SCREENING STUDY

SPP-LTSR-2016-003

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By SPP Engineering, SPP Transmission Service Studies

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION	COMMENTS
5/20/16	SPP	Original	
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CONTENTS

EXECUTIVE SUMMARY

Omaha Public Power District has requested a Screening Study to determine the impacts on SPP facilities due to the Long Term Service Requests for 500 MW. The service type requested for this screening study is Long Term Service Request (LTSR). OASIS# 82644521, 82644533, 82644541, and 82644569 were studied as one lump study based on multiple requests from 1/1/2017 to 1/1/2022.

The principal objective of this study is to identify system problems and potential system modifications necessary to facilitate the LTSR request while maintaining system reliability. The LTSR request was studied using two system scenarios. The service was modeled by the transfers from MPS, OPPD and SPS to OPPD. The two scenarios were studied to capture system limitations caused or impacted by the requested service. An analysis was conducted on the planning horizon from 1/1/2017 to 1/1/2022.

The service was modeled from MPS, OPPD and SPS to OPPD. Facilities on the SPP system were identified for the requested service due to the SPP Study Methodology criteria. Tables 1 and 2 summarize the results of the screening study analysis for the transfers for the scenarios listed in the table. Table 1 lists SPP thermal transfer limitations identified. Table 2 lists SPP voltage transfer limitations identified. Table 3 lists the network upgrades required to mitigate the limitations impacted by this request.

INTRODUCTION

Omaha Public Power District has requested a screening study to determine the impacts on SPP facilities for the Long Term Service Requests for 500 MW.

The purpose of the LTSR Option Screening Study is to provide the Eligible Customer with an approximation of the transmission remediation costs of each potential LTSR and a reasonable cost differential between alternatives for the purpose of an Eligible Customer's ranking of its potential LTSRs. The results of the Screening Study are not binding and the Eligible Customer retains the rights to enter the Aggregate Transmission Service Study. The Screening Study results will not assess the third party impacts and upgrades required. Service will not be granted based on the Screening Study for potential LTSRs on the Transmission System. To obtain a Service Agreement, Eligible Customers must apply for service and follow the application process set forth in Parts II and III of the Tariff.

This study includes steady-state contingency analysis (PSS/E function ACCC). The steady-state analysis considers the impact of the request on transmission line and transformer loadings for outages of single transmission lines, transformers, and generating units, and selected multiple transmission lines and transformers on the SPP and first-tier third party systems.

The LTSR request was studied using two system scenarios. The service was modeled by a transfer from MPS, OPPD and SPS to OPPD. The two scenarios were studied to capture the system limitations caused or impacted by the requested service. Scenario 0 includes projected usage of transmission service included in the SPP 2015 Series Cases. Scenario 5 includes transmission service not already included in the SPP 2015 Series Cases.

STUDY METHODOLOGY

DESCRIPTION

The facility study analysis was conducted to determine the steady-state impact of the requested service on the SPP and first tier non-SPP control area systems. The steady-state analysis was performed consistent with current SPP Criteria and NERC Reliability Standards requirements. SPP conforms to NERC Reliability Standards, which provide strict requirements related to voltage violations and thermal overloads during normal conditions and during a contingency. NERC Standards require all facilities to be within normal operating ratings for normal system conditions and within emergency ratings after a contingency.

Normal operating ratings and emergency operating ratings monitored are Rate A and B in the SPP Model Development Working Group (MDWG) models, respectively. The upper bound and lower bound of the normal voltage range monitored is 105% and 95%. The upper bound and lower bound of the emergency voltage range monitored is 105% and 90%. Transmission Owner voltage monitoring criteria is used if more restrictive. The SPS Tuco 230 kV bus voltage is monitored at 92.5% due to pre-determined system stability limitations. The WERE Wolf Creek 345 kV bus voltage is monitored at 103.5% and 98.5% due to transmission operating procedure.

The contingency set includes all SPP control area branches and ties 69 kV 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 control areas with SPP reserve share program redispatch. The monitored 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 115 kV and above. Voltage monitoring was performed for SPP control area buses 69 kV and above.

A 3% transfer distribution factor (TDF) cutoff was applied to all SPP control area facilities. For first tier non-SPP control area facilities, a 3% TDF cutoff was applied to AECI, AMRN (Ameren), and ENTR (Entergy) control areas. For voltage monitoring, a 0.02 per unit change in voltage must occur due to the transfer or modeling upgrades to be considered a valid limit to the transfer.

MODEL DEVELOPMENT

SPP used five seasonal models to study the MPS, OPPD and SPS to OPPD 500 MW request for the requested service period. The following SPP Transmission Expansion Plan 2015 Build 1 Cases were used to study the impact of the requested service on the transmission system:

- 2016/17 Winter Peak (16WP)
- 2017 Summer Peak (17SP)
- 2017/18 Winter Peak (17WP)
- 2020 Summer Peak (20SP)
- 2020/21 Winter Peak (20WP)

The Summer Peak models apply to June through September and the Winter Peak models apply to December through March.

The chosen base case models were modified to reflect the current modeling information. One group of requests was developed from the aggregate to model the requested service. From the seasonal models, two system scenarios were developed. Scenario 0 includes projected usage of transmission included in the SPP 2015 Series Cases. Scenario 5 includes transmission service not already included in the SPP 2015 Series Cases.

TRANSMISSION REQUEST MODELING

NITS requests are modeled as Generation to Load transfers in addition to Generation to Generation transfers. NITS requests are modeled as Generation to Load transfers in addition to Generation to Generation because the requested NITS is a request to serve network load with the new designated network resource, and the impacts on Transmission System are determined accordingly. PTP Transmission Service requests are modeled as Generation to Generation transfers. Generation to Generation transfers are accomplished by developing a post-transfer case for comparison by dispatching the request source and redispatching the request sink.

TRANSFER ANALYSIS

Using the selected cases both with and without the requested transfers modeled, the PSS/E Activity ACCC was run on the cases and compared to determine the facility overloads caused or impacted by the transfer. TDF cutoffs (SPP and 1st-Tier) and voltage threshold (0.02 change) were applied to determine the impacted facilities. The PSS/E options chosen to conduct the analysis can be found in Appendix A.

STUDY RESULTS

STUDY ANALYSIS RESULTS

Tables 1 and 2 contain the initial steady-state analysis results of the LTSR. The tables are attached to the end of this report, if applicable. The tables identify the scenario and season in which the event occurred, the transfer amount studied, the facility control area location, applicable ratings of the thermal transfer limitations and voltage transfer limitations, and the loading percentage and voltage per unit (pu).

TABLE 1

Table 1 lists the SPP thermal transfer limitations caused or impacted by the 500 MW requested transfers for applicable scenarios. Solutions are identified for the limitations in this table.

TABLE 2

Table 2 lists the SPP voltage transfer limitations caused or impacted by the 500 MW requested transfers for applicable scenarios. Solutions are identified for the violations in this table.

TABLE 3

Table 3 lists the network upgrades required to mitigate the limitations caused or impacted by this request. Engineering and construction costs are provided for assigned upgrades in this table.

CONCLUSION

The results of the screening study show that limiting constraints exist within the SPP regional transmission system for the requested transfer of 500 MW. The next steps are to WITHDRAW the request on OASIS and, if desired, enter a new OASIS request into the aggregate study queue.

The results contained in this study are for informational purposes only. Service will not be granted based on the Screening Study results. To obtain a Service Agreement, Eligible Customers must apply for service and follow the application processes set forth in Parts II and III of the Tariff and enter the Aggregate Study process. The results of the Aggregate Study may vary from the results of this screening study.

As a final step in this process, it is requested that the customer WITHDRAW the LTSR screening study request on OASIS.

APPENDIX A

PSS/E CHOICES IN RUNNING LOAD FLOW PROGRAM AND ACCC

BASE CASE SETTINGS:

- Solutions: Fixed slope decoupled Newton-Raphson solution (FDNS)
- Tap adjustment: Stepping
- Area Interchange Control: Tie lines and loads
- Var limits: Apply immediately
- Solution Options:

  X Phase shift adjustment
  _ Flat start
  _ Lock DC taps
  _ Lock switched shunts

ACCC CASE SETTINGS:

- Solutions: AC contingency checking (ACCC)
- MW mismatch tolerance: 0.5
- System intact rating: Rate A
- Contingency case rating: Rate B
- Percent of rating: 100
- Output code: Summary
- Min flow change in overload report: 3mw
- Excld cases w/ no overloads from report: YES
- Exclude interfaces from report: NO
- Perform voltage limit check: YES
- Elements in available capacity table: 60000
- Cutoff threshold for available capacity table: 99999.0
- Min. contng. Case Vltg chng for report: 0.02
- Sorted output: None
- Newton Solution:
- Tap adjustment: Stepping
- Area interchange control: Tie lines and loads (Disabled for generator outages)
- Var limits: Apply immediately
- Solution options: X Phase shift adjustment
  _ Flat start
  _ Lock DC taps
  _ Lock switched shunts

Scenario	Season	From Area	To Area	Monitored Branch Over 100% Rate B	Transfer Case % Loading	Max TDF (%)	Oasis #	Outaged Branch Causing Overload	Upgrade Name	Solution
5	17SP	NPPD	NPPD	GRAND ISLAND - SWEETWATER 345KV CKT 1	101.7	12.75%	82644533	AXTELL - SWEETWATER 345KV CKT 1	Cherry Co. - Gentleman 345 kV Ckt 1	Build new 110-mile 345 kV line from Gerald Gentleman Station substation to new Cherry County substation. This upgrade is contingent upon approval from Western Area Power Administration ("WAPA") to tap the Grand Island - Fort Thompson 345
5	17SP	NPPD	NPPD	GRAND ISLAND - SWEETWATER 345KV CKT 1	101.7	3.22%	82644521	AXTELL - SWEETWATER 345KV CKT 1	Cherry Co. - Gentleman 345 kV Ckt 1	Build new 110-mile 345 kV line from Gerald Gentleman Station substation to new Cherry County substation. This upgrade is contingent upon approval from Western Area Power Administration ("WAPA") to tap the Grand Island - Fort Thompson 345
5	16WP	NPPD	NPPD	VICTORY HILL (VICTORYHL T1) 230/115/13.8KV TRANSFORMER CKT 1	108.8	3.54%	82644533	STEGALL-LNX3230.00 - WAYSIDE 230KV CKT 1	Bobcat Canyon - Scottsbluff 115 kV Ckt 1	Install new 22-mile 115 kV line from Bobcat Canyon to Scottsbluff and install any necessary terminal equipment.
5	16WP	NPPD	NPPD	VICTORY HILL (VICTORYHL T1) 230/115/13.8KV TRANSFORMER CKT 1	108.7	3.54%	82644533	STEGALL - STEGALL-LNX3230.00 230KV CKT Z	Bobcat Canyon - Scottsbluff 115 kV Ckt 1	Install new 22-mile 115 kV line from Bobcat Canyon to Scottsbluff and install any necessary terminal equipment.
5	17SP	OKGE	OKGE	FPL SWITCH - WOODWARD 138KV CKT 1	136.9	3.06%	82644541	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1	Woodward EHV 138kV Phase Shifting Transformer circuit #1	Install one (1) 138 kV phase shifting transformer along with upgrading relay, protective, and metering equipment, and al associated and miscellaneous materials.
5	17WP	OKGE	OKGE	FPL SWITCH - WOODWARD 138KV CKT 1	106.2	3.08%	82644541	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1	Woodward EHV 138kV Phase Shifting Transformer circuit #1	Install one (1) 138 kV phase shifting transformer along with upgrading relay, protective, and metering equipment, and al associated and miscellaneous materials.
5	17SP	OKGE	WFEC	FPL SWITCH - MOORELAND 138KV CKT 1	101.3	3.06%	82644541	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1	Woodward EHV 138kV Phase Shifting Transformer circuit #1	Install one (1) 138 kV phase shifting transformer along with upgrading relay, protective, and metering equipment, and al associated and miscellaneous materials.
0	16WP	SPS	SPS	Harrington Station East Bus - POTTER COUNTY INTERCHANGE 230KV CKT 1	106.0	13.91%	82644541	CHERRY1 - POTTER COUNTY INTERCHANGE 230KV CKT 1	Potter Co. - Harrington 230 kV Terminal Upgrades	Upgrade terminal equipment at both Potter Co. and Harrington 230 kV substations.
0	16WP	SPS	SPS	Harrington Station East Bus - POTTER COUNTY INTERCHANGE 230KV CKT 1	105.9	11.61%	82644541	CHERRY1 - HARRINGTON STATION 230KV CKT 1	Potter Co. - Harrington 230 kV Terminal Upgrades	Upgrade terminal equipment at both Potter Co. and Harrington 230 kV substations.
0	17WP	SPS	SPS	Harrington Station East Bus - POTTER COUNTY INTERCHANGE 230KV CKT 1	105.3	13.51%	82644541	CHERRY1 - HARRINGTON STATION 230KV CKT 1	Potter Co. - Harrington 230 kV Terminal Upgrades	Upgrade terminal equipment at both Potter Co. and Harrington 230 kV substations.
0	17WP	SPS	SPS	Harrington Station East Bus - POTTER COUNTY INTERCHANGE 230KV CKT 1	105.0	18.38%	82644541	CHERRY1 - POTTER COUNTY INTERCHANGE 230KV CKT 1	Potter Co. - Harrington 230 kV Terminal Upgrades	Upgrade terminal equipment at both Potter Co. and Harrington 230 kV substations.
0	20SP	SPS	SPS	Harrington Station East Bus - POTTER COUNTY INTERCHANGE 230KV CKT 1	108.8	10.26%	82644541	CHERRY1 - HARRINGTON STATION 230KV CKT 1	Potter Co. - Harrington 230 kV Terminal Upgrades	Upgrade terminal equipment at both Potter Co. and Harrington 230 kV substations.
0	20SP	SPS	SPS	Harrington Station East Bus - POTTER COUNTY INTERCHANGE 230KV CKT 1	105.7	14.14%	82644541	CHERRY1 - POTTER COUNTY INTERCHANGE 230KV CKT 1	Potter Co. - Harrington 230 kV Terminal Upgrades	Upgrade terminal equipment at both Potter Co. and Harrington 230 kV substations.
0	17SP	SPS	SPS	LE-WEST_SUB3115.00 - LEA COUNTY REC-LOVINGTON INTERCHANGE 115KV CKT 1	100.4	3.83%	82644541	BUCKEYE TAP - LE-TXACO_TP3115.00 115KV CKT 1	INK BASIN 230/115 KV TRANSFORMER 1	Construct new Ink Basin substation at the intersection of the 230 kV line from Hobbs to Yoakum and the 115 kV line fron Allred Tap to LE Watts. Install 250 MVA 230/115 kV transformer at Ink Basin.
0	20SP	SPS	SPS	LE-WEST_SUB3115.00 - LEA COUNTY REC-LOVINGTON INTERCHANGE 115KV CKT 1	120.7	4.28%	82644541	BUCKEYE TAP - LE-TXACO_TP3115.00 115KV CKT 1	INK BASIN 230/115 KV TRANSFORMER 1	Construct new Ink Basin substation at the intersection of the 230 kV line from Hobbs to Yoakum and the 115 kV line fron Allred Tap to LE Watts. Install 250 MVA 230/115 kV transformer at Ink Basin.
0	20SP	SPS	SPS	LE-WEST_SUB3115.00 - LEA COUNTY REC-LOVINGTON INTERCHANGE 115KV CKT 1	106.2	4.28%	82644541	1758	INK BASIN 230/115 KV TRANSFORMER 1	Construct new Ink Basin substation at the intersection of the 230 kV line from Hobbs to Yoakum and the 115 kV line fron Allred Tap to LE Watts. Install 250 MVA 230/115 kV transformer at Ink Basin.
5	17SP	WERE	KCPL	SWISSVALE - WEST GARDNER 345KV CKT 1	101.1	8.19%	82644541	HOYT - STRANGER CREEK 345KV CKT 1	SWISSVALE - WEST GARDNER 345KV CKT 1 WERE	Replace Terminal Equipment
5	17SP	WERE	KCPL	SWISSVALE - WEST GARDNER 345KV CKT 1	100.4	7.58%	82644541	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1	SWISSVALE - WEST GARDNER 345KV CKT 1 WERE	Replace Terminal Equipment
5	17SP	WERE	WERE	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1	101.2	9.42%	82644541	AUBURN ROAD - JEFFREY ENERGY CENTER 230KV CKT 1	Multi - Geary County 345/115 kV and Geary - Chapman 115 kV	Build new Geary County 345/115 kV substation south of Junction City where JEC-Summit and McDowell Creek-Junction City #2 ckt separate. Construct new Geary County - Chapman 115 kV line.
5	17SP	WERE	WERE	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1	100.2	7.73%	82644541	JEFFREY ENERGY CENTER - MORRIS COUNTY 345KV CKT 1	Multi - Geary County 345/115 kV and Geary - Chapman 115 kV	Build new Geary County 345/115 kV substation south of Junction City where JEC-Summit and McDowell Creek-Junction City #2 ckt separate. Construct new Geary County - Chapman 115 kV line.
5	20SP	WERE	WERE	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1	100.2	9.19%	82644541	AUBURN ROAD - JEFFREY ENERGY CENTER 230KV CKT 1	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1	Rebuild 24 miles of line

Table 2- SPP Facility Voltage Transfer Limitations

Scenario	Season	Area	Monitored Bus with Violation	Transfer Case Voltage (PU)	Outaged Branch Causing Overload	Upgrade Name	Solution
			No Voltage Limitations				

Transmission Owner	Upgrade	Solution	Earliest Date Upgrade Required (DUN)	Estimated Date of Upgrade Completion (EOC)	Estimated Engineering & Construction Cost
WERE	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1	Rebuild 24 miles of line	6/1/2018	6/1/2018	$34,259,472.00

Construction Pending Projects - The requested service is contingent upon completion of the following upgrades. Cost is not assignable to the transmission customer.

Transmission Owner	Upgrade	Solution	Earliest Date Upgrade Required (DUN)	Estimated Date of Upgrade Completion (EOC)	Estimated Engineering & Construction Cost
OKGE	Woodward EHV 138kV Phase Shifting Transformer circuit #1	Install one (1) 138 kV phase shifting transformer along with upgrading relay, protective, and metering equipment, and all associated and miscellaneous materials.	6/1/2017	8/2/2017	$7,099,999.00

Expansion Plan Projects - The requested service is contingent upon completion of the following upgrades. Cost is not assignable to the transmission customer.

Transmission Owner	Upgrade	Solution	Earliest Date Upgrade Required (DUN)	Estimated Date of Upgrade Completion (EOC)
NPPD	Cherry Co. - Gentleman 345 kV Ckt 1	Build new 110-mile 345 kV line from Gerald Gentleman Station substation to new Cherry County substation. This upgrade is contingent upon approval from Western Area Power Administration ("WAPA") to tap the Grand Island - Fort Thompson 345 kV line.	6/1/2017	6/1/2018
NPPD	Bobcat Canyon - Scottsbluff 115 kV Ckt 1	Install new 22-mile 115 kV line from Bobcat Canyon to Scottsbluff and install any necessary terminal equipment.	1/1/2017	6/1/2017
SPS	Potter Co. - Harrington 230 kV Terminal Upgrades	Upgrade terminal equipment at both Potter Co. and Harrington 230 kV substations.	1/1/2017	12/31/2021
SPS	INK BASIN 230/115 KV TRANSFORMER 1	Construct new Ink Basin substation at the intersection of the 230 kV line from Hobbs to Yoakum and the 115 kV line from Allred Tap to LE Watts. Install 250 MVA 230/115 kV transformer at Ink Basin.	6/1/2017	6/1/2017
WERE	Multi - Geary County 345/115 kV and Geary - Chapman 115 kV	Build new Geary County 345/115 kV substation south of Junction City where JEC-Summit and McDowell Creek-Junction City #2 ckt separate. Construct new Geary County - Chapman 115 kV line.	6/1/2017	6/1/2018

Reliability Projects - The requested service is contingent upon completion of the following upgrades. Cost is not assignable to the transmission customer.

Transmission Owner	Upgrade	Solution	Earliest Date Upgrade Required (DUN)	Estimated Date of Upgrade Completion (EOC)
	No Reliability Project			

Planned Projects - The requested service is contingent upon completion of the following upgrades. Cost is not assignable to the transmission customer.

Transmission Owner	Upgrade	Solution	Earliest Date Upgrade Required (DUN)	Estimated Date of Upgrade Completion (EOC)
WERE	SWISSVALE - WEST GARDNER 345KV CKT 1 WERE	Replace Terminal Equipment	6/1/2017	6/1/2017