Impact Study of Limited Operation for Generator Interconnection

GEN-2009-020

March 2013
Generator Interconnection

SPP Southwest Power Pool

Executive Summary

<OMITTED TEXT> (Customer; GEN-2009-020) has requested a Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for 48.3 MW of wind generation to be interconnected as an Energy Resource (ER) into the Transmission System of Midwest Energy (MIDW) in Rush County, Kansas. GEN-2009-020, under GIA Section 5.9, has requested this Limited Operation Interconnection Study (LOIS) to determine the impacts of interconnecting to the transmission system before all required Network Upgrades identified in the DISIS-2010-001 (or most recent iteration) Impact Study can be placed into service.

The Customer has requested a restudy of the LOIS that was previously performed and posted to SPP OASIS on May 5, 2011. That study can be found at the following web address: http://sppoasis.spp.org/documents/swpp/transmission/studies/files/2009_Generation_Studies/GEN-2009-020_LOIS_5_5_11.pdf. The Customer has requested a restudy of this LOIS to confirm that adequate interconnection service remains after the withdrawals and Commercial Operation commencement of certain higher queued projects.

This LOIS addresses the effects of interconnecting the plant to the rest of the transmission system for the system topology and conditions as expected in March 2014. GEN-2009-020 is requesting the interconnection of twenty-one (21) Siemens SWT 2.3 MW wind turbine generators and associated facilities into the new 69kV substation tapping Nekoma-Balzine 69kV transmission line. For the typical LOIS, both a power flow and transient stability analysis are conducted. The LOIS assumes that only the higher queued projects listed within Table 1 of this study might go into service before the completion of all Network Upgrades identified within Table 2 of this report. If additional generation projects, listed within Table 3, with queue priority equal to or higher than the study project request rights to go into commercial operation before all Network Upgrades identified within Table 2 of this report are completed, this LOIS may need to be restudied to ensure that interconnection service remains for the GEN-2009-020 request.

Power flow analysis from this LOIS has determined that the GEN-2009-020 request can interconnect its full 48.3 MW of generation as an Energy Resource prior to the completion of the required Network Upgrades, listed within Table 2 of this report. Should any other projects, other than those listed within Table 1 of this report, come into service an additional study may be required to determine if any limited operation service is available. It should be noted that although this LOIS analyzed many of the most probable contingencies, it is not an all-inclusive list that can account for every operational situation. Additionally, the generator may not be able to inject any power onto the Transmission System due to constraints that fall below the threshold of mitigation for a Generator Interconnection request. Because of this, it is likely that the Customer may be required to reduce their generation output to 0 MW under certain system conditions to allow system operators to maintain the reliability of the transmission network.

The GEN-2009-020 Interconnection request is currently in the process of being restudied for the requested modification to change wind turbines from General Electric 1.6 MW to Siemens SWT 2.3 MW. The Impact Restudy for this turbine change has identified additional reactive power

compensation equipment required for the interconnection of GEN-2009-020. Transient stability analysis for this LOIS has determined that **with reactive equipment identified in the GEN-2009-020 turbine restudy**, the transmission system will remain stable for the sixty-nine (69) selected faults for the limited operation interconnection of GEN-2009-020 and will meet Low Voltage Ride Through (LVRT) requirements of FERC Order #661A.

Nothing in this study should be construed as a guarantee of transmission service. If the customer wishes to sell power from the facility, a separate request for transmission service must be requested on Southwest Power Pool's OASIS by the Customer.

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Purpose

<OMITTED TEXT> (Interconnection Customer) has requested a restudy of a Limited Operation System Impact Study (LOIS) under the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT) for an interconnection request into the Transmission System of Midwest Energy (MIDW).

The purpose of this study is to reevaluate the impacts of interconnecting GEN-2009-020 request of 48.3 MW comprised of twenty-one (21) Siemens SWT 2.3 MW wind turbine generators and associated facilities interconnecting into the new 69kV substation tapping Nekoma-Balzine 69kV transmission line in Rush County, Kansas. The Customer has requested this amount to be studied as an Energy Resource (ER) with a Limited Operation Interconnection Service to commence on or around March of 2014.

The Customer has requested a restudy of the LOIS that was previously performed and posted to SPP OASIS on May 5, 2011. That study can be found at the following web address: http://sppoasis.spp.org/documents/swpp/transmission/studies/files/2009_Generation_Studies/GEN-2009-020_LOIS_5_5_11.pdf. The Customer has requested a restudy of this LOIS to confirm that adequate interconnection service remains after the withdrawals and Commercial Operation commencement of certain higher queued projects.

Both power flow and transient stability analysis were conducted for this Limited Operation Interconnection Service. Limited Operation Studies are conducted under GIA Section 5.9.

The LOIS considers the Base Case as well as all Generating Facilities (and with respect to (b) below, any identified Network Upgrades associated with such higher queued interconnection) that, on the date the LOIS is commenced:

a) are directly interconnected to the Transmission System;
b) are interconnected to Affected Systems and may have an impact on the Interconnection Request;
c) have a pending higher queued Interconnection Request to interconnect to the Transmission System listed in Table 1; or
d) have no Queue Position but have executed an LGIA or requested that an unexecuted LGIA be filed with FERC.

Any changes to these assumptions, for example, one or more of the previously queued requests not included within this study execute an interconnection agreement and commencing commercial operation, may require a re-study of this LOIS at the expense of the Customer.

Nothing within this System Impact Study constitutes a request for transmission service or confers upon the Interconnection Customer any right to receive transmission service rights. Should the Customer require transmission service, those rights should be requested through SPP's Open Access Same-Time Information System (OASIS).

This LOIS study included prior queued generation interconnection requests. Those listed within Table 1 are the generation interconnection requests that are assumed to have rights to either full or partial interconnection service prior to the requested 3/2014 in-service of GEN-2009-020 for this LOIS. Also listed in Table 1 are both the amount of MWs of interconnection service expected at the effective time of this study and the total MWs requested of interconnection service, the fuel type, the point of interconnection (POI), and the current status of each particular prior queued request.

Table 1: Generation Requests Included within LOIS

Project	MW	Total MW	Fuel Source	POI	Status
GEN-2001-039A	105.0	105.0	Wind	Tap Greensburg - Ft Dodge (Shooting Star Tap) 115kV	Commercial Operation
GEN-2001-039M	99.0	99.0	Wind	Central Plains Tap 115kV	Commercial Operation
GEN-2002-025A	150.0	150.0	Wind	Spearville 230kV	Commercial Operation
GEN-2003-006A	200.0	200.0	Wind	Elm Creek 230kV	Commercial Operation
GEN-2003-019	250.0	250.0	Wind	Smoky Hills Tap 230kV	Commercial Operation
GEN-2004-014	154.5	154.5	Wind	Spearville 230kV	Commercial Operation
GEN-2005-012	167.0	250.0	Wind	Spearville 345kV	Commercial Operation
GEN-2006-021	101.0	101.0	Wind	Flat Ridge Tap 138kV	Commercial Operation
GEN-2007-040	132.0	200.0	Wind	Buckner 345kV	Commercial Operation
GEN-2008-018	405.0	405.0	Wind	Finney 345kV	IA Executed/On Schedule
GEN-2008-079	98.9	98.9	Wind	Tap Cudahy - Ft Dodge 115kV	Commercial Operation
GEN-2009-008	199.5	199.5	Wind	South Hays 230kV	IA Executed/On Suspension
GEN-2009-020	48.3	48.3	Wind	Tap Nekoma - Bazine 69kV	IA Executed/On Suspension
GEN-2010-009	165.6	165.6	Wind	Buckner 345kV	Commercial Operation

This LOIS was required because the Customer is requesting interconnection prior to the completion of all of their required upgrades listed within the latest iteration of their Definitive Interconnection System Impact Study (DISIS). Table 2 below lists the required upgrade projects for which this request has cost responsibility. GEN-2009-020 was included within the DISIS-2010-001 that was studied in spring 2010 and posted July 30, 2010. The cluster has been restudied a number of times since the original posting. These reports can be located here at the following GI Study URL: http://sppoasis.spp.org/documents/swpp/transmission/GenStudies.cfm?YearType=2010_Impact_Studies.

Table 2: Upgrade Projects not included but Required for Full Interconnection Service

Upgrade Project	Type	Description	Status
PostRock 345/230/13.8kV Autotransformer CKT 2	GIA Appendix A (2ca) Shared Network Upgrade to be designed, constructed, and owned by the Transmission Owner.	DISIS-2010-001 Customers	Not authorized to begin construction
South Hays – Hays Plant – Vine Street 115kV CKT 1 (Rebuild approx. 4 miles of 115kV)	GIA Appendix A (2ca) Shared Network Upgrade to be designed, constructed, and owned by the Transmission Owner.	DISIS-2010-001 Customers	Not authorized to begin construction
Hitchland – Woodward 345kV Dbl CKT	Most recent iteration of DISIS 2010-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Build Priority Project	Current Estimated In-Service date of 6/30/2014
Hitchland 345/230kV Autotransformer CKT 2	Most recent iteration of DISIS 2010-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Build Priority Project	Current Estimated In-Service date of 6/30/2014
Iatan – Nashua 345kV CKT 1	Most recent iteration of DISIS 2010-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Build Balanced Portfolio Project	Current Estimated In-Service date of 06/01/2015
Spearville – Clark – Thistle 345kV Dbl CKT	Most recent iteration of DISIS 2010-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Build Priority Project	Current Estimated In-Service date of 12/31/2014
Thistle – Wichita 345kV Dbl CKT	Most recent iteration of DISIS 2010-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Build Priority Project	Current Estimated In-Service date of 12/31/2014

Any changes to these assumptions, for example, one or more of the previously queued requests not included within this study execute an interconnection agreement and commencing commercial operation, may require a re-study of this LOIS at the expense of the Customer. The higher or equally queued projects that were not included in this study are listed in Table 3. While this list is not all inclusive it is a list of the most probable and affecting prior queued requests that were not included within this LOIS, either because no request for an LOIS has been made or the request is on suspension, etc.

Table 3: Higher or Equally Queued GI Requests not included within LOIS

Project	Remainder MW	Total MW	Fuel	POI	Status
GEN-2005-012	83.0	250.0	Wind	Spearville 345kV	IA Executed/On Schedule for 2015
GEN-2006-006	205.5	205.5	Wind	Spearville 345kV	IA Executed/On Schedule for 2015
GEN-2006-032	200.0	200.0	Wind	South Hays 230kV	IA Executed/On Suspension
GEN-2006-040	108.0	108.0	Wind	Mingo 115kV	IA Executed/On Suspension
GEN-2007-011	135.0	135.0	Wind	Syracuse 115kV	IA Executed/On Suspension
GEN-2007-038	200.0	200.0	Wind	Spearville 345kV	IA Executed/On Schedule for 08/25/2015
GEN-2007-040	68.0	200.0	Wind	Buckner 345kV	IA Executed/On Schedule for 2012
GEN-2008-017	300.0	300.0	Wind	Setab 345kV	IA Executed/On Schedule for 10/2015
GEN-2008-025	101.0	101.0	Wind	Ruleton 115kV	IA Executed/On Schedule for 06/01/2015
GEN-2008-092	201.0	201.0	Wind	Knoll 230kV	IA Pending
GEN-2008-124	200.1	200.1	Wind	Spearville 345kV	IA Executed/On Schedule for 01/01/2016
GEN-2010-015	200.1	200.1	Wind	Spearville 345kV	IA Executed/On Schedule for 01/01/2015

Nothing in this System Impact Study constitutes a request for transmission service or grants the Interconnection Customer any rights to transmission service.

Facilities

Generating Facility

GEN-2009-020 Interconnection Customer's request to interconnect a total of 48.3 MW is comprised of twenty-one (21) Siemens SWT 2.3 MW wind turbine generators and associated interconnection facilities.

Interconnection Facilities

The POI for GEN-2009-020 Interconnection Customer is through a tap with a new substation on the Transmission Owners Nekoma-Balzine 69kV transmission line in Rush County, Kansas. Figure 1 depicts the one-line diagram of the local transmission system including the POI as well as the power flow model representing the request.

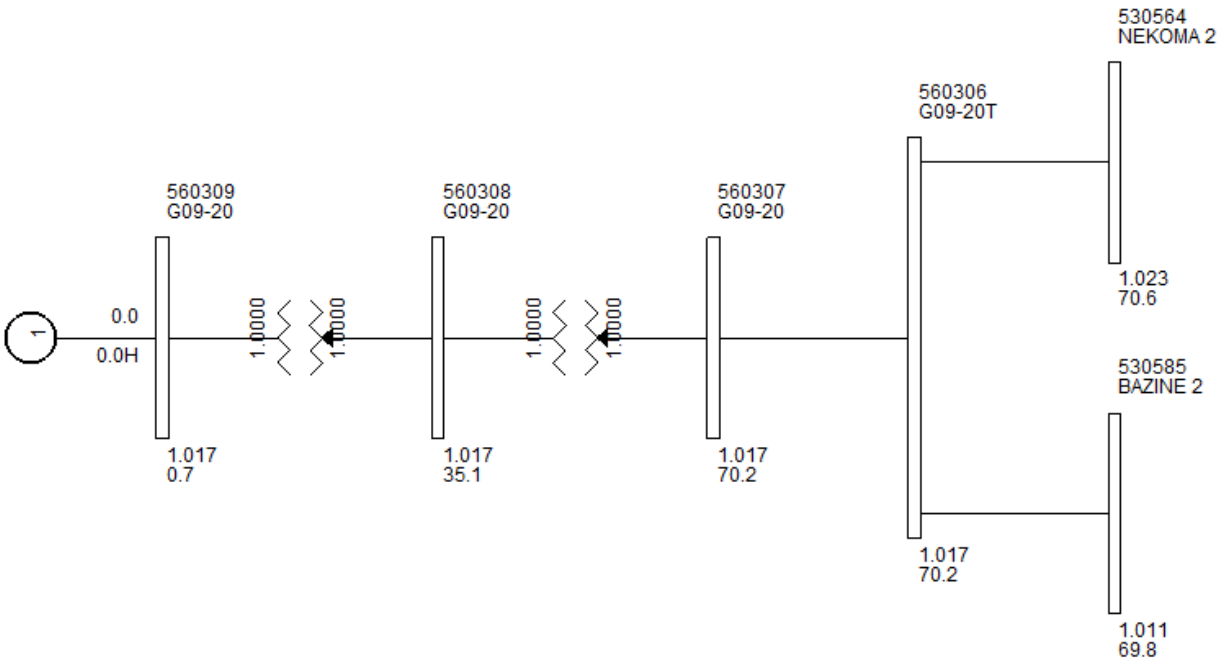

Figure 1: Proposed POI Configuration and Request Power Flow Model

Base Case Network Upgrades

The Network Upgrades included within the cases used for this LOIS study are those facilities that are a part of the SPP Transmission Expansion Plan or the Balanced Portfolio projects that have in-service dates prior to the GEN-2009-020 LOIS requested in-service date of March 2014. These facilities have an approved Notice to Construct (NTC), or are in construction stages and expected to be in-service at the effective time of this study. No other upgrades were included for this LOIS. If for some reason, construction on these projects is delayed or discontinued, a restudy may be needed to determine the interconnection service availability of the Customer.

Power Flow Analysis

Power flow analysis is used to determine if the transmission system can accommodate the injection from the request without violating thermal or voltage transmission planning criteria.

Model Preparation

Power flow analysis was performed using modified versions of the 2012 series of transmission service request study models including the 2014 (spring, summer, and winter) seasonal models. To incorporate the Interconnection Customer's request, a re-dispatch of existing generation within SPP was performed with respect to the amount of the Customer's injection and the interconnecting Balancing Authority. This method allows the request to be studied as an Energy Resource (ERIS) Interconnection Request. For this LOIS, only the previous queued requests listed in Table 1 were assumed to be in-service.

Study Methodology and Criteria

The ACCC function of PSS/E is used to simulate contingencies, including single and multiple facility (i.e. breaker-to-breaker, etc.) outages, within all of the control areas of SPP and other control areas external to SPP and the resulting data analyzed. This satisfies the "more probable" contingency testing criteria mandated by NERC and the SPP criteria.

The contingency set includes all SPP control area branches and ties 69kV and above, first tier Non-SPP control area branches and ties 115 kV and above, any defined contingencies for these control areas, and generation unit outages for the SPP control areas with SPP reserve share program redispatch.

The monitor elements include all SPP control area branches, ties, and buses 69 kV and above, and all first tier Non-SPP control area branches and ties 69 kV and above. NERC Power Transfer Distribution Flowgates for SPP and first tier Non-SPP control area are monitored. Additional NERC Flowgates are monitored in second tier or greater Non-SPP control areas. Voltage monitoring was performed for SPP control area buses 69 kV and above.

Results

The LOIS ACCC analysis indicates that the Customer can interconnect generation into the MIDW transmission system as requested before all required upgrades listed within the DISIS-2010-001 study can be placed into service. Should any other GI projects, other than those listed within Table 1 of this report, come into service an additional study may be required to determine if any limited operation service is available.

ACCC results for the LOIS can be found in Tables 4, 5 and Appendix A below. ~~Since~~ Generator Interconnection Energy Resource ~~ER~~ analysis doesn't mitigate for those issues in which the affecting GI request has less than a 20% OTDF, Table 5 and Appendix A are provided for informational purposes only so that the Customer understands there may be operational conditions when they may be required to reduce their output to maintain system reliability.

Limited Operation and System Reliability

In no way does this study guarantee limited operation for all periods of time. It should be noted that although this LOIS analyzed many of the most probable contingencies, it is not an all-inclusive list and cannot account for every operational situation. Because of this, it is likely that the Customer may be required to reduce their generation output to 0 MW under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Table 4: Interconnection Constraints for Mitigation of GEN-2009-020 LOIS @ 48.3MW

Season	Dispatch Group	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Available	Contingency
All	04G09_020		None					48.3	
All	03G09_020		None					48.3	
All	4		None					48.3	
All	3		None					48.3	

Table 5: Additional Constraints of GEN-2009-020 LOIS @ 48.3MW Not for Mitigation

Season	Dispatch Group	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	ATC Available	Contingency
Spring	03G09_020	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.034	127.7	0	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1'
Spring	03G09_020	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.034	154.1	0	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1'
Spring	03G09_020	TO->FROM	BARBER 3 115.00 - MEDICINE LODGE 115KV CKT 1	79.7	79.7	0.034	107.7	0	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1'
Spring	03G09_020	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.112	114.6	0	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1'
Spring	03G09_020	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.034	118.9	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
Spring	03G09_020	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.034	143.7	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
Spring	03G09_020	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.112	100.5	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
Spring	03G09_020	TO->FROM	HAYS PLANT - SOUTH HAYS 115KV CKT 1	83	99	0.053	112.2	0	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
Spring	03G09_020	FROM->TO	HAYS PLANT - VINE STREET 115KV CKT 1	80	88	0.053	102.9	0	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
Spring	03G09_020	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.109	100.7	0	KNOLL 230 - SMOKYHL6 230.00 230KV CKT 1
Spring	03G09_020	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.109	106.1	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1
Spring	03G09_020	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.104	101.2	0	RENO COUNTY - SUMMIT 345KV CKT 1
Spring	03G09_020	FROM->TO	MOUNDRIDGE (MOUND10X) 138/115/13.8KV TRANSFORMER CKT 1	100	110	0.082	102.1	0	RENO COUNTY - WICHITA 345KV CKT 1
Spring	03G09_020	FROM->TO	MOUNDRIDGE (MOUND10X) 138/115/13.8KV TRANSFORMER CKT 1	100	110	0.082	102.1	0	RENO COUNTY - WICHITA 345KV CKT 1
Spring	03G09_020	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.033	118.0	0	CIRCLE - MULLERGREN 230KV CKT 1
Spring	03G09_020	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.033	142.8	0	CIRCLE - MULLERGREN 230KV CKT 1
Spring	03G09_020	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.139	124.8	0	CIRCLE - MULLERGREN 230KV CKT 1
Spring	03G09_020	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.089	114.3	0	CIRCLE - HUTCHINSON ENERGY CENTER 115KV CKT 1
Spring	03G09_020	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.105	101.0	0	FLATRDG3 - HARPER 138KV CKT 1

Season	Dispatch Group	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	ATC Available	Contingency
Spring	03G09_020	FROM->TO	SEWRDMW3 (SEWARD T1) 115/69/12.5KV TRANSFORMER CKT 1	40	44.8	0.124	103.8	0	GREAT BEND TAP - MULLERGREN 115KV CKT 1
Spring	03G09_020	FROM->TO	SEWRDMW3 (SEWARD T1) 115/69/12.5KV TRANSFORMER CKT 1	40	44.8	0.124	103.1	0	GREAT BEND TAP - SEWARD 115KV CKT 1
Spring	03G09_020	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.105	100.4	0	HARPER - MILAN TAP 138KV CKT 1
Spring	03G09_020	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.033	118.3	0	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
Spring	03G09_020	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.033	143.1	0	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
Spring	03G09_020	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.114	104.4	0	CIRCLE (CIRCLE1X) 230/115/13.8KV TRANSFORMER CKT 1
Spring	03G09_020	FROM->TO	HEIZER - MULLERGREN 115KV CKT 1	120	120	0.038	100.2	0	MULLERGREN (MULGREN6) 230/115/13.8KV TRANSFORMER CKT 1
Spring	03G09_020	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.034	127.9	0	SPP-SWPS-05
Spring	03G09_020	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.034	154.3	0	SPP-SWPS-05
Spring	3	TO->FROM	BARBER 3 115.00 - MEDICINE LODGE 115KV CKT 1	79.7	79.7	0.034	108.0	0	SPP-SWPS-05
Spring	3	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.112	114.8	0	SPP-SWPS-05
Spring	3	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.105	100.9	0	SPP-MKEC-08
Spring	3	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.104	102.0	0	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
Spring	3	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.034	130.2	0	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1
Spring	3	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.034	156.8	0	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1
Spring	3	TO->FROM	BARBER 3 115.00 - MEDICINE LODGE 115KV CKT 1	79.7	79.7	0.034	105.7	0	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1
Spring	3	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.112	113.3	0	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1
Spring	3	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.034	118.6	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
Spring	3	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.034	143.4	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
Spring	3	TO->FROM	HAYS PLANT - SOUTH HAYS 115KV CKT 1	83	99	0.053	111.7	0	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
Spring	3	FROM->TO	HAYS PLANT - VINE STREET 115KV CKT 1	80	88	0.053	102.4	0	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
Spring	3	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.109	104.8	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1
Spring	3	FROM->TO	MOUNDRIDGE (MOUND10X) 138/115/13.8KV TRANSFORMER CKT 1	100	110	0.082	101.4	0	RENO COUNTY - WICHITA 345KV CKT 1
Spring	3	FROM->TO	MOUNDRIDGE (MOUND10X) 138/115/13.8KV TRANSFORMER CKT 1	100	110	0.082	101.3	0	RENO COUNTY - WICHITA 345KV CKT 1
Spring	3	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.033	117.7	0	CIRCLE - MULLERGREN 230KV CKT 1
Spring	3	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.033	142.4	0	CIRCLE - MULLERGREN 230KV CKT 1
Spring	3	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.139	123.1	0	CIRCLE - MULLERGREN 230KV CKT 1
Spring	3	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.089	113.2	0	CIRCLE - HUTCHINSON ENERGY CENTER 115KV CKT 1

Season	Dispatch Group	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	ATC Available	Contingency
Spring	3	FROM->TO	SEWRDMW3 (SEWARD T1) 115/69/12.5KV TRANSFORMER CKT 1	40	44.8	0.124	101.4	0	GREAT BEND TAP - MULLERGREN 115KV CKT 1
Spring	3	FROM->TO	SEWRDMW3 (SEWARD T1) 115/69/12.5KV TRANSFORMER CKT 1	40	44.8	0.124	100.6	0	GREAT BEND TAP - SEWARD 115KV CKT 1
Spring	3	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.033	117.9	0	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
Spring	3	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.033	142.6	0	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
Spring	3	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.114	103.1	0	CIRCLE (CIRCLE1X) 230/115/13.8KV TRANSFORMER CKT 1
Spring	3	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.034	130.4	0	SPP-SWPS-05
Spring	3	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.034	157.0	0	SPP-SWPS-05
Spring	3	TO->FROM	BARBER 3 115.00 - MEDICINE LODGE 115KV CKT 1	79.7	79.7	0.034	106.0	0	SPP-SWPS-05
Spring	3	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.112	113.5	0	SPP-SWPS-05
Spring	3	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	80.3	80.3	0.104	100.8	0	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1

Stability Analysis

Transient stability analysis is used to determine if the transmission system can maintain angular stability and ensure bus voltages stay within planning criteria bandwidth during and after a disturbance while considering the addition of a generator interconnection request.

Model Preparation

Transient stability analysis was performed using modified versions of the 2012 series of Model Development Working Group (MDWG) dynamic study models including the 2014 summer and 2013 winter peak dynamic cases. The cases were adapted to resemble the power flow study cases with regards to prior queued generation requests and topology. Finally the prior queued and study generation was dispatched into the SPP footprint. Initial simulations are then carried out for a no-disturbance run of twenty (20) seconds to verify the numerical stability of the model.

Disturbances

The sixty-nine (69) contingencies were identified for the Limited Operation scenario for use in this study. These faults are listed within Table 6. These contingencies included three-phase faults and single-phase line faults at locations defined by SPP. Single-phase line faults were simulated by applying fault impedance to the positive sequence network at the fault location to represent the effect of the negative and zero sequence networks on the positive sequence network. The fault impedance was computed to give a positive sequence voltage at the specified fault location of approximately 60% of pre-fault voltage. This method is in agreement with SPP current practice.

With exception to transformers, the typical sequence of events for a three-phase and single-phase fault is as follows:

1. apply fault at particular location
2. continue fault for five (5) cycles, clear the fault by tripping the faulted facility
3. after an additional twenty (20) cycles, re-close the previous facility back into the fault
4. continue fault for five (5) additional cycles
5. trip the faulted facility and remove the fault

Transformer faults are typically only performed for three-phase faults, unless otherwise noted. Additionally the sequence of events for a transformer is to 1) apply a three-phase fault for five (5) cycles and 2) clear the fault by tripping the affected transformer facility. Unless otherwise noted there will be no re-closing into a transformer fault.

Table 6: Contingencies Evaluated for Limited Operation

	Contingency Number and Name	Description
1	FLT_01_G0920TAP_BAZINE2_69kV_3PH	*3-Phase fault on the GEN-2009-020-Tap – Bazine 69kV line near the GEN-2009-020-Tap 69kV bus.*
2	FLT_02_G0920TAP_BAZINE2_69kV_1PH	*Single-phase fault similar to previous fault.*
3	FLT_03_G0920TAP_NEKOMA2_69kV_3PH	*3-Phase fault on the GEN-2009-020-Tap – Nekoma 69kV line near the GEN-2009-020-Tap 69kV bus.*
4	FLT_04_G0920TAP_NEKOMA2_69kV_1PH	*Single-phase fault similar to previous fault.*
5	FLT_05_NEKOMA2_ALBERT_69kV_3PH	*3-Phase fault on the Nekoma – Albert 69kV line near the Nekoma 69kV bus.*
6	FLT_06_NEKOMA2_ALBERT_69kV_1PH	*Single-phase fault similar to previous fault.*
7	FLT_07_NEKOMA3_ALXNDR3_115kV_3PH	*3-Phase fault on the Nekoma – Alexander 115kV line near the Nekoma 115kV bus.*
8	FLT_08_NEKOMA3_ALXNDR3_115kV_1PH	*Single-phase fault similar to previous fault.*
9	FLT_09_ALXNDR3_NESCTY3_115kV_3PH	*3-Phase fault on the Alexander- Ness City 115kV line near the Alexander 115kV bus.*
10	FLT_10_ALXNDR3_NESCTY3_115kV_1PH	*Single-phase fault similar to previous fault.*
11	FLT_11_NEKOMA3_LAXTAP3_115kV_3PH	*3-Phase fault on the Nekoma – Lacross Tap 115kV line near the Nekoma 115kV bus.*
12	FLT_12_NEKOMA3_LAXTAP3_115kV_1PH	*Single-phase fault similar to previous fault.*
13	FLT_13_LAXTAP3_HEIZER3_115kV_3PH	*3-Phase fault on the Lacross Tap – Heizer 115kV line near the Lacross Tap 115kV bus.*
14	FLT_14_LAXTAP3_HEIZER3_115kV_1PH	*Single-phase fault similar to previous fault.*
15	FLT_15_HEIZER3_GRTBEND3_115kV_3PH	*3-Phase fault on the Heizer – Great Bend 115kV line near the Heizer 115kV bus.*
16	FLT_16_HEIZER3_GRTBEND3_115kV_1PH	*Single-phase fault similar to previous fault.*
17	FLT_17_ELLSWTP3_GRTBEND3_115kV_3PH	*3-Phase fault on the Pioneer Tap N. – Great Bend 115kV line near the Pioneer Tap N. 115kV bus.*
18	FLT_18_ELLSWTP3_GRTBEND3_115kV_1PH	*Single-phase fault similar to previous fault.*
19	FLT_19_SETAB7_HOLCOMB_345kV_3PH	*3-Phase fault on the Setab – Holcomb 345kV line near the Setab 345kV bus.*
20	FLT_20_SETAB7_HOLCOMB_345kV_1PH	*Single-phase fault similar to previous fault.*
21	FLT_21_HOLCOMB_FINNEY_345kV_3PH	*3-Phase fault on the Holcomb – Finney 345kV line near the Holcomb 345kV bus.*
22	FLT_22_HOLCOMB_FINNEY_345kV_1PH	*Single-phase fault similar to previous fault.*
23	FLT_23_FINNEY_HITCHLAND7_345kV_3PH	*3-Phase fault on the Finney– Hitchland 345kV line near the Finney 345kV bus.*
24	FLT_24_FINNEY_HITCHLAND7_345kV_1PH	*Single-phase fault similar to previous fault.*
25	FLT_25_HOLCOMB_BUCKNER7_345kV_3PH	*3-Phase fault on the Holcomb – Buckner 345kV line near the Holcomb 345kV bus.*
26	FLT_26_HOLCOMB_BUCKNER7_345kV_1PH	*Single-phase fault similar to previous fault.*
27	FLT_27_BUCKNER7_SPERVIL7_345kV_3PH	*3-Phase fault on the Buckner – Spearville 345kV line near the Buckner 345kV bus.*
28	FLT_28_BUCKNER7_SPERVIL7_345kV_1PH	*Single-phase fault similar to previous fault.*
29	FLT_29_SPERVIL7_POSTROCK7_345kV_3PH	*3-Phase fault on the Spearville – Post Rock 345kV line near the Spearville 345kV bus.*
30	FLT_30_SPERVIL7_POSTROCK7_345kV_1PH	*Single-phase fault similar to previous fault.*
31	FLT_31_POSTROCK7_AXTELL3_345kV_3PH	*3-Phase fault on the Post Rock – Axtell 345kV line near the Post Rock 345kV bus.*
32	FLT_32_POSTROCK7_AXTELL3_345kV_1PH	*Single-phase fault similar to previous fault.*
33	FLT_33_SETAB7_MINGO7_345kV_3PH	*3-Phase fault on the Setab – Mingo 345kV line near the Setab 345kV bus.*
34	FLT_34_SETAB7_MINGO7_345kV_1PH	*Single-phase fault similar to previous fault.*
35	FLT_35_MINGO7_REDWILO3_345kV_3PH	*3-Phase fault on the Mingo – Red Willow 345kV line near the Mingo 345kV bus.*
36	FLT_36_MINGO7_REDWILO3_345kV_1PH	*Single-phase fault similar to previous fault.*
37	FLT_37_SMKYHLS6_KNOLL6_230kV_3PH	*3-Phase fault on the Smokey Hills – Knoll 230kV line near the Smokey Hills 230kV bus.*
38	FLT_38_SMKYHLS6_KNOLL6_230kV_1PH	*Single-phase fault similar to previous fault.*

	Contingency Number and Name	Description
39	FLT_39_SHAYS6_MULLER6_230kV_3PH	*3-Phase fault on the South Hays – Mullergren 230kV line near the South Hays 230kV bus.*
40	FLT_40_SHAYS6_MULLER6_230kV_1PH	*Single-phase fault similar to previous fault.*
41	FLT_41_MULLER6_CIRCLE6_230kV_3PH	*3-Phase fault on the Mullergren – Circle 230kV line near the Mullergren 230kV bus.*
42	FLT_42_MULLER6_CIRCLE6_230kV_1PH	*Single-phase fault similar to previous fault.*
43	FLT_43_MULLER6_SPEARV6_230kV_3PH	*3-Phase fault on the Mullergren – Spearville 230kV line near the Mullergren 230kV bus.*
44	FLT_44_MULLER6_SPEARV6_230kV_1PH	*Single-phase fault similar to previous fault.*
45	FLT_45_KNOLL3_SALINE3_115kV_3PH	*3-Phase fault on the Knoll – Saline 115kV line near the Knoll 115kV bus.*
46	FLT_46_KNOLL3_SALINE3_115kV_1PH	*Single-phase fault similar to previous fault.*
47	FLT_47_KNOLL3_REDLINE3_115kV_3PH	*3-Phase fault on the Knoll – Redline 115kV line near the Knoll 115kV bus.*
48	FLT_48_KNOLL3_REDLINE3_115kV_1PH	*Single-phase fault similar to previous fault.*
49	FLT_49_KNOLL3_NHAYS3_115kV_3PH	*3-Phase fault on the Knoll – North Hays 115kV line near the Knoll 115kV bus.*
50	FLT_50_KNOLL3_NHAYS3_115kV_1PH	*Single-phase fault similar to previous fault.*
51	FLT_51_BEACHS3_REDLINE3_115kV_3PH	*3-Phase fault on the Ross Beach – Redline 115kV line near the Ross Beach 115kV bus.*
52	FLT_52_BEACHS3_REDLINE3_115kV_1PH	*Single-phase fault similar to previous fault.*
53	FLT_53_GRAHAM3_BEACHS3_115kV_3PH	*3-Phase fault on the Graham – Ross Beach 115kV line near the Graham 115kV bus.*
54	FLT_54_GRAHAM3_BEACHS3_115kV_1PH	*Single-phase fault similar to previous fault.*
55	FLT_55_HOXIE3_BEACHS3_115kV_3PH	*3-Phase fault on the Hoxie – Ross Beach 115kV line near the Hoxie 115kV bus.*
56	FLT_56_HOXIE3_BEACHS3_115kV_1PH	*Single-phase fault similar to previous fault.*
57	FLT_57_SETAB7_SETAB3_345_115kV_3PH	*3-Phase fault on the Setab 345kV/115kV transformer near the Setab 345kV bus.*
58	FLT_58_MINGO7_MINGO3_345_115kV_3PH	*3-Phase fault on the Mingo 345kV/115kV transformer near the Mingo 345kV bus.*
59	FLT_59_SPERVIL7_SPEARVL6_345_230kV_3PH	*3-Phase fault on the Spearville 345kV/230kV transformer near the Spearville 345kV bus.*
60	FLT_60_POSTROCK7_POSTROCK6_345_230kV_3PH	*3-Phase fault on the Post Rock 345kV/230kV transformer near the Post Rock 345kV bus.*
61	FLT_61_AXTELL3_AXTELL7_345_115kV_3PH	*3-Phase fault on the Axtell 345kV/115kV transformer near the Axtell 345kV bus.*
62	FLT_62_HOLCOMB7_HOLCOMB3_345_115kV_3PH	*3-Phase fault on the Holcomb 345kV/115kV transformer near the Holcomb 345kV bus.*
63	FLT_63_KNOLL6_KNOLL3_230_115kV_3PH	*3-Phase fault on the Knoll 230kV/115kV transformer near the Knoll 230kV bus.*
64	FLT_64_SPEARVL6_SPEARVL3_230_115kV_3PH	*3-Phase fault on the Spearville 230kV/115kV transformer near the Spearville 230kV bus.*
65	FLT_65_SHAYS3_SHAYS6_115_230kV_3PH	*3-Phase fault on the South Hays 230kV/115kV transformer near the South Hays 115kV bus.*
66	FLT_66_CONCOR6_CONCOR3_230_115kV_3PH	*3-Phase fault on the Concordia 230kV/115kV transformer near the Concordia 230kV bus.*
67	FLT_67_NEKOMA3_NEKOMA2_115_69kV_3PH	*3-Phase fault on the Nekoma 115kV/69kV transformer near the Nekoma 115kV bus.*
68	FLT_68_HEIZER3_HEIZER2_115_69kV_3PH	*3-Phase fault on the Heizer 115kV/69kV transformer near the Heizer 115kV bus.*
69	FLT_69_SEWRDMW3_SEWARD2_115_69kV_3PH	*3-Phase fault on the Seward 115kV/69kV transformer near the Seward 69kV bus.*

Results

Results of the stability analysis are summarized in Table 7. These results are valid for GEN-2009-020 interconnecting with a generation amount up to 48.3 MW with reactive equipment identified in the

GEN-2009-020 Turbine Restudy. The required reactive equipment includes a minimum of 4.8 MVAR of capacitor banks and 8 MVAR of Static VAR Compensation. The results indicate that the transmission system remains stable for all contingencies studied. The plots will be available upon request.

Table 7: Fault Analysis Results for Limited Operation

	Contingency Number and Name	2014SP	2013WP
1	FLT_01_G0920TAP_BAZINE2_69kV_3PH	Stable	Stable
2	FLT_02_G0920TAP_BAZINE2_69kV_1PH	Stable	Stable
3	FLT_03_G0920TAP_NEKOMA2_69kV_3PH	Stable	Stable
4	FLT_04_G0920TAP_NEKOMA2_69kV_1PH	Stable	Stable
5	FLT_05_NEKOMA2_ALBERT_69kV_3PH	Stable	Stable
6	FLT_06_NEKOMA2_ALBERT_69kV_1PH	Stable	Stable
7	FLT_07_NEKOMA3_ALXNDR3_115kV_3PH	Stable	Stable
8	FLT_08_NEKOMA3_ALXNDR3_115kV_1PH	Stable	Stable
9	FLT_09_ALXNDR3_NESCTY3_115kV_3PH	Stable	Stable
10	FLT_10_ALXNDR3_NESCTY3_115kV_1PH	Stable	Stable
11	FLT_11_NEKOMA3_LAXTAP3_115kV_3PH	Stable	Stable
12	FLT_12_NEKOMA3_LAXTAP3_115kV_1PH	Stable	Stable
13	FLT_13_LAXTAP3_HEIZER3_115kV_3PH	Stable	Stable
14	FLT_14_LAXTAP3_HEIZER3_115kV_1PH	Stable	Stable
15	FLT_15_HEIZER3_GRTBEND3_115kV_3PH	Stable	Stable
16	FLT_16_HEIZER3_GRTBEND3_115kV_1PH	Stable	Stable
17	FLT_17_ELLSWTP3_GRTBEND3_115kV_3PH	Stable	Stable
18	FLT_18_ELLSWTP3_GRTBEND3_115kV_1PH	Stable	Stable
19	FLT_19_SETAB7_HOLCOMB_345kV_3PH	Stable	Stable
20	FLT_20_SETAB7_HOLCOMB_345kV_1PH	Stable	Stable
21	FLT_21_HOLCOMB_FINNEY_345kV_3PH	Stable	Stable
22	FLT_22_HOLCOMB_FINNEY_345kV_1PH	Stable	Stable
23	FLT_23_FINNEY_HITCHLAND7_345kV_3PH	Stable	Stable
24	FLT_24_FINNEY_HITCHLAND7_345kV_1PH	Stable	Stable
25	FLT_25_HOLCOMB_BUCKNER7_345kV_3PH	Stable	Stable
26	FLT_26_HOLCOMB_BUCKNER7_345kV_1PH	Stable	Stable
27	FLT_27_BUCKNER7_SPERVIL7_345kV_3PH	Stable	Stable
28	FLT_28_BUCKNER7_SPERVIL7_345kV_1PH	Stable	Stable
29	FLT_29_SPERVIL7_POSTROCK7_345kV_3PH	Stable	Stable
30	FLT_30_SPERVIL7_POSTROCK7_345kV_1PH	Stable	Stable
31	FLT_31_POSTROCK7_AXTELL3_345kV_3PH	Stable	Stable
32	FLT_32_POSTROCK7_AXTELL3_345kV_1PH	Stable	Stable
33	FLT_33_SETAB7_MINGO7_345kV_3PH	Stable	Stable
34	FLT_34_SETAB7_MINGO7_345kV_1PH	Stable	Stable
35	FLT_35_MINGO7_REDWILO3_345kV_3PH	Stable	Stable
36	FLT_36_MINGO7_REDWILO3_345kV_1PH	Stable	Stable
37	FLT_37_SMKYHLS6_KNOLL6_230kV_3PH	Stable	Stable
38	FLT_38_SMKYHLS6_KNOLL6_230kV_1PH	Stable	Stable
39	FLT_39_SHAYS6_MULLER6_230kV_3PH	Stable	Stable
40	FLT_40_SHAYS6_MULLER6_230kV_1PH	Stable	Stable
41	FLT_41_MULLER6_CIRCLE6_230kV_3PH	Stable	Stable
42	FLT_42_MULLER6_CIRCLE6_230kV_1PH	Stable	Stable
43	FLT_43_MULLER6_SPEARV6_230kV_3PH	Stable	Stable
44	FLT_44_MULLER6_SPEARV6_230kV_1PH	Stable	Stable
45	FLT_45_KNOLL3_SALINE3_115kV_3PH	Stable	Stable
46	FLT_46_KNOLL3_SALINE3_115kV_1PH	Stable	Stable
47	FLT_47_KNOLL3_REDLINE3_115kV_3PH	Stable	Stable
48	FLT_48_KNOLL3_REDLINE3_115kV_1PH	Stable	Stable
49	FLT_49_KNOLL3_NHAYS3_115kV_3PH	Stable	Stable

	Contingency Number and Name	2014SP	2013WP
50	FLT_50_KNOLL3_NHAYS3_115kV_1PH	Stable	Stable
51	FLT_51_BEACHS3_REDLINE3_115kV_3PH	Stable	Stable
52	FLT_52_BEACHS3_REDLINE3_115kV_1PH	Stable	Stable
53	FLT_53_GRAHAM3_BEACHS3_115kV_3PH	Stable	Stable
54	FLT_54_GRAHAM3_BEACHS3_115kV_1PH	Stable	Stable
55	FLT_55_HOXIE3_BEACHS3_115kV_3PH	Stable	Stable
56	FLT_56_HOXIE3_BEACHS3_115kV_1PH	Stable	Stable
57	FLT_57_SETAB7_SETAB3_345_115kV_3PH	Stable	Stable
58	FLT_58_MINGO7_MINGO3_345_115kV_3PH	Stable	Stable
59	FLT_59_SPERVIL7_SPEARVL6_345_230kV_3PH	Stable	Stable
60	FLT_60_POSTROCK7_POSTROCK6_345_230kV_3PH	Stable	Stable
61	FLT_61_AXTELL3_AXTELL7_345_115kV_3PH	Stable	Stable
62	FLT_62_HOLCOMB7_HOLCOMB3_345_115kV_3PH	Stable	Stable
63	FLT_63_KNOLL6_KNOLL3_230_115kV_3PH	Stable	Stable
64	FLT_64_SPEARVL6_SPEARVL3_230_115kV_3PH	Stable	Stable
65	FLT_65_SHAYS3_SHAYS6_115_230kV_3PH	Stable	Stable
66	FLT_66_CONCOR6_CONCOR3_230_115kV_3PH	Stable	Stable
67	FLT_67_NEKOMA3_NEKOMA2_115_69kV_3PH	Stable	Stable
68	FLT_68_HEIZER3_HEIZER2_115_69kV_3PH	Stable	Stable
69	FLT_69_SEWRDMW3_SEWARD2_115_69kV_3PH	Stable	Stable

FERC LVRT Compliance

FERC Order #661A places specific requirements on wind farms through its Low Voltage Ride Through (LVRT) provisions. For Interconnection Agreements signed after December 31, 2006, wind farms shall stay on line for faults at the POI that draw the voltage down at the POI to 0.0 pu.

Fault contingencies were developed to verify that wind farms remain on line when the POI voltage is drawn down to 0.0 pu. These contingencies are shown in Table 8.

Table 8: LVRT Contingencies

	Contingency Number and Name	Description
1	FLT_01_G0920TAP_BAZINE2_69kV_3PH	*3-Phase fault on the GEN-2009-020-Tap – Bazine 69kV line near the GEN-2009-020-Tap 69kV bus.*
2	FLT_03_G0920TAP_NEKOMA2_69kV_3PH	*3-Phase fault on the GEN-2009-020-Tap – Nekoma 69kV line near the GEN-2009-020-Tap 69kV bus.*

The required prior queued project wind farms remained online for the fault contingencies described in this section as well as the fault contingencies described in the Disturbances section of this report. GEN-2009-020 is found to be in compliance with FERC Order #661A.

Conclusion

<OMITTED TEXT> (Interconnection Customer, GEN-2009-020) has requested a Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for 48.3 MW of wind generation to be interconnected as an Energy Resource (ER) into a transmission facility of Midwest Energy (MIDW) in Rush County, Kansas. The point of interconnection will be a new 69kV substation tapping Nekoma-Balzine 69kV transmission line. GEN-2009-020, under GIA Section 5.9, has requested this Limited Operation Interconnection Study (LOIS) to determine the impacts of interconnecting to the transmission system before all required Network Upgrades identified in the DISIS-2010-001 (or most recent iteration) Impact Study can be placed into service.

Power flow analysis from this LOIS has determined that the GEN-2009-020 request can interconnect prior to the completion of the required Network Upgrades, listed within Table 2 of this report.

Transient stability analysis indicates that with the reactive equipment identified in the GEN-2009-020 turbine restudy, the transmission system will remain stable for the contingencies listed within Table 6 with the addition of GEN-2009-020 generation. Additionally, GEN-2009-020 was found to be in compliance with FERC Order #661A when studied as listed within this report.

Any changes to these assumptions, for example, one or more of the previously queued requests not included within this study execute an interconnection agreement and commencing commercial operation, may require a re-study of this LOIS at the expense of the Customer.

Nothing in this System Impact Study constitutes a request for transmission service or confers upon the Interconnection Customer any right to receive transmission service.

A. Additional Constraints Maximum Wind Scenario (Not for Mitigation)

See next page.

SEASON	GROUP	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB (MVA)	TDF	TC%LOADING (%MVA)	CONTINGENCY NAME
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	109.5311	'BASE CASE'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	133.3347	'BASE CASE'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.0584	115.3121	'LAWTON EASTSIDE - OKLAUNION 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.0584	139.9318	'LAWTON EASTSIDE - OKLAUNION 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.06015	113.2296	'Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.06015	137.5527	'Hitchland Interchange - POTTER COUNTY INTERCHANGE 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05874	113.3758	'GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05874	137.725	'GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1'
13G	03ALL	'FROM->TO'	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'	319	319	0.12077	107.775	'FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.06974	124.5178	'FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.06974	150.3996	'FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1'
13G	03ALL	'TO->FROM'	'HAYS PLANT - SOUTH HAYS 115KV CKT 1'	83	99	0.0519	105.9841	'KNOLL 230 - POSTROCK6 230.00 230KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05991	119.7068	'POST ROCK - SPEARVILLE 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05991	144.7629	'POST ROCK - SPEARVILLE 345KV CKT 1'
13G	03ALL	'FROM->TO'	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'	319	319	0.12706	109.7643	'AXTELL - POST ROCK 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.06402	117.4506	'AXTELL - POST ROCK 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.06402	142.4339	'AXTELL - POST ROCK 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.06178	122.6543	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.06178	148.2499	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.0754	115.01	'HUNTSVILLE - ST_JOHN 115KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.0754	139.6459	'HUNTSVILLE - ST_JOHN 115KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.0754	114.0939	'HUNTSVILLE - HUTCHINSON ENERGY CENTER 115KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.0754	138.5487	'HUNTSVILLE - HUTCHINSON ENERGY CENTER 115KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.0754	120.5883	'ST JOHN - ST_JOHN 115KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.0754	146.0116	'ST JOHN - ST_JOHN 115KV CKT 1'
13G	03ALL	'FROM->TO'	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'	319	319	0.09815	103.1799	'BUCKNER7 345.00 - HOLCOMB 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.06041	117.7768	'BUCKNER7 345.00 - HOLCOMB 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.06041	142.6909	'BUCKNER7 345.00 - HOLCOMB 345KV CKT 1'
13G	03ALL	'FROM->TO'	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'	319	319	0.08379	101.1784	'JEFFREY ENERGY CENTER - SUMMIT 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.0584	113.0664	'EMPORIA ENERGY CENTER - WICHITA 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.0584	137.3746	'EMPORIA ENERGY CENTER - WICHITA 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05856	112.9574	'RENO COUNTY - SUMMIT 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05856	137.2417	'RENO COUNTY - SUMMIT 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.06644	123.0285	'RENO COUNTY - WICHITA 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.06644	148.7986	'RENO COUNTY - WICHITA 345KV CKT 1'
13G	03ALL	'FROM->TO'	'MOUNDRIDGE (MOUND10X) 138/115/13.8KV TRANSFORMER CKT 1'	100	110	0.07281	151.5678	'RENO COUNTY - WICHITA 345KV CKT 1'
13G	03ALL	'FROM->TO'	'MOUNDRIDGE (MOUND10X) 138/115/13.8KV TRANSFORMER CKT 1'	100	110	0.07281	151.3054	'RENO COUNTY - WICHITA 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.0583	112.8916	'ROSE HILL - WOLF CREEK 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.0583	137.1929	'ROSE HILL - WOLF CREEK 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.0581	106.1337	'LACYGNE - WOLF CREEK 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.0581	129.4694	'LACYGNE - WOLF CREEK 345KV CKT 1'
13G	03ALL	'FROM->TO'	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'	319	319	0.15182	108.0581	'CIRCLE - MULLERGREN 230KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.07138	118.4053	'CIRCLE - MULLERGREN 230KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.07138	143.4717	'CIRCLE - MULLERGREN 230KV CKT 1'
13G	03ALL	'FROM->TO'	'SEWARD - ST JOHN 115KV CKT 1'	80.3	80.3	0.17829	101.1595	'CIRCLE - MULLERGREN 230KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05813	113.8341	'CENTENNIAL - COWSKIN 138KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05813	138.3425	'CENTENNIAL - COWSKIN 138KV CKT 1'
13G	03ALL	'FROM->TO'	'ST JOHN - ST_JOHN 115KV CKT 1'	86	86	0.09639	100.589	'CLEARWATER - MILAN TAP 138KV CKT 1'

13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05813	116.4135	'45TH ST4 138.00 - COWSKIN 138KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05813	141.3672	'45TH ST4 138.00 - COWSKIN 138KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05827	115.2835	'EVANS ENERGY CENTER SOUTH - LAKERIDGE 138KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05827	140.0286	'EVANS ENERGY CENTER SOUTH - LAKERIDGE 138KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05813	116.5306	'45TH ST4 138.00 - EVANS ENERGY CENTER SOUTH 138KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05813	141.5045	'45TH ST4 138.00 - EVANS ENERGY CENTER SOUTH 138KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05698	106.7979	'GILL ENERGY CENTER SOUTH - GILL ENERGY CENTER WEST 138KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05698	130.2966	'GILL ENERGY CENTER SOUTH - GILL ENERGY CENTER WEST 138KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05827	114.5913	'HOOVER NORTH - LAKERIDGE 138KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05827	139.2203	'HOOVER NORTH - LAKERIDGE 138KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.06075	106.3953	'CIRCLE - HUTCHINSON ENERGY CENTER 115KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.06075	129.7288	'CIRCLE - HUTCHINSON ENERGY CENTER 115KV CKT 1'
13G	03ALL	'FROM->TO'	'ST JOHN - ST_JOHN 115KV CKT 1'	86	86	0.09639	107.0248	'FLATRDG3 - HARPER 138KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05856	115.0666	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05856	139.6097	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05856	115.2132	'CUDAHY - KISMET 3 115.00 115KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05856	139.7327	'CUDAHY - KISMET 3 115.00 115KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05856	115.7217	'CUDAHY - G08-79T 115.00 115KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05856	140.3447	'CUDAHY - G08-79T 115.00 115KV CKT 1'
13G	03ALL	'FROM->TO'	'SEWARD - ST JOHN 115KV CKT 1'	80.3	80.3	0.14005	106.726	'GREENSBURG - SUN CITY 115KV CKT 1'
13G	03ALL	'FROM->TO'	'SEWARD - ST JOHN 115KV CKT 1'	80.3	80.3	0.14005	111.2863	'GREENSBURG - SSTARTP3 115.00 115KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.06036	103.6806	'GREAT BEND TAP - MULLERGREN 115KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.06036	126.5293	'GREAT BEND TAP - MULLERGREN 115KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.06036	103.7065	'GREAT BEND TAP - SEWARD 115KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.06036	126.5568	'GREAT BEND TAP - SEWARD 115KV CKT 1'
13G	03ALL	'FROM->TO'	'ST JOHN - ST_JOHN 115KV CKT 1'	86	86	0.09639	102.9138	'HARPER - MILAN TAP 138KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05731	101.724	'JUDSON LARGE - NORTH JUDSON LARGE SUB 115KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05731	124.4572	'JUDSON LARGE - NORTH JUDSON LARGE SUB 115KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05856	115.7229	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05856	140.3455	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
13G	03ALL	'FROM->TO'	'SEWARD - ST JOHN 115KV CKT 1'	80.3	80.3	0.14005	105.3395	'MEDICINE LODGE - SUN CITY 115KV CKT 1'
13G	03ALL	'FROM->TO'	'SEWARD - ST JOHN 115KV CKT 1'	80.3	80.3	0.14005	102.7001	'BARBER 3 115.00 - MEDICINE LODGE 115KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05623	120.6358	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05623	145.7479	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05967	112.7337	'AXTELL - PAULINE 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05967	136.9907	'AXTELL - PAULINE 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05933	113.6414	'GRAND ISLAND - SWEETWATER 345KV CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05933	138.028	'GRAND ISLAND - SWEETWATER 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05941	112.928	'Hitchland Interchange (H TB80155502) 345/230/13.2KV TRANSFORMER CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05941	137.2116	'Hitchland Interchange (H TB80155502) 345/230/13.2KV TRANSFORMER CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.06015	114.2741	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.06015	138.7462	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.06663	116.3971	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.06663	141.1358	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05623	120.0452	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05623	145.1307	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.0754	115.0174	'MIDW-CATB05'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.0754	139.6517	'MIDW-CATB05'

13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	109.5311	'NC1_GEN-NEBRASKA CITY 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	133.3347	'NC1_GEN-NEBRASKA CITY 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05875	113.7203	'SPP-SWPS-03'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05875	138.1185	'SPP-SWPS-03'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.06015	113.063	'SPP-SWPS-04'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.06015	137.3627	'SPP-SWPS-04'
13G	03ALL	'FROM->TO'	'ST JOHN - ST_JOHN 115KV CKT 1'	86	86	0.09639	102.02	'SPP-MKEC-05'
13G	03ALL	'FROM->TO'	'ST JOHN - ST_JOHN 115KV CKT 1'	86	86	0.09639	101.9651	'SPP-WEPL-03'
13G	03ALL	'FROM->TO'	'ST JOHN - ST_JOHN 115KV CKT 1'	86	86	0.09639	100.5337	'SPP-WEPL-03A'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05827	114.085	'SPP-WERE-32'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05827	138.6307	'SPP-WERE-32'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	113.1189	'GEN514805 1-SOONER UNIT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	137.4459	'GEN514805 1-SOONER UNIT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	112.9174	'GEN514806 1-SOONER UNIT 2'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	137.2111	'GEN514806 1-SOONER UNIT 2'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	105.2945	'GEN523971 1-HARRINGTON GEN #1 24 KV'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	128.4902	'GEN523971 1-HARRINGTON GEN #1 24 KV'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	105.2908	'GEN523972 1-HARRINGTON GEN #2 24 KV'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	128.4853	'GEN523972 1-HARRINGTON GEN #2 24 KV'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	105.3258	'GEN523973 1-HARRINGTON GEN #3 24 KV'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	128.5252	'GEN523973 1-HARRINGTON GEN #3 24 KV'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	104.3076	'GEN525561 1-TOLK GEN #1 24 KV'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	127.3655	'GEN525561 1-TOLK GEN #1 24 KV'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	104.1029	'GEN525562 1-TOLK GEN #2 24 KV'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	127.1321	'GEN525562 1-TOLK GEN #2 24 KV'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	119.8454	'GEN531447 1-HOLCOMB GENERATOR'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	106.439	'GEN531495 1-CNTRLPLWG1 0.6900'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	129.7941	'GEN531495 1-CNTRLPLWG1 0.6900'
13G	03ALL	'FROM->TO'	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'	319	319	0.09012	101.0578	'GEN532651 1-JEFFREY ENERGY CENTER UNIT 1'
13G	03ALL	'FROM->TO'	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'	319	319	0.09012	101.4419	'GEN532652 1-JEFFREY ENERGY CENTER UNIT 2'
13G	03ALL	'FROM->TO'	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'	319	319	0.09012	101.4406	'GEN532653 1-JEFFREY ENERGY CENTER UNIT 3'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	115.5092	'GEN532722 1-EVANS ENERGY CENTER UNIT 2'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	140.1646	'GEN532722 1-EVANS ENERGY CENTER UNIT 2'
13G	03ALL	'FROM->TO'	'MOUNDRIDGE (MOUND10X) 138/115/13.8KV	100	110	0.03306	101.3554	'GEN532722 1-EVANS ENERGY CENTER UNIT 2'
13G	03ALL	'FROM->TO'	'MOUNDRIDGE (MOUND10X) 138/115/13.8KV TRANSFORMER CKT 1'	100	110	0.03306	101.0792	'GEN532722 1-EVANS ENERGY CENTER UNIT 2'
13G	03ALL	'FROM->TO'	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'	319	319	0.09012	101.9447	'GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	119.0212	'GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	144.144	'GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	122.3239	'GEN539670 4-JUDSON LARGE GENERATOR'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	105.344	'GEN539753 1-CLR_2 0.6900'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	128.5478	'GEN539753 1-CLR_2 0.6900'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	110.3175	'GEN539762 1-SSWIND 1 34.500'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	122.3842	'GEN539767 1-GRAY COUNTY WIND FARM'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	103.3728	'GEN560140 1-G09-08 0.7000'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	126.2831	'GEN560140 1-G09-08 0.7000'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	105.0508	'GEN560209 1-G07-40 0.5750'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	128.2115	'GEN560209 1-G07-40 0.5750'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	103.9114	'GEN560238 1-G10-09 0.6900'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	126.9086	'GEN560238 1-G10-09 0.6900'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	101.676	'GEN560279 1-G08-18 0.6900'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	124.3534	'GEN560279 1-G08-18 0.6900'

13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	105.3721	'GEN560514 1-G04_014 0.6900'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	128.5713	'GEN560514 1-G04_014 0.6900'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	103.6295	'GEN560522 1-G05-12 0.6900'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	126.5852	'GEN560522 1-G05-12 0.6900'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	106.5939	'GEN560669 1-G10_057 0.6900'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	129.9549	'GEN560669 1-G10_057 0.6900'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	105.4343	'GEN640009 1-COOPER NUCLEAR STATION'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	128.6371	'GEN640009 1-COOPER NUCLEAR STATION'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	102.7326	'GEN640010 1-GERALD GENTLEMAN STATION UNIT 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	125.5535	'GEN640010 1-GERALD GENTLEMAN STATION UNIT 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	102.8751	'GEN640011 2-GERALD GENTLEMAN STATION UNIT 2'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	125.7169	'GEN640011 2-GERALD GENTLEMAN STATION UNIT 2'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	106.335	'GEN645001 1-FORT CALHOUN 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	129.6723	'GEN645001 1-FORT CALHOUN 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	105.7812	'GEN645011 1-NEBRASKA CITY 1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	129.037	'GEN645011 1-NEBRASKA CITY 1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	105.421	'GEN645012 2-NEBRASKA CITY 2'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	128.6239	'GEN645012 2-NEBRASKA CITY 2'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	106.1671	'GEN659103 1-ANTELOPE VALLEY UNIT1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	129.4822	'GEN659103 1-ANTELOPE VALLEY UNIT1'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	106.1671	'GEN659107 2-ANTELOPE VALLEY UNIT2'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	129.4822	'GEN659107 2-ANTELOPE VALLEY UNIT2'
13G	03ALL	'TO->FROM'	'CLEARWATER - MILAN TAP 138KV CKT 1'	110	110	0.05832	100	'GEN659118 1-LARAMIE RIVER UNIT1'
13G	03ALL	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.05832	122.4748	'GEN659118 1-LARAMIE RIVER UNIT1'