Screening Study
SPP-LTSR-2015-001

5/28/2015

SPP Engineering, SPP Transmission Service Studies

Southwest Power Pool

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Executive Summary

City Utilities of Springfield, MO has requested a Screening Study to determine the impacts on SPP facilities due to the Long Term Service Requests for 50 MW. The service type requested for this screening study is Long Term Service Request (LTSR). OASIS# 81017512 was studied as one request from 6/1/2017 to 6/1/2067.

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 NPPD to SPRM. 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 6/1/2017 to 6/1/2067.

The service was modeled from NPPD to SPRM. 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

City Utilities of Springfield, MO has requested a screening study to determine the impacts on SPP facilities for the Long Term Service Requests for 50 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 NPPD to SPRM. 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 2014 Series Cases. Scenario 5 includes transmission service not already included in the SPP 2014 Series Cases.

Study Methodology

Description

The facility study analysis was conducted to determine the steady-state impact of the requested service on the SPP system. The steady-state analysis was performed to ensure current SPP Criteria and NERC Reliability Standards requirements are fulfilled. 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 monitor elements include all SPP control area branches, ties, and buses 69 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 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 four seasonal models to study the NPPD to SPRM 50 MW request for the requested service period. The following SPP Transmission Expansion Plan 2014 Build 1 Cases were used to study the impact of the requested service on the transmission system:

2020 Summer Peak (20SP)
2020/21 Winter Peak (20WP)
2025 Summer Peak (25SP)
2025/26 Summer Peak (25SP)

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 2014 Series Cases. Scenario 5 includes transmission service not already included in the SPP 2014 Series Cases.

Transmission Request Modeling

Network Integration Transmission Service requests are modeled as Generation to Load transfers in addition to Generation to Generation because the requested Network Integration Transmission Service is a request to serve network load with the new designated network resource, and the impacts on the Transmission System are determined accordingly. 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 transfer modeled, the PSS/E Activity ACCC was run on the cases and compared to determine the facility overloads caused or impacted by the transfer. Transfer distribution factor cutoffs 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 lists the SPP thermal transfer limitations caused or impacted by the 50 MW requested transfers for applicable scenarios. Solutions are identified for the limitations in this table.

Table 2 lists the SPP voltage transfer limitations caused or impacted by the 50 MW requested transfers for applicable scenarios. Solutions are identified for the violations in this table.

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 50 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	TDF (%)	Outaged Branch Causing Overload	Upgrade Name	Solution
5	20WP	MIDW	WERE	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	108.1	4.87%	MULLERGREN - SOUTH HAYS 230KV CKT 1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	Rebuild 38.56 Miles of line
5	20WP	MIDW	WERE	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	107.1	4.78%	CIRCLE - MULLERGREN 230KV CKT 1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	Rebuild 38.56 Miles of line
5	20WP	MIDW	WERE	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	102.5	4.32%	SPSCONT-05B	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	Rebuild 38.56 Miles of line
5	20WP	MIDW	WERE	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	101.8	4.32%	SPSCONT-04	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	Rebuild 38.56 Miles of line
5	25WP	MIDW	WERE	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	104.4	4.82%	MULLERGREN - SOUTH HAYS 230KV CKT 1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	Rebuild 38.56 Miles of line
5	25WP	MIDW	WERE	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	102.9	4.72%	CIRCLE - MULLERGREN 230KV CKT 1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	Rebuild 38.56 Miles of line
5	25SP	NPPD	LES	SHELDON - SW7&BENNET7 115.00 115KV CKT 1	105.1	12.41%	SHELDON - SW7TH & PLEASANT HILL 115KV CKT 1	SHELDON - SW7&BENNET7 115.00 115KV CKT 1	Terminal Equipment
5	25WP	OKGE	OKGE	CIMARRON - DRAPER LAKE 345KV CKT 1	102.2	3.95%	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1	CIMARRON - DRAPER LAKE 345KV CKT 1	Upgrade CT and wavetrap at both Cimarron and Draper 345 kV substations to 2000 A to achieve a new rating of 119 MVA on the Cimarron - Draper 345 kV line.
5	20SP	SUNC	SUNC	BUCKNER7 345.00 - SPEARVILLE 345KV CKT 1	118.1	10.49%	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1	BUCKNER - SPEARVILLE 345 KV CKT 1 Terminal Upgrades	Replace breaker, switches, CTs, and relays at the Buckner and Spearville 345 kV substations to increase the rating of th 345 kV line from Buckner to Spearville.
5	20WP	SUNC	SUNC	BUCKNER7 345.00 - SPEARVILLE 345KV CKT 1	105.6	15.22%	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1	BUCKNER - SPEARVILLE 345 KV CKT 1 Terminal Upgrades	Replace breaker, switches, CTs, and relays at the Buckner and Spearville 345 kV substations to increase the rating of th 345 kV line from Buckner to Spearville.
5	25SP	SUNC	SUNC	BUCKNER7 345.00 - SPEARVILLE 345KV CKT 1	114.3	9.36%	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1	BUCKNER - SPEARVILLE 345 KV CKT 1 Terminal Upgrades	Replace breaker, switches, CTs, and relays at the Buckner and Spearville 345 kV substations to increase the rating of th 345 kV line from Buckner to Spearville.
5	25WP	SUNC	SUNC	BUCKNER7 345.00 - SPEARVILLE 345KV CKT 1	108.8	15.41%	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1	BUCKNER - SPEARVILLE 345 KV CKT 1 Terminal Upgrades	Replace breaker, switches, CTs, and relays at the Buckner and Spearville 345 kV substations to increase the rating of th 345 kV line from Buckner to Spearville.
5	25WP	SWPA	SPRM	CLAY - SPRINGFIELD 161KV CKT 1	100.6	14.50%	JAMES RIVER - SOUTHWEST 161KV CKT 1	CLAY - SPRINGFIELD 161KV CKT 1 SWPA #2	Replace four structures
5	20WP	SWPA	SWPA	NIXA (NXA X2) 161/69/13.8KV TRANSFORMER CKT 1	123.1	4.31%	NIXA (NXA X1) 161/69/13.8KV TRANSFORMER CKT 1	NIXA (NXA X2) 161/69/13.8KV TRANSFORMER CKT 1	Replace Transformer
5	25WP	SWPA	SWPA	NIXA (NXA X2) 161/69/13.8KV TRANSFORMER CKT 1	128.5	4.92%	NIXA (NXA X1) 161/69/13.8KV TRANSFORMER CKT 1	NIXA (NXA X2) 161/69/13.8KV TRANSFORMER CKT 1	Replace Transformer
5	25WP	SWPA	SWPA	NIXA DT - NX ESPY2 69.000 69KV CKT 1	104.0	14.15%	JAMES RIVER (JRPSTX1) 161/69/13.2KV TRANSFORMER CKT 1	NIXA DT - NX ESPY2 69.000 69KV CKT 1	Rebuild 1.5 miles of line
5	25WP	SWPA	SWPA	NIXA DT - NX ESPY2 69.000 69KV CKT 1	100.6	10.60%	GEN549893 2-SOUTHWEST 2	NIXA DT - NX ESPY2 69.000 69KV CKT 1	Rebuild 1.5 miles of line
5	20SP	WERE	KCPL	SWISSVALE - WEST GARDNER 345KV CKT 1	104.7	3.90%	HOYT - STRANGER CREEK 345KV CKT 1	SWISSVALE - WEST GARDNER 345KV CKT 1 WERE	Replace Terminal Equipment
5	20SP	WERE	KCPL	SWISSVALE - WEST GARDNER 345KV CKT 1	103.1	3.07%	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1	SWISSVALE - WEST GARDNER 345KV CKT 1 WERE	Replace Terminal Equipment
5	25SP	WERE	KCPL	SWISSVALE - WEST GARDNER 345KV CKT 1	105.3	4.03%	HOYT - STRANGER CREEK 345KV CKT 1	SWISSVALE - WEST GARDNER 345KV CKT 1 WERE	Replace Terminal Equipment
5	25SP	WERE	KCPL	SWISSVALE - WEST GARDNER 345KV CKT 1	104.5	3.45%	HOYT - JEFFREY ENERGY CENTER 345KV CKT 1	SWISSVALE - WEST GARDNER 345KV CKT 1 WERE	Replace Terminal Equipment

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
			None				

Transmission Owner	Upgrade	Solution	Earliest Date Upgrade Required (DUN)	Estimated Date of Upgrade Completion (EOC)	Estimated Engineering & Construction Cost
SPRM	NIXA (NXA X2) 161/69/13.8KV TRANSFORMER CKT 1	Replace Transformer with 70MVA	6/1/2017	6/1/2019.	$3,859,619
SPRM	NIXA DT - NX ESPY2 69.000 69KV CKT 1	Rebuild 1.5 miles of line	6/1/2017	6/1/2019	$1,100,223

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
MIDW	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	Rebuild 38.56 Miles of line	10/1/2017	6/1/2018	$37,200,528.00
NPPD	SHELDON - SW7&BENNET7 115.00 115KV CKT 1	Terminal Equipment	6/1/2021	6/1/2021	$324,585.00
WERE	SWISSVALE - WEST GARDNER 345KV CKT 1 WERE	Replace Terminal Equipment	6/1/2017	6/1/2019	$3,400,000.00

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)
	No Expansion Plan Project			

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)
OKGE	CIMARRON - DRAPER LAKE 345KV CKT 1	Upgrade CT and wavetrap at both Cimarron and Draper 345 kV substations to 2000 A to achieve a new rating of 1195 MVA on the Cimarron - Draper 345 kV line.	10/1/2021	10/1/2021
SUNC	BUCKNER - SPEARVILLE 345 KV CKT 1 Terminal Upgrades	Replace breaker, switches, CTs, and relays at the Buckner and Spearville 345 kV substations to increase the rating of the 345 kV line from Buckner to Spearville.	6/1/2017	6/1/2017
SWPA	CLAY - SPRINGFIELD 161KV CKT 1 SWPA #2	Replace four structures	10/1/2021	10/1/2021