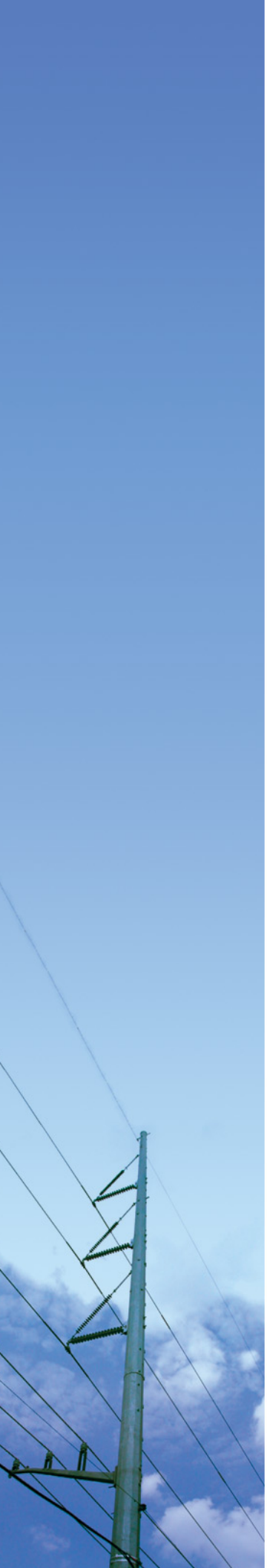

Screening Study
SPP-LTSR-2010-008&009

For OASIS Request #74845906 & 74845899

MAINTAINED BY
SPP Engineering, SPP Transmission Service Studies
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SPP Southwest Power Pool

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Executive Summary

Arkansas Electric Cooperative Corporation has requested a screening study to determine the impacts on SPP facilities due to the Long Term Service Requests for 610 MW. The service type requested for this screening study is Long Term Service Request (LTSR). OASIS# 74845977 and OASIS# 74845976 were studied as one request from 6/1/2015 to 6/1/2035.

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 AEPW to AEPW and OKGE. 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 6/1/2015 to 6/1/2035.

The service was modeled from AEPW to AEPW and OKGE. 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

Arkansas Electric Cooperative Corporation has requested a screening study to determine the impacts on SPP facilities for the Long Term Service Requests for 610 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 AEPW to AEPW and OKGE. 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 2010 Series Cases. Scenario 5 includes transmission service not already included in the SPP 2010 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 Updates

SPP used three seasonal models to study AEPW to AEPW and OKGE 610 MW request for the requested service period. The following SPP Transmission Expansion Plan 2010

Build 2 Cases were used to study the impact of the requested service on the transmission system:

2016 Summer Peak (16SP)
2016/17 Winter Peak (16WP)
2021 Summer Peak (21SP)

The Spring Peak models apply to April and May, the Summer Peak models apply to June through September, the Fall Peak models apply to October and November, and the Winter Peak models apply to December through March.

The chosen base case models were modified to reflect the current modeling information. From the three seasonal models, two system scenarios were developed. Scenario 0 includes projected usage of transmission included in the SPP 2010 Series Cases. Scenario 5 includes transmission not already included in the SPP 2010 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 610 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 610 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 610 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 CASES:

- 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 CASES for system intact:

- Solutions: AC contingency checking (ACCC)
- MW mismatch tolerance: 0.5
- Contingency case rating: Rate A
- Percent of rating: 100
- Output code: Summary
- Min flow change in overload report: 3 MW
- Excld cases w/ no overloads form 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
- VAR limits: Apply automatically
- Solution options:

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

ACCC CASES for branch and transformer contingencies:

- Solutions: AC contingency checking (ACCC)
- MW mismatch tolerance: 0.5
- Contingency case rating: Rate B
- Percent of rating: 100
- Output code: Summary

- Min flow change in overload report: 3mw
- Excld cases w/ no overloads form 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
- VAR limits: Apply automatically
- Solution options:

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

ACCC CASES for generator contingencies (largest machine at a bus):

- Solutions: AC contingency checking (ACCC)
- MW mismatch tolerance: 0.5
- Contingency case rating: Rate B
- Percent of rating: 100
- Output code: Summary
- Min flow change in overload report: 3mw
- Excld cases w/ no overloads form 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: Disabled
- Var limits: Apply automatically
- 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	Rating (MVA)	Transfer Case % Loading	TDF	Outaged Branch Causing Overload	Upgrade Name	Solution
5	16SP	OKGE	OKGE	5 TRIBES - HANCOCK 161KV CKT 1	223	103.4	5.1%	AGENCY - PECAN CREEK 161KV CKT 1	5 TRIBES - HANCOCK 161KV CKT 1	Replace 800A Wave Trap, increase Relay CTR to 1200-5A.
5	16SP	OKGE	OKGE	5 TRIBES - HANCOCK 161KV CKT 1	223	101.6	5.6%	AGENCY - EUCLID 161KV CKT 1	5 TRIBES - HANCOCK 161KV CKT 1	Replace 800A Wave Trap, increase Relay CTR to 1200-5A.
5	21SP	OKGE	OKGE	5 TRIBES - HANCOCK 161KV CKT 1	223	105.9	5.3%	AGENCY - PECAN CREEK 161KV CKT 1	5 TRIBES - HANCOCK 161KV CKT 1	Replace 800A Wave Trap, increase Relay CTR to 1200-5A.
5	21SP	OKGE	OKGE	5 TRIBES - HANCOCK 161KV CKT 1	223	104.2	5.9%	AGENCY - EUCLID 161KV CKT 1	5 TRIBES - HANCOCK 161KV CKT 1	Replace 800A Wave Trap, increase Relay CTR to 1200-5A.
5	21SP	OKGE	OKGE	5 TRIBES - HANCOCK 161KV CKT 1	223	100.7	5.9%	EUCLID - MUSKOGEE PORT 161KV CKT 1	5 TRIBES - HANCOCK 161KV CKT 1	Replace 800A Wave Trap, increase Relay CTR to 1200-5A.
5	21SP	AECI	AECI	5CDRCRST 161.00 - 5LOCSTGV 161.00 161KV CKT 1	250	103.9	3.0%	MUSKOGEE - ROSS LAKE 161KV CKT 1	5CDRCRST 161.00 - 5LOCSTGV 161.00 161KV CKT 1 GRDA	Rebuild 7 miles of the 32.2 mile GRDA Maid to Taulequah 161 kV line
5	21SP	GRDA	AECI	5LOCSTGV 161.00 - MAID 161KV CKT 1	250	105.1	3.0%	MUSKOGEE - ROSS LAKE 161KV CKT 1	5LOCSTGV 161.00 - MAID 161KV CKT 1	Rebuild 7.7 miles of the 32.2 mile GRDA Maid to Taulequah 161 kV line
5	21SP	AEPW	AEPW	BONANZA - HACKETT AECC 161KV CKT 1	152	108.3	5.1%	BASE CASE	Multi - Bonanza - North Huntington 69kV	Rebuild and reconductor 4.0 miles of 4/0 ACSR 69 kV to 1590 ACSR 161 kV from converting North Huntington to Midland REC to 161 kV. Add 161 kV terminal at North Huntington.,Rebuild and reconductor Midland REC-Midland from 69 kV 4/0 ACSR to 161 kV 1590 ACSR.,Add 161/69 kV autotransformer at Midland.,Build Bonanza-Midland 1590 ACSR 161 kV line. Old Midland-Excelsior section to be converted from 69 kV to 161 kV. Add 4-161 kV breakers at Bonanza.
5	21SP	AEPW	AEPW	BONANZA - HACKETT AECC 161KV CKT 1	177	107.1	5.1%	AES - TARBY 161KV CKT 1	Multi - Bonanza - North Huntington 69kV	Rebuild and reconductor 4.0 miles of 4/0 ACSR 69 kV to 1590 ACSR 161 kV from converting North Huntington to Midland REC to 161 kV. Add 161 kV terminal at North Huntington.,Rebuild and reconductor Midland REC-Midland from 69 kV 4/0 ACSR to 161 kV 1590 ACSR.,Add 161/69 kV autotransformer at Midland.,Build Bonanza-Midland 1590 ACSR 161 kV line. Old Midland-Excelsior section to be converted from 69 kV to 161 kV. Add 4-161 kV breakers at Bonanza.
5	21SP	AEPW	AEPW	BONANZA - HACKETT AECC 161KV CKT 1	177	103.9	5.8%	GRAND PRAIRIE - VBI 161KV CKT 1	Multi - Bonanza - North Huntington 69kV	Rebuild and reconductor 4.0 miles of 4/0 ACSR 69 kV to 1590 ACSR 161 kV from converting North Huntington to Midland REC to 161 kV. Add 161 kV terminal at North Huntington.,Rebuild and reconductor Midland REC-Midland from 69 kV 4/0 ACSR to 161 kV 1590 ACSR.,Add 161/69 kV autotransformer at Midland.,Build Bonanza-Midland 1590 ACSR 161 kV line. Old Midland-Excelsior section to be converted from 69 kV to 161 kV. Add 4-161 kV breakers at Bonanza.
5	21SP	AEPW	AEPW	BONANZA - HACKETT AECC 161KV CKT 1	177	103.7	5.2%	ARKANSAS NUCLEAR ONE (ANO) 500/161/22.0KV TRANSFORMER CKT 1	Multi - Bonanza - North Huntington 69kV	Rebuild and reconductor 4.0 miles of 4/0 ACSR 69 kV to 1590 ACSR 161 kV from converting North Huntington to Midland REC to 161 kV. Add 161 kV terminal at North Huntington.,Rebuild and reconductor Midland REC-Midland from 69 kV 4/0 ACSR to 161 kV 1590 ACSR.,Add 161/69 kV autotransformer at Midland.,Build Bonanza-Midland 1590 ACSR 161 kV line. Old Midland-Excelsior section to be converted from 69 kV to 161 kV. Add 4-161 kV breakers at Bonanza.
5	16SP	AEPW	AEPW	CHAMBER SPRINGS - FARMINGTON AECC 161KV CKT 1	353	100.8	10.2%	ELM SPRINGS REC - TONTITOWN 161KV CKT 1	CHAMBER SPRINGS - FARMINGTON AECC 161KV CKT 1 Accelerate	Rebuild and reconductor 11.1 mile Chamber Springs-Farmington REC 161 kV line with 2156 ACSR. Replace wave traps at Chamber Springs and bus at Farmington REC.
5	21SP	AEPW	AEPW	CHAMBER SPRINGS - FARMINGTON AECC 161KV CKT 1	353	118.4	9.9%	ELM SPRINGS REC - TONTITOWN 161KV CKT 1	CHAMBER SPRINGS - FARMINGTON AECC 161KV CKT 1 Accelerate	Rebuild and reconductor 11.1 mile Chamber Springs-Farmington REC 161 kV line with 2156 ACSR. Replace wave traps at Chamber Springs and bus at Farmington REC.
5	21SP	AEPW	AEPW	CHAMBER SPRINGS - FARMINGTON AECC 161KV CKT 1	353	115.9	9.6%	CHAMBER SPRINGS - TONTITOWN 345KV CKT 1	CHAMBER SPRINGS - FARMINGTON AECC 161KV CKT 1 Accelerate	Rebuild and reconductor 11.1 mile Chamber Springs-Farmington REC 161 kV line with 2156 ACSR. Replace wave traps at Chamber Springs and bus at Farmington REC.
5	21SP	AEPW	AEPW	CHAMBER SPRINGS - FARMINGTON AECC 161KV CKT 1	294	115.9	7.9%	BASE CASE	CHAMBER SPRINGS - FARMINGTON AECC 161KV CKT 1 Accelerate	Rebuild and reconductor 11.1 mile Chamber Springs-Farmington REC 161 kV line with 2156 ACSR. Replace wave traps at Chamber Springs and bus at Farmington REC.
5	21SP	AEPW	AEPW	CHAMBER SPRINGS - FARMINGTON AECC 161KV CKT 1	353	115.9	9.6%	TONTITOWN () 345/161/13.8KV TRANSFORMER CKT 1	CHAMBER SPRINGS - FARMINGTON AECC 161KV CKT 1 Accelerate	Rebuild and reconductor 11.1 mile Chamber Springs-Farmington REC 161 kV line with 2156 ACSR. Replace wave traps at Chamber Springs and bus at Farmington REC.
5	21SP	AEPW	AEPW	ELM SPRINGS REC - TONTITOWN 161KV CKT 1	592	103.3	14.1%	DYESS - TONTITOWN 161KV CKT 1	ELM SPRINGS REC - TONTITOWN 161KV CKT 1	Replace Tontitown wavetrap & jumpers
5	21SP	OKGE	OKGE	FT SMITH (FTSMITH5) 345/161/13.8KV TRANSFORMER CKT 5	493	103.9	12.4%	FT SMITH (FTSMITH1) 500/345/13.8KV TRANSFORMER CKT 1	FT SMITH (FTSMITH6) 345/161/13.8KV TRANSFORMER CKT 6	Install 2nd 345/161 kV bus tie in Ft. Smith Sub - Make 345 & 161 kv breaker and one-half
5	16SP	SWPA	SWPA	GORE - MUSKOGEE TAP 161KV CKT 1	206	101.7	4.3%	FT SMITH - MUSKOGEE 345KV CKT 1	GORE - MUSKOGEE TAP 161KV CKT 1 Accelerate	Rebuild w/ 1192 ACSR. Upgrade terminal equipment.

5	21SP	SWPA	SWPA	GORE - MUSKOGEE TAP 161KV CKT 1	206	110.5	4.6%	FT SMITH - MUSKOGEE 345KV CKT 1	GORE - MUSKOGEE TAP 161KV CKT 1 Accelerate	Rebuild w/ 1192 ACSR. Upgrade terminal equipment.
5	16SP	SWPA	SWPA	GORE - SALLISAW 161KV CKT 1	189	100.1	5.6%	FT SMITH - MUSKOGEE 345KV CKT 1	GORE - SALLISAW 161KV CKT 1 Accelerate	Eight structures (#212, 243, 247, 262, 294, 295, 304, and 313) would need to be replaced.
5	21SP	SWPA	SWPA	GORE - SALLISAW 161KV CKT 1	189	108.2	5.9%	FT SMITH - MUSKOGEE 345KV CKT 1	GORE - SALLISAW 161KV CKT 1 Accelerate	Eight structures (#212, 243, 247, 262, 294, 295, 304, and 313) would need to be replaced.
5	21SP	OKGE	OKGE	HIGHWAY 59 - VBI 161KV CKT 1	167	101.9	3.9%	FT SMITH - MUSKOGEE 345KV CKT 1	HIGHWAY 59 - VBI 161KV CKT 1	Replace 600A Switch 131 in VBI Substation with 1200A and rebuild 1.12 with 477 ACSR.
5	16SP	OKGE	OKGE	MUSKOGEE - ROSS LAKE 161KV CKT 1	223	101.1	3.7%	5LOCSTGV 161.00 - MAID 161KV CKT 1	MUSKOGEE - ROSS LAKE 161KV CKT 1 Accelerate	Replace 800A wave trap at Muskogee and increase relay CTR to 1200-5.
5	16SP	OKGE	OKGE	MUSKOGEE - ROSS LAKE 161KV CKT 1	223	100.4	3.7%	5CDRCRST 161.00 - 5LOCSTGV 161.00 161KV CKT 1	MUSKOGEE - ROSS LAKE 161KV CKT 1 Accelerate	Replace 800A wave trap at Muskogee and increase relay CTR to 1200-5.
5	21SP	OKGE	OKGE	MUSKOGEE - ROSS LAKE 161KV CKT 1	223	109.0	3.9%	5LOCSTGV 161.00 - MAID 161KV CKT 1	MUSKOGEE - ROSS LAKE 161KV CKT 1 Accelerate	Replace 800A wave trap at Muskogee and increase relay CTR to 1200-5.
5	21SP	OKGE	OKGE	MUSKOGEE - ROSS LAKE 161KV CKT 1	223	108.4	3.9%	5CDRCRST 161.00 - 5LOCSTGV 161.00 161KV CKT 1	MUSKOGEE - ROSS LAKE 161KV CKT 1 Accelerate	Replace 800A wave trap at Muskogee and increase relay CTR to 1200-5.

Scenario	Season	Area	Monitored Bus with Violation	Transfer Case Voltage (pu)	Outaged Branch Causing Overload	Upgrade Name	Solution
5	16SP	AEPW	BONANZA 161KV	0.8940	BONANZA - BONANZA TAP 161KV CKT 1	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron
5	16SP	AEPW	EXCELSIOR 161KV	0.8973	BONANZA - BONANZA TAP 161KV CKT 1	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron
5	16SP	AEPW	HACKETT AECC 161KV	0.8947	BONANZA - BONANZA TAP 161KV CKT 1	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron
5	16SP	AEPW	HUNTINGTON 69KV	0.8888	BONANZA - BONANZA TAP 161KV CKT 1	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron
5	16SP	AEPW	HUNTINGTON REC 69KV	0.8830	BONANZA - BONANZA TAP 161KV CKT 1	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron
5	16SP	AEPW	MIDLAND 69KV	0.8970	BONANZA - BONANZA TAP 161KV CKT 1	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron
5	16SP	AEPW	MIDLAND REC 69KV	0.8943	BONANZA - BONANZA TAP 161KV CKT 1	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron
5	16SP	AEPW	NORTH HUNTINGTON 69KV	0.8906	BONANZA - BONANZA TAP 161KV CKT 1	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron
5	16SP	AEPW	SUGRLF 2 69.000 69KV	0.8970	BONANZA - BONANZA TAP 161KV CKT 1	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron
5	16SP	AEPW	WALDRON 69KV	0.8565	BONANZA - BONANZA TAP 161KV CKT 1	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron
5	16SP	AEPW	WALDRON 69KV	0.8762	OGE3TERM45	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron
5	16SP	AEPW	WALDRON 69KV	0.8767	BONANZA - HACKETT AECC 161KV CKT 1	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron

Transmission Owner	Upgrade	Solution	Earliest Date Upgrade Required (DUN)	Estimated Date of Upgrade Completion (EOC)	* Estimated Engineering & Construction Cost	RTO Determined Need Date
AEPW	CHAMBER SPRINGS - FARMINGTON AECC 161KV CKT 1 Accelerate	Rebuild and reconductor 11.1 mile Chamber Springs-Farmington REC 16 kV line with 2156 ACSR. Replace wave traps at Chamber Springs and bus at Farmington REC.	6/1/2013	6/1/2014	$ 12,500,000	6/1/2020
AEPW	WALDRON CAPACITOR Accelerate	Install additional cap bank at Waldron	6/1/2013	6/1/2013	$ 300,000	6/1/2017
OKGE	5 TRIBES - HANCOCK 161KV CKT 1	Replace 800A Wave Trap, increase Relay CTR to 1200-5	6/1/2013	6/1/2013	$ 100,000	
OKGE	FT SMITH (FTSMITH6) 345/161/13.8KV TRANSFORMER CKT 6	Install 2nd 345/161 kV bus tie in Ft. Smith Sub - Make 345 & 161 kv breake and one-half	6/1/2017	6/1/2017	$ 14,500,000	
OKGE	HIGHWAY 59 - VBI 161KV CKT 1	Replace 600A Switch 131 in VBI Substation with 1200A and rebuild 1.12 with 477 ACSR.	6/1/2017	6/1/2017	$ 400,000	
OKGE	MUSKOGEE - ROSS LAKE 161KV CKT 1 Accelerate	Replace 800A wave trap at Muskogee and increase relay CTR to 1200-5.	6/1/2013	6/1/2013	$ 350,000	6/1/2017
SWPA	GORE - MUSKOGEE TAP 161KV CKT 1 Accelerate	Rebuild w/ 1192 ACSR. Upgrade terminal equipmen	6/1/2013	6/1/2014	$ 8,000,000	6/1/2017
SWPA	GORE - SALLISAW 161KV CKT 1 Accelerate	Eight structures (#212, 243, 247, 262, 294, 295, 304, and 313) would nee to be replaced.	6/1/2013	6/1/2013	$ 250,000	6/1/2017

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
GRDA	5CDRCRST 161.00 - 5LOCSTGV 161.00 161KV CKT 1 GRDA	Rebuild 7 miles of the 32.2 mile GRDA Maid to Taulequah 161 kV line; $ million per mile	6/1/2017	6/1/2017	$ 7,000,000
GRDA	5LOCSTGV 161.00 - MAID 161KV CKT 1	Rebuild 7.7 miles of the 32.2 mile GRDA Maid to Taulequah 161 kV line; $ million per mile	6/1/2017	6/1/2017	$ 7,700,000

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)
AEPW	ELM SPRINGS REC - TONTITOWN 161KV CKT 1	Replace Tontitown wavetrap & jumper	6/1/2017	6/1/2017
AEPW	Multi - Bonanza - North Huntington 69kV	Rebuild and reconductor 4.0 miles of 4/0 ACSR 69 kV to 1590 ACSR 16 kV from converting North Huntington to Midland REC to 161 kV. Add 161 k terminal at North Huntington.,Rebuild and reconductor Midland REC-Midlan from 69 kV 4/0 ACSR to 161 kV 1590 ACSR.,Add 161/69 kV autotransformer at Midland.,Build Bonanza-Midland 1590 ACSR 161 kV line Old Midland-Excelsior section to be converted from 69 kV to 161 kV. Add 4- 161 kV breakers at Bonanza.	6/1/2019	6/1/2019

* The previously identified Network Upgrade may be accelerated. The accelerated cost would be based on the change in date from the respective "RTO Determined Need Date" to the Estimated Date of Upgrade Completion (EOC) in accordance with Financial Analysis of the Aggregate Transmission Service Study (See Financial Analysis section). An expected cost may be estimated by assuming 5-10% of the Estimated Engineering & Construction Cost per year.