fault effectively disconnects the generator from the system. The clearing time requirement for a three-phase fault will be specific to the wind generating plant substation location, as determined by and documented by the transmission provider. The maximum clearing time the wind generating plant shall be required to withstand for a three-phase fault shall be 9 cycles after which, if the fault remains following the location-specific normal clearing time for three-phase faults, the wind generating plant may disconnect from the transmission system. A wind generating plant shall remain interconnected during such a fault on the transmission system for a voltage level as low as zero volts, as measured at the high voltage side of the wind GSU.

2. This requirement does not apply to faults that would occur between the wind generator terminals and the high side of the GSU.

3. Wind generating plants may be tripped after the fault period if this action is intended as part of a special protection system.

4. Wind generating plants may meet the LVRT requirements of this standard by the performance of the generators or by installing additional equipment (*e.g.* Static VAr Compensator) within the wind generating plant or by a combination of generator performance and additional equipment.

5. Existing individual generator units that are, or have been, interconnected to the network at the same location at the effective date of the Appendix G LVRT Standard are exempt from meeting the Appendix G LVRT Standard for the remaining life of the existing generation equipment. Existing individual generator units that are replaced are required to meet the Appendix G LVRT Standard.

ii. <u>Power Factor Design Criteria (Reactive Power)</u>

A wind generating plant shall maintain a factor within the range of 0.95 leading to 0.95 lagging, unless Transmission Provider has established different requirements that apply to all Generating Facilities in the Local Balancing Authority on a comparable basis, measured at the Point of Interconnection as defined in this GIA, if the Transmission Provider's System Impact Study shows that such a requirement is necessary to ensure safety or reliability. The power factor range standard can be met by using, for example, power electronics designed to supply this level of reactive capability (taking into account any limitations due to voltage level, real power output, etc.) or fixed and switched capacitors if agreed to by Transmission Provider, or a combination of the two. Interconnection Customer shall not disable power factor equipment while the wind plant is in operation. Wind plants shall also be able to provide sufficient dynamic voltage support in lieu of the power system stabilizer and automatic voltage regulation at the generator excitation system if the System Impact Study shows this to be required for system safety or reliability.

iii. <u>Supervisory Control and Data Acquisition (SCADA) Capability</u>

The wind plant shall provide SCADA capability to transmit data and receive instructions from Transmission Provider to protect system reliability. Transmission Provider and Interconnection Customer shall determine what SCADA information is essential for the proposed wind plant, taking into account the size of the plant and its characteristics, location, and importance in maintaining generation resource adequacy and transmission system reliability in its area.

Appendix H - Not Applicable
Interconnection Requirements for Provisional GIA

Provisional Agreement

This GIA is being provided in accordance with Section 11.5 of the Transmission Provider's GIP, which provides among other things, that an Interconnection Customer may request that Transmission Provider provide Interconnection Customer with a provisional GIA that limits the transfer of energy by Interconnection Customer commensurate with that allowed for Energy Resource Interconnection Service. Interconnection Customer requested Transmission Provider to provide a provisional GIA for limited operation at the discretion of Transmission Provider based upon the results of available studies (by Interconnection Customer and by Transmission Provider).

An Optional Study, the results of which are posted on the confidential portion of the Transmission Provider's internet website, was performed by Transmission Provider in order to confirm the facilities that are required for provisional Interconnection Service and to require them to be in place prior to commencement of service under the GIA.

Interconnection Customer represents that the Interconnection Customer facilities (including Network Upgrades, Interconnection Facilities, Distribution Upgrades, System Protection Upgrades and/or Generator Upgrades) that are necessary to commence provisional Interconnection Service and meet the requirements of NERC, or any applicable regional entity for the interconnection of a new generator are in place prior to the commencement of generation from the Generating Facility and will remain in place during the term of the service. The requisite Interconnection Studies were performed for the Generating Facility (under Optional Studies). Interconnection Customer shall meet any additional requirements (including reactive power requirements) pursuant to the results of applicable future Interconnection System Impact Studies. Until such time as the applicable Interconnection Studies and any identified facilities are completed, the output of the Generating Facility will operate within the output limit prescribed in a future, if applicable, operating guide.

The maximum permissible output of the Generating Facility under Appendix A will be updated by Transmission Provider on a quarterly basis, determined in accordance with Section 11.5 of the GIP, by finding the transfer limit of energy commensurate with the analysis for Energy Resource Interconnection Service ("ERIS"). This study shall be performed assuming the system topology represented by the base cases used to calculate Available Flowgate Capability, as described in Attachment C of the Tariff, with dispatch and optimization algorithms posted on the MISO internet site and operation above those limits will be deemed as unauthorized use of the Transmission System and subject to provisions in the Tariff surrounding that use.

Use of interim operating guide

Implementation of interim operating guide, if applicable, will constitute an interim solution that will permit Interconnection Customer to operate the Generating Facility under conditional Interconnection Service until planned Network Upgrades are constructed. Any interim operating guide will be subject to the approval of Transmission Owner and Transmission Provider. Minimum requirements for an interim operating guide are as indicated below.

* Transmission Operator will have control of breaker(s) dedicated to the Generating Facility and will be able to trip the Interconnection Customer's Generating Facility
* Protection schemes must be tested and operative
* Interconnection Customer will provide continuous communication capability with the Generator Operator
* Interconnection Customer and the owner of the existing Generating Facility will enter into an operating agreement or similar agreement which designates, among other things, the responsibilities and authorities of each of the parties and shall be subject to the acceptance of Transmission Provider and Transmission Owner.
* A termination date consistent with completion of construction of Network Upgrades will be included as part of all operating guides accepted by Transmission Owner and Transmission Provider.

Interconnection Customer assumes all risks and liabilities with respect to changes, which may impact the Generator Interconnection Agreement including, but not limited to, change in output limits and responsibilities for future Network Upgrade and cost responsibilities that have not yet been identified on the direct connect Transmission System as well as all affected Transmission, Distribution or Generation System(s) including non-Transmission Provider System's. Such upgrades will be determined pursuant to the Tariff and Policies in effect at the time of the Interconnection Studies.

Appendix I – Not Applicable
Requirements Applicable to Net Zero Interconnection Service

Where this GIA provides for Net Zero Interconnection Service, Interconnection Customer acknowledges, agrees to, and will be required to operate under the following conditions:

1) The combined Real-Time Offers, including Energy and Operating Reserves, of the Generating Facility and the existing generating facility with which Interconnection Customer has an executed Energy Displacement Agreement must be less than or equal to Interconnection Service limit (MW, MVAR, MVA output) provided in Exhibit I-1 (Monitoring and Consent Agreement) (hereinafter, "Interconnection Service limit"). In the event that the sum of the simultaneous energy output of the Generating Facility and the existing generating facility exceeds such Interconnection Service limit, MISO reserves the right to curtail and/or disconnect the Generating Facility immediately.

   In the event that the sum of the emergency and/or economic maximum offer limits of the Generating Facility and the existing generating facility exceeds the Interconnection Service limit, MISO reserves the right to curtail and/or disconnect the Generating Facility immediately.
2) The total MW, MVAR, MVA output at the Point of Interconnection resulting from the combined output of the Generating Facility and the existing generating facility with which Interconnection Customer has an executed Energy Displacement Agreement shall not at any time exceed the Interconnection Service limit.

3) The existing generating facility with which Interconnection Customer has an executed Energy Displacement Agreement is not relieved of any applicable requirements under the RAR of the Tariff.

4) The Interconnection Customer shall submit to the Transmission Provider a report by the seventh Calendar Day of each month showing the prior month's output, by 15 minute increment, the combined real-time offers and cleared energy injection. The existing generating facility and the Interconnection Customer shall cooperate consistent with other provisions in the Tariff to the extent necessary to ensure accuracy of the report. Transmission Provider shall provide a template for this report.

Exhibit I-1 (Completed Monitoring and Consent Agreement - Appendix 11 of the GIP)

Exhibit I-2 (Completed Energy Displacement Agreement - Appendix 12 of the GIP)

Bid Cover Sheet

1) Project / Facility Name: Blazing Star I

2) Project Location (City, County, State):

City, County, State: Townships of Hansonville, Hendricks, Marble, Royal, & Shaokatan in Lincoln County, MN

Latitude, Longitude: 44.539 °N -96.376 °W

(decimal format; accurate to three (3) decimal places)

3) Bidder Contact:

The individual whose name appears as the Bidder Contact will be the person designated by the bid respondent to receive and respond to communications regarding this bid.

Name: Frank Qie
Company: Xcel Energy
Address: 414 Nicollet Mall, 2nd Floor, Minneapolis, MN 55401
Phone / Fax: 612-330-5651
email: frank.s.qie@xcelenergy.com

4) Alternate Contact:

Name: Bradley Morrison
Company: Xcel Energy
Address: 414 Nicollet Mall, 2nd Floor, Minneapolis, MN 55401
Phone / Fax: 612-330-6283
email: bradley.morrison@xcelenergy.com

5) Facility Nameplate Capacity * 200.000 **MW** **Capacity Factor (%):** REDACTED

* Unless noted otherwise, kW, kWh, MW, MWh refer to AC power and energy.

6) Annual Generation: REDACTED **MWh**

7) Commercial Operation Date: December 13, 2019 **8) PPA Term (years) :**

9) Proposed Structure
x NSP Ownership
_ PPA
_ Other

10) Estimated Useful Life of Facility at Commercial Operation Date (Years): 25

11) Proposed Facility Status:
_ Qualifying Facility
_ Sale from Greenfield Facility
_ Exempt Wholesale Generator
_ Sale from Existing Facility
_ Sale from Modification of Existing Facility
x Other NSP MN owned generation

12) Point of Interconnection Description: Brookings -Lyon county transmission line

13) Point of Interconnection is on the:
_ NSP Transmission System
_ NSP Distribution System
x Other Great River Energy

14) Name of Utility Providing Retail Service at Proposed Location: Lyon-Lincoln Electric Cooperative

15) MISO Capacity Zone Location: Zone Number (ex. 1, 2, 3) 1

16) MISO Interconnection State State (MN, ND, SD, WI, MI) MN

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Pricing and Quantity - BOT or Ownership

If bidder proposes more than one pricing option, a separate bid must be submitted.

All pricing is expected to be fully compliant with NSP's Wind Farm Technical Requirements (Attachment B) and NSP's Model Term Sheet for the Purchase and Sale of an Operational Wind Project (Attachment C). Proposal pricing should include the cost to fully construct and must include the full cost for all transmission interconnection and system upgrade costs previously identified or anticipated to be identified by MISO. Exceptions should be noted in Section (C) Notes to BOT or Ownership pricing.

(A) Expected Generation - Provide expected generation levels for each year of the project's expected life, net of expected degradation impacts, if any. Expected generation should be estimated at the Point of Interconnection.

(B) Schedule of Payments - Provide a schedule and amount of payments from NSP to the bidder that separately identifies payments for, 1) engineering, procurement & construction costs, 2) land and easement costs 3) transmission interconnection and network upgrade cost (including potential contingency costs that are anticipated to be NSP's responsibility, 4) optional items available for selection at NSP's discretion, and 5) all other project related payments to be made by NSP. Payments can be made in a periodic or single lump sum manner. All dollar amounts should be entered in nominal dollars.

(C) Notes to BOT or Ownership Generation and Pricing - Include pricing assumptions related to this bid. This should include assumptions regarding federal tax incentives applicable to the proposed project on the proposed in-service date. Also identify if these incentives are due to expire or decline during the term of the proposed agreement.

(A) Expected Generation

Year	MWh
2019	REDACTED
2020	
2021	
2022	
2023	
2024	
2025	
2026	
2027	
2028	
2029	
2030	
2031	
2032	
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2069	
2070	

(B) Schedule of Payments

Date (dd/mm/yyyy)	Engineering, Procurement & Construction Costs	Land and Easement Costs	Transmission Interconnection and Network Upgrade Costs (Include Estimated Contingency Costs)	Optional Items Available for Selection at NSP's Discretion	All Other Project Related Payments to be Made by NSP	Total
REDACTED						

(C) Notes to Ownership Generation and Pricing:

O&M & Ongoing Capital Expenditures BOT

Provide expected O&M and ongoing capital investment requirements for projects, in as much detail as possible, for the period of 25 years following the anticipated transfer of ownership date of the project to the Company.

1) Does the project have a Service Maintenance Agreement (SMA)? Yes

2) What is the term of the SMA? (Years) 3

3) If SMA provides for an availability bonus payment, describe how the bonus is calculated. REDACTED

4) Does the turbine supply agreement (TSA) include OEM diagnostic software equivalent to the software used by the vendor's technicians? Yes

5) If OEM diagnostic software is not included in the TSA, provide the cost of this software.

Year	Service Management Agreement (SMA)	SMA Bonus	Easement	Other Operating (Excluding Major Component Replacements)	Total Operating (before Major Component Replacements)	Major Component Replacements
2019	REDACTED					
2020						
2021						
2022						
2023						
2024						
2025						
2026						
2027						
2028						
2029						
2030						
2031						
2032						
2033						
2034						
2035						
2036						
2037						
2038						
2039						
2040						
2041						
2042						
2043						

Notes to O&M and Ongoing Capital Expenditures:

Construction Milestones

Insert the proposed date for each milestone shown here, as would be found on the detailed Development Schedule provided with the proposal. Milestones should be based on the requirements to achieve the proposed commercial operation date. See the NSP Wind Power Purchase Agreement (Attachment A) for defined terms.

PPA Bids:

Construction Milestone Date	**Construction Milestones**
XX/XX/20XX	Seller and all required counterparties have executed major procurement contracts, the Construction Contract, any operating agreements, and the Interconnection Agreement needed to commence construction of the Facility.
XX/XX/20XX	Seller shall have achieved closing on financing for the Facility or provided Company with proof of financial capability to construct the Facility.
XX/XX/20XX	Seller shall have laid the foundation for all Facility buildings, generating facilities and step-up transformation facilities.
XX/XX/20XX	The turbine(s)/generator(s)/step-up transformer shall have been delivered to, and installed at, the Site.
XX/XX/20XX	Seller shall have constructed Seller's Interconnection Facilities and such facilities are capable of being energized.
XX/XX/20XX	Start-up testing of the Facility commences.
XX/XX/20XX	Seller shall make all applications and/or filings required by Applicable Law for REC accreditation and for the provision of such RECs to Company.
XX/XX/20XX	Commercial Operation Milestone.
XX/XX/20XX	All final documentation and as-builts.

BOT Bids:

Development or Construction Milestone Date	**Development/Construction Milestones**

REDACTED

12/13/19	Project Substantial Completion. **All generators connected to the grid & available for generation**
03/13/19	Project Completion.

Technical Description

The proposal must include all pertinent technical information for the project including detailed turbine information and facility information.

Turbine Level Information

Manufacturer:	REDACTED
Model #:	
Nameplate Capacity per Turbine (MW):	
Rotor Diameter (meters):	
Tower Height (meters):	
Lower Operating Temperature, standard package (° C):	
Lower Operating Temperature, cold weather package (° C):	
Indicate whether or not pricing includes Cold Weather Package	

Facility Level Information

Number of Turbines:	REDACTED
Annual Plant Availability (%):	
Annual Expected Forced Outages Rate%	
Expected Average Annual Maintenance Requirements (days/year)	
Estimated Land Area (acres):	37,200

Turbine Site Suitability Study

x Yes

___ No

3rd Party Pre-Construction Energy Production Reports

Bidders are requested to provide any 3rd party wind reports providing pre-construction energy production details. Information of particular interest includes:

- Turbine layout coordinates
- Power and thrust curves including air density value assumptions
- Met tower locations
- Validated data and/or description of validation criteria and monthly wind speeds
- Description of remote sensing data used if applicable
- Description of adjustments made to the data; why; how (i.e. Wake, DFW, TI, etc.)
- MCP methods, long-term wind speeds at each mast, chosen reference station and correlations. If modeled datasets are used, the time series used in the assessment.
- Assumed wind rose
- Frequency distribution used in energy capture
- Modeling/energy capture software used
- Gross and net energy; array average wind speed
- Loss factors and description of losses

Additional Notes Regarding Technical Description:

REDACTED

Energy Production Profile - Annual and Monthly

Assuming the facility had been in commercial operation during 2013, 2014, and 2015 estimate annual energy production for each of these years utilizing whatever historical meteorological data available for the site, or a nearby site with similar meteorological characteristics. If the facility has been in commercial operation, provide actual generation data for this period.

Provide the average expected hourly generation from the proposed project for each month. Estimated energy production should be net of any expected plant degradation over time. Time is hour ending, Central Standard Time; do not adjust for daylight savings time.

Explain fully the meteorogical data, and source, used for the annual estimates.

Calendar Year	Estimated Annual Energy Production (MWh)
2013	REDACTED
2014	
2015	

Maximum expected hourly generation (MWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
max	REDACTED											

Average (P50) expected hourly generation (MWh)

HE (CST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	REDACTED											
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
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16												
17												
18												
19												
20												
21												
22												
23												
24												
sum												

		Yearly Total
Days in Mo	REDACTED	
Total MWH/Mo		
% of Yearly		

Notes to Energy Production Profile:

REDACTED

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Interconnection Details

Proposals must include all pertinent MISO interconnection or bidder prepared studies including generator interconnection request information, generation interconnection study information, generation interconnection agreement information, MISO document links and information, general project transmission information, congestion and curtailment analyses, and a point of contact for all transmission related information.

Bidders must also provide a summary of all anticipated interconnection and/or system upgrade costs included in their proposal pricing including financial analyses related to any costs expected to be incurred with regard to interconnection, including the cost of installing the interconnection facilities, the network upgrades, distribution upgrades, affected system upgrades, and system protection facilities that have been identified, and a discussion of any unknown or contingent network upgrades for which the project may be responsible.

To the extent that bidders actual transmission interconnection and/or system upgrade costs are lower *or higher* than projections included in the pricing in their proposal(s), bidders must also provide a proposed bid price adjustment mechanism. For BOTs, bidders are expected to provide a bid *decrease* ~~reduction~~ value in terms of dollars per $1,000,000 *for unanticipated incremental or decremental* ~~in avoided~~ transmission costs. For PPAs, bidders are expected to provide a bid *increase value and a bid decrease* ~~reduction~~ value in terms of $/MWh per $1,000,000 in *higher or lower actual* ~~avoided~~ transmission costs. For example, PPA bidders could specify that the PPA purchase price will be ~~reduced~~ *increased and* by $2/MWh for every $1,000,000 in avoided transmission costs *above or below amounts factored into the initial bid* .

Bidders are requested to attach third party studies on projected interconnection/system upgrade costs for all projects.

1) **Generator Interconnection Request Information**

Project Name	Blazing Star I
MISO Project Number	J460
MW Requested	200
Point of Interconnection (detailed description)	Tap Brookings County - Lyon County 345 kV line
Point of Interconnection Voltage	345
Location of Point of interconnection (Latitude/Longitude)	44.5327/-96.3615
Interconnection Transmission Owner	Great River Energy
State/County	Lincoln County, Minnesota
Interconnection Service Type	NRIS
MISO Local Resource Zone (LRZ) number	Zone 1

2) **Generator Interconnection Study Information**

MISO Study Cycle/Group	DPP-February-2016
MISO Study Status (ongoing, completed, etc.)	Not started
Has MISO deliverability study been completed?	N/A
Identify MW NRIS and MW ERIS from study	N/A
Conditions for NRIS and date NRIS effective	N/A

3) **Generator Interconnection Agreement Information**

GIA Execution Date	N/A
Was GIA filed unexecuted (yes/no)	N/A
Is GIA provisional? (yes/no)	N/A
Status of project (under construction, operating, etc.)	Under development
Is the project in service? (yes/no)	No
COD (actual or proposed)	12/13/19

4) **MISO document links** (provide URL for the following or attach hard copy if not publically available)

System Impact Study or Restudies	N/A
Facility Studies	N/A
Optional or Other Studies	N/A
Generator Interconnection Agreement	N/A

5) **Project Transmission Information**

Location of collector substation (state/county)	Lincoln County, Minnesota
Location of Collector Station (Latitude/Longitude)	44.534/-96.361
Provide collector step-up transformer Rated MVA and Impedance on 100 MVA base	TBD
Provide transmission line characteristics between collector substation and interconnection substation including length, conductor and impedance	REDACTED
Provide routing details, permit information or studies performed for transmission line between collector substation and interconnection substation	NA
Identify all equipment required to meet FERC Order Number 827 for Reactive Power Requirements for Non-Synchronous Generation and provide any supporting studies	TBD
Provide power factor	TBD
Total MW at Point of Interconnection (following all losses)	TBD

6) **Network Upgrade Information**

Provide a list of all Network Upgrades, Affected System Upgrades and Shared Network Upgrades (as defined by MISO) included in your proposal that are required for interconnection	REDACTED

Provide cost estimates for the Network Upgrades, Affected System Upgrades and Shared Network Upgrades included in your proposal and identify whether these costs where shared with other MISO projects (i.e. J1234)	REDACTED
Provide a description and associated costs for all Interconnection Facilities included in your proposal that are required for interconnection	
Provide all studies supporting the Network Upgrades, Affected System Upgrades and Shared Network Upgrades included in your proposal that are required for interconnection	Xcel Energy commissioned Excel Engineering to perform analysis to determine required network upgrades and associated costs.
Identify the MISO study group model used for the evaluation and list all MISO projects added or removed to the studies	DPP-August-2015 modified for February 2016

7) Project Congestion/Curtailment Information

Provide CPNode or CPNodes nearest to plant for LMP analysis purposes.	NSP.LYONCO.MVP
Provide an analysis and discussion of the issues surrounding congestion and expected curtailments pertaining to the project, or if this is an operating project, historical curtailment data for the project.	REDACTED

8) Wind Turbine Generator Information

Manufacturer	REDACTED
Model #	
Nameplate Capacity per Turbine (MW)	
Number of Turbines	
Turbine Voltage	
Turbine Type for generic dynamic stability models	
Turbine Step Up Transformer Rated MVA and Impedance on 100 MVA base	
Collector Voltage	

9) Point of Contact for Transmission Information

Contact Name	Randall Oye
Contact Phone Number	612-330-2886
Contact e-mail	randall.l.oye@xcelenergy.com

10) Proposed Bid Price Adjustment Mechanism for Transmission Cost Uncertainty

Bidder's estimated interconnection and/or upgrade cost included in bid price ($/MWH for PPA, $ for BOT)	REDACTED
Price reduction for each $1,000,000 in actual transmission interconnection or upgrade costs below bid price projection ($/MWH for PPA, $ for BOT)	
Price increase for each $1,000,000 in actual transmission interconnection or upgrade costs above bid price projection ($/MWH for PPA, $ for BOT)	

Project Financing, Credit Worthiness, and Legal Claims

1) Project Financing

Describe the financial and legal organizational structure including any subsidiaries. In addition please enclose an ownership structure showing the legal name and the percentage of ownership of each owner.	NSP will acquire 100% of the ownership interests in the project company holding the assets of the project. Following closing, the project company will be merged into NSP.
Describe the financing or funding plan, equity participants and any project financing guarantees.	NSP will own the 100% of project and will finance the acquistion utilizing existing financing sources. No project specific financing will be required.
	REDACTED
Disclose any threshold requirements that must be met prior to having access to the various components of the financing or funding plan described above.	
Do you foresee any issues in obtaining and maintaining a security fund per the requirements described in NSP's Model Wind Power Purchase Agreement (Attachment A) and NSP's Model Term Sheet for the Purchase and Sale of an Operational Wind Project (Attachment C)?	Because NSP would own the project, no security would be needed.
Please identify the guarantor	Not applicable
Provide the current credit rating of the guarantor.	Not applicable
Is the guarantor on credit watch?	Not applicable

2) Credit Worthiness

Describe any credit issues (e.g. bankruptcy, events of default, etc.) for any participant who will have a more than a 20% share of the equity position in the project.	None

3) Legal Claims

Disclose any past, current, or anticipated future litigation related to projects owned or managed by the bidder or any of its affiliates in the United States.	None

Siting Environmental - BOT

1) Project Description

Overview of Project	200 MW Wind Farm in Lincoln County, MN
Project Site Map and Geospatial Data : Illustrate physical location of project as related to other area features, including roads, county boundaries, State or Federal Owned properties and transmission facilities	See folder labeled 1.02 Project Site Map
Legal Description: Describe project location by Section(s), Township(s) and Range(s)	REDACTED
Timeline: Provide an overall project acquisition plan, permitting plan and schedule for the project.	REDACTED

2) Site Control

Overall Land Lease and Acquisition Document Completeness: Provide an overview of the lease and acquisition process for turbine sites, access roads, collector lines. Include status of agreements (signed, in process, declined), timeline to complete and any potential issues and include on a corresponding map.	REDACTED
Documents: Provide copies of all signed agreements, provide copies of any draft agreements, and any easement templates	See folder 2.02 for agreement copies and templates, which include: - Land Lease and Wind Easement Agreement - Memorandum of Land Lease and Wind Easement Agreements - Setback Easement Agreement - Easement and Exclusive Right to Negotiate Lease
Existing Property Easements/Programs: Describe any parcels that have state or federal agency conservation easements, including the USFWS, state DNR, Dept. of Agriculture Conservation Programs	REDACTED
Other Agreements: Provide a discussion of additional agreement types other than Land Lease and Wind Easements and provide on map. (Example: Setback or Neighbor Agreements)	Setback agreements have been acquired in order to include landowners in the project who are not opposed to the project, but are uninterested in hosting a turbine or other facilities. The setback agreement reduces applicable setback requirements.
Records Related to Land Owner Meetings: Provide landowner diaries	A review has been completed on the developer provided landowner diaries in the file "Blazing Star_Parcel Status Landowner Activity Summary". Spreadsheet located in folder 2.01. This project is well received by the affected landowners.

Siting Environmental - BOT

REDACTED

Itemized Costs of Long-term Land Leases For the Site: Provide overview of the long term payment commitments to landowners

Land Ownership Agreements for O&M Building and Substation: Provide land ownership or option agreements for O&M building, substation, laydown yard, and batch plant.

Non Participant Land Owner Risks: Provide overview of any known non-participants opposed to the project.	Non-participant landowners are not opposed to the project.

REDACTED

Land Title/Tax Risks: Provide an overview of any impacts to landowner tax payments that may fall to owner. Describe any potential title issues identified.

Collector Lines and Substation: Provide copies of all signed agreements, provide copies of any draft agreements	Collector line rights are acquired through the "Land Lease and Wind Easement Agreement" See Documents section. Substation land Purchase Option Agreement - See Land Ownership Agreements for O&M Building and Substation section.
Generation Tie Line: Provide copies of all signed agreements, provide copies of any draft agreements	See the Project Transmission Line Easement section below.
Project Transmission Line Easement: Complete list of Transmission Easement Agreements signed and targeted. Include copies of signed Transmission Easement Agreements and Transmission Easement compensation schedules	Transmission Line Easements not required. Interconnect substation located near project collector substation.
Underground Utility Crossing Risks: Please provide all consent agreements for all foreign utility crossings	No known risks. Utility crossing matrix will be indentified during the title curative process. C&C agreements will be developed and pursued Q1 2017

3) Local Permitting

REDACTED

Local Zoning/Permits: Provide an overview of any local zoning permit requirements, timeline to acquire, and the status of acquiring those permits.

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NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Siting Environmental - BOT

REDACTED

Local Government Interactions: Provide an overview of local government interactions, describe any local support and include all correspondence from county and townships as well as project notes

Roadway Improvement Agreements: Provide a summary of any discussions with the local governments regarding road use and commitments to repair after construction. Include any draft or final documents.

4) State Permits, Overall Permit Requirements

REDACTED

State Site Permits: Provide an overview of any State Site permit requirements and the status of acquiring those permits

Overall State Permit Document Completeness: Please provide Site Permit application and supporting data.

Permitting Analysis: Provide an analysis of all permits required for the project, including, but not limited to any state permits, local permits, take permits, wetland permits, stream crossing permits, storm water permits. Include timeline to acquire permits and expected cost.

5) Environmental studies, agency consultation and permit analysis

REDACTED

Site Environmental Studies: Provide a general summary of environmental studies related to project.

Siting Environmental - BOT

Potential Project Risks: Provide a summary of any environmental permitting risks, possible impact to project and expected.	The project is actively working through site permitting process with the PUC and has submitted a site permit application; timing of project development is dependent on receiving a site permit. The Tyler radar facility is located within the vicinity of the project area, and Blazing Star has been working with the DOD on a final mitigation and voluntary contribution agreement for the Tyler radar facility. Details of the proposed mitigation of the Tyler Radar facility are available in the Site Permit Application (SPA) (see Folder 5.00 Environmental Reports, subfolder 5.11).
Site Assessments: Provide any Phase I ESAs for the project.	REDACTED
History and Background: Provide any past environmental issues related to the project site	
Cultural Resource Studies: Please provide copies of state historic preservation consultation and literature survey reports for the project.	
Environmental Siting Analysis: Please provide copies Tier 1 and Tier 2 reports in accordance with USFWS Land Based Wind Energy Guidance	Tier 1/ Tier 2 Site Characterization Study report by WEST, Inc. dated July 18, 2016.See folder 5.00 Environmental Reports, Document 5.5. REDACTED
Avian Studies: Please provide copies of avian surveys, or avian survey study plans, if completed. Provide any determinations that may require mitigation.	
Bat Studies: Please provide copies of bat surveys, or bat survey study plans, if completed.	

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Siting Environmental - BOT

REDACTED

Raptor Studies: Please provide copies of raptor surveys, or raptor survey study plans, if completed.	
T&E and State Projected Species: Please provide copies of T&E and T&E Critical Habitat surveys completed. Provide a summary of any T&E species that may require additional follow-up work or mitigation	
Agency Consultation: Provide status of discussions with permitting agencies including those listed in this section.	Project notifications submitted to the following agencies between April and July 2016: MN Dept. of Agriculture, MN Dept. of Employment and Economic Development, MN Dept of Commerce - EFP, MN Dept. of Health, MN DNR, USFWS, MN DOT, MN Historical Society, MN Dept. of Public Safety, MPCA, MN Office of the State Archaeologist, South West Regional Development Commission, US Army Corps of Engineers, Lincoln County Environmental Office, DOC-NTIA, Marble Township, Hendricks Township, Hansonville Township, and Royal Township. Copies of these notifications, as well as agency responses are included in Appendix D of the SPA. An initial project coordination meeting with the MN DNR and USFWS took place on May 2, 2016, and a meeting with DNR to discuss the results of studies to date took place on October 17, 2016.
USFWS Consultation: Provides copies of all USFWS correspondence to date	Blazing Star Wind Farm Coordination Meeting Notes, dated May 2, 2016. See folder 5.00 Environmental Reports, Document 5.4 No formal response has been received from the USFWS to date; a meeting to discuss the ABPP is anticipated in December 2016.
State DNR Consultation: Provides copies of all State DNR correspondence to date	An initial project coordination meeting with the MN DNR and USFWS took place on May 2, 2016 and meeting notes are available. The MN DNR provided a Preliminary Review dated June 6, 2016. A meeting with DNR to discuss the results of studies to date took place on October 17, 2016, and an additional meeting to discuss the project ABPP is anticipated in December 2016. See Folder 5.00 Environmental Reports, Document 5.4.

REDACTED

Army Corps of Engineers: Please provide any 404 jurisdictional determination obtained by the project, if needed.	
Wetlands: Provide an overview of potential wetland impacts and any completed wetland delineation reports	
Noise Model: Please provide any noise modeling report developed for the project.	Preliminary Noise Compliance Report, Blazing Star Wind Farm, RSG, dated August 31, 2016. See Folder 5.00 Environmental Reports, Documents 5.1 and 5.1a.
Flicker Studies: Provide any flicker studies	Final Report Blazing Star Wind Farm Shadow Flicker Study, EAPC Wind Energy, dated August 4, 2016. See Folder 5.00 Environmental Reports, Document 5.2.

Siting Environmental - BOT

Other Environmental Issues and Risks: Provide a summary and documentation regarding any other potential environmental concerns or risks.	None identified.

6) Geospatial Data

Provide the following information in ESRI GIS Shape files. This list may include information previously identified.

Project Boundaries	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.01 Project Boundaries
Site and Turbine Layout	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.02 Site and Turbine Layout
Turbine Coordinate Information - Location of generation tie	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.03 Turbine Coordinate Information - Location of Generation Tie. No Generation transmission line will be constructed for this project.
Access roads	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.04 Access Roads
Site substation, feeder lines and Gen-tie	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.05 Site Substation, Feeder Lines and Gen-Tie
Site layout design optimization potential	The site will be optimized based on specific wind resource characteristics, turbine technology and environmental constraints. We will be working with developers, wind consultants and turbine suppliers to fully explore the optimization potential of the project site. We will drive the design optimization process during the development and implementation phase of the project, in order to maximize the value of the asset for our customers.
Unique Site features and Setback risks - Identify acquired easements, expired easements	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.07 Unique Site Features and Setback Risks. Constraints shapefile includes data for both Blazing Star I & II projects. For Easements; see folder labeled 6.08 Lease and Easement Polygons.
Lease & Easement polygons	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled Section 6.08 Lease and Easement Polygons.
Collector and transmission line locations	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.09 Collector and Transmission Line Locations. No transmission will be built for this project.
Environmental data	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.07 Unique Site Features and Setback Risks. Constraints shapefile includes data for both Blazing Star I & II projects.

7) Legal Claims

Disclose any past, current, or anticipated future litigation related to projects owned or managed by the bidder or any of its affiliates in the United States.	None.

Bid Cover Sheet

1) Project / Facility Name: Blazing Star II

2) Project Location (City, County, State):

City, County, State: Townships of Ash Lake, Hendricks, Marble, Royal, Shaokatan & Ivanhoe in Lincoln County, MN

Latitude, Longitude: 44.506 °N -96.316 °W

(decimal format; accurate to three (3) decimal places)

3) Bidder Contact:

The individual whose name appears as the Bidder Contact will be the person designated by the bid respondent to receive and respond to communications regarding this bid.

Name: Frank Qie
Company: Xcel Energy
Address: 414 Nicollet Mall, 2nd Floor, Minneapolis, MN 55401
Phone / Fax: 612-330-5651
email: frank.s.qie@xcelenergy.com

4) Alternate Contact:

Name: Bradley Morrison
Company: Xcel Energy
Address: 414 Nicollet Mall, 2nd Floor, Minneapolis, MN 55401
Phone / Fax: 612-330-6283
email: bradley.morrison@xcelenergy.com

5) Facility Nameplate Capacity * 200.000 **MW** **Capacity Factor (%):** REDACTED

* Unless noted otherwise, kW, kWh, MW, MWh refer to AC power and energy.

6) Annual Generation: REDACTED **MWh**

7) Commercial Operation Date: September 1, 2020 **8) PPA Term (years) :** ____

9) Proposed Structure

x NSP Ownership
_ PPA
_ Other

10) Estimated Useful Life of Facility at Commercial Operation Date (Years): 25

11) Proposed Facility Status:

_ Qualifying Facility
_ Sale from Greenfield Facility
_ Exempt Wholesale Generator
_ Sale from Existing Facility
_ Sale from Modification of Existing Facility
x Other NSP MN owned generation

12) Point of Interconnection Description: Brookings to Lyon County transmission line

13) Point of Interconnection is on the:

_ NSP Transmission System
_ NSP Distribution System
x Other Great River Energy transmission system

14) Name of Utility Providing Retail Service at Proposed Location: Lyon-Lincoln Electric Cooperative

15) MISO Capacity Zone Location: Zone Number (ex. 1, 2, 3) 1

16) MISO Interconnection State State (MN, ND, SD, WI, MI) MN

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Pricing and Quantity - BOT or Ownership

If bidder proposes more than one pricing option, a separate bid must be submitted.

All pricing is expected to be fully compliant with NSP's Wind Farm Technical Requirements (Attachment B) and NSP's Model Term Sheet for the Purchase and Sale of an Operational Wind Project (Attachment C). Proposal pricing should include the cost to fully construct and must include the full cost for all transmission interconnection and system upgrade costs previously identified or anticipated to be identified by MISO. Exceptions should be noted in Section (C) Notes to BOT or Ownership pricing.

(A) Expected Generation - Provide expected generation levels for each year of the project's expected life, net of expected degradation impacts, if any. Expected generation should be estimated at the Point of Interconnection.

(B) Schedule of Payments - Provide a schedule and amount of payments from NSP to the bidder that separately identifies payments for, 1) engineering, procurement & construction costs, 2) land and easement costs 3) transmission interconnection and network upgrade cost (including potential contingency costs that are anticipated to be NSP's responsibility, 4) optional items available for selection at NSP's discretion, and 5) all other project related payments to be made by NSP. Payments can be made in a periodic or single lump sum manner. All dollar amounts should be entered in nominal dollars.

(C) Notes to BOT or Ownership Generation and Pricing - Include pricing assumptions related to this bid. This should include assumptions regarding federal tax incentives applicable to the proposed project on the proposed in-service date. Also identify if these incentives are due to expire or decline during the term of the proposed agreement.

(A) Expected Generation

Year	MWh
2020	REDACTED
2021	
2022	
2023	
2024	
2025	
2026	
2027	
2028	
2029	
2030	
2031	
2032	
2033	
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2070	
2071	

(B) Schedule of Payments

Date (dd/mm/yyyy)	Engineering, Procurement & Construction Costs	Land and Easement Costs	Transmission Interconnection and Network Upgrade Costs (Include Estimated Contingency Costs)	Optional Items Available for Selection at NSP's Discretion	All Other Project Related Payments to be Made by NSP	Total
REDACTED						

(C) Notes to Ownership Generation and Pricing:

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O&M & Ongoing Capital Expenditures BOT

Provide expected O&M and ongoing capital investment requirements for projects, in as much detail as possible, for the period of 25 years following the anticipated transfer of ownership date of the project to the Company.

1) Does the project have a Service Maintenance Agreement (SMA)? Yes

2) What is the term of the SMA? (Years) 3

3) If SMA provides for an availability bonus payment, describe how the bonus is calculated. REDACTED

4) Does the turbine supply agreement (TSA) include OEM diagnostic software equivalent to the software used by the vendor's technicians? Yes

5) If OEM diagnostic software is not included in the TSA, provide the cost of this software.

Year	Service Management Agreement (SMA)	SMA Bonus	Easement	Other Operating (Excluding Major Component Replacements)	Total Operating (before Major Component Replacements)	Major Component Replacements
2020	REDACTED					
2021						
2022						
2023						
2024						
2025						
2026						
2027						
2028						
2029						
2030						
2031						
2032						
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2036						
2037						
2038						
2039						
2040						
2041						
2042						
2043						
2044						

Notes to O&M and Ongoing Capital Expenditures:

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Construction Milestones

Insert the proposed date for each milestone shown here, as would be found on the detailed Development Schedule provided with the proposal. Milestones should be based on the requirements to achieve the proposed commercial operation date. See the NSP Wind Power Purchase Agreement (Attachment A) for defined terms.

PPA Bids:

Construction Milestone Date	Construction Milestones
XX/XX/20XX	Seller and all required counterparties have executed major procurement contracts, the Construction Contract, any operating agreements, and the Interconnection Agreement needed to commence construction of the Facility.
XX/XX/20XX	Seller shall have achieved closing on financing for the Facility or provided Company with proof of financial capability to construct the Facility.
XX/XX/20XX	Seller shall have laid the foundation for all Facility buildings, generating facilities and step-up transformation facilities.
XX/XX/20XX	The turbine(s)/generator(s)/step-up transformer shall have been delivered to, and installed at, the Site.
XX/XX/20XX	Seller shall have constructed Seller's Interconnection Facilities and such facilities are capable of being energized.
XX/XX/20XX	Start-up testing of the Facility commences.
XX/XX/20XX	Seller shall make all applications and/or filings required by Applicable Law for REC accreditation and for the provision of such RECs to Company.
XX/XX/20XX	Commercial Operation Milestone.
XX/XX/20XX	All final documentation and as-builts.

BOT Bids:

Development or Construction Milestone Date	Development/Construction Milestones
REDACTED	
09/01/20	Project Substantial Completion. (All generators connected to the grid and available for generation)
12/01/20	Project Completion.

Technical Description

The proposal must include all pertinent technical information for the project including detailed turbine information and facility information.

Turbine Level Information

Manufacturer:	REDACTED
Model #:	
Nameplate Capacity per Turbine (MW):	
Rotor Diameter (meters):	
Tower Height (meters):	
Lower Operating Temperature, standard package (° C):	
Lower Operating Temperature, cold weather package (° C):	
Indicate whether or not pricing includes Cold Weather Package	

Facility Level Information

Number of Turbines:	REDACTED
Annual Plant Availability (%):	
Annual Expected Forced Outages Rate%	
Expected Average Annual Maintenance Requirements (days/year)	
Estimated Land Area (acres):	30,000 acres

Turbine Site Suitability Study

x Yes
___ No

3rd Party Pre-Construction Energy Production Reports

Bidders are requested to provide any 3rd party wind reports providing pre-construction energy production details. Information of particular interest includes:

Turbine layout coordinates
Power and thrust curves including air density value assumptions
Met tower locations
Validated data and/or description of validation criteria and monthly wind speeds
Description of remote sensing data used if applicable
Description of adjustments made to the data; why; how (i.e. Wake, DFW, TI, etc.)
MCP methods, long-term wind speeds at each mast, chosen reference station and correlations. If modeled datasets are used, the time series used in the assessment.
Assumed wind rose
Frequency distribution used in energy capture
Modeling/energy capture software used
Gross and net energy; array average wind speed
Loss factors and description of losses

Additional Notes Regarding Technical Description:

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REDACTED

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Energy Production Profile - Annual and Monthly

Assuming the facility had been in commercial operation during 2013, 2014, and 2015 estimate annual energy production for each of these years utilizing whatever historical meteorological data available for the site, or a nearby site with similar meteorological characteristics. If the facility has been in commercial operation, provide actual generation data for this period.

Provide the average expected hourly generation from the proposed project for each month. Estimated energy production should be net of any expected plant degradation over time. Time is hour ending, Central Standard Time; do not adjust for daylight savings time.

Explain fully the meteorogical data, and source, used for the annual estimates.

Calendar Year	Estimated Annual Energy Production (MWh)
2013	REDACTED
2014	
2015	

Maximum expected hourly generation (MWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
max	REDACTED											

Average (P50) expected hourly generation (MWh)

HE (CST)												
1	REDACTED											
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
sum												

		Yearly Total
Days in Mo	REDACTED	
Total MWH/Mo		
% of Yearly		

Notes to Energy Production Profile:
REDACTED

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Interconnection Details

Proposals must include all pertinent MISO interconnection or bidder prepared studies including generator interconnection request information, generation interconnection study information, generation interconnection agreement information, MISO document links and information, general project transmission information, congestion and curtailment analyses, and a point of contact for all transmission related information.

Bidders must also provide a summary of all anticipated interconnection and/or system upgrade costs included in their proposal pricing including financial analyses related to any costs expected to be incurred with regard to interconnection, including the cost of installing the interconnection facilities, the network upgrades, distribution upgrades, affected system upgrades, and system protection facilities that have been identified, and a discussion of any unknown or contingent network upgrades for which the project may be responsible.

To the extent that bidders actual transmission interconnection and/or system upgrade costs are lower *or higher* than projections included in the pricing in their proposal(s), bidders must also provide a proposed bid price adjustment mechanism. For BOTs, bidders are expected to provide a bid *decrease* ~~reduction~~ value in terms of dollars per $1,000,000 *for unanticipated incremental or decremental* ~~in avoided~~ transmission costs. For PPAs, bidders are expected to provide a bid *increase value and a bid decrease* ~~reduction~~ value in terms of $/MWh per $1,000,000 in *higher or lower actual* ~~avoided~~ transmission costs. For example, PPA bidders could specify that the PPA purchase price will be ~~reduced~~ *increased and* by $2/MWh for every $1,000,000 in avoided transmission costs *above or below amounts factored into the initial bid*.

Bidders are requested to attach third party studies on projected interconnection/system upgrade costs for all projects.

1) Generator Interconnection Request Information

Project Name	Blazing Star II
MISO Project Number	J587
MW Requested	200
Point of Interconnection (detailed description)	Blazing Star 345 kV substation (installed for Blazing Star I)
Point of Interconnection Voltage	345 kV
Location of Point of interconnection (Latitude/Longitude)	44.5327/-96.3615
Interconnection Transmission Owner	Great River Energy
State/County	Lincoln County, Minnesota
Interconnection Service Type	NRIS
MISO Local Resource Zone (LRZ) number	Zone 1

2) Generator Interconnection Study Information

MISO Study Cycle/Group	DPP-August-2016
MISO Study Status (ongoing, completed, etc.)	Not started
Has MISO deliverability study been completed?	N/A
Identify MW NRIS and MW ERIS from study	N/A
Conditions for NRIS and date NRIS effective	N/A

3) Generator Interconnection Agreement Information

GIA Execution Date	N/A
Was GIA filed unexecuted (yes/no)	N/A
Is GIA provisional? (yes/no)	N/A
Status of project (under construction, operating, etc.)	Development
Is the project in service? (yes/no)	No
COD (actual or proposed)	9/1/2020

4) MISO document links (provide URL for the following or attach hard copy if not publically available)

System Impact Study or Restudies	N/A
Facility Studies	N/A
Optional or Other Studies	N/A
Generator Interconnection Agreement	N/A

5) Project Transmission Information

Location of collector substation (state/county)	Lincoln County, Minnesota
Location of Collector Station (Latitude/Longitude)	To be determined
Provide collector step-up transformer Rated MVA and Impedance on 100 MVA base	To be determined
Provide transmission line characteristics between collector substation and interconnection substation including length, conductor and impedance	To be determined
Provide routing details, permit information or studies performed for transmission line between collector substation and interconnection substation	To be determined
Identify all equipment required to meet FERC Order Number 827 for Reactive Power Requirements for Non-Synchronous Generation and provide any supporting studies	To be determined
Provide power factor	To be determined
Total MW at Point of Interconnection (following all losses)	To be determined

6) Network Upgrade Information

Provide a list of all Network Upgrades, Affected System Upgrades and Shared Network Upgrades (as defined by MISO) included in your proposal that are required for interconnection	REDACTED

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Provide cost estimates for the Network Upgrades, Affected System Upgrades and Shared Network Upgrades included in your proposal and identify whether these costs where shared with other MISO projects (i.e. J1234)	REDACTED
Provide a description and associated costs for all Interconnection Facilities included in your proposal that are required for interconnection	
Provide all studies supporting the Network Upgrades, Affected System Upgrades and Shared Network Upgrades included in your proposal that are required for interconnection	Xcel Energy commissioned Excel Engineering to perform analysis to determine required network upgrades and associated costs.
Identify the MISO study group model used for the evaluation and list all MISO projects added or removed to the studies	DPP-August-2015 updated to August 2016

7) Project Congestion/Curtailment Information

Provide CPNode or CPNodes nearest to plant for LMP analysis purposes.	NSP.LYONCO.MVP
Provide an analysis and discussion of the issues surrounding congestion and expected curtailments pertaining to the project, or if this is an operating project, historical curtailment data for the project.	REDACTED

8) Wind Turbine Generator Information

Manufacturer	REDACTED
Model #	
Nameplate Capacity per Turbine (MW)	
Number of Turbines	
Turbine Voltage	
Turbine Type for generic dynamic stability models	
Turbine Step Up Transformer Rated MVA and Impedance on 100 MVA base	
Collector Voltage	

9) Point of Contact for Transmission Information

Contact Name	Randall L. Oye
Contact Phone Number	612-330-2886
Contact e-mail	randall.l.oye@xcelenergy.com

10) Proposed Bid Price Adjustment Mechanism for Transmission Cost Uncertainty

Bidder's estimated interconnection and/or upgrade cost included in bid price ($/MWH for PPA, $ for BOT)	REDACTED
Price reduction for each $1,000,000 in actual transmission interconnection or upgrade costs below bid price projection ($/MWH for PPA, $ for BOT)	
Price increase for each $1,000,000 in actual transmission interconnection or upgrade costs above bid price projection ($/MWH for PPA, $ for BOT)	

Project Financing, Credit Worthiness, and Legal Claims

1) Project Financing

Describe the financial and legal organizational structure including any subsidiaries. In addition please enclose an ownership structure showing the legal name and the percentage of ownership of each owner.	NSP will acquire 100% of the ownership interests in the project company holding the assets of the project. Following closing, the project company will be merged into NSP.
Describe the financing or funding plan, equity participants and any project financing guarantees.	NSP will own the 100% of project and will finance the acquistion utilizing existing financing sources. No project specific financing will be required.
	REDACTED
Disclose any threshold requirements that must be met prior to having access to the various components of the financing or funding plan described above.	
Do you foresee any issues in obtaining and maintaining a security fund per the requirements described in NSP's Model Wind Power Purchase Agreement (Attachment A) and NSP's Model Term Sheet for the Purchase and Sale of an Operational Wind Project (Attachment C)?	Because NSP would own the project, no security would be needed.
Please identify the guarantor	Not applicable
Provide the current credit rating of the guarantor.	Not applicable
Is the guarantor on credit watch?	Not applicable

2) Credit Worthiness

Describe any credit issues (e.g. bankruptcy, events of default, etc.) for any participant who will have a more than a 20% share of the equity position in the project.	None

3) Legal Claims

Disclose any past, current, or anticipated future litigation related to projects owned or managed by the bidder or any of its affiliates in the United States.	None

Siting Environmental - BOT

1) Project Description

Overview of Project	200 MW Wind Farm in Lincoln County, MN
Project Site Map and Geospatial Data : Illustrate physical location of project as related to other area features, including roads, county boundaries, State or Federal Owned properties and transmission facilities	See folder labeled 1.02 Project Site Map
Legal Description: Describe project location by Section(s), Township(s) and Range(s)	REDACTED
Timeline: Provide an overall project acquisition plan, permitting plan and schedule for the project.	

2) Site Control

Overall Land Lease and Acquisition Document Completeness: Provide an overview of the lease and acquisition process for turbine sites, access roads, collector lines. Include status of agreements (signed, in process, declined), timeline to complete and any potential issues and include on a corresponding map.	REDACTED
Documents: Provide copies of all signed agreements, provide copies of any draft agreements, and any easement templates	See Folder 2.02 Agreement Documents for copies of agreements including: - Land Lease and Wind Easement Agreements - Memorandum of Land Lease and Wind Easement Agreements
Existing Property Easements/Programs: Describe any parcels that have state or federal agency conservation easements, including the USFWS, state DNR, Dept. of Agriculture Conservation Programs	REDACTED
Other Agreements: Provide a discussion of additional agreement types other than Land Lease and Wind Easements and provide on map. (Example: Setback or Neighbor Agreements)	Setback agreements have been acquired in order to include landowners in the project who are not opposed to the project, but are uninterested in hosting a turbine or other facilities. The setback agreement reduces applicable setback requirements. See Folder 2.02 Agreement Documents for Setback Agreement Template.
Records Related to Land Owner Meetings: Provide landowner diaries	A review has been completed on the developer provided landowner diaries in the file "Blazing Star_Parcel Status Landowner Activity Summary". See folder 2.01 Land Lease and Wind Easement Completeness for document. This project is well received by the landowners and there is not much opposition.
Itemized Costs of Long-term Land Leases For the Site: Provide overview of the long term payment commitments to landowners	REDACTED
Land Ownership Agreements for O&M Building and Substation: Provide land ownership or option agreements for O&M building, substation, laydown yard, and batch plant.	

Siting Environmental - BOT

Non Participant Land Owner Risks: Provide overview of any known non-participants opposed to the project.	Non-participant landowners are not opposed to the project.
	REDACTED
Land Title/Tax Risks: Provide an overview of any impacts to landowner tax payments that may fall to owner. Describe any potential title issues identified.	
Collector Lines and Substation: Provide copies of all signed agreements, provide copies of any draft agreements	Collector line rights are acquired through the "Land Lease and Wind Easement Agreement" See Documents section. Substation land Purchase Option Agreement - See Land Ownership Agreements for O&M Building and Substation section.
Generation Tie Line: Provide copies of all signed agreements, provide copies of any draft agreements	See Project Transmission Line Easement below.
Project Transmission Line Easement: Complete list of Transmission Easement Agreements signed and targeted. Include copies of signed Transmission Easement Agreements and Transmission Easement compensation schedules	REDACTED
Underground Utility Crossing Risks: Please provide all consent agreements for all foreign utility crossings	

3) Local Permitting

	REDACTED
Local Zoning/Permits: Provide an overview of any local zoning permit requirements, timeline to acquire, and the status of acquiring those permits.	
Local Government Interactions: Provide an overview of local government interactions, describe any local support and include all correspondence from county and townships as well as project notes	Geronimo has been engaged with local government including townships, the Lincoln County Board and the nearby cities. Blazing Star had meetings and phone calls with local government officials to introduce the project.
Roadway Improvement Agreements: Provide a summary of any discussions with the local governments regarding road use and commitments to repair after construction. Include any draft or final documents.	Developer has provided a draft Road Use Agreement to Lincoln County. The agreement will be finalized following MPUC siting approval.

4) State Permits, Overall Permit Requirements

State Site Permits: Provide an overview of any State Site permit requirements and the status of acquiring those permits	The State Site Permitting application, review and approval are described in the attached schedule. Application to the MPUC for a Certificate of Need and a Large Wind Energy Conversion System Site Permit will be made in February 2017, with Commission review and approval anticipated to take 9-12 months.
Overall State Permit Document Completeness: Please provide Site Permit application and supporting data.	The State Site Permitting application, review and approval are described in the attached schedule. Application to the MNPUC for a Certificate of Need and a Large Wind Energy Conversion System Site Permit will be made in February 2017, with Commission review and approval anticipated to take 9-12 months.
Permitting Analysis: Provide an analysis of all permits required for the project, including, but not limited to any state permits, local permits, take permits, wetland permits, stream crossing permits, storm water permits. Include timeline to acquire permits and expected cost.	REDACTED

5) Environmental studies, agency consultation and permit analysis

	REDACTED
Site Environmental Studies: Provide a general summary of environmental studies related to project.	
Potential Project Risks: Provide a summary of any environmental permitting risks, possible impact to project and expected.	
Site Assessments: Provide any Phase I ESAs for the project.	

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Siting Environmental - BOT

REDACTED

History and Background: Provide any past environmental issues related to the project site	
Cultural Resource Studies: Please provide copies of state historic preservation consultation and literature survey reports for the project.	
Environmental Siting Analysis: Please provide copies Tier 1 and Tier 2 reports in accordance with USFWS Land Based Wind Energy Guidance	Although a Tier 1/2 report has not been completed for the project, information has been reviewed in accordance with the WEGs. The first phase of the Blazing Star project is located adjacent and in the same ecological landscape. As such, the results of the Tier 1/ Tier 2 Site Characterization Study report prepared by WEST are applicable to this phase of the project.
Avian Studies: Please provide copies of avian surveys, or avian survey study plans, if completed. Provide any determinations that may require mitigation.	REDACTED
Bat Studies: Please provide copies of bat surveys, or bat survey study plans, if completed.	
Raptor Studies: Please provide copies of raptor surveys, or raptor survey study plans, if completed.	
T&E and State Projected Species: Please provide copies of T&E and T&E Critical Habitat surveys completed. Provide a summary of any T&E species that may require additional follow-up work or mitigation	
Agency Consultation: Provide status of discussions with permitting agencies including those listed in this section.	
USFWS Consultation: Provides copies of all USFWS correspondence to date	
State DNR Consultation: Provides copies of all State DNR correspondence to date	
Army Corps of Engineers: Please provide any 404 jurisdictional determination obtained by the project, if needed.	
Wetlands: Provide an overview of potential wetland impacts and any completed wetland delineation reports	
Noise Model: Please provide any noise modeling report developed for the project.	Not yet initiated; expected early 2017.
Flicker Studies: Provide any flicker studies	Not yet initiated; expected early 2017.
Other Environmental Issues and Risks: Provide a summary and documentation regarding any other potential environmental concerns or risks.	None identified.

6) Geospatial Data

Provide the following information in ESRI GIS Shape files. This list may include information previously identified.

Project Boundaries	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.01 Project Boundaries.
Site and Turbine Layout	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.02 Site and Turbine Layout.
Turbine Coordinate Information - Location of generation tie	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.03 Turbine Coordinate Information - Location of Generation Tie.
Access roads	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.04 Access Roads.
Site substation, feeder lines and Gen-tie	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.05 Site Substation, Feeder Lines and Gen - Tie.
Site layout design optimization potential	The site will be optimized based on specific wind resource characteristics, turbine technology and environmental constraints. We will be working with developers, wind consultants and turbine suppliers to fully explore the optimization potential of the project site. We will drive the design optimization process during the development and implementation phase of the project, in order to maximize the value of the asset for our customers.
Unique Site features and Setback risks - Identify acquired easements, expired easements	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.07 Unique Site Features and Setback Risks. For easement polygons; see 6.08.
Lease & Easement polygons	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.08 Lease and Easement Polygons.
Collector and transmission line locations	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.09 Collector and Transmission Line Locations
Environmental data	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.07 Unique Site Features and Setback Risks. For easement polygons; see 6.08.

7) Legal Claims

Disclose any past, current, or anticipated future litigation related to projects owned or managed by the bidder or any of its affiliates in the United States.	None.

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Bid Cover Sheet

1) Project / Facility Name: Freeborn Wind

City, County, State: Township of Hayward, London, Oakland, Shell Rock & Myrtle in Freeborn County, MN

Latitude, Longitude: 43.562 °N -93.209 °W
(decimal format; accurate to three (3) decimal places)

3) Bidder Contact:

The individual whose name appears as the Bidder Contact will be the person designated by the bid respondent to receive and respond to communications regarding this bid.

Name:	Frank Qie
Company:	Xcel Energy
Address:	414 Nicollet Mall, 2nd Floor, Minneapolis, MN 55401
Phone / Fax:	612-330-5651
email:	frank.s.qie@xcelenergy.com

4) Alternate Contact:

Name:	Bradley Morrison
Company:	Xcel Energy
Address:	414 Nicollet Mall, 2nd Floor, Minneapolis, MN 55401
Phone / Fax:	612-330-6283
email:	bradley.morrison@xcelenergy.com

5) Facility Nameplate Capacity * 200.000 **MW** **Capacity Factor (%):** REDACTED
* Unless noted otherwise, kW, kWh, MW, MWh refer to AC power and energy.

6) Annual Generation: REDACTED **MWh**

7) Commercial Operation Date: December 15, 2020 **8) PPA Term (years) :**

9) Proposed Structure
x NSP Ownership
_ PPA
_ Other

10) Estimated Useful Life of Facility at Commercial Operation Date (Years): 25

11) Proposed Facility Status:
_ Qualifying Facility
_ Sale from Greenfield Facility
_ Exempt Wholesale Generator
_ Sale from Existing Facility
_ Sale from Modification of Existing Facility
x Other NSP MN owned generation

12) Point of Interconnection Description: Glenworth Substation

13) Point of Interconnection is on the:
_ NSP Transmission System
_ NSP Distribution System
x Other ITC Midwest transmission system

14) Name of Utility Providing Retail Service at Proposed Location: Freeborn Mower Coop

15) MISO Capacity Zone Location: Zone Number (ex. 1, 2, 3) 3

16) MISO Interconnection State State (MN, ND, SD, WI, MI) MN

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Pricing and Quantity - BOT or Ownership

If bidder proposes more than one pricing option, a separate bid must be submitted.

All pricing is expected to be fully compliant with NSP's Wind Farm Technical Requirements (Attachment B) and NSP's Model Term Sheet for the Purchase and Sale of an Operational Wind Project (Attachment C). Proposal pricing should include the cost to fully construct and must include the full cost for all transmission interconnection and system upgrade costs previously identified or anticipated to be identified by MISO. Exceptions should be noted in Section (C) Notes to BOT or Ownership pricing.

(A) Expected Generation - Provide expected generation levels for each year of the project's expected life, net of expected degradation impacts, if any. Expected generation should be estimated at the Point of Interconnection.

(B) Schedule of Payments - Provide a schedule and amount of payments from NSP to the bidder that separately identifies payments for, 1) engineering, procurement & construction costs, 2) land and easement costs 3) transmission interconnection and network upgrade cost (including potential contingency costs that are anticipated to be NSP's responsibility, 4) optional items available for selection at NSP's discretion, and 5) all other project related payments to be made by NSP. Payments can be made in a periodic or single lump sum manner. All dollar amounts should be entered in nominal dollars.

(C) Notes to BOT or Ownership Generation and Pricing - Include pricing assumptions related to this bid. This should include assumptions regarding federal tax incentives applicable to the proposed project on the proposed in-service date. Also identify if these incentives are due to expire or decline during the term of the proposed agreement.

(A) Expected Generation

Year	MWh
2020	REDACTED
2021	
2022	
2023	
2024	
2025	
2026	
2027	
2028	
2029	
2030	
2031	
2032	
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2070	
2071	

(B) Schedule of Payments

Date (dd/mm/yyyy)	Engineering, Procurement & Construction Costs	Land and Easement Costs	Transmission Interconnection and Network Upgrade Costs (Include Estimated Contingency Costs)	Optional Items Available for Selection at NSP's Discretion	All Other Project Related Payments to be Made by NSP	Total
REDACTED						

(C) Notes to Ownership Generation and Pricing:

O&M & Ongoing Capital Expenditures BOT

Provide expected O&M and ongoing capital investment requirements for projects, in as much detail as possible, for the period of 25 years following the anticipated transfer of ownership date of the project to the Company.

1) Does the project have a Service Maintenance Agreement (SMA)? Yes

2) What is the term of the SMA? (Years) 3

3) If SMA provides for an availability bonus payment, describe how the bonus is calculated. REDACTED

4) Does the turbine supply agreement (TSA) include OEM diagnostic software equivalent to the software used by the vendor's technicians? Yes

5) If OEM diagnostic software is not included in the TSA, provide the cost of this software.

Year	Service Management Agreement (SMA)	SMA Bonus	Easement	Other Operating (Excluding Major Component Replacements)	Total Operating (before Major Component Replacements)	Major Component Replacements
2020	REDACTED					
2021						
2022						
2023						
2024						
2025						
2026						
2027						
2028						
2029						
2030						
2031						
2032						
2033						
2034						
2035						
2036						
2037						
2038						
2039						
2040						
2041						
2042						
2043						
2044						

Notes to O&M and Ongoing Capital Expenditures:

Construction Milestones

Insert the proposed date for each milestone shown here, as would be found on the detailed Development Schedule provided with the proposal. Milestones should be based on the requirements to achieve the proposed commercial operation date. See the NSP Wind Power Purchase Agreement (Attachment A) for defined terms.

PPA Bids:

Construction Milestone Date	Construction Milestones
XX/XX/20XX	Seller and all required counterparties have executed major procurement contracts, the Construction Contract, any operating agreements, and the Interconnection Agreement needed to commence construction of the Facility.
XX/XX/20XX	Seller shall have achieved closing on financing for the Facility or provided Company with proof of financial capability to construct the Facility.
XX/XX/20XX	Seller shall have laid the foundation for all Facility buildings, generating facilities and step-up transformation facilities.
XX/XX/20XX	The turbine(s)/generator(s)/step-up transformer shall have been delivered to, and installed at, the Site.
XX/XX/20XX	Seller shall have constructed Seller’s Interconnection Facilities and such facilities are capable of being energized.
XX/XX/20XX	Start-up testing of the Facility commences.
XX/XX/20XX	Seller shall make all applications and/or filings required by Applicable Law for REC accreditation and for the provision of such RECs to Company.
XX/XX/20XX	Commercial Operation Milestone.
XX/XX/20XX	All final documentation and as-builts.

BOT Bids:

Development or Construction Milestone Date	Development/Construction Milestones
REDACTED	
12/15/20	Project Substantial Completion. (All generators connected to the grid and available for generation)
03/15/21	Project Completion.

Technical Description

The proposal must include all pertinent technical information for the project including detailed turbine information and facility information.

Turbine Level Information

Manufacturer:	REDACTED
Model #:	
Nameplate Capacity per Turbine (MW):	
Rotor Diameter (meters):	
Tower Height (meters):	
Lower Operating Temperature, standard package (° C):	
Lower Operating Temperature, cold weather package (° C):	
Indicate whether or not pricing includes Cold Weather Package	

Facility Level Information

Number of Turbines:	REDACTED
Annual Plant Availability (%):	
Annual Expected Forced Outages Rate%	
Expected Average Annual Maintenance Requirements (days/year)	
Estimated Land Area (acres):	40,000 acres

Turbine Site Suitability Study

x Yes
___ No

3rd Party Pre-Construction Energy Production Reports

Bidders are requested to provide any 3rd party wind reports providing pre-construction energy production details. Information of particular interest includes:

- Turbine layout coordinates
- Power and thrust curves including air density value assumptions
- Met tower locations
- Validated data and/or description of validation criteria and monthly wind speeds
- Description of remote sensing data used if applicable
- Description of adjustments made to the data; why; how (i.e. Wake, DFW, TI, etc.)
- MCP methods, long-term wind speeds at each mast, chosen reference station and correlations. If modeled datasets are used, the time series used in the assessment.
- Assumed wind rose
- Frequency distribution used in energy capture
- Modeling/energy capture software used
- Gross and net energy; array average wind speed
- Loss factors and description of losses

Additional Notes Regarding Technical Description:

REDACTED

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Energy Production Profile - Annual and Monthly

Assuming the facility had been in commercial operation during 2013, 2014, and 2015 estimate annual energy production for each of these years utilizing whatever historical meteorological data available for the site, or a nearby site with similar meteorological characteristics. If the facility has been in commercial operation, provide actual generation data for this period.

Provide the average expected hourly generation from the proposed project for each month. Estimated energy production should be net of any expected plant degradation over time. Time is hour ending, Central Standard Time; do not adjust for daylight savings time.

Explain fully the meteorogical data, and source, used for the annual estimates.

Calendar Year	Estimated Annual Energy Production (MWh)
2013	REDACTED
2014	
2015	

Maximum expected hourly generation (MWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
max	REDACTED											

Average (P50) expected hourly generation (MWh)

HE (CST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	REDACTED											
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
sum												

		Yearly Total
Days in Mo	REDACTED	
Total MWH/Mo		
% of Yearly		

Notes to Energy Production Profile:
REDACTED

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Interconnection Details

Proposals must include all pertinent MISO interconnection or bidder prepared studies including generator interconnection request information, generation interconnection study information, generation interconnection agreement information, MISO document links and information, general project transmission information, congestion and curtailment analyses, and a point of contact for all transmission related information.

Bidders must also provide a summary of all anticipated interconnection and/or system upgrade costs included in their proposal pricing including financial analyses related to any costs expected to be incurred with regard to interconnection, including the cost of installing the interconnection facilities, the network upgrades, distribution upgrades, affected system upgrades, and system protection facilities that have been identified, and a discussion of any unknown or contingent network upgrades for which the project may be responsible.

To the extent that bidders actual transmission interconnection and/or system upgrade costs are lower *or higher* than projections included in the pricing in their proposal(s), bidders must also provide a proposed bid price adjustment mechanism. For BOTs, bidders are expected to provide a bid *decrease* ~~reduction~~ value in terms of dollars per $1,000,000 *for unanticipated incremental or decremental* ~~in avoided~~ transmission costs. For PPAs, bidders are expected to provide a bid *increase value and a bid decrease* ~~reduction~~ value in terms of $/MWh per $1,000,000 in *higher or lower actual* ~~avoided~~ transmission costs. For example, PPA bidders could specify that the PPA purchase price will be ~~reduced~~ *increased and* by $2/MWh for every $1,000,000 in avoided transmission costs *above or below amounts factored into the initial bid* .

Bidders are requested to attach third party studies on projected interconnection/system upgrade costs for all projects.

1) Generator Interconnection Request Information

Project Name	Freeborn Wind
MISO Project Number	J407
MW Requested	200
Point of Interconnection (detailed description)	Glenworth substation
Point of Interconnection Voltage	161 kV
Location of Point of interconnection (Latitude/Longitude)	43.5594, -93.2695
Interconnection Transmission Owner	ITC Midwest
State/County	MN

2)

MISO Study Status (ongoing, completed, etc.)	DPP SIS + Phase I Facilities Study Completed; Phase II Facilities Study ongoing, but expected soon
Has MISO deliverability study been completed?	Yes
Identify MW NRIS and MW ERIS from study	145.96 MW NRIS and 200 MW ERIS
Conditions for NRIS and date NRIS effective	Project will likely be granted NRIS under the MISO Interim Deliveriblity Process in the 2020 timeframe.

3) Generator Interconnection Agreement Information

GIA Execution Date	Not executed
Was GIA filed unexecuted (yes/no)	N/A
Is GIA provisional? (yes/no)	GIA will not be provisional
Status of project (under construction, operating, etc.)	Development
Is the project in service? (yes/no)	No
COD (actual or proposed)	12/15/2020

4) MISO document links (provide URL for the following or attach hard copy if not publically available)

System Impact Study or Restudies	See Attachments D1 and D2 to this response.
Facility Studies	Not complete at this time
Optional or Other Studies	None
Generator Interconnection Agreement	Not complete at this time

5) Project Transmission Information

Location of collector substation (state/county)	Minnesota; Freeborn County
Location of Collector Station (Latitude/Longitude)	To be determined
Provide collector step-up transformer Rated MVA and Impedance on 100 MVA base	To be determined
Provide transmission line characteristics between collector substation and interconnection substation including length, conductor and impedance	Design for the 161 kV transmission line has not been completed at this time
Provide routing details, permit information or studies performed for transmission line between collector substation and interconnection substation	An approximately 5-mile, 161 kV transmission line connection is a necessary component of the wind farm project. Although the route for the line has not been finalized yet, it will require a High Voltage Transmission Line Route Permit from the MPUC. The HVTL Route Permit Application will be filed concurrently with the LWECS Site Permit application in the 2nd quarter of 2017.
Identify all equipment required to meet FERC Order Number 827 for Reactive Power Requirements for Non-Synchronous Generation and provide any supporting studies	To be determined
Provide power factor	To be determined
Total MW at Point of Interconnection (following all losses)	To be determined

6) Network Upgrade Information

Provide a list of all Network Upgrades, Affected System Upgrades and Shared Network Upgrades (as defined by MISO) included in your proposal that are required for interconnection	Rebuild Colby-NIW 161 kV Line, Replace Glenworth 161/69V Transformer, Upgrade PJM Wilton 765 kV Bus (19.85% Assigned to Freeborn; shared with J411, J298, J455)

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Provide cost estimates for the Network Upgrades, Affected System Upgrades and Shared Network Upgrades included in your proposal and identify whether these costs where shared with other MISO projects (i.e. J1234)	REDACTED
Provide a description and associated costs for all Interconnection Facilities included in your proposal that are required for interconnection	
Provide all studies supporting the Network Upgrades, Affected System Upgrades and Shared Network Upgrades included in your proposal that are required for interconnection	See MISO studies which are attached
Identify the MISO study group model used for the evaluation and list all MISO projects added or removed to the studies	N/A

7) Project Congestion/Curtailment Information

Provide CPNode or CPNodes nearest to plant for LMP analysis purposes.	ALTW.TOI
Provide an analysis and discussion of the issues surrounding congestion and expected curtailments pertaining to the project, or if this is an operating project, historical curtailment data for the project.	REDACTED

8) Wind Turbine Generator Information

Manufacturer	REDACTED
Model #	
Nameplate Capacity per Turbine (MW)	
Number of Turbines	
Turbine Voltage	
Turbine Type for generic dynamic stability models	
Turbine Step Up Transformer Rated MVA and Impedance on 100 MVA base	
Collector Voltage	

9) Point of Contact for Transmission Information

Contact Name	Randy Oye
Contact Phone Number	612-330-2886
Contact e-mail	randall.l.oye@xcelenergy.com

10) Proposed Bid Price Adjustment Mechanism for Transmission Cost Uncertainty

Bidder's estimated interconnection and/or upgrade cost included in bid price ($/MWH for PPA, $ for BOT)	REDACTED
Price reduction for each $1,000,000 in actual transmission interconnection or upgrade costs below bid price projection ($/MWH for PPA, $ for BOT)	
Price increase for each $1,000,000 in actual transmission interconnection or upgrade costs above bid price projection ($/MWH for PPA, $ for BOT)	

Project Financing, Credit Worthiness, and Legal Claims

1) Project Financing

Describe the financial and legal organizational structure including any subsidiaries. In addition please enclose an ownership structure showing the legal name and the percentage of ownership of each owner.	NSP will acquire 100% of the ownership interests in the project company holding the assets of the project. Following closing, the project company will be merged into NSP.
Describe the financing or funding plan, equity participants and any project financing guarantees.	NSP will own the 100% of project and will finance the acquistion utilizing existing financing sources. No project specific financing will be required.
	REDACTED
Disclose any threshold requirements that must be met prior to having access to the various components of the financing or funding plan described above.	
Do you foresee any issues in obtaining and maintaining a security fund per the requirements described in NSP's Model Wind Power Purchase Agreement (Attachment A) and NSP's Model Term Sheet for the Purchase and Sale of an Operational Wind Project (Attachment C)?	Because NSP would own the project, no security would be needed.
Please identify the guarantor	Not applicable
Provide the current credit rating of the guarantor.	Not applicable
Is the guarantor on credit watch?	Not applicable

2) Credit Worthiness

Describe any credit issues (e.g. bankruptcy, events of default, etc.) for any participant who will have a more than a 20% share of the equity position in the project.	None

3) Legal Claims

Disclose any past, current, or anticipated future litigation related to projects owned or managed by the bidder or any of its affiliates in the United States.	None

Siting Environmental - BOT

1) Project Description

Overview of Project	200 MW wind farm in Freeborn County, MN
Project Site Map and Geospatial Data : Illustrate physical location of project as related to other area features, including roads, county boundaries, State or Federal Owned properties and transmission facilities	See folder labeled 1.02 Project Site Map
Legal Description: Describe project location by Section(s), Township(s) and Range(s)	REDACTED
Timeline: Provide an overall project acquisition plan, permitting plan and schedule for the project.	

2) Site Control

REDACTED

Overall Land Lease and Acquisition Document Completeness: Provide an overview of the lease and acquisition process for turbine sites, access roads, collector lines. Include status of agreements (signed, in process, declined), timeline to complete and any potential issues and include on a corresponding map.	
Documents: Provide copies of all signed agreements, provide copies of any draft agreements, and any easement templates	
Existing Property Easements/Programs: Describe any parcels that have state or federal agency conservation easements, including the USFWS, state DNR, Dept of Agriculture Conservation Programs	
Other Agreements: Provide a discussion of additional agreement types other than Land Lease and Wind Easements and provide on map. (Example: Setback or Neighbor Agreements)	Neighbor Agreements are being pursued in order to include landowners in the project who are not opposed to the project, but are uninterested in hosting a turbine or other improvements. The Neighbor Agreement reduces applicable setback requirements. There are currently 38 Neighbor Agreements signed for this project with additional agreements to be pursued, if necessary. Refer to folder 2.04 Other Agreements for "Freeborn - Neighbor Agreement - Template"
Records Related to Land Owner Meetings: Provide landowner diaries	REDACTED

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NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

Siting Environmental - BOT

Itemized Costs of Long-term Land Leases For the Site: Provide overview of the long term payment commitments to landowners	REDACTED
Land Ownership Agreements for O&M Building and Substation: Provide land ownership or option agreements for O&M building, substation, laydown yard, and batch plant.	
Non Participant Land Owner Risks: Provide overview of any known non-participants opposed to the project.	Refer to the declined section of "Freeborn - LASR Hybrid.pdf" document located in folder 2.01 Land Lease and Wind Easement Completeness for additional information related to non-participant landowners.
Land Title/Tax Risks: Provide an overview of any impacts to landowner tax payments that may fall to owner. Describe any potential title issues identified.	No property tax increase is expected for the landowners. The county assessor may assess a personal property tax on the Operator for wind farm improvements. The title work is currently in process. Issues identified through the title work will be cleared during Invenergy's title curative process.
Collector Lines and Substation: Provide copies of all signed agreements, provide copies of any draft agreements	The Agreement Regarding Easements grants the right to place collection lines on the property. Collection only easements may be pursued for landowners who are not interested in hosting a turbine.
Generation Tie Line: Provide copies of all signed agreements, provide copies of any draft agreements	See the Project Transmission Line Easement section below.
Project Transmission Line Easement: Complete list of Transmission Easement Agreements signed and targeted. Include copies of signed Transmission Easement Agreements and Transmission Easement compensation schedules	REDACTED
Underground Utility Crossing Risks: Please provide all consent agreements for all foreign utility crossings	

3) Local Permitting

Local Zoning/Permits: Provide an overview of any local zoning permit requirements, timeline to acquire, and the status of acquiring those permits.	REDACTED
Local Government Interactions: Provide an overview of local government interactions, describe any local support and include all correspondence from county and townships as well as project notes	During fall 2016, the project developer has met with all five of the townships in Freeborn County that would potentially host turbines as well as Freeborn County Administrator, Freeborn County Environmental Services Supervisor and Freeborn County Engineer. They were introductory meetings that sometimes produced questions and concerns and some not. We have also contacted Freeborn County Farm Services Agency director about getting Conservation Reserve Program mapping data (which is unavailable per 2008 Farm Act). Over the last 2 years Invenergy has met with members of the local government in various informal capacities where no official correspondence exists. In early November 2016, the project developer held a meeting in Northwood, Iowa with the Worth County Commissioners, Worth County Engineer and representatives from both Grove and Deer Creek townships.

Siting Environmental - BOT

Roadway Improvement Agreements: Provide a summary of any discussions with the local governments regarding road use and commitments to repair after construction. Include any draft or final documents.	REDACTED

4) State Permits, Overall Permit Requirements

State Site Permits: Provide an overview of any State Site permit requirements and the status of acquiring those permits	REDACTED
Overall State Permit Document Completeness: Please provide Site Permit application and supporting data.	
Permitting Analysis: Provide an analysis of all permits required for the project, including, but not limited to any state permits, local permits, take permits, wetland permits, stream crossing permits, storm water permits. Include timeline to acquire permits and expected cost.	

5) Environmental studies, agency consultation and permit analysis

Site Environmental Studies: Provide a general summary of environmental studies related to project.	REDACTED
Potential Project Risks: Provide a summary of any environmental permitting risks, possible impact to project and expected.	
Site Assessments: Provide any Phase I ESAs for the project.	
History and Background: Provide any past environmental issues related to the project site	None identified.
Cultural Resource Studies: Please provide copies of state historic preservation consultation and literature survey reports for the project.	REDACTED
Environmental Siting Analysis: Please provide copies Tier 1 and Tier 2 reports in accordance with USFWS Land Based Wind Energy Guidance	See folder 5.00 Environmental Reports, Document 5.5 Site Characterization Study for the Freeborn Wind Energy Project, Freeborn County, Minnesota, Final Report dated September 10, 2016, prepared by WEST, Inc.
Avian Studies: Please provide copies of avian surveys, or avian survey study plans, if completed. Provide any determinations that may require mitigation.	See folder 5.00 Environmental Reports, Document 5.9 Avian Use Study for the Freeborn Wind Energy Project, Freeborn County, Minnesota, Final Report January 2015 - March 2016, dated September 12, 2016, prepared by WEST, Inc.
Bat Studies: Please provide copies of bat surveys, or bat survey study plans, if completed.	See folder 5.00 Environmental Reports, Document 5.6 Bat Acoustic Study, Freeborn Wind Energy Project, Freeborn County, Minnesota, Final Report April 14 - November 14, 2015, dated September 9, 2016, prepared by WEST, Inc.
Raptor Studies: Please provide copies of raptor surveys, or raptor survey study plans, if completed.	See folder 5.00 Environmental Reports, Documents 5.3 and 5.7 Raptor Nest Survey, Freeborn Wind Energy Project, Freeborn County, Minnesota, Final Report March 20 - August 12, 2015, dated September 2, 2016, prepared by WEST, Inc. Raptor and eagle-specific assessment included in Avian Use Study report by WEST, Inc.

Siting Environmental - BOT

REDACTED

T&E and State Projected Species: Please provide copies of T&E and T&E Critical Habitat surveys completed. Provide a summary of any T&E species that may require additional follow-up work or mitigation	
Agency Consultation: Provide status of discussions with permitting agencies including those listed in this section.	Formal consultation will be carried out as part of the site permitting process; some coordination has occurred with individual agencies (see below).
USFWS Consultation: Provides copies of all USFWS correspondence to date	Invenergy has met with USFWS on four occasions (most recently in Summer 2016) to discuss the project. See folder 5.00 Environmental Reports, Folder 5.11
State DNR Consultation: Provides copies of all State DNR correspondence to date	Invenergy has met three times with DNR staff to discuss the project. See folder 5.00 Environmental Reports, Folder 5.10. NHIS query results dated March 26, 2015. See folder 5.00 Environmental Reports, Document 5.2. Preliminary review letter dated March 18. 2015. See folder 5.00 Environmental Reports, Document 5.1
Army Corps of Engineers: Please provide any 404 jurisdictional determination obtained by the project, if needed.	Dependent on outcome of wetland surveys.
Wetlands: Provide an overview of potential wetland impacts and any completed wetland delineation reports	Wetland delineations pending layout; See folder 5.00 Environmental Reports, Document 5.4 Preliminary Water Resource Evaluation, Freeborn Wind Energy Project, Freeborn County, MN, Final Report April 9, 2015, prepared by WEST, Inc.
Noise Model: Please provide any noise modeling report developed for the project.	Will be completed in early 2017 as part of site permitting process.
Flicker Studies: Provide any flicker studies	Will be completed in early 2017 as part of site permitting process.
Other Environmental Issues and Risks: Provide a summary and documentation regarding any other potential environmental concerns or risks.	None identified.

6) Geospatial Data

Provide the following information in ESRI GIS Shape files. This list may include information previously identified.

Project Boundaries	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.01 Project Boundaries.
Site and Turbine Layout	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.02 Site and Turbine Layout.
Turbine Coordinate Information - Location of generation tie	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labled 6.03 Turbine Coordinate Information
Access roads	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. Access road locations pending layout.
Site substation, feeder lines and Gen-tie	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. Site substation, feeder lines and Gen-Tie pending layout.
Site layout design optimization potential	The site will be optimized based on specific wind resource characteristics, turbine technology and environmental constraints. We will be working with developers, wind consultants and turbine suppliers to fully explore the optimization potential of the project site. We will drive the design optimization process during the development and implementation phase of the project, in order to maximize the value of the asset for our customers.
Unique Site features and Setback risks - Identify acquired easements, expired easements	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. For unique site features and setbacks, see folder labeled 6.07; for land status see folder labeled 6.08 Lease and Easement Polygons.
Lease & Easement polygons	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.08 Lease and Easement Polygons.
Collector and transmission line locations	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. Collector and transmission line locations pending layout.
Environmental data	Xcel Energy has received all relevant shapefiles from the project developer, and can send individual files upon request. See folder labeled 6.10 Environmental Data.

7) Legal Claims

Disclose any past, current, or anticipated future litigation related to projects owned or managed by the bidder or any of its affiliates in the United States.	None.

Report Number: R022-16

MISO DPP 2015 February West Area Study

Prepared for

MISO

Submitted by:
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William Wang, Consultant
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05/25/2016

Siemens PTI Project Number 62OT-001277

Revision History

Date	Rev.	Description
05/25/2016	A	Initial Draft

Contents

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Executive Summary

This report presents results of a System Impact Study (SIS) performed to evaluate the interconnection of the DPP 2015 February West Area Group (DPP West Area) generating facilities. The results for 2025 scenario are summarized below, and the results for the 2018 scenario can be found in Appendix L.

1.1 Project List

The DPP West Area study group has ten (10) generation projects with a combined nameplate rating of 1325.5 MW. The DPP West Area generating facilities are listed in Table ES-1. The approximate location of each Point of Interconnection (POI) is shown in Appendix B.3.

Table ES-1: Generating Facilities in DPP 2015 February West Area Group

MISO Project #	Service Type	TO	County, State	Point Of Interconnection	Fuel Type	Max Output	SH Output	SPK Output	Stability Output
G736	NR	OTP	Grant, SD	Big Stone South 230kV sub	Wind	200	200	40	200
J299	ER	Xcel	Blue Earth, MN	Wilmarth sub	CC	73	36.5	73	73
J385	NR	Xcel	Chisago, MN	Chisago 115 kV sub	Solar	100	0	100	100
J391	NR	MRES	Lyon, MN	MMU's N 7th Street sub	CT	50	0	50	50
J400	NR	Xcel	Lyon, MN	Lyon County 115kV sub	Solar	62.5	0	62.5	62.5
J405	NR	MDIU	Richland, MT	Lewis & Clark Jct sub	CT	40	0	40	40
J407	NR	ITCM	Freeborn, MN	Glenworth 161 kV Sub	Wind	200	200	40	200
J411	NR	MEC	Ida, IA	Lehigh-Raun 345 kV Line	Wind	300	300	60	300
J416	NR	ITCM	Franklin, IA	Emery-Blackhawk 345 kV Line	Wind	200	200	40	200
J426	NR	Xcel	Pipestone, MN	Chanarambie 34.5 sub	Wind	100	100	20	100

1.2 Total Network Upgrades for all Projects

The cost allocation of Network Upgrades for the study group reflects responsibilities for mitigating system impacts based on Interconnection Customer-elected level of Network Resource Interconnection Service as of the System Impact Study report date. The total cost of network upgrades in the interconnection plan required for each generation project is listed in Table ES-2 for the 2025 scenario. The costs for Network Upgrades are planning level estimates and subject to be revised in the facility studies.

Table ES-2: Total Cost of Network Upgrades for Generation Projects in 2025 Scenario

Project Num	ERIS Network Upgrades ($)			NRIS Network Upgrades ($)	Interconnection Facilities ($)		Shared Network Upgrade	Total Cost ($)
	Steady-State & Voltage Stability	Transient Stability	Short-circuit	Deliverability	TO Network Upgrades	TO - Owned Direct assigned		
G736	$0	$0	$0	$0	$1,854,806	$351,391	$0	$2,206,197
J299	$0	$0	$0	$0	$0	$0	$0	$0
J385	$0	$0	$0	$0	$2,238,000	$260,000	$0	$2,498,000
J391	$0	$0	$0	$0	$17,000	$459,000	$0	$476,000
J400	$0	$0	$0	$0	$1,010,000	$261,000	$0	$1,271,000
J405	$0	$0	$0	$0	$0	$614,540	$0	$614,540
J407	$8,250,000	$0	$0	$2,500,000[1]	$477,461	$387,904	$0	$11,615,365
J411	$0	$0	$0	$0	$9,162,000	$860,000	$0	$10,022,000
J416	$0	$0	$0	$0	$10,119,531	$15,393,953	$0	$25,513,484
J426	$0	$0	$0	$0	$3,413,000	$1,816,000	$0	$5,229,000
Total ($)	**$8,250,000**	**$0**	**$0**	**$2,500,000**	**$28,291,798**	**$20,403,788**	**$0**	**$59,445,586**

Note 1: Final cost will be determined based on actual NRIS election.

The study was performed under the direction of MISO by Siemens PTI and an ad hoc study group. The ad hoc study group was formed to review the study scope, methodology, models and results. The ad hoc study group consisted of representatives from the interconnection customers and the following utility companies – Ameren, American Transmission Company, Basin Electric Power, Central Iowa Power Cooperative, City of Springfield (IL) Water Light & Power, Columbia (MO) Water and Light, Commonwealth Edison, Corn Belt Power Cooperative, Dairyland Power, Great River Energy, ITC Midwest, Lincoln Electric System, Manitoba Hydro, MidAmerican Energy Company, MISO, Minnesota Power, Minnkota Power, Missouri River Energy Services, Montana-Dakota Utilities Co., Muscatine Power & Water, Nebraska Public Power District, Northwestern Public Service, Omaha Public Power District, Otter Tail Power, PJM, Southern Illinois Power Cooperative, Southern Minnesota Municipal Power Agency, SPP, Western Area Power Administration, and Xcel Energy.

1.3 Per Project Summary

This section provides estimated cost of Network Upgrades on a per project basis for the 2025 scenario. The shared cost of Network Upgrades for all the generation projects are listed below.

The Interconnection Customers are only required to mitigate the constraints observed from the 2025 scenario. Constraints that are mitigated by modeling the entire Multi Value Project portfolio do not require mitigation. However, if there are near term stability constraints and the

Interconnection Customers desire to bring the projects online earlier, then a near term stability study will be required and further mitigation may be needed.

1.3.1 G736 Summary

Network Upgrade	Cost	G736
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

1.3.2 J299 Summary

Network Upgrade	Total Cost	J299
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

1.3.3 J385 Summary

Network Upgrade	Total Cost	J385
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

1.3.4 J391 Summary

Network Upgrade	Total Cost	J391
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

1.3.5 J400 Summary

Network Upgrade	Cost	J400
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

1.3.6 J405 Summary

Network Upgrade	Cost	J405
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

1.3.7 J407 Summary

Network Upgrade	Cost	J407
631036 NIW 5 161 631202 COLBY5 161 1	$8,250,000	$8,250,000
Total Cost Per Project for ERIS for each Project		**$8,250,000**

1.3.8 J411 Summary

Network Upgrade	Cost	J411
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

1.3.9 J416 Summary

Network Upgrade	Cost	J416
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

1.3.10 J426 Summary

Network Upgrade	Cost	J426
Not Required	$0	$0
Total Cost Per Project for Actual NRIS Elections for each Project		**$0**

1.4 Study Compliance with NERC FAC-002-2 Standard

This DPP 2015 February West Area study was completed in compliance with NERC FAC-002-2:

R1.1: The reliability impact of the new interconnection, or materially modified existing interconnection, on affected system(s).

Section 2 covers steady-state analysis results which include thermal and voltage constraints impacted by the DPP West Area generating facilities. Thermal and voltage upgrades required to interconnect the new generating facilities are also identified.

Section 3.1 covers reliability impact of the new generating facilities in the CIPCO and MPC affected systems. Network Upgrades required to interconnect the new generating facilities are also identified.

Section 3.2 covers reliability impact of the new generating facilities in the PJM affected systems. Network Upgrades required to interconnect the new generating facilities are also identified.

Section 3.3 covers reliability impact of the new generating facilities in the SPP affected systems.

Section 4 covers transient stability analysis results. No additional Network Upgrades are required for transient stability in the 2025 scenario.

Section 5 covers voltage stability (PV) analysis on the MWEX System Operating Limit (SOL) under the AS King-Eau Claire-Arpin 345 kV line contingency. No additional Network Upgrades are required.

Section 6 covers short circuit reliability impact of the new generating facilities.

Section 7 covers Deliverability reliability impact of the new NRIS generating facilities.

R1.2: Adherence to applicable NERC Reliability Standards; regional and Transmission Owner planning criteria; and Facility interconnection requirements.

Sections 2.3-2.5, Section 3, and Section 4 all cover NERC Reliability Standard TPL-001-4.

Section 3.1 covers CIPCO and MPC's Local Planning Criteria (LPC).

Section 3.2 covers PJM system planning criteria.

Section 3.3 covers SPP system planning criteria.

Section 5 (voltage stability analysis) covers individual system planning criteria (ATC).

Section 7 covers MISO system planning criteria.

R1.3: Steady-state, short-circuit, and dynamics studies, as necessary, to evaluate system performance under both normal and contingency conditions.

Section 2 covers MISO steady-state assessment including NERC category P0 to P7 contingencies (TPL-001-4).

Section 3.1 covers CIPCO and MPC's LPC steady-state assessment including NERC category P0 to P7 contingencies (TPL-001-4).

Section 3.2 covers PJM steady-state assessment including NERC category P0 to P7 contingencies (TPL-001-4).

Section 3.3 covers SPP steady-state assessment including NERC category P0 to P7 contingencies (TPL-001-4).

Section 4 covers transient stability studies under NERC category P0 to P7 contingencies (TPL-001-4).

Section 6 covers short-circuit assessment.

Section 7 covers MISO deliverability study (steady-state assessment) including NERC category P0 to P7 contingencies (TPL-001-4).

R1.4: Study assumptions, system performance, alternatives considered, and coordinated recommendations. While these studies may be performed independently, the results shall be evaluated and coordinated by the entities involved.

Section 2.2, Section 2.3, Section 2.4, Section 2.5, Section 4.2, Section 4.3, and Section 4.4 cover study assumptions and system performance criteria.

Alternatives considered can be found in Appendix L (2018 scenario).

Jointly coordinated recommendations can be found in Sections 3.1 (MISO, CIPCO, and MPC), Section 3.2 (MISO and PJM), Section 3.3 (MISO and SPP), and Section 5 (MISO and ATC). Results in Section 2, 3, 4, 6, and 7 have also been reviewed by PJM, SPP, CIPCO, and MPC.

Section
1

Introduction

Ten (10) generation projects, listed in Appendix A.1, Table A-7, have requested to interconnect to the MISO transmission network in the West Area and have advanced to the Definitive Planning Phase (DPP) 2015 February study (DPP West Area). Generating facility J299 has requested Energy Resource Interconnection Service (ERIS), and other generating facilities have requested both ERIS and Network Resource Interconnection Service (NRIS).

This report presents the study results of a System Impact Study (SIS) performed to evaluate the interconnection of the generating facilities in the DPP West Area group.

The study was performed under the direction of MISO by Siemens PTI and an ad hoc study group. The ad hoc study group was formed to review the study scope, methodology, models and results. The ad hoc study group consisted of representatives from the interconnection customers and the following utility companies – Ameren, American Transmission Company, Basin Electric Power, Central Iowa Power Cooperative, City of Springfield (IL) Water Light & Power, Columbia (MO) Water and Light, Commonwealth Edison, Corn Belt Power Cooperative, Dairyland Power, Great River Energy, ITC Midwest, Lincoln Electric System, Manitoba Hydro, MidAmerican Energy Company, MISO, Minnesota Power, Minnkota Power, Missouri River Energy Services, Montana-Dakota Utilities Co., Muscatine Power & Water, Nebraska Public Power District, Northwestern Public Service, Omaha Public Power District, Otter Tail Power, PJM, Southern Illinois Power Cooperative, Southern Minnesota Municipal Power Agency, SPP, Western Area Power Administration, and Xcel Energy.

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Section
2

Steady-State Analysis

Steady-state analysis was performed to identify thermal and voltage upgrades required to interconnect the generating facilities in the DPP 2015 February West Area group to the transmission system.

2.1 Study Procedure

2.1.1 Computer Programs

Steady-state analyses were performed using PSS®E version 32.2.4 and PSS®MUST version 12.0.

2.1.2 Study Methodology

Study cases representing near-term (2018) and out-year (2025) summer shoulder (SH) and summer peak (SPK) system conditions with generating facilities in the DPP 2015 February West Area group were created from the models used for the MISO DPP 2014 August West Area study. Benchmark cases were created by removing the DPP West Area generating facilities from the study cases. Nonlinear (AC) contingency analysis was performed on the benchmark and study cases, and the incremental impact of the DPP West Area generating facilities was evaluated by comparing the steady-state performance of the transmission system in the benchmark and study cases. Network upgrades were identified to mitigate any constraints.

2.2 Model Development

2.2.1 Study Cases

Power flow study cases representing near-term (2018) and out-year (2025) summer shoulder and summer peak conditions were developed from the DPP 2014 August West Area study models.

The study cases for DPP 2015 February study were created as follows:

- DPP 2012 August generation projects in Appendix A.6 were modeled and dispatched. The output was sunk to the MISO market (Appendix A.14, Table A-32), where generation was scaled in proportion to Pgen – Pmin.
- Network Upgrades (NU) required for generation projects in the DPP 2012 August West Area study group were modeled (Appendix A.7).
- DPP 2013 February generation projects in Appendix A.5 were modeled and dispatched. The output was sunk to the MISO market, where generation was scaled in proportion to Pgen – Pmin.

- Network Upgrades (NU) required for generation projects in the DPP 2013 February West Area study group were modeled (Appendix A.8).
- DPP 2013 August generation projects in Appendix A.4 were modeled and dispatched. The output was sunk to the MISO market, where generation was scaled in proportion to Pgen – Pmin.
- Network Upgrades (NU) required for generation projects in the DPP 2013 August West Area study group were modeled (Appendix A.9).
- DPP 2014 February generation projects in Appendix A.3 were modeled and dispatched. The output was sunk to the MISO market, where generation was scaled in proportion to Pgen – Pmin.
- Network Upgrades (NU) required for generation projects in the DPP 2014 February West Area study group were modeled (Appendix A.10).
- DPP 2014 August generation projects in Appendix A.2 were modeled and dispatched. The output was sunk to the MISO market, where generation was scaled in proportion to Pgen – Pmin.
- Network Upgrades (NU) required for generation projects in the DPP 2014 August West Area study group were modeled (Appendix A.11).
- DPP 2015 February generation projects in the Central Area (Table A-3), ATC Area (Table A-4), Michigan Area (Table A-5), and South Area (Table A-6) were modeled and dispatched. The output was sunk to the MISO market, where generation was scaled in proportion to Pgen – Pmin.
- DPP 2015 February generation projects in the West Area (DPP West Area, Table A-1) were modeled and dispatched. The output was sunk to the MISO market, where generation was scaled in proportion to Pgen – Pmin.
- PJM generation projects (Appendix A.12, Table A-29) were modeled and dispatched. Their required Network Upgrades (Table A-30) were also modeled. The generation output was sunk to the PJM market (Appendix A.15, Table A-33), where generation was scaled in proportion to Pgen – Pmin.
- The Briggs Road – North Madison – Cardinal 345 kV line (MVP project) was also included in the 2018 models; the Briggs Road-Cardinal 345 kV line project has an in-service date of 12/31/2018.
- Models were further reviewed by the Ad Hoc study members (transmission owners and customers). Model corrections and changes were made based on the comments and feedback. These modeling changes are listed in Appendix A.13.
- Adjusted Square Butte DC to match the total output of the Bison wind farms.
- Adjusted CU DC to match the total output of Coal Creek generation units #1 and #2.
- Set MHEX interface transfer level at 1848 MW for 2018 cases; Set MHEX interface transfer level at 2431 MW for 2025 cases.

The study power flow cases were solved with transformer tap adjustment enabled, area interchange disabled, phase shifter adjustment enabled and switched shunt adjustment enabled.

The interface transfer levels in the 2018 and 2025 study cases are summarized in Table 2-1.

Table 2-1: Interface Transfer Levels in 2018 & 2025 Steady State Study Cases

Interface	2018 SH Case (MW)	2018 SPK Case (MW)	2025 SH Case (MW)	2025 SPK Case (MW)
MHEX	1848	1848	2431	2430
MWEX	1470	582	1543	599
Arrowhead – Stone Lake 345 kV	609	219	683	260

2.2.2 Benchmark Cases

Benchmark cases are used to benchmark system performance without the DPP West Area generating facilities, and were created by removing the DPP West Area generating facilities from the study cases. The MISO market was used for power balance, where generation was scaled in proportion to Pmax - Pgen.

2.3 Contingency Criteria

A variety of contingencies were considered for steady-state analysis:

- NERC Category P0 with system intact (no contingencies)
- NERC Category P1 contingencies
  - NERC Category P1 contingencies, at buses with a nominal voltage of 69 kV and above, in the following areas: CWLD (area 333), AMMO (area 356), AMIL (area 357), CWLP (area 360), SIPC (area 361), WEC (area 295), WEC MI (area 296), XCEL (area 600), MP (area 608), SMMPA (area 613), GRE (area 615), OTP (area 620), ITCM (area 627), MPW (area 633), MEC (area 635), MDU (area 661), MHEB (area 667), DPC (area 680), ALTE (area 694), WPS (area 696), MGE (area 697), UPPC (area 698), CE(area 222), NPPD (area 640), OPPD (area 645), LES (area 650), WAPA (area 652), AECI (area 330), MIPU(area 540), KCPL (area 541), KACY (area 542), INDN (area 545).
  - Multiple-element NERC Category P1 contingencies, in Dakotas, Illinois, Iowa, Manitoba, Minnesota, Missouri, and Wisconsin. These specified Category P1 contingencies are listed in Appendix A.17.
- NERC Category P2-P7 contingencies
  - Selected NERC Category P2-P7 contingencies provided by the Ad Hoc Study Group, in the study region of Dakotas, Illinois, Iowa, Manitoba, Minnesota, Missouri, and Wisconsin. These specified Category P2-P7 contingencies are listed in Appendix A.17.

For all contingency and post-disturbance analyses, cases were solved with transformer tap adjustment enabled, area interchange adjustment disabled, phase shifter adjustment disabled (fixed) and switched shunt adjustment enabled.

2.4 Monitored Elements

The study area is defined in Table 2-2. Facilities in the study area were monitored for system intact and contingency conditions. Under NERC category P0 conditions (system intact) branches were monitored for loading above the normal (PSS®E rate A) rating. Under NERC category P1-P7 conditions, branches were monitored for loading as shown in the column labeled "Post-Disturbance Thermal Limits".

Table 2-2: Monitored Elements

Owner / Area	Monitored Facilities	Thermal Limits [1]		Voltage Limits [2]	
		Pre-Disturbance	Post-Disturbance	Pre-Disturbance	Post-Disturbance
AECI	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
AMIL	69 kV and above	100% of Rate A	100% of Rate B	1.05/1.0	1.05/0.95
AMMO	69 kV and above	100% of Rate A	100% of Rate B	1.05/1.0	1.05/0.95
ATCLLC	69 kV and above	95% of Rate A	95% of Rate B	1.05/0.95	1.1/0.9
CWLD	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
CWLP	69 kV and above	100% of Rate A	100% of Rate B	1.05/1.0	1.05/0.95
CE	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
DPC	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
GRE	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.92
INDN	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
ITCM	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/1.07/0.93
KACY	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
KCPL	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
LES	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
MDU	57 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
MEC	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.96/0.95	1.05/0.94/0.93
MHEB	69 kV and above	100% of Rate A	100% of Rate B	1.12/1.1/1.07/1.05/1.04/ 0.99/0.97/0.96/0.95	1.15/1.1/0.94/0.9
MIPU	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
MP	69 kV and above	100% of Rate A	100% of Rate B	1.05/1.0	1.1/0.95
MPW	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.06/0.92
NPPD	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
OPPD	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
OTP	40 kV and above	100% of Rate A	100% of Rate B	1.07/1.05/0.97	1.1/0.92
PPI	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.05/0.95
SIPC	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.05/0.91
SMMPA	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
WAPA	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.1/0.9
XEL	69 kV and above	100% of Rate A	100% of Rate B	1.05/0.95	1.05/0.92

Notes
1: PSS®E Rate A, Rate B or Rate C
2: Limits dependent on nominal bus voltage

2.5 Performance Criteria

A branch is considered as a thermal injection constraint if the branch is loaded above its applicable normal or emergency rating for the post-change case, and any of the following conditions are met:

1) the generator (NR/ER) has a larger than 20% DF on the overloaded facility under post contingent condition or 5% DF under system intact condition, or
2) the megawatt impact due to the generator is greater than or equal to 20% of the applicable rating (normal or emergency) of the overloaded facility, or
3) the overloaded facility or the overload-causing contingency is at generator's outlet.

A bus is considered a voltage constraint if both of the following conditions are met. All voltage constraints must be resolved before a project can receive interconnection service.

1) the bus voltage is outside of applicable normal or emergency limits for the post-change case, and
2) the change in bus voltage is greater than 0.01 per unit.

All DPP 2015 February study generators must mitigate thermal injection constraints and voltage constraints in order to obtain unconditional Interconnection Service.

Further, all generators requesting Network Resource Interconnection Service (NRIS) must mitigate constraints found by using the deliverability algorithm, to meet the system performance criteria for NERC category P0-P1 and selected P2-P7 events, if the constraint demonstrates an incremental flow caused by the generator equal to or greater than 5% of the generator's maximum dispatch level in each case.

2.6 Reactive Power Requirement Analysis

FERC Order 661-A dictates the required performance characteristics of wind farms for low voltage ride through and reactive power support. An analysis was performed to study the reactive power requirement for each wind generation project and solar generation project in the DPP West Area group. The analysis was performed as follows:

- Set the reactive power limits of wind and solar generation projects to 0 MVAR.
- Check if voltages in the area around each wind and solar generation project remain within the range required by TOs for category A conditions and for loss of outlet facilities;
- If voltages remain within range, then no specific reactive power range is required. If voltages do not stay within the range, then a power factor range of +/- 0.95 is required.

2.6.1 Reactive Power Requirements for 2018

Details of reactive power requirement analysis results for the 2018 scenario can be found in Appendix C.1.

2.6.2 Reactive Power Requirements for 2025

Appendix C.2 lists reactive power requirement analysis results in the 2025 scenario. The results are summarized as following:

- Low voltage violations were observed in the areas of G736 and J411. Projects G736 and J411 are required to have ±0.95 power factor to meet FERC Order 661-A.

- No specific reactive power range is required for renewable generation projects J385, J400, J407, J416, or J426 to meet FERC Order 661-A.

2.7 2018 Contingency Analysis Results

Details of contingency analysis results for the 2018 scenario can be found in Appendix L.3.

2.8 2025 Contingency Analysis Results

The incremental impact of the proposed interconnection on individual facilities was evaluated by comparing flows and voltages between benchmark cases (without DPP West Area projects) and study cases (with DPP West Area projects). Analysis was performed in the 2025 summer shoulder and summer peak scenarios using PSS®E and PSS®MUST.

2.8.1 2025 Summer Shoulder Contingency Analysis Results

2.8.1.1 System Intact Conditions

No thermal or voltage constraints were identified for NERC category P0 (system intact) conditions (Table E-1, Table E-2).

2.8.1.2 Post Contingency Conditions

The results in this Section are for analysis of conditions following NERC Category P1-P7 contingencies. All category P1 contingencies were converged.

Six category P2-P7 contingencies (Table E-5) were not converged. They were not converged in the benchmark or study cases. No mitigation plan is required for the study projects for these contingencies.

For contingencies in the 2025 summer shoulder scenario, thermal constraints are listed in Table E-3. No voltage constraints were identified (Table E-4).

2.8.1.3 Worst Thermal Violations

Table 2-3 lists worst thermal constraints in the 2025 summer shoulder scenario.

Table 2-3: 2025 Shoulder Thermal Constraints, Maximum Screened Loading

Constraint	Rating	Owner	Worst Loading (MVA)	Worst Loading (%)	Contingency	Cont Type	Generator
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	272.6	136.3	ITCM-B110-NW HAYWD#28 69.0 - HAYWD#25 161 1 HAYWD#25 161 - GLENWRTH5 161 1 MURPHY CR 5 161 - HAYWD#25 161 1	P1	J407
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	272.6	136.3	P22:161:ITCM:HAYWD#25 L2:MN HAYWD#25 161 - HAYWD#15 161 1 HAYWD#25 161 - GLENWRTH5 161 1 MURPHY CR 5 161 - HAYWD#25 161 1 HAYWD#28 69.0 - HAYWD#25 161 1	P2-P7	J407

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NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

2.8.2 2025 Summer Peak Contingency Analysis Results

2.8.2.1 System Intact Conditions

No thermal or voltage constraints were identified for NERC category P0 (system intact) conditions (Table E-7, Table E-8).

2.8.2.2 Post Contingency Conditions

The results in this Section are for analysis of conditions following NERC Category P1-P7 contingencies. All category P1 contingencies were converged.

Six category P2-P7 contingencies (Table E-11) were not converged. They were not converged in the benchmark or study cases. No mitigation plan is required for the study projects for these contingencies.

No thermal or voltage constraints were identified in the 2025 summer peak scenario (Table E-9, Table E-10).

2.9 Network Upgrades Identified in MISO ERIS Analysis for 2025 Scenario

Based on the MISO steady state analyses, the highest loading of each facility that violates criteria in the 2025 scenario (SH, SPK) is shown in Table 2-4. Potential network upgrades are also included.

Costs of the network upgrades identified in the MISO steady state analysis for the 2025 scenario are listed in Table 2-5.

Table 2-4: Network Upgrades for Thermal Constraints in 2025 Scenario, Maximum Screened Loading

Generator	Constraint	Rating	Owner	Worst Loading (MVA)	Worst Loading (%)	Contingency	Cont Type	Scenario	Mitigation
J407	NIW-Colby 161 kV	200.0	ITCM	272.6	136.3	ITCM-B110-NW HAYWD#28 69.0 - HAYWD#25 161 1 HAYWD#25 161 - GLENWRTH5 161 1 MURPHY CR 5 161 - HAYWD#25 161 1	P1	2025 SH	Rebuild ~7.6 miles of 161 kV with T2-795 ACSR. Rating would be 335 due to terminal limit at NIW.
J407	NIW-Colby 161 kV	200.0	ITCM	272.6	136.3	P22:161:ITCM:HAYWD#25 L2:MN HAYWD#25 161 - HAYWD#15 161 1 HAYWD#25 161 - GLENWRTH5 161 1 MURPHY CR 5 161 - HAYWD#25 161 1 HAYWD#28 69.0 - HAYWD#25 161 1	P2-P7	2025 SH	Rebuild ~7.6 miles of 161 kV with T2-795 ACSR. Rating would be 335 due to terminal limit at NIW.

Table 2-5: Network Upgrades and Cost Identified in MISO Steady State Analysis for 2025 Scenario

Constraint	Owner	Mitigation	Cost ($)
NIW-Colby 161 kV	ITCM	Rebuild ~7.6 miles of 161 kV with T2-795 ACSR. Rating would be 335 due to terminal limit at NIW.	$8,250,000

Section
3

Affected System Steady-State Analysis

Steady state analyses were performed to identify constraints on affected systems.

3.1 Local Planning Criteria Analysis for CIPCO and MPC Companies

Per CIPCO and MPC's Local Planning Criteria (LPC), transmission facilities which meet all of the following three (3) conditions are considered as constraints:

1) the branch is loaded above its applicable normal or emergency rating for the post-change case, and
2) the generator has a larger than 3% DF on the overloaded facility under post contingent condition or 5% DF under system intact condition, and
3) the loading increase of the overloaded facility is greater than 1 MVA compared with that in the pre-change case under system intact or contingency conditions.

AC contingency analysis was performed for this LPC analysis, using the DPP 2015 February West Area benchmark (pre-change) cases and post-DPP 2015 February study (post-change) cases for the 2018 and 2025 summer peak and summer shoulder scenarios. All NERC category P0-P7 contingencies described in Section 2.3 were simulated. The CIPCO and MPC affected systems were monitored.

The additional thermal constraints in the affected systems identified in this LPC analysis are listed in Appendix F.1. These include the thermal constraints for the 2018 and 2025 summer peak and shoulder scenarios. Whether these constraints will be mitigated or not will be determined by the affected transmission owning company's local planning criteria.

The highest loading of CIPCO and MPC thermal constraints and potential network upgrades are listed in Table 3-1 for the 2025 summer shoulder scenario. No CIPCO or MPC's thermal constraints were identified in the 2025 summer peak scenario.

Table 3-1: Thermal Constraints Identified in LPC Analysis and their Highest Loadings in 2025 SH Scenario

Constraint	Rating	Owner	Worst Loading		Cont Type	Generator	Mitigation	Cost ($)
			(MVA)	(%)				
631100 LIBERTY5 161 631159 HCKRYCK5 161 1	223.0	CIPCO ITCM	223.4	100.2	P1	J407, J416	CIPCO: No Mitigation needed	$0

3.2 PJM Affected System AC Contingency Analysis

The PJM affected system analysis details can be found in Appendix F.2.

3.2.1 Study Methodology

PJM performed the contingency analysis to evaluate the impact of MISO DPP 2015 February generating facilities on PJM systems.

The analyses were performed in both PJM summer peak case (PJM AA1 Queue SIS 2018 Summer Peak case) and light load case (PJM AA1 Queue SIS 2018 Light Load case). All DPP 2015 February and DPP 2015 August generation projects and previous DPP generation projects were added to the cases. PJM performed contingency analyses with all PJM category P1, P2, P4, and P7 contingencies.

3.2.2 Study Results

3.2.2.1 Summer Peak Analysis Results

In the summer peak scenario, PJM impacts were identified for the J407, J411, and J416 generation project in DPP 2015 February West Area study group. Details are in Table 3-2.

3.2.2.2 Light Load Analysis Results

In the light load scenario, no PJM impacts were identified in the DPP 2015 February West Area study group.

3.2.3 Study Summary

Three projects J407, J411, and J416 in the MISO DPP 2015 February West Area group contribute loading to three overloads in the PJM system. These three projects can wait until B2692.1 & B2692.2 are placed into service or the projects can pay an advancement cost to place B2692.1 & B2692.2 into service earlier, if feasible per ComEd.

Table 3-2: PJM Impacts in Summer Peak

Impacted PJM Facility	Rating	AC %	Cont Label	Mitigations	Cost ($)	Impacting GI Projects	Project Mitigation Option
Cordova-Nelson 345 kV	1528	108.42%	345-L0404___-R	Existing PJM baseline upgrades B2692.1 & B2692.2 are planned to be put into service by summer 2019. B2692.1 & B2692.2 will upgrade the Cordova-Nelson 345 kV line. The new line ratings will be 1679/2058/2280 MVA (SN/SE/SLD).	NA	J407, J411, J416	These projects can wait until B2692.1 & B2692.2 are placed into service or the projects can pay an advancement cost to place B2692.1 & B2692.2 into service earlier, if feasible per ComEd.
Quad Cities–ESS H471 345 kV	1528	108.39%	345-L15503_B-R	Existing PJM baseline upgrades B2692.1 & B2692.2 are planned to be put into service by summer 2019. B2692.1 & B2692.2 will upgrade the Cordova-Nelson 345 kV line. The new line ratings will be 1679/2058/2280 MVA (SN/SE/SLD).	NA	J407, J411, J416	These projects can wait until B2692.1 & B2692.2 are placed into service or the projects can pay an advancement cost to place B2692.1 & B2692.2 into service earlier, if feasible per ComEd.
ESS H471-Nelson 345 kV	1528	108.28%	345-L15503_B-R	Existing PJM baseline upgrades B2692.1 & B2692.2 are planned to be put into service by summer 2019. B2692.1 & B2692.2 will upgrade the Cordova-Nelson 345 kV line. The new line ratings will be 1679/2058/2280 MVA (SN/SE/SLD).	NA	J407, J411, J416	These projects can wait until B2692.1 & B2692.2 are placed into service or the projects can pay an advancement cost to place B2692.1 & B2692.2 into service earlier, if feasible per ComEd.

3.3 SPP Affected System AC Contingency Analysis

Southwest Power Pool (SPP) conducted an Affected System Interconnection System Impact Study to evaluate potential impacts to the SPP Transmission System related to the interconnection of generators on the Mid-Continent Independent System Operation (MISO) Transmission System.

Power flow analysis has indicated that for the power flow cases studied, the SPP Transmission System is impacted from the interconnection of the MISO DPP 2015 February cycle West Area generation. Impacts can be mitigated by the Gentleman Generation Station (GGS) – Thedford - Holt 345kV (R-Plan) transmission line, Nebraska City – Mullin Creek – Sibley 345kV transmission line, and certain terminal equipment and line upgrades for Western Area Power Administration (WAPA) facilities. Constraints identified on tie-line circuits between Western Area Power Administration and other MISO membership areas should be reviewed by MISO for potential MISO facilities' Network Upgrades required for mitigation. Within the scope of this affected system impact study, SPP coordinated with WAPA for planning level estimates for mitigation of constraints requiring transmission reinforcements and will require facilities studies analysis if the MISO Interconnection Request(s) impacting the SPP transmission system proceed forward.

Certain constraints identified can be mitigated with either previously approved SPP or MISO upgrades. These include the Gentleman Generation Station (GGS) – Thedford - Holt 345kV (R-Plan) transmission line, and Nebraska City – Mullin Creek – Sibley 345kV line, and MISO MVP projects, which are scheduled to be placed in service by 2019. Interconnection Service for these requests may need to be delayed until that time period.

Additional analysis is also required to determine the impacts of the future generator retirements on the SPP Transmission System. This analysis is presently being performed and SPP will update this report as those results become available.

If the Affected System Interconnection Requests proceed, additional analysis will be required through an Affected System Facility Study. The purpose of the Affected System Facility Study is to perform additional analysis required to refine the scope, cost estimates, and expected time of construction of system facilities identified as Network Upgrades that would be placed in service under the SPP Open Access Transmission Tariff.

The SPP affected system analysis results for this study are in Appendix F.3.

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Section
4

Stability Analysis

Stability analysis was performed to evaluate the transient stability and impact on the region of the generating facilities in the DPP 2015 February West Area group.

4.1 Procedure

4.1.1 Computer Programs

Stability analysis was performed using PSS®E revision 32.2.4.

4.1.2 Study Methodology

Study cases representing near-term (2018) and out-year (2025) summer shoulder (SH) conditions with generating facilities in the DPP 2015 February West Area group were created from the DPP 2014 August West Area study models. Benchmark cases were created by removing the DPP West Area generating facilities from the study cases. Disturbances were simulated to evaluate the transient stability and impact on the region of the generating facilities. If a simulation for the study case violates MISO transient stability criteria or local TOs' planning criteria, the simulation was repeated on the benchmark case to assess the impact of the generating facilities on the violation.

4.2 Case Development

4.2.1 Study Cases

Study cases representing near-term (2018) and out-year (2025) shoulder (SH) high transfer conditions were developed from the DPP 2014 August West Area study models.

The stability study cases for DPP 2015 February study were created as described in Section 2.2.1. The interface transfer levels are summarized in Table 4-1.

Table 4-1: Interface Transfer Levels in 2018 & 2025 Stability Study Cases

Interface	2018 SH Case (MW)	2025 SH Case (MW)
MHEX	1848	2432
MWEX	1628	1695
Arrowhead – Stone Lake 345 kV	675	741

4.2.2 Benchmark Cases

The DPP West Area generating facilities as described in Table A-1 (Appendix A.1) were removed from the study cases. MISO market was used for power balance, where generation was scaled in proportion to Pmax - Pgen.

4.3 Disturbance Criteria

The stability simulations performed as part of this study considered all the regional and local contingencies listed in Table 4-2. For local contingencies, generic clearing times (Table 4-3) were used, and local fault admittances for single line to ground faults (SLG) were estimated by assuming that the Thevenin impedance of the positive, negative and zero sequence networks at the fault point are equal.

Table 4-2: Regional and Local Disturbance Descriptions

Disturbance Name	Description	NERC Cat.	Area
0682_w_gre__c4__ei2_coalcreek	CU DC Permanent Bipole fault with tripping of both Coal Creek units	P7-2	GRE
0683_w_gre__c4__eis_coalcreek	permanent bipole fault on cu dc line; one Coal Creek unit tripped at 0.28 sec, both CU hvdc poles blocked	P7-2	GRE
0684_w_gre__c6__es1_stanton	SLG fault Stanton 230 kV; stuck breaker, clear fault trip Stanton generation and bus	P4-5	GRE
0685_w_gre__c6__fq1_coalcreek	SLG fault Coal Creek 230 kV; stuck breaker, trip Coal Creek unit 1, trip Coal Creek dc pole 2, ramp pole 1 to 500 MW	P4-5	GRE
0686_w_gre__c6__fq4_coalcreek	SLG fault Coal Creek 230 kV; stuck breaker, trip Coal Creek unit 1 and dc pole 2	P4-5	GRE
0687_w_gre__c6__fs4_coalcreek	SLG fault Coal Creek unit 1; stuck breaker, trip Coal Creek unit 1 and dc pole 2	P4-1	GRE
0688_w_gre__c6__fs5_coalcreek	SLG fault Coal Creek unit 1; stuck breaker, trip Coal Creek unit 1 and isolate CCS	P4-1	GRE
0689_w_gre__c7__eq1_coalcreek	SLGBF Coal Creek 230 kV; clear CU HVDC #1; Coal Creek Gen #2	P4-5	GRE
0690_w_gre__c7__gs1_at_stanton-coaltp_oos	5 cy SLGF at Stanton 230 KV on bus 1, brkr 31rb7 stuck. Clear at 15.5 cy by tripping faulted bus & Coal Creek-McHenry 230 kV line.	P4-5	GRE
0691_w_gre__c7__gu1_at_stanton-coaltp	5 cycle SLGF at Stanton 230 kV on unit 1, breaker 31rb2 stuck. Clear at 17 cycles by tripping unit 1 & Leland Olds tie.	P4-1	GRE
0692_w_gre__c8__er1_coalcreek-stkbrk	SLG fault Coal Creek 230 kV; stuck breaker, trip CCS 2 and runback CU pole 1 to 1/2 power	P4-5	GRE
0693_w_gre__c8__sb_gct_near_615295_gre-kohlmnlx	SLG fault near GRE-Kohlman Lake on the Kohlman Lake-Terminal 345 kV line; trip at 4 cyc; stuck breaker; generic clearing at 19.25 cyc	P4-2	GRE
0703_w_itcm_b2__arnold_hazleton	3PH fault at Arnold 345 kV bus with normal clearing on Arnold-Hazleton 345 kV line	P1-2	ITCM
0708_w_itcm_b2__cmvp_hazlton3_blackhaw_fr	3PH fault; generic clearing; on Hazleton-Blackhawk 345 kV; at Hazleton 345 kV	P1-2	ITCM
0709_w_itcm_b2__cmvp_hazlton3_blackhaw_to	3PH fault; generic clearing; on Hazleton-Blackhawk 345 kV; at	P1-2	ITCM

Disturbance Name	Description	NERC Cat.	Area
	Blackhawk 345 kV		
0713_w_itcm_b2__cmvp_limeck___emery____to	3PH fault; generic clearing; on Colby-Killdeer; at Killdeer 345	P1-2	ITCM
0715_w_itcm_b2__cmvp_winnebag_3pts_____to	3PH fault; generic clearing; on Huntley-Ledyard; at Ledyard 345	P1-2	ITCM
0717_w_itcm_c7__arn_haz_bk0710	SLG fault on Arnlod-Hazleton 345 kV w/ failed Arnold breaker 0710. Delayed clr Morgan Valley-Arnold 345kV, Arnold 345/161 kV	P4-2	ITCM
0719_w_itcm_c8__arnold_hazleton_bk4730	SLG fault at Arnold-Hazleton 345 kV w/ failed breaker 0710. Prior outage of Arnold-Fairfax 161 kV. Delayed clr Morgan Valley-Arnold 345 kV, 345/161 xfmr.	P4-2	ITCM
0724_w_itcm_c8__emery_cerro_gordo_bk5331	SLG fault on Emery-Cerro Gordo 161 kV with failed Emery breaker 5331. Delayed clearing on Emery CT1	P4-2	ITCM
0725_w_itcm_c8__emery_floyd_bk5337	SLG fault on Emery-Floyd 161 kV with failed Emery breaker 5337. Delayed clearing on Emery ST1	P4-2	ITCM
0726_w_itcm_c8__emery_lime_ck_bk5346	SLG fault on Emery-Lime Creek 161 kV 1 with failed Emery breaker 5346. Delayed clearing on Emery 161/69 kV	P4-2	ITCM
0727_w_itcm_c8__emery_sheffield_bk5334	SLG fault on Emery-Sheffield 161 kV with failed Emery breaker 5334. delayed clearing on Emery CT2	P4-2	ITCM
0729_w_itcm_c8__lansing_postville_bk471	SLG fault at Lansing-Postville 161 kV w/ failed breaker 471. Delayed clearing on Lansing 161/69 kV and Lansing unit 3.	P4-2	ITCM
0730_w_itcm_c8__lime_ck_barton_bk032	Near G735. SLG fault on Lime Creek-Barton 161 kV with failed Lime Creek breaker 032. Delayed clr on Lime Creek 161 kV bus 2	P4-2	ITCM
0731_w_itcm_c8__mitchell_adams_bk1130	Near G172. SLG fault on Mitchell-Adams 345 kV with failed Mitchell breaker 1130. Delayed clr on Mitchell unit G2	P4-2	ITCM
0735_w_itcm_c8__sb_gct_near_631157_g172_g1	SLG fault near 631157 G172_G1 on the Adams-Pleasant Valley 345 kV line; trip at 4 cyc; stuck breaker; generic clearing at 16 cyc	P4-2	ITCM
0736_w_itcm_c8__winnebago_faribault_bk797	Near G870. SLG fault on Winnebago-Faribault 161 kV with failed Winnebago breaker 797. Delayed clr on Winnebago 161 kV bus 2	P4-2	ITCM
0755_w_mec__b2__cmvp_obrien__kossuth_____to	3PH fault; generic clearing; on Obrien - Kossuth 345 kV; at Kossuth 345	P1-2	MEC
0756_w_mec__b2__cmvp_webster__kossuth_____fr	3PH fault; generic clearing; on Webster-Kossuth 345 kV; at Webster 345	P1-2	MEC
0757_w_mec__b2__cmvp_webster__kossuth_____to	3PH fault; generic clearing; on Webster-Kossuth 345 kV; at Kossuth 345	P1-2	MEC
0760_w_mec__c3__ia-n4-1c3_at_raun-sioux_city	3PH fault at Raun on Raun-Sioux City 345 kV line; prior outage of Obrien-Lakefield 345 kV line	P6	MEC
0761_w_mec__c3__ia-n4-2c3_at_raun-ft_calhoun	3PH fault at Raun on Raun-Ft. Calhoun 345 kV line; Prior outage of Raun-Hoskins 345 kV line	P6	MEC
0766_w_mec__c8__ia-n2-1c8_at_neal-raun	SLG fault at Neal North on Neal North-Raun 161 kV, stuck breaker; Trip Neal North-Raun @ 5 cycle, Delayed trip Neal 161-69 kV xfmr @ 16.5 cycle.	P4-2	MEC

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Disturbance Name	Description	NERC Cat.	Area
0767_w_mec__c8__ia-n4-1d_at_raun-highland	SLG fault at Raun on Raun-Highland 345 kV, stuck breaker; clear Raun-Lehigh 345 kV; prior outage of Raun-Sioux City 345 kV	Extreme	MEC
0771_w_mec__c8__sb_gct_near_635213_neal_3g	SLG fault @ Raun 345 kV on the Raun-Sub 3451 345 kV line; trip at 4 cyc; stuck breaker; generic clearing at 13.5 cyc	P4-2	MEC
0800_w_mp___b2__fds_sqbutte	5.0 cy 3PH fault at Square Butte 230 kV on Stanton line clear Square Butte end at 4 cy, Stanton end at 5 cy	P1-2	MP
0803_w_mp___b2__yb3_at_arrowhead-stonelk	3PH fault at Arrowhead 345 kV, clear the Arrowhead-Stone Lake 345 kV line	P1-2	MP
0810_w_mp___c8__yas_at_arrowhead	SLG fault at Arrowhead 230 kV on Arrowhead-Gardner Park ckt 1; Arrowhead breaker stuck, clear by tripping Arrowhead-Gardner Park bus section	P4-2	MP
0822_w_otp__b2__eb3_center	3PH Center 345 kV; clear Center-Jamestown 345 kV line	P1-2	OTP
0823_w_otp__b2__ec3_center	3PH Center 230 kV; clear Center-Heskett 230 kV line	P1-2	OTP
0824_w_otp__b2__el3_center	3PH Center 230 kV; clear Center-Square Butte 230 kV line	P1-2	OTP
0825_w_otp__b2__evs_sqbutte_dc	3PH Square Butte DC Pole #1; clear Square Butte DC Pole #1; Ramp Square Butte Pole 2 > 1100 Amps	P1-4	OTP
0826_w_otp__c7__eb4_at_center-jamestown	4.5 cy SLG fault at Center 345 kV on Jamestown line, Center breaker 3235 or 3245 stuck, clear Center at 12.5 cy, trip Coyote at 16 cy	P4-2	OTP
0829_w_otp__c7__fd1_sqbutte	SLGBF Square Butte 230 kV; Clear Square Butte end fault line; breaker 18 stuck, trip Square Butte-Stanton 230 at 11 cylces, ac feed to pole 2, pole 1 restart at 17 cycles	P4-2	OTP
0830_w_otp__c7__fd4_sqbutte_new	SLGBF Square Butte 230 kV; clear Square Butte end fault line; breaker 17 stuck, trip Square Butte-Stanton 230 kV, both dc poles restart at 17 cycles	P4-2	OTP
0831_w_otp__c8__ec1_center-heskett	SLG fault Center 230 kV; stuck breaker, block Square Butte at 6 cycles, trip Center-Heskett at 12 cycles, ramp down Square Butte at 17 cy	P4-5	OTP
0832_w_otp__c8__eg1_coalcreek-stanton	SLG fault Coal Creek 230 kV; stuck breaker, clear Underwood-Harvey 230 kV, Coal Creek-Underwood 230 kV, Stanton-Coal Creek 230 kV, isolate CCS	P4-5	OTP
0833_w_otp__c8__ev6_sqbutte	SLG fault Square Butte 230 kV; stuck breaker, Square Butte pole 1, pole 2 blocked, fault cleared, trip bus and ramp SQBT dc pole 2 back	P4-5	OTP
0834_w_otp__c8__evk_sqbutte	SLG fault Square Butte 230 kV; stuck breaker, SQBT pole 1 blocked, Square Butte-Center 230 kV tripped, Young 2 unit tripped, SQBT pole 2 ramped down	P4-5	OTP
0855_w_xel__b2__brookingsco-yankee	3PH fault at Yankee on Yankee-Brookings Co 115 kV line; trip Yankee-Brookings Co 115 kV	P1-2	XEL
0858_w_xel__b2__cmvp_brkngco3_lyon_co__to	3PH fault; generic clearing; on Brookings Co-Lyon Co 345 kV; at Lyon Co 345 kV	P1-2	XEL
0863_w_xel__b2__cmvp_hazel_ck_minvalt4_fr	3PH fault; generic clearing; on Hazel Creek-Minn Valley 230 kV; at Hazel Creek 230 kV	P1-2	XEL

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Disturbance Name	Description	NERC Cat.	Area
0865_w_xel__b2__cmvp_helena_3_lkmarion_fr	3PH fault; generic clearing; on Helena-Lake Marion 345 kV; at Helena 345 kV	P1-2	XEL
0867_w_xel__b2__cmvp_hmpt_cnr_lkmarion_fr	3PH fault; generic clearing; on Hampton Corner-Lake Marion 345 kV; at Hampton Corner 345 kV	P1-2	XEL
0869_w_xel__b2__cmvp_lyon_co__cedar_mt_fr	3PH fault; generic clearing; on Lyon Co-Cedar Mountain 345 kV; at Lyon Co 345 kV	P1-2	XEL
0871_w_xel__b2__cmvp_lyon_co__hazel_ck_fr	3PH fault; generic clearing; on Lyon Co-Hazel Creek 345 kV; at Lyon Co 345 kV	P1-2	XEL
0879_w_xel__b2__hn3_hamptoncorner	3PH Hampton Corner 345 kV; clear Hampton Corner-North Rochester 345 kV	P1-2	XEL
0888_w_xel__b2__nmz_chisagoco	3PH Chisago Co 500 kV; clear Chisago Co-Forbes 500 kV line; 100% dc reduction	P1-2	XEL
0889_w_xel__b2__pas_forbes	SLGBF Forbes 500 kV; clear Forbes-Dorsey 500 kV line; Forbes-Chisago Co 500 kV	P1-2	XEL
0890_w_xel__b2__pc3_at_king-eauclaire_new	3PH fault on King–Eau Claire 345 kV line, cross trip Eau Claire-Arpin 345 kV	P1-2	XEL
0892_w_xel__b2__py3_at_prairieis-byron	3PH fault on Prairie Island–North Rochester 345 kV line.	P1-2	XEL
0896_w_xel__b2__sh3_at_sherco_benton	3PH fault on Sherco-Benton 345 kV line	P1-2	XEL
0900_w_xel_p12_vts_lakefieldgen_NoSPS	3PH Lakefield Gen 345 kV; trip Lakefield Gen - Crandall (G826_Sub) 345 kV at 6 cyc.	P1-2	XEL
0909_w_xel__c7__buffaloridge-5x109-stuck	SLG fault at Buffalo Ridge on Buffalo Ridge-Yankee 115 kV; delayed clear on Buffalo Ridge-Yankee/-Pipestone/-tr 2	P4-2	XEL
0910_w_xel__c7__chanarambie-5x93	SLG fault at Chanarambie on Chanarambie-Fenton 115 kV; delayed clear Chanarambie-Fenton/-tr 2	P4-2	XEL
0911_w_xel__c7__chanarambie-5x94	SLG fault at Chanarambie on Chanarambie-Fenton 115 kV; delayed clear Chanarambie-Fenton/-Ellsborough-Lake Yankton 115 kV	P4-2	XEL
0916_w_xel__c7__mqs	SLGBF fault at Sherco on unit 3; trip Sherco unit 3, Sherco-Benton Co 345 kV and Benton Co 345/230 kV xfmr	P4-1	XEL
0917_w_xel__c7__mts	SLGBF fault at Monticello with 8n6 stuck	P4-5	XEL
0919_w_xel__c7__pcs	SLG fault at King-Eau Claire 345 kV line with a breaker failure at King 345 kV	P4-2	XEL
0921_w_xel__c7__pri_8h8	SLG fault at Prairie Island 345 kV with stuck breaker; normal clear Prairie Island-N Rochester 345 kV; Delayed clear Prairie Island-Red Rock 345 kV	P4-5	XEL
0926_w_xel__c8__sb_gct_near_600001_sherc32g	SLG fault near 600001 Sherco on the Sherco-GRE Benton Co line; trip at 4 cyc; stuck breaker; generic clearing at 19.25 cyc	P4-2	XEL
0928_w_xel__c8__sb_gct_near_600005_mntce31g	SLG fault near 600005 Monticello on the Elm Creek-Parkers Lake 345 kV line; trip at 4 cyc; stuck breaker; generic clearing at 19.25 cyc	P4-2	XEL
0929_w_xel__c8__sb_gct_near_600006_king_31g	SLG fault near 600006 King 31g on the as King-Kolman Lake 345 kV line; trip at 4 cyc; stuck breaker; generic clearing at 19.25 cyc	P4-2	XEL

Disturbance Name	Description	NERC Cat.	Area
0930_w_xel__c9__edp-8m45	13.75 cycle SLG fault at Eden Prairie 345 kV bus with failure of 8m45; trip Eden Prairie-Parkers Lake/-Blue Lake 345 kV	P4-5	XEL
0976_x_wapa_b2__ae3_antelope-leland	3PH Antelope 345 kV; trip Antelope-Leland Olds 345 kV	P1-2	WAPA
0977_x_wapa_b2__ai3_leland-lelandtie	3PH fault Leland Olds 345 kV; trip Leland Olds tie	P1-2	WAPA
0978_x_wapa_b2__aq3_at_groton-watertown	4 cycle 3PH fault at Groton 345 kV. Clear the Groton-Watertown 345 kV line	P1-2	WAPA
0981_x_wapa_b2__bh3_at_heskett-ward-bismark	3PH fault normal clearing at Heskett 230 kV. Trip Heskett-Ward 230 kV and Bismark-Ward 230 kV	P1-2	WAPA
0984_x_wapa_c7__ah1_leland-groton_new	SLG fault at Leland 345 kV; trip Leland Olds-Groton 345 kV, Leland Olds Tie 345 kV	P4-2	WAPA
0985_x_wapa_c7__cf1_at_antelopev-lelandolds_new	4 cy SLG fault at Antelope Valley 345 on Leland Olds 2 line, Leland Olds breaker 2196 stuck, clr at 11 cy by tripping faulted line & Leland Olds 2 xfmr	P4-2	WAPA
BigStone_3ph_230-115-14_xfmr	3PH fault on Big Stone 230 kV side of 230-115-13.8 kV xfmr #1; Cleared at 5 cycles	P1-3	G736
BigStone_3ph_230-24_xfmr	3PH fault on Big Stone 230 kV side of 230-24 kV xfmr #1; Cleared at 5 cycles	P1-3	G736
BigStone_Blair-Fault	3PH fault at Big Stone 230 kV on Blair; Cleared at 5 cycles, trip Big Stone-Blair 230 kV line	P1-2	G736
BigStone_BrownsValley-Fault	3PH fault at Big Stone 230 kV on Hankinson; Cleared at 6 cycles, trip Big Stone-Browns Valley-Hankinson 230 kV line	P1-2	G736
BigStone_SLG_230-115-14_xfmr	SLG fault on Big Stone 230 kV side of 230-115-13.8 kV xfmr #1; Delayed clear Big Stone 230-115-13.8 kV xfmr #1	P5-3	G736
BigStone_SLG_230-24_xfmr	SLG fault on Big Stone 230 kV side of 230-24 kV xfmr #1; Delayed clear Big Stone 230-24 kV xfmr #1	P5-3	G736
BigStone_SLG_Blair_230	SLG fault at Big Stone on Big Stone-Blair 230 kV; delayed clear Big Stone-Blair 230 kV	P5-2	G736
BigStone_SLG_BrownsValley_230	SLG fault at Big Stone on Big Stone-Hankinson 230 kV; delayed clear Big Stone-Browns Valley-Hankinson 230 kV	P5-2	G736
0901_w_xel_p12_wds_fieldon_NoSPS	3PH at Wilmarth 345 kV; trip Wilmarth - Crandall (G826_Sub) 345 kV at 6 cyc.	P1-2	J299
0925_w_xel__c7__wts_wilmarth_NoSPS	SLG fault on Wilmarth 345 kV, trip Wilmarth - Crandall (G826_Sub) 345 kV at 4 cyc; due to Wilmarth 8S23 stuck,MEC ST at 10 cyc	P4-2	J299
Wilmarth_3ph_SheasLk_345	3PH fault on Wilmarth to Sheas Lake 345 kV line; Cleared at 4 cycles	P1-2	J299
Wilmarth_3ph_345-115-14_xfmr9	3PH fault on Wilmarth 345 kV side of 345-115-13.8 kV xfmr #9; Cleared at 4 cycles	P1-3	J299
Wilmarth_SLG_SheasLk_345	SLG fault at Wilmarth on Wilmarth-Sheas Lake 345 kV; delayed clear Wilmarth-Sheas Lake 345 kV	P5-2	J299
Wilmarth_SLG_345-115-14_xfmr9	SLG fault on Wilmarth 345 kV side of 345-115-13.8 kV xfmr #9; Delayed clear Wilmarth 345-115-13.8 kV xfmr #9	P5-3	J299

Disturbance Name	Description	NERC Cat.	Area
Wilmarth_3ph_SwanLk_115	3PH fault on Wilmarth to Swan Lake 115 kV line; Cleared at 6 cycles	P1-2	J299
Wilmarth_3ph_Summit_115	3PH fault on Wilmarth to Summit 115 kV line; Cleared at 6 cycles	P1-2	J299
Wilmarth_3ph_Eastwood_115	3PH fault on Wilmarth to Eastwood 115 kV line; Cleared at 6 cycles	P1-2	J299
Wilmarth_3ph_NorthPt_115	3PH fault on Wilmarth to North Point 115 kV line; Cleared at 6 cycles	P1-2	J299
Wilmarth_3ph_115-345-14_xfmr9	3PH fault on Wilmarth 115 kV side of 345-115-13.8 kV xfmr #9; Cleared at 6 cycles	P1-3	J299
Wilmarth_3ph_115-69_xfmr6	3PH fault on Big Stone 230 kV side of 230-24 kV xfmr #1; Cleared at 5 cycles	P1-3	J299
Wilmarth_SLG_SwanLk_115	SLG fault at Wilmarth on Wilmarth-Swan Lake 115 kV line; delayed clear Wilmarth-Swan Lake 115 kV	P5-2	J299
Wilmarth_SLG_Summit_115	SLG fault at Wilmarth on Wilmarth-Summit 115 kV line; delayed clear Wilmarth-Summit 115 kV	P5-2	J299
Wilmarth_SLG_Eastwood_115	SLG fault at Wilmarth on Wilmarth-Eastwood 115 kV line; delayed clear Wilmarth-Eastwood 115 kV	P5-2	J299
Wilmarth_SLG_NorthPt_115	SLG fault at Wilmarth on Wilmarth-North Point 115 kV line; delayed clear Wilmarth-North Point 115 kV	P5-2	J299
Wilmarth_SLG_115-345-14_xfmr9	SLG fault on Wilmarth 115 kV side of 345-115-13.8 kV xfmr #9; Delayed clear Wilmarth 345-115-13.8 kV xfmr #9	P5-3	J299
Wilmarth_SLG_115-69_xfmr6	SLG fault on Wilmarth 115 kV side of 115-69 kV xfmr #6; Delayed clear Wilmarth 115-69 kV xfmr #6	P5-3	J299
Chisago_3ph_115-345-35_xfmr1	3PH fault on Chisago 115 kV side of 115-345-34.5 kV xfmr #1; Cleared at 6 cycles	P1-3	J385
Chisago_3ph_115-345-35_xfmr2	3PH fault on Chisago 115 kV side of 115-345-34.5 kV xfmr #2; Cleared at 6 cycles	P1-3	J385
Chisago_3ph_Lindstrom_115	3PH fault on Chisago to Lindstrom 115 kV line; Cleared at 6 cycles	P1-2	J385
Chisago_3ph_Wyoming_115	3PH fault on Chisago to Wyoming 115 kV line; Cleared at 6 cycles	P1-2	J385
Chisago_SLG_115-345-35_xfmr1	SLG fault on Chisago 115 kV side of 115-345-34.5 kV xfmr #1; Delayed clear Chisago 115-345-34.5 kV xfmr #1	P5-3	J385
Chisago_SLG_115-345-35_xfmr2	SLG fault on Chisago 115 kV side of 115-345-34.5 kV xfmr #2; Delayed clear Chisago 115-345-34.5 kV xfmr #2	P5-3	J385
Chisago_SLG_Lindstrom_115	SLG fault at Chisago on Chisago-Lindstrom 115 kV; delayed clear Chisago-Lindstrom 115 kV	P5-2	J385
Chisago_SLG_Wyoming_115	SLG fault at Chisago on Chisago-Wyoming 115 kV; delayed clear Chisago-Wyoming 115 kV	P5-2	J385
D01_MMU-7ST_3PH_Marshall	3PH fault at North 7th St 115 kV on Marshall line, trip North 7th St-Marshall at 4.6+1 cycles.	P1-2	J391
D02_Marshall_SLG_MMU-7ST_P52	SLG fault at Marshall 115 kV on North 7th St line; Primary protection failure. Clear Marshall end of line at 5.3+1 cycles. Clear North 7th St end of line at 25.3+1 cycles.	P5-2	J391

Disturbance Name	Description	NERC Cat.	Area
D03_MMU-7ST_SLG_Marshall_P42	SLG fault at North 7th St 115 kV on Marshall line; Stuck breaker at North 7th St. Clear Marshall end of line at 4.2+1 cycles. Clear North 7th St end of line and disconnect North 7th St bus at 22.2+1 cycles.	P4-2	J391
D04_MMU-7ST_3PH_ErieRd	3PH fault at North 7th St 115 kV on Erie Road line, trip North 7th St-Erie Road at 4.6+1 cycles.	P1-2	J391
D05_ErieRd_SLG_MMU-7ST_P52	SLG fault at Erie Road 115 kV on North 7th St line; Primary protection failure. Clear Erie Road end of line at 5.3+1 cycles. Clear North 7th St. end of line at 25.3+1 cycles	P5-2	J391
D06_MMU-7ST_SLG_ErieRd_P42	SLG fault at North 7th St 115 kV on Erie Road line; Stuck breaker at North 7th St. end. Clear Erie Road end of line at 4.6+1 cycles. Clear North 7th St. end of line and disconnect North 7th St. bus at 22.2+1 cycles.	P4-2	J391
D14_Southwest_SLG_Saratoga_P42	SLG fault at Southwest 115 kV on Southwest-Saratoga line; Stuck breaker (5N161) at Southwest end. Clear Saratoga end of line at 6.0+1 cycles. Clear Southwest end of line at 20.9+1 cycles and trip one 21 Mvar cap.	P4-2	J391
D15_Southwest_SLG_Southeast_P42	SLG fault at Southwest 115 kV on Southwest-Southeast line; Stuck breaker (5N184) at Southwest end. Clear Southeast end of line at 6.0+1 cycles. Clear Southwest end of line at 20.9+1 cycles and trip one 21 Mvar cap.	P4-2	J391
D16_Southwest_SLG_Yankton_P42	SLG fault at Southwest 115 kV on Southwest-Yankton line; Stuck breaker (5N159) at Southwest end. Clear Yankton end of line at 6.5+1 cycles. Clear Southwest end of line at 20.9+1 cycles and disconnect load.	P4-2	J391
LyonCo_3ph_115-345-35_xfmr	3PH fault on Lyon Co 115 kV side of 115-345-34.5 kV xfmr #9; Cleared at 6 cycles	P1-3	J400
LyonCo_3ph_115-69_xfmr	3PH fault on Lyon Co 115 kV side of 115-69 kV xfmr #1; Cleared at 6 cycles	P1-3	J400
LyonCo_3ph_LakeYankton_115	3PH fault on Lyon Co to Lake Yankton 115 kV line; Cleared at 6 cycles	P1-2	J400
LyonCo_3ph_Marshal_115	3PH fault on Lyon Co to Marshal 115 kV line; Cleared at 6 cycles	P1-2	J400
LyonCo_SLG_115-345-35_xfmr	SLG fault on Lyon Co 115 kV side of 115-345-34.5 kV xfmr #9; Delayed clear Lyon Co 115-345-34.5 kV xfmr #1	P5-3	J400
LyonCo_SLG_115-69_xfmr	SLG fault on Lyon Co 115 kV side of 115-69 kV xfmr #1; Delayed clear Lyon Co 115-69 kV xfmr #1	P5-3	J400
LyonCo_SLG_345_8N60Stuck	SLG fault on Lyon Co 345 kV on Line to Cedar Mountain ckt 1, breaker 8N60 Stuck; Delayed clear on Line to Cedar Mountain ckt 2	P5-2	J400
LyonCo_SLG_LakeYankton_115	SLG fault at Lyon Co on Lyon Co-Lake Yankton 115 kV; delayed clear Lyon Co-Lake Yankton 115 kV	P5-2	J400
LyonCo_SLG_Marshal_115	SLG fault at Lyon Co on Lyon Co-Marshal 115 kV; delayed clear Lyon Co-Marshal 115 kV	P5-2	J400
Lewis_3ph_115-14_xfmr	3PH fault on Lewis 115 kV side of 115-13.8 kV xfmr #1; Cleared at 6	P1-3	J405

Disturbance Name	Description	NERC Cat.	Area
	cycles		
Lewis_3ph_Dawson Co_115	3PH fault on Lewis to Dawson Co 115 kV line; Cleared at 6 cycles	P1-2	J405
Lewis_3ph_Richland_115	3PH fault on Lewis to Richland 115 kV line; Cleared at 6 cycles	P1-2	J405
Lewis_SLG_115-14_xfmr	SLG fault on Lewis 115 kV side of 115-13.8 kV xfmr #1; Delayed clear Lewis 115-13.8 kV xfmr #1	P5-3	J405
Lewis_SLG_Dawson Co_115	SLG fault at Lewis on Lewis-Dawson Co 115 kV; delayed clear Lewis-Dawson Co 115 kV	P5-2	J405
Lewis_SLG_Richland_115	SLG fault at Lewis on Lewis-Richland 115 kV; delayed clear Lewis-Richland 115 kV	P5-2	J405
Haywood_3ph_Adams_161	3PH fault on Haywood on line to Adams 161 kV Line; Cleared at 6 cycles	P1-2	J407
Haywood_3ph_Freeborn_161	3PH fault on Haywood on line to Freeborn 161 kV Line; Cleared at 6 cycles	P1-2	J407
Haywood_3ph_GLENWRTH_161	3PH fault on Haywood on line to Adams 161 kV Line; Cleared at 6 cycles	P1-2	J407
Haywood_3ph_Murphy CR_161	3PH fault on Haywood on line to Murphy CR 161 kV Line; Cleared at 6 cycles	P1-2	J407
Haywood_SLG_Adams_161	SLG fault on Haywood on line to Adams 161 kV Line; Delayed cleared at 18 cycles	P5-2	J407
Haywood_SLG_Freeborn_161	SLG fault on Haywood on line to Freeborn 161 kV Line; Delayed cleared at 18 cycles	P5-2	J407
Haywood_SLG_GLENWRTH_161	SLG fault on Haywood on line to Adams 161 kV Line; Delayed cleared at 18 cycles	P5-2	J407
Haywood_SLG_Murphy CR_161	SLG fault on Haywood on line to Murphy CR 161 kV Line; Delayed cleared at 18 cycles	P5-2	J407
J411_3ph_Lehigh_345	3PH fault on J411 on line to Lehigh 345 kV Line; Cleared at 4 cycles	P1-2	J411
J411_3ph_Raun_345	3PH fault on J411 on line to Raun 345 kV Line; Cleared at 4 cycles	P1-2	J411
J411_SLG_Lehigh_345	3PH fault on J411 on line to Lehigh 345 kV Line; Delayed cleared at 13.5 cycles	P5-2	J411
J411_SLG_Raun_345	3PH fault on J411 on line to Raun 345 kV Line; Delayed cleared at 13.5 cycles	P5-2	J411
J411_3ph_Raun_345priorLehighGrimes	3PH fault on J411 on line to Raun 345 kV Line; Prior outage of Lehigh-Grimes 345 kV line	P6	J411
J416_3ph_Blackhawk_345	3PH fault on J416 on line to Blackhawk 345 kV Line; Cleared at 4 cycles	P1-2	J416
J416_3ph_Killdeer_345	3PH fault on J416 on line to Killdeer 345 kV Line; Cleared at 4 cycles	P1-2	J416
J416_SLG_Blackhawk_345	SLG fault on J416 on line to Blackhawk 345 kV Line; Delayed cleared at 11 cycles	P5-2	J416
J416_SLG_Killdeer_345	SLG fault on J416 on line to Killdeer 345 kV Line; Delayed cleared at	P5-2	J416

Disturbance Name	Description	NERC Cat.	Area
	11 cycles		
Chanarambie_3ph_35-115_xfmr3	3PH fault on Lewis 115 kV side of 115-13.8 kV xfmr #1; Cleared at 6 cycles	P1-2	J426
Chanarambie_3ph_Pipestone_115	3PH fault on Chanarambie to Pipestone 115 kV line; Cleared at 6 cycles	P1-2	J426
Chanarambie_3ph_Fenton_115	3PH fault on Chanarambie to Fenton 115 kV line; Cleared at 6 cycles	P1-2	J426
Chanarambie_3ph_Ellsboro_115	3PH fault on Chanarambie to Ellsboro 115 kV line; Cleared at 6 cycles	P1-2	J426
Chanarambie_SLG_35-115_xfmr3	SLG fault on Chanarambie 34.5 kV side of 115-34.5 kV xfmr #3; Delayed clear Chanarambie 115-34.5 kV xfmr #3	P5-3	J426
Chanarambie_SLG_Pipestone_115	SLG fault at Chanarambie on Chanarambie-Pipestone 115 kV; delayed clear Chanarambie-Pipestone 115 kV	P5-2	J426
Chanarambie_SLG_Fenton_115	SLG fault at Chanarambie on Chanarambie-Fenton 115 kV; delayed clear Chanarambie-Fenton 115 kV	P5-2	J426
Chanarambie_SLG_Ellsboro_115	SLG fault at Chanarambie on Chanarambie-Ellsboro 115 kV; delayed clear Chanarambie-Ellsboro 115 kV	P5-2	J426

Table 4-3: Generic Clearing Time Assumption

Voltage Level (kV)	Primary Clearing Time (cycle)	Backup Clearing Time (cycle)
345 kV	4	11
230 kV	5	13
161/138 kV	6	18
115 kV	6	20
69 kV	8	24

4.4 Performance Criteria

Stability simulation results are evaluated based on the following MISO criteria:

- All on-line generating units are stable
- No unexpected generator tripping
- Post-fault transient voltage limits: 1.2 per unit maximum, 0.7 per unit minimum.
- Per local TOs's planning criteria, specific transient voltage limits are applied to specific buses, areas or companies that have different requirements.
- All machine rotor angle oscillations must be positively damped with a minimum damping ratio of 0.81633% for disturbances with a fault or 1.6766% for line trips without a fault.

4.5 Stability Results

The contingencies listed in Table 4-2 were simulated using the 2018 and 2025 study cases. If a transient stability criteria violation was identified, the same disturbance was repeated in the corresponding benchmark case.

Appendix G contains plots of generator rotor angles, generator power output, generator terminal voltages, bus voltages, and branch flows for each simulation. Simulations were performed with a 2.0 seconds steady-state run followed by the appropriate disturbance. Simulations were run for a 10-second duration.

4.5.1 2018 Stability Analysis Results and Mitigations

Details of stability analysis results and mitigations for the 2018 scenario can be found in Appendix L.5.

4.5.2 2025 Stability Analysis Results

The following stability related issues were identified. No mitigations are required.

4.5.2.1 Tripping of J290-Rugby 230 kV OOS Relay

Out of step (OOS) relay on J290 – Rugby 230 kV line tripped during disturbance of "0685_w_gre__c6__fq1_coalcreek". The same OOS tripping also occurred in the benchmark case. No stability violations were identified if this OOS relay was disabled. The OOS relay settings should be adjusted after the J290 generation project is interconnected in the Glenboro – Rugby 230 kV line.

4.5.2.2 Tripping of DS Zone 2 at Ramsey to Kohlman Lake 115 kV Line

Distance relay (DS) zone 2 at Ramsey to Kohlman Lake 115 kV line tripped the line during disturbance of "0693_w_gre__c8__sb_gct_near_615295_gre-kohlmnlx". The distance relay model zone 2 reach was originally set as 2.6 pu at Ramsey, which is unreasonably large for the Ramsey-Kohlman Lake 115 kV line with reactance X=0.018 pu. The TO provided the correct DS zone 2 reach of 125% of the line impedance. With the DS relay settings corrected, no line tripping occurs and no stability violations are identified.

4.6 Network Upgrades Identified in Stability Analysis for 2025 Scenario

No additional Network Upgrades are required in stability analysis for the 2025 scenario.

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Section
5

MWEX Voltage Stability Study

ATC performed steady state voltage stability analysis. The results show that both the Pre-DPP and Post-DPP scenarios in the 2025 shoulder load cases are voltage stable as defined by having an acceptable real power margin from the initial condition to the nose of the PV curve.

There is a violation of ATC planning criteria due to the post contingent PV nose occurring at a voltage greater than the minimum emergency voltage of 0.95 per unit in the Post-DPP case. However, MISO ERIS Constraint Criteria requires a steady state voltage criteria violation and that the voltage degradation is greater than 0.01 per unit. The difference in PV nose voltages is 0.0034 per unit, therefore no Network Upgrades will be assigned to the Interconnection Customers.

The MWEX voltage stability study details can be found in Appendix H.

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Section
6

Short Circuit Analysis

6.1 Introduction

Siemens PTI, MISO, and several transmission owning companies performed short circuit analysis for the DPP West Area generation projects.

6.2 G736 Short Circuit Study Performed by OTP

The G736 short circuit study was performed by OTP. Based on the short circuit study results, the fault current ratings of the Otter Tail Power equipment in the area are not exceeded. With the proposed G736 project additions, the fault currents are estimated to be roughly 11.5 kA at the Big Stone South 230 kV bus. There are no short circuit related upgrades needed for G736.

Study details can be found in Appendix I.1.

6.3 J299 Short Circuit Study

Generation project J299 is a 73 MW expansion of the existing Mankato combined cycle power plant in Xcel Energy. A short circuit study is not required.

6.4 J385 Short Circuit Study Performed by MISO

The J385 short circuit study was performed by MISO. The study results show that contribution of the J385 generation project on fault currents in local area is fairly small. The J385 project increases three phase fault current at the POI by approximately 559 Amps and single-line-to-ground fault current by approximately 565 Amps. XCEL Energy reviewed the results and confirmed that the post-J385 fault currents are below the breakers' interrupting capabilities and no breaker upgrades are required for the proposed interconnection.

Study details can be found in Appendix I.2.

6.5 J391 Short Circuit Study Performed by Siemens PTI

The J391 short circuit facilities study was performed by Siemens PTI. The study results show that the change in fault current at buses in the Study Project area is relatively small. Based on the Transmission Owner's short circuit criteria, interconnection of the J391 generation project does not cause any Transmission Owner short circuit constraints

Study details can be found in Appendix I.3.

6.6 J400 Short Circuit Study Performed by Siemens PTI

The J400 short circuit facilities study was performed by Siemens PTI. The study results show that the change in fault current at buses around the Study Project area is relatively small. Based on the Transmission Owner's short circuit criteria, interconnection of the J400 generation project does not cause any Transmission Owner short circuit constraints.

Study details can be found in Appendix I.4.

6.7 J405 Short Circuit Study Performed by MISO

The J405 short circuit study was performed by MISO. The study results show that contribution of the J405 generation project on fault currents in the local area is fairly small. The J405 project increases three phase fault current at the POI by approximately 900 Amps and single-line-to-ground fault current by approximately 644 Amps. MDU, BEPC, and WAPA reviewed the results and confirmed that the post-J405 fault currents are below the breakers' interrupting capabilities at their respective substations and no breaker upgrades are required for the proposed interconnection.

Study details can be found in Appendix I.5.

6.8 J407 Short Circuit Study Performed by ITCM

The J407 short circuit study was performed by ITCM. The study shows that all of the Hayward or Glenworth circuit breakers have acceptable interrupting ratings. The J407 generation project results in fault currents that are well below the breaker interrupting ratings.

Study details can be found in Appendix I.6.

6.9 J411 Short Circuit Facilities Study Performed by MEC

The J411 short circuit facilities study was performed by MEC. Based on the Transmission Owner's short circuit criteria, interconnection of the J411 generation project does not cause any Transmission Owner short circuit constraints. The applicable short circuit bus results were shared with other potentially impacted transmission owners if the modeled change in fault current was greater than 100 Amps, and no short circuit constraints were identified.

Study details can be found in Appendix I.7.

6.10 J416 Short Circuit Facilities Study Performed by ITCM

The J416 short circuit facilities study was performed by ITCM. Explicit modeling of the J416 project was not warranted for the evaluation. The interrupting ratings of 345 kV circuit breakers at the Killdeer substation are 50 kA. If an approximation of 4 times the rated current capacity of the generating facility at 345 kV were utilized, the fault current contribution of project J416 would be approximately 1340A. It can be safely assumed that upgrades to Killdeer 345 kV will not be required due to the fault current contribution of the J416 project.

Study details can be found in Appendix I.8.

6.11 J426 Short Circuit Facilities Study Performed by Siemens PTI

The J426 short circuit facilities study was performed by Siemens PTI. The change in fault current at buses in the Study Project area is shown in Appendix I.9. Based on the Transmission Owner's short circuit criteria, interconnection of the J426 generation project does not cause any Transmission Owner short circuit constraints.

Study details can be found in Appendix I.9.

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Section
7

Deliverability Study

7.1 Project Description

Interconnection requests requesting Network Resource Interconnection Services (NRIS) were considered for deliverability analysis.

7.2 Introduction

Generator interconnection projects have to pass Generator Deliverability Study to be granted Network Resource Interconnection Services (NRIS).

If the generator is determined as not fully deliverable, the customer can choose either to change his project to an Energy Resource (ER) project or proceed with the system upgrades that will make the generator fully deliverable.

Generator Deliverability Study ensures that the Network Resources, on an aggregate basis, can meet the MISO aggregate load requirements during system peak condition without getting bottled up. The wind generators are tested at 100 % of their maximum output level which then can be used to meet Resource Adequacy obligations, under Module E, of the Midwest ISO Transmission and Energy Market Tariff (TEMT).

7.3 Study Methodology

MISO Generator Deliverability Study whitepaper describing the algorithm can be found at "https://www.misoenergy.org/Library/Repository/Study/Generator%20Interconnection/Generator%20Deliverability%20Study%20Methodology.pdf".

7.4 Determining the MW restriction

If one facility is overloaded based on the assessed "severe yet credible dispatch" scenario described in the study methodology, and the generator under study is in the "Top 30 DF List" (see white paper for detail), part or all of its output is not deliverable. The restricted MW is calculated as following:

(MW restricted) = (worst loading – MW rating) / (generator sensitivity factor)

If the result is larger than the maximum output of the generator, 100% of this generator's output is not deliverable.

The generator is also responsible for any NEW base case (pre-shift) overload or NEW "severe yet credible dispatch overload" where the generator is not in the "Top 30 DF List", if the generator's DF is greater than 5%. Please see white paper for detail. The formula above also applies to these situations.

7.5 Study Result

7.5.1 2018 Deliverability Study Results

Details of deliverability study results for the 2018 scenario can be found in Appendix L.

7.5.2 2025 Deliverability Study Results

7.5.2.1 G736

G736 Deliverable (NRIS) Amount in Outyear Case: (Conditional on ERIS upgrades and case assumptions)	200 MW (100%)

7.5.2.2 J385

J385 Deliverable (NRIS) Amount in Outyear Case: (Conditional on ERIS upgrades and case assumptions)	100 MW (100%)

7.5.2.3 J391

J391 Deliverable (NRIS) Amount in Outyear Case: (Conditional on ERIS upgrades and case assumptions)	50 MW (100%)

7.5.2.4 J400

J400 Deliverable (NRIS) Amount in Outyear Case: (Conditional on ERIS upgrades and case assumptions)	62.5 MW (100%)

7.5.2.5 J405

J405 Deliverable (NRIS) Amount in Outyear Case: (Conditional on ERIS upgrades and case assumptions)	40 MW (100%)

7.5.2.6 J407

J407 Deliverable (NRIS) Amount in Outyear Case: (Conditional on ERIS upgrades and case assumptions)	135.08 MW (67.54%)						
Next Upgrade for Higher NRIS Level (cumulative) (i.e. All upgrades must be made for 100% NRIS)	**Level of Service Attainable**	**Distribution Factor**	**Constraint in ERIS Analysis?**	**Projects Associated With ERIS Constraint**	**Projects Associated With NRIS Constraint**	**Upgrade Cost Allocated to Project**	**Total Cost of Upgrade**
Glenworth 161-69 kV xfmr	145.96	21.65%	No		J407	$2,500,000	$2,500,000

7.5.2.7 J411

J411 Deliverable (NRIS) Amount in Outyear Case: (Conditional on ERIS upgrades and case assumptions)	**300 MW (100%)**

7.5.2.8 J416

J416 Deliverable (NRIS) Amount in Outyear Case: (Conditional on ERIS upgrades and case assumptions)	**200 MW (100%)**

7.5.2.9 J426

J426 Deliverable (NRIS) Amount in Outyear Case: (Conditional on ERIS upgrades and case assumptions)	**100 MW (100%)**

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Section
8

Shared Network Upgrades Analysis

Shared Network Upgrade (SNU) test for Network Upgrades driven by higher queued interconnection project was performed for this System Impact Study. No SNUs were identified in this study.

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Section
9

Cost Allocation

The cost allocation of Network Upgrades for the study group reflects responsibilities for mitigating system impacts based on Interconnection Customer-elected level of Network Resource Interconnection service as of the draft System Impact Study report date.

9.1 Cost Assumptions for Network Upgrades

The cost estimate for each thermal network upgrade was provided by the corresponding transmission owning company. The cost estimate for reactive support network upgrades (shunt capacitors) is based on assumptions used in previous MISO facility studies, and costs of previous similar projects. Table 9-1 summarizes all the cost assumptions used for shunt capacitors in the calculation of network upgrade costs.

Table 9-1: Shunt Capacitor Cost Assumptions

Shunt Capacitor	Fixed Cost ($)	Variable Cost ($)
69/115 kV Shunt Capacitor	$100K	$6.77K/Mvar
161/230 kV Shunt Capacitor	$400K	$6.77K/Mvar
345 kV Shunt Capacitor	$1,650K	$6.77K/Mvar

9.2 ERIS Network Upgrades Proposed for DPP West Area Projects

Network upgrades for Energy Resource Interconnection Service (ERIS) were identified in the MISO ERIS analysis and the affected system analysis. The ERIS network upgrades include reactive support network upgrades, thermal network upgrades identified in the MISO steady-state analysis, thermal network upgrades identified in the affected system analysis, reactive support network upgrades identified in the MISO voltage stability analysis, and stability network upgrades identified in the MISO transient stability analysis. The total costs of network upgrades for the 2018 scenario and the 2025 scenario are summarized in Table 9-2.

Table 9-2: Summary of ERIS Network Upgrades

Category of Network Upgrades	2018 Cost ($)	2025 Cost ($)
Network Upgrades Identified in MISO Steady-State Analysis	$17,550,000	$8,250,000
Network Upgrades Identified in Voltage Stability analysis	$0	$0
Network Upgrades Identified in Transient Stability Analysis	$0	$0
Additional Network Upgrades Identified in Affected System Analysis	$0	$0

Category of Network Upgrades	2018 Cost ($)	2025 Cost ($)
Shared Network Upgrades	$0	$0
Total	**$17,550,000**	**$8,250,000**

ERIS network upgrades for the 2018 scenario and the 2025 scenario are listed in the following sections.

9.2.1 ERIS Network Upgrades for 2018 Scenario

Details of ERIS network upgrades for the 2018 scenario can be found in Appendix L.7.1.

9.2.2 ERIS Network Upgrades for 2025 Scenario

Table 9-3: Network Upgrades in MISO Steady-State Analysis for 2025 Scenario

Constraint	Owner	Mitigation	Cost ($)
NIW-Colby 161 kV	ITCM	Rebuild ~7.6 miles of 161 kV with T2-795 ACSR. Rating would be 335 due to terminal limit at NIW.	$8,250,000

Table 9-4: Additional CIPCO & MPC Network Upgrades for 2025 Scenario

Constraint	Owner	Mitigation	Cost ($)
Liberty-Hickory Creek 161 kV	CIPCO ITCM	CIPCO: No Mitigation needed	$0

Table 9-5: PJM Network Upgrades for 2025 Scenario

Constraint	Owner	Mitigation	Cost ($)
No Constraints			$0

Table 9-6: SPP Network Upgrades for 2025 Scenario

Constraint	Owner	Mitigation	Cost ($)
No Constraints			$0

Table 9-7: Network Upgrades in Voltage Stability Analysis for 2025 Scenario

Constraint	Owner	Mitigation	Cost ($)
No Constraints			$0

Table 9-8: Additional Network Upgrades in Transient Stability Analysis for 2025 Scenario

Constraint	Owner	Mitigation	Cost ($)
No Constraints			$0

Table 9-9: Shared Network Upgrades for 2025 Scenario

Shared Network Upgrades	Upgrade Cost $
None	$0

9.3 Cost Allocation Methodology

The costs of Network Upgrades (NU) for a set of generation projects (one or more sub-groups or entire group with identified NU) are allocated based on the MW impact from each project on the constrained facilities in the Post Case. For constraints identified in the shoulder peak scenario, the MW impact is calculated using the shoulder peak post-DPP case. The MW impact on constraints identified only in the summer peak scenario is calculated using the summer peak post-DPP case. With all Group Study generation projects dispatched in the Post Case, all thermal and voltage constraints will be identified and a distribution factor from each project on each constraint will be obtained.

Constraints which are mitigated by one or a subset of NU are identified. The MW contribution on these constraints from each generating facility is calculated in the Post Case without any network upgrades. Then the cost of each NU is allocated based on the pro rata share of the MW contribution from each generating facility on the constraints mitigated or partly mitigated by this NU. The methodology to determine the cost allocation of NU is:

Project A cost portion of NU = Cost of NU x $\left(\frac{Max(Proj.A\ \text{MW}\ contribution\ \text{on constraint})}{\sum_i Max(Proj.i\ \text{MW}\ contribution\ \text{on constraint})} \right)$

9.4 Cost Allocation

The cost allocation of Network Upgrades for the study group reflects responsibilities for mitigating system impacts based on Interconnection Customer-elected level of Network Resource Interconnection service as of the draft System Impact Study report date.

The Distribution Factor (DF) from each generating facility is calculated on the constraints identified in the steady-state analysis in the Post Case without any network upgrades. For a reactive support network upgrade, DFs are calculated under the most critical contingency (King-Eau Claire-Arpin contingency in most cases) on all branches (proxy branches for reactive support network upgrade) connecting to the high voltage side of the transformer, where the reactive support network upgrade is located in the same substation.

For each constraint, the maximum MW contribution (increasing flow) from each generating facility is calculated. MW contribution from one generating facility is set as zero if the MW contribution is less than 1 MW, or the constraint is not categorized as MISO ERIS constraint or affected system constraint for that specific generating facility. For a reactive support network upgrade, the generators in same local area with positive MW impact will be responsible for mitigating the voltage violations.

The calculated DF results and the MW contribution on each constraint are in Appendix J.1 for the 2018 scenario and Appendix K.1 for the 2025 scenario.

Finally, the cost allocation for each NU is calculated based on the MW contribution of each generating facility, as detailed in Appendix J.2 for the 2018 scenario and Appendix K.2 for the 2025 scenario.

Assuming all generating facilities in the DPP 2015 February West Area group advance, a summary of the costs for total NUs (NUs for ERIS, NRIS, and Interconnection Facilities) allocated to each generating facility is listed in Table 9-10 for the 2025 scenario.

Table 9-10: Summary of Total NU Costs Allocated to Each Generation Project for 2025 Scenario

Project	Max Output (MW)	Total Cost of NU per Project ($)	$/MW	Share %
G736	200	$2,206,197	$11,031	3.71%
J299	73	$0	$0	0.00%
J385	100	$2,498,000	$24,980	4.20%
J391	50	$476,000	$9,520	0.80%
J400	62.5	$1,271,000	$20,336	2.14%
J405	40	$614,540	$15,364	1.03%
J407	200	$11,615,365	$58,077	19.54%
J411	300	$10,022,000	$33,407	16.86%
J416	200	$25,513,484	$127,567	42.92%
J426	100	$5,229,000	$52,290	8.80%
Total/Average	**1325.5**	**$59,445,586**	**$35,257**	**100.00%**

Appendix
A

Model Development for Steady-State and Stability Analysis

A.1 DPP 2015 February Generation Projects

Table A-1: DPP 2015 February West Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
G736	SD	Grant	OTP	Big Stone South 230kV sub	200	Wind	NR
J299	MN	Blue Earth	Xcel	Wilmarth sub	73	CC	ER
J385	MN	Chisago	Xcel	Chisago 115 kV sub	100	Solar	NR
J391	MN	Lyon	MRES	MMU's N 7th Street sub	50	CT	NR
J400	MN	Lyon	Xcel	Lyon County 115kV sub	62.5	Solar	NR
J405	MT	Richland	MDIU	Lewis & Clark Jct sub	40	CT	NR
J407	MN	Freeborn	ITCM	Glenworth 161 kV Sub	200	Wind	NR
J411	IA	Ida	MEC	Lehigh-Raun 345 kV Line	300	Wind	NR
J416	IA	Franklin	ITCM	Emery-Blackhawk 345 kV Line	200	Wind	NR
J426	MN	Pipestone	Xcel	Chanarambie 34.5 sub	100	Wind	NR

Table A-2: Dynamic Modeling for DPP West Area Projects

MISO Project #	Dynamic Modeling
G736	112 GE 1.79 MW turbines (GEWTG2, GEWTE2)
J299	Expansion of existing Mankato CC power plant
J385	134 PV arrays of SMA SC 750CP-US 0.75 MW (SMASC, SMAPPC)
J391	GENSAL, AC8B, GGOV1
J400	84 PV arrays of SMA SC 750CP-US 0.75 MW (SMASC, SMAPPC)
J405	GENSAL, AC7B, GGOV1
J407	112 GE 1.79 MW turbines (GEWTG2, GEWTE2)
J411	168 GE 1.79 MW turbines (GEWTG2, GEWTE2)
J416	100 Vestas V110 2.0MW Mk10 (VWCOR8)
J426	50 Vestas V110 VCSS 2.0 MW 60 Hz Mk10 (VWCOR8)

Table A-3: DPP 2015 February Central Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J375	IL	Ford	AMIL	Gibson City South 138 kV Sub	124	Wind	ER
J401	IN	Marion	IPL	Stout South 138 kV Sub	20	Battery Storage	NRIS
J431	IN	Benton	NIPS	Goodland 138 / 69 kV Sub	100	Wind	NRIS Only

Table A-4: DPP 2015 February ATC Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J384	WI	Cambridge	ATC	2346 Clearview Road, Cambridge	21	CT	NR
J390	WI	Rock	ATC	Townline Road 138 kV Sub	702 Sum / 711 Win	CC	NR
J394	MI	Marquette	ATC	Tilden 138 kV Sub	280 Sum / 327 Win	CC	NR
J395	WI	Lafayette	ATC	Section 34 Township 3N Range 2E	98	Wind	ER

Table A-5: DPP 2015 February Michigan Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J301	MI	Tuscola	ITC	Bauer-Rapson 345 kV	101	Wind	NR
J308	MI	Sanilac	ITC	Rapson-Banner 345 kV	301	Wind	NR
J321	MI	Sanilac	ITC	Rapson-Banner 345 kV	151.2	Wind	NR
J392	MI	Otsego	METC	Livingston-Stover 138 kV	383.1 Sum / 420.7 Win	CT Gas	NR
J406	MI	Wexford	METC	Wexford Sub	4	CC Wood	External NRIS
J408	MI	Sanilac	ITC	Banner 345 kV Sub	200	Wind	NR
J419	MI	Washtenaw	ITC	Milan 120 kV Sub	100	Solar	NR
J421	MI	Monroe	ITC	Need to Update Fermi POI	32	Nuclear	NRIS Only
J422	MI	St. Clair	ITC	Greenwood Energy Center	30	Gas	NRIS Only

Table A-6: DPP 2015 February South Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J319	AR	Pope	Entergy	ANO-Pleasant Hill 500 Kv	500	HVDC	NR
J417	LA	Calcasieu	Entergy	Graywood 230 Kv sub Big Lake Road	43	Waste Heat Recovery	NR

A.2 DPP 2014 August Generation Projects

Table A-7: DPP 2014 August West Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J285	IA	O'Brien	MEC	O'Brien County 345 kV sub	250	Wind	NR
J289	IA	Madison	MEC	Winterset Junction-Creston 161 kV	20	Wind	NR
J316	ND	Dickey	MDU	Tatanka-Ellendale 230 kV	150	Wind	NR
J320	MN	Ramsey	Xcel	High Bridge 115 kV sub	0/55	CC	ER
J329	IA	Marion	MEC	Pella West Sub	55	Hydro	NR
J343	IA	Adams	MEC	Creston-Clarinda 161 kV	150	Wind	NR
J344	IA	Mahaska	ITCM	Poweshiek-Oskaloosa 161 kV	169	Wind	NR
J382	WI	Cambridge	ATC	Cambridge	48.3	Gas	NRIS Only

Table A-8: DPP 2014 August Central Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J339	IL	Ford	AMIL	Gibson City South sub	68/96	Gas	NRIS Only
J371	IL	Ogle	ComEd	Byron sub	2300	Nuclear	External NRIS
J372	IL	Rock Island	ComEd	Quad Cities sub	1364.3	Nuclear	External NRIS
J374	PA	Bucks	PECO	Fairless Hills plant	30	Landfill Gas	External NRIS

Table A-9: DPP 2014 August East Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J325	MI	Huron	ITC	Minden sub	4	Wind	ER
J327	MI	Huron	ITC	Raphson 120 kV sub	150	Wind	NR
J340	MI	Huron	ITC	Cosmo-Bad Axe 120 kV	100	Wind	NR
J354	MI	Huron	ITC	Grassmere	52	Wind	NR

Table A-10: DPP 2014 August South Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J348	AR	Arkansas	Entergy	Stuttgart Rcuskey-Almyra 115 kV line	81	PV	NR

A.3 DPP 2014 February Generation Projects

Table A-11: DPP 2014 February West Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J292	Manitoba		MH	Limestone, Long Spruce and Kettle Generating Station	3576	Hydro	External NRIS

Table A-12: DPP Central and East Areas Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J246	MI	Gratiot	METC	Slate 345 kV sub	7	Wind	NR
J276	IL	Iroquois	AMIL	Sheldon South	150	Wind	NRIS Only

A.4 DPP 2013 August Generation Projects

Table A-13: DPP 2013 August West Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J233	IA	Marshall	ITCM	Marshalltown 161 kV sub	635 (Sum); 700 (Win)	Gas	NR
J274	IA	Madison	MEC	Winterset. - Creston 161 kV (50%)	100	Wind	NR
J278	MN	Mower	XEL	Pleasant Valley 161 kV sub	200	Wind	NR
J279	IA	Woodbury	MEC	Raun 345 kV sub	30	Coal	NR
J290	XEL	Rolette	XEL	Rugby – Glenboro 230 kV (50%)	150	Wind	NR

Table A-14: DPP Central and East Areas Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
G997	MI	Huron	ITCT	Wyatt - Harbor Beach 120kV	50	Wind	NR

A.5 DPP 2013 February Generation Projects

Table A-15: DPP 2013 February West Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J262	ND	Stutsman	OTP	Jamestown 345/115 kV sub	100	Wind	NR
J263	ND	Stutsman	OTP	Jamestown 345/115 kV sub	100	Wind	NR
G858	MN	Stearns	XEL	Black Oak 69 kV sub	38	Wind	NR
H071	MN	Stearns	XEL	Black Oak 69 kV sub	40	Wind	NR

Table A-16: DPP Central and East Areas Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J256	IN	Marshall	NIPS	NE corner of Marshall St & Michigan Rd, Argos	8	Gas	ER
J201	MI	Bay	METC	METC Manning 138 kV sub	20	Wind	NR

A.6 DPP 2012 August Generation Projects

Table A-17: DPP 2012 August West Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
G735	IA	Hancock	ITCM	Lime Creek Substation	200	Wind	ER
G798	IA	Story	ITCM	Fernald substation via a radial 9 mile 115 kV gen-tie line	150	Wind	NR
G826	MN	Jackson	XEL	Lakefield Generation SW - Lakefield JCT 345kV	200	Wind	NR
G830	ND	McHenry	GRE	McHenry substation	99	Wind	NR
G870	MN	Freeborn	ITCM	Hayward-Winnebago 161KV (11 miles west of Hayward and 38 miles east of Winnebago)	201	Wind	NR
G947	IA	Franklin	ITCM	Switchyard for G573,4,5 near Iowa Falls Ind Substn	99	Wind	NR
H008	IA	Fayette	ITCM	69 kV Richfield sub	36	Wind	NR
H009	IA	Tama	ITCM	161kV line between Traer and Marshalltown	150	Wind	ER
H021	IA	Grundy	ITCM	Wellsburg substation 115 kV bus	138.6	Wind	NR
H081	MN	Lyon	XEL	Brookings County - Lyon County 345kV	201	Wind	ER
H096	IA	Greene	ITCM	Newly built 161kV substation south of Grand Junction on Grand Jct. - Perry 161 kV	50	Wind	NR
J091	IA	Hancock	ITCM	161 kV Lime Creek substation	66	Wind	NR
J112	MN	Winona	ITCM	69 KV line southwest corner of section 11, Utica Township	4.95	Wind	ER
J171	MN	Swift	GRE	Benson 115 kV substation	7	Biomass	NR
J183[1]	MN	Rock	XEL	Split Rock Substation	200	Wind	ER
J191	IA	Cass	MEC	Rolling Hills 345 kV Substation	101.2	Wind	NR
J200	ND	Morton	MDU	RM Heskett Station 115 kV & 41.6 kV	75/99	Gas	NR
J249[2]	ND	Dickey	MDU	Tatanka 230 kV Substation	180	Existing Wind	NRIS Only
R42	IA	Webster	MEC	345 kV Lehigh Substation	250	Wind	NR

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
R49	IA	Pomeroy	MEC	Pomeroy Generating station	12	Wind	NR
R65	IA	Cass	MEC	R34 Expansion	92	Wind	NR

Note 1: J183 request for Net Zero Interconnection Service (NZIS)

Note 2: J249 requests for NRIS for the existing MISO project G132

Table A-18: DPP Central Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J232	IL	Randolph	AMRN	Baldwin Substation	35	Coal	NR
J238	IN	Morgan	IPL	Eagle Valley 138 kV Substation	725	CC	NR

Table A-19: DPP East Area Projects

MISO Project Num	State	County	Transmission Owner	Point Of Interconnection	Max Output	Fuel Type	Service Type
J075	MI	Huron	ITCT	Bauer-Rapson 345 kV	150	Wind	NR
J161	MI	Tuscola	ITCT	Bauer-Rapson 345 kV	155	Wind	NR
J202	MI	Tuscola	ITCT	Atlanta-Tuscola 115 kV	101	Wind	NR
J226	MI	Mason	METC	Ludington Substation	70	Hydro	NR
J227	MI	Mason	METC	Ludington Substation	70	Hydro	NR
J228	MI	Mason	METC	Ludington Substation	70	Hydro	NR
J229	MI	Mason	METC	Ludington Substation	70	Hydro	NR
J230	MI	Mason	METC	Ludington Substation	70	Hydro	NR
J231	MI	Mason	METC	Ludington Substation	70	Hydro	NR
J235	MI	Huron	ITCT	Bauer-Rapson 345 kV	110	Wind	NR
J241	WI	Florence	ATC	Twin Falls Substation	3.7	Hydro	NR

A.7 Network Upgrades Identified in DPP 2012 August West Area Restudy

Table A-20: NUs Identified in MISO Analysis

Constraint	Owner
Boone Jct-Fort Dodge 161 kV	MEC CIPCO
Dinsdale-Traer Tap 69 kV	ITCM
Hawkeye Tap-Richfield 69 kV	ITCM
Hawkeye Tap-Windsor 69 kV	ITCM
Hayward-Freeborn 161 kV	ITCM
Huntley-Freeborn 161 kV	ITCM
Jasper-Aurora 69 kV	ITCM
Traer-Traer Tap 69 kV	ITCM
Wellsburg 161-69 kV Transformer	ITCM
Voltage violations in area of Blackhawk	MEC

Table A-21: Additional NUs Identified in Affected System Analysis

Constraint	Owner
Lawrence-Sioux Falls 115 kV	XEL WAPA
Mt Vernon-Wyoming 161 kV	CIPCO
Liberty-Dundee 161 kV	CIPCO
Twin Church-Sioux City 230 kV	WAPA NPPD
Fargo 230-115-13.2 kV xfmr #2	WAPA

A.8 Network Upgrades Identified in DPP 2013 February West Area Restudy

Table A-22: NUs Identified in MISO Analysis

Constraint	Owner
Sheyenne-Mapleton 115 kV	XEL OTP
East Melrose-Melrose Muni 69 kV	XEL
East Melrose-Millwood Tap 69 kV	XEL
Black Oak-Melrose Muni 69 kV	XEL
Jamestown 345-115 kV #1	OTP
Jamestown 345-115 kV #2	OTP

Table A-23: Additional NUs Identified in Affected System Analysis

Constraint	Owner
Buffalo-Bison 345 kV	MPC
Jamestown-Buffalo 345 kV	MPC

A.9 Network Upgrades Identified in DPP 2013 August West Area Restudy

Table A-24: NUs Identified in MISO Analysis

Constraint	Owner
J274 POI-Creston 161 kV	MEC WAPA
Litchfield Tap–Litchfield 69 kV	GRE
Lake Lilian–Cosmo Tap 69 kV	XEL
Lake Lilian–Melville Tap 69 kV	XEL
Panther–Melville Tap 69 kV	XEL
Rugby OTP-Rugby Tap 115 kV	BEPC CPEC WAPA
Rugby 230-115-13.8 kV xfmr	OTP
Jasper 161-69 kV xfmr	ITCM
Newton 161-69 kV xfmr	ITCM
Newton-Colfax 69 kV	MEC ITCM
Aurora-Maytag 69 kV	ITCM
Patterson REC-Winterset 69 kV	CIPCO
Winterset 161-69 kV xfmr	CIPCO
Marshalltown-Blairstown 115 kV	ITCM
Jasper–Newton 161 kV	ITCM
Jasper-Laurel 161 kV	ITCM
Hazleton-Mitchell Co 345 kV	ITCM MEC
Raun-Tekamah 161 kV	MEC OPPD NPPD
Rugby-Rugby Tap 115 kV	BEPC CPEC WAPA
Voltage constraints in area of Blackhawk	MEC

Table A-25: Additional NUs Identified in Affected System Analysis

Constraint	Owner
N Summit Lake - S Summit Lake 69 kV	CIPCO
Ward-Mandan 230 kV	WAPA MDU
Richer-Roseau 230 kV series compensation[1]	MPC
G82R dc reduction scheme and OOS relay revision	MH
Letellier Station L20D Equipment	MH
Drayton Station L20D Equipment	MH
Quad Cities-MEC Cordova 345 kV	PJM

Note 1: Richer-Roseau 230 kV line is NRIS only constraint.

A.10 Network Upgrades Identified in DPP 2014 February West Area Study

Table A-26: NUs Identified in DPP 2014 February West Area Study

Constraint	Owner
No constraints	

A.11 Network Upgrades Identified in DPP 2014 August West Area Study

Table A-27: NUs Identified in MISO Analysis

Constraint	Owner
J316 Sub-Ellendale 230 kV	MDU
J344 Sub-Beacon 161 kV	MEC ITCM
Maryville-Clarinda 161 kV	MEC GMO
Wincor-Wincor Muncipal 69 kV	CIPCO
Clarinda-Brooks 161 kV	MEC

Table A-28: Additional NUs Identified in Affected System Analysis

Constraint	Owner
Twin Church-Sioux City 230 kV	WAPA NPPD

A.12 PJM Generation Projects and NUs Modeled

Table A-29: PJM Generation Projects Modeled

PJM Queue #	Project Name	County, State	Pmax (MW)	Fuel Type	MISO SH Output	MISO SPK Output
Q39	Kewanee 138kV	Henry, IL	105	wind	105	21
Q49	Dresden 345kV	Grundy, IL	957	nuclear	45	45
Q50	Dresden 345kV	Grundy, IL	957	nuclear	58	58
Q51	Quad City 345kV	Rock Island, IL	2028	nuclear	30	30
Q57	Steward-Waterman 138kV	Lee, IL	240	wind	22	4.4
R16	Lena 138kV	Stephenson, IL	126	wind	126	25.2
R30	Pontiac Mid-Point 345kV	Livingston, IL	500	wind	500	100
R33	Nelson 345kV	Unknown, IL	600	natural gas	0	600
S27	Blue Mound I	McLean, IL	198	wind	198	39.6
S28	Blue Mound II	McLean, IL	198	wind	198	39.6
S36	Kankakee 138kV	Kankakee, IL	175	wind	175	35
S37	Kankakee 138kV	Kankakee, IL	175	wind	175	35
S55	Zion 345kV	Lake, IL	780	natural gas	0	510
S57		IL	3500	HVDC	3500	1192
U1-054	Calumet	Cook, IL	327	natural gas	0	54
U3-031	Lincoln Generating Facility	Will, IL	616	natural gas	0	40
U4-033	University Park North	Will, IL	540	natural gas	0	36
05MLCS	Meadow Lake	IL	600	wind	600	120
Q01, Q03	Fowler Ridge		750	wind	750	150
T130	Convoy – East Lima 345kV	OH	300	wind	300	60
T131	Lincoln – Sterling 138kV	OH	150	wind	150	30
T142	Southwest Lima – Marysville 345kV	OH	300	wind	300	60
T143	Hennepin 138kV	IL	250	wind	250	50
T148	Caledonia Wind II 100 MW	IL	100	wind	100	20
T94	Cook – Palesades 345kV	MI	1035	natural gas	0	1035
T99	Caledonia Wind 100 MW	IL	100	wind	100	20
U2-028A_AT1	Ironville 138kV	OH	135	other	135	135
U2-072	East Lima – Marysville 345kV	OH	300	wind	300	60
U3-021	Silver Lake – Cherry Valley 345kV	IL	100	natural gas	0	100

PJM Queue #	Project Name	County, State	Pmax (MW)	Fuel Type	MISO SH Output	MISO SPK Output
U4-027	Normandy-Kewanee 138kV	IL	100	natural gas	0	100
V1-011	Haviland 138kV	OH	100	wind	100	20
V1-012	Haviland 138kV	OH	150	wind	150	30
V2-006	East Leipsic 138kV	OH	150	wind	150	30
V3-007	Desoto-Tanners Creek #1 345kV	IN	200	wind	200	40
V3-008	Desoto-Tanners Creek #1 345kV	IN	200	wind	200	40
V3-009	Desoto-Tanners Creek #1 345kV	IN	200	wind	200	40
V4-010	Tiffin Center 138kV	OH	200	wind	200	40
V4-015	Fostoria Central 138kV	OH	66.6	wind	66.6	13.32
V4-016	Valley 138kV	MI	200	wind	200	40
W1-072A_AT5	Lemoyne 345kV	OH	40	natural gas	0	40
W2-001	Fostoria Central 138kV	OH	66.6	wind	66.6	13.32
W3-059A_At6	Avery – Greenfield 138kV	OH	99	wind	99	19.8
W3-088	South West Lima 345kV	OH	200	wind	200	40
W3-128	Sporn – Waterford 345kV	OH	652	natural gas	0	652
W3-170	Buckskin 69kV	OH	12	solar	12	12
X1-027A_AT12	Davis Besse – Beaver 345kV	OH	500	wind	500	100
Y1-006	Jubal Early – Austinville 138kV	VA	72	wind	72	14.4
Y1-069	Bay Shore – Fostoria Central 345kV	OH	799	natural gas	0	799
V1-024	LaSalle 1	LaSalle, IL	1188	nuclear	20	20
V1-025	LaSalle 2	LaSalle, IL	1191	nuclear	20	20
V4-046	Byron 1	Ogle, IL	1249	nuclear	20	20
V4-047	Byron 2	Ogle, IL	1223	nuclear	20	20
V4-048	Braidwood 1	Will, IL	1247	nuclear	20	20
V4-049	Braidwood 2	Will, IL	1219	nuclear	20	20
W2-048	Pontiac MidPoint – Lanesville 345kV	Logan, IL	63	wind	62.5	12.5
W3-046	Powerton 345kV – Katydid 345kV	Mason, IL	208	wind	208	41.6
W4-005	Pontiac Midpoint – Latham	Macon	351	wind	351	70.2

PJM Queue #	Project Name	County, State	Pmax (MW)	Fuel Type	MISO SH Output	MISO SPK Output
	345kV					
X1-096	Loretto-Kings Creek 138kV	Somerset	150	wind	150	30
X2-022	Pontiac Midpoint-Lanesville II	Logan	189	wind	189	37.8
X2-031	Krayn 115kV	Cambria	50	wind	50	10
X2-052	Dumont-Olive 345kV	Adams	675	natural gas	0	675
X3-051	Flatlick 765kV	Unknown	1460	natural gas	0	610
X4-025	Millbrook Park 138kV	Greenup	80	coal	80	80
Y1-030	Forest 69kV	Wyandot	100	wind	100	20
Y1-065	Rock Spring 500kV	Cecil	852	natural gas	0	852
X1-087	Stillman Valley	IL	19	methane	0	19
X3-023	S. Greenwich-Willard 69kV	OH	60	wind	60	12
Y2-050	Tidd-Canton Central	OH	742	natural gas,CC	0	742
Y2-053	Lemoyne 138kV	OH	35	Gas	0	35
Y3-088	Kendall I	IL	20	natural gas,CC	0	20
Y3-089	Kendall II	IL	20	natural gas,CC	0	20
Y3-090	Kendall III	IL	20	natural gas,CC	0	20
Y3-091	Kendall IV	IL	20	natural gas,CC	0	20
Y3-103	Valley-Raccoon 138kV	PA	205	natural gas,CC	0	205
V4-033		Randolph, IN	299.2	wind	299.2	59.84
W4-004		Henry, IN	90	wind	90	18
W4-008		Henry, IN	90	wind	90	18
X2-006		Lawrence, KY	585	CC	292.5	585
Y3-038		Spencer, IN	36	coal	36	36
Z1-035		Unknown, OH	18	wind	18	3.6
Z1-051		Berrien, MI	102	nuclear	102	102
Z1-079		Butler, OH	513	CC	256.5	513
Z1-127		Will, IL	20	Peaker	0	20

Table A-30: NUs Required by PJM Generation Projects

Idev File Name	Network Upgrade
Dumont CAP.idv	250 Mvar switched cap at Dumont 765 kV bus
Sorenson_ELima345kV.idv	Sorenson-East Lima 345 kV new line

A.13 Model Review Comments

Table A-31: Model Review Comments

Company	Python/ Idev File Name	2025 SH	2025 SPK	2025 Stability	2018 SH	2018 SPK	2018 Stability
MISO	Correct_J422.idv	x	x	x	x	x	x
MISO	Model_Corrections_SPTI.idv	x	x	x	x	x	x
MISO	RMV_J303-J309.py	x	x	x	x	x	x
MISO	RMV_J288.py	x	x	x	x	x	x
MISO	RMV_G359.py	x	x	x	x	x	x
J299	J299_dispatch_adj_per_model_review_comments_SPK_StabilityCases.py J299_dispatch_adj_per_model_review_comments_SPK_StabilityCases_Benchmark.py		x	x		x	x
J299	J299_dispatch_adj_per_model_review_comments_SHCases.py J299_dispatch_adj_per_model_review_comments_SHCases_Benchmark.py	x			x		
J405	MDU-Change_RICE_GEN_RemoteBus_2018SH.idv				x		x
J405	MDU-Change_RICE_GSU_Owner&Ratings_2018SH.idv				x		x
J405	MDU-Change_RICE_GEN_RemoteBus_2018SPK.idv					x	
J405	MDU-Change_RICE_GSU_Owner&Ratings_2018SPK.idv					x	
J405	MDU-Change_RICE_GEN_RemoteBus_2025SH.idv	x		x			
J405	MDU-Change_RICE_GSU_Owner&Ratings_2025SH.idv	x		x			
J405	MDU-Change_RICE_GEN_RemoteBus_2025SPK.idv		x				
J405	MDU-Change_RICE_GSU_Owner&Ratings_2025SPK.idv		x				
J407	J407_Change_POI_to_Glenworth161kV_631174.idv	x	x	x	x	x	x
J416	J416_Adjust_POI_to22MilesFromKilldeer.idv	x	x	x	x	x	x
J416	J416_StepUpXfmr_ratings.idv	x	x	x	x	x	x
J426	J426_DPP-2015-FEB_Steady-State_Updates.idv	x	x	x	x	x	x
J426	Adjust_J235_2018ST.py						x
J426	Adjust_J235_2025ST.py			x			
J426	Correct_913030.py		x	x		x	x
J426	Correct_199281-SWS.py	x	x		x	x	
MDU	MDU-Replace_WishekAutoXfmr_2018SH.idv				x		x

Company	Python/ Idev File Name	2025 SH	2025 SPK	2025 Stability	2018 SH	2018 SPK	2018 Stability
MDU	MDU-Update_2W-XfmrRatings&Z_2018SH.idv				x		x
MDU	MDU-Update_3W-XfmrRatings_2018SH.idv				x		x
MDU	MDU-Update_LineRatings&Z_2018SH.idv				x		x
MDU	MDU-Update_Merricourt_2018SH.idv				x		x
MDU	MDU-Update_OtherGEN_2018SH.idv				x		x
MDU	MDU-Update_Tatanka_2018SH.idv				x		x
MDU	MDU-Update_ThunderSpirit_2018SH.idv				x		x
MDU	MDU-Replace_WishekAutoXfmr_2018SPK.idv					x	
MDU	MDU-Update_2W-XfmrRatings&Z_2018SPK.idv					x	
MDU	MDU-Update_3W-XfmrRatings_2018SPK.idv					x	
MDU	MDU-Update_LineRatings&Z_2018SPK.idv					x	
MDU	MDU-Update_Merricourt_2018SPK.idv					x	
MDU	MDU-Update_OtherGEN_2018SPK.idv					x	
MDU	MDU-Update_Tatanka_2018SPK.idv					x	
MDU	MDU-Update_ThunderSpirit_2018SPK.idv					x	
MDU	MDU-Remove_Tatanka-EllendaleMVP_Duplicate230Line_2025SH.idv	x		x			
MDU	MDU-Replace_WishekAutoXfmr_2025SH.idv	x		x			
MDU	MDU-Update_2W-XfmrRatings&Z_2025SH.idv	x		x			
MDU	MDU-Update_3W-XfmrRatings_2025SH.idv	x		x			
MDU	MDU-Update_LineRatings&Z_2025SH.idv	x		x			
MDU	MDU-Update_Merricourt_2025SH.idv	x		x			
MDU	MDU-Update_OtherGEN_2025SH.idv	x		x			
MDU	MDU-Update_Tatanka_2025SH.idv	x		x			
MDU	MDU-Update_ThunderSpirit_2025SH.idv	x		x			
MDU	MDU-Remove_Tatanka-EllendaleMVP_Duplicate230Line_2025SPK.idv		x				
MDU	MDU-Replace_WishekAutoXfmr_2025SPK.idv		x				
MDU	MDU-Update_2W-XfmrRatings&Z_2025SPK.idv		x				
MDU	MDU-Update_3W-XfmrRatings_2025SPK.idv		x				
MDU	MDU-Update_LineRatings&Z_2025SPK.idv		x				
MDU	MDU-Update_Merricourt_2025SPK.idv		x				
MDU	MDU-Update_OtherGEN_2025SPK.idv		x				
MDU	MDU-Update_Tatanka_2025SPK.idv		x				

Company	Python/ Idev File Name	2025 SH	2025 SPK	2025 Stability	2018 SH	2018 SPK	2018 Stability
MDU	MDU-Update_ThunderSpirit_2025SPK.idv		x				
MEC	2018_Sh_MEC_Updates.py				x		x
MEC	2018_SPK_MEC_Updates.py					x	
MEC	2025_Sh_MEC_Updates.py	x		x			
MEC	2025_SPK_MEC_Updates.py		x				
MEC	Remove_R49_perMECcomments.py	x	x	x	x	x	x
MEC	2018_RMV_Sandburg-Fargo.py				x	x	x
MPC	MPC-fix-ratings-DPP-FEB15-both.idv	x	x	x	x	x	x
MPC	MPC01200-Add-ROFR-portion-v32.idv	x	x	x			
MPC	MPC02100_CenMan_POI_100_MW.IDV	x	x	x	x	x	x
OTP	BigStonePlant_TransformerTapCorrections_10-7-15.idv	x	x	x	x	x	x
OTP	BigStonePlant_VschedCorrection_10-7-15.idv	x	x	x	x	x	x
OTP	BigStoneSouth_Addition.idv				x	x	x
OTP	BigStoneSouth_Reactors_10-7-15.idv	x	x	x			
OTP	Buffalo-CasseltonImpedanceCorrection_1-15-16.idv	x	x	x	x	x	x
OTP	G736_InterconnectionPoint.idv	x	x	x	x	x	x
OTP	PerhamTopologyCorrection_1-11-16.idv	x	x	x	x	x	x
OTP	Rugby#2Transformer_12-31-15.idv	x	x	x	x	x	x
OTP	Disp_HootLk_Pmax.py	x	x	x	x	x	x
OTP	Disp_Bigstone_Pmax.py	x	x	x	x	x	x
MRES	SaratogaSt_MWF_25SPK_Bench_Redisp.idv SaratogaSt_MWF_25SPK_Study_Redisp.idv		x				
MRES	J391_GSU_Ratings.py	x	x	x	x	x	x
J391	Correct_J391_Modeling.py						
MRES	MWF_Pmax_Correction.idv	x	x	x	x	x	x
MRES	MWF_2018SH_SteadySt_Bench_MVAR_Control_Correct.idv MWF_2018SH_SteadySt_Change_MVAR_Control_Correct.idv				x		
MRES	MWF_2018SH_Stability_MVAR_Control_Correct.idv						x
MRES	Marshall_Saratoga_Updates_v32.idv			x			x
MRES	2018SH_Stability_MMU_Load_Profile.idv						x

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Company	Python/ Idev File Name	2025 SH	2025 SPK	2025 Stability	2018 SH	2018 SPK	2018 Stability
ATC	set_MackinacHVDCto_30MW_NorthtoSouth.py	x	x		x	x	
ATC	set_MackinacHVDCto_30MW_NorthtoSouth_Stability.py			x			x
ATC	Set_PointBeach_Pmax.py	x	x	x	x	x	x
ATC	Hickory Creek-2.idv	x	x	x	x	x	x
ATC	RMV_Retired_Units.py	x	x	x	x	x	x
ATC	Turn_On_J395-DAR.py	x	x	x	x	x	x
ATC	RMV_693403-693404.idv	x	x	x	x	x	x
GRE	GRE-xfmr-ratings-160107.py	x	x	x	x	x	x
MRES	J391-MISO-DPP-Feb-2015-2018SH-StabCase-Correction-Saratoga-Load.idv						x
MISO	Correct J299 Gen-Tie.py	x	x	x	x	x	x
MISO	Big Stone-Brookings.idv				x	x	x

A.14 MISO Market as the Study Sink

Table A-32: MISO Market as the Study Sink

Area #	Area Name	Area #	Area Name
207	HE	361	SIPC
208	DEI	502	CLEC
210	SIGE	503	LAFA
216	IPL	504	LEPA
217	NIPS	600	Xcel
218	METC	608	MP
219	ITC	613	SMMPA
295	WEC	615	GRE
296	MIUP	620	OTP
314	BREC	627	ALTW
327	EES-EAI	633	MPW
332	LAGN	635	MEC
333	CWLD	661	MDU
349	SMEPA	680	DPC
351	EES	694	ALTE
356	AMMO	696	WPS
357	AMIL	697	MGE
360	CWLP	698	UPPC

A.15 PJM Market as PJM Projects Sink

Table A-33: PJM Market as PJM Projects Sink

Area #	Area Name	Area #	Area Name
201	AP	229	PPL
202	ATSI	230	PECO
205	AEP	231	PSE&G
209	DAY	232	BGE
212	DEO&K	233	PEPCO
215	DLCO	234	AE
222	CE	235	DP&L
225	PJM	236	UGI
226	PENELEC	237	RECO
227	METED	320	EKPC
228	JCP&L	345	DVP

A.16 SPP Market as SPP Projects Sink

Table A-34: SPP Market as SPP Projects Sink

Area #	Area Name	Area #	Area Name
515	SWPA	540	GMO
520	AEPW	541	KCPL
523	GRDA	542	KACY
524	OKGE	544	EMDE
525	WFEC	545	INDN
526	SPS	546	SPRM
527	OMPA	640	NPPD
531	MIDW	645	OPPD
534	SUNC	650	LES
536	WERE	652	WAPA

A.17 Contingency Files used in Steady-State Analysis

Table A-35: List of Contingencies used in Steady-State Analysis

Contingency File Name	Description	2025	2018
Automatic single element contingencies	Single element outages at buses 60 kV and above in the study region	x	x
ATC_P1P2_2017_DPP.con	Specified category P1, P2 contingencies in ATC		x
ATC_P1P2_2024_DPP.con	Specified category P1, P2 contingencies in ATC	x	
ATC_P5_2017_DPP.con	Specified category P5 contingencies in ATC		x
ATC_P5_2024_DPP.con	Specified category P5 contingencies in ATC	x	
ATC_P7_2017_DPP.con	Specified category P7 contingencies in ATC		x
ATC_P7_2024_DPP.con	Specified category P7 contingencies in ATC	x	
MNTACT-P1P2-SingleContingency.con	Specified category P1-P2 contingencies in Minnesota	x	x
MNTACT-P4-P5-P7-MultipleContingency.con	Specified category P4, P5, P7 contingencies in Minnesota	x	x
MDU-DPP-2018-P1.con	Specified category P1 contingencies in MDU		x
MDU-DPP-2025-P1.con	Specified category P1 contingencies in MDU	x	
MDU-DPP-2018-P2.con	Specified category P2 contingencies in MDU		x
MDU-DPP-2025-P2.con	Specified category P2 contingencies in MDU	x	
MDU-DPP-2018-P4.con	Specified category P4 contingencies in MDU		x
MDU-DPP-2025-P4.con	Specified category P4 contingencies in MDU	x	
MDU-DPP-2018-P7.con	Specified category P7 contingencies in MDU		x
MDU-DPP-2025-P7.con	Specified category P7 contingencies in MDU	x	
MPC_CatP1.con	Specified category P1 contingencies in MPC	x	x
MPC_CatP2.con	Specified category P2 contingencies in MPC	x	x
MPC_CatP4.con	Specified category P4 contingencies in MPC	x	x
MPC_CatP5.con	Specified category P5 contingencies in MPC	x	x
MPC_CatP7.con	Specified category P7 contingencies in MPC	x	x
MPC_CatX_MNTACT.CON	Specified category Extreme contingencies in MPC	x	x
OTP P5 Contingencies.con	Specified category P5 contingencies in OTP	x	x
CIPC Additional Contingencies_09192013_C_fixed.con	Specified category P6 contingencies in CIPCO	x	x

Contingency File Name	Description	2025	2018
MEC DPP2015 FEB 2018 Cat P1.con	Specified category P1 contingencies in MEC		x
MEC DPP2015 FEB 2025 Cat P1.con	Specified category P1 contingencies in MEC	x	
MEC DPP2015 FEB 2018 Cat P2.con	Specified category P2 contingencies in MEC		x
MEC DPP2015 FEB 2025 Cat P2.con	Specified category P2 contingencies in MEC	x	
MEC DPP2015 FEB 2018 Cat P3.con	Specified category P3 contingencies in MEC		x
MEC DPP2015 FEB 2025 Cat P3.con	Specified category P3 contingencies in MEC	x	
MEC DPP2015 FEB 2018 Cat P4.con	Specified category P4 contingencies in MEC		x
MEC DPP2015 FEB 2025 Cat P4.con	Specified category P4 contingencies in MEC	x	
MEC DPP2015 FEB 2018 Cat P5.con	Specified category P5 contingencies in MEC		x
MEC DPP2015 FEB 2025 Cat P5.con	Specified category P5 contingencies in MEC	x	
MEC DPP2015 FEB 2018 Cat P6.con	Specified category P6 contingencies in MEC		x
MEC DPP2015 FEB 2025 Cat P6.con	Specified category P6 contingencies in MEC	x	
MEC DPP2015 FEB 2018 Cat P7.con	Specified category P7 contingencies in MEC		x
MEC DPP2015 FEB 2025 Cat P7.con	Specified category P7 contingencies in MEC	x	
MTEP14_2019_ITCM_Cat_B.con	Specified category P1 contingencies in ITCM		x
MTEP14_2024_ITCM_Cat_B.CON	Specified category P1 contingencies in ITCM	x	
MTEP14_2019_ITCM_Cat_C.CON	Specified category P2-P7 contingencies in ITCM		x
MTEP14_2024_ITCM_Cat_C.CON	Specified category P2-P7 contingencies in ITCM	x	
MPW_NERC_Cat_B_2014.con	Specified category P1 contingencies in MPW	x	x
MPW_other_Cat_B_2014.con	Specified category P1 contingencies in MPW	x	x
MPW_NERC_Cat_C1_C2_C5_2014.con	Specified category P2-P7 contingencies in MPW	x	x
MPW_other_Cat_C1_C2_C3_C5_2014.con	Specified category P2-P7 contingencies in MPW	x	x
XEL_MTEP13_B_non-MNTACT.con	Specified category P1 contingencies in XEL	x	x
XEL_MTEP13_C_non-MNTACT.con	Specified category P2-P7 contingencies in XEL	x	x
HVDC_Red_2017SH.con	Specified category P1 contingencies with HVDC reduction in 2018 shoulder		x
HVDC_Red_2024SH.con	Specified category P1 contingencies with HVDC reduction in 2025 shoulder	x	
HVDC_Red_2017SPK.con	Specified category P1 contingencies with HVDC		x

Contingency File Name	Description	2025	2018
	reduction in 2018 peak		
HVDC_Red_2024SPK.con	Specified category P1 contingencies with HVDC reduction in 2025 peak	x	
Without_SPS_MN_2017.con	Specified category P1 contingencies without LGS and Mankato Energy Center SPS		x
Without_SPS_MN_2024.con	Specified category P1 contingencies without LGS and Mankato Energy Center SPS	x	
Selected_WAPA_CONS_C.con	Specified category P2-P7 contingencies in WAPA	x	x
AMRN_B_2019S.con	Specified category P1 contingencies in AMRN		x
AMRN_B_2024S.con	Specified category P1 contingencies in AMRN	x	
AMRN_C1_2019.con	Specified category P2 contingencies in AMRN		x
AMRN_C1_2024.con	Specified category P2 contingencies in AMRN	x	
AMRN_C2_2019.con	Specified category P2 contingencies in AMRN		x
AMRN_C2_2024.con	Specified category P2 contingencies in AMRN	x	
AMRN_C5_2019.con	Specified category P7 contingencies in AMRN		x
AMRN_C5_2024.con	Specified category P7 contingencies in AMRN	x	
C1_Explicit_CWLD_2017_MISO.con	Specified category P2 contingencies in CWLD	x	x
C2_Explicit_CWLD_2017_MISO_2018-Revision.con	Specified category P2 contingencies in CWLD	x	x
C5_Explicit_CWLD_2017_MISO.con	Specified category P7 contingencies in CWLD	x	x
ComEd_RTEP_Cat_B_2017.con	Specified category P1 contingencies in ComEd		x
ComEd_RTEP_Cat_B_2024.con	Specified category P1 contingencies in ComEd	x	
ComEd_RTEP_Cat_C_fixed.con	Specified category P2-P7 contingencies in ComEd	x	x

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Appendix
B

Model Data

B.1 Power Flow Model Data

G736

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DATA FOR BUS   6060 [G736        0.6900] RESIDING IN AREA  620, ZONE  655, OWNER  620:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 0.99802 129.02

                                                  X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
     200.0    31.6    65.9   -65.9 1.02500 100.00   6062 G736_T      230.00 1.02500

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1  200.0   31.6   65.9  -65.9  211.0 0.0000 0.8000 0.0000 0.0000 1.0000  200.0  200.0  620 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M    R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6061 G736_COL    34.500  1               1 T T 2 1  0.00767  0.05750  211.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6061 G736_COL    34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000  218.3  218.3  218.3  620 1.000

 X------- TO BUS --------X     W C                                     X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6061 G736_COL    34.500  1  T 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000


 DATA FOR BUS   6061 [G736_COL    34.500] RESIDING IN AREA  620, ZONE  655, OWNER  620:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 0.98355 125.90

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M    R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6060 G736        0.6900  1               1 F F 2 1  0.00767  0.05750  211.0  0.00000  0.00000  0
   6062 G736_T      230.00  1               1 T T 2 1  0.00162  0.08100  135.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6060 G736        0.6900  1  1 1.00000 0.0000    0.0 1.00000 0.0000  218.3  218.3  218.3  620 1.000
   6062 G736_T      230.00  1  3 1.00000 241.50    0.0 1.00000 34.500  225.0  225.0  225.0  620 1.000

 X------- TO BUS --------X     W C                                     X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6060 G736        0.6900  1  F 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000
   6062 G736_T      230.00  1  T 3  0 1.05000 0.95000 1.10000 0.90000    5                              0.000


 DATA FOR BUS   6062 [G736_T      230.00] RESIDING IN AREA  620, ZONE  655, OWNER  620:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.02500 118.79

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 620322 BSSOUTH4    230.00  1   0.03277  0.12692  0.00000  1  T   999.0  999.0    0.0   42.0     620 1.000
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 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6061 G736_COL    34.500  1               1 F F 2 1  0.00162  0.08100  135.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6061 G736_COL    34.500  1  3 1.00000 241.50    0.0 1.00000 34.500  225.0  225.0  225.0  620 1.000

 X------- TO BUS --------X     W C                                        X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6061 G736_COL    34.500  1  F 3  0 1.05000 0.95000 1.10000 0.90000    5                              0.000


 DATA FOR BUS 620322 [BSSOUTH4    230.00] RESIDING IN AREA  620, ZONE  655, OWNER  620:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 0.99795 104.49

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6062 G736_T      230.00  1   0.03277  0.12692  0.00000  1  F   999.0  999.0    0.0   42.0     620 1.000
 620314 BIGSTON4    230.00  1   0.00050  0.00293  0.00584  1  F   674.0  742.0    0.0    0.0     620 1.000
 620314 BIGSTON4    230.00  2   0.00050  0.00293  0.00584  1  F   674.0  742.0    0.0    0.0     620 1.000

 X- XFRMER -X X---- WINDING 1 BUS ----X X---- WINDING 2 BUS ----X X---- WINDING 3 BUS ----X     S C C C
 X-- NAME --X   BUS# X-- NAME --X BASKV   BUS# X-- NAME --X BASKV   BUS# X-- NAME --X BASKV CKT T W Z M OWN1
FRAC1 OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 345-1        620417 BSSOUTH3    345.00 620322 BSSOUTH4    230.00 620320 BSS1 13.8   13.800  1  1 2 2 1  620
1.000
 345-2        620417 BSSOUTH3    345.00 620322 BSSOUTH4    230.00 620321 BSS2 13.8   13.800  2  1 2 2 1  620
1.000

 X- XFRMER -X S C X--------- SPECIFIED NOMINAL MEASURED IMPEDANCES AND MVA BASES ----------X X-ACTUAL
IMPEDANCES FROM IMPEDANCE CORRECTION TABLE-X
 X-- NAME --X T Z   R 1-2    X 1-2 SBAS1-2   R 2-3    X 2-3 SBAS2-3   R 3-1    X 3-1 SBAS3-1   R 1-2    X 1-2
R 2-3    X 2-3    R 3-1    X 3-1
 345-1        1 2  0.00036  0.02203  100.0  0.00535  0.01507  100.0  0.00536  0.13080  100.0
 345-2        1 2  0.00036  0.02203  100.0  0.00535  0.01507  100.0  0.00536  0.13080  100.0

 X- XFRMER -X X----- WINDING BUS -----X  S C    MAGNETIZING Y   SYSTEM BASE NOM.                          TBL
CORRECTED   STAR POINT BUS
 X-- NAME --X   BUS# X-- NAME --X BASKV  T M    MAG1     MAG2   R WNDNG  X WNDNG  RATEA  RATEB  RATEC TBL R
WNDNG  X WNDNG VOLTAGE  ANGLE
 345-1        620417 BSSOUTH3    345.00  1 1  0.00000  0.00000  0.00018  0.06888  448.0  560.0  448.0  0
0.97050  107.7
              620322 BSSOUTH4    230.00* 1                      0.00018 -0.04685  448.0  560.0  448.0  0
              620320 BSS1 13.8   13.800* 1                      0.00518  0.06192   72.8   91.0   72.8  0
 345-2        620417 BSSOUTH3    345.00  1 1  0.00000  0.00000  0.00018  0.06888  448.0  560.0  448.0  0
0.97050  107.7
              620322 BSSOUTH4    230.00* 1                      0.00018 -0.04685  448.0  560.0  448.0  0
              620321 BSS2 13.8   13.800* 1                      0.00518  0.06192   72.8   91.0   72.8  0

 X- XFRMER -X X----- WINDING BUS -----X C                                                            X----
CONTROLLED BUS ----X CNXTN
 X-- NAME --X   BUS# X-- NAME --X BASKV W CN  WIND V  NOM V  ANGLE   RMAX    RMIN    VMAX    VMIN  NTPS
BUS# X-- NAME --X BASKV ANGLE    CR      CX
 345-1        620417 BSSOUTH3    345.00 2  0  336.38 0.0000    0.0 1.10000 0.90000 1.10000 0.90000   33
0.0
              620322 BSSOUTH4    230.00    0  230.00 0.0000    0.0 1.10000 0.90000 1.10000 0.90000   33
0.0
              620320 BSS1 13.8   13.800    0  13.800 0.0000  -30.0 1.10000 0.90000 1.10000 0.90000   33
0.0
 345-2        620417 BSSOUTH3    345.00 2  0  336.38 0.0000    0.0 1.10000 0.90000 1.10000 0.90000   33
0.0
              620322 BSSOUTH4    230.00    0  230.00 0.0000    0.0 1.10000 0.90000 1.10000 0.90000   33
0.0
              620321 BSS2 13.8   13.800    0  13.800 0.0000  -30.0 1.10000 0.90000 1.10000 0.90000   33
0.0
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J299

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DATA FOR BUS  50010 [MEC-CT2     15.000] RESIDING IN AREA  600, ZONE  601, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2    10.0     6.2     0.0     0.0     0.0     0.0     0.0     0.0 0.98462 -35.80

 ID ST     PSI   P Q - L O A D     I - L O A D     Y - L O A D  AREA  ZONE OWNER SCALE
 1   1   1.000    10.0     6.2     0.0     0.0     0.0     0.0   600   601   600  YES

                                                 X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
     210.0    -1.0   108.0   -80.0 1.02000  50.00 603179 MEC-115     115.00 1.02000

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1  210.0   -1.0  108.0  -80.0  226.0 0.0020 0.2015 0.0000 0.0000 1.0000  210.0  210.0  605 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M    R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
 603179 MEC-115     115.00  1               1 F F 1 1  0.00000  0.05217  100.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
 603179 MEC-115     115.00  1  1 1.00000 0.0000    0.0 1.02600 0.0000  230.0  230.0  230.0  600 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
 603179 MEC-115     115.00  1  F 1  0 1.50000 0.51000 1.50000 0.51000   33                                0.000


 DATA FOR BUS 600047 [MEC-CT1     15.000] RESIDING IN AREA  600, ZONE  604, OWNER  605:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2    10.0     6.2     0.0     0.0     0.0     0.0     0.0     0.0 0.98462 -35.80

 ID ST     PSI   P Q - L O A D     I - L O A D     Y - L O A D  AREA  ZONE OWNER SCALE
 X4  1   1.000    10.0     6.2     0.0     0.0     0.0     0.0   600   601   605  YES

                                                 X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
     210.0    -1.0   108.0   -80.0 1.02000  50.00 603179 MEC-115     115.00 1.02000

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1  210.0   -1.0  108.0  -80.0  226.0 0.0020 0.2027 0.0000 0.0000 1.0000  210.0  210.0  605 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M    R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
 603179 MEC-115     115.00  1               1 T T 1 1  0.00000  0.05217  100.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
 603179 MEC-115     115.00  1  1 1.02600 0.0000    0.0 1.00000 0.0000  230.0  230.0  230.0  600 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
 603179 MEC-115     115.00  1  T 1  0 1.50000 0.51000 1.50000 0.51000   33                                0.000


 DATA FOR BUS 603179 [MEC-115     115.00] RESIDING IN AREA  600, ZONE  604, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.02000 -41.92

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 603002 WILMART7    115.00  1   0.00026  0.00150  0.00021  1  F   316.3  318.7    0.0    0.0     600 1.000
 603002 WILMART7    115.00  2   0.00026  0.00150  0.00021  1  F   310.0  310.0  310.0    0.0     600 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M    R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
  50010 MEC-CT2     15.000  1               1 T T 1 1  0.00000  0.05217  100.0  0.00000  0.00000  0
 600047 MEC-CT1     15.000  1               1 F F 1 1  0.00000  0.05217  100.0  0.00000  0.00000  0
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 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
  50010 MEC-CT2     15.000  1  1 1.00000 0.0000    0.0 1.02600 0.0000  230.0  230.0  230.0  600 1.000
 600047 MEC-CT1     15.000  1  1 1.02600 0.0000    0.0 1.00000 0.0000  230.0  230.0  230.0  600 1.000

 X------- TO BUS --------X     W C                                     X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
  50010 MEC-CT2     15.000  1  T 1  0 1.50000 0.51000 1.50000 0.51000   33                              0.000
 600047 MEC-CT1     15.000  1  F 1  0 1.50000 0.51000 1.50000 0.51000   33                              0.000


 DATA FOR BUS 603002 [WILMART7    115.00] RESIDING IN AREA  600, ZONE  604, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.01992 -42.09

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 603003 SWAN LK7    115.00  1   0.02660  0.09620  0.01158  1  F   116.9  116.9    0.0   16.5     600 1.000
 603179 MEC-115     115.00  1   0.00026  0.00150  0.00021  1  T   316.3  318.7    0.0    0.0     600 1.000
 603179 MEC-115     115.00  2   0.00026  0.00150  0.00021  1  T   310.0  310.0  310.0    0.0     600 1.000
 603186 SUMMIT      115.00  1   0.00022  0.00123  0.00018  1  F   308.3  347.8    0.0    0.1     600 1.000
 603188 EASTWD18    115.00  1   0.00451  0.02609  0.00345  1  F   190.8  209.9    0.0    4.4     600 1.000
 603275 WILMARH CAP 115.00  Z   0.00010  0.00020  0.00000  1  T   888.0  888.0  888.0    0.0     600 1.000
 617200 GRE-NORTHPT7115.00  1   0.00672  0.02467  0.00293  1  F   140.4  154.5    0.0    0.0     600 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M    R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
 605012 WILMART8    69.000  6              1 T T 3 2    75450  0.03990   37.5    24100  0.00670  0
 605012 WILMART8    69.000  7              1 T T 3 2    77163  0.03990   37.5    25000  0.00690  0
 605012 WILMART8    69.000  8              1 T T 3 2    76943  0.03970   37.5    24850  0.00670  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
 605012 WILMART8    69.000  6  1 1.00801 0.0000    0.0 1.00870 0.0000   70.0   80.5    0.0  600 1.000
 605012 WILMART8    69.000  7  1 1.00801 0.0000    0.0 1.00870 0.0000   70.0   80.5    0.0  600 1.000
 605012 WILMART8    69.000  8  1 1.00801 0.0000    0.0 1.00870 0.0000   70.0   80.5    0.0  600 1.000

 X------- TO BUS --------X     W C                                     X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
 605012 WILMART8    69.000  6  T 1  1 1.11580 0.91290 1.03500 1.01500   33 -605012 WILMART8    69.000   0.000
 605012 WILMART8    69.000  7  T 1  1 1.11580 0.91290 1.03500 1.01500   33 -605012 WILMART8    69.000   0.000
 605012 WILMART8    69.000  8  T 1  1 1.11580 0.91290 1.03500 1.01500   33 -605012 WILMART8    69.000   0.000

 X- XFRMER -X X---- WINDING 1 BUS ----X X---- WINDING 2 BUS ----X X---- WINDING 3 BUS ----X     S C C C
 X-- NAME --X   BUS# X-- NAME --X BASKV   BUS# X-- NAME --X BASKV   BUS# X-- NAME --X BASKV CKT T W Z M OWN1
FRAC1 OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
              601004 WILMART3    345.00 603002 WILMART7    115.00 605727 WILMARTH 9  13.800  9  1 1 3 2  600
1.000
 345/115      601004 WILMART3    345.00 603002 WILMART7    115.00 605786 WILMARTH 10 13.800  10 1 2 3 2  600
1.000

 X- XFRMER -X S C X--------- SPECIFIED NOMINAL MEASURED IMPEDANCES AND MVA BASES ----------X X-ACTUAL
IMPEDANCES FROM IMPEDANCE CORRECTION TABLE-X
 X-- NAME --X T Z    R 1-2    X 1-2 SBAS1-2   R 2-3    X 2-3 SBAS2-3   R 3-1    X 3-1 SBAS3-1   R 1-2    X 1-2
R 2-3    X 2-3    R 3-1    X 3-1
              1 3   272680  0.06080  240.0        0  0.42110  240.0        0  0.48770  240.0
 345/115      1 3   260869  0.05940  240.0        0  0.27900  240.0        0  0.30800  240.0

 X- XFRMER -X X----- WINDING BUS -----X  S C    MAGNETIZING Y   SYSTEM BASE NOM.                            TBL
CORRECTED   STAR POINT BUS
 X-- NAME --X   BUS# X-- NAME --X BASKV  T M    MAG1     MAG2   R WNDNG  X WNDNG  RATEA  RATEB  RATEC TBL R
WNDNG  X WNDNG VOLTAGE  ANGLE
              601004 WILMART3    345.00* 1 2   218700  0.00560  0.00024  0.02654  448.0  515.2    0.0  0
0.99374  -42.1
              603002 WILMART7    115.00  1                      0.00024 -0.00121  448.0  515.2    0.0  0
              605727 WILMARTH 9  13.800* 1                     -0.00024  0.17667    0.0    0.0    0.0  0
 345/115      601004 WILMART3    345.00  1 2   212480  0.00790  0.00023  0.01841  448.0  560.0  448.0  0
0.99525  -42.1
              603002 WILMART7    115.00* 1                      0.00023  0.00633  448.0  560.0  448.0  0
              605786 WILMARTH 10 13.800* 1                     -0.00023  0.10992  119.1  148.9  119.1  0

 X- XFRMER -X X----- WINDING BUS -----X C                                                             X----
CONTROLLED BUS ----X CNXTN
 X-- NAME --X   BUS# X-- NAME --X BASKV W CN  WIND V  NOM V  ANGLE   RMAX    RMIN    VMAX    VMIN  NTPS
BUS# X-- NAME --X BASKV ANGLE    CR      CX
              601004 WILMART3    345.00 1  0 1.02600 345.00    0.0 1.10000 0.90000 1.10000 0.90000  159
0.0
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              603002 WILMART7    115.00    0 1.02609 115.00    0.0 1.50000 0.51000 1.50000 0.51000  159
0.0
              605727 WILMARTH 9  13.800    0 1.00000 13.800  -30.0 1.10000 0.90000 1.10000 0.90000  159
0.0
 345/115      601004 WILMART3    345.00 2  0  354.00 345.00    0.0 1.10000 0.90000 1.10000 0.90000    5
0.0
              603002 WILMART7    115.00    0  118.00 118.00    0.0 1.10000 0.90000 1.10000 0.90000    5
0.0
              605786 WILMARTH 10 13.800    0  13.800 13.800  -30.0 1.10000 0.90000 1.10000 0.90000   33
0.0

 DATA FOR BUS 600046 [MEC-ST      19.500] RESIDING IN AREA  600, ZONE  604, OWNER  605:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 0.99412 -35.70

                                                X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
     340.0     4.0   270.0  -190.0 1.02500 100.00 601030 MEC-345     345.00 1.02500

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1  340.0    4.0  270.0 -190.0  470.0 0.0024 0.2360 0.0000 0.0000 1.0000  340.0  340.0  605 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
 601030 MEC-345     345.00  1               1 T T 1 1  0.00000  0.03250  100.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
 601030 MEC-345     345.00  1  1 1.02600 0.0000    0.0 1.00000 0.0000  400.0  400.0  400.0  600 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
 601030 MEC-345     345.00  1  T 1  0 1.50000 0.51000 1.50000 0.51000   33                               0.000


 DATA FOR BUS 601030 [MEC-345     345.00] RESIDING IN AREA  600, ZONE  604, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.02500 -42.09

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 601004 WILMART3    345.00  1   0.00001  0.00010  0.00854  1  F  1378.0 1515.8    0.0    0.2     600 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
 600046 MEC-ST      19.500  1               1 F F 1 1  0.00000  0.03250  100.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
 600046 MEC-ST      19.500  1  1 1.02600 0.0000    0.0 1.00000 0.0000  400.0  400.0  400.0  600 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
 600046 MEC-ST      19.500  1  F 1  0 1.50000 0.51000 1.50000 0.51000   33                               0.000


 DATA FOR BUS 601004 [WILMART3    345.00] RESIDING IN AREA  600, ZONE  604, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.02500 -42.11

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 601030 MEC-345     345.00  1   0.00001  0.00010  0.00854  1  T  1378.0 1515.8    0.0    0.2     600 1.000
 601033 FIELD_N3    345.00  1   0.00150  0.01380  0.22285  1  F  1349.3 1493.9    0.0   32.1     600 1.000
 601072 SHEAS LK3   345.00  1   0.00120  0.01112  0.18058  1  F  1298.0 1298.0    0.0    0.0     600 1.000

 X- XFRMER -X X---- WINDING 1 BUS ----X X---- WINDING 2 BUS ----X X---- WINDING 3 BUS ----X     S C C C
 X-- NAME --X   BUS# X-- NAME --X BASKV   BUS# X-- NAME --X BASKV   BUS# X-- NAME --X BASKV CKT T W Z M OWN1
FRAC1 OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
              601004 WILMART3    345.00 603002 WILMART7    115.00 605727 WILMARTH 9  13.800  9  1 1 3 2  600
1.000
```

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

```
 345/115      601004 WILMART3    345.00 603002 WILMART7    115.00 605786 WILMARTH 10 13.800  10 1 2 3 2  600
1.000

 X- XFRMER -X S C X--------- SPECIFIED NOMINAL MEASURED IMPEDANCES AND MVA BASES ----------X X-ACTUAL
IMPEDANCES FROM IMPEDANCE CORRECTION TABLE-X
 X-- NAME --X T Z   R 1-2    X 1-2 SBAS1-2   R 2-3    X 2-3 SBAS2-3   R 3-1    X 3-1 SBAS3-1   R 1-2    X 1-2
R 2-3    X 2-3    R 3-1    X 3-1
              1 3   272680  0.06080  240.0        0  0.42110  240.0        0  0.48770  240.0
 345/115      1 3   260869  0.05940  240.0        0  0.27900  240.0        0  0.30800  240.0

 X- XFRMER -X X----- WINDING BUS -----X  S C    MAGNETIZING Y   SYSTEM BASE NOM.                          TBL
CORRECTED   STAR POINT BUS
 X-- NAME --X   BUS# X-- NAME --X BASKV  T M    MAG1     MAG2   R WNDNG  X WNDNG  RATEA  RATEB  RATEC TBL R
WNDNG  X WNDNG VOLTAGE  ANGLE
              601004 WILMART3    345.00* 1 2   218700  0.00560  0.00024  0.02654  448.0  515.2    0.0  0
0.99374  -42.1
              603002 WILMART7    115.00  1                      0.00024 -0.00121  448.0  515.2    0.0  0
              605727 WILMARTH 9  13.800* 1                     -0.00024  0.17667    0.0    0.0    0.0  0
 345/115      601004 WILMART3    345.00  1 2   212480  0.00790  0.00023  0.01841  448.0  560.0  448.0  0
0.99525  -42.1
              603002 WILMART7    115.00* 1                      0.00023  0.00633  448.0  560.0  448.0  0
              605786 WILMARTH 10 13.800* 1                     -0.00023  0.10992  119.1  148.9  119.1  0

 X- XFRMER -X X----- WINDING BUS -----X C                                                             X----
CONTROLLED BUS ----X CNXTN
 X-- NAME --X   BUS# X-- NAME --X BASKV W CN  WIND V  NOM V  ANGLE   RMAX    RMIN    VMAX    VMIN  NTPS
BUS# X-- NAME --X BASKV ANGLE    CR      CX
              601004 WILMART3    345.00 1  0 1.02600 345.00    0.0 1.10000 0.90000 1.10000 0.90000  159
0.0
              603002 WILMART7    115.00    0 1.02609 115.00    0.0 1.50000 0.51000 1.50000 0.51000  159
0.0
              605727 WILMARTH 9  13.800    0 1.00000 13.800  -30.0 1.10000 0.90000 1.10000 0.90000  159
0.0
 345/115      601004 WILMART3    345.00 2  0  354.00 345.00    0.0 1.10000 0.90000 1.10000 0.90000    5
0.0
              603002 WILMART7    115.00    0  118.00 118.00    0.0 1.10000 0.90000 1.10000 0.90000    5
0.0
              605786 WILMARTH 10 13.800    0  13.800 13.800  -30.0 1.10000 0.90000 1.10000 0.90000   33
0.0
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J385

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DATA FOR BUS  12050 [J385_GEN    0.3420] RESIDING IN AREA  600, ZONE  601, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.02676 -36.97

                                                  X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
     100.0    10.3    32.9   -32.9 1.02500 100.00  12152 J385_PV     115.00 1.02500

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1  100.0   10.3   32.9  -32.9  100.0 0.0000******* 0.0000 0.0000 1.0000  100.0  100.0  600 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
  12049 J385_34.5   34.500  1               1 T T 2 1  0.00000  0.05500  110.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
  12049 J385_34.5   34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000  108.0  108.0  108.0  600 1.000

 X------- TO BUS --------X     W C                                       X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
  12049 J385_34.5   34.500  1  T 1  0 1.10000 0.90000 1.10000 0.90000    5                              0.000


 DATA FOR BUS  12049 [J385_34.5   34.500] RESIDING IN AREA  600, ZONE  601, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.02290 -39.70

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
  12050 J385_GEN    0.3420  1               1 F F 2 1  0.00000  0.05500  110.0  0.00000  0.00000  0
  12152 J385_PV     115.00  1  MAIN OR GSU  1 T T 2 1  0.00000  0.09500   65.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
  12050 J385_GEN    0.3420  1  1 1.00000 0.0000    0.0 1.00000 0.0000  108.0  108.0  108.0  600 1.000
  12152 J385_PV     115.00  1  1 1.00000 0.0000    0.0 1.00000 0.0000  108.0  108.0  108.0  600 1.000

 X------- TO BUS --------X     W C                                       X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
  12050 J385_GEN    0.3420  1  F 1  0 1.10000 0.90000 1.10000 0.90000    5                              0.000
  12152 J385_PV     115.00  1  T 1  0 1.10000 0.90000 1.10000 0.90000    5                              0.000


 DATA FOR BUS  12152 [J385_PV     115.00] RESIDING IN AREA  600, ZONE  601, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.02500 -47.71

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 603065 CHISAGO7    115.00  1   0.00049  0.00261  0.00000  1  F   999.0  999.0  999.0    0.5     600 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
  12049 J385_34.5   34.500  1  MAIN OR GSU  1 F F 2 1  0.00000  0.09500   65.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
  12049 J385_34.5   34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000  108.0  108.0  108.0  600 1.000

 X------- TO BUS --------X     W C                                       X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
  12049 J385_34.5   34.500  1  F 1  0 1.10000 0.90000 1.10000 0.90000    5                              0.000


 DATA FOR BUS 603065 [CHISAGO7    115.00] RESIDING IN AREA  600, ZONE  601, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
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PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

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  1    10.7     1.5     0.0     0.0     0.0     0.0     0.0     0.0 1.02474 -47.86

 ID ST     PSI   P Q - L O A D     I - L O A D     Y - L O A D  AREA  ZONE OWNER SCALE
 X0  1   1.000    10.7     1.5     0.0     0.0     0.0     0.0   600   601   600  YES

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
  12152 J385_PV     115.00  1   0.00049  0.00261  0.00000  1  T   999.0  999.0  999.0    0.5     600 1.000
 603172 WYOMING7    115.00  1   0.01379  0.07625  0.01173  1  F   308.3  347.9    0.0   14.4     600 1.000
 603259 CHISAGO CAP7115.00  Z   0.00010  0.00020  0.00000  1  F  8888.0 8888.0 8888.0    0.0     600 1.000
 605269 LINDSTM7    115.00  1   0.00665  0.03663  0.00558  1  F   316.3  347.9    0.0    7.1     600 1.000

 X- XFRMER -X X---- WINDING 1 BUS ----X X---- WINDING 2 BUS ----X X---- WINDING 3 BUS ----X     S C C C
 X-- NAME --X   BUS# X-- NAME --X BASKV   BUS# X-- NAME --X BASKV   BUS# X-- NAME --X BASKV CKT T W Z M OWN1
FRAC1 OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 TB80132701   601018 CHIS CO3    345.00 603065 CHISAGO7    115.00 605710 CHISAGOTR6T934.500  6  1 1 3 2  600
1.000
 TB80132701   601018 CHIS CO3    345.00 603065 CHISAGO7    115.00 605745 CHISAGOTR5  34.500  6  1 1 3 2  600
1.000

 X- XFRMER -X S C X--------- SPECIFIED NOMINAL MEASURED IMPEDANCES AND MVA BASES ----------X X-ACTUAL
IMPEDANCES FROM IMPEDANCE CORRECTION TABLE-X
 X-- NAME --X T Z   R 1-2    X 1-2 SBAS1-2   R 2-3    X 2-3 SBAS2-3   R 3-1    X 3-1 SBAS3-1   R 1-2    X 1-2
R 2-3    X 2-3    R 3-1    X 3-1
 TB80132701   1 3   851417  0.11750  448.0   173588  0.10310   80.0   175800  0.13640   80.0
 TB80132701   1 3   851417  0.11750  448.0   173588  0.10310   80.0   175800  0.13640   80.0

 X- XFRMER -X X----- WINDING BUS -----X  S C    MAGNETIZING Y   SYSTEM BASE NOM.                          TBL
CORRECTED   STAR POINT BUS
 X-- NAME --X   BUS# X-- NAME --X BASKV  T M    MAG1     MAG2   R WNDNG  X WNDNG  RATEA  RATEB  RATEC TBL R
WNDNG  X WNDNG VOLTAGE  ANGLE
 TB80132701   601018 CHIS CO3    345.00* 1 2   167846  0.00186  0.00023  0.03393  448.0  515.2    0.0  0
0.99812  -48.3
              603065 CHISAGO7    115.00  1                      0.00019 -0.00770  448.0  515.2    0.0  0
              605710 CHISAGOTR6T934.500* 1                      0.00252  0.13655   80.0   80.0    0.0  0
 TB80132701   601018 CHIS CO3    345.00* 1 2   167846  0.00186  0.00023  0.03393  448.0  515.0    0.0  0
0.99812  -48.3
              603065 CHISAGO7    115.00  1                      0.00019 -0.00770  448.0  515.0    0.0  0
              605745 CHISAGOTR5  34.500* 1                      0.00252  0.13655   80.0   92.0    0.0  0

 X- XFRMER -X X----- WINDING BUS -----X C                                                              X----
CONTROLLED BUS ----X CNXTN
 X-- NAME --X   BUS# X-- NAME --X BASKV W CN  WIND V  NOM V  ANGLE   RMAX    RMIN    VMAX    VMIN  NTPS
BUS# X-- NAME --X BASKV ANGLE    CR      CX
 TB80132701   601018 CHIS CO3    345.00 1  0 1.02600 345.00    0.0 1.10000 0.90000 1.10000 0.90000   33
0.0
              603065 CHISAGO7    115.00    0 1.02610 115.00    0.0 1.10000 0.90000 1.10000 0.90000   33
0.0
              605710 CHISAGOTR6T934.500    0 1.00000 34.500   30.0 1.10000 0.90000 1.10000 0.90000   33
0.0
 TB80132701   601018 CHIS CO3    345.00 1  0 1.02600 345.00    0.0 1.10000 0.90000 1.10000 0.90000   33
0.0
              603065 CHISAGO7    115.00    0 1.02610 115.00    0.0 1.10000 0.90000 1.10000 0.90000   33
0.0
              605745 CHISAGOTR5  34.500    0 1.00000 34.500   30.0 1.10000 0.90000 1.10000 0.90000   33
0.0
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J391

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DATA FOR BUS  58070 [J391        13.800] RESIDING IN AREA  600, ZONE 1627, OWNER  658:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.04206 -38.96

                                                  X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
      50.0    10.8    31.0   -31.0 1.02000 100.00 658070 MMU 7ST7    115.00 1.02000

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1   50.0   10.8   31.0  -31.0   58.0 0.0000 0.2200 0.0000 0.0000 1.0000   50.0   50.0  658 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
  58071 J391_TAP    115.00  1               1 T T 2 1  0.00225  0.08997   39.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
  58071 J391_TAP    115.00  1  1 1.00000 0.0000    0.0 1.00000 0.0000   52.0   65.0    0.0  658 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
  58071 J391_TAP    115.00  1  T 1  0 1.05000 0.95000 1.10000 0.90000    5                               0.000


 DATA FOR BUS  58071 [J391_TAP    115.00] RESIDING IN AREA  600, ZONE 1627, OWNER  658:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.02139 -45.14

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 658070 MMU 7ST7    115.00  1   0.00220  0.00619  0.00078  1  T    65.0   65.0    0.0    0.5     658 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
  58070 J391        13.800  1               1 F F 2 1  0.00225  0.08997   39.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
  58070 J391        13.800  1  1 1.00000 0.0000    0.0 1.00000 0.0000   52.0   65.0    0.0  658 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
  58070 J391        13.800  1  F 1  0 1.05000 0.95000 1.10000 0.90000    5                               0.000


 DATA FOR BUS 658070 [MMU 7ST7    115.00] RESIDING IN AREA  600, ZONE 1627, OWNER  658:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1    43.0     7.3     0.0     0.0     0.0     0.0     0.0     0.0 1.02000 -45.31

 ID ST     PSI   P Q - L O A D     I - L O A D     Y - L O A D  AREA  ZONE OWNER SCALE
 R2  1   1.000    43.0     7.3     0.0     0.0     0.0     0.0   652  1624   658   NO
 W2  1   1.000     0.0     0.0     0.0     0.0     0.0     0.0   652  1604   652  YES

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
  58071 J391_TAP    115.00  1   0.00220  0.00619  0.00078  1  F    65.0   65.0    0.0    0.5     658 1.000
 658068 MARSHAL7    115.00  1   0.00213  0.00652  0.00084  1  T   140.0  154.0  140.0    1.1     658 1.000
 658072 ERIE RD7    115.00  1   0.00091  0.00328  0.00044  1  F   140.0  154.0  140.0    0.6     658 1.000
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J400

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DATA FOR BUS   6050 [J400        0.3420] RESIDING IN AREA  600, ZONE  606, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00897 -34.73

                                                  X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
      62.5    -4.3    21.0   -21.0 1.02200 100.00 603046 LYON CO7    115.00 1.02200

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1   62.5   -4.3   21.0  -21.0   63.0 0.0000******* 0.0000 0.0000 1.0000   62.5   62.5  600 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M    R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6051 J400_COL    34.500  1              1 F F 2 1  0.00845  0.06000   63.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6051 J400_COL    34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000   65.0   65.0   65.0  600 1.000

 X------- TO BUS --------X     W C                                        X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6051 J400_COL    34.500  1  F 1  0 1.05000 0.95000 1.10000 0.90000    5                               0.000


 DATA FOR BUS   6051 [J400_COL    34.500] RESIDING IN AREA  600, ZONE  606, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00649 -38.12

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M    R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6050 J400        0.3420  1              1 T T 2 1  0.00845  0.06000   63.0  0.00000  0.00000  0
 603046 LYON CO7    115.00  1              1 F F 2 1  0.00426  0.07500   39.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6050 J400        0.3420  1  1 1.00000 0.0000    0.0 1.00000 0.0000   65.0   65.0   65.0  600 1.000
 603046 LYON CO7    115.00  1  1 1.00000 0.0000    0.0 1.00000 0.0000   65.0   65.0   65.0  600 1.000

 X------- TO BUS --------X     W C                                        X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6050 J400        0.3420  1  T 1  0 1.05000 0.95000 1.10000 0.90000    5                               0.000
 603046 LYON CO7    115.00  1  F 1  0 1.05000 0.95000 1.10000 0.90000    5                               0.000


 DATA FOR BUS 603046 [LYON CO7    115.00] RESIDING IN AREA  600, ZONE  606, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.02200 -44.83

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 603010 LKYNKTN7    115.00  1   0.01941  0.11663  0.01555  1  T   316.3  347.9    0.0   29.0     600 1.000
 603010 LKYNKTN7    115.00  2   0.01941  0.11663  0.01555  1  T   360.7  396.8    0.0   20.5     600 1.000
 603258 LYON CO CAP7115.00  Z   0.00010  0.00020  0.00000  1  F  8888.0 8888.0 8888.0    0.0     600 1.000
 658068 MARSHAL7    115.00  1   0.00783  0.02393  0.00308  1  T   140.0  154.0  140.0    4.0     658 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M    R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6051 J400_COL    34.500  1              1 T T 2 1  0.00426  0.07500   39.0  0.00000  0.00000  0
 605256 LYON CO8    69.000  1              1 T T 3 2    49400  0.04560   42.0    15000  0.00043  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6051 J400_COL    34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000   65.0   65.0   65.0  600 1.000
 605256 LYON CO8    69.000  1  1 1.00625 0.0000    0.0 1.02610 0.0000   70.0   80.5    0.0  600 1.000

 X------- TO BUS --------X     W C                                        X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6051 J400_COL    34.500  1  T 1  0 1.05000 0.95000 1.10000 0.90000    5                               0.000
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 605256 LYON CO8    69.000  1  T 1  1 1.10000 0.90000 1.04000 1.00000   33 -605256 LYON CO8    69.000   0.000

 X- XFRMER -X X---- WINDING 1 BUS ----X X---- WINDING 2 BUS ----X X---- WINDING 3 BUS ----X     S C C C
 X-- NAME --X   BUS# X-- NAME --X BASKV   BUS# X-- NAME --X BASKV   BUS# X-- NAME --X BASKV CKT T W Z M OWN1
FRAC1 OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 8779072      601048 LYON CO 3   345.00 603046 LYON CO7    115.00 605750 LYON COT    34.500  9  1 1 3 2  600
1.000

 X- XFRMER -X S C X--------- SPECIFIED NOMINAL MEASURED IMPEDANCES AND MVA BASES ----------X X-ACTUAL
IMPEDANCES FROM IMPEDANCE CORRECTION TABLE-X
 X-- NAME --X T Z   R 1-2    X 1-2 SBAS1-2   R 2-3    X 2-3 SBAS2-3   R 3-1    X 3-1 SBAS3-1   R 1-2    X 1-2
R 2-3    X 2-3    R 3-1    X 3-1
 8779072      1 3   301926  0.07350  270.0    67685  0.04560   62.7    68985  0.06750   62.7

 X- XFRMER -X X----- WINDING BUS -----X  S C    MAGNETIZING Y   SYSTEM BASE NOM.                          TBL
CORRECTED   STAR POINT BUS
 X-- NAME --X   BUS# X-- NAME --X BASKV  T M    MAG1     MAG2   R WNDNG  X WNDNG  RATEA  RATEB  RATEC TBL R
WNDNG  X WNDNG VOLTAGE  ANGLE
 8779072      601048 LYON CO 3   345.00* 1 2    99574  0.00050  0.00022  0.03108  448.0  515.0  448.0  0
0.99644  -44.8
              603046 LYON CO7    115.00  1                      0.00019 -0.00386  448.0  515.0  448.0  0
              605750 LYON COT    34.500* 1                      0.00153  0.07656   80.0   92.0   80.0  0

 X- XFRMER -X X----- WINDING BUS -----X C                                                           X----
CONTROLLED BUS ----X CNXTN
 X-- NAME --X   BUS# X-- NAME --X BASKV W CN  WIND V  NOM V  ANGLE   RMAX    RMIN    VMAX    VMIN  NTPS
BUS# X-- NAME --X BASKV ANGLE    CR      CX
 8779072      601048 LYON CO 3   345.00 1  0 1.02610 345.00    0.0 1.10000 0.90000 1.10000 0.90000   33
0.0
              603046 LYON CO7    115.00    0 1.02610 115.00    0.0 1.10000 0.90000 1.10000 0.90000   33
0.0
              605750 LYON COT    34.500    0 1.00000 34.500   30.0 1.10000 0.90000 1.10000 0.90000   33
0.0
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J405

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DATA FOR BUS  12053 [J405        13.800] RESIDING IN AREA  661, ZONE 1636, OWNER  661:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00000 -51.42

                                                  X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
      40.0    14.2    24.8   -24.8 1.00000 100.00

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1   40.0   14.2   24.8  -24.8   46.7 0.0000 0.1670 0.0000 0.0000 1.0000   40.0   40.0  661 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
 661056 LEWIS  7    115.00  1  MAIN OR GSU  1 T T 2 1  0.00334  0.08493   40.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
 661056 LEWIS  7    115.00  1  3 1.00000 118.37    0.0 1.00000 13.800   53.3   66.6    0.0  661 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
 661056 LEWIS  7    115.00  1  T 3  0 1.10000 0.90000 1.10000 0.90000    5                              0.000


 DATA FOR BUS 661056 [LEWIS  7    115.00] RESIDING IN AREA  661, ZONE 1636, OWNER  661:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1    49.2    16.8     0.0     0.0     0.0     0.0     0.0     0.0 0.99864 -56.37

 ID ST     PSI   P Q - L O A D     I - L O A D     Y - L O A D  AREA  ZONE OWNER SCALE
 BB  1   1.000    19.4     6.1     0.0     0.0     0.0     0.0   652  1614   659  YES
 BW  1   1.000     0.6     0.2     0.0     0.0     0.0     0.0   652  1614   659  YES
 W0  1   1.000     3.5    -0.4     0.0     0.0     0.0     0.0   652  1614   652  YES
 Y0  1   1.000    25.7    10.9     0.0     0.0     0.0     0.0   661  1636   661  YES

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 652404 DAWSONC7    115.00  1   0.10340  0.28870  0.03540  1  F   101.0  101.0    0.0    0.0     652 0.947
661 0.053
 652451 RICHLND7    115.00  1   0.00592  0.01652  0.00203  1  F   101.0  101.0    0.0    0.0     661 0.986
652 0.014

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
  12053 J405        13.800  1  MAIN OR GSU  1 F F 2 1  0.00334  0.08493   40.0  0.00000  0.00000  0
 661055 LEWIS71G    13.800  1  LEWIS GSU    1 F F 1 1  0.01020  0.23180  100.0  0.00000 -0.00110  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
  12053 J405        13.800  1  3 1.00000 118.37    0.0 1.00000 13.800   53.3   66.6    0.0  661 1.000
 661055 LEWIS71G    13.800  1  1 1.02930 0.0000    0.0 1.00000 0.0000   53.0   66.0    0.0  661 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
  12053 J405        13.800  1  F 3  0 1.10000 0.90000 1.10000 0.90000    5                              0.000
 661055 LEWIS71G    13.800  1  F 1  0 1.50000 0.50000 1.10000 0.90000 9999                              0.000
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J407

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DATA FOR BUS   6004 [J407 G1     0.6900] RESIDING IN AREA  627, ZONE  665, OWNER  627:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00000  97.36

                                                  X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
     100.0     2.4    32.8   -32.8 1.00000 100.00

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1  100.0    2.4   32.8  -32.8  105.5 0.0000 0.8000 0.0000 0.0000 1.0000  100.0  100.0  627 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6002 J407 COL1   34.500  1               1 T T 2 1  0.00000  0.05750  117.6  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6002 J407 COL1   34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6002 J407 COL1   34.500  1  T 1  0 1.10000 0.90000 1.10000 0.90000   33                              0.000


 DATA FOR BUS   6005 [J407 G2     0.7000] RESIDING IN AREA  627, ZONE  665, OWNER  627:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00000  97.36

                                                  X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
     100.0     2.4    32.8   -32.8 1.00000 100.00

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1  100.0    2.4   32.8  -32.8  105.5 0.0000 0.8000 0.0000 0.0000 1.0000  100.0  100.0  627 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6003 J407 COL2   34.500  1               1 T T 2 1  0.00000  0.05750  117.6  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6003 J407 COL2   34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6003 J407 COL2   34.500  1  T 1  0 1.10000 0.90000 1.10000 0.90000   33                              0.000


 DATA FOR BUS   6003 [J407 COL2   34.500] RESIDING IN AREA  627, ZONE  665, OWNER  627:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00001  94.56

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6001 J407 POI    161.00  1               1 T T 2 1  0.00225  0.08997   66.0  0.00000  0.00000  0
   6005 J407 G2     0.7000  1               1 F F 2 1  0.00000  0.05750  117.6  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6001 J407 POI    161.00  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000
   6005 J407 G2     0.7000  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6001 J407 POI    161.00  1  T 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000
   6005 J407 G2     0.7000  1  F 1  0 1.10000 0.90000 1.10000 0.90000   33                              0.000
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 DATA FOR BUS   6002 [J407 COL1   34.500] RESIDING IN AREA  627, ZONE  665, OWNER  627:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00001  94.56

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6001 J407 POI    161.00  1              1 T T 2 1  0.00225  0.08997   66.0  0.00000  0.00000  0
   6004 J407 G1     0.6900  1              1 F F 2 1  0.00000  0.05750  117.6  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6001 J407 POI    161.00  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000
   6004 J407 G1     0.6900  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6001 J407 POI    161.00  1  T 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000
   6004 J407 G1     0.6900  1  F 1  0 1.10000 0.90000 1.10000 0.90000   33                              0.000


 DATA FOR BUS   6001 [J407 POI    161.00] RESIDING IN AREA  627, ZONE  665, OWNER  627:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00924  86.79

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 631174 GLENWRTH5   161.00  1   0.00037  0.00209  0.00207  1  F   210.0  210.0    0.0    1.0     627 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6002 J407 COL1   34.500  1              1 F F 2 1  0.00225  0.08997   66.0  0.00000  0.00000  0
   6003 J407 COL2   34.500  1              1 F F 2 1  0.00225  0.08997   66.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6002 J407 COL1   34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000
   6003 J407 COL2   34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6002 J407 COL1   34.500  1  F 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000
   6003 J407 COL2   34.500  1  F 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000


 DATA FOR BUS 631174 [GLENWRTH5   161.00] RESIDING IN AREA  627, ZONE  665, OWNER    1:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00918  86.55

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6001 J407 POI    161.00  1   0.00037  0.00209  0.00207  1  T   210.0  210.0    0.0    1.0     627 1.000
 631036 NIW    5    161.00  1   0.00559  0.03139  0.03115  1  F   452.0  452.0  452.0   15.1     627 1.000
 631044 HAYWD#25    161.00  1   0.00229  0.01286  0.01276  1  T   325.0  325.0  325.0    6.2     627 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
 680542 GLENWTH8    69.000  1              1 F F 1 1  0.00000  0.12100  100.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
 680542 GLENWTH8    69.000  1  1 0.99375 0.0000    0.0 1.00000 0.0000  100.0  100.0  100.0  627 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
 680542 GLENWTH8    69.000  1  F 1  1 1.10000 0.90000 1.03500 1.00500   33  680542 GLENWTH8    69.000   0.000
```

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

J411

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DATA FOR BUS   6204 [J411 G1     0.7000] RESIDING IN AREA  635, ZONE  679, OWNER  635:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00000  90.38

                                                  X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
     150.0    -5.8    49.3   -49.3 1.00000 100.00

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1  150.0   -5.8   49.3  -49.3  158.3 0.0000 0.8000 0.0000 0.0000 1.0000  150.0  150.0  627 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6202 J411 COL1   34.500  1               1 T T 2 1  0.00000  0.05750  176.4  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6202 J411 COL1   34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6202 J411 COL1   34.500  1  T 1  0 1.10000 0.90000 1.10000 0.90000   33                               0.000


 DATA FOR BUS   6205 [J411 G2     0.7000] RESIDING IN AREA  635, ZONE  679, OWNER  635:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00000  90.38

                                                  X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
     150.0    -5.8    49.3   -49.3 1.00000 100.00

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1  150.0   -5.8   49.3  -49.3  158.3 0.0000 0.8000 0.0000 0.0000 1.0000  150.0  150.0  627 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6203 J411 COL2   34.500  1               1 T T 2 1  0.00000  0.05750  176.4  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6203 J411 COL2   34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6203 J411 COL2   34.500  1  T 1  0 1.10000 0.90000 1.10000 0.90000   33                               0.000


 DATA FOR BUS   6202 [J411 COL1   34.500] RESIDING IN AREA  635, ZONE  679, OWNER  635:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00307  87.58

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6201 J411 POI    345.00  1               1 T T 2 1  0.00225  0.08997   96.0  0.00000  0.00000  0
   6204 J411 G1     0.7000  1               1 F F 2 1  0.00000  0.05750  176.4  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6201 J411 POI    345.00  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000
   6204 J411 G1     0.7000  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6201 J411 POI    345.00  1  T 1  0 1.05000 0.95000 1.10000 0.90000    5                               0.000
   6204 J411 G1     0.7000  1  F 1  0 1.10000 0.90000 1.10000 0.90000   33                               0.000
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 DATA FOR BUS   6203 [J411 COL2   34.500] RESIDING IN AREA  635, ZONE  679, OWNER  635:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00307  87.58

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6201 J411 POI    345.00  1               1 T T 2 1  0.00225  0.08997   96.0  0.00000  0.00000  0
   6205 J411 G2     0.7000  1               1 F F 2 1  0.00000  0.05750  176.4  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6201 J411 POI    345.00  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000
   6205 J411 G2     0.7000  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6201 J411 POI    345.00  1  T 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000
   6205 J411 G2     0.7000  1  F 1  0 1.10000 0.90000 1.10000 0.90000   33                              0.000


 DATA FOR BUS   6201 [J411 POI    345.00] RESIDING IN AREA  635, ZONE  679, OWNER  635:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.02152  79.68

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
 635200 RAUN   3    345.00  1   0.00280  0.02660  0.42661  1  F   956.0  961.0  956.0   51.6     635 1.000
 636010 LEHIGH 3    345.00  1   0.00351  0.03331  0.53423  1  T   956.0  961.0  956.0   64.6     635 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   6202 J411 COL1   34.500  1               1 F F 2 1  0.00225  0.08997   96.0  0.00000  0.00000  0
   6203 J411 COL2   34.500  1               1 F F 2 1  0.00225  0.08997   96.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   6202 J411 COL1   34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000
   6203 J411 COL2   34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000    0.0    0.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   6202 J411 COL1   34.500  1  F 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000
   6203 J411 COL2   34.500  1  F 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000
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J416

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DATA FOR BUS  32003 [J416 G1     0.6900] RESIDING IN AREA  627, ZONE  665, OWNER  627:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00000  89.68

                                                  X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
     100.0     6.3    20.3   -29.2 1.00000 100.00

 ID ST  PGEN    QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1  100.0     6.3   20.3  -29.2  100.0 0.0050 0.1991 0.0000 0.0000 1.0000  100.0  100.0  627 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
  32001 J416 34.5 1 34.500  1               1 T T 2 1  0.00630  0.07580  105.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
  32001 J416 34.5 1 34.500  1  1 1.00000 34.500    0.0 1.00000 0.6900  120.0  125.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                        X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
  32001 J416 34.5 1 34.500  1  T 1  0 1.05000 0.95000 1.10000 0.90000    5                               0.000


 DATA FOR BUS  32004 [J416 G2     0.7000] RESIDING IN AREA  627, ZONE  665, OWNER  627:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.00000  89.68

                                                  X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
     100.0     6.3    20.3   -29.2 1.00000 100.00

 ID ST  PGEN    QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1  100.0     6.3   20.3  -29.2  100.0 0.0050 0.1991 0.0000 0.0000 1.0000  100.0  100.0  627 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
  32002 J416 34.5 2 34.500  1               1 T T 2 1  0.00630  0.07580  105.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
  32002 J416 34.5 2 34.500  1  1 1.00000 34.500    0.0 1.00000 0.7000  120.0  125.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                        X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
  32002 J416 34.5 2 34.500  1  T 1  0 1.05000 0.95000 1.10000 0.90000    5                               0.000


 DATA FOR BUS  32001 [J416 34.5 1 34.500] RESIDING IN AREA  627, ZONE  665, OWNER  627:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 0.99206  85.53

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
  32000 J416 345    345.00  1               1 T T 2 1  0.00283  0.10196   78.0  0.00000  0.00000  0
  32003 J416 G1     0.6900  1               1 F F 2 1  0.00630  0.07580  105.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
  32000 J416 345    345.00  1  1 1.00000 0.0000    0.0 1.00000 0.0000  120.0  125.0    0.0  627 1.000
  32003 J416 G1     0.6900  1  1 1.00000 34.500    0.0 1.00000 0.6900  120.0  125.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                        X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
  32000 J416 345    345.00  1  T 1  0 1.05000 0.95000 1.10000 0.90000    5                               0.000
  32003 J416 G1     0.6900  1  F 1  0 1.05000 0.95000 1.10000 0.90000    5                               0.000
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 DATA FOR BUS  32002 [J416 34.5 2 34.500] RESIDING IN AREA  627, ZONE  665, OWNER  627:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 0.99206  85.53

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
  32000 J416 345    345.00  1               1 T T 2 1  0.00283  0.10196   78.0  0.00000  0.00000  0
  32004 J416 G2     0.7000  1               1 F F 2 1  0.00630  0.07580  105.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
  32000 J416 345    345.00  1  1 1.00000 0.0000    0.0 1.00000 0.0000  120.0  125.0    0.0  627 1.000
  32004 J416 G2     0.7000  1  1 1.00000 34.500    0.0 1.00000 0.7000  120.0  125.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                        X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
  32000 J416 345    345.00  1  T 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000
  32004 J416 G2     0.7000  1  F 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000


 DATA FOR BUS  32000 [J416 345    345.00] RESIDING IN AREA  627, ZONE  665, OWNER  627:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 0.99832  77.99

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
  31199 J416 POI    345.00  1   0.00030  0.00328  0.05590  1  F     0.0    0.0    0.0    0.0     627 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
  32001 J416 34.5 1 34.500  1               1 F F 2 1  0.00283  0.10196   78.0  0.00000  0.00000  0
  32002 J416 34.5 2 34.500  1               1 F F 2 1  0.00283  0.10196   78.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
  32001 J416 34.5 1 34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000  120.0  125.0    0.0  627 1.000
  32002 J416 34.5 2 34.500  1  1 1.00000 0.0000    0.0 1.00000 0.0000  120.0  125.0    0.0  627 1.000

 X------- TO BUS --------X     W C                                        X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
  32001 J416 34.5 1 34.500  1  F 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000
  32002 J416 34.5 2 34.500  1  F 1  0 1.05000 0.95000 1.10000 0.90000    5                              0.000


 DATA FOR BUS  31199 [J416 POI    345.00] RESIDING IN AREA  627, ZONE  665, OWNER  627:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 0.99859  77.61

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
  32000 J416 345    345.00  1   0.00030  0.00328  0.05590  1  T     0.0    0.0    0.0    0.0     627 1.000
 631199 KILLDEER3   345.00  1   0.00083  0.01049  0.20052  1  T  1739.0 1739.0 1739.0   22.0     627 0.330
635 0.670
 636199 BLACKHAWK 3 345.00  1   0.00248  0.03147  0.60156  1  F  1739.0 1739.0 1739.0   66.0     627 0.330
635 0.670
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J426

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DATA FOR BUS   5675 [J426        0.6900] RESIDING IN AREA  600, ZONE  606, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  2     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.01951 116.01

                                              X--------- REMOTE BUS ----------X
 PLNT PGEN    QGEN    QMAX    QMIN  VSCHED  PCT Q   BUS# X-- NAME --X BASKV VOLTAGE
     100.0     1.0    20.3   -29.2 0.99000 100.00 605674 CHANARAMBIE434.500 0.99000

 ID ST  PGEN   QGEN   QMAX   QMIN  MBASE  Z S O R C E    X T R A N   GENTAP   PMAX   PMIN OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4 WMOD   WPF
 1  1  100.0    1.0   20.3  -29.2  100.0 0.0050 0.1991 0.0000 0.0000 1.0000  100.0  100.0  600 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   5674 J426 34.5    34.500  1               1 T T 1 1  0.00863  0.09286  105.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   5674 J426 34.5    34.500  1  1 1.00000 34.500    0.0 1.00000 0.6900  110.0  110.0  110.0  600 1.000

 X------- TO BUS --------X     W C                                        X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   5674 J426 34.5    34.500  1  T 1  0 1.10000 0.90000 1.10000 0.90000    5                              0.000


 DATA FOR BUS   5674 [J426 34.5    34.500] RESIDING IN AREA  600, ZONE  606, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 1.01424 110.86

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
   5673 J426_PPC    34.500  1   0.02622  0.02992  0.08797  1  F   110.0  110.0  110.0    0.0     600 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
   5675 J426        0.6900  1               1 F F 1 1  0.00863  0.09286  105.0  0.00000  0.00000  0

 X------- TO BUS --------X     C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
   5675 J426        0.6900  1  1 1.00000 34.500    0.0 1.00000 0.6900  110.0  110.0  110.0  600 1.000

 X------- TO BUS --------X     W C                                        X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
   5675 J426        0.6900  1  F 1  0 1.10000 0.90000 1.10000 0.90000    5                              0.000


 DATA FOR BUS   5673 [J426_PPC    34.500] RESIDING IN AREA  600, ZONE  606, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 0.99008 109.12

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
   5674 J426 34.5    34.500  1   0.02622  0.02992  0.08797  1  T   110.0  110.0  110.0    0.0     600 1.000
 605674 CHANARAMBIE434.500  1   0.00008  0.00012  0.00025  1  T   110.0  110.0  110.0    0.0     600 1.000


 DATA FOR BUS 605674 [CHANARAMBIE434.500] RESIDING IN AREA  600, ZONE  606, OWNER  600:

 CODE P Q - L O A D     I - L O A D     Y - L O A D G-SHUNT B-SHUNT VOLTAGE  ANGLE
  1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0 0.99000 109.11

 X------- TO BUS --------X
   BUS# X-- NAME --X BASKV CKT   LINE R   LINE X CHARGING ST MET RATE-A RATE-B RATE-C LENGTH ZI OWN1 FRAC1
OWN2 FRAC2 OWN3 FRAC3 OWN4 FRAC4
   5673 J426_PPC    34.500  1   0.00008  0.00012  0.00025  1  F   110.0  110.0  110.0    0.0     600 1.000
 605683 CHB341      34.500  1   0.01600  0.05900  0.00000  1  F  8888.0 8888.0 8888.0    0.0     601 1.000

 X------- TO BUS --------X        XFRMER    S W M C C      SPECIFIED              MAGNETIZING Y        TBL
CORRECTED
   BUS# X-- NAME --X BASKV CKT X-- NAME --X T 1 T Z M   R 1-2    X 1-2  SBAS1-2   MAG1     MAG2  TBL  R 1-2
X 1-2
 603180 CHANRMB7    115.00  3               1 T F 3 2   110100  0.04600   72.0    33200  0.00080  0
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 603180 CHANRMB7    115.00  4               1 T F 3 2   110100  0.04600   72.0    33200  0.00080  0

 X------- TO BUS --------X      C
   BUS# X-- NAME --X BASKV CKT W  WINDV1  NOMV1  ANGLE  WINDV2  NOMV2  RATEA  RATEB  RATEC OWN1 FRAC1 OWN2
FRAC2 OWN3 FRAC3 OWN4 FRAC4
 603180 CHANRMB7    115.00  3  1 1.02610 0.0000    0.0 1.00000 0.0000  120.0  138.0    0.0  600 1.000
 603180 CHANRMB7    115.00  4  1 1.02610 0.0000    0.0 1.00000 0.0000  120.0  138.0    0.0  600 1.000

 X------- TO BUS --------X      W C                                         X---- CONTROLLED BUS ----X CONECXN
   BUS# X-- NAME --X BASKV CKT 1 W CN   RMAX    RMIN    VMAX    VMIN  NTPS    BUS# X-- NAME --X BASKV   ANGLE
CR      CX
 603180 CHANRMB7    115.00  3  T 1  0 1.50000 0.51000 1.50000 0.51000  159                             0.000
 603180 CHANRMB7    115.00  4  T 1  0 1.50000 0.51000 1.50000 0.51000  159                             0.000
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B.2 Dynamic Model Data

G736

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PLANT MODELS

 REPORT FOR ALL MODELS                      BUS 6060 [G736       0.6900] MODELS


 ** GEWTG2 **  BUS X-- NAME --X   BASEKV MC  C O N S     S T A T E S        VAR        ICON
              6060    G736      0.6900 1  403104-403121 139269-139271  85286-85290   53807-53810

   PRATE        XEQ    VLVPL1    VLVPL2    GLVPL2   VHVRCR2
   1.7900       0.8    0.5000    0.9000    1.2200    1.2000

   CURHVRCR2 VLVACR1   VLVACR2   RIp_LVPL   T_LVPL     LVPL1V
   2.0000    0.4000    0.8000   10.0000    0.0200    0.0000


   LVPL1P   LVPL2V    LVPL2P    LVPL3V     LVPL3P     XLVPL
   0.0000    0.5000    0.1670    0.9000    0.9250    0.0000


 NUMBER OF AGGREGATED ORIGINAL WT UNITS:  112
 WT UNITS USE DFIGs


 ** GEWTE2 OF GEWTG **  BUS X-- NAME --X BASEKV MC       C O N S       S T A T E S     VAR         ICON
                       6060 G736        0.6900 1  404264-404330 139690-139707  85928-85936   53944-53955

   TFV      KPV       KIV       RC        XC        TFP       KPP
   0.1500    2.0000    1.0000    0.0000    0.0000    0.0500    3.0000

   KIP       PMX       PMN       QMX      QMN        IPMAX     TRV
   0.6000    1.1200    0.0400    0.4360   -0.4360    1.1000    0.0200

   RPMX      RPMN      T_POWER   KQi      VMINCL     VMAXCL    KVi
   0.4500   -0.4500   60.0000    0.1000    0.9000    1.1000   40.0000

   XIQmin    XIQmax    Tv        Tp       Fn         TPav
   0.5000    1.4500    0.0500    0.0500    1.0000    0.1500

   FRa       FRb       FRc       FRd
   0.9600    0.9960    1.0040    1.0400

   PFRa      PFRb      PFRc      PFRd
   1.0000    1.0000    1.0000    0.4000

   PFRmax    PFRmin    TW        T_LVPL   V_LVPL
   1.0000    0.2000    1.0000    0.2500   -1.0000

   SPDW1     SPDWMX    SPDWMN    SPD_LOW  WTTHRES
  14.0000   25.0000    3.0000   -0.9000    8.0000

   EBST      KDBR      Pdbr_MAX
   0.2000   10.0000    1.0000

   ImaxTD    Iphl      Iqhl      TIpqd     Kqd       Xqd      Kwi
   1.7000    1.2200    1.2500    5.0000    0.0000    0.0000    0.0000

   dbwi      Tipwi     Twowi     urIwi    drIwi    Pmxwi      Pmnwi
   0.0025    1.0000    5.5000    0.1000   -1.0000    0.1000    0.0000

   Vermx     Vermn     Vfrz      QmxZP    QmnZP
   0.1000   -0.1000    0.7000    0.1200   -0.1200



 Remote controlled Bus #      6060
               VARFLG =  1 PFAFLG =  0
               APCFLG =  0 FRFLG =  0
               PQFLAG =  0 WindFREE Enabling Bit = 0
 Q Droop Branch FROM Bus=       0  TO Bus =       0  ID =  1


 **  GEWTT1 **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S      ICON
              6060    G736      0.6900 1  405197-405201 139946-139949  86355-86357   54089

     H          DAMP          Htfrac       Freq1       DSHAFT
    4.1341       0.0000       0.0000       1.8800       1.5000


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CONEC MODELS

 REPORT FOR ALL MODELS                      BUS 6060 [G736        0.6900] MODELS


  ** WGUSTD ** BUS X-- NAME --X     BASEKV MC    C O N S       V A R S        ICONS
              6060     G736         0.6900 1  405869-405874  86693-86696   54203-54205

  T1G          TG       MAXG       T1R      T2R       MAXR
  9999.000     5.000    30.000  9999.000  9999.000    30.000
               Wind generator Bus #   6060
               Wind Generator ID       1


 ** GEWTA1 for GEWTG **      BUS X-- NAME --X BASEKV MC    C O N S        STATE         VAR         ICON
                        6060 G736         0.6900 1  405875-405883  140160-140160  86697-86700   54206-54208

     Lambda_Max      Lambda_Min   PITCH_MAX    PITCH_MIN      Ta         RHO
      20.0000       0.0000      27.0000      -4.0000       0.0000       1.2250

       Radius      GB_RATIO        SYNCHR
      50.0000      89.2200        1200.0000


               Wind Generator Bus #   6060
               Wind Generator ID       1


 ** GEWTP1 for GEWTG **  BUS X-- NAME --X BASEKV MC    C O N S        STATE         VAR         ICON
                        6060 G736         0.6900 1  405884-405893  140161-140163  86701-86703   54209-54211

        Tp            Kpp        Kip           Kpc          Kic
       0.3000     150.0000      25.0000       3.0000      30.0000
         TetaMin   TetaMax   RTetaMin   RTetaMax    PMX
         -4.0000   27.0000  -10.0000   10.0000    1.0000


               Wind Generator Bus #   6060
               Wind Generator ID       1


  ** GEWPLT ** BUS X-- NAME --X    BASEKV MC       V A R S        ICONS
              6060    G736         0.69001       86704-86720   54212-54213


               Wind generator Bus #   6060
               Wind Generator ID       1

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CONET MODELS

 REPORT FOR ALL MODELS                      BUS 6060 [G736        0.6900] MODELS


               *** CALL VTGTPA( 54766,406727,     0, 87165) ***

                BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
               6060 G736    .690            6060 G736    .690    1

                  I C O N S     C O N S       S T A T E  V A R
                 54766-54771  406727-406730        0     87165

                    VLO       VUP      PICKUP     TB
                    0.200     5.000     1.000     0.080


               *** CALL VTGTPA( 54772,406731,     0, 87166) ***

                BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
               6060 G736    .690            6060 G736    .690    1

                  I C O N S     C O N S       S T A T E  V A R
                 54772-54777  406731-406734        0     87166

                    VLO       VUP      PICKUP     TB
                    0.400     5.000     1.700     0.080


               *** CALL VTGTPA( 54778,406735,     0, 87167) ***

                BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
               6060 G736    .690            6060 G736    .690    1

                  I C O N S     C O N S       S T A T E  V A R
                 54778-54783  406735-406738        0     87167
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      VLO       VUP      PICKUP     TB
      0.600     5.000     2.200     0.080

*** CALL VTGTPA( 54784,406739,     0, 87168) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6060 G736    .690            6060 G736    .690    1

    I C O N S     C O N S       S T A T E   V A R
   54784-54789  406739-406742        0     87168

      VLO       VUP      PICKUP     TB
      0.750     5.000     3.000     0.080

*** CALL VTGTPA( 54790,406743,     0, 87169) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6060 G736    .690            6060 G736    .690    1

    I C O N S     C O N S       S T A T E   V A R
   54790-54795  406743-406746        0     87169

      VLO       VUP      PICKUP     TB
      0.850     5.000    10.000     0.080

*** CALL VTGTPA( 54796,406747,     0, 87170) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6060 G736    .690            6060 G736    .690    1

    I C O N S     C O N S       S T A T E   V A R
   54796-54801  406747-406750        0     87170

      VLO       VUP      PICKUP     TB
      0.900     5.000   600.000     0.080

*** CALL VTGTPA( 54802,406751,     0, 87171) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6060 G736    .690            6060 G736    .690    1

    I C O N S     C O N S       S T A T E   V A R
   54802-54807  406751-406754        0     87171

      VLO       VUP      PICKUP     TB
      0.000     1.101     1.000     0.080

*** CALL VTGTPA( 54808,406755,     0, 87172) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6060 G736    .690            6060 G736    .690    1

    I C O N S     C O N S       S T A T E   V A R
   54808-54813  406755-406758        0     87172

      VLO       VUP      PICKUP     TB
      0.000     1.150     0.500     0.080

*** CALL VTGTPA( 54814,406759,     0, 87173) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6060 G736    .690            6060 G736    .690    1

    I C O N S     C O N S       S T A T E   V A R
   54814-54819  406759-406762        0     87173

      VLO       VUP      PICKUP     TB
      0.000     1.175     0.200     0.080

*** CALL VTGTPA( 54820,406763,     0, 87174) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6060 G736    .690            6060 G736    .690    1

    I C O N S     C O N S       S T A T E   V A R
   54820-54825  406763-406766        0     87174

      VLO       VUP      PICKUP     TB
      0.000     1.200     0.100     0.080
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*** CALL VTGTPA( 54826,406767,     0, 87175) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6060 G736    .690            6060 G736    .690    1

    I C O N S      C O N S       S T A T E   V A R
   54826-54831  406767-406770         0     87175

      VLO       VUP      PICKUP     TB
      0.000     1.300     0.010     0.080
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J299

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PLANT MODELS

 REPORT FOR ALL MODELS                     BUS 50010 [MEC-CT2     15.000] MODELS


 ** GENROU **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S
             50010 MEC-CT2      15.000 1  407073-407086 140279-140284

             MBASE     Z S O R C E         X T R A N       GENTAP
             226.0  0.00200+J 0.20270  0.00000+J 0.00000  1.00000

  T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
 10.11 0.047  1.12 0.081   1.71  0.00 2.0775 2.0238 0.2674 0.4550 0.2027 0.1728

                                S(1.0)  S(1.2)
                                0.0740  0.2830


 ** PSS2B  **   BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S      I C O N S
             50010 MEC-CT2      15.000 1  407087-407109 140285-140301  87295-87298   55126-55131

                    IC1 REMBUS1     IC2 REMBUS2       M       N
                      1       0       3       0       2       4

       TW1      TW2      T6       TW3      TW4      T7       KS2      KS3
      5.000    5.000    0.000    5.000    0.000    5.000    0.462    1.000

       T8       T9      KS1       T1       T2       T3       T4       T10      T11
      0.300    0.150    4.000    0.300    0.030    0.100    0.010    5.000    5.000

       VS1MAX   VS1MIN   VS2MAX   VS2MIN    VSTMAX   VSTMIN
      0.500    -0.500    2.000    -2.000    0.050   -0.050


 **  AC7B **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S
             50010 MEC-CT2      15.000 1  407110-407136 140302-140307  87299-87300

        TR          KPR          KIR          KDR         TDR          VRMAX         VRMIN
       0.0000      34.0000      56.7000       0.0000       1.0000      17.0000     -17.0000

       KPA          KIA          VAMAX        VAMIN        KP          KL
       7.1000      35.5000      40.1000     -32.1000       0.0000      10.0000

       KF1          KF2          KF3          TF3          KC           KD           KE
       0.0000       1.0000       0.0000       1.0000       0.6100       2.5900       1.0000

        TE          VFEMAX       VEMIN         E1          S(E1)        E2           S(E2)
       0.8000      17.0000       0.0000       7.1000       0.4100       5.4000       0.1800


  **  GGOV1 ** BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S       ICONS
             50010 MEC-CT2      15.000 1  407170-407202 140318-140327  87322-87342   55134-55135

     R    TPELEC   MAXERR  MINERR  KPGOV   KIGOV   KDGOV   TDGOV    VMAX    VMIN
   0.040   0.200   0.025  -0.025  14.000   1.400   0.000   1.000   1.000   0.115

    TACT   KTURB    WFNL     TB      TC      TENG   TFLOAD  KPLOAD   KILOAD  LDREF
   0.200   1.738   0.157   0.590   0.000   0.000   4.000   4.500   1.360   1.000

     DM    ROPEN  RCLOSE    KIMW    ASET      KA      TA    TRATE     DB
   0.000  99.000 -99.000   0.000   0.010  10.000   0.050 211.000   0.000

    TSA     TSB     RUP    RDOWN
  12.000  17.000  99.000 -99.000


               ICON(M)= 1 (Feedback signal for governor droop)
               ICON(M+1)= 1 (Switch for fuel source characteristic)

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PLANT MODELS

 REPORT FOR ALL MODELS                    BUS 600046 [MEC-ST      19.500] MODELS


 ** GENROU **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S
            600046 MEC-ST       19.500 1   95937-95950   37763-37768

             MBASE     Z S O R C E         X T R A N       GENTAP
             470.0  0.00240+J 0.23600  0.00000+J 0.00000  1.00000

  T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
  5.60 0.028  1.20 0.046   3.95  0.00 2.1700 2.1300 0.2850 0.4720 0.2360 0.2080
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PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

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                              S(1.0)  S(1.2)
                              0.1338  0.3750

 ** PSS2A  **   BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S      I C O N S
           600046 MEC-ST       19.500 1  132825-132841  62595-62610   23931-23934   10985-10990

                   IC1 REMBUS1     IC2 REMBUS2       M       N
                     3       0       0       0       1       0

      TW1      TW2      T6       TW3      TW4      T7       KS2      KS3
     2.000    0.000    0.000    1.000    0.000    0.000    0.000    0.000

      T8       T9       KS1      T1       T2       T3       T4       VSTMAX   VSTMIN
     1.000    0.000   -0.480    1.000    1.000    0.140    0.070    0.050   -0.050

 ** ESST1A **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S    I C O N S
           600046 MEC-ST       19.500 1  234903-234920  92004-92008   14688-14689

   UEL VOS     TR    VIMAX   VIMIN     TC      TB     TC1     TB1     KA
    0   0    0.000   0.100  -0.100   0.700   6.670   1.000   1.000  400.0

    TA    VAMAX   VAMIN   VRMAX   VRMIN    KC      KF      TF    KLR    ILR
  0.030   4.400  -3.100   4.400  -3.100  0.000  0.000  1.000 10.000  5.000

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PLANT MODELS

 REPORT FOR ALL MODELS                    BUS 600047 [MEC-CT1     15.000] MODELS

 ** GENROU **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S
           600047 MEC-CT1      15.000 1   95951-95964   37769-37774

            MBASE     Z S O R C E         X T R A N       GENTAP
            226.0  0.00200+J 0.20270  0.00000+J 0.00000  1.00000

  T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
 10.11 0.047  1.12 0.081   1.71  0.00 2.0775 2.0238 0.2674 0.4550 0.2027 0.1728

                              S(1.0)  S(1.2)
                              0.0740  0.2830

 ** PSS2B  **   BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S      I C O N S
           600047 MEC-CT1      15.000 1  132842-132864  62611-62627   23935-23938   10991-10996

                   IC1 REMBUS1     IC2 REMBUS2       M       N
                     1       0       3       0       2       4

      TW1      TW2      T6       TW3      TW4      T7       KS2      KS3
     5.000    5.000    0.000    5.000    0.000    5.000    0.462    1.000

      T8       T9       KS1      T1       T2       T3       T4       T10      T11
     0.300    0.150    4.000    0.300    0.030    0.100    0.010    5.000    5.000

      VS1MAX   VS1MIN   VS2MAX   VS2MIN    VSTMAX   VSTMIN
     0.500    -0.500    2.000    -2.000    0.050   -0.050

 **  AC7B **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S
           600047 MEC-CT1      15.000 1  234921-234947  92009-92014   28834-28835

       TR          KPR           KIR          KDR          TDR          VRMAX         VRMIN
      0.0000      34.0000      56.7000      0.0000       1.0000      17.0000     -17.0000

      KPA          KIA           VAMAX        VAMIN         KP           KL
      7.1000      35.5000      40.1000     -32.1000      0.0000      10.0000

      KF1          KF2           KF3          TF3           KC           KD           KE
      0.0000       1.0000       0.0000       1.0000       0.6100       2.5900       1.0000

       TE          VFEMAX        VEMIN         E1          S(E1)         E2          S(E2)
      0.8000      17.0000       0.0000       7.1000       0.4100       5.4000       0.1800

  **  GGOV1 ** BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S        ICONS
           600047 MEC-CT1      15.000 1  407137-407169 140308-140317  87301-87321   55132-55133

    R    TPELEC   MAXERR  MINERR  KPGOV   KIGOV   KDGOV   TDGOV    VMAX    VMIN
  0.040   0.200   0.025  -0.025  14.000   1.400   0.000   1.000   1.000   0.115

   TACT   KTURB    WFNL     TB      TC     TENG   TFLOAD  KPLOAD   KILOAD  LDREF
  0.200   1.738   0.157   0.590   0.000   0.000   4.000   4.500   1.360   1.000
```

DM	ROPEN	RCLOSE	KIMW	ASET	KA	TA	TRATE	DB
0.000	99.000	-99.000	0.000	0.010	10.000	0.050	211.000	0.000

TSA	TSB	RUP	RDOWN
12.000	17.000	99.000	-99.000

ICON(M)= 1 (Feedback signal for governor droop)
ICON(M+1)= 1 (Switch for fuel source characteristic)

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

J385

PLANT MODELS

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REPORT FOR ALL MODELS                    BUS 12050 [J385_GEN    0.3420] MODELS


** SMASC **   BUS X-- NAME --X BASEKV MC      C O N S   S T A T E S      V A R S
           12050 J385_GEN     0.3420 1  403122-403197 139272-139286  85291- 85392

           MBASE          Z S O R C E            X T R A N   GENTAP
           100.0      0.00+J  10000.00      0.00+J      0.00  1.00000
```

PPrim	PWNom	PF_PFExtStr	PF_PFStr	PF_WNomStr	PF_PFExtStop
1.000	1.000	0.000	0.900	0.500	1.000
PF_PFStop	PF_WNomStop	PWCtlHzMod	PHzStr	PHzStop	PHzWGra
0.900	0.900	0.000	0.200	0.050	0.400
VArCtlVol_VArTm	QVArMod	VArCtlVol_Volref	VArCtlVol_VolDB	VArCtlVol_VArGra	VArCtlVol_VArMax
2.000	1.000	1.000	0.000	5.000	0.500
PFExt	PF	QVArNom	DGSMod	DGSArGraNom	DGSqPWMVolNom
0.000	1.000	0.000	1.000	2.000	0.000
DGSqPWMTm	DGSNqPWMVolNom	DGSNqPWMTm	DGSHystVolNom	VolCtl_hhhLim	VolCtl_hhhLimTm
5.000	0.900	0.000	0.050	1.200	0.160
VolCtl_hhLim	VolCtl_hhLimTm	VolCtl_hLim	VolCtl_hLimTm	VolCtl_lLim	VolCtl_lLimTm
1.200	0.160	1.100	1.000	0.880	2.000
VolCtl_llLim	VolCtl_llLimTm	VolCtl_lllLim	VolCtl_lllLimTm	VolCtl_ReconMax	VolCtl_ReconMin
0.500	0.160	0.500	0.160	1.060	0.950
FrqCtl_hhhLim	FrqCtl_hhhLimTm	FrqCtl_hhLim	FrqCtl_hhLimTm	FrqCtl_hLim	FrqCtl_hLimTm
65.000	0.100	65.000	0.100	60.500	0.160
FrqCtl_lLim	FrqCtl_lLimTm	FrqCtl_llLim	FrqCtl_llLimTm	FrqCtl_lllLim	FrqCtl_lllLimTm
59.300	0.160	57.000	0.160	50.000	0.100
FrqCtl_ReconMax	FrqCtl_ReconMin	KPLL1	PLLFlag	KPPLL2	KIPLL2
60.500	59.300	30.000	1.000	10.000	30.000
WriteFileNum	WriteTimeSpan	GenTrpFlag	DGSqRcvrTm	DGSNqRcvrTm	WGra
0.000	0.000	0.000	0.200	0.200	0.350
VArGra	PFGra	DGSArGraNomHi	DGSArGraNomLo	DbVolNomMax	DbVolNomMin
0.350	0.349	2.000	2.000	0.100	-0.100
VolCtlCharEna	VolCtllGTm	VolCtlCorTm	VArCmdFltTm		
0.000	0.150	0.100	0.010		

```
** SMAPPC **  BUS X-- NAME --X        MC      C O N S   S T A T E S      V A R S
           12050 J385_GEN          1  404331-404352 139708-139716  85937- 85945
```

RBus	CtlMod	KP_PF	KI_PF	PFXdcrTm	PFDB
12049	1.000	5.000	1.000	0.100	0.000
KP_Vol	KI_Vol	VolXdcrTm	VolDB	PFNomTot	VolNomTot
5.000	1.000	0.100	0.000	0.000	1.000
QNomTot	VolDroop	HybCtlTun	KP_P	KI_P	PXdcrTm
0.000	20.000	0.170	5.000	1.000	0.100
PDB	PNomTot	QCommTm	PCommTm	PFLim	
0.000	1.000	0.200	20.000	0.800	

J391

PLANT MODELS

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 REPORT FOR ALL MODELS                    BUS 58070 [J391       13.800] MODELS


 ** GENSAL **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S
             58070 J391         13.800 1  403198-403209 139287-139291

             MBASE     Z S O R C E         X T R A N       GENTAP
              58.0  0.00000+J 0.22000  0.00000+J 0.00000  1.00000

   T'D0   T''D0   T''Q0     H    DAMP    XD      XQ      X'D    X''D     XL
  9.100   0.130   0.600   3.34   0.00  2.0100  1.0400  0.3000  0.2200  0.1270

                              S(1.0)  S(1.2)
                              0.2500  0.8000


 **   AC8B **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S
             58070 J391         13.800 1  404353-404373 139717-139721  85954-85956

       TR          KPR          KIR         KDR         TDR       VPIDMAX       VPIDMIN
      0.0200      44.2600      15.6400      10.4600      0.3000       7.7630       0.1553

       KA          TA          VRMAX       VRMIN        KC          KD
      1.0000      0.0000      12.2430      0.0000      0.7900      0.3700

       KE          TE          VFEMAX      VEMIN
      1.0000      0.4030      13.4700      0.0000

      E1          S(E1)       E2          S(E2)
      6.6000      0.0200      4.2000      0.0200


  **  GGOV1 ** BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S        ICONS
             58070 J391         13.800 1  405202-405234 139950-139959  86358-86378   54090-54091

     R    TPELEC   MAXERR  MINERR  KPGOV   KIGOV   KDGOV   TDGOV    VMAX    VMIN
   0.050   1.000   0.200  -0.200   7.700   1.100   0.000   0.100   0.655   0.050

    TACT   KTURB    WFNL     TB      TC     TENG   TFLOAD  KPLOAD  KILOAD  LDREF
   0.200   2.083   0.175   0.100   0.100   0.000   0.100  10.000   1.000   2.000

     DM    ROPEN  RCLOSE    KIMW    ASET      KA      TA    TRATE    DB
   0.000   3.300  -3.300   0.000   1.000  10.000   0.100  50.500   0.000

    TSA     TSB     RUP    RDOWN
   0.100   0.100  99.000 -99.000

               ICON(M)= 1 (Feedback signal for governor droop)
               ICON(M+1)= 0 (Switch for fuel source characteristic)
```

PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

J400

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PLANT MODELS

 REPORT FOR ALL MODELS                     BUS 6050 [J400       0.3420] MODELS


 ** SMASC **   BUS X-- NAME --X BASEKV MC       C O N S   S T A T E S       V A R S
             6050 J400         0.3420 1  403210-403285 139292-139306  85393- 85494

            MBASE         Z S O R C E            X T R A N   GENTAP
             63.0      0.00+J  10000.00      0.00+J      0.00  1.00000

  PPrim            PWNom            PF_PFExtStr      PF_PFStr         PF_WNomStr       PF_PFExtStop
             1.000            1.000            0.000            0.900            0.500            1.000

  PF_PFStop        PF_WNomStop      PWCtlHzMod       PHzStr           PHzStop          PHzWGra
             0.900            0.900            0.000            0.200            0.050            0.400

  VArCtlVol_VArTm  QVArMod          VArCtlVol_Volref  VArCtlVol_VolDB  VArCtlVol_VArGra  VArCtlVol_VArMax
             2.000            1.000            1.000            0.000            5.000            0.500

  PFExt            PF               QVArNom          DGSMod           DGSArGraNom      DGSqPWMVolNom
             0.000            1.000            0.000            1.000            2.000            0.000

  DGSqPWMTm        DGSNqPWMVolNom   DGSNqPWMTm       DGSHystVolNom    VolCtl_hhhLim    VolCtl_hhhLimTm
             5.000            0.900            0.000            0.050            1.200            0.160

  VolCtl_hhLim     VolCtl_hhLimTm   VolCtl_hLim      VolCtl_hLimTm    VolCtl_lLim      VolCtl_lLimTm
             1.200            0.160            1.100            1.000            0.880            2.000

  VolCtl_llLim     VolCtl_llLimTm   VolCtl_lllLim    VolCtl_lllLimTm  VolCtl_ReconMax  VolCtl_ReconMin
             0.500            0.160            0.500            0.160            1.060            0.950

  FrqCtl_hhhLim    FrqCtl_hhhLimTm  FrqCtl_hhLim     FrqCtl_hhLimTm   FrqCtl_hLim      FrqCtl_hLimTm
            65.000            0.100           65.000            0.100           60.500            0.160

  FrqCtl_lLim      FrqCtl_lLimTm    FrqCtl_llLim     FrqCtl_llLimTm   FrqCtl_lllLim    FrqCtl_lllLimTm
            59.300            0.160           57.000            0.160           50.000            0.100

  FrqCtl_ReconMax  FrqCtl_ReconMin  KPLL1            PLLFlag          KPPLL2           KIPLL2
            60.500           59.300           30.000            1.000           10.000           30.000

  WriteFileNum     WriteTimeSpan    GenTrpFlag       DGSqRcvrTm       DGSNqRcvrTm      WGra
             0.000            0.000            0.000            0.200            0.200            0.350

  VArGra           PFGra            DGSArGraNomHi    DGSArGraNomLo    DbVolNomMax      DbVolNomMin
             0.350            0.349            2.000            2.000            0.100           -0.100

  VolCtlCharEna    VolCtllGTm       VolCtlCorTm      VArCmdFltTm
             0.000            0.150            0.100            0.010


 ** SMAPPC **  BUS X-- NAME --X        MC       C O N S   S T A T E S       V A R S
             6050 J400                 1  404374-404395 139722-139730  85957- 85965

  RBus             CtlMod           KP_PF            KI_PF            PFXdcrTm         PFDB
              6051            1.000            5.000            1.000            0.100            0.000

  KP_Vol           KI_Vol           VolXdcrTm        VolDB            PFNomTot         VolNomTot
             5.000            1.000            0.100            0.000            0.000            1.000

  QNomTot          VolDroop         HybCtlTun        KP_P             KI_P             PXdcrTm
             0.000           20.000            0.170            5.000            1.000            0.100

  PDB              PNomTot          QCommTm          PCommTm          PFLim
             0.000            1.000            0.200           20.000            0.800
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J405

PLANT MODELS

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 REPORT FOR ALL MODELS                     BUS 12053 [J405        13.800] MODELS


 ** GENSAL **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S
            12053 J405         13.800 1  403286-403297 139307-139311

            MBASE     Z S O R C E         X T R A N       GENTAP
             46.7  0.00000+J 0.16700  0.00000+J 0.00000  1.00000

   T'D0   T''D0   T''Q0     H    DAMP    XD      XQ      X'D    X''D     XL
  7.805   0.030   0.123   1.08   0.00  1.7580  0.8860  0.2950  0.1670  0.1380

                              S(1.0)  S(1.2)
                              0.1560  0.4020


 **  AC7B **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S
            12053 J405         13.800 1  404396-404422 139731-139736  85974-85975

       TR            KPR           KIR           KDR          TDR          VRMAX         VRMIN
      0.0200       1.0000       0.0000       0.1500       0.0500       6.4900      -6.4900

      KPA            KIA          VAMAX        VAMIN         KP           KL
     63.0000      20.9300       6.4900       0.1000       1.0000      10.0000

      KF1           KF2           KF3           TF3           KC            KD            KE
      0.0000       0.0000       0.0000       1.0000       0.0500       0.4500       1.0000

       TE          VFEMAX        VEMIN          E1          S(E1)          E2          S(E2)
      0.2000       5.1000       0.0000       7.0600       0.3600       5.3000       0.0500


  **  GGOV1 ** BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S       ICONS
            12053 J405         13.800 1  405235-405267 139960-139969  86379-86399   54092-54093

     R    TPELEC   MAXERR  MINERR  KPGOV   KIGOV   KDGOV   TDGOV    VMAX    VMIN
   0.040   1.000   0.050  -0.050  10.000   2.000   0.001   0.010   1.000   0.071

    TACT   KTURB    WFNL     TB      TC     TENG   TFLOAD  KPLOAD   KILOAD  LDREF
   0.025   1.080   0.071   0.015  -0.015   0.029   1.000   1.000   1.000   1.000

     DM    ROPEN  RCLOSE    KIMW    ASET      KA      TA    TRATE    DB
   0.000   0.100  -0.100   0.000   0.000   0.000   1.000  40.000   0.000

    TSA     TSB     RUP    RDOWN
   1.000   1.000  99.000 -99.000

               ICON(M)= 1 (Feedback signal for governor droop)
               ICON(M+1)= 1 (Switch for fuel source characteristic)
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J407

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PLANT MODELS

 REPORT FOR ALL MODELS                      BUS 6004 [J407 G1     0.6900] MODELS


 ** GEWTG2 **  BUS X-- NAME --X   BASEKV MC  C O N S     S T A T E S        VAR        ICON
             6004    J407 G1   0.6900 1  403298-403315 139312-139314  85495-85499   53811-53814

   PRATE        XEQ    VLVPL1    VLVPL2    GLVPL2   VHVRCR2
   1.7900       0.8    0.5000    0.9000    1.2200    1.2000

   CURHVRCR2 VLVACR1   VLVACR2   RIp_LVPL   T_LVPL     LVPL1V
   2.0000    0.4000    0.8000   10.0000    0.0200    0.0000


   LVPL1P   LVPL2V    LVPL2P    LVPL3V     LVPL3P     XLVPL
   0.0000    0.5000    0.1670    0.9000    0.9250    0.0000


 NUMBER OF AGGREGATED ORIGINAL WT UNITS:   56
 WT UNITS USE DFIGs


 ** GEWTE2 OF GEWTG **  BUS X-- NAME --X BASEKV MC       C O N S      S T A T E S     VAR         ICON
                        6004 J407 G1      0.6900 1  404423-404489 139737-139754  85976-85984   53964-53975

   TFV      KPV        KIV       RC        XC        TFP       KPP
   0.1500    2.0000    1.0000    0.0000    0.0000    0.0500    3.0000

   KIP       PMX       PMN       QMX      QMN        IPMAX     TRV
   0.6000    1.1200    0.0400    0.4360   -0.4360    1.1000    0.0200

   RPMX      RPMN      T_POWER   KQi      VMINCL     VMAXCL    KVi
   0.4500   -0.4500   60.0000    0.1000    0.9000    1.1000   40.0000

   XIQmin    XIQmax    Tv        Tp       Fn         TPav
   0.5000    1.4500    0.0500    0.0500    1.0000    0.1500

   FRa       FRb       FRc       FRd
   0.9600    0.9960    1.0040    1.0400

   PFRa      PFRb      PFRc      PFRd
   1.0000    1.0000    1.0000    0.4000

   PFRmax    PFRmin    TW        T_LVPL   V_LVPL
   1.0000    0.2000    1.0000    0.2500   -1.0000

   SPDW1     SPDWMX    SPDWMN    SPD_LOW  WTTHRES
  14.0000   25.0000    3.0000   -0.9000    8.0000

   EBST      KDBR      Pdbr_MAX
   0.2000   10.0000    1.0000

   ImaxTD    Iphl      Iqhl      TIpqd      Kqd      Xqd      Kwi
   1.7000    1.2200    1.2500    5.0000    0.0000    0.0000    0.0000

   dbwi      Tipwi     Twowi     urIwi    drIwi    Pmxwi      Pmnwi
   0.0025    1.0000    5.5000    0.1000   -1.0000    0.1000    0.0000

   Vermx     Vermn     Vfrz      QmxZP    QmnZP
   0.1000   -0.1000    0.7000    0.1200   -0.1200


 Remote controlled Bus #      6004
               VARFLG =  1 PFAFLG =  0
               APCFLG =  0 FRFLG =  0
               PQFLAG =  0 WindFREE Enabling Bit = 0
 Q Droop Branch FROM Bus=       0  TO Bus =       0  ID =  1


 **  GEWTT1 **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S      ICON
             6004    J407 G1   0.6900 1  405268-405272 139970-139973  86400-86402   54094

     H          DAMP         Htfrac       Freq1       DSHAFT
    4.1341      0.0000       0.0000       1.8800      1.5000


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PLANT MODELS

 REPORT FOR ALL MODELS                      BUS 6005 [J407 G2     0.7000] MODELS
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** GEWTG2 **  BUS X-- NAME --X   BASEKV MC  C O N S     S T A T E S        VAR        ICON
             6005    J407 G2   0.7000 1  403316-403333 139315-139317  85500-85504   53815-53818

  PRATE        XEQ    VLVPL1    VLVPL2    GLVPL2   VHVRCR2
  1.7900       0.8    0.5000    0.9000    1.2200    1.2000

  CURHVRCR2 VLVACR1   VLVACR2   RIp_LVPL   T_LVPL     LVPL1V
  2.0000    0.4000    0.8000   10.0000    0.0200    0.0000


  LVPL1P   LVPL2V    LVPL2P    LVPL3V     LVPL3P     XLVPL
  0.0000    0.5000    0.1670    0.9000    0.9250    0.0000


NUMBER OF AGGREGATED ORIGINAL WT UNITS:   56
WT UNITS USE DFIGs


** GEWTE2 OF GEWTG **  BUS X-- NAME --X BASEKV MC       C O N S      S T A T E S     VAR         ICON
                        6005 J407 G2      0.7000 1  404490-404556 139755-139772  85985-85993   53976-53987

  TFV      KPV        KIV       RC        XC        TFP       KPP
  0.1500    2.0000    1.0000    0.0000    0.0000    0.0500    3.0000

  KIP       PMX       PMN       QMX       QMN       IPMAX     TRV
  0.6000    1.1200    0.0400    0.4360   -0.4360    1.1000    0.0200

  RPMX      RPMN      T_POWER   KQi       VMINCL    VMAXCL    KVi
  0.4500   -0.4500   60.0000    0.1000    0.9000    1.1000   40.0000

  XIQmin    XIQmax    Tv        Tp        Fn        TPav
  0.5000    1.4500    0.0500    0.0500    1.0000    0.1500

  FRa       FRb       FRc       FRd
  0.9600    0.9960    1.0040    1.0400

  PFRa      PFRb      PFRc      PFRd
  1.0000    1.0000    1.0000    0.4000

  PFRmax    PFRmin    TW        T_LVPL   V_LVPL
  1.0000    0.2000    1.0000    0.2500   -1.0000

  SPDW1     SPDWMX    SPDWMN    SPD_LOW  WTTHRES
 14.0000   25.0000    3.0000   -0.9000    8.0000

  EBST      KDBR      Pdbr_MAX
  0.2000   10.0000    1.0000

  ImaxTD    Iphl      Iqhl      TIpqd      Kqd      Xqd      Kwi
  1.7000    1.2200    1.2500    5.0000    0.0000    0.0000    0.0000

  dbwi      Tipwi     Twowi     urIwi    drIwi    Pmxwi      Pmnwi
  0.0025    1.0000    5.5000    0.1000   -1.0000    0.1000    0.0000

  Vermx     Vermn     Vfrz      QmxZP    QmnZP
  0.1000   -0.1000    0.7000    0.1200   -0.1200


Remote controlled Bus #      6005
               VARFLG =  1 PFAFLG =  0
               APCFLG =  0 FRFLG =  0
               PQFLAG =  0 WindFREE Enabling Bit = 0
Q Droop Branch FROM Bus=       0  TO Bus =       0  ID =  1


**  GEWTT1 **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S      ICON
             6005    J407 G2   0.7000 1  405273-405277 139974-139977  86403-86405   54095

    H           DAMP          Htfrac       Freq1       DSHAFT
   4.1341       0.0000       0.0000       1.8800       1.5000


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CONEC MODELS

 REPORT FOR ALL MODELS                      BUS 6004 [J407 G1     0.6900] MODELS


  ** WGUSTD ** BUS X-- NAME --X     BASEKV MC    C O N S      V A R S       ICONS
             6004     J407 G1      0.6900 1  405894-405899  86721-86724   54214-54216

 T1G          TG       MAXG       T1R      T2R       MAXR
 9999.000     5.000    30.000  9999.000  9999.000    30.000
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PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

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              Wind generator Bus #   6004
              Wind Generator ID       1

 ** GEWTA1 for GEWTG **      BUS X-- NAME --X BASEKV MC    C O N S        STATE         VAR        ICON
                        6004 J407 G1      0.6900 1  405900-405908  140164-140164  86725-86728   54217-54219

     Lambda_Max      Lambda_Min   PITCH_MAX    PITCH_MIN      Ta         RHO
      20.0000       0.0000      27.0000      -4.0000       0.0000       1.2250

       Radius      GB_RATIO        SYNCHR
      50.0000      89.2200        1200.0000

              Wind Generator Bus #   6004
              Wind Generator ID       1

 ** GEWTP1 for GEWTG **  BUS X-- NAME --X BASEKV MC    C O N S        STATE         VAR         ICON
                        6004 J407 G1      0.6900 1  405909-405918  140165-140167  86729-86731   54220-54222

        Tp             Kpp        Kip           Kpc           Kic
       0.3000     150.0000      25.0000       3.0000       30.0000
         TetaMin   TetaMax   RTetaMin   RTetaMax    PMX
         -4.0000   27.0000  -10.0000   10.0000    1.0000

              Wind Generator Bus #   6004
              Wind Generator ID       1

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CONEC MODELS

 REPORT FOR ALL MODELS                      BUS 6005 [J407 G2     0.7000] MODELS

  ** WGUSTD ** BUS X-- NAME --X     BASEKV MC    C O N S       V A R S       ICONS
             6005     J407 G2      0.7000 1  405919-405924  86732-86735   54223-54225

  T1G          TG       MAXG       T1R      T2R       MAXR
  9999.000     5.000    30.000  9999.000  9999.000    30.000
              Wind generator Bus #   6005
              Wind Generator ID       1

 ** GEWTA1 for GEWTG **      BUS X-- NAME --X BASEKV MC    C O N S        STATE         VAR        ICON
                        6005 J407 G2      0.7000 1  405925-405933  140168-140168  86736-86739   54226-54228

     Lambda_Max      Lambda_Min   PITCH_MAX    PITCH_MIN      Ta         RHO
      20.0000       0.0000      27.0000      -4.0000       0.0000       1.2250

       Radius      GB_RATIO        SYNCHR
      50.0000      89.2200        1200.0000

              Wind Generator Bus #   6005
              Wind Generator ID       1

 ** GEWTP1 for GEWTG **  BUS X-- NAME --X BASEKV MC    C O N S        STATE         VAR         ICON
                        6005 J407 G2      0.7000 1  405934-405943  140169-140171  86740-86742   54229-54231

        Tp             Kpp        Kip           Kpc           Kic
       0.3000     150.0000      25.0000       3.0000       30.0000
         TetaMin   TetaMax   RTetaMin   RTetaMax    PMX
         -4.0000   27.0000  -10.0000   10.0000    1.0000

              Wind Generator Bus #   6005
              Wind Generator ID       1

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CONET MODELS

 REPORT FOR ALL MODELS                      BUS 6004 [J407 G1     0.6900] MODELS

              *** CALL VTGTPA( 54832,406771,     0, 87176) ***

               BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
              6004 J407 G1 .690           6004 J407 G1 .690    1

                 I C O N S     C O N S       S T A T E  V A R
                54832-54837  406771-406774        0     87176
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     VLO       VUP      PICKUP     TB
     0.200     5.000     1.000     0.080

*** CALL VTGTPA( 54838,406775,     0, 87177) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6004 J407 G1 .690            6004 J407 G1 .690    1

    I C O N S     C O N S       S T A T E   V A R
   54838-54843  406775-406778        0     87177

     VLO       VUP      PICKUP     TB
     0.400     5.000     1.700     0.080

*** CALL VTGTPA( 54844,406779,     0, 87178) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6004 J407 G1 .690            6004 J407 G1 .690    1

    I C O N S     C O N S       S T A T E   V A R
   54844-54849  406779-406782        0     87178

     VLO       VUP      PICKUP     TB
     0.600     5.000     2.200     0.080

*** CALL VTGTPA( 54850,406783,     0, 87179) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6004 J407 G1 .690            6004 J407 G1 .690    1

    I C O N S     C O N S       S T A T E   V A R
   54850-54855  406783-406786        0     87179

     VLO       VUP      PICKUP     TB
     0.750     5.000     3.000     0.080

*** CALL VTGTPA( 54856,406787,     0, 87180) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6004 J407 G1 .690            6004 J407 G1 .690    1

    I C O N S     C O N S       S T A T E   V A R
   54856-54861  406787-406790        0     87180

     VLO       VUP      PICKUP     TB
     0.850     5.000    10.000     0.080

*** CALL VTGTPA( 54862,406791,     0, 87181) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6004 J407 G1 .690            6004 J407 G1 .690    1

    I C O N S     C O N S       S T A T E   V A R
   54862-54867  406791-406794        0     87181

     VLO       VUP      PICKUP     TB
     0.900     5.000   600.000     0.080

*** CALL VTGTPA( 54868,406795,     0, 87182) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6004 J407 G1 .690            6004 J407 G1 .690    1

    I C O N S     C O N S       S T A T E   V A R
   54868-54873  406795-406798        0     87182

     VLO       VUP      PICKUP     TB
     0.000     1.101     1.000     0.080

*** CALL VTGTPA( 54874,406799,     0, 87183) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6004 J407 G1 .690            6004 J407 G1 .690    1

    I C O N S     C O N S       S T A T E   V A R
   54874-54879  406799-406802        0     87183

     VLO       VUP      PICKUP     TB
     0.000     1.150     0.500     0.080
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*** CALL VTGTPA( 54880,406803,     0, 87184) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6004 J407 G1 .690           6004 J407 G1 .690    1

    I C O N S     C O N S       S T A T E  V A R
   54880-54885  406803-406806        0     87184

      VLO       VUP      PICKUP     TB
      0.000     1.175     0.200     0.080

*** CALL VTGTPA( 54886,406807,     0, 87185) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6004 J407 G1 .690           6004 J407 G1 .690    1

    I C O N S     C O N S       S T A T E  V A R
   54886-54891  406807-406810        0     87185

      VLO       VUP      PICKUP     TB
      0.000     1.200     0.100     0.080

*** CALL VTGTPA( 54892,406811,     0, 87186) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6004 J407 G1 .690           6004 J407 G1 .690    1

    I C O N S     C O N S       S T A T E  V A R
   54892-54897  406811-406814        0     87186

      VLO       VUP      PICKUP     TB
      0.000     1.300     0.010     0.080

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CONET MODELS

 REPORT FOR ALL MODELS                      BUS 6005 [J407 G2     0.7000] MODELS

*** CALL VTGTPA( 54898,406815,     0, 87187) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6005 J407 G2 .700           6005 J407 G2 .700    1

    I C O N S     C O N S       S T A T E  V A R
   54898-54903  406815-406818        0     87187

      VLO       VUP      PICKUP     TB
      0.200     5.000     1.000     0.080

*** CALL VTGTPA( 54904,406819,     0, 87188) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6005 J407 G2 .700           6005 J407 G2 .700    1

    I C O N S     C O N S       S T A T E  V A R
   54904-54909  406819-406822        0     87188

      VLO       VUP      PICKUP     TB
      0.400     5.000     1.700     0.080

*** CALL VTGTPA( 54910,406823,     0, 87189) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6005 J407 G2 .700           6005 J407 G2 .700    1

    I C O N S     C O N S       S T A T E  V A R
   54910-54915  406823-406826        0     87189

      VLO       VUP      PICKUP     TB
      0.600     5.000     2.200     0.080

*** CALL VTGTPA( 54916,406827,     0, 87190) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6005 J407 G2 .700           6005 J407 G2 .700    1

    I C O N S     C O N S       S T A T E  V A R
   54916-54921  406827-406830        0     87190
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      VLO       VUP      PICKUP     TB
      0.750     5.000     3.000     0.080

*** CALL VTGTPA( 54922,406831,     0, 87191) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6005 J407 G2 .700            6005 J407 G2 .700    1

    I C O N S     C O N S       S T A T E   V A R
   54922-54927  406831-406834         0     87191

      VLO       VUP      PICKUP     TB
      0.850     5.000    10.000     0.080

*** CALL VTGTPA( 54928,406835,     0, 87192) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6005 J407 G2 .700            6005 J407 G2 .700    1

    I C O N S     C O N S       S T A T E   V A R
   54928-54933  406835-406838         0     87192

      VLO       VUP      PICKUP     TB
      0.900     5.000   600.000     0.080

*** CALL VTGTPA( 54934,406839,     0, 87193) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6005 J407 G2 .700            6005 J407 G2 .700    1

    I C O N S     C O N S       S T A T E   V A R
   54934-54939  406839-406842         0     87193

      VLO       VUP      PICKUP     TB
      0.000     1.101     1.000     0.080

*** CALL VTGTPA( 54940,406843,     0, 87194) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6005 J407 G2 .700            6005 J407 G2 .700    1

    I C O N S     C O N S       S T A T E   V A R
   54940-54945  406843-406846         0     87194

      VLO       VUP      PICKUP     TB
      0.000     1.150     0.500     0.080

*** CALL VTGTPA( 54946,406847,     0, 87195) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6005 J407 G2 .700            6005 J407 G2 .700    1

    I C O N S     C O N S       S T A T E   V A R
   54946-54951  406847-406850         0     87195

      VLO       VUP      PICKUP     TB
      0.000     1.175     0.200     0.080

*** CALL VTGTPA( 54952,406851,     0, 87196) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6005 J407 G2 .700            6005 J407 G2 .700    1

    I C O N S     C O N S       S T A T E   V A R
   54952-54957  406851-406854         0     87196

      VLO       VUP      PICKUP     TB
      0.000     1.200     0.100     0.080

*** CALL VTGTPA( 54958,406855,     0, 87197) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6005 J407 G2 .700            6005 J407 G2 .700    1

    I C O N S     C O N S       S T A T E   V A R
   54958-54963  406855-406858         0     87197

      VLO       VUP      PICKUP     TB
      0.000     1.300     0.010     0.080
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PUBLIC DOCUMENT
NOT PUBLIC (OR PRIVILEGED) DATA HAS BEEN EXCISED

J411

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PLANT MODELS

 REPORT FOR ALL MODELS                      BUS 6204 [J411 G1     0.7000] MODELS


 ** GEWTG2 **  BUS X-- NAME --X   BASEKV MC  C O N S     S T A T E S        VAR         ICON
             6204    J411 G1   0.7000 1  403334-403351 139318-139320  85505-85509   53819-53822

   PRATE        XEQ    VLVPL1    VLVPL2    GLVPL2   VHVRCR2
   1.7900       0.8    0.5000    0.9000    1.2200    1.2000

   CURHVRCR2 VLVACR1   VLVACR2   RIp_LVPL   T_LVPL     LVPL1V
   2.0000    0.4000    0.8000   10.0000    0.0200    0.0000


   LVPL1P   LVPL2V    LVPL2P    LVPL3V     LVPL3P     XLVPL
   0.0000    0.5000    0.1670    0.9000    0.9250    0.0000


 NUMBER OF AGGREGATED ORIGINAL WT UNITS:   84
 WT UNITS USE DFIGs


 ** GEWTE2 OF GEWTG **  BUS X-- NAME --X BASEKV MC       C O N S      S T A T E S     VAR          ICON
                         6204 J411 G1      0.7000 1  404557-404623 139773-139790  85994-86002   53988-53999

   TFV      KPV        KIV       RC        XC        TFP       KPP
   0.1500    2.0000    1.0000    0.0000    0.0000    0.0500    3.0000

   KIP       PMX       PMN       QMX      QMN        IPMAX     TRV
   0.6000    1.1200    0.0400    0.4360   -0.4360    1.1000    0.0200

   RPMX      RPMN      T_POWER   KQi      VMINCL     VMAXCL    KVi
   0.4500   -0.4500   60.0000    0.1000    0.9000    1.1000   40.0000

   XIQmin    XIQmax    Tv        Tp       Fn         TPav
   0.5000    1.4500    0.0500    0.0500    1.0000    0.1500

   FRa       FRb       FRc       FRd
   0.9600    0.9960    1.0040    1.0400

   PFRa      PFRb      PFRc      PFRd
   1.0000    1.0000    1.0000    0.4000

   PFRmax    PFRmin    TW        T_LVPL   V_LVPL
   1.0000    0.2000    1.0000    0.2500   -1.0000

   SPDW1     SPDWMX    SPDWMN    SPD_LOW  WTTHRES
  14.0000   25.0000    3.0000   -0.9000    8.0000

   EBST      KDBR      Pdbr_MAX
   0.2000   10.0000    1.0000

   ImaxTD    Iphl      Iqhl      TIpqd      Kqd       Xqd       Kwi
   1.7000    1.2200    1.2500    5.0000    0.0000    0.0000    0.0000

   dbwi      Tipwi     Twowi     urIwi    drIwi    Pmxwi      Pmnwi
   0.0025    1.0000    5.5000    0.1000   -1.0000    0.1000    0.0000

   Vermx     Vermn     Vfrz      QmxZP    QmnZP
   0.1000   -0.1000    0.7000    0.1200   -0.1200


 Remote controlled Bus #      6204
                VARFLG =  1 PFAFLG =  0
                APCFLG =  0 FRFLG =  0
                PQFLAG =  0 WindFREE Enabling Bit = 0
 Q Droop Branch FROM Bus=       0  TO Bus =       0  ID =  1


 **  GEWTT1 **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S      ICON
             6204    J411 G1   0.7000 1  405278-405282 139978-139981  86406-86408   54096

     H          DAMP          Htfrac       Freq1       DSHAFT
    4.1341      0.0000       0.0000       1.8800       1.5000


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PLANT MODELS

 REPORT FOR ALL MODELS                      BUS 6205 [J411 G2     0.7000] MODELS
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** GEWTG2 **  BUS X-- NAME --X   BASEKV MC  C O N S     S T A T E S        VAR        ICON
             6205    J411 G2   0.7000 1  403352-403369 139321-139323  85510-85514   53823-53826

  PRATE        XEQ    VLVPL1    VLVPL2    GLVPL2   VHVRCR2
  1.7900       0.8    0.5000    0.9000    1.2200    1.2000

  CURHVRCR2 VLVACR1   VLVACR2   RIp_LVPL   T_LVPL     LVPL1V
  2.0000    0.4000    0.8000   10.0000    0.0200    0.0000


  LVPL1P   LVPL2V    LVPL2P    LVPL3V     LVPL3P     XLVPL
  0.0000    0.5000    0.1670    0.9000    0.9250    0.0000


NUMBER OF AGGREGATED ORIGINAL WT UNITS:   84
WT UNITS USE DFIGs


** GEWTE2 OF GEWTG **  BUS X-- NAME --X BASEKV MC       C O N S      S T A T E S     VAR         ICON
                        6205 J411 G2      0.7000 1  404624-404690 139791-139808  86003-86011   54000-54011

  TFV      KPV        KIV       RC        XC        TFP       KPP
  0.1500    2.0000    1.0000    0.0000    0.0000    0.0500    3.0000

  KIP       PMX       PMN       QMX       QMN       IPMAX     TRV
  0.6000    1.1200    0.0400    0.4360   -0.4360    1.1000    0.0200

  RPMX      RPMN      T_POWER   KQi       VMINCL    VMAXCL    KVi
  0.4500   -0.4500   60.0000    0.1000    0.9000    1.1000   40.0000

  XIQmin    XIQmax    Tv        Tp        Fn        TPav
  0.5000    1.4500    0.0500    0.0500    1.0000    0.1500

  FRa       FRb       FRc       FRd
  0.9600    0.9960    1.0040    1.0400

  PFRa      PFRb      PFRc      PFRd
  1.0000    1.0000    1.0000    0.4000

  PFRmax    PFRmin    TW        T_LVPL   V_LVPL
  1.0000    0.2000    1.0000    0.2500   -1.0000

  SPDW1     SPDWMX    SPDWMN    SPD_LOW  WTTHRES
 14.0000   25.0000    3.0000   -0.9000    8.0000

  EBST      KDBR      Pdbr_MAX
  0.2000   10.0000    1.0000

  ImaxTD    Iphl      Iqhl      TIpqd      Kqd       Xqd      Kwi
  1.7000    1.2200    1.2500    5.0000    0.0000    0.0000    0.0000

  dbwi      Tipwi     Twowi     urIwi    drIwi    Pmxwi      Pmnwi
  0.0025    1.0000    5.5000    0.1000   -1.0000    0.1000    0.0000

  Vermx     Vermn     Vfrz      QmxZP    QmnZP
  0.1000   -0.1000    0.7000    0.1200   -0.1200


Remote controlled Bus #      6205
               VARFLG =  1 PFAFLG =  0
               APCFLG =  0 FRFLG =  0
               PQFLAG =  0 WindFREE Enabling Bit = 0
Q Droop Branch FROM Bus=       0  TO Bus =       0  ID =  1


**  GEWTT1 **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S      ICON
             6205    J411 G2   0.7000 1  405283-405287 139982-139985  86409-86411   54097

    H           DAMP          Htfrac       Freq1       DSHAFT
   4.1341       0.0000       0.0000       1.8800       1.5000


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CONEC MODELS

REPORT FOR ALL MODELS                      BUS 6204 [J411 G1     0.7000] MODELS


 ** WGUSTD ** BUS X-- NAME --X     BASEKV MC    C O N S      V A R S       ICONS
             6204     J411 G1      0.7000 1  405944-405949  86743-86746   54232-54234

 T1G          TG       MAXG       T1R      T2R       MAXR
 9999.000     5.000    30.000  9999.000  9999.000    30.000
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              Wind generator Bus #   6204
              Wind Generator ID       1

 ** GEWTA1 for GEWTG **      BUS X-- NAME --X BASEKV MC    C O N S        STATE         VAR        ICON
                       6204 J411 G1      0.7000 1  405950-405958  140172-140172  86747-86750   54235-54237

     Lambda_Max      Lambda_Min   PITCH_MAX    PITCH_MIN      Ta        RHO
      20.0000       0.0000      27.0000      -4.0000       0.0000       1.2250

       Radius      GB_RATIO        SYNCHR
      50.0000      89.2200        1200.0000

              Wind Generator Bus #   6204
              Wind Generator ID       1

 ** GEWTP1 for GEWTG **  BUS X-- NAME --X BASEKV MC    C O N S        STATE         VAR        ICON
                       6204 J411 G1      0.7000 1  405959-405968  140173-140175  86751-86753   54238-54240

        Tp           Kpp        Kip           Kpc          Kic
       0.3000     150.0000      25.0000       3.0000      30.0000
         TetaMin   TetaMax   RTetaMin   RTetaMax    PMX
         -4.0000   27.0000  -10.0000   10.0000    1.0000

              Wind Generator Bus #   6204
              Wind Generator ID       1

  ** GEWPLT ** BUS X-- NAME --X    BASEKV MC       V A R S       ICONS
             6204    J411 G1      0.70001       86754-86770   54241-54242

              Wind generator Bus #   6204
              Wind Generator ID       1
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CONEC MODELS

 REPORT FOR ALL MODELS                      BUS 6205 [J411 G2     0.7000] MODELS

  ** WGUSTD ** BUS X-- NAME --X     BASEKV MC    C O N S      V A R S       ICONS
             6205     J411 G2      0.7000 1  405969-405974  86771-86774   54243-54245

  T1G          TG       MAXG       T1R      T2R       MAXR
  9999.000     5.000    30.000  9999.000  9999.000    30.000
              Wind generator Bus #   6205
              Wind Generator ID       1

 ** GEWTA1 for GEWTG **      BUS X-- NAME --X BASEKV MC    C O N S        STATE         VAR        ICON
                       6205 J411 G2      0.7000 1  405975-405983  140176-140176  86775-86778   54246-54248

     Lambda_Max      Lambda_Min   PITCH_MAX    PITCH_MIN      Ta        RHO
      20.0000       0.0000      27.0000      -4.0000       0.0000       1.2250

       Radius      GB_RATIO        SYNCHR
      50.0000      89.2200        1200.0000

              Wind Generator Bus #   6205
              Wind Generator ID       1

 ** GEWTP1 for GEWTG **  BUS X-- NAME --X BASEKV MC    C O N S        STATE         VAR        ICON
                       6205 J411 G2      0.7000 1  405984-405993  140177-140179  86779-86781   54249-54251

        Tp           Kpp        Kip           Kpc          Kic
       0.3000     150.0000      25.0000       3.0000      30.0000
         TetaMin   TetaMax   RTetaMin   RTetaMax    PMX
         -4.0000   27.0000  -10.0000   10.0000    1.0000

              Wind Generator Bus #   6205
              Wind Generator ID       1

  ** GEWPLT ** BUS X-- NAME --X    BASEKV MC       V A R S       ICONS
             6205    J411 G2      0.70001       86782-86798   54252-54253

              Wind generator Bus #   6205
              Wind Generator ID       1
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CONET MODELS

 REPORT FOR ALL MODELS                      BUS 6204 [J411 G1     0.7000] MODELS

              *** CALL VTGTPA( 54964,406859,     0, 87198) ***

               BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
              6204 J411 G1 .700            6204 J411 G1 .700    1

                  I C O N S     C O N S       S T A T E  V A R
                 54964-54969  406859-406862        0     87198

                    VLO       VUP      PICKUP     TB
                    0.200     5.000     1.000     0.080

              *** CALL VTGTPA( 54970,406863,     0, 87199) ***

               BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
              6204 J411 G1 .700            6204 J411 G1 .700    1

                  I C O N S     C O N S       S T A T E  V A R
                 54970-54975  406863-406866        0     87199

                    VLO       VUP      PICKUP     TB
                    0.400     5.000     1.700     0.080

              *** CALL VTGTPA( 54976,406867,     0, 87200) ***

               BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
              6204 J411 G1 .700            6204 J411 G1 .700    1

                  I C O N S     C O N S       S T A T E  V A R
                 54976-54981  406867-406870        0     87200

                    VLO       VUP      PICKUP     TB
                    0.600     5.000     2.200     0.080

              *** CALL VTGTPA( 54982,406871,     0, 87201) ***

               BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
              6204 J411 G1 .700            6204 J411 G1 .700    1

                  I C O N S     C O N S       S T A T E  V A R
                 54982-54987  406871-406874        0     87201

                    VLO       VUP      PICKUP     TB
                    0.750     5.000     3.000     0.080

              *** CALL VTGTPA( 54988,406875,     0, 87202) ***

               BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
              6204 J411 G1 .700            6204 J411 G1 .700    1

                  I C O N S     C O N S       S T A T E  V A R
                 54988-54993  406875-406878        0     87202

                    VLO       VUP      PICKUP     TB
                    0.850     5.000    10.000     0.080

              *** CALL VTGTPA( 54994,406879,     0, 87203) ***

               BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
              6204 J411 G1 .700            6204 J411 G1 .700    1

                  I C O N S     C O N S       S T A T E  V A R
                 54994-54999  406879-406882        0     87203

                    VLO       VUP      PICKUP     TB
                    0.900     5.000   600.000     0.080

              *** CALL VTGTPA( 55000,406883,     0, 87204) ***

               BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
              6204 J411 G1 .700            6204 J411 G1 .700    1

                  I C O N S     C O N S       S T A T E  V A R
                 55000-55005  406883-406886        0     87204
```

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      VLO       VUP      PICKUP     TB
      0.000     1.101     1.000     0.080


*** CALL VTGTPA( 55006,406887,     0, 87205) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6204 J411 G1 .700           6204 J411 G1 .700    1

    I C O N S     C O N S       S T A T E  V A R
   55006-55011  406887-406890        0    87205

      VLO       VUP      PICKUP     TB
      0.000     1.150     0.500     0.080


*** CALL VTGTPA( 55012,406891,     0, 87206) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6204 J411 G1 .700           6204 J411 G1 .700    1

    I C O N S     C O N S       S T A T E  V A R
   55012-55017  406891-406894        0    87206

      VLO       VUP      PICKUP     TB
      0.000     1.175     0.200     0.080


*** CALL VTGTPA( 55018,406895,     0, 87207) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6204 J411 G1 .700           6204 J411 G1 .700    1

    I C O N S     C O N S       S T A T E  V A R
   55018-55023  406895-406898        0    87207

      VLO       VUP      PICKUP     TB
      0.000     1.200     0.100     0.080


*** CALL VTGTPA( 55024,406899,     0, 87208) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6204 J411 G1 .700           6204 J411 G1 .700    1

    I C O N S     C O N S       S T A T E  V A R
   55024-55029  406899-406902        0    87208

      VLO       VUP      PICKUP     TB
      0.000     1.300     0.010     0.080
--------------------------------------------------------------------------------

CONET MODELS

 REPORT FOR ALL MODELS                       BUS 6205 [J411 G2     0.7000] MODELS


*** CALL VTGTPA( 55030,406903,     0, 87209) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6205 J411 G2 .700           6205 J411 G2 .700    1

    I C O N S     C O N S       S T A T E  V A R
   55030-55035  406903-406906        0    87209

      VLO       VUP      PICKUP     TB
      0.200     5.000     1.000     0.080


*** CALL VTGTPA( 55036,406907,     0, 87210) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6205 J411 G2 .700           6205 J411 G2 .700    1

    I C O N S     C O N S       S T A T E  V A R
   55036-55041  406907-406910        0    87210

      VLO       VUP      PICKUP     TB
      0.400     5.000     1.700     0.080


*** CALL VTGTPA( 55042,406911,     0, 87211) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6205 J411 G2 .700           6205 J411 G2 .700    1
```

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   I C O N S     C O N S       S T A T E  V A R
  55042-55047  406911-406914        0     87211

     VLO       VUP      PICKUP     TB
     0.600     5.000     2.200     0.080

*** CALL VTGTPA( 55048,406915,     0, 87212) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6205 J411 G2 .700           6205 J411 G2 .700    1

   I C O N S     C O N S       S T A T E  V A R
  55048-55053  406915-406918        0     87212

     VLO       VUP      PICKUP     TB
     0.750     5.000     3.000     0.080

*** CALL VTGTPA( 55054,406919,     0, 87213) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6205 J411 G2 .700           6205 J411 G2 .700    1

   I C O N S     C O N S       S T A T E  V A R
  55054-55059  406919-406922        0     87213

     VLO       VUP      PICKUP     TB
     0.850     5.000    10.000     0.080

*** CALL VTGTPA( 55060,406923,     0, 87214) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6205 J411 G2 .700           6205 J411 G2 .700    1

   I C O N S     C O N S       S T A T E  V A R
  55060-55065  406923-406926        0     87214

     VLO       VUP      PICKUP     TB
     0.900     5.000   600.000     0.080

*** CALL VTGTPA( 55066,406927,     0, 87215) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6205 J411 G2 .700           6205 J411 G2 .700    1

   I C O N S     C O N S       S T A T E  V A R
  55066-55071  406927-406930        0     87215

     VLO       VUP      PICKUP     TB
     0.000     1.101     1.000     0.080

*** CALL VTGTPA( 55072,406931,     0, 87216) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6205 J411 G2 .700           6205 J411 G2 .700    1

   I C O N S     C O N S       S T A T E  V A R
  55072-55077  406931-406934        0     87216

     VLO       VUP      PICKUP     TB
     0.000     1.150     0.500     0.080

*** CALL VTGTPA( 55078,406935,     0, 87217) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6205 J411 G2 .700           6205 J411 G2 .700    1

   I C O N S     C O N S       S T A T E  V A R
  55078-55083  406935-406938        0     87217

     VLO       VUP      PICKUP     TB
     0.000     1.175     0.200     0.080

*** CALL VTGTPA( 55084,406939,     0, 87218) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6205 J411 G2 .700           6205 J411 G2 .700    1

   I C O N S     C O N S       S T A T E  V A R
  55084-55089  406939-406942        0     87218
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```
      VLO       VUP      PICKUP     TB
      0.000     1.200     0.100     0.080

*** CALL VTGTPA( 55090,406943,     0, 87219) ***

 BUS   NAME  BSKV        GENR BUS   NAME  BSKV   ID
6205 J411 G2 .700            6205 J411 G2 .700    1

    I C O N S      C O N S       S T A T E   V A R
   55090-55095  406943-406946         0     87219

      VLO       VUP      PICKUP     TB
      0.000     1.300     0.010     0.080
```

J416

```
PLANT MODELS

 REPORT FOR ALL MODELS                     BUS 32003 [J416 G1     0.6900] MODELS


      ** VWCOR8 ** at bus 32003 machine 1

      Uses CONs 408388-408432   ICON 55684-55685   STATEs 140641-140663   VARs 88157-88260

--------------------------------------------------------------------------------

PLANT MODELS

 REPORT FOR ALL MODELS                     BUS 32004 [J416 G2     0.7000] MODELS


      ** VWCOR8 ** at bus 32004 machine 1

      Uses CONs 408433-408477   ICON 55686-55687   STATEs 140664-140686   VARs 88261-88364

--------------------------------------------------------------------------------

CONEC MODELS

 REPORT FOR ALL MODELS                     BUS 32003 [J416 G1     0.6900] MODELS


      ** VWVAR8 ** at bus 32003 machine 1

      Uses ICONs 55688-55689   VARs 88365-88394


      ** VWLVR8 ** at bus 32003 machine 1

      Uses CONs 408478-408542   ICONs 55690-55692   STATEs 140687-140696   VARs 88395-88429


      ** VWPWR8 ** at bus 32003 machine 1

      Uses CONs 408543-408582   ICONs 55693-55695   STATEs 140697-140703   VARs 88430-88459


      ** VWMEC8 ** at bus 32003 machine 1

      Uses CONs 408583-408592   ICONs 55696-55697   STATEs 140704-140711


      ** VWMEA8 ** at bus 32003 machine 1

      Uses CONs 408593-408602   ICONs 55698-55699   STATEs 140712-140719   VARs 88460-88464

--------------------------------------------------------------------------------

CONEC MODELS

 REPORT FOR ALL MODELS                     BUS 32004 [J416 G2     0.7000] MODELS


      ** VWVAR8 ** at bus 32004 machine 1

      Uses ICONs 55700-55701   VARs 88465-88494


      ** VWLVR8 ** at bus 32004 machine 1

      Uses CONs 408603-408667   ICONs 55702-55704   STATEs 140720-140729   VARs 88495-88529


      ** VWPWR8 ** at bus 32004 machine 1

      Uses CONs 408668-408707   ICONs 55705-55707   STATEs 140730-140736   VARs 88530-88559


      ** VWMEC8 ** at bus 32004 machine 1

      Uses CONs 408708-408717   ICONs 55708-55709   STATEs 140737-140744


      ** VWMEA8 ** at bus 32004 machine 1

      Uses CONs 408718-408727   ICONs 55710-55711   STATEs 140745-140752   VARs 88560-88564

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CONET MODELS
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 REPORT FOR ALL MODELS                     BUS 32003 [J416 G1     0.6900] MODELS

      ** VWVPR8 **   Uses CONs 408728-408757   ICONs 55712-55718   VARs 88565-88582

      Vestas voltage relay monitoring bus 32003

      ** VWFPR8 **   Uses CONs 408758-408769   ICONs 55719-55721   VAR 88583-88589

      Vestas frequency relay monitoring bus 32003
--------------------------------------------------------------------------------
CONET MODELS
 REPORT FOR ALL MODELS                     BUS 32004 [J416 G2     0.7000] MODELS

      ** VWVPR8 **   Uses CONs 408770-408799   ICONs 55722-55728   VARs 88590-88607

      Vestas voltage relay monitoring bus 32004

      ** VWFPR8 **   Uses CONs 408800-408811   ICONs 55729-55731   VAR 88608-88614

      Vestas frequency relay monitoring bus 32004
```

J426

```
PLANT MODELS

 REPORT FOR ALL MODELS                      BUS 5675 [J426       0.6900] MODELS

      ** VWCOR8 ** at bus 5675 machine 1

      Uses CONs 407301-407345   ICON 55345-55346   STATEs 140366-140388   VARs 87554-87657
--------------------------------------------------------------------------------
CONEC MODELS

 REPORT FOR ALL MODELS                      BUS 5675 [J426       0.6900] MODELS

      ** VWVAR8 ** at bus 5675 machine 1

      Uses ICONs 55484-55485   VARs 87950-87979

      ** VWLVR8 ** at bus 5675 machine 1

      Uses CONs 408067-408131   ICONs 55486-55488   STATEs 140600-140609   VARs 87980-88014

      ** VWPWR8 ** at bus 5675 machine 1

      Uses CONs 408132-408171   ICONs 55489-55491   STATEs 140610-140616   VARs 88015-88044

      ** VWMEC8 ** at bus 5675 machine 1

      Uses CONs 408172-408181   ICONs 55492-55493   STATEs 140617-140624

      ** VWMEA8 ** at bus 5675 machine 1

      Uses CONs 408182-408191   ICONs 55494-55495   STATEs 140625-140632   VARs 88045-88049
--------------------------------------------------------------------------------
CONET MODELS

 REPORT FOR ALL MODELS                      BUS 5675 [J426       0.6900] MODELS

      ** VWVPR8 **   Uses CONs 408242-408271   ICONs 55518-55524   VARs 88106-88123

      Vestas voltage relay monitoring bus 5675

      ** VWFPR8 **   Uses CONs 408272-408283   ICONs 55525-55527   VAR 88124-88130

      Vestas frequency relay monitoring bus 5675
```

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B.3 Slider Diagrams

B.3.1 2018 Slider Diagrams

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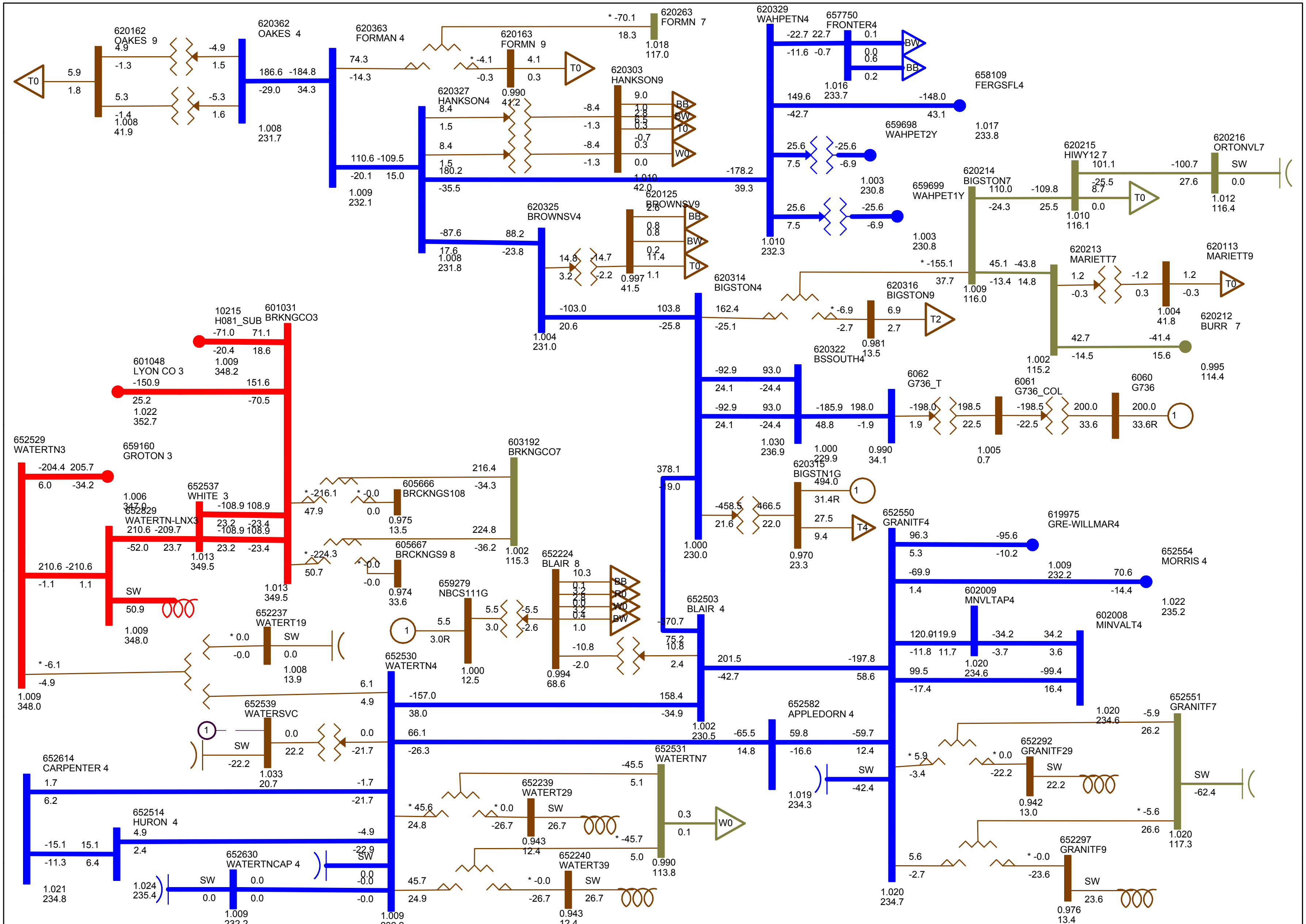

2018 SHOULDER CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:26

G736

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

PUBLIC DOCUMENT
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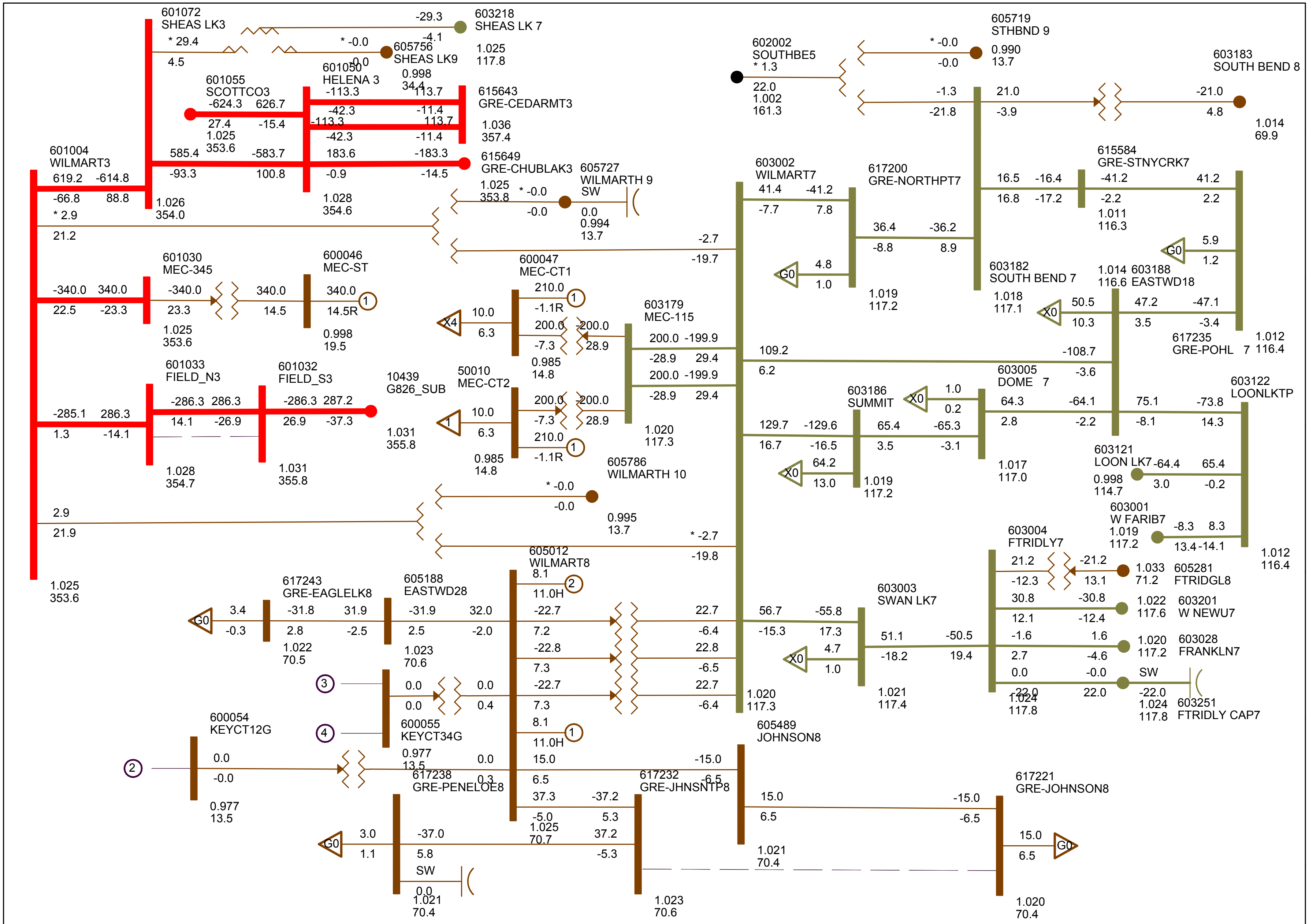

2018 SUMMER PEAK CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:38

J299

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

PUBLIC DOCUMENT
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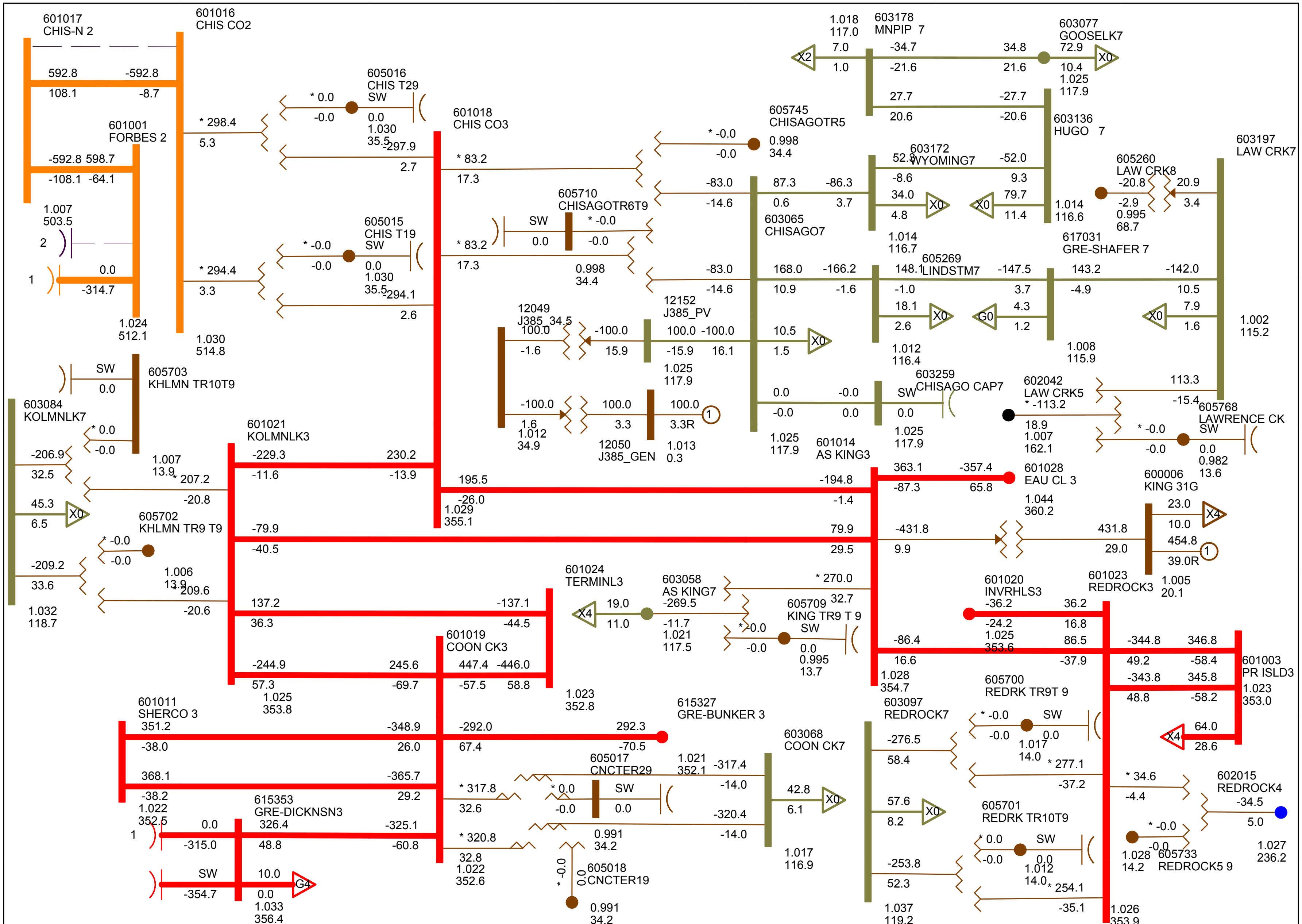

2018 SUMMER PEAK CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:37

J385

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

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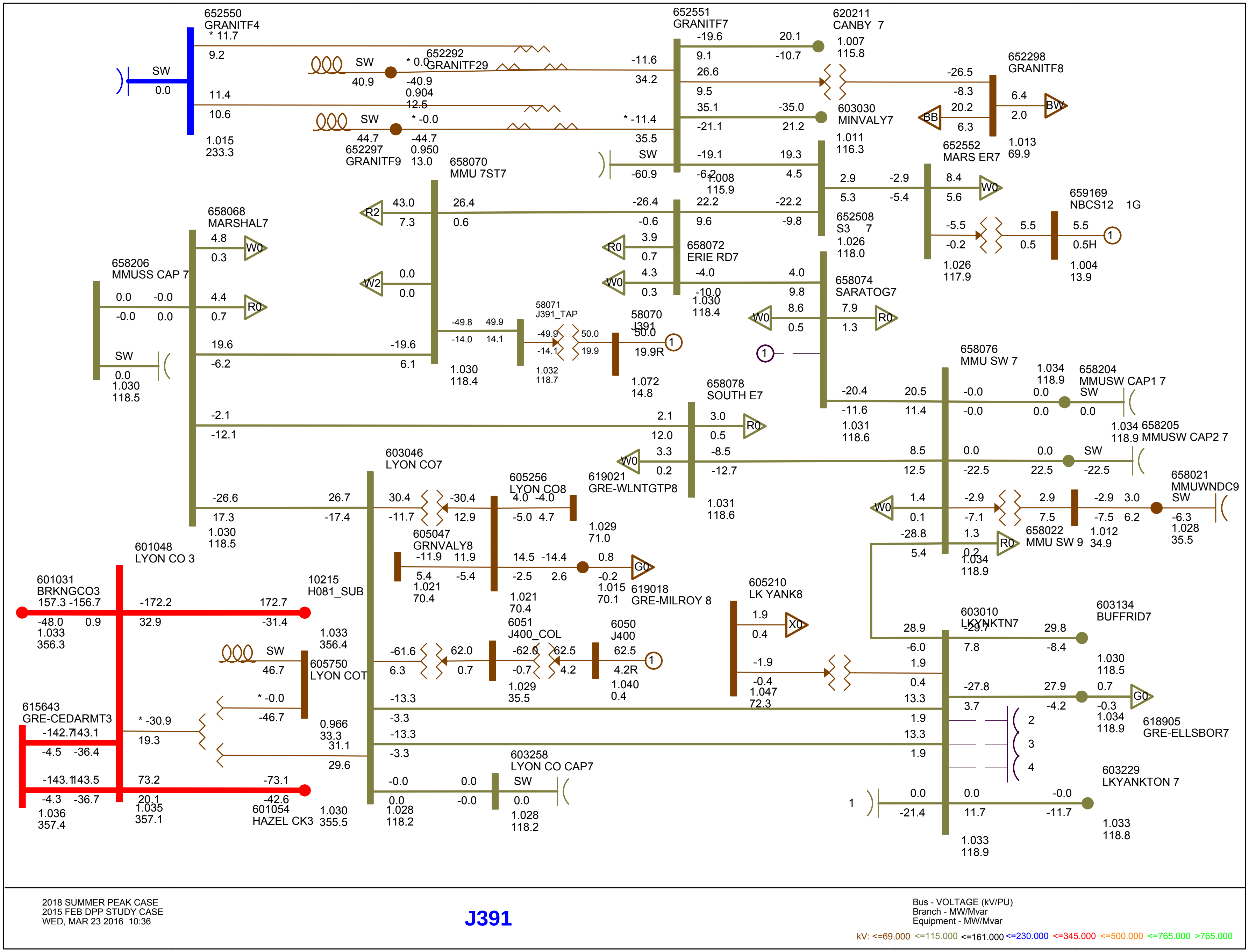

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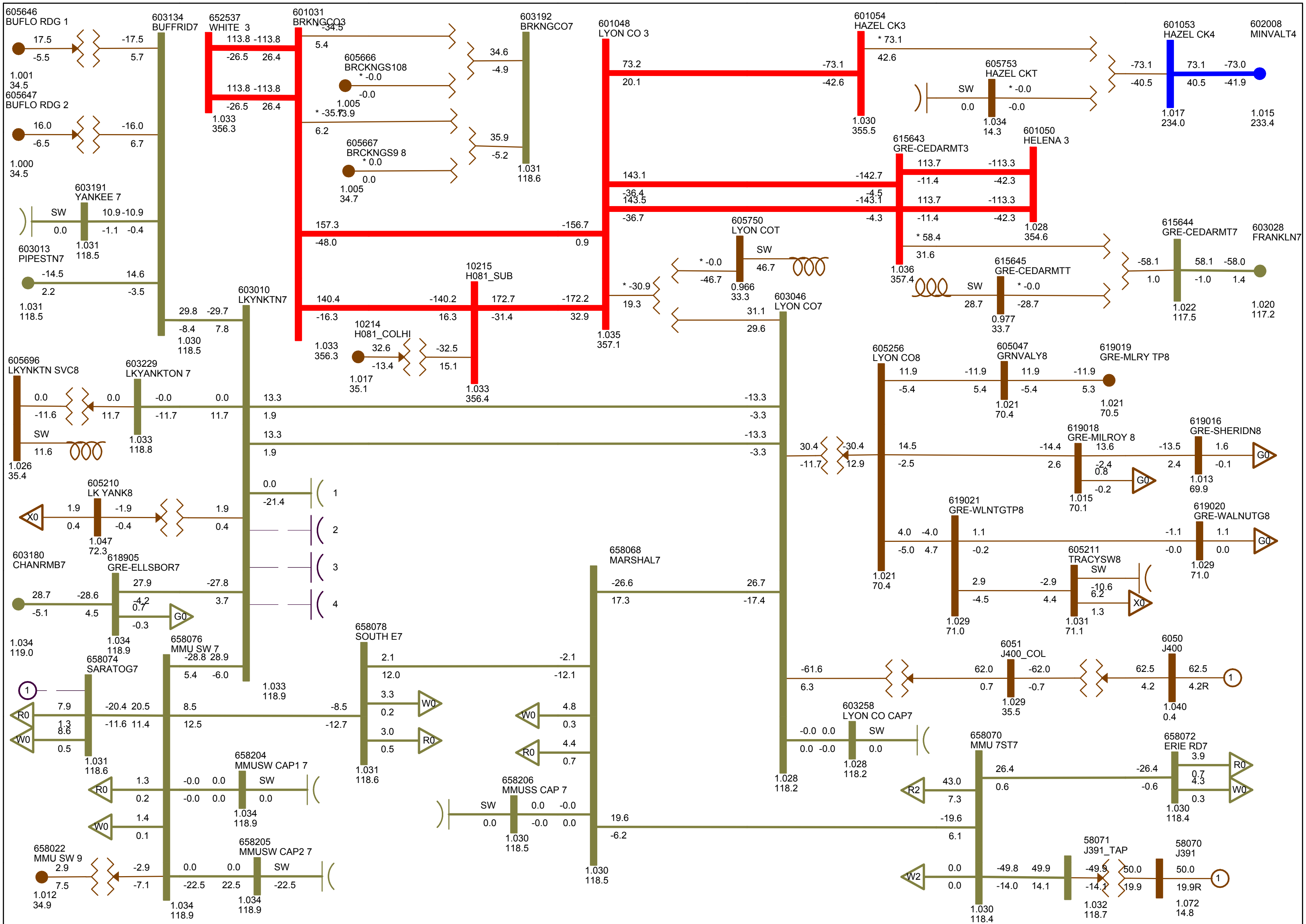

2018 SUMMER PEAK CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:33

J400

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

PUBLIC DOCUMENT
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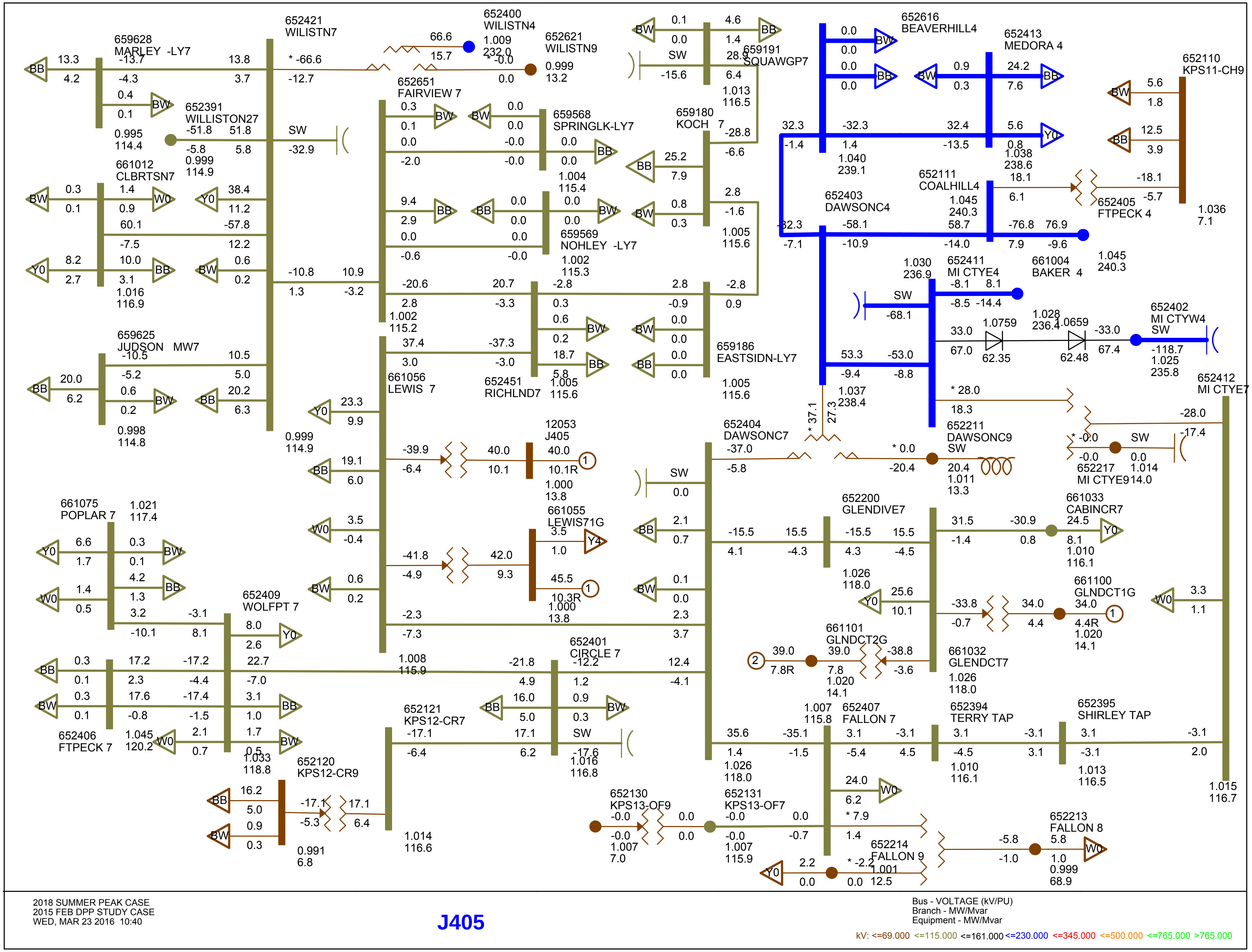

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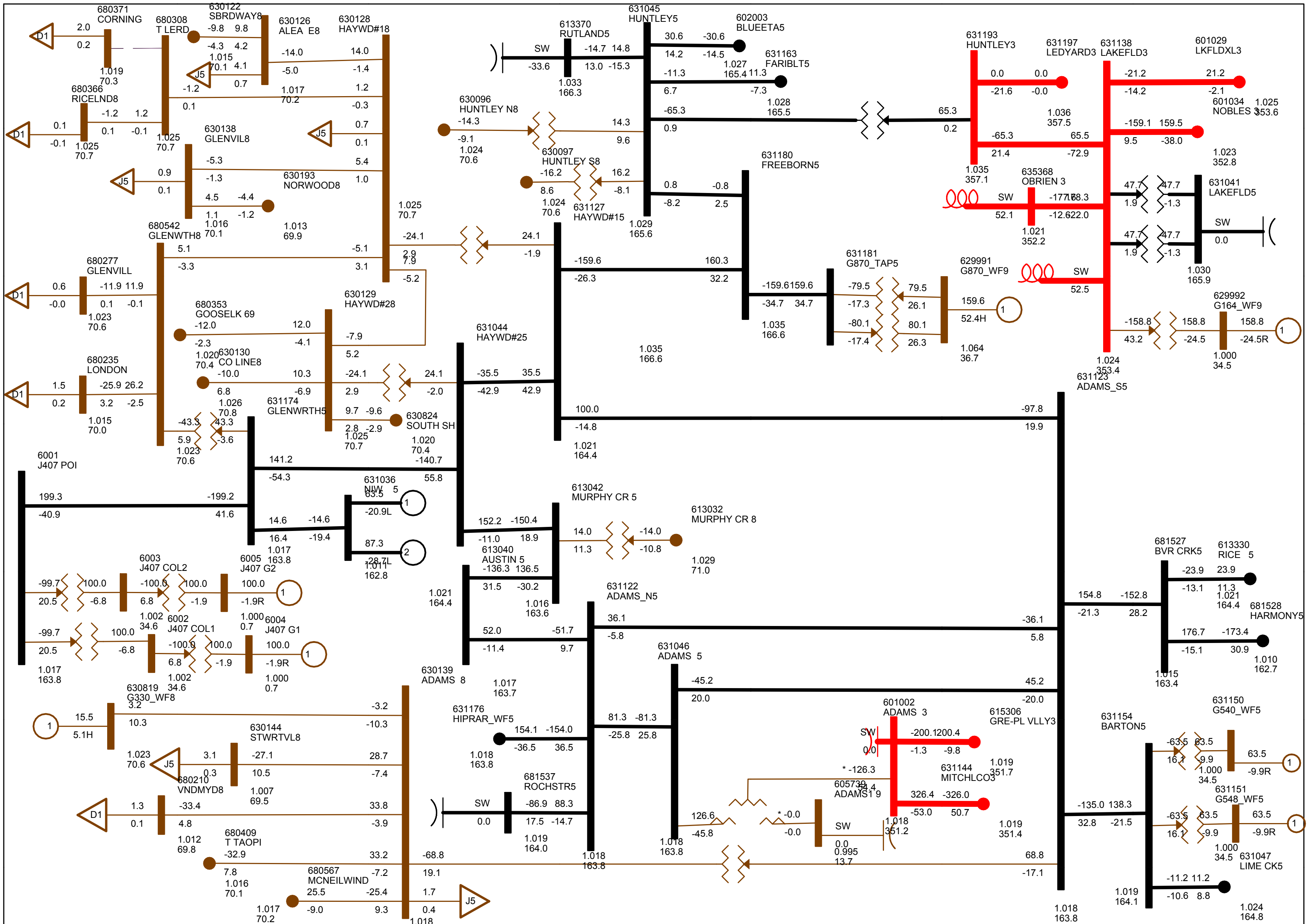

2018 SHOULDER CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:42

J407

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

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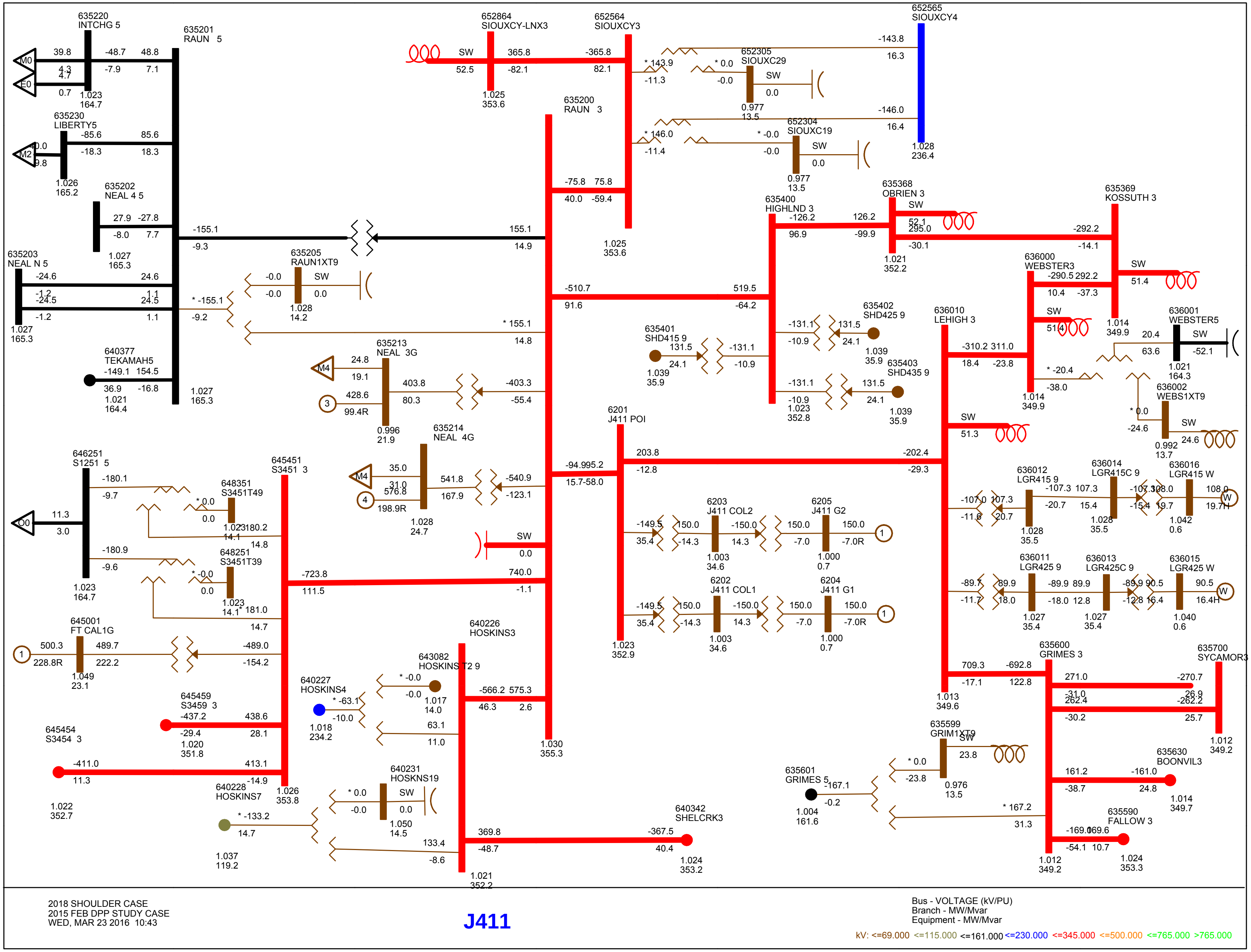

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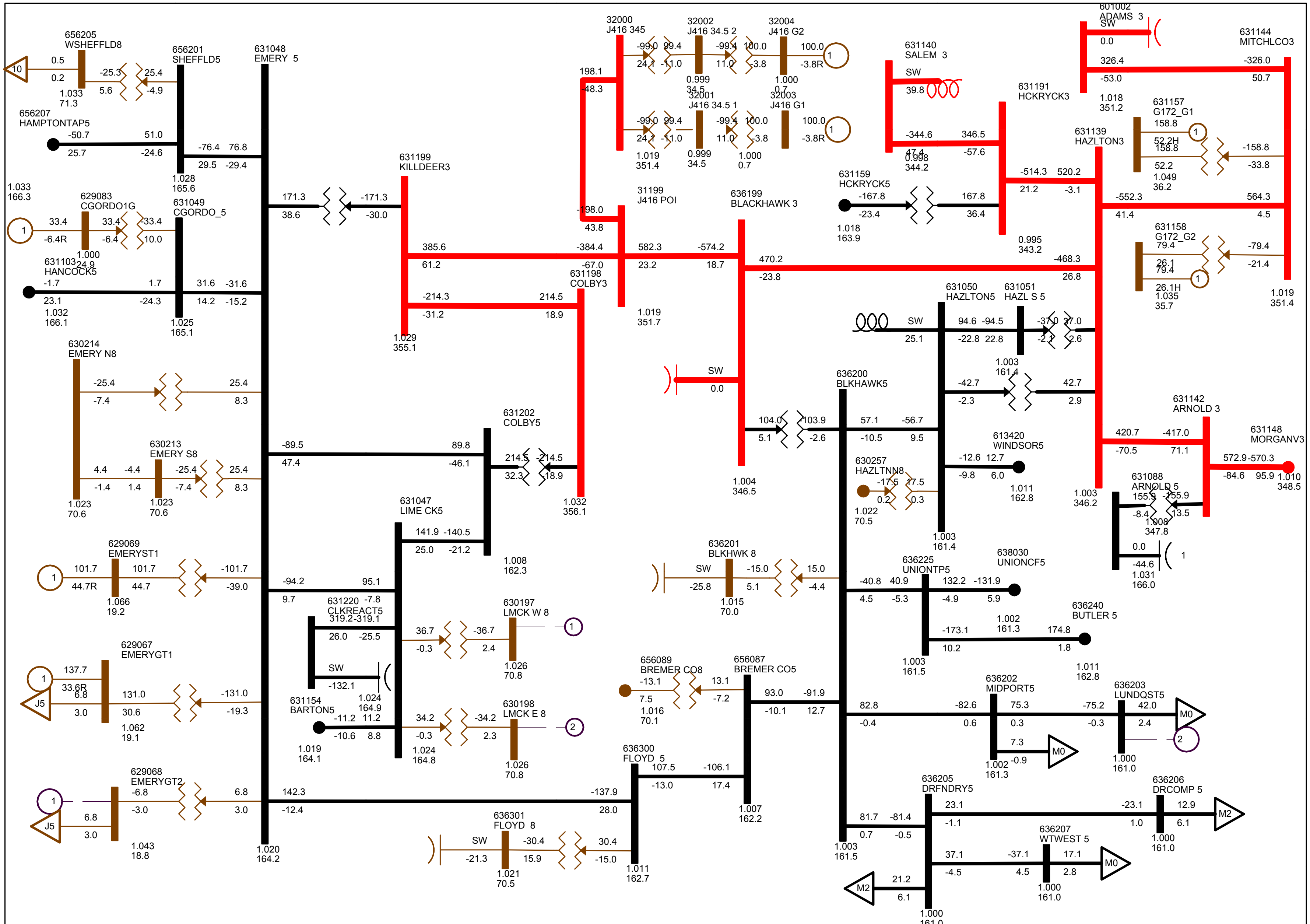

2018 SHOULDER CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:45

J416

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

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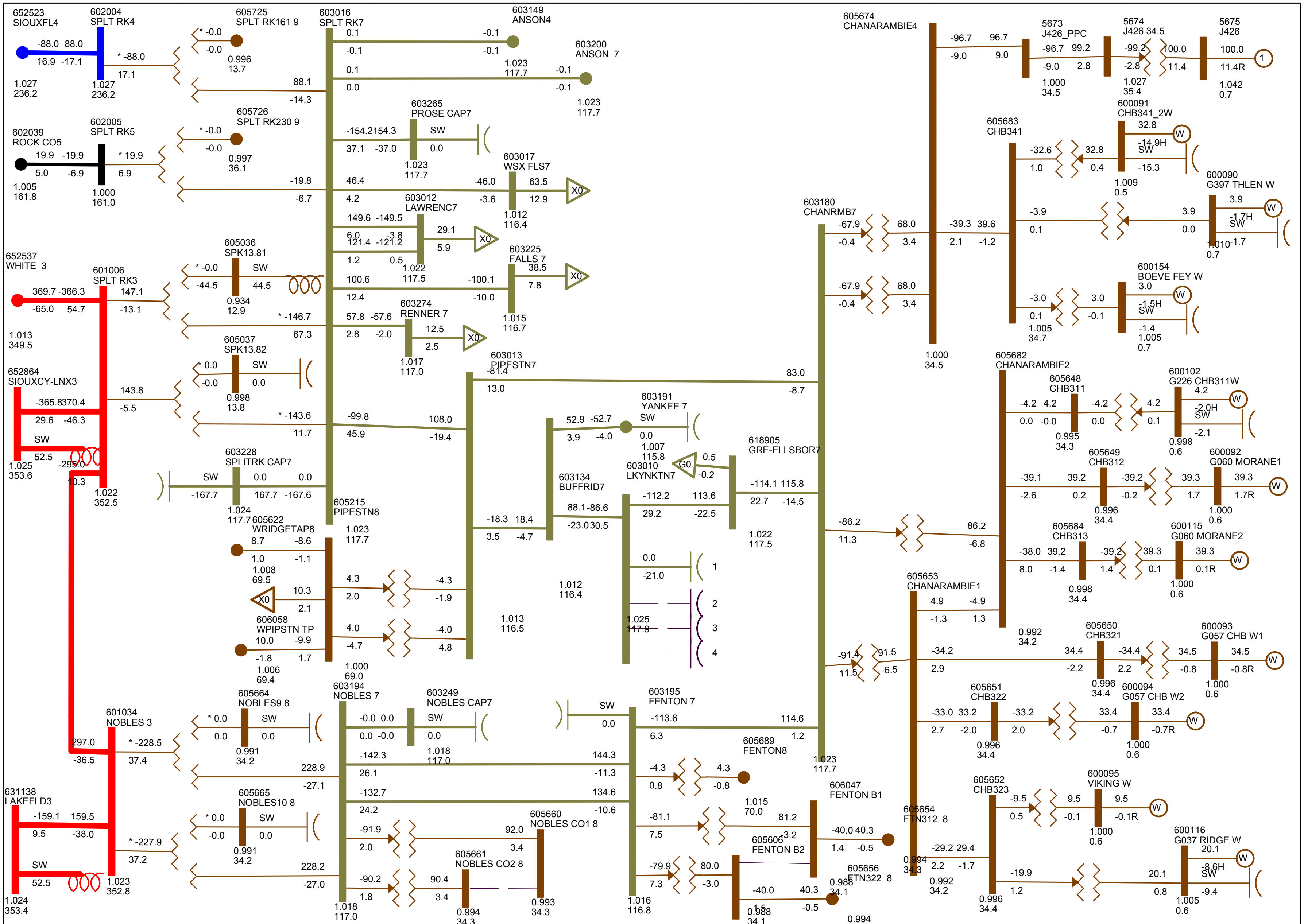

2018 SHOULDER CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:46

J426

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

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B.3.2 2025 Slider Diagrams

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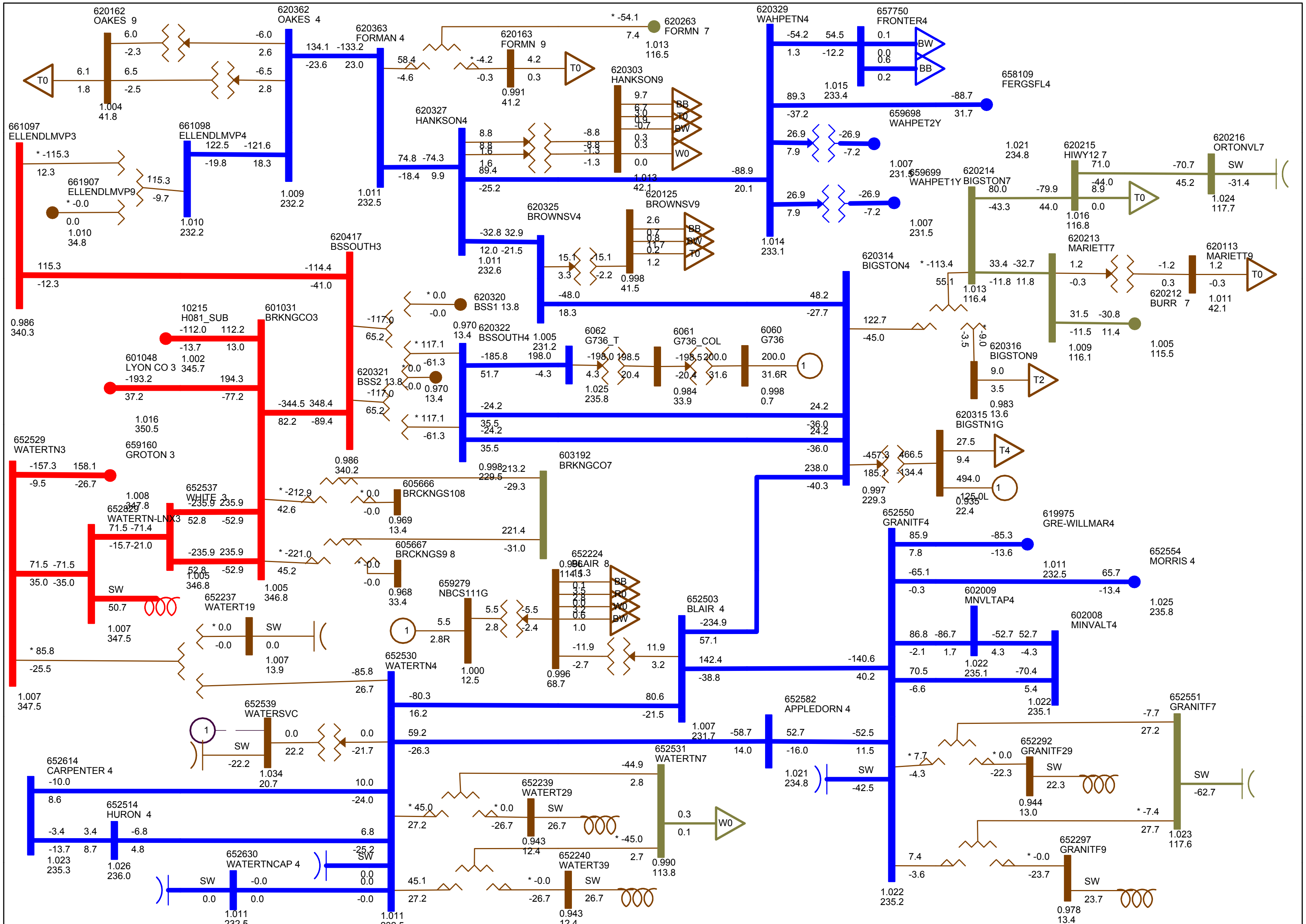

2025 SHOULDER CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:50

G736

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

PUBLIC DOCUMENT
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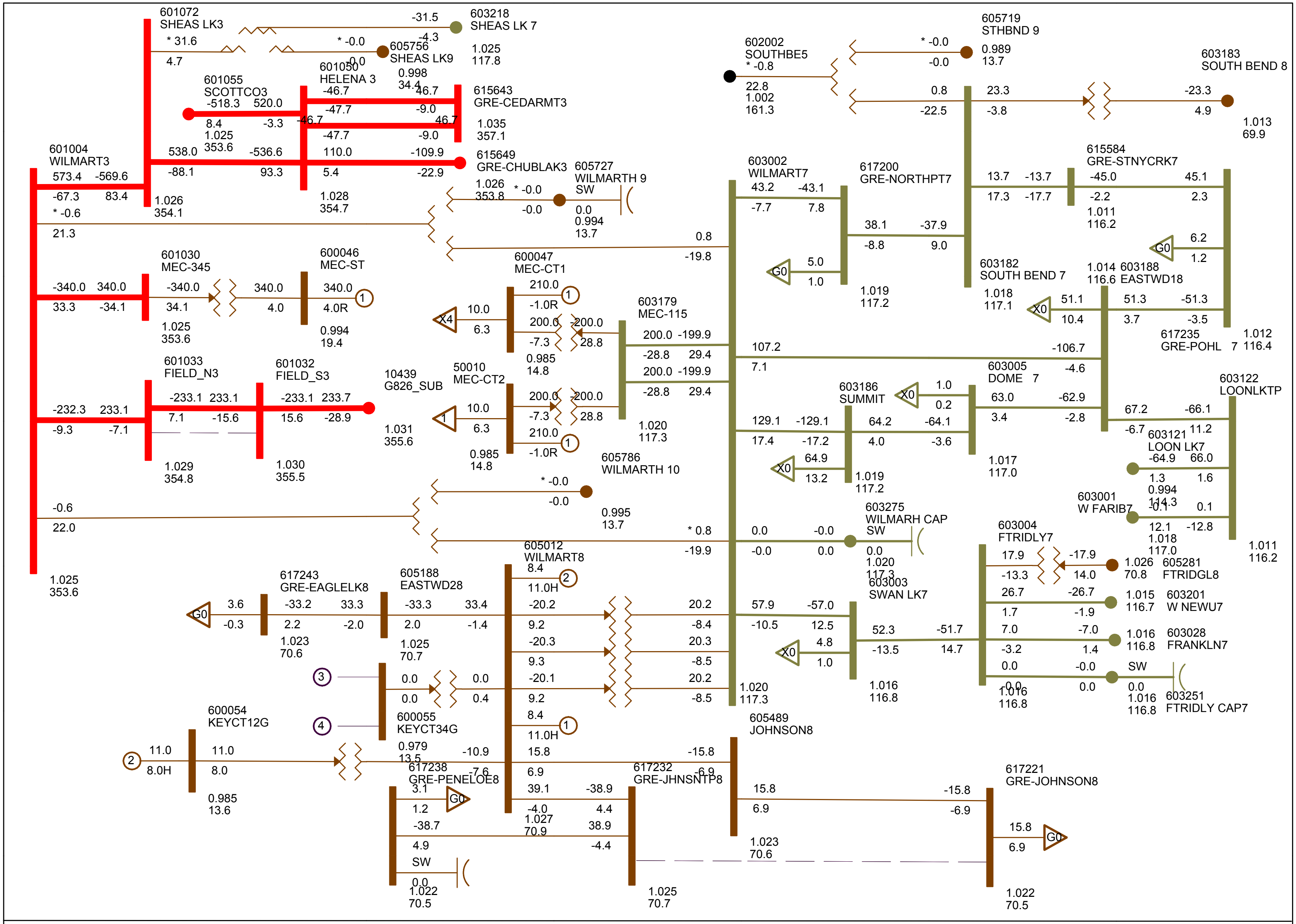

2025 SUMMER PEAK CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:52

J299

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

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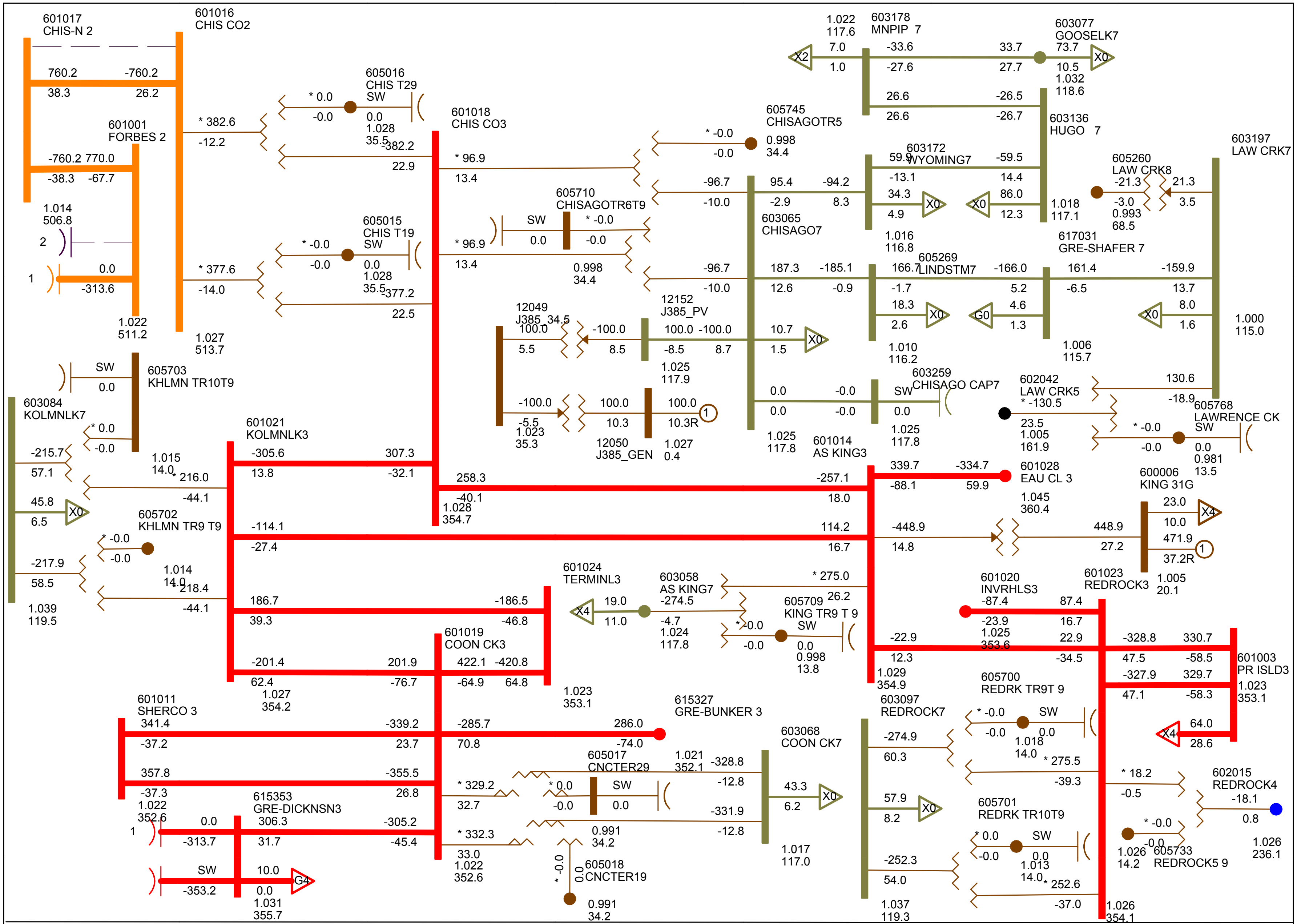

2025 SUMMER PEAK CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:53

J385

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

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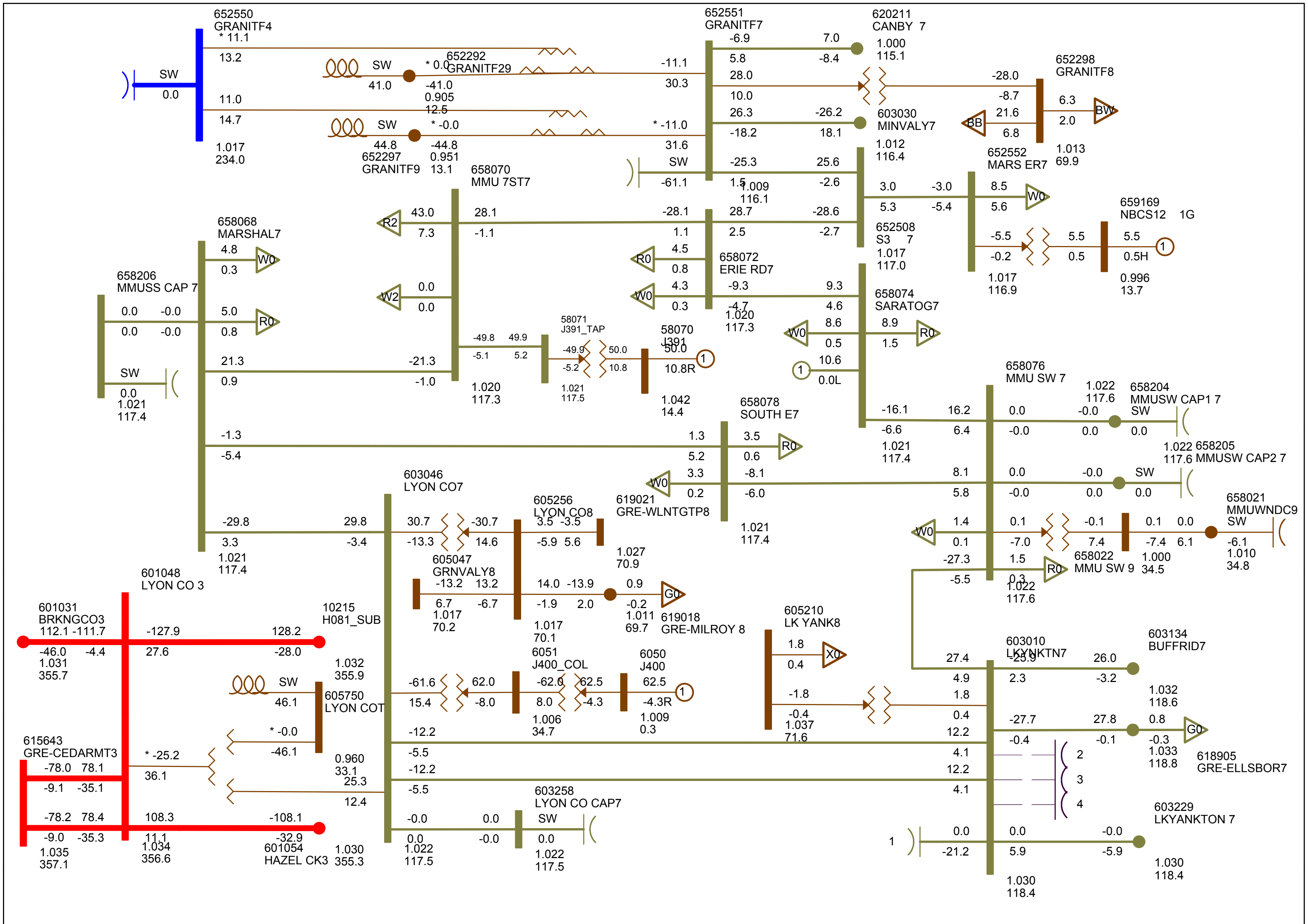

2025 SUMMER PEAK CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:54

J391

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

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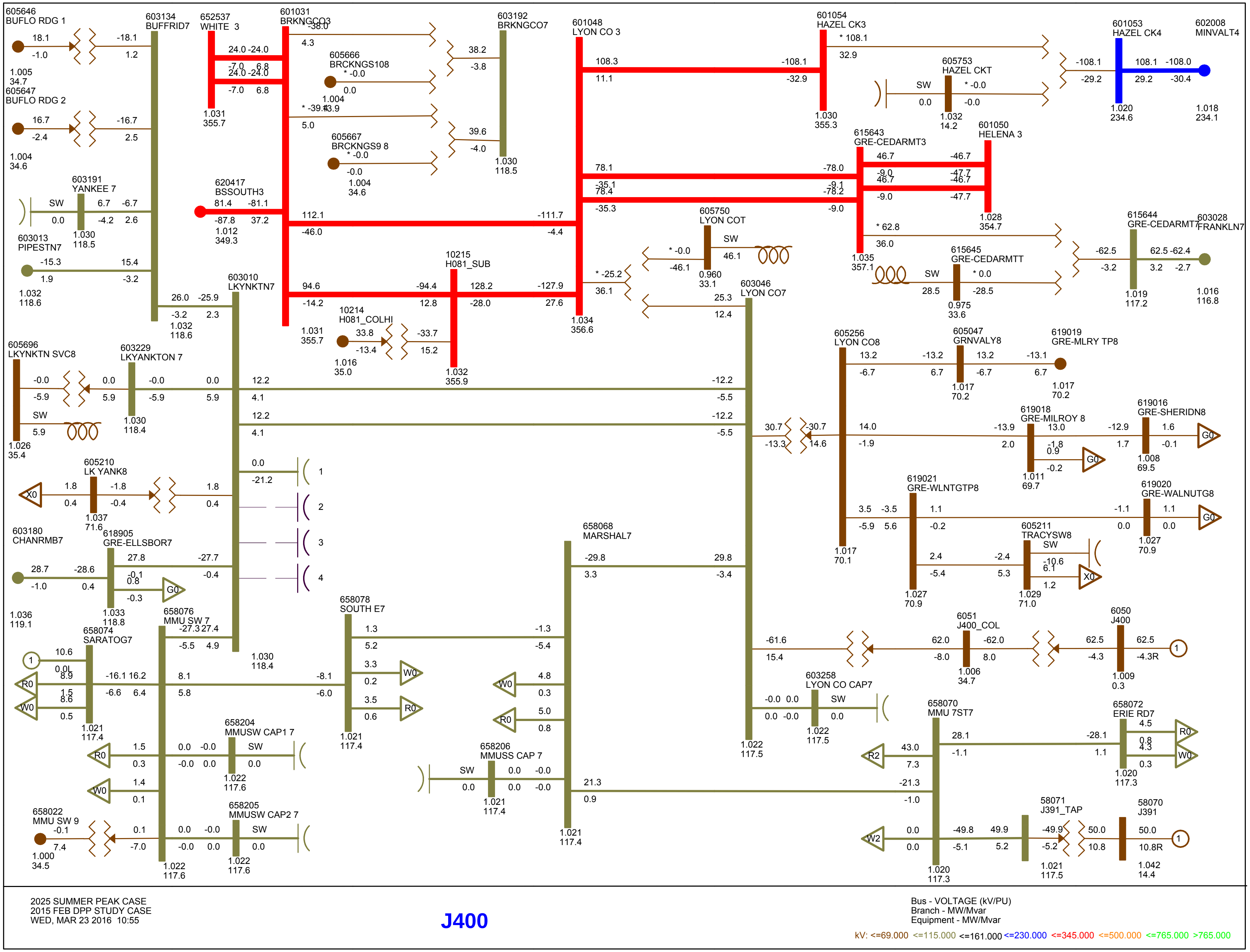

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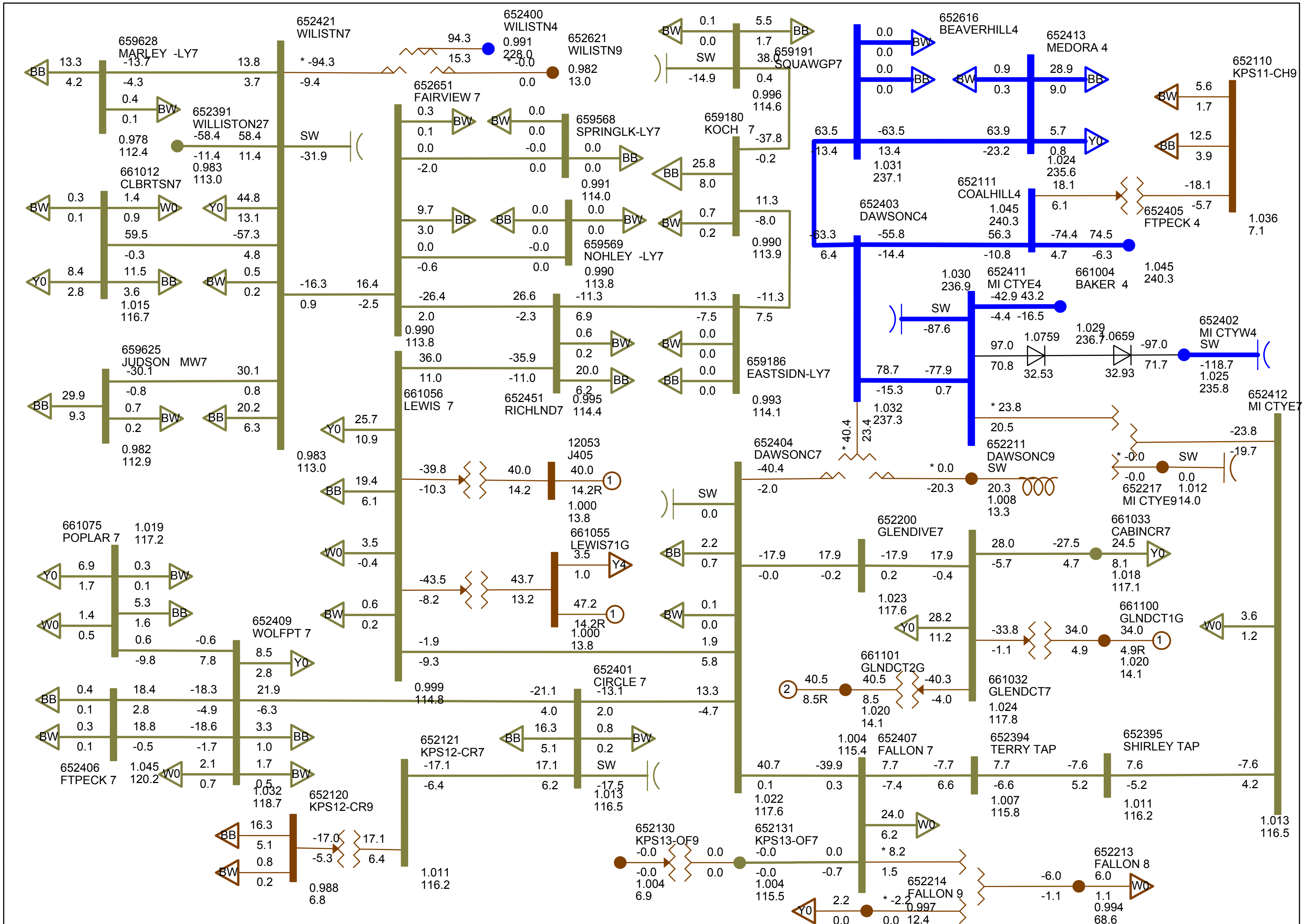

2025 SUMMER PEAK CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:58

J405

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

PUBLIC DOCUMENT
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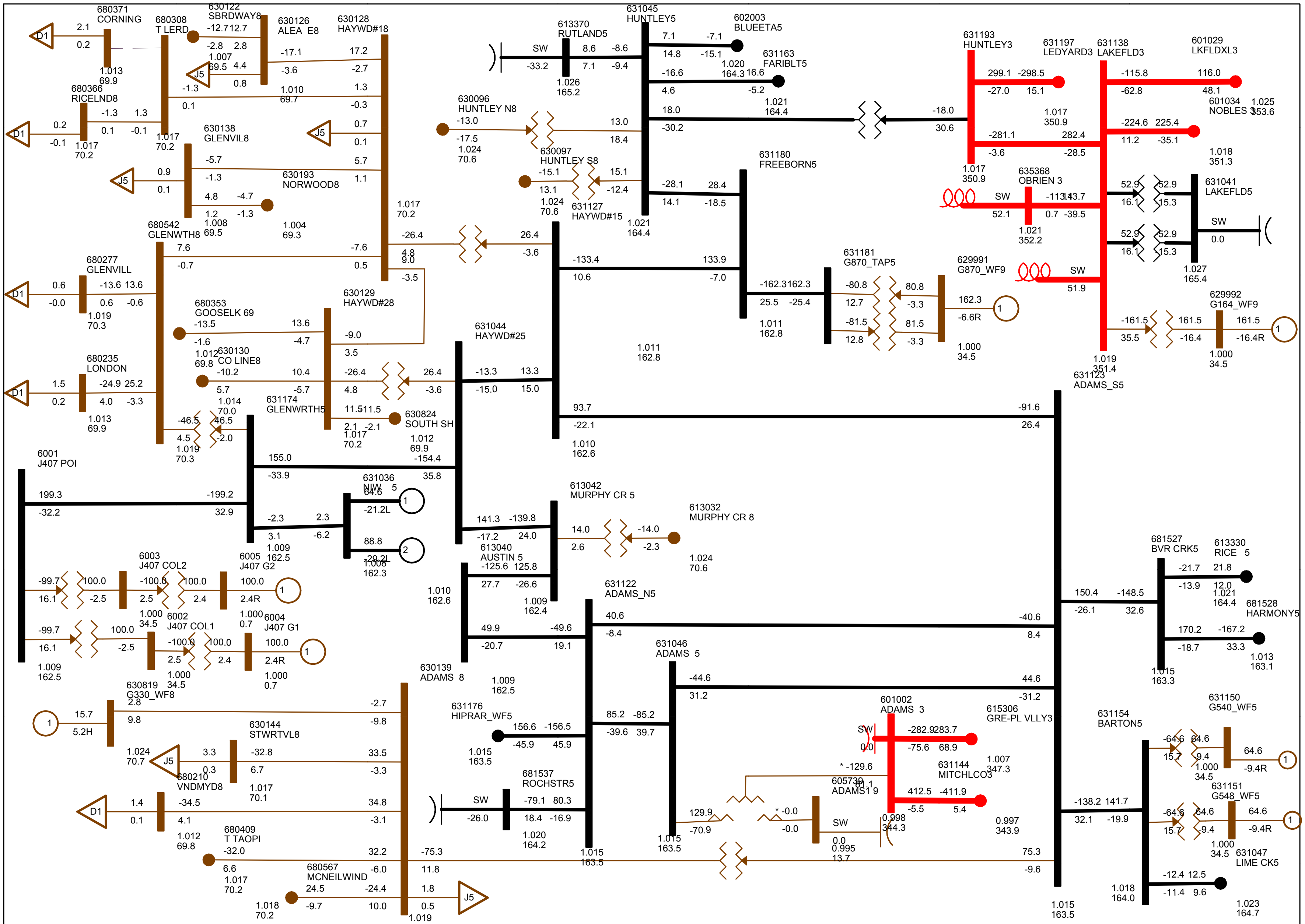

2025 SHOULDER CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 10:59

J407

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

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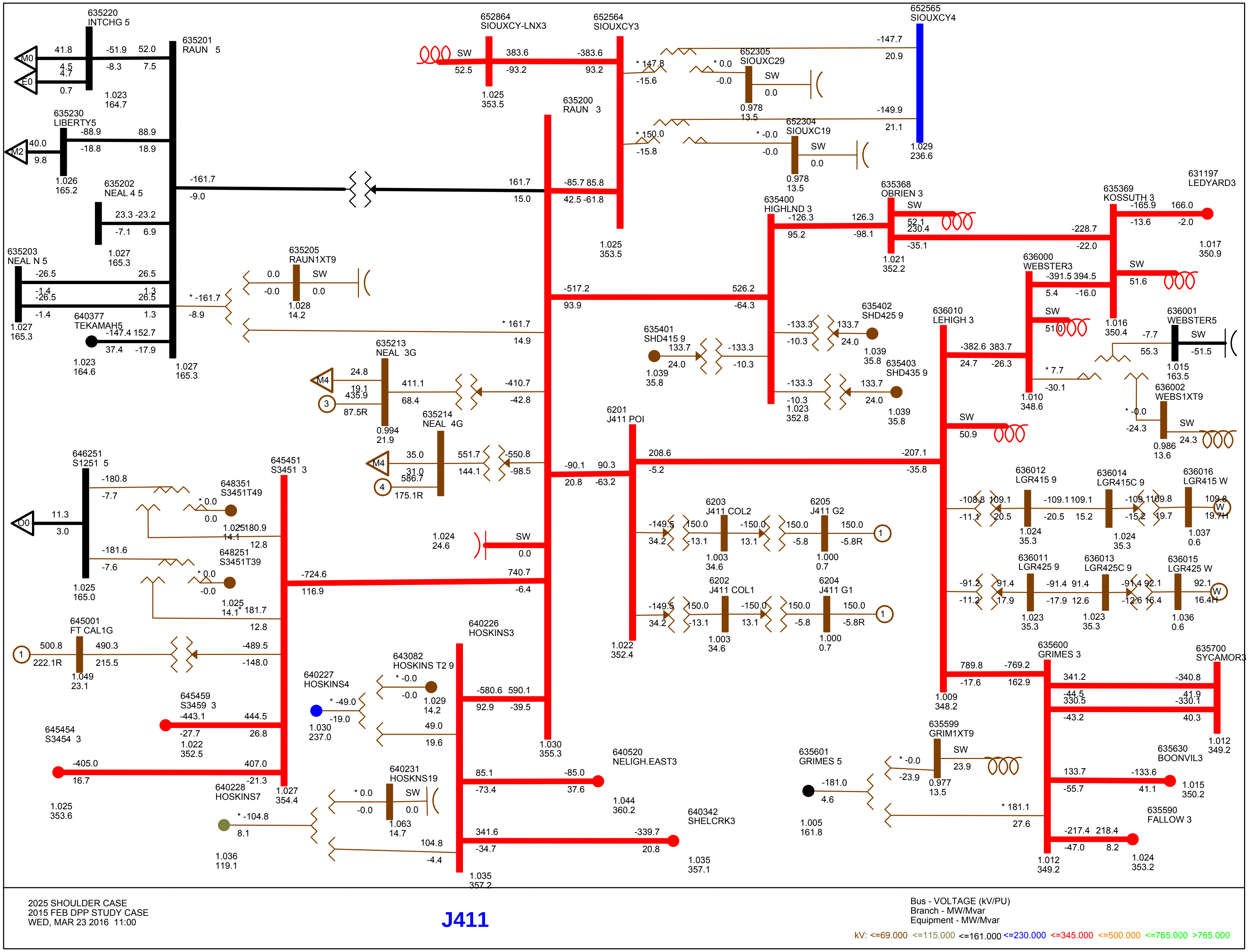

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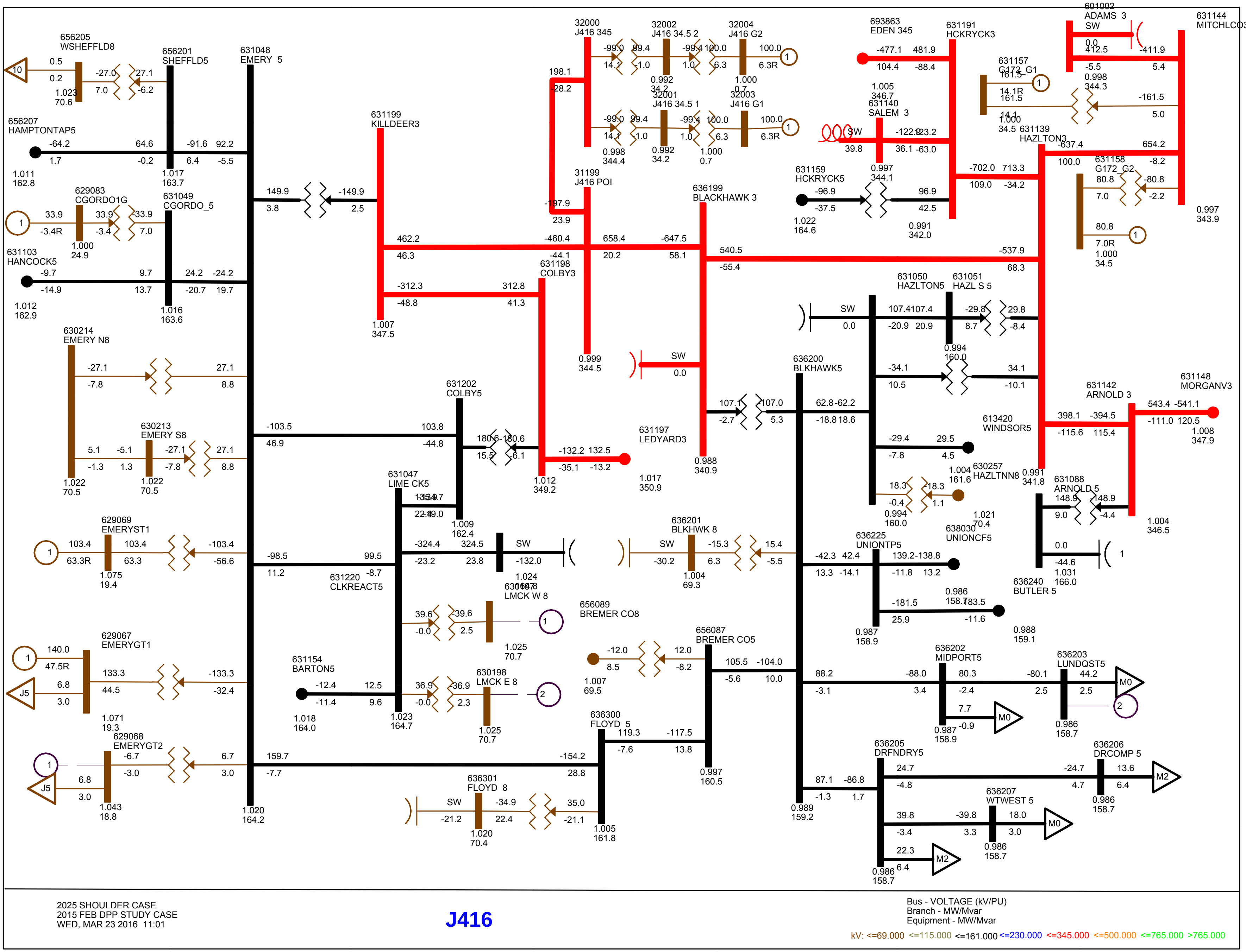

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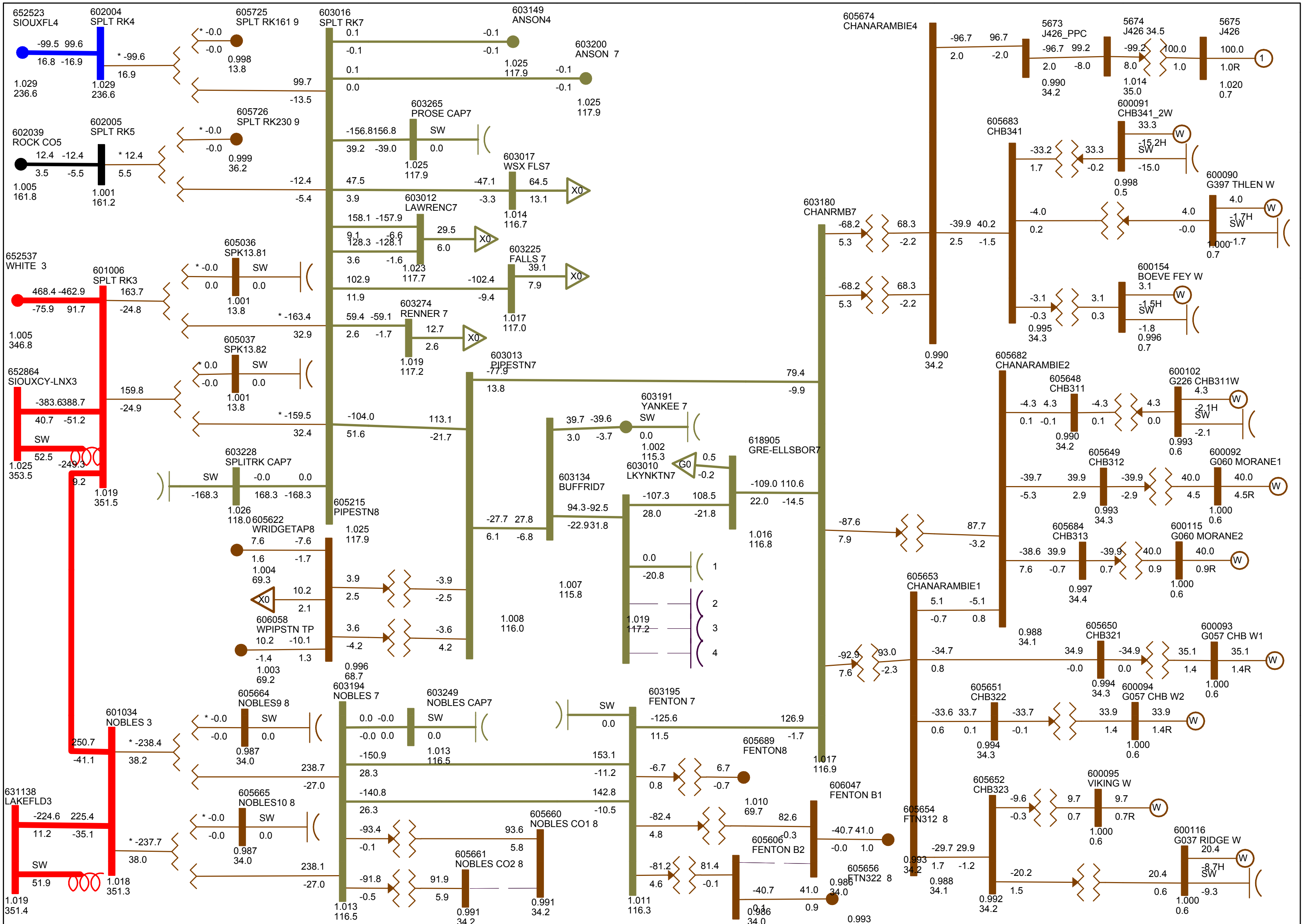

2025 SHOULDER CASE
2015 FEB DPP STUDY CASE
WED, MAR 23 2016 11:02

J426

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

kV: <=69.000 <=115.000 <=161.000 <=230.000 <=345.000 <=500.000 <=765.000 >765.000

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Appendix
C

Reactive Power Requirement Analysis Results

C.1 Reactive Power Requirement Results for 2018

2018 Shoulder Case - G736 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
6062	G736_T 230	620 OTP	0.97	1.05	0.9741	System Intact	voltage is within range
620214	BIGSTON7 115	620 OTP	0.97	1.07	1.0088	System Intact	voltage is within range
620314	BIGSTON4 230	620 OTP	0.97	1.05	1.0000	System Intact	voltage is within range
620315	BIGSTN1G 24	620 OTP	0.97	1.07	0.9786	System Intact	voltage is within range
620316	BIGSTON9 13.8	620 OTP	0.97	1.07	0.9807	System Intact	voltage is within range
620322	BSSOUTH4 230	620 OTP	0.97	1.05	0.9991	System Intact	voltage is within range
620325	BROWNSV4 230	620 OTP	0.97	1.05	1.0043	System Intact	voltage is within range
652503	BLAIR 4 230	652 WAPA	0.95	1.05	1.0025	System Intact	voltage is within range
6062	G736_T 230	620 OTP	0.92	1.10	0.9728	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620214	BIGSTON7 115	620 OTP	0.92	1.10	1.0088	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620314	BIGSTON4 230	620 OTP	0.92	1.10	1.0000	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620315	BIGSTN1G 24	620 OTP	0.92	1.10	0.9789	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620316	BIGSTON9 13.8	620 OTP	0.92	1.10	0.9807	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620322	BSSOUTH4 230	620 OTP	0.92	1.10	0.9981	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620325	BROWNSV4 230	620 OTP	0.92	1.10	1.0043	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
652503	BLAIR 4 230	652 WAPA	0.90	1.10	1.0025	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
6062	G736_T 230	620 OTP	0.92	1.10	0.9728	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620214	BIGSTON7 115	620 OTP	0.92	1.10	1.0088	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620314	BIGSTON4 230	620 OTP	0.92	1.10	1.0000	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620315	BIGSTN1G 24	620 OTP	0.92	1.10	0.9789	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620316	BIGSTON9 13.8	620 OTP	0.92	1.10	0.9807	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620322	BSSOUTH4 230	620 OTP	0.92	1.10	0.9981	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620325	BROWNSV4 230	620 OTP	0.92	1.10	1.0043	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range

2018 Shoulder Case - G736 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
652503	BLAIR 4 230	652 WAPA	0.90	1.10	1.0025	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range

2018 Summer Peak Case - J385 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
12049	J385_34.5 34.5	600 XEL	0.95	1.05	1.0067	System Intact	voltage is within range
12050	J385_GEN 0.342	600 XEL	0.95	1.05	1.0054	System Intact	voltage is within range
12152	J385_PV 115	600 XEL	0.95	1.05	1.0242	System Intact	voltage is within range
601014	AS KING3 345	600 XEL	0.95	1.05	1.0280	System Intact	voltage is within range
601016	CHIS CO2 500	600 XEL	0.95	1.05	1.0292	System Intact	voltage is within range
601018	CHIS CO3 345	600 XEL	0.95	1.05	1.0290	System Intact	voltage is within range
601021	KOLMNLK3 345	600 XEL	0.95	1.05	1.0253	System Intact	voltage is within range
603065	CHISAGO7 115	600 XEL	0.95	1.05	1.0242	System Intact	voltage is within range
603136	HUGO 7 115	600 XEL	0.95	1.05	1.0137	System Intact	voltage is within range
603172	WYOMING7 115	600 XEL	0.95	1.05	1.0139	System Intact	voltage is within range
603259	CHISAGO CAP7 115	600 XEL	0.95	1.05	1.0242	System Intact	voltage is within range
605015	CHIS T19 34.5	600 XEL	0.95	1.05	1.0293	System Intact	voltage is within range
605016	CHIS T29 34.5	600 XEL	0.95	1.05	1.0293	System Intact	voltage is within range
605269	LINDSTM7 115	600 XEL	0.95	1.05	1.0111	System Intact	voltage is within range
605710	CHISAGOTR6T9 34.5	600 XEL	0.95	1.05	0.9971	System Intact	voltage is within range
605745	CHISAGOTR5 34.5	600 XEL	0.95	1.05	0.9971	System Intact	voltage is within range
617031	GRE-SHAFER 7 115	600 XEL	0.95	1.05	1.0076	System Intact	voltage is within range
12049	J385_34.5 34.5	600 XEL	0.92	1.05	1.0070	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
12050	J385_GEN 0.342	600 XEL	0.92	1.05	1.0058	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
12152	J385_PV 115	600 XEL	0.92	1.05	1.0245	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
601014	AS KING3 345	600 XEL	0.92	1.05	1.0275	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
601016	CHIS CO2 500	600 XEL	0.92	1.05	1.0294	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
601018	CHIS CO3 345	600 XEL	0.92	1.05	1.0292	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
601021	KOLMNLK3 345	600 XEL	0.92	1.05	1.0245	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
603065	CHISAGO7 115	600 XEL	0.92	1.05	1.0246	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
603136	HUGO 7 115	600 XEL	0.92	1.05	1.0056	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
603172	WYOMING7 115	600 XEL	0.92	1.05	0.9986	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
603259	CHISAGO CAP7 115	600 XEL	0.92	1.05	1.0246	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
605015	CHIS T19 34.5	600 XEL	0.92	1.05	1.0294	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range

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2018 Summer Peak Case - J385 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
605016	CHIS T29 34.5	600 XEL	0.92	1.05	1.0294	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
605269	LINDSTM7 115	600 XEL	0.92	1.05	1.0107	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
605710	CHISAGOTR6T9 34.5	600 XEL	0.92	1.05	0.9973	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
605745	CHISAGOTR5 34.5	600 XEL	0.92	1.05	0.9973	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
617031	GRE-SHAFER 7 115	600 XEL	0.92	1.05	1.0070	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
12049	J385_34.5 34.5	600 XEL	0.92	1.05	1.0103	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
12050	J385_GEN 0.342	600 XEL	0.92	1.05	1.0091	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
12152	J385_PV 115	600 XEL	0.92	1.05	1.0276	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
601014	AS KING3 345	600 XEL	0.92	1.05	1.0274	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
601016	CHIS CO2 500	600 XEL	0.92	1.05	1.0308	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
601018	CHIS CO3 345	600 XEL	0.92	1.05	1.0306	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
601021	KOLMNLK3 345	600 XEL	0.92	1.05	1.0251	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
603065	CHISAGO7 115	600 XEL	0.92	1.05	1.0277	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
603136	HUGO 7 115	600 XEL	0.92	1.05	1.0138	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
603172	WYOMING7 115	600 XEL	0.92	1.05	1.0149	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
603259	CHISAGO CAP7 115	600 XEL	0.92	1.05	1.0277	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
605015	CHIS T19 34.5	600 XEL	0.92	1.05	1.0308	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range

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2018 Summer Peak Case - J385 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
605016	CHIS T29 34.5	600 XEL	0.92	1.05	1.0309	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
605269	LINDSTM7 115	600 XEL	0.92	1.05	0.9731	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
605710	CHISAGOTR6T9 34.5	600 XEL	0.92	1.05	1.0007	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
605745	CHISAGOTR5 34.5	600 XEL	0.92	1.05	1.0007	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
617031	GRE-SHAFER 7 115	600 XEL	0.92	1.05	0.9739	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
12049	J385_34.5 34.5	600 XEL	0.92	1.05	1.0026	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
12050	J385_GEN 0.342	600 XEL	0.92	1.05	1.0013	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
12152	J385_PV 115	600 XEL	0.92	1.05	1.0203	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
601014	AS KING3 345	600 XEL	0.92	1.05	1.0280	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
601016	CHIS CO2 500	600 XEL	0.92	1.05	1.0295	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
601018	CHIS CO3 345	600 XEL	0.92	1.05	1.0293	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
601021	KOLMNLK3 345	600 XEL	0.92	1.05	1.0252	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
603065	CHISAGO7 115	600 XEL	0.92	1.05	1.0203	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
603136	HUGO 7 115	600 XEL	0.92	1.05	1.0128	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
603172	WYOMING7 115	600 XEL	0.92	1.05	1.0119	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
603259	CHISAGO CAP7 115	600 XEL	0.92	1.05	1.0203	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
605015	CHIS T19 34.5	600 XEL	0.92	1.05	1.0295	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range

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2018 Summer Peak Case - J385 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
605016	CHIS T29 34.5	600 XEL	0.92	1.05	1.0296	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
605269	LINDSTM7 115	600 XEL	0.92	1.05	1.0084	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
605745	CHISAGOTR5 34.5	600 XEL	0.92	1.05	0.9925	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
617031	GRE-SHAFER 7 115	600 XEL	0.92	1.05	1.0053	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
12049	J385_34.5 34.5	600 XEL	0.92	1.05	1.0026	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
12050	J385_GEN 0.342	600 XEL	0.92	1.05	1.0013	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
12152	J385_PV 115	600 XEL	0.92	1.05	1.0203	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
601014	AS KING3 345	600 XEL	0.92	1.05	1.0280	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
601016	CHIS CO2 500	600 XEL	0.92	1.05	1.0295	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
601018	CHIS CO3 345	600 XEL	0.92	1.05	1.0293	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
601021	KOLMNLK3 345	600 XEL	0.92	1.05	1.0252	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
603065	CHISAGO7 115	600 XEL	0.92	1.05	1.0203	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
603136	HUGO 7 115	600 XEL	0.92	1.05	1.0128	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
603172	WYOMING7 115	600 XEL	0.92	1.05	1.0119	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
603259	CHISAGO CAP7 115	600 XEL	0.92	1.05	1.0203	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
605015	CHIS T19 34.5	600 XEL	0.92	1.05	1.0295	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
605016	CHIS T29 34.5	600 XEL	0.92	1.05	1.0296	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range

2018 Summer Peak Case - J385 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
605269	LINDSTM7 115	600 XEL	0.92	1.05	1.0084	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
605710	CHISAGOTR6T9 34.5	600 XEL	0.92	1.05	0.9925	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
617031	GRE-SHAFER 7 115	600 XEL	0.92	1.05	1.0053	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
12049	J385_34.5 34.5	600 XEL	0.92	1.05	1.0067	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
12050	J385_GEN 0.342	600 XEL	0.92	1.05	1.0054	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
12152	J385_PV 115	600 XEL	0.92	1.05	1.0242	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
601014	AS KING3 345	600 XEL	0.92	1.05	1.0280	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
601016	CHIS CO2 500	600 XEL	0.92	1.05	1.0292	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
601018	CHIS CO3 345	600 XEL	0.92	1.05	1.0290	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
601021	KOLMNLK3 345	600 XEL	0.92	1.05	1.0253	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
603065	CHISAGO7 115	600 XEL	0.92	1.05	1.0242	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
603136	HUGO 7 115	600 XEL	0.92	1.05	1.0137	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
603172	WYOMING7 115	600 XEL	0.92	1.05	1.0139	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
605015	CHIS T19 34.5	600 XEL	0.92	1.05	1.0293	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
605016	CHIS T29 34.5	600 XEL	0.92	1.05	1.0293	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
605269	LINDSTM7 115	600 XEL	0.92	1.05	1.0111	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
605710	CHISAGOTR6T9 34.5	600 XEL	0.92	1.05	0.9971	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range

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2018 Summer Peak Case - J385 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
605745	CHISAGOTR5 34.5	600 XEL	0.92	1.05	0.9971	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
617031	GRE-SHAFER 7 115	600 XEL	0.92	1.05	1.0076	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range

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2018 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
6050	J400 0.342	600 XEL	0.95	1.05	1.0272	System Intact	voltage is within range
6051	J400_COL 34.5	600 XEL	0.95	1.05	1.0207	System Intact	voltage is within range
10215	H081_SUB 345	600 XEL	0.95	1.05	1.0328	System Intact	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.95	1.05	1.0326	System Intact	voltage is within range
601048	LYON CO 3 345	600 XEL	0.95	1.05	1.0349	System Intact	voltage is within range
601054	HAZEL CK3 345	600 XEL	0.95	1.05	1.0302	System Intact	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.95	1.05	1.0333	System Intact	voltage is within range
603046	LYON CO7 115	600 XEL	0.95	1.05	1.0274	System Intact	voltage is within range
603134	BUFFRID7 115	600 XEL	0.95	1.05	1.0301	System Intact	voltage is within range
603229	LKYANKTON 7 115	600 XEL	0.95	1.05	1.0333	System Intact	voltage is within range
603258	LYON CO CAP7 115	600 XEL	0.95	1.05	1.0274	System Intact	voltage is within range
605047	GRNVALY8 69	600 XEL	0.95	1.05	1.0203	System Intact	voltage is within range
605210	LK YANK8 69	600 XEL	0.95	1.05	1.0471	System Intact	voltage is within range
605256	LYON CO8 69	600 XEL	0.95	1.05	1.0202	System Intact	voltage is within range
605750	LYON COT 34.5	600 XEL	0.95	1.05	0.9653	System Intact	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.95	1.05	1.0357	System Intact	voltage is within range
618905	GRE-ELLSBOR7 115	600 XEL	0.95	1.05	1.0340	System Intact	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.95	1.05	1.0149	System Intact	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.95	1.05	1.0290	System Intact	voltage is within range
658068	MARSHAL7 115	600 XEL	0.95	1.05	1.0299	System Intact	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.95	1.05	1.0300	System Intact	voltage is within range
658076	MMU SW 7 115	600 XEL	0.95	1.05	1.0338	System Intact	voltage is within range
658078	SOUTH E7 115	600 XEL	0.95	1.05	1.0312	System Intact	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.95	1.05	1.0299	System Intact	voltage is within range
6050	J400 0.342	600 XEL	0.92	1.05	1.0264	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
6051	J400_COL 34.5	600 XEL	0.92	1.05	1.0199	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
10215	H081_SUB 345	600 XEL	0.92	1.05	1.0326	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0325	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
601048	LYON CO 3 345	600 XEL	0.92	1.05	1.0346	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
601054	HAZEL CK3 345	600 XEL	0.92	1.05	1.0300	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.92	1.05	1.0340	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
603046	LYON CO7 115	600 XEL	0.92	1.05	1.0266	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
603134	BUFFRID7 115	600 XEL	0.92	1.05	1.0303	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range

2018 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
603229	LKYANKTON 7 115	600 XEL	0.92	1.05	1.0340	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
603258	LYON CO CAP7 115	600 XEL	0.92	1.05	1.0266	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
605047	GRNVALY8 69	600 XEL	0.92	1.05	1.0196	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
605210	LK YANK8 69	600 XEL	0.92	1.05	1.0478	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
605256	LYON CO8 69	600 XEL	0.92	1.05	1.0195	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
605750	LYON COT 34.5	600 XEL	0.92	1.05	0.9646	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.92	1.05	1.0356	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
618905	GRE-ELLSBOR7 115	600 XEL	0.92	1.05	1.0345	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.92	1.05	1.0143	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.92	1.05	1.0283	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
658068	MARSHAL7 115	600 XEL	0.92	1.05	1.0298	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.92	1.05	1.0300	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
658076	MMU SW 7 115	600 XEL	0.92	1.05	1.0339	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
658078	SOUTH E7 115	600 XEL	0.92	1.05	1.0312	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.92	1.05	1.0298	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
6050	J400 0.342	600 XEL	0.92	1.05	1.0264	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
6051	J400_COL 34.5	600 XEL	0.92	1.05	1.0199	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range

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2018 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
10215	H081_SUB 345	600 XEL	0.92	1.05	1.0326	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0325	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
601048	LYON CO 3 345	600 XEL	0.92	1.05	1.0346	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
601054	HAZEL CK3 345	600 XEL	0.92	1.05	1.0300	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.92	1.05	1.0340	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
603046	LYON CO7 115	600 XEL	0.92	1.05	1.0266	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
603134	BUFFRID7 115	600 XEL	0.92	1.05	1.0303	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
603229	LKYANKTON 7 115	600 XEL	0.92	1.05	1.0340	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
603258	LYON CO CAP7 115	600 XEL	0.92	1.05	1.0266	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
605047	GRNVALY8 69	600 XEL	0.92	1.05	1.0196	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
605210	LK YANK8 69	600 XEL	0.92	1.05	1.0478	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
605256	LYON CO8 69	600 XEL	0.92	1.05	1.0195	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
605750	LYON COT 34.5	600 XEL	0.92	1.05	0.9646	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.92	1.05	1.0356	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
618905	GRE-ELLSBOR7 115	600 XEL	0.92	1.05	1.0345	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.92	1.05	1.0143	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.92	1.05	1.0283	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range

2018 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
658068	MARSHAL7 115	600 XEL	0.92	1.05	1.0298	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.92	1.05	1.0300	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
658076	MMU SW 7 115	600 XEL	0.92	1.05	1.0339	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
658078	SOUTH E7 115	600 XEL	0.92	1.05	1.0312	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.92	1.05	1.0298	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
6050	J400 0.342	600 XEL	0.92	1.05	1.0259	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
6051	J400_COL 34.5	600 XEL	0.92	1.05	1.0194	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
10215	H081_SUB 345	600 XEL	0.92	1.05	1.0326	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0324	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
601048	LYON CO 3 345	600 XEL	0.92	1.05	1.0346	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
601054	HAZEL CK3 345	600 XEL	0.92	1.05	1.0299	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.92	1.05	1.0329	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
603046	LYON CO7 115	600 XEL	0.92	1.05	1.0261	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
603134	BUFFRID7 115	600 XEL	0.92	1.05	1.0300	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
603229	LKYANKTON 7 115	600 XEL	0.92	1.05	1.0329	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
603258	LYON CO CAP7 115	600 XEL	0.92	1.05	1.0261	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
605047	GRNVALY8 69	600 XEL	0.92	1.05	1.0139	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range

2018 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
605210	LK YANK8 69	600 XEL	0.92	1.05	1.0467	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
605256	LYON CO8 69	600 XEL	0.92	1.05	1.0139	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
605750	LYON COT 34.5	600 XEL	0.92	1.05	0.9640	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.92	1.05	1.0355	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
618905	GRE-ELLSBOR7 115	600 XEL	0.92	1.05	1.0338	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.92	1.05	1.0099	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.92	1.05	1.0185	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
658068	MARSHAL7 115	600 XEL	0.92	1.05	1.0296	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.92	1.05	1.0300	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
658076	MMU SW 7 115	600 XEL	0.92	1.05	1.0336	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
658078	SOUTH E7 115	600 XEL	0.92	1.05	1.0309	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.92	1.05	1.0296	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
6050	J400 0.342	600 XEL	0.92	1.05	1.0229	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
6051	J400_COL 34.5	600 XEL	0.92	1.05	1.0164	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
10215	H081_SUB 345	600 XEL	0.92	1.05	1.0320	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0320	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
601048	LYON CO 3 345	600 XEL	0.92	1.05	1.0337	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range

2018 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
601054	HAZEL CK3 345	600 XEL	0.92	1.05	1.0292	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.92	1.05	1.0320	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
603046	LYON CO7 115	600 XEL	0.92	1.05	1.0233	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
603134	BUFFRID7 115	600 XEL	0.92	1.05	1.0295	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
603229	LKYANKTON 7 115	600 XEL	0.92	1.05	1.0320	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
603258	LYON CO CAP7 115	600 XEL	0.92	1.05	1.0233	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
605047	GRNVALY8 69	600 XEL	0.92	1.05	1.0176	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
605210	LK YANK8 69	600 XEL	0.92	1.05	1.0458	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
605256	LYON CO8 69	600 XEL	0.92	1.05	1.0175	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
605750	LYON COT 34.5	600 XEL	0.92	1.05	0.9610	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.92	1.05	1.0350	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
618905	GRE-ELLSBOR7 115	600 XEL	0.92	1.05	1.0331	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.92	1.05	1.0125	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.92	1.05	1.0269	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
658068	MARSHAL7 115	600 XEL	0.92	1.05	1.0305	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.92	1.05	1.0300	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
658076	MMU SW 7 115	600 XEL	0.92	1.05	1.0340	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range

2018 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
658078	SOUTH E7 115	600 XEL	0.92	1.05	1.0317	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.92	1.05	1.0305	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
6050	J400 0.342	600 XEL	0.92	1.05	1.0349	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
6051	J400_COL 34.5	600 XEL	0.92	1.05	1.0285	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
10215	H081_SUB 345	600 XEL	0.92	1.05	1.0343	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0335	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
601048	LYON CO 3 345	600 XEL	0.92	1.05	1.0370	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
601054	HAZEL CK3 345	600 XEL	0.92	1.05	1.0320	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.92	1.05	1.0360	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
603046	LYON CO7 115	600 XEL	0.92	1.05	1.0349	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
603134	BUFFRID7 115	600 XEL	0.92	1.05	1.0314	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
603229	LKYANKTON 7 115	600 XEL	0.92	1.05	1.0359	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
603258	LYON CO CAP7 115	600 XEL	0.92	1.05	1.0349	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
605047	GRNVALY8 69	600 XEL	0.92	1.05	1.0273	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
605210	LK YANK8 69	600 XEL	0.92	1.05	1.0498	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
605256	LYON CO8 69	600 XEL	0.92	1.05	1.0272	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.92	1.05	1.0370	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range

2018 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
618905	GRE-ELLSBOR7 115	600 XEL	0.92	1.05	1.0357	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.92	1.05	1.0208	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.92	1.05	1.0354	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
658068	MARSHAL7 115	600 XEL	0.92	1.05	1.0314	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.92	1.05	1.0300	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
658076	MMU SW 7 115	600 XEL	0.92	1.05	1.0349	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
658078	SOUTH E7 115	600 XEL	0.92	1.05	1.0325	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.92	1.05	1.0314	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
6050	J400 0.342	600 XEL	0.92	1.05	1.0272	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
6051	J400_COL 34.5	600 XEL	0.92	1.05	1.0207	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
10215	H081_SUB 345	600 XEL	0.92	1.05	1.0328	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0326	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
601048	LYON CO 3 345	600 XEL	0.92	1.05	1.0349	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
601054	HAZEL CK3 345	600 XEL	0.92	1.05	1.0302	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.92	1.05	1.0333	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
603046	LYON CO7 115	600 XEL	0.92	1.05	1.0274	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
603134	BUFFRID7 115	600 XEL	0.92	1.05	1.0301	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range

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2018 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
603229	LKYANKTON 7 115	600 XEL	0.92	1.05	1.0333	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
605047	GRNVALY8 69	600 XEL	0.92	1.05	1.0203	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
605210	LK YANK8 69	600 XEL	0.92	1.05	1.0471	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
605256	LYON CO8 69	600 XEL	0.92	1.05	1.0202	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
605750	LYON COT 34.5	600 XEL	0.92	1.05	0.9653	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.92	1.05	1.0357	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
618905	GRE-ELLSBOR7 115	600 XEL	0.92	1.05	1.0340	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.92	1.05	1.0149	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.92	1.05	1.0290	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
658068	MARSHAL7 115	600 XEL	0.92	1.05	1.0299	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.92	1.05	1.0300	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
658076	MMU SW 7 115	600 XEL	0.92	1.05	1.0338	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
658078	SOUTH E7 115	600 XEL	0.92	1.05	1.0312	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.92	1.05	1.0299	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range

2018 Shoulder Case - J407 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
6001	J407 POI 161	627 ALTW	0.95	1.05	1.0185	System Intact	voltage is within range
6002	J407 COL1 34.5	627 ALTW	0.95	1.05	1.0063	System Intact	voltage is within range
6003	J407 COL2 34.5	627 ALTW	0.95	1.05	1.0063	System Intact	voltage is within range
6004	J407 G1 0.69	627 ALTW	0.95	1.05	1.0051	System Intact	voltage is within range
6005	J407 G2 0.7	627 ALTW	0.95	1.05	1.0051	System Intact	voltage is within range
613042	MURPHY CR 5 161	613 SMMPA	0.95	1.05	1.0169	System Intact	voltage is within range
630128	HAYWD#18 69	627 ALTW	0.95	1.05	1.0261	System Intact	voltage is within range
630129	HAYWD#28 69	627 ALTW	0.95	1.05	1.0261	System Intact	voltage is within range
631036	NIW 5 161	627 ALTW	0.95	1.05	1.0116	System Intact	voltage is within range
631044	HAYWD#25 161	627 ALTW	0.95	1.05	1.0221	System Intact	voltage is within range
631127	HAYWD#15 161	627 ALTW	0.95	1.05	1.0222	System Intact	voltage is within range
631174	GLENWRTH5 161	627 ALTW	0.95	1.05	1.0186	System Intact	voltage is within range
631202	COLBY5 161	627 ALTW	0.95	1.05	1.0084	System Intact	voltage is within range
680235	LONDON 69	680 DPC	0.95	1.05	1.0153	System Intact	voltage is within range
680277	GLENVILL 69	680 DPC	0.95	1.05	1.0237	System Intact	voltage is within range
680542	GLENWTH8 69	680 DPC	0.95	1.05	1.0239	System Intact	voltage is within range
6001	J407 POI 161	627 ALTW	0.93	1.10	1.0284	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
6002	J407 COL1 34.5	627 ALTW	0.93	1.10	1.0166	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
6003	J407 COL2 34.5	627 ALTW	0.93	1.10	1.0166	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
6004	J407 G1 0.69	627 ALTW	0.93	1.10	1.0154	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
6005	J407 G2 0.7	627 ALTW	0.93	1.10	1.0154	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
613042	MURPHY CR 5 161	613 SMMPA	0.90	1.10	1.0205	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
630128	HAYWD#18 69	627 ALTW	0.93	1.10	1.0328	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
630129	HAYWD#28 69	627 ALTW	0.93	1.10	1.0328	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
631036	NIW 5 161	627 ALTW	0.93	1.10	1.0033	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
631044	HAYWD#25 161	627 ALTW	0.93	1.10	1.0295	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
631127	HAYWD#15 161	627 ALTW	0.93	1.10	1.0296	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
631174	GLENWRTH5 161	627 ALTW	0.93	1.10	1.0284	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range

2018 Shoulder Case - J407 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
631202	COLBY5 161	627 ALTW	0.93	1.10	1.0054	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
680235	LONDON 69	680 DPC	0.90	1.10	1.0207	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
680277	GLENVILL 69	680 DPC	0.90	1.10	1.0311	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
680542	GLENWTH8 69	680 DPC	0.90	1.10	1.0314	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
6001	J407 POI 161	627 ALTW	0.93	1.10	0.9975	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
6002	J407 COL1 34.5	627 ALTW	0.93	1.10	0.9842	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
6003	J407 COL2 34.5	627 ALTW	0.93	1.10	0.9842	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
6004	J407 G1 0.69	627 ALTW	0.93	1.10	0.9830	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
6005	J407 G2 0.7	627 ALTW	0.93	1.10	0.9830	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
613042	MURPHY CR 5 161	613 SMMPA	0.90	1.10	1.0224	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
630128	HAYWD#18 69	627 ALTW	0.93	1.10	1.0241	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
630129	HAYWD#28 69	627 ALTW	0.93	1.10	1.0241	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
631036	NIW 5 161	627 ALTW	0.93	1.10	1.0000	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
631044	HAYWD#25 161	627 ALTW	0.93	1.10	1.0322	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
631127	HAYWD#15 161	627 ALTW	0.93	1.10	1.0323	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
631174	GLENWRTH5 161	627 ALTW	0.93	1.10	0.9975	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
631202	COLBY5 161	627 ALTW	0.93	1.10	1.0015	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range

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Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
680235	LONDON 69	680 DPC	0.90	1.10	1.0104	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
680277	GLENVILL 69	680 DPC	0.90	1.10	1.0177	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
680542	GLENWTH8 69	680 DPC	0.90	1.10	1.0179	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
6001	J407 POI 161	627 ALTW	0.93	1.10	1.0179	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
6002	J407 COL1 34.5	627 ALTW	0.93	1.10	1.0056	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
6003	J407 COL2 34.5	627 ALTW	0.93	1.10	1.0056	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
6004	J407 G1 0.69	627 ALTW	0.93	1.10	1.0044	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
6005	J407 G2 0.7	627 ALTW	0.93	1.10	1.0044	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
613042	MURPHY CR 5 161	613 SMMPA	0.90	1.10	1.0161	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
630128	HAYWD#18 69	627 ALTW	0.93	1.10	1.0245	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
630129	HAYWD#28 69	627 ALTW	0.93	1.10	1.0246	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
631036	NIW 5 161	627 ALTW	0.93	1.10	1.0112	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
631044	HAYWD#25 161	627 ALTW	0.93	1.10	1.0208	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
631127	HAYWD#15 161	627 ALTW	0.93	1.10	1.0209	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
631174	GLENWRTH5 161	627 ALTW	0.93	1.10	1.0179	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
631202	COLBY5 161	627 ALTW	0.93	1.10	1.0081	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
680235	LONDON 69	680 DPC	0.90	1.10	1.0108	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range

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2018 Shoulder Case - J407 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
680277	GLENVILL 69	680 DPC	0.90	1.10	1.0151	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
680542	GLENWTH8 69	680 DPC	0.90	1.10	1.0154	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range

2018 Shoulder Case - J411 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
6201	J411 POI 345.00	635 MEC	1.00	1.05	1.0257	System Intact	voltage is within range
6202	J411 COL1 34.500	635 MEC	1.00	1.05	1.0131	System Intact	voltage is within range
6203	J411 COL2 34.500	635 MEC	1.00	1.05	1.0131	System Intact	voltage is within range
6204	J411 G1 0.7000	635 MEC	1.00	1.05	1.0119	System Intact	voltage is within range
6205	J411 G2 0.7000	635 MEC	1.00	1.05	1.0119	System Intact	voltage is within range
635200	RAUN 3 345.00	635 MEC	1.00	1.05	1.0300	System Intact	voltage is within range
635201	RAUN 5 161.00	635 MEC	0.95	1.05	1.0268	System Intact	voltage is within range
635205	RAUN1XT9 13.800	635 MEC	1.00	1.05	1.0275	System Intact	voltage is within range
635213	NEAL 3G 22.000	635 MEC	1.00	1.05	0.9955	System Intact	Low Voltage Violation
635214	NEAL 4G 24.000	635 MEC	1.00	1.05	1.0265	System Intact	voltage is within range
635400	HIGHLND 3 345.00	635 MEC	1.00	1.05	1.0227	System Intact	voltage is within range
635600	GRIMES 3 345.00	635 MEC	0.96	1.05	1.0123	System Intact	voltage is within range
636000	WEBSTER3 345.00	635 MEC	0.96	1.05	1.0149	System Intact	voltage is within range
636010	LEHIGH 3 345.00	635 MEC	1.00	1.05	1.0142	System Intact	voltage is within range
636011	LGR425 9 34.500	635 MEC	1.00	1.05	1.0280	System Intact	voltage is within range
636012	LGR415 9 34.500	635 MEC	1.00	1.05	1.0294	System Intact	voltage is within range
640226	HOSKINS3 345.00	640 NPPD	0.95	1.05	1.0210	System Intact	voltage is within range
645451	S3451 3 345.00	645 OPPD	0.95	1.05	1.0255	System Intact	voltage is within range
652564	SIOUXCY3 345.00	652 WAPA	0.95	1.05	1.0249	System Intact	voltage is within range
6201	J411 POI 345.00	635 MEC	1.00	1.05	0.9961	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	Low Voltage Violation
6202	J411 COL1 34.500	635 MEC	1.00	1.05	0.9821	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	Low Voltage Violation
6203	J411 COL2 34.500	635 MEC	1.00	1.05	0.9821	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	Low Voltage Violation
6204	J411 G1 0.7000	635 MEC	1.00	1.05	0.9808	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	Low Voltage Violation
6205	J411 G2 0.7000	635 MEC	1.00	1.05	0.9808	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	Low Voltage Violation
635200	RAUN 3 345.00	635 MEC	1.00	1.05	1.0300	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
635201	RAUN 5 161.00	635 MEC	0.93	1.05	1.0265	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
635205	RAUN1XT9 13.800	635 MEC	1.00	1.05	1.0272	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
635213	NEAL 3G 22.000	635 MEC	1.00	1.05	0.9956	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	Low Voltage Violation
635214	NEAL 4G 24.000	635 MEC	1.00	1.05	1.0267	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
635400	HIGHLND 3 345.00	635 MEC	1.00	1.05	1.0224	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range

2018 Shoulder Case - J411 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
635600	GRIMES 3 345.00	635 MEC	0.94	1.05	1.0100	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
636000	WEBSTER3 345.00	635 MEC	0.94	1.05	1.0052	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
636010	LEHIGH 3 345.00	635 MEC	1.00	1.05	1.0016	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
636011	LGR425 9 34.500	635 MEC	1.00	1.05	1.0153	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
636012	LGR415 9 34.500	635 MEC	1.00	1.05	1.0167	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
640226	HOSKINS3 345.00	640 NPPD	0.90	1.10	1.0216	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
645451	S3451 3 345.00	645 OPPD	0.90	1.10	1.0259	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
652564	SIOUXCY3 345.00	652 WAPA	0.90	1.10	1.0247	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
6201	J411 POI 345.00	635 MEC	1.00	1.05	1.0266	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
6202	J411 COL1 34.500	635 MEC	1.00	1.05	1.0141	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
6203	J411 COL2 34.500	635 MEC	1.00	1.05	1.0141	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
6204	J411 G1 0.7000	635 MEC	1.00	1.05	1.0129	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
6205	J411 G2 0.7000	635 MEC	1.00	1.05	1.0129	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
635200	RAUN 3 345.00	635 MEC	1.00	1.05	1.0300	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
635201	RAUN 5 161.00	635 MEC	0.93	1.05	1.0272	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
635205	RAUN1XT9 13.800	635 MEC	1.00	1.05	1.0280	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
635213	NEAL 3G 22.000	635 MEC	1.00	1.05	0.9965	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	Low Voltage Violation

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2018 Shoulder Case - J411 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
635214	NEAL 4G 24.000	635 MEC	1.00	1.05	1.0286	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
635400	HIGHLND 3 345.00	635 MEC	1.00	1.05	1.0227	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
635600	GRIMES 3 345.00	635 MEC	0.94	1.05	1.0119	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
636000	WEBSTER3 345.00	635 MEC	0.94	1.05	1.0063	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
636010	LEHIGH 3 345.00	635 MEC	1.00	1.05	1.0048	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
636011	LGR425 9 34.500	635 MEC	1.00	1.05	1.0185	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
636012	LGR415 9 34.500	635 MEC	1.00	1.05	1.0199	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
640226	HOSKINS3 345.00	640 NPPD	0.90	1.10	1.0195	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
645451	S3451 3 345.00	645 OPPD	0.90	1.10	1.0245	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
652564	SIOUXCY3 345.00	652 WAPA	0.90	1.10	1.0252	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range

2018 Shoulder Case - J416 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
31199	J416 POI 345.00	627 ALTW	0.95	1.05	1.0195	System Intact	**voltage is within range**
32000	J416 345 345.00	627 ALTW	0.95	1.05	1.0186	System Intact	**voltage is within range**
32001	J416 34.5 1 34.500	627 ALTW	0.95	1.05	0.9994	System Intact	**voltage is within range**
32002	J416 34.5 2 34.500	627 ALTW	0.95	1.05	0.9994	System Intact	**voltage is within range**
631048	EMERY 5 161.00	627 ALTW	0.95	1.05	1.0200	System Intact	**voltage is within range**
631139	HAZLTON3 345.00	627 ALTW	0.95	1.05	1.0033	System Intact	**voltage is within range**
631198	COLBY3 345.00	627 ALTW	0.95	1.05	1.0320	System Intact	**voltage is within range**
631199	KILLDEER3 345.00	627 ALTW	0.95	1.05	1.0292	System Intact	**voltage is within range**
636199	BLACKHAWK 3 345.00	635 MEC	0.96	1.05	1.0045	System Intact	**voltage is within range**
636200	BLKHAWK5 161.00	635 MEC	0.95	1.05	1.0033	System Intact	**voltage is within range**
31199	J416 POI 345.00	627 ALTW	0.93	1.10	1.0344	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	**voltage is within range**
32000	J416 345 345.00	627 ALTW	0.93	1.10	1.0330	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	**voltage is within range**
32001	J416 34.5 1 34.500	627 ALTW	0.93	1.10	1.0046	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	**voltage is within range**
32002	J416 34.5 2 34.500	627 ALTW	0.93	1.10	1.0046	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	**voltage is within range**
631048	EMERY 5 161.00	627 ALTW	0.93	1.10	1.0200	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	**voltage is within range**
631139	HAZLTON3 345.00	627 ALTW	0.93	1.10	0.9927	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	**voltage is within range**
631198	COLBY3 345.00	627 ALTW	0.93	1.10	1.0400	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	**voltage is within range**
631199	KILLDEER3 345.00	627 ALTW	0.93	1.10	1.0378	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	**voltage is within range**
636199	BLACKHAWK 3 345.00	635 MEC	0.94	1.05	0.9904	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	**voltage is within range**
636200	BLKHAWK5 161.00	635 MEC	0.93	1.05	0.9824	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	**voltage is within range**
31199	J416 POI 345.00	627 ALTW	0.93	1.10	1.0046	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	**voltage is within range**
32000	J416 345 345.00	627 ALTW	0.93	1.10	1.0042	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	**voltage is within range**
32001	J416 34.5 1 34.500	627 ALTW	0.93	1.10	0.9942	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	**voltage is within range**

2018 Shoulder Case - J416 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
32002	J416 34.5 2 34.500	627 ALTW	0.93	1.10	0.9942	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	**voltage is within range**
631048	EMERY 5 161.00	627 ALTW	0.93	1.10	1.0200	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	**voltage is within range**
631139	HAZLTON3 345.00	627 ALTW	0.93	1.10	1.0003	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	**voltage is within range**
631198	COLBY3 345.00	627 ALTW	0.93	1.10	1.0465	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	**voltage is within range**
631199	KILLDEER3 345.00	627 ALTW	0.93	1.10	1.0453	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	**voltage is within range**
636199	BLACKHAWK 3 345.00	635 MEC	0.94	1.05	1.0014	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	**voltage is within range**
636200	BLKHAWK5 161.00	635 MEC	0.93	1.05	0.9939	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	**voltage is within range**

2018 Shoulder Case - J426 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
5673	J426_PPC 34.500	600 XEL	0.95	1.05	1.0001	System Intact	voltage is within range
5674	J426 34.5 34.500	600 XEL	0.95	1.05	1.0272	System Intact	voltage is within range
600090	G397 THLEN W0.7000	600 XEL	0.95	1.05	1.0103	System Intact	voltage is within range
600091	CHB341_2W 0.5000	600 XEL	0.95	1.05	1.0092	System Intact	voltage is within range
600154	BOEVE FEY W 0.7000	600 XEL	0.95	1.05	1.0055	System Intact	voltage is within range
603013	PIPESTN7 115.00	600 XEL	0.95	1.05	1.0133	System Intact	voltage is within range
603180	CHANRMB7 115.00	600 XEL	0.95	1.05	1.0233	System Intact	voltage is within range
603195	FENTON 7 115.00	600 XEL	0.95	1.05	1.0159	System Intact	voltage is within range
605653	CHANARAMBIE134.500	600 XEL	0.95	1.05	0.9924	System Intact	voltage is within range
605674	CHANARAMBIE434.500	600 XEL	0.95	1.05	1.0000	System Intact	voltage is within range
605682	CHANARAMBIE234.500	600 XEL	0.95	1.05	0.9924	System Intact	voltage is within range
605683	CHB341 34.500	600 XEL	0.95	1.05	1.0053	System Intact	voltage is within range
618905	GRE-ELLSBOR7115.00	600 XEL	0.95	1.05	1.0219	System Intact	voltage is within range
5673	J426_PPC 34.500	600 XEL	0.92	1.05	1.0001	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
5674	J426 34.5 34.500	600 XEL	0.92	1.05	1.0275	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
600090	G397 THLEN W0.7000	600 XEL	0.95	1.05	1.0103	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
600091	CHB341_2W 0.5000	600 XEL	0.95	1.05	1.0092	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
600154	BOEVE FEY W 0.7000	600 XEL	0.95	1.05	1.0055	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
603013	PIPESTN7 115.00	600 XEL	0.92	1.05	1.0124	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
603180	CHANRMB7 115.00	600 XEL	0.92	1.05	1.0218	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
603195	FENTON 7 115.00	600 XEL	0.92	1.05	1.0154	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
605653	CHANARAMBIE134.500	600 XEL	0.92	1.05	0.9916	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
605674	CHANARAMBIE434.500	600 XEL	0.92	1.05	1.0000	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
605682	CHANARAMBIE234.500	600 XEL	0.92	1.05	0.9914	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
605683	CHB341 34.500	600 XEL	0.92	1.05	1.0053	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
618905	GRE-ELLSBOR7115.00	600 XEL	0.92	1.05	1.0211	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range

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2018 Shoulder Case - J426 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
5673	J426_PPC 34.500	600 XEL	0.92	1.05	1.0001	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
5674	J426 34.5 34.500	600 XEL	0.92	1.05	1.0275	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
600090	G397 THLEN W0.7000	600 XEL	0.95	1.05	1.0103	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
600091	CHB341_2W 0.5000	600 XEL	0.95	1.05	1.0092	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
600154	BOEVE FEY W 0.7000	600 XEL	0.95	1.05	1.0055	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
603013	PIPESTN7 115.00	600 XEL	0.92	1.05	1.0124	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
603180	CHANRMB7 115.00	600 XEL	0.92	1.05	1.0218	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
603195	FENTON 7 115.00	600 XEL	0.92	1.05	1.0154	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
605653	CHANARAMBIE134.500	600 XEL	0.92	1.05	0.9916	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
605674	CHANARAMBIE434.500	600 XEL	0.92	1.05	1.0000	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
605682	CHANARAMBIE234.500	600 XEL	0.92	1.05	0.9914	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
605683	CHB341 34.500	600 XEL	0.92	1.05	1.0053	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
618905	GRE-ELLSBOR7115.00	600 XEL	0.92	1.05	1.0211	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range

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C.2 Reactive Power Requirement Results for 2025

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2025 Shoulder Case - G736 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
6062	G736_T 230	620 OTP	0.97	1.05	0.9544	System Intact	Low Voltage Violation
601031	BRKNGCO3 345	600 XEL	0.95	1.05	1.0021	System Intact	voltage is within range
620214	BIGSTON7 115	620 OTP	0.97	1.07	1.0003	System Intact	voltage is within range
620314	BIGSTON4 230	620 OTP	0.97	1.05	0.9834	System Intact	voltage is within range
620315	BIGSTN1G 24	620 OTP	0.97	1.07	0.9217	System Intact	Low Voltage Violation
620316	BIGSTON9 13.8	620 OTP	0.97	1.07	0.9710	System Intact	voltage is within range
620320	BSS1 13.8 13.8	620 OTP	0.97	1.07	0.9499	System Intact	Low Voltage Violation
620321	BSS2 13.8 13.8	620 OTP	0.97	1.07	0.9499	System Intact	Low Voltage Violation
620322	BSSOUTH4 230	620 OTP	0.97	1.05	0.9840	System Intact	voltage is within range
620325	BROWNSV4 230	620 OTP	0.97	1.05	0.9960	System Intact	voltage is within range
620417	BSSOUTH3 345	620 OTP	0.97	1.05	0.9756	System Intact	voltage is within range
652503	BLAIR 4 230	652 WAPA	0.95	1.05	1.0000	System Intact	voltage is within range
661097	ELLENDLMVP3 345	661 MDU	0.95	1.05	0.9830	System Intact	voltage is within range
6062	G736_T 230	620 OTP	0.92	1.10	0.9545	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0021	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620214	BIGSTON7 115	620 OTP	0.92	1.10	0.9998	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620314	BIGSTON4 230	620 OTP	0.92	1.10	0.9829	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620315	BIGSTN1G 24	620 OTP	0.92	1.10	0.9212	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620316	BIGSTON9 13.8	620 OTP	0.92	1.10	0.9706	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620320	BSS1 13.8 13.8	620 OTP	0.92	1.10	0.9500	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620321	BSS2 13.8 13.8	620 OTP	0.92	1.10	0.9500	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620322	BSSOUTH4 230	620 OTP	0.92	1.10	0.9841	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620325	BROWNSV4 230	620 OTP	0.92	1.10	0.9957	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
620417	BSSOUTH3 345	620 OTP	0.92	1.10	0.9757	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
652503	BLAIR 4 230	652 WAPA	0.90	1.10	0.9997	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range
661097	ELLENDLMVP3 345	661 MDU	0.90	1.10	0.9830	G736-OUTLET1 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 1	voltage is within range

2025 Shoulder Case - G736 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
6062	G736_T 230	620 OTP	0.92	1.10	0.9545	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0021	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620214	BIGSTON7 115	620 OTP	0.92	1.10	0.9998	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620314	BIGSTON4 230	620 OTP	0.92	1.10	0.9829	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620315	BIGSTN1G 24	620 OTP	0.92	1.10	0.9212	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620316	BIGSTON9 13.8	620 OTP	0.92	1.10	0.9706	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620320	BSS1 13.8 13.8	620 OTP	0.92	1.10	0.9500	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620321	BSS2 13.8 13.8	620 OTP	0.92	1.10	0.9500	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620322	BSSOUTH4 230	620 OTP	0.92	1.10	0.9841	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620325	BROWNSV4 230	620 OTP	0.92	1.10	0.9957	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
620417	BSSOUTH3 345	620 OTP	0.92	1.10	0.9757	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
652503	BLAIR 4 230	652 WAPA	0.90	1.10	0.9997	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
661097	ELLENDLMVP3 345	661 MDU	0.90	1.10	0.9830	G736-OUTLET2 620322 [BSSOUTH4 230.00] TO 620314 [BIGSTON4 230.00] 2	voltage is within range
6062	G736_T 230	620 OTP	0.92	1.10	0.9494	G736-OUTLET3 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620320 [BSS1 13.8 13.800] 1	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0033	G736-OUTLET3 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620320 [BSS1 13.8 13.800] 1	voltage is within range
620214	BIGSTON7 115	620 OTP	0.92	1.10	0.9974	G736-OUTLET3 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620320 [BSS1 13.8 13.800] 1	voltage is within range
620314	BIGSTON4 230	620 OTP	0.92	1.10	0.9800	G736-OUTLET3 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620320 [BSS1 13.8 13.800] 1	voltage is within range

2025 Shoulder Case - G736 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
620315	BIGSTN1G 24	620 OTP	0.92	1.10	0.9227	G736-OUTLET3 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620320 [BSS1 13.8 13.800] 1	voltage is within range
620316	BIGSTON9 13.8	620 OTP	0.92	1.10	0.9682	G736-OUTLET3 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620320 [BSS1 13.8 13.800] 1	voltage is within range
620321	BSS2 13.8 13.8	620 OTP	0.92	1.10	0.9271	G736-OUTLET3 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620320 [BSS1 13.8 13.800] 1	voltage is within range
620322	BSSOUTH4 230	620 OTP	0.92	1.10	0.9802	G736-OUTLET3 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620320 [BSS1 13.8 13.800] 1	voltage is within range
620325	BROWNSV4 230	620 OTP	0.92	1.10	0.9938	G736-OUTLET3 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620320 [BSS1 13.8 13.800] 1	voltage is within range
620417	BSSOUTH3 345	620 OTP	0.92	1.10	0.9828	G736-OUTLET3 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620320 [BSS1 13.8 13.800] 1	voltage is within range
652503	BLAIR 4 230	652 WAPA	0.90	1.10	0.9981	G736-OUTLET3 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620320 [BSS1 13.8 13.800] 1	voltage is within range
661097	ELLENDLMVP3 345	661 MDU	0.90	1.10	0.9848	G736-OUTLET3 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620320 [BSS1 13.8 13.800] 1	voltage is within range
6062	G736_T 230	620 OTP	0.92	1.10	0.9494	G736-OUTLET4 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620321 [BSS2 13.8 13.800] 2	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0033	G736-OUTLET4 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620321 [BSS2 13.8 13.800] 2	voltage is within range
620214	BIGSTON7 115	620 OTP	0.92	1.10	0.9974	G736-OUTLET4 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620321 [BSS2 13.8 13.800] 2	voltage is within range
620314	BIGSTON4 230	620 OTP	0.92	1.10	0.9800	G736-OUTLET4 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620321 [BSS2 13.8 13.800] 2	voltage is within range
620315	BIGSTN1G 24	620 OTP	0.92	1.10	0.9227	G736-OUTLET4 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620321 [BSS2 13.8 13.800] 2	voltage is within range
620316	BIGSTON9 13.8	620 OTP	0.92	1.10	0.9682	G736-OUTLET4 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620321 [BSS2 13.8 13.800] 2	voltage is within range
620320	BSS1 13.8 13.8	620 OTP	0.92	1.10	0.9271	G736-OUTLET4 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620321 [BSS2 13.8 13.800] 2	voltage is within range
620322	BSSOUTH4 230	620 OTP	0.92	1.10	0.9802	G736-OUTLET4 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620321 [BSS2 13.8 13.800] 2	voltage is within range
620325	BROWNSV4 230	620 OTP	0.92	1.10	0.9938	G736-OUTLET4 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620321 [BSS2 13.8 13.800] 2	voltage is within range

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Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
620417	BSSOUTH3 345	620 OTP	0.92	1.10	0.9828	G736-OUTLET4 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620321 [BSS2 13.8 13.800] 2	voltage is within range
652503	BLAIR 4 230	652 WAPA	0.90	1.10	0.9981	G736-OUTLET4 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620321 [BSS2 13.8 13.800] 2	voltage is within range
661097	ELLENDLMVP3 345	661 MDU	0.90	1.10	0.9848	G736-OUTLET4 620322 [BSSOUTH4 230.00] TO 620417 [BSSOUTH3 345.00] TO 620321 [BSS2 13.8 13.800] 2	voltage is within range

2025 Summer Peak Case - J385 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
12049	J385_34.5 34.5	600 XEL	0.95	1.05	1.0049	System Intact	voltage is within range
12050	J385_GEN 0.342	600 XEL	0.95	1.05	1.0037	System Intact	voltage is within range
12152	J385_PV 115	600 XEL	0.95	1.05	1.0225	System Intact	voltage is within range
601014	AS KING3 345	600 XEL	0.95	1.05	1.0285	System Intact	voltage is within range
601016	CHIS CO2 500	600 XEL	0.95	1.05	1.0265	System Intact	voltage is within range
601018	CHIS CO3 345	600 XEL	0.95	1.05	1.0271	System Intact	voltage is within range
601021	KOLMNLK3 345	600 XEL	0.95	1.05	1.0263	System Intact	voltage is within range
603065	CHISAGO7 115	600 XEL	0.95	1.05	1.0225	System Intact	voltage is within range
603136	HUGO 7 115	600 XEL	0.95	1.05	1.0171	System Intact	voltage is within range
603172	WYOMING7 115	600 XEL	0.95	1.05	1.0146	System Intact	voltage is within range
603259	CHISAGO CAP7 115	600 XEL	0.95	1.05	1.0225	System Intact	voltage is within range
605015	CHIS T19 34.5	600 XEL	0.95	1.05	1.0274	System Intact	voltage is within range
605016	CHIS T29 34.5	600 XEL	0.95	1.05	1.0272	System Intact	voltage is within range
605269	LINDSTM7 115	600 XEL	0.95	1.05	1.0082	System Intact	voltage is within range
605710	CHISAGOTR6T9 34.5	600 XEL	0.95	1.05	0.9956	System Intact	voltage is within range
605745	CHISAGOTR5 34.5	600 XEL	0.95	1.05	0.9956	System Intact	voltage is within range
617031	GRE-SHAFER 7 115	600 XEL	0.95	1.05	1.0044	System Intact	voltage is within range
12049	J385_34.5 34.5	600 XEL	0.92	1.05	1.0044	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
12050	J385_GEN 0.342	600 XEL	0.92	1.05	1.0032	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
12152	J385_PV 115	600 XEL	0.92	1.05	1.0221	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
601014	AS KING3 345	600 XEL	0.92	1.05	1.0279	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
601016	CHIS CO2 500	600 XEL	0.92	1.05	1.0264	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
601018	CHIS CO3 345	600 XEL	0.92	1.05	1.0270	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
601021	KOLMNLK3 345	600 XEL	0.92	1.05	1.0255	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
603065	CHISAGO7 115	600 XEL	0.92	1.05	1.0221	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
603136	HUGO 7 115	600 XEL	0.92	1.05	1.0111	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
603172	WYOMING7 115	600 XEL	0.92	1.05	1.0042	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
603259	CHISAGO CAP7 115	600 XEL	0.92	1.05	1.0221	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
605015	CHIS T19 34.5	600 XEL	0.92	1.05	1.0272	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range

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2025 Summer Peak Case - J385 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
605016	CHIS T29 34.5	600 XEL	0.92	1.05	1.0271	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
605269	LINDSTM7 115	600 XEL	0.92	1.05	1.0070	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
605710	CHISAGOTR6T9 34.5	600 XEL	0.92	1.05	0.9949	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
605745	CHISAGOTR5 34.5	600 XEL	0.92	1.05	0.9949	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
617031	GRE-SHAFER 7 115	600 XEL	0.92	1.05	1.0030	J385-OUTLET1 603065 [CHISAGO7 115.00] TO 603172 [WYOMING7 115.00] 1	voltage is within range
12049	J385_34.5 34.5	600 XEL	0.92	1.05	1.0089	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
12050	J385_GEN 0.342	600 XEL	0.92	1.05	1.0077	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
12152	J385_PV 115	600 XEL	0.92	1.05	1.0263	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
601014	AS KING3 345	600 XEL	0.92	1.05	1.0277	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
601016	CHIS CO2 500	600 XEL	0.92	1.05	1.0284	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
601018	CHIS CO3 345	600 XEL	0.92	1.05	1.0289	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
601021	KOLMNLK3 345	600 XEL	0.92	1.05	1.0260	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
603065	CHISAGO7 115	600 XEL	0.92	1.05	1.0264	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
603136	HUGO 7 115	600 XEL	0.92	1.05	1.0170	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
603172	WYOMING7 115	600 XEL	0.92	1.05	1.0156	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
603259	CHISAGO CAP7 115	600 XEL	0.92	1.05	1.0264	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
605015	CHIS T19 34.5	600 XEL	0.92	1.05	1.0291	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range

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2025 Summer Peak Case - J385 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
605016	CHIS T29 34.5	600 XEL	0.92	1.05	1.0290	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
605269	LINDSTM7 115	600 XEL	0.92	1.05	0.9638	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
605710	CHISAGOTR6T9 34.5	600 XEL	0.92	1.05	0.9995	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
605745	CHISAGOTR5 34.5	600 XEL	0.92	1.05	0.9995	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
617031	GRE-SHAFER 7 115	600 XEL	0.92	1.05	0.9647	J385-OUTLET2 603065 [CHISAGO7 115.00] TO 605269 [LINDSTM7 115.00] 1	voltage is within range
12049	J385_34.5 34.5	600 XEL	0.92	1.05	1.0270	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
12050	J385_GEN 0.342	600 XEL	0.92	1.05	1.0259	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
12152	J385_PV 115	600 XEL	0.92	1.05	1.0435	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
601014	AS KING3 345	600 XEL	0.92	1.05	1.0310	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
601016	CHIS CO2 500	600 XEL	0.92	1.05	1.0333	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
601018	CHIS CO3 345	600 XEL	0.92	1.05	1.0343	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
601021	KOLMNLK3 345	600 XEL	0.92	1.05	1.0291	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
603065	CHISAGO7 115	600 XEL	0.92	1.05	1.0435	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
603136	HUGO 7 115	600 XEL	0.92	1.05	1.0252	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
603172	WYOMING7 115	600 XEL	0.92	1.05	1.0290	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
603259	CHISAGO CAP7 115	600 XEL	0.92	1.05	1.0437	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
605015	CHIS T19 34.5	600 XEL	0.92	1.05	1.0346	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range

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2025 Summer Peak Case - J385 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
605016	CHIS T29 34.5	600 XEL	0.92	1.05	1.0343	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
605269	LINDSTM7 115	600 XEL	0.92	1.05	1.0270	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
605745	CHISAGOTR5 34.5	600 XEL	0.92	1.05	1.0206	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
617031	GRE-SHAFER 7 115	600 XEL	0.92	1.05	1.0223	J385-OUTLET3 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605710 [CHISAGOTR6T934.500] 6	voltage is within range
12049	J385_34.5 34.5	600 XEL	0.92	1.05	1.0270	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
12050	J385_GEN 0.342	600 XEL	0.92	1.05	1.0259	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
12152	J385_PV 115	600 XEL	0.92	1.05	1.0435	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
601014	AS KING3 345	600 XEL	0.92	1.05	1.0310	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
601016	CHIS CO2 500	600 XEL	0.92	1.05	1.0333	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
601018	CHIS CO3 345	600 XEL	0.92	1.05	1.0343	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
601021	KOLMNLK3 345	600 XEL	0.92	1.05	1.0291	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
603065	CHISAGO7 115	600 XEL	0.92	1.05	1.0435	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
603136	HUGO 7 115	600 XEL	0.92	1.05	1.0252	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
603172	WYOMING7 115	600 XEL	0.92	1.05	1.0290	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
603259	CHISAGO CAP7 115	600 XEL	0.92	1.05	1.0437	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
605015	CHIS T19 34.5	600 XEL	0.92	1.05	1.0346	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
605016	CHIS T29 34.5	600 XEL	0.92	1.05	1.0343	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range

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2025 Summer Peak Case - J385 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
605269	LINDSTM7 115	600 XEL	0.92	1.05	1.0270	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
605710	CHISAGOTR6T9 34.5	600 XEL	0.92	1.05	1.0206	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
617031	GRE-SHAFER 7 115	600 XEL	0.92	1.05	1.0223	J385-OUTLET4 603065 [CHISAGO7 115.00] TO 601018 [CHIS CO3 345.00] TO 605745 [CHISAGOTR5 34.500] 6	voltage is within range
12049	J385_34.5 34.5	600 XEL	0.92	1.05	1.0049	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
12050	J385_GEN 0.342	600 XEL	0.92	1.05	1.0037	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
12152	J385_PV 115	600 XEL	0.92	1.05	1.0225	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
601014	AS KING3 345	600 XEL	0.92	1.05	1.0285	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
601016	CHIS CO2 500	600 XEL	0.92	1.05	1.0265	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
601018	CHIS CO3 345	600 XEL	0.92	1.05	1.0271	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
601021	KOLMNLK3 345	600 XEL	0.92	1.05	1.0263	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
603065	CHISAGO7 115	600 XEL	0.92	1.05	1.0225	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
603136	HUGO 7 115	600 XEL	0.92	1.05	1.0171	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
603172	WYOMING7 115	600 XEL	0.92	1.05	1.0146	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
605015	CHIS T19 34.5	600 XEL	0.92	1.05	1.0274	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
605016	CHIS T29 34.5	600 XEL	0.92	1.05	1.0272	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
605269	LINDSTM7 115	600 XEL	0.92	1.05	1.0082	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
605710	CHISAGOTR6T9 34.5	600 XEL	0.92	1.05	0.9956	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range

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2025 Summer Peak Case - J385 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
605745	CHISAGOTR5 34.5	600 XEL	0.92	1.05	0.9956	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range
617031	GRE-SHAFER 7 115	600 XEL	0.92	1.05	1.0044	J385-OUTLET5 603065 [CHISAGO7 115.00] TO 603259 [CHISAGO CAP7115.00] Z	voltage is within range

2025 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
6050	J400 0.342	600 XEL	0.95	1.05	1.0223	System Intact	voltage is within range
6051	J400_COL 34.5	600 XEL	0.95	1.05	1.0158	System Intact	voltage is within range
10215	H081_SUB 345	600 XEL	0.95	1.05	1.0317	System Intact	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.95	1.05	1.0312	System Intact	voltage is within range
601048	LYON CO 3 345	600 XEL	0.95	1.05	1.0339	System Intact	voltage is within range
601054	HAZEL CK3 345	600 XEL	0.95	1.05	1.0299	System Intact	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.95	1.05	1.0300	System Intact	voltage is within range
603046	LYON CO7 115	600 XEL	0.95	1.05	1.0226	System Intact	voltage is within range
603134	BUFFRID7 115	600 XEL	0.95	1.05	1.0318	System Intact	voltage is within range
603229	LKYANKTON 7 115	600 XEL	0.95	1.05	1.0300	System Intact	voltage is within range
603258	LYON CO CAP7 115	600 XEL	0.95	1.05	1.0226	System Intact	voltage is within range
605047	GRNVALY8 69	600 XEL	0.95	1.05	1.0172	System Intact	voltage is within range
605210	LK YANK8 69	600 XEL	0.95	1.05	1.0372	System Intact	voltage is within range
605256	LYON CO8 69	600 XEL	0.95	1.05	1.0170	System Intact	voltage is within range
605750	LYON COT 34.5	600 XEL	0.95	1.05	0.9604	System Intact	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.95	1.05	1.0353	System Intact	voltage is within range
618905	GRE-ELLSBOR7 115	600 XEL	0.95	1.05	1.0329	System Intact	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.95	1.05	1.0112	System Intact	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.95	1.05	1.0277	System Intact	voltage is within range
658068	MARSHAL7 115	600 XEL	0.95	1.05	1.0206	System Intact	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.95	1.05	1.0200	System Intact	voltage is within range
658076	MMU SW 7 115	600 XEL	0.95	1.05	1.0226	System Intact	voltage is within range
658078	SOUTH E7 115	600 XEL	0.95	1.05	1.0212	System Intact	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.95	1.05	1.0206	System Intact	voltage is within range
6050	J400 0.342	600 XEL	0.92	1.05	1.0214	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
6051	J400_COL 34.5	600 XEL	0.92	1.05	1.0148	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
10215	H081_SUB 345	600 XEL	0.92	1.05	1.0316	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0311	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
601048	LYON CO 3 345	600 XEL	0.92	1.05	1.0336	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
601054	HAZEL CK3 345	600 XEL	0.92	1.05	1.0297	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.92	1.05	1.0310	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
603046	LYON CO7 115	600 XEL	0.92	1.05	1.0217	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
603134	BUFFRID7 115	600 XEL	0.92	1.05	1.0321	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range

2025 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
603229	LKYANKTON 7 115	600 XEL	0.92	1.05	1.0310	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
603258	LYON CO CAP7 115	600 XEL	0.92	1.05	1.0217	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
605047	GRNVALY8 69	600 XEL	0.92	1.05	1.0164	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
605210	LK YANK8 69	600 XEL	0.92	1.05	1.0382	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
605256	LYON CO8 69	600 XEL	0.92	1.05	1.0163	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
605750	LYON COT 34.5	600 XEL	0.92	1.05	0.9594	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.92	1.05	1.0351	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
618905	GRE-ELLSBOR7 115	600 XEL	0.92	1.05	1.0335	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.92	1.05	1.0105	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.92	1.05	1.0270	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
658068	MARSHAL7 115	600 XEL	0.92	1.05	1.0205	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.92	1.05	1.0200	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
658076	MMU SW 7 115	600 XEL	0.92	1.05	1.0227	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
658078	SOUTH E7 115	600 XEL	0.92	1.05	1.0212	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.92	1.05	1.0205	J400-OUTLET1 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 1	voltage is within range
6050	J400 0.342	600 XEL	0.92	1.05	1.0214	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
6051	J400_COL 34.5	600 XEL	0.92	1.05	1.0148	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range

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2025 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
10215	H081_SUB 345	600 XEL	0.92	1.05	1.0316	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0311	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
601048	LYON CO 3 345	600 XEL	0.92	1.05	1.0336	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
601054	HAZEL CK3 345	600 XEL	0.92	1.05	1.0297	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.92	1.05	1.0310	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
603046	LYON CO7 115	600 XEL	0.92	1.05	1.0217	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
603134	BUFFRID7 115	600 XEL	0.92	1.05	1.0321	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
603229	LKYANKTON 7 115	600 XEL	0.92	1.05	1.0310	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
603258	LYON CO CAP7 115	600 XEL	0.92	1.05	1.0217	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
605047	GRNVALY8 69	600 XEL	0.92	1.05	1.0164	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
605210	LK YANK8 69	600 XEL	0.92	1.05	1.0382	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
605256	LYON CO8 69	600 XEL	0.92	1.05	1.0163	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
605750	LYON COT 34.5	600 XEL	0.92	1.05	0.9594	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.92	1.05	1.0351	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
618905	GRE-ELLSBOR7 115	600 XEL	0.92	1.05	1.0335	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.92	1.05	1.0105	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.92	1.05	1.0270	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range

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Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
658068	MARSHAL7 115	600 XEL	0.92	1.05	1.0205	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.92	1.05	1.0200	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
658076	MMU SW 7 115	600 XEL	0.92	1.05	1.0227	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
658078	SOUTH E7 115	600 XEL	0.92	1.05	1.0212	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.92	1.05	1.0205	J400-OUTLET2 603046 [LYON CO7 115.00] TO 603010 [LKYNKTN7 115.00] 2	voltage is within range
6050	J400 0.342	600 XEL	0.92	1.05	1.0208	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
6051	J400_COL 34.5	600 XEL	0.92	1.05	1.0143	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
10215	H081_SUB 345	600 XEL	0.92	1.05	1.0315	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0310	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
601048	LYON CO 3 345	600 XEL	0.92	1.05	1.0336	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
601054	HAZEL CK3 345	600 XEL	0.92	1.05	1.0296	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.92	1.05	1.0296	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
603046	LYON CO7 115	600 XEL	0.92	1.05	1.0212	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
603134	BUFFRID7 115	600 XEL	0.92	1.05	1.0317	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
603229	LKYANKTON 7 115	600 XEL	0.92	1.05	1.0296	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
603258	LYON CO CAP7 115	600 XEL	0.92	1.05	1.0212	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
605047	GRNVALY8 69	600 XEL	0.92	1.05	1.0142	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range

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2025 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
605210	LK YANK8 69	600 XEL	0.92	1.05	1.0368	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
605256	LYON CO8 69	600 XEL	0.92	1.05	1.0142	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
605750	LYON COT 34.5	600 XEL	0.92	1.05	0.9588	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.92	1.05	1.0351	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
618905	GRE-ELLSBOR7 115	600 XEL	0.92	1.05	1.0327	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.92	1.05	1.0090	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.92	1.05	1.0199	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
658068	MARSHAL7 115	600 XEL	0.92	1.05	1.0203	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.92	1.05	1.0200	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
658076	MMU SW 7 115	600 XEL	0.92	1.05	1.0224	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
658078	SOUTH E7 115	600 XEL	0.92	1.05	1.0209	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.92	1.05	1.0203	J400-OUTLET3 603046 [LYON CO7 115.00] TO 605256 [LYON CO8 69.000] 1	voltage is within range
6050	J400 0.342	600 XEL	0.92	1.05	1.0229	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
6051	J400_COL 34.5	600 XEL	0.92	1.05	1.0163	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
10215	H081_SUB 345	600 XEL	0.92	1.05	1.0319	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0313	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
601048	LYON CO 3 345	600 XEL	0.92	1.05	1.0342	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range

2025 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
601054	HAZEL CK3 345	600 XEL	0.92	1.05	1.0302	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.92	1.05	1.0301	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
603046	LYON CO7 115	600 XEL	0.92	1.05	1.0232	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
603134	BUFFRID7 115	600 XEL	0.92	1.05	1.0320	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
603229	LKYANKTON 7 115	600 XEL	0.92	1.05	1.0301	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
603258	LYON CO CAP7 115	600 XEL	0.92	1.05	1.0232	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
605047	GRNVALY8 69	600 XEL	0.92	1.05	1.0180	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
605210	LK YANK8 69	600 XEL	0.92	1.05	1.0374	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
605256	LYON CO8 69	600 XEL	0.92	1.05	1.0178	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
605750	LYON COT 34.5	600 XEL	0.92	1.05	0.9609	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.92	1.05	1.0355	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
618905	GRE-ELLSBOR7 115	600 XEL	0.92	1.05	1.0329	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.92	1.05	1.0119	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.92	1.05	1.0286	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
658068	MARSHAL7 115	600 XEL	0.92	1.05	1.0202	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.92	1.05	1.0200	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
658076	MMU SW 7 115	600 XEL	0.92	1.05	1.0226	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range

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2025 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
658078	SOUTH E7 115	600 XEL	0.92	1.05	1.0210	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.92	1.05	1.0202	J400-OUTLET4 603046 [LYON CO7 115.00] TO 658068 [MARSHAL7 115.00] 1	voltage is within range
6050	J400 0.342	600 XEL	0.92	1.05	1.0268	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
6051	J400_COL 34.5	600 XEL	0.92	1.05	1.0202	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
10215	H081_SUB 345	600 XEL	0.92	1.05	1.0343	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0326	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
601048	LYON CO 3 345	600 XEL	0.92	1.05	1.0376	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
601054	HAZEL CK3 345	600 XEL	0.92	1.05	1.0331	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.92	1.05	1.0316	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
603046	LYON CO7 115	600 XEL	0.92	1.05	1.0270	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
603134	BUFFRID7 115	600 XEL	0.92	1.05	1.0330	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
603229	LKYANKTON 7 115	600 XEL	0.92	1.05	1.0316	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
603258	LYON CO CAP7 115	600 XEL	0.92	1.05	1.0270	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
605047	GRNVALY8 69	600 XEL	0.92	1.05	1.0216	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
605210	LK YANK8 69	600 XEL	0.92	1.05	1.0389	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
605256	LYON CO8 69	600 XEL	0.92	1.05	1.0215	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.92	1.05	1.0376	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range

2025 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
618905	GRE-ELLSBOR7 115	600 XEL	0.92	1.05	1.0340	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.92	1.05	1.0149	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.92	1.05	1.0320	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
658068	MARSHAL7 115	600 XEL	0.92	1.05	1.0215	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.92	1.05	1.0200	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
658076	MMU SW 7 115	600 XEL	0.92	1.05	1.0232	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
658078	SOUTH E7 115	600 XEL	0.92	1.05	1.0220	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.92	1.05	1.0215	J400-OUTLET5 603046 [LYON CO7 115.00] TO 601048 [LYON CO 3 345.00] TO 605750 [LYON COT 34.500] 9	voltage is within range
6050	J400 0.342	600 XEL	0.92	1.05	1.0223	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
6051	J400_COL 34.5	600 XEL	0.92	1.05	1.0158	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
10215	H081_SUB 345	600 XEL	0.92	1.05	1.0317	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
601031	BRKNGCO3 345	600 XEL	0.92	1.05	1.0312	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
601048	LYON CO 3 345	600 XEL	0.92	1.05	1.0339	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
601054	HAZEL CK3 345	600 XEL	0.92	1.05	1.0299	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
603010	LKYNKTN7 115	600 XEL	0.92	1.05	1.0300	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
603046	LYON CO7 115	600 XEL	0.92	1.05	1.0226	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
603134	BUFFRID7 115	600 XEL	0.92	1.05	1.0318	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range

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2025 Summer Peak Case - J400 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
603229	LKYANKTON 7 115	600 XEL	0.92	1.05	1.0300	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
605047	GRNVALY8 69	600 XEL	0.92	1.05	1.0172	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
605210	LK YANK8 69	600 XEL	0.92	1.05	1.0372	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
605256	LYON CO8 69	600 XEL	0.92	1.05	1.0170	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
605750	LYON COT 34.5	600 XEL	0.92	1.05	0.9604	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
615643	GRE-CEDARMT3 345	600 XEL	0.92	1.05	1.0353	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
618905	GRE-ELLSBOR7 115	600 XEL	0.92	1.05	1.0329	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
619018	GRE-MILROY 8 69	600 XEL	0.92	1.05	1.0112	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
619021	GRE-WLNTGTP8 69	600 XEL	0.92	1.05	1.0277	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
658068	MARSHAL7 115	600 XEL	0.92	1.05	1.0206	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
658070	MMU 7ST7 115	600 XEL	0.92	1.05	1.0200	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
658076	MMU SW 7 115	600 XEL	0.92	1.05	1.0226	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
658078	SOUTH E7 115	600 XEL	0.92	1.05	1.0212	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range
658206	MMUSS CAP 7 115	600 XEL	0.92	1.05	1.0206	J400-OUTLET6 603046 [LYON CO7 115.00] TO 603258 [LYON CO CAP7115.00] Z	voltage is within range

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2025 Shoulder Case - J407 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
6001	J407 POI 161	627 ALTW	0.95	1.05	1.0078	System Intact	voltage is within range
6002	J407 COL1 34.5	627 ALTW	0.95	1.05	0.9950	System Intact	voltage is within range
6003	J407 COL2 34.5	627 ALTW	0.95	1.05	0.9950	System Intact	voltage is within range
6004	J407 G1 0.69	627 ALTW	0.95	1.05	0.9938	System Intact	voltage is within range
6005	J407 G2 0.7	627 ALTW	0.95	1.05	0.9938	System Intact	voltage is within range
613042	MURPHY CR 5 161	613 SMMPA	0.95	1.05	1.0082	System Intact	voltage is within range
630128	HAYWD#18 69	627 ALTW	0.95	1.05	1.0164	System Intact	voltage is within range
630129	HAYWD#28 69	627 ALTW	0.95	1.05	1.0164	System Intact	voltage is within range
631036	NIW 5 161	627 ALTW	0.95	1.05	1.0071	System Intact	voltage is within range
631044	HAYWD#25 161	627 ALTW	0.95	1.05	1.0091	System Intact	voltage is within range
631127	HAYWD#15 161	627 ALTW	0.95	1.05	1.0092	System Intact	voltage is within range
631174	GLENWRTH5 161	627 ALTW	0.95	1.05	1.0078	System Intact	voltage is within range
631202	COLBY5 161	627 ALTW	0.95	1.05	1.0085	System Intact	voltage is within range
680235	LONDON 69	680 DPC	0.95	1.05	1.0121	System Intact	voltage is within range
680277	GLENVILL 69	680 DPC	0.95	1.05	1.0182	System Intact	voltage is within range
680542	GLENWTH8 69	680 DPC	0.95	1.05	1.0184	System Intact	voltage is within range
6001	J407 POI 161	627 ALTW	0.93	1.10	1.0081	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
6002	J407 COL1 34.5	627 ALTW	0.93	1.10	0.9954	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
6003	J407 COL2 34.5	627 ALTW	0.93	1.10	0.9954	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
6004	J407 G1 0.69	627 ALTW	0.93	1.10	0.9942	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
6005	J407 G2 0.7	627 ALTW	0.93	1.10	0.9942	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
613042	MURPHY CR 5 161	613 SMMPA	0.90	1.10	1.0084	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
630128	HAYWD#18 69	627 ALTW	0.93	1.10	1.0166	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
630129	HAYWD#28 69	627 ALTW	0.93	1.10	1.0166	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
631036	NIW 5 161	627 ALTW	0.93	1.10	1.0057	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
631044	HAYWD#25 161	627 ALTW	0.93	1.10	1.0094	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
631127	HAYWD#15 161	627 ALTW	0.93	1.10	1.0094	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
631174	GLENWRTH5 161	627 ALTW	0.93	1.10	1.0082	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range

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2025 Shoulder Case - J407 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
631202	COLBY5 161	627 ALTW	0.93	1.10	1.0079	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
680235	LONDON 69	680 DPC	0.90	1.10	1.0122	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
680277	GLENVILL 69	680 DPC	0.90	1.10	1.0184	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
680542	GLENWTH8 69	680 DPC	0.90	1.10	1.0186	J407-OUTLET1 631174 [GLENWRTH5 161.00] TO 631036 [NIW 5 161.00] 1	voltage is within range
6001	J407 POI 161	627 ALTW	0.93	1.10	0.9953	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
6002	J407 COL1 34.5	627 ALTW	0.93	1.10	0.9820	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
6003	J407 COL2 34.5	627 ALTW	0.93	1.10	0.9820	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
6004	J407 G1 0.69	627 ALTW	0.93	1.10	0.9807	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
6005	J407 G2 0.7	627 ALTW	0.93	1.10	0.9807	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
613042	MURPHY CR 5 161	613 SMMPA	0.90	1.10	1.0115	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
630128	HAYWD#18 69	627 ALTW	0.93	1.10	1.0122	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
630129	HAYWD#28 69	627 ALTW	0.93	1.10	1.0121	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
631036	NIW 5 161	627 ALTW	0.93	1.10	1.0000	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
631044	HAYWD#25 161	627 ALTW	0.93	1.10	1.0138	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
631127	HAYWD#15 161	627 ALTW	0.93	1.10	1.0139	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
631174	GLENWRTH5 161	627 ALTW	0.93	1.10	0.9954	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
631202	COLBY5 161	627 ALTW	0.93	1.10	1.0033	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range

2025 Shoulder Case - J407 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
680235	LONDON 69	680 DPC	0.90	1.10	1.0089	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
680277	GLENVILL 69	680 DPC	0.90	1.10	1.0150	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
680542	GLENWTH8 69	680 DPC	0.90	1.10	1.0152	J407-OUTLET2 631174 [GLENWRTH5 161.00] TO 631044 [HAYWD#25 161.00] 1	voltage is within range
6001	J407 POI 161	627 ALTW	0.93	1.10	1.0074	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
6002	J407 COL1 34.5	627 ALTW	0.93	1.10	0.9947	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
6003	J407 COL2 34.5	627 ALTW	0.93	1.10	0.9947	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
6004	J407 G1 0.69	627 ALTW	0.93	1.10	0.9935	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
6005	J407 G2 0.7	627 ALTW	0.93	1.10	0.9935	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
613042	MURPHY CR 5 161	613 SMMPA	0.90	1.10	1.0075	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
630128	HAYWD#18 69	627 ALTW	0.93	1.10	1.0145	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
630129	HAYWD#28 69	627 ALTW	0.93	1.10	1.0145	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
631036	NIW 5 161	627 ALTW	0.93	1.10	1.0069	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
631044	HAYWD#25 161	627 ALTW	0.93	1.10	1.0081	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
631127	HAYWD#15 161	627 ALTW	0.93	1.10	1.0081	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
631174	GLENWRTH5 161	627 ALTW	0.93	1.10	1.0075	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
631202	COLBY5 161	627 ALTW	0.93	1.10	1.0082	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
680235	LONDON 69	680 DPC	0.90	1.10	1.0064	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range

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2025 Shoulder Case - J407 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
680277	GLENVILL 69	680 DPC	0.90	1.10	1.0078	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range
680542	GLENWTH8 69	680 DPC	0.90	1.10	1.0080	J407-OUTLET3 631174 [GLENWRTH5 161.00] TO 680542 [GLENWTH8 69.000] 1	voltage is within range

2025 Shoulder Case - J411 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
6201	J411 POI 345.00	635 MEC	1.00	1.05	1.0237	System Intact	voltage is within range
6202	J411 COL1 34.500	635 MEC	1.00	1.05	1.0110	System Intact	voltage is within range
6203	J411 COL2 34.500	635 MEC	1.00	1.05	1.0110	System Intact	voltage is within range
6204	J411 G1 0.7000	635 MEC	1.00	1.05	1.0099	System Intact	voltage is within range
6205	J411 G2 0.7000	635 MEC	1.00	1.05	1.0099	System Intact	voltage is within range
635200	RAUN 3 345.00	635 MEC	1.00	1.05	1.0300	System Intact	voltage is within range
635201	RAUN 5 161.00	635 MEC	0.95	1.05	1.0268	System Intact	voltage is within range
635205	RAUN1XT9 13.800	635 MEC	1.00	1.05	1.0276	System Intact	voltage is within range
635213	NEAL 3G 22.000	635 MEC	1.00	1.05	0.9938	System Intact	Low Voltage Violation
635214	NEAL 4G 24.000	635 MEC	1.00	1.05	1.0232	System Intact	voltage is within range
635400	HIGHLND 3 345.00	635 MEC	1.00	1.05	1.0225	System Intact	voltage is within range
635600	GRIMES 3 345.00	635 MEC	0.96	1.05	1.0121	System Intact	voltage is within range
636000	WEBSTER3 345.00	635 MEC	0.96	1.05	1.0109	System Intact	voltage is within range
636010	LEHIGH 3 345.00	635 MEC	1.00	1.05	1.0100	System Intact	voltage is within range
636011	LGR425 9 34.500	635 MEC	1.00	1.05	1.0235	System Intact	voltage is within range
636012	LGR415 9 34.500	635 MEC	1.00	1.05	1.0249	System Intact	voltage is within range
640226	HOSKINS3 345.00	640 NPPD	0.95	1.05	1.0353	System Intact	voltage is within range
645451	S3451 3 345.00	645 OPPD	0.95	1.05	1.0272	System Intact	voltage is within range
652564	SIOUXCY3 345.00	652 WAPA	0.95	1.05	1.0247	System Intact	voltage is within range
6201	J411 POI 345.00	635 MEC	1.00	1.05	1.0015	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
6202	J411 COL1 34.500	635 MEC	1.00	1.05	0.9877	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	Low Voltage Violation
6203	J411 COL2 34.500	635 MEC	1.00	1.05	0.9877	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	Low Voltage Violation
6204	J411 G1 0.7000	635 MEC	1.00	1.05	0.9865	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	Low Voltage Violation
6205	J411 G2 0.7000	635 MEC	1.00	1.05	0.9865	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	Low Voltage Violation
635200	RAUN 3 345.00	635 MEC	1.00	1.05	1.0300	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
635201	RAUN 5 161.00	635 MEC	0.93	1.05	1.0266	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
635205	RAUN1XT9 13.800	635 MEC	1.00	1.05	1.0273	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
635213	NEAL 3G 22.000	635 MEC	1.00	1.05	0.9935	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	Low Voltage Violation
635214	NEAL 4G 24.000	635 MEC	1.00	1.05	1.0226	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
635400	HIGHLND 3 345.00	635 MEC	1.00	1.05	1.0224	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
635600	GRIMES 3 345.00	635 MEC	0.94	1.05	1.0112	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
636000	WEBSTER3 345.00	635 MEC	0.94	1.05	1.0087	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
636010	LEHIGH 3 345.00	635 MEC	1.00	1.05	1.0066	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
636011	LGR425 9 34.500	635 MEC	1.00	1.05	1.0201	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
636012	LGR415 9 34.500	635 MEC	1.00	1.05	1.0215	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
640226	HOSKINS3 345.00	640 NPPD	0.90	1.10	1.0358	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range

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2025 Shoulder Case - J411 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
645451	S3451 3 345.00	645 OPPD	0.90	1.10	1.0276	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
652564	SIOUXCY3 345.00	652 WAPA	0.90	1.10	1.0245	J411-OUTLET-1 6201 [J411 POI 345.00] TO 635200 [RAUN 3 345.00] 1	voltage is within range
6201	J411 POI 345.00	635 MEC	1.00	1.05	1.0266	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
6202	J411 COL1 34.500	635 MEC	1.00	1.05	1.0141	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
6203	J411 COL2 34.500	635 MEC	1.00	1.05	1.0141	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
6204	J411 G1 0.7000	635 MEC	1.00	1.05	1.0129	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
6205	J411 G2 0.7000	635 MEC	1.00	1.05	1.0129	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
635200	RAUN 3 345.00	635 MEC	1.00	1.05	1.0300	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
635201	RAUN 5 161.00	635 MEC	0.93	1.05	1.0272	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
635205	RAUN1XT9 13.800	635 MEC	1.00	1.05	1.0281	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
635213	NEAL 3G 22.000	635 MEC	1.00	1.05	0.9944	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	Low Voltage Violation
635214	NEAL 4G 24.000	635 MEC	1.00	1.05	1.0244	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
635400	HIGHLND 3 345.00	635 MEC	1.00	1.05	1.0227	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
635600	GRIMES 3 345.00	635 MEC	0.94	1.05	1.0130	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
636000	WEBSTER3 345.00	635 MEC	0.94	1.05	1.0092	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
636010	LEHIGH 3 345.00	635 MEC	1.00	1.05	1.0091	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
636011	LGR425 9 34.500	635 MEC	1.00	1.05	1.0227	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
636012	LGR415 9 34.500	635 MEC	1.00	1.05	1.0240	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
640226	HOSKINS3 345.00	640 NPPD	0.90	1.10	1.0340	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
645451	S3451 3 345.00	645 OPPD	0.90	1.10	1.0262	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range
652564	SIOUXCY3 345.00	652 WAPA	0.90	1.10	1.0252	J411-OUTLET-2 6201 [J411 POI 345.00] TO 636010 [LEHIGH 3 345.00] 1	voltage is within range

2025 Shoulder Case - J416 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
31199	J416 POI 345.00	627 ALTW	0.95	1.05	0.9986	System Intact	voltage is within range
32000	J416 345 345.00	627 ALTW	0.95	1.05	0.9983	System Intact	voltage is within range
32001	J416 34.5 1 34.500	627 ALTW	0.95	1.05	0.9921	System Intact	**voltage is within range**
32002	J416 34.5 2 34.500	627 ALTW	0.95	1.05	0.9921	System Intact	**voltage is within range**
631048	EMERY 5 161.00	627 ALTW	0.95	1.05	1.0200	System Intact	voltage is within range
631139	HAZLTON3 345.00	627 ALTW	0.95	1.05	0.9907	System Intact	voltage is within range
631198	COLBY3 345.00	627 ALTW	0.95	1.05	1.0120	System Intact	voltage is within range
631199	KILLDEER3 345.00	627 ALTW	0.95	1.05	1.0071	System Intact	voltage is within range
636199	BLACKHAWK 3 345.00	635 MEC	0.96	1.05	0.9882	System Intact	voltage is within range
636200	BLKHAWK5 161.00	635 MEC	0.95	1.05	0.9888	System Intact	voltage is within range
31199	J416 POI 345.00	627 ALTW	0.93	1.10	1.0142	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	voltage is within range
32000	J416 345 345.00	627 ALTW	0.93	1.10	1.0134	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	voltage is within range
32001	J416 34.5 1 34.500	627 ALTW	0.93	1.10	0.9975	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	**voltage is within range**
32002	J416 34.5 2 34.500	627 ALTW	0.93	1.10	0.9975	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	**voltage is within range**
631048	EMERY 5 161.00	627 ALTW	0.93	1.10	1.0200	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	voltage is within range
631139	HAZLTON3 345.00	627 ALTW	0.93	1.10	0.9867	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	voltage is within range
631198	COLBY3 345.00	627 ALTW	0.93	1.10	1.0187	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	voltage is within range
631199	KILLDEER3 345.00	627 ALTW	0.93	1.10	1.0157	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	voltage is within range
636199	BLACKHAWK 3 345.00	635 MEC	0.94	1.05	0.9838	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	voltage is within range
636200	BLKHAWK5 161.00	635 MEC	0.93	1.05	0.9747	J416-OUTLET1 31199 [J416 POI 345.00] TO 636199 [BLACKHAWK 3 345.00] 1	voltage is within range
31199	J416 POI 345.00	627 ALTW	0.93	1.10	0.9989	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	voltage is within range
32000	J416 345 345.00	627 ALTW	0.93	1.10	0.9986	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	voltage is within range
32001	J416 34.5 1 34.500	627 ALTW	0.93	1.10	0.9922	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	**voltage is within range**
32002	J416 34.5 2 34.500	627 ALTW	0.93	1.10	0.9922	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	**voltage is within range**

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2025 Shoulder Case - J416 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
631048	EMERY 5 161.00	627 ALTW	0.93	1.10	1.0200	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	voltage is within range
631139	HAZLTON3 345.00	627 ALTW	0.93	1.10	0.9930	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	voltage is within range
631198	COLBY3 345.00	627 ALTW	0.93	1.10	1.0209	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	voltage is within range
631199	KILLDEER3 345.00	627 ALTW	0.93	1.10	1.0184	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	voltage is within range
636199	BLACKHAWK 3 345.00	635 MEC	0.94	1.05	0.9941	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	voltage is within range
636200	BLKHAWK5 161.00	635 MEC	0.93	1.05	0.9854	J416-OUTLET2 31199 [J416 POI 345.00] TO 631199 [KILLDEER3 345.00] 1	voltage is within range

2025 Shoulder Case - J426 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
5673	J426_PPC 34.500	600 XEL	0.95	1.05	0.9901	System Intact	voltage is within range
5674	J426 34.5 34.500	600 XEL	0.95	1.05	1.0142	System Intact	voltage is within range
600090	G397 THLEN W0.7000	600 XEL	0.95	1.05	0.9996	System Intact	voltage is within range
600091	CHB341_2W 0.5000	600 XEL	0.95	1.05	0.9985	System Intact	voltage is within range
600154	BOEVE FEY W 0.7000	600 XEL	0.95	1.05	0.9957	System Intact	voltage is within range
603013	PIPESTN7 115.00	600 XEL	0.95	1.05	1.0084	System Intact	voltage is within range
603180	CHANRMB7 115.00	600 XEL	0.95	1.05	1.0168	System Intact	voltage is within range
603195	FENTON 7 115.00	600 XEL	0.95	1.05	1.0114	System Intact	voltage is within range
605653	CHANARAMBIE134.500	600 XEL	0.95	1.05	0.9885	System Intact	voltage is within range
605674	CHANARAMBIE434.500	600 XEL	0.95	1.05	0.9900	System Intact	voltage is within range
605682	CHANARAMBIE234.500	600 XEL	0.95	1.05	0.9881	System Intact	voltage is within range
605683	CHB341 34.500	600 XEL	0.95	1.05	0.9953	System Intact	voltage is within range
618905	GRE-ELLSBOR7115.00	600 XEL	0.95	1.05	1.0158	System Intact	voltage is within range
5673	J426_PPC 34.500	600 XEL	0.92	1.05	0.9901	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
5674	J426 34.5 34.500	600 XEL	0.92	1.05	1.0157	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
600090	G397 THLEN W0.7000	600 XEL	0.95	1.05	0.9996	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
600091	CHB341_2W 0.5000	600 XEL	0.95	1.05	0.9985	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
600154	BOEVE FEY W 0.7000	600 XEL	0.95	1.05	0.9957	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
603013	PIPESTN7 115.00	600 XEL	0.92	1.05	1.0082	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
603180	CHANRMB7 115.00	600 XEL	0.92	1.05	1.0165	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
603195	FENTON 7 115.00	600 XEL	0.92	1.05	1.0113	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
605653	CHANARAMBIE134.500	600 XEL	0.92	1.05	0.9883	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
605674	CHANARAMBIE434.500	600 XEL	0.92	1.05	0.9900	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
605682	CHANARAMBIE234.500	600 XEL	0.92	1.05	0.9879	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
605683	CHB341 34.500	600 XEL	0.92	1.05	0.9953	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range
618905	GRE-ELLSBOR7115.00	600 XEL	0.92	1.05	1.0157	J426-OUTLET-1 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 3	voltage is within range

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2025 Shoulder Case - J426 Reactive Power Requirement Analysis Results

Bus#	Bus Name	Area	Voltage Low Limit	Voltage High Limit	Voltage in studycase (with Qlimits set at 0 MVAR)	Contingency	Comments
5673	J426_PPC 34.500	600 XEL	0.92	1.05	0.9901	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
5674	J426 34.5 34.500	600 XEL	0.92	1.05	1.0157	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
600090	G397 THLEN W0.7000	600 XEL	0.95	1.05	0.9996	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
600091	CHB341_2W 0.5000	600 XEL	0.95	1.05	0.9985	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
600154	BOEVE FEY W 0.7000	600 XEL	0.95	1.05	0.9957	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
603013	PIPESTN7 115.00	600 XEL	0.92	1.05	1.0082	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
603180	CHANRMB7 115.00	600 XEL	0.92	1.05	1.0165	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
603195	FENTON 7 115.00	600 XEL	0.92	1.05	1.0113	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
605653	CHANARAMBIE134.500	600 XEL	0.92	1.05	0.9883	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
605674	CHANARAMBIE434.500	600 XEL	0.92	1.05	0.9900	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
605682	CHANARAMBIE234.500	600 XEL	0.92	1.05	0.9879	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
605683	CHB341 34.500	600 XEL	0.92	1.05	0.9953	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range
618905	GRE-ELLSBOR7115.00	600 XEL	0.92	1.05	1.0157	J426-OUTLET-2 605674 [CHANARAMBIE4 34.5] TO 603180 [CHANRMB7 115.00] 4	voltage is within range

Appendix
D

2018 Contingency Analysis Results

D.1 2018 Summer Shoulder (SH) Constraints

Table D-1: 2018 SH System Intact Thermal Constraints

Table D-2: 2018 SH System Intact Voltage Constraints

Table D-3: 2018 SH Category P1-P7 Thermal Constraints

Table D-4: 2018 SH Category P1-P7 Voltage Constraints

Table D-5: 2018 SH Non-Converged Category P2-P7 Contingencies

Table D-6: 2018 SH Non-Converged Category P2-P7 Contingencies DCCC Results

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Table D-1: 2018 SH System Intact Thermal Constraints

Monitored Element	Rating	Owner	Benchmark Case		Study Case		Contingency label	Contingency	Type	J299 ST	J299 CT	G736	J385	J391	J400	J405	J407	J411	J416	J426	DF>5%	MW>20%*Rating	Outlet Con.	Outlet Mon.	Summary
			Pre Loading (MVA)	Pre Loading (%)	Post Loading (MVA)	Post Loading (%)				5	31.5	200	0	0	0	0	200	300	200	100	GIP With Impact-1	GIP With Impact-2	GIP With Impact-3	GIP With Impact-4	GIP With Impact
										ER	ER	NR	NR	NR	NR	NR	NR	NR	NR	NR					
No constraints																									

Table D-2: 2018 SH System Intact Voltage Constraints

Bus	Area	Vlow	Vhi	Benchmark	StudyCase	Delta (> 0.01 p.u.)	Contingency Details	Cont Type
				VCONT	VCONT			
No constraints								

Table D-3: 2018 SH Category P1-P7 Thermal Constraints

Monitored Element	Rating	Owner	Benchmark Case		Study Case		Contingency label	Contingency	Type	J299 ST	J299 CT	G736	J385	J391	J400	J405	J407	J411	J416	J426	DF>20%	MW>20%*Rating	Outlet Con.	Outlet Mon.	Summary
			Pre Loading (MVA)	Pre Loading (%)	Post Loading (MVA)	Post Loading (%)				5	31.5	200	0	0	0	0	200	300	200	100	GIP With Impact-1	GIP With Impact-2	GIP With Impact-3	GIP With Impact-4	GIP With Impact
										ER	ER	NR	NR	NR	NR	NR	NR	NR	NR	NR					
613210 OWATANA1 69.0 630116 PRAT T 8 69.0 1	45.0	ITCM	42.2	93.7	50.5	112.2	P42:161:ITCM:COLBY5-NI	NIW 5 161 - COLBY5 161 1 LIME CK5 161 - COLBY5 161 1	P4-2	-0.00391	-0.00546	-0.00359	-0.00518	-0.00322	-0.00325	-0.00301	0.04678	0.00018	0.00323	-0.00172		J407,			J407,
613210 OWATANA1 69.0 630116 PRAT T 8 69.0 1	45.0	ITCM	41.8	92.9	50.1	111.4	P42:161:ITCM:COLBY5-NI	NIW 5 161 - COLBY5 161 1 COLBY3 345 - COLBY5 161 1	P4-2	-0.00394	-0.00550	-0.00361	-0.00522	-0.00324	-0.00327	-0.00303	0.04662	0.00022	0.00332	-0.00174		J407,			J407,
613210 OWATANA1 69.0 630116 PRAT T 8 69.0 1	45.0	ITCM	41.5	92.2	49.8	110.7	631036 NIW 5 16	NIW 5 161 - COLBY5 161 1	P1	-0.00397	-0.00552	-0.00363	-0.00524	-0.00326	-0.00329	-0.00304	0.04655	0.00020	0.00369	-0.00176		J407,			J407,
629990 ELLENDALE5 69.0 630131 STELCTR8 69.0 1	45.0	ITCM	43.8	97.3	52.1	115.7	P42:161:ITCM:COLBY5-NI	NIW 5 161 - COLBY5 161 1 LIME CK5 161 - COLBY5 161 1	P4-2	-0.00391	-0.00546	-0.00359	-0.00518	-0.00322	-0.00325	-0.00301	0.04678	0.00018	0.00323	-0.00172		J407,			J407,
629990 ELLENDALE5 69.0 630131 STELCTR8 69.0 1	45.0	ITCM	43.4	96.5	51.7	115.0	P42:161:ITCM:COLBY5-NI	NIW 5 161 - COLBY5 161 1 COLBY3 345 - COLBY5 161 1	P4-2	-0.00394	-0.00550	-0.00361	-0.00522	-0.00324	-0.00327	-0.00303	0.04662	0.00022	0.00332	-0.00174		J407,			J407,
629990 ELLENDALE5 69.0 630131 STELCTR8 69.0 1	45.0	ITCM	43.1	95.7	51.4	114.2	631036 NIW 5 16	NIW 5 161 - COLBY5 161 1	P1	-0.00397	-0.00552	-0.00363	-0.00524	-0.00326	-0.00329	-0.00304	0.04655	0.00020	0.00369	-0.00176		J407,			J407,
630116 PRAT T 8 69.0 630131 STELCTR8 69.0 1	45.0	ITCM	43.2	96.0	51.5	114.5	P42:161:ITCM:COLBY5-NI	NIW 5 161 - COLBY5 161 1 LIME CK5 161 - COLBY5 161 1	P4-2	-0.00391	-0.00546	-0.00359	-0.00518	-0.00322	-0.00325	-0.00301	0.04678	0.00018	0.00323	-0.00172		J407,			J407,
630116 PRAT T 8 69.0 630131 STELCTR8 69.0 1	45.0	ITCM	42.8	95.2	51.1	113.7	P42:161:ITCM:COLBY5-NI	NIW 5 161 - COLBY5 161 1 COLBY3 345 - COLBY5 161 1	P4-2	-0.00394	-0.00550	-0.00361	-0.00522	-0.00324	-0.00327	-0.00303	0.04662	0.00022	0.00332	-0.00174		J407,			J407,
630116 PRAT T 8 69.0 630131 STELCTR8 69.0 1	45.0	ITCM	42.5	94.4	50.8	113.0	631036 NIW 5 16	NIW 5 161 - COLBY5 161 1	P1	-0.00397	-0.00552	-0.00363	-0.00524	-0.00326	-0.00329	-0.00304	0.04655	0.00020	0.00369	-0.00176		J407,			J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	126.5	63.2	273.4	136.7	P22:161:ITCM:HAYWD#25	HAYWD#25 161 - HAYWD#15 161 1 HAYWD#25 161 - GLENWRTH5 161 1 MURPHY CR 5 161 - HAYWD#25 161 1 HAYWD#28 69.0 - HAYWD#25 161 1	P2-2	0.01263	0.01416	0.00813	0.00904	0.00903	0.00908	0.00647	0.76268	-0.00154	-0.05023	0.00911	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	126.5	63.2	273.4	136.7	P13:161-69:ITCM:HAYWD#	HAYWD#25 161 - HAYWD#15 161 1 HAYWD#25 161 - GLENWRTH5 161 1 MURPHY CR 5 161 - HAYWD#25 161 1 HAYWD#28 69.0 - HAYWD#25 161 1	P1	0.01263	0.01416	0.00813	0.00904	0.00903	0.00908	0.00647	0.76268	-0.00154	-0.05023	0.00911	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	126.5	63.2	273.4	136.7	ITCM-B110-NW	HAYWD#28 69.0 - HAYWD#25 161 1 HAYWD#25 161 - GLENWRTH5 161 1 MURPHY CR 5 161 - HAYWD#25 161 1	P1	0.01263	0.01416	0.00813	0.00904	0.00903	0.00908	0.00647	0.76268	-0.00154	-0.05023	0.00911	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	118.1	59.0	269.7	134.8	ITCM-C218-NW	HAYWD#15 161 - FREEBORN5 161 1 HAYWD#18 69.0 - HAYWD#15 161 1 HAYWD#25 161 - HAYWD#15 161 1 ADAMS_S5 161 - HAYWD#15 161 1 HAYWD#25 161 - GLENWRTH5 161 1 MURPHY CR 5 161 - HAYWD#25 161 1 HAYWD#28 69.0 - HAYWD#25 161 1	P4	0.01191	0.01359	0.00759	0.00838	0.00842	0.00847	0.00602	0.78703	-0.00138	-0.04511	0.00843	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	124.1	62.1	268.0	134.0	631044 HAYWD#25 16	HAYWD#25 161 - GLENWRTH5 161 1	P1	0.01175	0.01303	0.00806	0.00979	0.00868	0.00873	0.00637	0.75198	-0.00241	-0.05218	0.00826	J407,	J407,	J407-Outlet2		J407, J407, J407-Outlet2
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	186.4	93.2	247.7	123.8	631139 HAZLTON3 34	HAZLTON3 345 - MITCHLCO3 345 1	P1	0.04998	0.05315	0.03950	0.04861	0.04092	0.04112	0.03290	0.38113	-0.00099	-0.14660	0.03755	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	186.7	93.3	245.7	122.8	ITCM-C939-LN	HAZLTON3 345 - MITCHLCO3 345 1 SALEM 3 345 - ROCK CK3 345 1	P6	0.04891	0.05207	0.03852	0.04769	0.03990	0.04010	0.03197	0.37935	-0.00208	-0.14942	0.03651	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	189.5	94.8	236.4	118.2	P24:161:ITCM:LIME CK5	LIME CK5 161 - EMERY 5 161 2 LIME CK5 161 - BARTON5 161 1 LIME CK5 161 - COLBY5 161 1 LIME CK5 161 - CLKREACT5 161 1 LMCK W 8 69.0 - LIME CK5 161 1 LMCK E 8 69.0 - LIME CK5 161 1	P2-4	0.03802	0.04104	0.02876	0.03636	0.02996	0.03012	0.02345	0.35148	-0.00614	-0.16807	0.02742	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	165.4	82.7	226.9	113.5	P55:345:ITCM:MITCHLCO3	MITCHLCO3 345 - G172_G1 34.5 1 MITCHLCO3 345 - G172_G2 34.5 1 ADAMS 3 345 - MITCHLCO3 345 1 HAZLTON3 345 - MITCHLCO3 345 1	P5-5	0.05052	0.05369	0.04004	0.04915	0.04146	0.04166	0.03344	0.38168	-0.00045	-0.14606	0.03809	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	169.8	84.9	226.9	113.4	P23:345:ITCM:HAZLTON3	HAZLTON3 345 - HCKRYCK3 345 1 HAZLTON3 345 - MITCHLCO3 345 1	P2-3	0.04783	0.05097	0.03764	0.04685	0.03895	0.03915	0.03118	0.37598	-0.00292	-0.15689	0.03552	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	170.2	85.1	222.5	111.3	P22:161:ITCM:LIME CK5	LMCK W 8 69.0 - LIME CK5 161 1 LIME CK5 161 - COLBY5 161 1 LIME CK5 161 - CLKREACT5 161 1	P2-2	0.03499	0.03789	0.02573	0.03118	0.02721	0.02735	0.02108	0.35177	-0.00366	-0.14892	0.02571	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	170.3	85.1	222.5	111.3	P13:161-69:ITCM:LIME C	LMCK W 8 69.0 - LIME CK5 161 1 LIME CK5 161 - COLBY5 161 1 LIME CK5 161 - CLKREACT5 161 1 CRYSTLK5 161 - CLKREACT5 161 1 G735_WF5 34.5 - CRYSTLKII5 161 1 CRYSTLK5 161 - CRYSTLKII5 161 1 G595_WF9 34.5 - CRYSTLK5 161 1	P1	0.03499	0.03789	0.02573	0.03118	0.02721	0.02735	0.02108	0.35177	-0.00366	-0.14892	0.02571	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	166.7	83.4	222.5	111.2	631155 CRYSTLK5 16	CRYSTLK5 161 - CLKREACT5 161 1	P1	0.03479	0.03772	0.02540	0.03027	0.02697	0.02711	0.02090	0.36678	-0.00284	-0.13574	0.02576	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	166.5	83.2	222.0	111.0	631047 LIME CK5 16	LIME CK5 161 - CLKREACT5 161 1	P1	0.03479	0.03772	0.02540	0.03027	0.02697	0.02711	0.02090	0.36678	-0.00284	-0.13574	0.02576	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	155.8	77.9	218.6	109.3	P23:345:GRE:PVS 19JB3	ADAMS 3 345 - GRE-PL VLLY3 345 1 ADAMS 3 345 - ADAMS 5 161 - ADAMS1 9 13.8 9 GRE-PL VLLY3 345 - GRE-PL VLLY5 161 - GRE-PL VLL1T13.8 1	P2-3	0.04931	0.05255	0.03869	0.04726	0.04020	0.04039	0.03229	0.38587	-0.00044	-0.14380	0.03718	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	155.8	77.9	218.7	109.3	P23:345:GRE:PVS 19JB2	GRE-PL VLLY3 345 - GRE-PL VLLY5 161 - GRE-PL VLL2T13.8 2 ADAMS 3 345 - GRE-PL VLLY3 345 1 ADAMS 3 345 - ADAMS 5 161 - ADAMS1 9 13.8 9	P2-3	0.04929	0.05254	0.03867	0.04724	0.04018	0.04037	0.03227	0.38594	-0.00044	-0.14377	0.03717	J407,	J407,			J407, J407,

Table D-3: 2018 SH Category P1-P7 Thermal Constraints

Monitored Element	Rating	Owner	Benchmark Case		Study Case		Contingency label	Contingency	Type	J299 ST	J299 CT	G736	J385	J391	J400	J405	J407	J411	J416	J426	DF>20%	MW>20%*Rating	Outlet Con.	Outlet Mon.	Summary
			Pre Loading (MVA)	Pre Loading (%)	Post Loading (MVA)	Post Loading (%)				5	31.5	200	0	0	0	0	200	300	200	100	GIP With Impact-1	GIP With Impact-2	GIP With Impact-3	GIP With Impact-4	GIP With Impact
										ER	ER	NR	NR	NR	NR	NR	NR	NR	NR	NR					
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	154.2	77.1	216.7	108.4	P22:345:XEL:ADAMS 3 N1	ADAMS 3 345 - GRE-PL VLLY3 345 1 ADAMS 5 161 - ADAMS_N5 161 1 ADAMS 5 161 - ADAMS_S5 161 1 ADAMS 3 345 - ADAMS 5 161 - ADAMS1 9 13.8 9 REMOVE SWSHUNT FROM BUS 601002	P2-2	0.04961	0.05281	0.03905	0.04778	0.04053	0.04073	0.03260	0.38447	-0.00044	-0.14437	0.03741	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	154.1	77.1	216.7	108.3	B2.ADM-PVS AS	ADAMS 3 345 - ADAMS 5 161 - ADAMS1 9 13.8 9 ADAMS 3 345 - GRE-PL VLLY3 345 1	P1	0.04960	0.05281	0.03905	0.04777	0.04053	0.04072	0.03260	0.38447	-0.00044	-0.14436	0.03741	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	154.1	77.0	216.6	108.3	P12:345:XEL-ITC:AMD-PV	ADAMS 3 345 - GRE-PL VLLY3 345 1 ADAMS 3 345 - MITCHLCO3 345 1 ADAMS 3 345 - ADAMS 5 161 - ADAMS1 9 13.8 9	P1	0.04960	0.05281	0.03905	0.04777	0.04053	0.04072	0.03260	0.38447	-0.00044	-0.14436	0.03741	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	153.8	76.9	209.5	104.8	GENS: EMERYST1 + G735_	REMOVE UNIT 1 FROM BUS EMERYST1 18.0 REMOVE UNIT 1 FROM BUS G735_WF5 34.5	P3	0.03479	0.03772	0.02540	0.03027	0.02697	0.02711	0.02090	0.36678	-0.00284	-0.13574	0.02576	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	152.9	76.4	208.2	104.1	GENS: ARNOLD1G + G735_	REMOVE UNIT 1 FROM BUS ARNOLD1G 22.0 REMOVE UNIT 1 FROM BUS G735_WF5 34.5	P3	0.03479	0.03772	0.02540	0.03027	0.02697	0.02711	0.02090	0.36678	-0.00284	-0.13574	0.02576	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	146.0	73.0	201.5	100.7	GENS: OTTUMW1G + G735_	REMOVE UNIT 1 FROM BUS OTTUMW1G 24.0 REMOVE UNIT 1 FROM BUS G735_WF5 34.5	P3	0.03479	0.03772	0.02540	0.03027	0.02697	0.02711	0.02090	0.36678	-0.00284	-0.13574	0.02576	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	145.4	72.7	201.0	100.5	GENS: LOUIS31G + G735_	REMOVE UNIT 1 FROM BUS LOUIS31G 24.0 REMOVE UNIT 1 FROM BUS G735_WF5 34.5	P3	0.03479	0.03772	0.02540	0.03027	0.02697	0.02711	0.02090	0.36678	-0.00284	-0.13574	0.02576	J407,	J407,			J407, J407,

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Table D-4: 2018 SH Category P1-P7 Voltage Constraints

Bus	Area	Vlow	Vhi	Benchmark VCONT	StudyCase VCONT	Delta (> 0.01 p.u.)	Contingency Details	Cont Type
No constraints								

Table D-5: 2018 SH Non-Converged Category P2-P7 Contingencies

Contingency	Contingency Details	Benchmark	Study
CIPC-56	631069 [ANTA TP5 161.00] TO 631070 [ANITA 5 161.00] 1 631071 [SCRANTN5 161.00] TO 631072 [GU CTR 5 161.00] 1	Blown up	Blown up
CIPC-57	631069 [ANTA TP5 161.00] TO 631070 [ANITA 5 161.00] 1 631071 [SCRANTN5 161.00] TO 631074 [GR JCT 5 161.00] 1	Blown up	Blown up
ITCM-C925-LN	618900 [GRE-BREWSTR5161.00] TO 631040 [HRN LK 5 161.00] 1 602005 [SPLT RK5 161.00] TO 602039 [ROCK CO5 161.00] 1 602039 [ROCK CO5 161.00] TO 605618 [ROCKCOFDR1_134.500] 1	Blown up	Blown up
ITCM-C927-LN	631069 [ANTA TP5 161.00] TO 631070 [ANITA 5 161.00] 1 631071 [SCRANTN5 161.00] TO 631072 [GU CTR 5 161.00] 1 629111 [SCRANTN9 34.500] TO 631071 [SCRANTN5 161.00] 1 631071 [SCRANTN5 161.00] TO 631074 [GR JCT 5 161.00] 1	Blown up	Blown up
ITCM-C932-LN	602039 [ROCK CO5 161.00] TO 631038 [MAGNLIA5 161.00] 1 630056 [MAGNLIA8 69.000] TO 631038 [MAGNLIA5 161.00] 1 631038 [MAGNLIA5 161.00] TO 631039 [ELK 5 161.00] 1 631040 [HRN LK 5 161.00] TO 631041 [LAKEFLD5 161.00] 1 630066 [HERONLK8 69.000] TO 631040 [HRN LK 5 161.00] 2	Blown up	Blown up
ITCM-C938-LN	631104 [EIC 5 161.00] TO 631134 [TRICNTY5 161.00] 1 631115 [OTTUMWA5 161.00] TO 631116 [BRDGPRT5 161.00] 1	Blown up	Blown up

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Table D-6: 2018 SH Non-Converged Category P2-P7 Contingencies DCCC Results

Monitored Element	Rating	Owner	Benchmark Case		Study Case		Contingency label	Contingency	Type	J299 ST	J299 CT	G736	J385	J391	J400	J405	J407	J411	J416	J426	DF>20%	MW>20%*Rating	Outlet Con.	Outlet Mon.	Summary
			Pre Loading (MVA)	Pre Loading (%)	Post Loading (MVA)	Post Loading (%)				5	31.5	200	0	0	0	0	200	300	200	100	GIP With Impact-1	GIP With Impact-2	GIP With Impact-3	GIP With Impact-4	GIP With Impact
										ER	ER	NR	NR	NR	NR	NR	NR	NR	NR	NR					
No constraints																									

D.2 2018 Summer Peak (SPK) Constraints

Table D-7: 2018 SPK System Intact Thermal Constraints

Table D-8: 2018 SPK System Intact Voltage Constraints

Table D-9: 2018 SPK Category P1-P7 Thermal Constraints

Table D-10: 2018 SPK Category P1-P7 Voltage Constraints

Table D-11: 2018 SPK Non-Converged Category P2-P7 Contingencies

Table D-12: 2018 SPK Non-Converged Category P2-P7 Contingencies DCCC Results

Table D-7: 2018 SPK System Intact Thermal Constraints

Monitored Element	Rating (A)	Owner	Benchmark Case		Study Case		Contingency label	Contingency	Type	J299 ST	J299 CT	G736	J385	J391	J400	J405	J407	J411	J416	J426	DF>5%	MW>20%*Rating	Outlet Con.	Outlet Mon.	Summary
			Pre Loading (MVA)	Pre Loading (%)	Post Loading (MVA)	Post Loading (%)				10	63	40	100	50	62.5	40	40	60	40	20	GIP With Impact-1	GIP With Impact-2	GIP With Impact-3	GIP With Impact-4	GIP With Impact
										ER	ER	NR	NR	NR	NR	NR	NR	NR	NR	NR					
No constraints																									

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Table D-8: 2018 SPK System Intact Voltage Constraints

Bus	Area	Vlow	Vhi	Benchmark VCONT	StudyCase VCONT	Delta (> 0.01 p.u.)	Contingency Details	Cont Type
No constraints								

Table D-9: 2018 SPK Category P1-P7 Thermal Constraints

Monitored Element	Rating	Owner	Benchmark Case		Study Case		Contingency label	Contingency	Type	J299 ST	J299 CT	G736	J385	J391	J400	J405	J407	J411	J416	J426	DF>20%	MW>20%*Rating	Outlet Con.	Outlet Mon.	Summary
			Pre Loading (MVA)	Pre Loading (%)	Post Loading	Post Loading (%)				10	63	40	100	50	62.5	40	40	60	40	20	GIP With Impact-1	GIP With Impact-2	GIP With Impact-3	GIP With Impact-4	GIP With Impact
										ER	ER	NR	NR	NR	NR	NR	NR	NR	NR	NR					
603002 WILMART7 115 603003 SWAN LK7 115 1	116.9	XEL	116.2	99.4	119.4	102.2	601050 HELENA 3 34	HELENA 3 345 - SHEAS LK3 345 1	P1	0.08342	0.10663	-0.02366	-0.01867	-0.02257	-0.02265	-0.01239	0.00788	0.01358	0.00422	0.00213				J299-Outlet1	J299-Outlet1
603002 WILMART7 115 603003 SWAN LK7 115 1	116.9	XEL	116.3	99.5	119.1	101.9	P23:345:XEL:8S72 HNA	HELENA 3 345 - GRE-CHUBLAK3 345 1 HELENA 3 345 - SHEAS LK3 345 1	P2-3	0.08280	0.10605	-0.02508	-0.01867	-0.02473	-0.02490	-0.01334	0.00833	0.01309	0.00455	0.00060				J299-Outlet1	J299-Outlet1
603002 WILMART7 115 603003 SWAN LK7 115 1	116.9	XEL	114.8	98.2	118.0	101.0	P23:345:XEL:8S82 SSL	SHEAS LK3 345 - SHEAS LK 7 115 - SHEAS LK9 34.5 9 SHEAS LK 7 115 - SHEAS LK8 69.0 5 WILMART3 345 - SHEAS LK3 345 1 HELENA 3 345 - SHEAS LK3 345 1	P2-3	0.08325	0.10704	-0.02365	-0.01864	-0.02257	-0.02265	-0.01239	0.00789	0.01355	0.00423	0.00211				J299-Outlet1	J299-Outlet1
603002 WILMART7 115 603003 SWAN LK7 115 1	116.9	XEL	114.8	98.2	118.0	101.0	P23:345:XEL:8S81 SSL	SHEAS LK3 345 - SHEAS LK 7 115 - SHEAS LK9 34.5 9 WILMART3 345 - SHEAS LK3 345 1 HELENA 3 345 - SHEAS LK3 345 1	P2-3	0.08325	0.10704	-0.02365	-0.01864	-0.02257	-0.02265	-0.01239	0.00789	0.01355	0.00423	0.00211				J299-Outlet1	J299-Outlet1

Table D-10: 2018 SPK Category P1-P7 Voltage Constraints

Bus	Area	Vlow	Vhi	Benchmark VCONT	StudyCase VCONT	Delta (> 0.01 p.u.)	Contingency Details	Cont Type
No constraints								

Table D-11: 2018 SPK Non-Converged Category P2-P7 Contingencies

Contingency	Contingency Details	Benchmark	Study
CIPC-56	631069 [ANTA TP5 161.00] TO 631070 [ANITA 5 161.00] 1 631071 [SCRANTN5 161.00] TO 631072 [GU CTR 5 161.00] 1	Blown up	Blown up
CIPC-57	631069 [ANTA TP5 161.00] TO 631070 [ANITA 5 161.00] 1 631071 [SCRANTN5 161.00] TO 631074 [GR JCT 5 161.00] 1	Blown up	Blown up
ITCM-C925-LN	618900 [GRE-BREWSTR5161.00] TO 631040 [HRN LK 5 161.00] 1 602005 [SPLT RK5 161.00] TO 602039 [ROCK CO5 161.00] 1 602039 [ROCK CO5 161.00] TO 605618 [ROCKCOFDR1_134.500] 1	Blown up	Blown up
ITCM-C927-LN	631069 [ANTA TP5 161.00] TO 631070 [ANITA 5 161.00] 1 631071 [SCRANTN5 161.00] TO 631072 [GU CTR 5 161.00] 1 629111 [SCRANTN9 34.500] TO 631071 [SCRANTN5 161.00] 1 631071 [SCRANTN5 161.00] TO 631074 [GR JCT 5 161.00] 1	Blown up	Blown up
ITCM-C932-LN	602039 [ROCK CO5 161.00] TO 631038 [MAGNLIA5 161.00] 1 630056 [MAGNLIA8 69.000] TO 631038 [MAGNLIA5 161.00] 1 631038 [MAGNLIA5 161.00] TO 631039 [ELK 5 161.00] 1 631040 [HRN LK 5 161.00] TO 631041 [LAKEFLD5 161.00] 1 630066 [HERONLK8 69.000] TO 631040 [HRN LK 5 161.00] 2	Blown up	Blown up
ITCM-C938-LN	631104 [EIC 5 161.00] TO 631134 [TRICNTY5 161.00] 1 631115 [OTTUMWA5 161.00] TO 631116 [BRDGPRT5 161.00] 1	Blown up	Blown up

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Table D-12: 2018 SPK Non-Converged Category P2-P7 Contingencies DCCC Results

Monitored Element	Rating	Owner	Benchmark Case		Study Case		Contingency label	Contingency	Type	J299 ST	J299 CT	G736	J385	J391	J400	J405	J407	J411	J416	J426	DF>20%	MW>20%*Rating	Outlet Con.	Outlet Mon.	Summary
			Pre Loading (MVA)	Pre Loading (%)	Post Loading (MVA)	Post Loading (%)				10	63	40	100	50	62.5	40	40	60	40	20	GIP With Impact-1	GIP With Impact-2	GIP With Impact-3	GIP With Impact-4	GIP With Impact
										ER	ER	NR	NR	NR	NR	NR	NR	NR	NR	NR					
No constraints																									

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Appendix
E

2025 Contingency Analysis Results

E.1 2025 Summer Shoulder (SH) Constraints

Table E-1: 2025 SH System Intact Thermal Constraints

Table E-2: 2025 SH System Intact Voltage Constraints

Table E-3: 2025 SH Category P1-P7 Thermal Constraints

Table E-4: 2025 SH Category P1-P7 Voltage Constraints

Table E-5: 2025 SH Non-Converged Category P2-P7 Contingencies

Table E-6: 2025 SH Non-Converged Category P2-P7 Contingencies DCCC Results

Table E-1: 2025 SH System Intact Thermal Constraints

Monitored Element	Rating	Owner	Benchmark Case		Study Case		Contingency label	Contingency	Type	J299 ST	J299 CT	G736	J385	J391	J400	J405	J407	J411	J416	J426	DF>5%	MW>20%*Rating	Outlet Con.	Outlet Mon.	Summary
			Pre Loading (MVA)	Pre Loading (%)	Post Loading (MVA)	Post Loading (%)				5	31.5	200	0	0	0	0	200	300	200	100	GIP With Impact-1	GIP With Impact-2	GIP With Impact-3	GIP With Impact-4	GIP With Impact
										ER	ER	NR	NR	NR	NR	NR	NR	NR	NR	NR					
No constraints																									

Table E-2: 2025 SH System Intact Voltage Constraints

Bus	Area	Vlow	Vhi	Benchmark	StudyCase	Delta	Contingency Details	Cont
				VCONT	VCONT	(> 0.01 p.u.)		Type
No constraints								

Table E-3: 2025 SH Category P1-P7 Thermal Constraints

Monitored Element	Rating	Owner	Benchmark Case		Study Case		Contingency label	Contingency	Type	J299 ST	J299 CT	G736	J385	J391	J400	J405	J407	J411	J416	J426	DF>20%	MW>20%*Rating	Outlet Con.	Outlet Mon.	Summary
			Pre Loading (MVA)	Pre Loading (%)	Post Loading (MVA)	Post Loading (%)				5	31.5	200	0	0	0	0	200	300	200	100	GIP With Impact-1	GIP With Impact-2	GIP With Impact-3	GIP With Impact-4	GIP With Impact
										ER	ER	NR	NR	NR	NR	NR	NR	NR	NR	NR					
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	122.5	60.8	272.6	136.3	P22:161:ITCM:HAYWD#25	HAYWD#25 161 - HAYWD#15 161 1 HAYWD#25 161 - GLENWRTH5 161 1 MURPHY CR 5 161 - HAYWD#25 161 1 HAYWD#28 69.0 - HAYWD#25 161 1	P2-2	0.00453	0.00594	0.00287	0.00609	0.00317	0.00323	0.00204	0.78155	-0.00527	-0.02700	0.00162	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	122.5	60.8	272.6	136.3	ITCM-B110-NW	HAYWD#28 69.0 - HAYWD#25 161 1 HAYWD#25 161 - GLENWRTH5 161 1 MURPHY CR 5 161 - HAYWD#25 161 1	P1	0.00453	0.00594	0.00287	0.00609	0.00317	0.00323	0.00204	0.78155	-0.00527	-0.02700	0.00162	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	120.3	60.2	***268.4***	134.2	J407-Outlet2	GLENWRTH5 161 - HAYWD#25 161 1	P1	0.00393	0.00511	0.00277	0.00691	0.00299	0.00305	0.00197	0.77118	-0.00630	-0.02869	0.00099	J407,	J407,	J407-Outlet2		J407, J407, J407-Outlet2
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	109.4	54.7	264.2	132.1	ITCM-C218-NW	HAYWD#15 161 - FREEBORN5 161 1 HAYWD#18 69.0 - HAYWD#15 161 1 HAYWD#25 161 - HAYWD#15 161 1 ADAMS_S5 161 - HAYWD#15 161 1 HAYWD#25 161 - GLENWRTH5 161 1 MURPHY CR 5 161 - HAYWD#25 161 1 HAYWD#28 69.0 - HAYWD#25 161 1	P4	0.00435	0.00585	0.00274	0.00589	0.00301	0.00307	0.00195	0.80453	-0.00502	-0.02429	0.00141	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	166.1	82.3	233.0	116.5	631139 HAZLTON3 34	HAZLTON3 345 - MITCHLCO3 345 1	P1	0.02580	0.02875	0.02205	0.03797	0.02295	0.02318	0.01862	0.40215	-0.01177	-0.08144	0.01538	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	165.2	82.6	233.0	116.5	ITCM-C939-LN	HAZLTON3 345 - MITCHLCO3 345 1 SALEM 3 345 - ROCK CK3 345 1	P3	0.02549	0.02845	0.02177	0.03768	0.02267	0.02290	0.01836	0.40176	-0.01202	-0.08196	0.01510	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	149.3	73.9	213.2	106.6	P23:345:ITCM:HAZLTON3	HAZLTON3 345 - HCKRYCK3 345 1 HAZLTON3 345 - MITCHLCO3 345 1	P2-3	0.02388	0.02682	0.02043	0.03688	0.02125	0.02148	0.01713	0.39878	-0.01394	-0.08830	0.01347	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	144.5	71.6	211.8	105.9	P55:345:ITCM:MITCHLCO3	MITCHLCO3 345 - G172_G1 34.5 1 MITCHLCO3 345 - G172_G2 34.5 1 ADAMS 3 345 - MITCHLCO3 345 1 HAZLTON3 345 - MITCHLCO3 345 1	P5-5	0.02621	0.02917	0.02247	0.03838	0.02337	0.02360	0.01904	0.40257	-0.01135	-0.08103	0.01580	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	141.0	69.9	209.6	104.8	P23:345:GRE:PVS 19JB3	ADAMS 3 345 - GRE-PL VLLY3 345 1 ADAMS 3 345 - ADAMS 5 161 - ADAMS1 9 13.8 9 GRE-PL VLLY3 345 - GRE-PL VLLY5 161 - GRE-PL VLL1T13.8 1	P2-3	0.02461	0.02767	0.02073	0.03553	0.02161	0.02183	0.01749	0.40853	-0.01108	-0.07879	0.01467	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	139.3	69.1	207.6	103.8	B2.ADM-PVS AS	ADAMS 3 345 - ADAMS 5 161 - ADAMS1 9 13.8 9 ADAMS 3 345 - GRE-PL VLLY3 345 1	P1	0.02490	0.02792	0.02107	0.03610	0.02196	0.02218	0.01780	0.40700	-0.01112	-0.07920	0.01489	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	139.3	69.1	207.6	103.8	P22:345:XEL:ADAMS 3 N1	ADAMS 3 345 - GRE-PL VLLY3 345 1 ADAMS 5 161 - ADAMS_N5 161 1 ADAMS 5 161 - ADAMS_S5 161 1 ADAMS 3 345 - ADAMS 5 161 - ADAMS1 9 13.8 9 REMOVE SWSHUNT FROM BUS 601002	P2-2	0.02490	0.02792	0.02107	0.03610	0.02196	0.02218	0.01780	0.40700	-0.01112	-0.07920	0.01489	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	139.3	69.1	207.6	103.8	P23:345:XEL-ITC:8S2 AD	ADAMS 3 345 - GRE-PL VLLY3 345 1 ADAMS 3 345 - MITCHLCO3 345 1 ADAMS 3 345 - ADAMS 5 161 - ADAMS1 9 13.8 9	P2-3	0.02490	0.02792	0.02107	0.03610	0.02196	0.02218	0.01780	0.40700	-0.01112	-0.07920	0.01489	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	151.8	75.2	206.8	103.4	P24:161:ITCM:LIME CK5	LIME CK5 161 - EMERY 5 161 2 LIME CK5 161 - BARTON5 161 1 LIME CK5 161 - COLBY5 161 1 LIME CK5 161 - CLKREACT5 161 1 LMCK W 8 69.0 - LIME CK5 161 1 LMCK E 8 69.0 - LIME CK5 161 1	P2-4	0.01439	0.01728	0.01225	0.02804	0.01269	0.01290	0.00983	0.38017	-0.01916	-0.09366	0.00516	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	138.2	68.4	205.6	102.8	601002 ADAMS 3 34	ADAMS 3 345 - MITCHLCO3 345 1	P1	0.02621	0.02917	0.02247	0.03838	0.02337	0.02360	0.01904	0.40257	-0.01135	-0.08103	0.01580	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	124.3	61.5	205.4	102.7	P23:161:SMP:MURPHY CR	MURPHY CR 5 161 - HAYWD#25 161 1 MURPHY CR 8 69.0 - MURPHY CR 5 161 1	P2-3	0.01585	0.01931	0.01099	0.01771	0.01193	0.01206	0.00880	0.46436	-0.00845	-0.06540	0.00885	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	124.3	61.5	205.4	102.7	P23:161:SMP:MURPHY CR	MURPHY CR 5 161 - HAYWD#25 161 1 AUSTIN 5 161 - MURPHY CR 5 161 1 AUSTIN NE8 69.0 - AUSTIN 5 161 1	P2-3	0.01585	0.01931	0.01099	0.01771	0.01193	0.01206	0.00880	0.46436	-0.00845	-0.06540	0.00885	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	124.3	61.5	205.4	102.7	613042 MURPHY CR 5 16	MURPHY CR 5 161 - HAYWD#25 161 1	P1	0.01585	0.01931	0.01099	0.01771	0.01193	0.01206	0.00880	0.46436	-0.00845	-0.06540	0.00885	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	124.0	61.3	205.0	102.5	P23:161:SMP:MURPHY CR	AUSTIN 5 161 - MURPHY CR 5 161 1 AUSTIN NE8 69.0 - AUSTIN 5 161 1 MURPHY CR 8 69.0 - MURPHY CR 5 161 1	P2-3	0.01585	0.01931	0.01099	0.01771	0.01193	0.01206	0.00880	0.46436	-0.00845	-0.06540	0.00885	J407,	J407,			J407, J407,
631036 NIW 5 161 631202 COLBY5 161 1	200.0	ITCM	141.6	70.8	203.0	101.5	ITCM-C310-NW	LMCK W 8 69.0 - LIME CK5 161 1 LIME CK5 161 - COLBY5 161 1 LIME CK5 161 - CLKREACT5 161 1	P4	0.01343	0.01623	0.01106	0.02421	0.01154	0.01172	0.00886	0.37812	-0.01608	-0.08324	0.00524	J407,	J407,			J407, J407,

Table E-4: 2025 SH Category P1-P7 Voltage Constraints

Bus	Area	Vlow	Vhi	Benchmark VCONT	StudyCase VCONT	Delta (> 0.01 p.u.)	Contingency Details	Cont Type
No constraints								

Table E-5: 2025 SH Non-Converged Category P2-P7 Contingencies

Contingency	Contingency Details	Benchmark	Study
CIPC-56	631069 [ANTA TP5 161.00] TO 631070 [ANITA 5 161.00] 1 631071 [SCRANTN5 161.00] TO 631072 [GU CTR 5 161.00] 1	Blown up	Blown up
CIPC-57	631069 [ANTA TP5 161.00] TO 631070 [ANITA 5 161.00] 1 631071 [SCRANTN5 161.00] TO 631074 [GR JCT 5 161.00] 1	Blown up	Blown up
ITCM-C925-LN	618900 [GRE-BREWSTR5161.00] TO 631040 [HRN LK 5 161.00] 1 602005 [SPLT RK5 161.00] TO 602039 [ROCK CO5 161.00] 1 602039 [ROCK CO5 161.00] TO 605618 [ROCKCOFDR1_134.500] 1	Blown up	Blown up
ITCM-C927-LN	631069 [ANTA TP5 161.00] TO 631070 [ANITA 5 161.00] 1 631071 [SCRANTN5 161.00] TO 631072 [GU CTR 5 161.00] 1 629111 [SCRANTN9 34.500] TO 631071 [SCRANTN5 161.00] 1 631071 [SCRANTN5 161.00] TO 631074 [GR JCT 5 161.00] 1	Blown up	Blown up
ITCM-C932-LN	602039 [ROCK CO5 161.00] TO 631038 [MAGNLIA5 161.00] 1 630056 [MAGNLIA8 69.000] TO 631038 [MAGNLIA5 161.00] 1 631038 [MAGNLIA5 161.00] TO 631039 [ELK 5 161.00] 1 631040 [HRN LK 5 161.00] TO 631041 [LAKEFLD5 161.00] 1 630066 [HERONLK8 69.000] TO 631040 [HRN LK 5 161.00] 2	Blown up	Blown up
ITCM-C938-LN	631104 [EIC 5 161.00] TO 631134 [TRICNTY5 161.00] 1 631115 [OTTUMWA5 161.00] TO 631116 [BRDGPRT5 161.00] 1	Blown up	Blown up

Table E-6: 2025 SH Non-Converged Category P2-P7 Contingencies DCCC Results

Monitored Element	Rating	Owner	Benchmark Case		Study Case		Contingency label	Contingency	Type	J299 ST	J299 CT	G736	J385	J391	J400	J405	J407	J411	J416	J426	DF>20%	MW>20%*Rating	Outlet Con.	Outlet Mon.	Summary
			Pre Loading (MVA)	Pre Loading (%)	Post Loading (MVA)	Post Loading (%)				5	31.5	200	0	0	0	0	200	300	200	100	GIP With Impact-1	GIP With Impact-2	GIP With Impact-3	GIP With Impact-4	GIP With Impact
										ER	ER	NR	NR	NR	NR	NR	NR	NR	NR	NR					
No constraints																									

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E.2 2025 Summer Peak (SPK) Constraints

Table E-7: 2025 SPK System Intact Thermal Constraints

Table E-8: 2025 SPK System Intact Voltage Constraints

Table E-9: 2025 SPK Category B Thermal Constraints

Table E-10: 2025 SPK Category B Voltage Constraints

Table E-11: 2025 SPK Non-Converged Category C Contingencies

Table E-12: 2025 SPK Non-Converged Category C Contingencies DCCC Results

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Table E-7: 2025 SPK System Intact Thermal Constraints

Monitored Element	Rating	Owner	Benchmark Case		Study Case		Contingency label	Contingency	Type	J299 ST	J299 CT	G736	J385	J391	J400	J405	J407	J411	J416	J426	DF>5%	MW>20%*Rating	Outlet Con.	Outlet Mon.	Summary
			Pre Loading (MVA)	Pre Loading (%)	Post Loading (MVA)	Post Loading (%)				10	63	40	100	50	62.5	40	40	60	40	20	GIP With Impact-1	GIP With Impact-2	GIP With Impact-3	GIP With Impact-4	GIP With Impact
										ER	ER	NR	NR	NR	NR	NR	NR	NR	NR	NR					
No constraints																									

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Table E-8: 2025 SPK System Intact Voltage Constraints

Bus	Area	Vlow	Vhi	Benchmark	StudyCase	Delta	Contingency Details	Cont
				VCONT	VCONT	(> 0.01 p.u.)		Type
No constraints								