SPP Southwest Power Pool

System Impact Study For Network Service Requested By Empire District Electric Company

From 4/1/03 To 4/1/08

SPP Transmission Planning

SPP IMPACT STUDIES (#SPP-2001-250 REV.2)
October 5, 2001

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1. Executive Summary

The Empire District Electric Company has requested Transmission Service for Network Integration Transmission Service. The period of the Network Service is from 4/1/03 to 4/1/08. The request is for reservation 275856.

The principal objective of this study is to identify system constraints and potential system modifications necessary to provide the applied for Network Service while maintaining system reliability. Tables 1 and 2 document Network Facilities within Empire District Electric Company identified as having voltage and thermal violations. Table 3 summarizes the Network Facility Limits identified in the Generation Sensitivity Analysis.

2. Introduction

Empire District Electric Company has requested an impact study for Network Integration Transmission Service. The transmission service runs from 4/1/03 to 4/1/08.

The principal objective of the study is to identify the restraints on the SPP Regional Tariff System, which includes the Empire District Electric Company Transmission System that limit the Network Integration Transmission Service. This study includes a steady-state contingency analysis (PSS/E function ACCC) and PTI's MUST Generation Sensitivity Analysis.

The steady-state analysis considers transmission line loading and transmission bus voltages for outages of transmission lines and transformers on the Empire District Electric Company system.

The Generation Sensitivity analysis shows the amount of First Contingency Incremental Transfer Capabilities (FCITC) between the specified designated Network Resources and Network Loads and what the limitations are, if any, for a given generation dispatch to serve load.

3. Study Methodology

A. Description

The system impact study consists of two analyses. PSS/E's ACCC steady-state contingency analysis was used to identify any system criteria violations on the Empire District Electric Company Transmission System. Power Technologies Inc.'s MUST software Generation Sensitivity function was used to identify any SPP system overloads caused by the worst dispatch of the Designated Network Resources to serve the designated Network Load.

The steady-state analysis and generation sensitivity was done to ensure current SPP Criteria and NERC Planning Standards requirements are fulfilled. The Southwest Power Pool (SPP) conforms to the NERC Planning Standards, which provide the strictest requirements, related to voltage violations and thermal overloads during normal conditions and during a contingency. It requires that all facilities be within normal operating ratings for normal system conditions and within emergency ratings after a contingency.

B. Model Updates

SPP used five seasonal models to study the Empire District Electric Company Network Integration Transmission Service. The SPP 2001 Series Cases used are as follows. The 2003 Spring Peak, 2004 Summer Peak, 2004/05 Winter Peak, 2006 Summer Peak and 2006/07 Winter Peak were used to study the impact of the Network Service on the SPP system during the transmission request period of 4/1/03 to 4/1/08.

The chosen base case models were modified to reflect the most current modeling information. The cases were modified to reflect future firm transfers during the request period that were not already included in the January 2001 base case series models. These modified models were then used in the steady-state contingency analysis. For the Generation Sensitivity analysis, the models were further adjusted to model the designated Network Resource of Empire District Electric Company designated Network Resources and Network Loads to model a 100MW transfer from the Network Resources to the Network Load.

C. Steady-state Contingency Analysis and Generation Sensitivity Analysis

Using the first set of created models and the ACCC function of PSS\E, single and select double contingency outages were analyzed to determine Empire District Electric Company facility thermal and voltage violations during a contingency. The PSS/E options chosen to conduct the Impact Study analysis can be found in Appendix A.

The MUST Generation Sensitivity Analysis was used to determine any thermal constraints due to specific generation dispatches of the designated Network Resources. The analysis requires the modeling of a transfer, in this case the transfer from Network Resources to Network Load. To overcome this limitation, the power flow model was modified to provide room for a 100MW transfer as mentioned above in the model update section. The GSA function of MUST finds dispatches that minimize the FCITC of a study transfer. The study transfer in this case is from the Designated Network Resources to the Designated Network Load.

4. Study Results

A. Study Analysis Results

Tables 1 and 2 contain the analysis results of the steady-state contingency analysis. The tables identify the seasonal case in which the event occurred; the emergency rating of the overloaded circuit (Rate B) if applicable, the contingent loading percentage of the circuit or per unit voltage, and any solutions received from the transmission owners.

Table 1 contains the voltage violations found above and below ten percent of the nominal voltages respectively for normal and contingency conditions. SPP criterion states that transmission system voltages must be maintained within plus or minus 10% of nominal voltage on load serving buses for contingency conditions.

Table 2 contains the Empire District Electric Company Network Facilities overloaded above 100% of their emergency ratings.

The remaining tables that follow Tables 1 and 2 contain the results of the Generation Sensitivity Analysis. Table 3 contains the Network Facilities that limit the studied 100MW transfer from Network Resources to Network Load for all five of the cases studied. For each numbered constraint found in Table 3, a generation adjustment table documents the dispatches that cause these reduced FCITCs. The limitation of the MUST Generation Sensitivity is that it requires a transfer. To overcome this limitation, the models were adjusted appropriately to allow room for a 100MW transfer from the Network Resources to the Network Load.

For an explanation of the columns found in Table 3 the following descriptions are included. The Worst Dispatch FCITC column contains the FCITC that results from the dispatch found in the Limiting Constraints Generator adjustments page. The Base FCITC is the FCITC that results from a dispatch using fixed generator participation factors, which are easily calculated from a generator's Pgen or Porig and Pmax and the total generation available for dispatch. The Study Flow column is the flow on the line when the Worst Dispatch FCITC number is used with fixed generator participation factors, which has a flow less than the limit. In addition, the fix generator participation factor dispatch has the specified OTDF shown in Table 3.

Table 1 – THE EMPIRE DISTRICT COMPANY – Voltage below 10% of nominal.

CASE	Bus #	AREA 544 BUSES WITH VOLTAGE LESS THAN 0.9500 PU:	KV	V(PU) AFTER CONTINGENCY	V(PU) BEFORE CONTINGENCY	CONTINGENCY - OPEN BRANCH FROM BUS TO BUS	CKT
04SP	59420	SUB 186 - WELCH NORTH	34.5	0.8948	0.8948	2004 SUMMER PEAK BASE CASE	
04SP	59640	SUB 318 - COLLINS SOUTH	34.5	0.8299	0.9539	59635 SUB 217 - FAIRPLAY EAST TO 59639 SUB 283 - DUNNEGAN	1
04SP	59420	SUB 186 - WELCH NORTH	34.5	0.8485	0.8948	59487/59601 SUB 404 - HOCKERVILLE 161/69KV TRANSFORMER	1
04SP	59639	SUB 283 – DUNNEGAN	34.5	0.8503	0.9966	59635 SUB 217 - FAIRPLAY EAST TO 59639 SUB 283 - DUNNEGAN	1
04SP	59635	SUB 217 - FAIRPLAY EAST	34.5	0.8516	1.0216	59545/59635 SUB 217 - FAIRPLAY EAST 69/34.5KV TRANSFORMER	1
04SP	59637	SUB 308 - HUMANSVILLE WEST	34.5	0.8517	0.9728	59635 SUB 217 - FAIRPLAY EAST TO 59639 SUB 283 - DUNNEGAN	1
04SP	59607	SUB 422 - JOP. 24TH & CONNECTICUT	161	0.8710	0.9866	59483 SUB 389 - JOPLIN SOUTHWEST TO 59607 SUB 422 - JOP. 24TH & CONNECTICUT	1
04SP	59593	SUB 391 - JOPLIN SOUTHEAST	161	0.8714	0.9861	59483 SUB 389 - JOPLIN SOUTHWEST TO 59607 SUB 422 - JOP. 24TH & CONNECTICUT	1
04SP	59417	SUB 299 - CHETOPA CITY	34.5	0.8720	0.9170	59487/59601 SUB 404 - HOCKERVILLE 161/69KV TRANSFORMER	1
04SP	59419	SUB 388 - CHETOPA TWIN VALLEY	34.5	0.8742	0.9191	59487/59601 SUB 404 - HOCKERVILLE 161/69KV TRANSFORMER	1
04SP	59418	SUB 300 - CHETOPA SOUTH	34.5	0.8752	0.9200	59487/59601 SUB 404 - HOCKERVILLE 161/69KV TRANSFORMER	1
04SP	59416	SUB 299 - CHETOPA CITY TAP	34.5	0.8758	0.9206	59487/59601 SUB 404 - HOCKERVILLE 161/69KV TRANSFORMER	1
04SP	59570	SUB 330 - OZARK NORTHWEST	69	0.8781	1.0000	59570 SUB 330 - OZARK NORTHWEST TO 59604 SUB 415 - BLACKHAWK JCT.	1
04SP	59500	SUB 393 – REINMILLER	161	0.8723	0.9862	59593 SUB 391 - JOPLIN SOUTHEAST TO 59607 SUB 422 - JOP. 24TH & CONNECTICUT	1
04SP	59609	SUB 434 - OZARK SOUTHEAST	69	0.8832	0.9966	59570 SUB 330 - OZARK NORTHWEST TO 59604 SUB 415 - BLACKHAWK JCT.	1
04SP	59425	SUB 209 – HERMITAGE	69	0.8888	0.9850	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
04SP	59434	SUB 409 - BUFFALO NORTH	69	0.8896	0.9632	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
04SP	59604	SUB 415 - BLACKHAWK JCT.	69	0.8965	1.0042	59604 SUB 415 - BLACKHAWK JCT. TO 96673 AEC-JAMESVILLE	1
04SP	59575	SUB 342 - BUFFALO SOUTH	69	0.8979	0.9708	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
04SP	59404	SUB 390 - PURDY SOUTH	69	0.8998	0.9544	59480/59591 SUB 383 - MONETT 161/69KV TRANSFORMER	1
04WP	59640	SUB 318 - COLLINS SOUTH	34.5	0.8080	0.9539	59635 SUB 217 - FAIRPLAY EAST TO 59639 SUB 283 - DUNNEGAN	1
04WP	59639	SUB 283 – DUNNEGAN	34.5	0.8246	0.9964	59635 SUB 217 - FAIRPLAY EAST TO 59639 SUB 283 - DUNNEGAN	1
04WP	59635	SUB 217 - FAIRPLAY EAST	34.5	0.8260	1.0248	59545/59635 SUB 217 - FAIRPLAY EAST 69/34.5KV TRANSFORMER	1
04WP	59637	SUB 308 - HUMANSVILLE WEST	34.5	0.8268	0.9698	59635 SUB 217 - FAIRPLAY EAST TO 59639 SUB 283 - DUNNEGAN	1
04WP	59570	SUB 330 - OZARK NORTHWEST	69	0.8940	1.0082	59570 SUB 330 - OZARK NORTHWEST TO 59604 SUB 415 - BLACKHAWK JCT.	1
04WP	59434	SUB 409 - BUFFALO NORTH	69	0.8888	0.9724	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
04WP	59425	SUB 209 – HERMITAGE	69	0.8909	0.9984	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
04WP	59575	SUB 342 - BUFFALO SOUTH	69	0.8976	0.9804	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
04WP	59609	SUB 434 - OZARK SOUTHEAST	69	0.8978	1.0041	59570 SUB 330 - OZARK NORTHWEST TO 59604 SUB 415 - BLACKHAWK JCT.	1
04WP	59568	SUB 324 – STOCKTON NORTHWEST	69	0.8988	0.9909	59568 SUB 324 - STOCKTON NORTHWEST TO 59616 SUB 631 - STOCKTON CITY	1
06SP	59420	SUB 186 - WELCH NORTH	34.5	0.8833	0.8833	2006 SUMMER PEAK BASE CASE	
06SP	59640	SUB 318 - COLLINS SOUTH	34.5	0.8349	0.9568	59635 SUB 217 - FAIRPLAY EAST TO 59639 SUB 283 - DUNNEGAN	1

Table 1 continued - *THE EMPIRE DISTRICT COMPANY – **Voltage below 10% of nominal.***

CASE	Bus #	AREA 544 BUSES WITH VOLTAGE LESS THAN 0.9500 PU:	KV	V(PU) AFTER CONTINGENCY	V(PU) BEFORE CONTINGENCY	CONTINGENCY - OPEN BRANCH FROM BUS TO BUS	CKT
06SP	59420	SUB 186 - WELCH NORTH	34.5	0.8354	0.8833	59487/59601 SUB 404 – HOCKERVILLE 161/69KV TRANSFORMER	1
06SP	59639	SUB 283 - DUNNEGAN	34.5	0.8566	0.9998	59635 SUB 217 - FAIRPLAY EAST TO 59639 SUB 283 - DUNNEGAN	1
06SP	59635	SUB 217 - FAIRPLAY EAST	34.5	0.8583	1.0239	59545/59635 SUB 217 - FAIRPLAY EAST 69/34.5KV TRANSFORMER	1
06SP	59637	SUB 308 - HUMANSVILLE WEST	34.5	0.8581	0.9769	59635 SUB 217 - FAIRPLAY EAST TO 59639 SUB 283 - DUNNEGAN	1
06SP	59417	SUB 299 - CHETOPA CITY	34.5	0.8598	0.9064	59487/59601 SUB 404 - HOCKERVILLE 161/69KV TRANSFORMER	1
06SP	59419	SUB 388 - CHETOPA TWIN VALLEY	34.5	0.8622	0.9087	59487/59601 SUB 404 - HOCKERVILLE 161/69KV TRANSFORMER	1
06SP	59418	SUB 300 - CHETOPA SOUTH	34.5	0.8633	0.9097	59487/59601 SUB 404 - HOCKERVILLE 161/69KV TRANSFORMER	1
06SP	59416	SUB 299 - CHETOPA CITY TAP	34.5	0.8639	0.9103	59487/59601 SUB 404 - HOCKERVILLE 161/69KV TRANSFORMER	1
06SP	59570	SUB 330 - OZARK NORTHWEST	69	0.8732	0.9980	59570 SUB 330 - OZARK NORTHWEST TO 59604 SUB 415 - BLACKHAWK JCT.	1
06SP	59609	SUB 434 - OZARK SOUTHEAST	69	0.8784	0.9943	59570 SUB 330 - OZARK NORTHWEST TO 59604 SUB 415 - BLACKHAWK JCT.	1
06SP	59425	SUB 209 - HERMITAGE	69	0.8805	0.9889	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
06SP	59434	SUB 409 - BUFFALO NORTH	69	0.8815	0.9647	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
06SP	59404	SUB 390 - PURDY SOUTH	69	0.8875	0.9424	59480/59591 SUB 383 - MONETT 161/69KV TRANSFORMER	1
06SP	59604	SUB 415 - BLACKHAWK JCT.	69	0.8921	1.0025	59604 SUB 415 - BLACKHAWK JCT. TO 96673 AEC-JAMESVILLE	1
06SP	59575	SUB 342 - BUFFALO SOUTH	69	0.8904	0.9728	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
06SP	59547	SUB 243 - BUFFALO SHELL	69	0.8986	0.9705	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
06SP	59432	SUB 243 – BUFFALO SHELL JCT.	69	0.8987	0.9706	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
06SP	59535	SUB 114 - NIXA	69	0.8998	0.9975	59604 SUB 415 - BLACKHAWK JCT. TO 96673 AEC-JAMESVILLE	1
06WP	59640	SUB 318 - COLLINS SOUTH	34.5	0.7775	0.9409	59635 SUB 217 - FAIRPLAY EAST TO 59639 SUB 283 - DUNNEGAN	1
06WP	59639	SUB 283 - DUNNEGAN	34.5	0.7949	0.9856	59635 SUB 217 - FAIRPLAY EAST TO 59639 SUB 283 - DUNNEGAN	1
06WP	59635	SUB 217 - FAIRPLAY EAST	34.5	0.7966	1.0157	59545/59635 SUB 217 - FAIRPLAY EAST 69/34.5KV TRANSFORMER	1
06WP	59637	SUB 308 - HUMANSVILLE WEST	34.5	0.7980	0.9579	59635 SUB 217 - FAIRPLAY EAST TO 59639 SUB 283 - DUNNEGAN	1
06WP	59568	SUB 324 - STOCKTON NORTHWEST	69	0.8775	0.9869	59568 SUB 324 - STOCKTON NORTHWEST TO 59616 SUB 631 - STOCKTON CITY	1
06WP	59425	SUB 209 – HERMITAGE	69	0.8787	0.9923	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
06WP	59570	SUB 330 - OZARK NORTHWEST	69	0.8813	1.0039	59570 SUB 330 - OZARK NORTHWEST TO 59604 SUB 415 - BLACKHAWK JCT.	1
06WP	59609	SUB 434 - OZARK SOUTHEAST	69	0.8856	0.9997	59570 SUB 330 - OZARK NORTHWEST TO 59604 SUB 415 - BLACKHAWK JCT.	1
06WP	59434	SUB 409 - BUFFALO NORTH	69	0.8780	0.9662	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
06WP	59575	SUB 342 - BUFFALO SOUTH	69	0.8869	0.9743	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
06WP	59584	SUB 367 – BOLIVAR SOUTHEAST	69	0.8951	0.9917	59528 SUB 73 – BOLIVAR BURNS TO 59584 SUB 367 – BOLIVAR SOUTHEAST	1
06WP	59547	SUB 243 - BUFFALO SHELL	69	0.8966	0.9731	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
06WP	59432	SUB 243 - BUFFALO SHELL JCT.	69	0.8967	0.9733	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
06WP	59612	SUB 602 – BOLIVAR PLANT	69	0.8994	0.9899	59528 SUB 73 – BOLIVAR BURNS TO 59584 SUB 367 – BOLIVAR SOUTHEAST	1
06WP	59572	SUB 333 - FAIRGROVE CHEROKEE	69	0.8995	0.9738	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1
06WP	59528	SUB 73 - BOLIVAR BURNS	69	0.8999	1.0107	59464/59528 SUB 73 BOLIVAR BURNS 161/69KV TRANSFORMER	1

Table 2 – The Empire District Electric Company Network Facilities with Thermal Loading above 100% Rate B

STUDY YEAR	OVERLOADED BRANCH	Rate B <MVA>	% Loading	OUTAGED BRANCH	MITIGATION PLAN, SOLUTION
03G	**NONE**				
	SUB 217 - FAIRPLAY EAST 69/34.5KV TRANSFORMER			**SUB 324 - STOCKTON NORTHWEST TO SUB 304 - CAPLINGER**	
04SP	59545 FRP217 2 TO 59635 FRP217 1 CKT1	5	109.8	59638 STK324 1 TO 59641 CAP304 1 CKT 1	
	SUB 217 - FAIRPLAY EAST 69/34.5KV TRANSFORMER			**SUB 324 - STOCKTON NORTHWEST TO SUB 304 - CAPLINGER**	
04WP	59545 FRP217 2 TO 59635 FRP217 1 CKT1	5	151.4	59638 STK324 1 TO 59641 CAP304 1 CKT 1	
	SUB 217 - FAIRPLAY EAST 69/34.5KV TRANSFORMER			**SUB 324 - STOCKTON NORTHWEST TO SUB 304 - CAPLINGER**	
06SP	59545 FRP217 2 TO 59635 FRP217 1 CKT1	5	113.8	59638 STK324 1 TO 59641 CAP304 1 CKT 1	
	SUB 124 - AURORA H.T. 161/69KV TRANSFORMER			**SUB 383 – MONETT 161/69KV TRANSFORMER**	
06SP	59468 AUR124 5 TO 59537 AUR124 2 CKT3	42	102.5	59480 MON383 5 TO 59591 MON383 2 CKT 1	
	SUB 389 - JOPLIN SOUTHWEST 161/69KV TRANSFORMER			**SUB 389 - JOPLIN SOUTHWEST TO SUB 422 - JOPLIN 24TH & CONNECTICUT**	
06SP	59483 JOP389 5 TO 59592 JOP389 2 CKT1	75	101.9	59483 JOP389 5 TO 59607 JOP422 5 CKT 1	
	SUB 217 - FAIRPLAY EAST 69/34.5KV TRANSFORMER			**SUB 324 - STOCKTON NORTHWEST TO SUB 304 - CAPLINGER**	
06WP	59545 FRP217 2 TO 59635 FRP217 1 CKT1	5	164.0	59638 STK324 1 TO 59641 CAP304 1 CKT 1	

Table 3 – **The Empire District Electric Company** Network Facilities identified as limits in the MUST Generation Sensitivity Analysis

MUST Generation Sensitivity Analysis												
Study Case	Limiting Constraint	Worst Dispatch FCITC	Base FCITC	Limiting Facility	Initial Flow	Limit	Study Flow	OTDF	LODF	Outaged Facility	Mitigation Plan, Solutions	Owner
04SP	1	74.2	129.3	59483/59592(1) JOP389 5 161/69KV XFMR	67.8	75.0	71.9	0.0558	-0.1065	59472 TIP292 5 to 59483 JOP389 5 (1) 161KV		EDE
04SP	2	83.6	130.6	59483/59592(1) JOP389 5 161/69KV XFMR	67.2	75.0	72.2	0.0598	0.1907	59483 JOP389 5 to 59607 JOP422 5 (1) 161KV		EDE
04SP	3	98.8	177.0	59500/59595(1) RNM393 5 161/69KV XFMR	65.8	75.0	70.9	0.0518	-0.1146	59472 TIP292 5 to 59483 JOP389 5 (1) 161KV		EDE
06SP	4	39.8	73.1	59483/59592(1) JOP389 5 161/69KV XFMR	71.1	75.0	73.2	0.0528	-0.1064	59472 TIP292 5 to 59483 JOP389 5 (1) 161KV		EDE
06SP	5	51.9	87.0	59483/59592(1) JOP389 5 161/69KV XFMR	70.2	75.0	73.1	0.0554	0.1907	59483 JOP389 5 to 59607 JOP422 5 (1) 161KV		EDE
06SP	6	60.4	111.9	59500/59595(1) RNM393 5 161/69KV XFMR	69.4	75.0	72.4	0.0500	-0.1146	59472 TIP292 5 to 59483 JOP389 5 (1) 161KV		EDE
06SP	7	84.9	165.3	59483/59592(1) JOP389 5 161/69KV XFMR	66.7	75.0	71.0	0.0500	-0.0878	59470 JOP145 5 to 59498 STL439 5 (1) 161KV		EDE

Table 4 – **NON – SPP FACILITIES** Network Facilities identified as limits in the MUST Generation Sensitivity Analysis

MUST Generation Sensitivity Analysis												
Study Case	Limiting Constraint	Worst Dispatch FCITC	Base FCITC	Limiting Facility	Initial Flow	Limit	Study Flow	OTDF	LODF	Outaged Facility	Mitigation Plan, Solutions	Owner
04SP	8	4.6	6.1	96659 2BOWRML to 96751 2REEDS (1) 69KV	-35.9	-36.0	-36.0	-0.0206	-0.2417	96649 2JASPER to 96651 2LAMAR (1) 69KV		AEC
04SP	9	62.1	66.1	96089/96673(1) JAMESVILLE 161/69KV XFMR	54.4	56.0	55.9	0.0236	0.4136	96089/96673(2) JAMESVILLE 161/69KV XFMR		AEC
04SP	10	76.6	91.8	96659 2BOWRML to 96751 2REEDS (1) 69KV	-33.9	-36.0	-35.7	-0.0230	0.0589	59468 AUR124 5 to 59480 MON383 5 (1) 161KV		AEC
04SP	11	81.4	111.5	96659 2BOWRML to 96751 2REEDS (1) 69KV	-33.4	-36.0	-35.3	-.02350	-0.0468	59479 LAR382 5 to 59480 MON383 5 (1) 161KV		AEC
06SP	12	38.7	49.5	96659 2BOWRML to 96751 2REEDS (1) 69KV	-35.0	-36.0	-35.8	-0.0204	-0.2414	96649 2JASPER to 96651 2LAMAR (1) 69KV		AEC
06SP	13	98.7	116.3	96659 2BOWRML to 96751 2REEDS (1)69KV	-33.4	-36.0	-35.6	-0.0226	0.0588	59468 AUR124 5 to 59480 MON383 5 (1) 161KV		AEC
06WP	14	92.5	97.1	96089/96673(2) JAMESVILLE 161/69KV XFMR	53.5	56.0	55.9	0.0256	0.4284	96089/96673(1) JAMESVILLE 161/69KV XFMR		AEC

Generation Adjustment Tables For Limits Found In Generation Sensitivity Analysis

2004 Summer Peak

Generator Adjustments For Limiting Constraint Number 1

59483/59592(1) JOP389 5 161/69KV XFMR

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	22.8	
59645 R8G167	--	0	54	36.4	
59646 R9G167	--	0	12	10.9	
59647 R10G167	--	0	33	23.7	
59648 OZD312	--	0	18	14.6	
59649 A1G349	--	0	192	168.4	
59650 A2G349	--	0	20	18.2	
59651 L1G382	--	0	82	63.7	
59652 L2G382	--	0	82	63.7	
59653 L3G382	--	0	55	45.5	
59655 S1G439	8.1	0	90	81.9	90
59658 S4G439	53	0	205	152	205
59795 S2G EMD	--	0	75	45.5	
59797 S3G EMD	13.1	0	75	45.5	58.6
59687 JECU1EM	--	0	162	147.4	
59689 IATG1EM	--	0	80	72.8	

2004 Summer Peak

Generator Adjustments For Limiting Constraint Number 2

59483/59592(1) JOP389 5 161/69KV XFMR

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	22.8	
59645 R8G167	--	0	54	36.4	
59646 R9G167	--	0	12	10.9	
59647 R10G167	--	0	33	23.7	
59648 OZK312	--	0	18	14.6	
59649 A1G349	--	0	192	168.4	
59650 A2G349	--	0	20	18.2	
59651 L1G382	--	0	82	63.7	
59652 L2G382	--	0	82	63.7	
59653 L3G382	--	0	55	45.5	
59655 S1G439	8.1	0	90	81.9	90.0
59658 S4G439	16.5	0	205	152	168.5
59795 S2G EDE	29.5	0	75	45.5	75.0
59797 S3G EDE	29.5	0	75	45.5	75.0
59687 JECU1EDE	--	0	162	147.4	
59689 IATG1EDE	--	0	80	72.8	

2004 Summer Peak

Generator Adjustments For Limiting Constraint Number 3

59500/59595(1) RNM393 5 161/69KV XFMR

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	22.8	
59645 R8G167	--	0	54	36.4	
59646 R9G167	--	0	12	10.9	
59647 R10G167	--	0	33	23.7	
59648 OZK312	--	0	18	14.6	
59649 A1G349	--	0	192	168.4	
59650 A2G349	--	0	20	18.2	
59651 L1G382	--	0	82	63.7	
59652 L2G382	--	0	82	63.7	
59653 L3G382	--	0	55	45.5	
59655 S1G439	--	0	90	81.9	
59658 S4G439	53	0	205	152	205
59795 S2G EDE	29.5	0	75	45.5	75
59797 S3G EDE	16.3	0	75	45.5	61.8
59687 JECU1EDE	--	0	162	147.4	
59689 IATG1EDE	--	0	80	72.8	

2006 Summer Peak

Generator Adjustments For Limiting Constraint Number 4

59483/59592(1) JOP389 5 161/69KV XFMR

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	29.3	
59645 R8G167	--	0	54	30.9	
59646 R9G167	--	0	12	11	
59647 R10G167	--	0	33	23.8	
59648 OZK312	--	0	18	14.6	
59649 A1G349	--	0	192	169.2	
59650 A2G349	--	0	20	14.6	
59651 L1G382	--	0	82	72.3	
59652 L2G382	--	0	82	72.3	
59653 L3G382	--	0	55	50.3	
59658 S4G439	12.4	0	205	168.3	180.6
59795 S2G EDE	27.4	0	75	47.6	75
59797 S3G EDE	--	0	75	47.6	
59687 JECU1EDE	--	0	162	148.2	
59689 IATG1EDE	--	0	80	73.2	

2006 Summer Peak

Generator Adjustments For Limiting Constraint Number 5

59483/59592(1) JOP389 5 161/69KV XFMR

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	29.3	
59645 R8G167	--	0	54	30.9	
59646 R9G167	--	0	12	11	
59647 R10G167	--	0	33	23.8	
59648 OZK312	--	0	18	14.6	
59649 A1G349	--	0	192	169.2	
59650 A2G349	--	0	20	14.6	
59651 L1G382	--	0	82	72.3	
59652 L2G382	--	0	82	72.3	
59653 L3G382	--	0	55	50.3	
59658 S4G439	36.7	0	90	168.3	205
59795 S2G EDE	--	0	205	47.6	
59797 S3G EDE	15.2	0	75	47.6	62.8
59687 JECU1EDE	--	0	75	148.2	
59689 IATG1EDE	--	0	162	73.2	

2006 Summer Peak

Generator Adjustments For Limiting Constraint Number 6

59500/59595(1) RNM393 5 161/69KV XFMR

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	29.3	
59645 R8G167	--	0	54	30.9	
59646 R9G167	--	0	12	11	
59647 R10G167	--	0	33	23.8	
59648 OZK312	--	0	18	14.6	
59649 A1G349	--	0	192	169.2	
59650 A2G349	--	0	20	14.6	
59651 L1G382	--	0	82	72.3	
59652 L2G382	--	0	82	72.3	
59653 L3G382	--	0	55	50.3	
59658 S4G439	36.7	0	205	168.3	205
59795 S2G EDE	23.7	0	75	47.6	71.2
59797 S3G EDE	--	0	75	47.6	
59687 JECU1EDE	--	0	162	148.2	
59689 IATG1EDE	--	0	80	73.2	

2006 Summer Peak

Generator Adjustments For Limiting Constraint Number 7

59483/59592(1) JOP389 5 161/69KV XFMR

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	29.3	
59645 R8G167	--	0	54	30.9	
59646 R9G167	--	0	12	11	
59647 R10G167	--	0	33	23.8	
59648 OZK312	--	0	18	14.6	
59649 A1G349	--	0	192	169.2	
59650 A2G349	--	0	20	14.6	
59651 L1G382	--	0	82	72.3	
59652 L2G382	--	0	82	72.3	
59653 L3G382	--	0	55	50.3	
59658 S4G439	36.7	0	205	168.3	205
59795 S2G EDE	20.7	0	75	47.6	68.3
59797 S3G EDE	27.4	0	75	47.6	75
59687 JECU1EDE	--	0	162	148.2	
59689 IATG1EDE	--	0	80	73.2	

2004 Summer Peak

Generator Adjustments For Limiting Constraint Number 8

96659 2BOWRML to 96751 2REEDS (1) 69KV

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	22.8	
59645 R8G167	--	0	54	36.4	
59646 R9G167	--	0	12	10.9	
59647 R10G167	--	0	33	23.7	
59648 OZK312	--	0	18	14.6	
59649 A1G349	4.6	0	192	168.4	173
59650 A2G349	--	0	20	18.2	
59651 L1G382	--	0	82	63.7	
59652 L2G382	--	0	82	63.7	
59653 L3G382	--	0	55	45.5	
59655 S1G439	--	0	90	81.9	
59658 S4G439	--	0	205	152	
59795 S2G EDE	--	0	75	45.5	
59797 S3G EDE	--	0	75	45.5	
59687 JECU1EDE	--	0	162	147.4	
59689 IATG1EDE	--	0	80	72.8	

2004 Summer Peak

Generator Adjustments For Limiting Constraint Number 9

96089/96673(1) JAMESVILLE 161/69KV XFMR

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	22.8	
59645 R8G167	--	0	54	36.4	
59646 R9G167	--	0	12	10.9	
59647 R10G167	9.3	0	33	23.7	33
59648 OZK312	--	0	18	14.6	
59649 A1G349	23.6	0	192	168.4	192
59650 A2G349	1.8	0	20	18.2	20
59651 L1G382	--	0	82	63.7	
59652 L2G382	5.6	0	82	63.7	69.3
59653 L3G382	--	0	55	45.5	
59655 S1G439	--	0	90	81.9	
59658 S4G439	--	0	205	152	
59795 S2G EDE	--	0	75	45.5	
59797 S3G EDE	--	0	75	45.5	
59687 JECU1EDE	14.6	0	162	147.4	162
59689 IATG1EDE	7.2	0	80	72.8	80

2004 Summer Peak

Generator Adjustments For Limiting Constraint Number 10

96659 2BOWRML to 96751 2REEDS (1) 69KV

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	22.8	
59645 R8G167	--	0	54	36.4	
59646 R9G167	--	0	12	10.9	
59647 R10G167	--	0	33	23.7	
59648 OZK312	--	0	18	14.6	
59649 A1G349	23.6	0	192	168.4	192
59650 A2G349	1.8	0	20	18.2	20
59651 L1G382	18.3	0	82	63.7	82
59652 L2G382	18.3	0	82	63.7	82
59653 L3G382	9.5	0	55	45.5	55
59655 S1G439	--	0	90	81.9	
59658 S4G439	--	0	205	152	
59795 S2G EDE	--	0	75	45.5	
59797 S3G EDE	5.2	0	75	45.5	50.7
59687 JECU1EDE	--	0	162	147.4	
59689 IATG1EDE	--	0	80	72.8	

2004 Summer Peak

Generator Adjustments For Limiting Constraint Number 11

96659 2BOWRML to 96751 2REEDS (1) 69KV

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	9.9	0	38	22.8	32.6
59645 R8G167	--	0	54	36.4	
59646 R9G167	--	0	12	10.9	
59647 R10G167	--	0	33	23.7	
59648 OZK312	--	0	18	14.6	
59649 A1G349	23.6	0	192	168.4	192
59650 A2G349	1.8	0	20	18.2	20
59651 L1G382	18.3	0	82	63.7	82
59652 L2G382	18.3	0	82	63.7	82
59653 L3G382	9.5	0	55	45.5	55
59655 S1G439	--	0	90	81.9	
59658 S4G439	--	0	205	152	
59795 S2G EDE	--	0	75	45.5	
59797 S3G EDE	--	0	75	45.5	
59687 JECU1EDE	--	0	162	147.4	
59689 IATG1EDE	--	0	80	72.8	

2006 Summer Peak

Generator Adjustments For Limiting Constraint Number 12

96659 2BOWRML to 96751 2REEDS (1) 69KV

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	29.3	
59645 R8G167	--	0	54	30.9	
59646 R9G167	--	0	12	11	
59647 R10G167	--	0	33	23.8	
59648 OZK312	--	0	18	14.6	
59649 A1G349	22.8	0	192	169.2	192
59650 A2G349	5.4	0	20	14.6	20
59651 L1G382	--	0	82	72.3	
59652 L2G382	--	0	82	72.3	
59653 L3G382	--	0	55	50.3	
59658 S4G439	--	0	205	168.3	
59795 S2G EDE	10.6	0	75	47.6	58.1
59797 S3G EDE	--	0	75	47.6	
59687 JECU1EDE	--	0	162	148.2	
59689 IATG1EDE	--	0	80	73.2	

2006 Summer Peak

Generator Adjustments For Limiting Constraint Number 13

96659 2BOWRML to 96751 2REEDS (1) 69KV

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	29.3	
59645 R8G167	--	0	54	30.9	
59646 R9G167	--	0	12	11	
59647 R10G167	--	0	33	23.8	
59648 OZK312	--	0	18	14.6	
59649 A1G349	22.8	0	192	169.2	192
59650 A2G349	5.4	0	20	14.6	20
59651 L1G382	9.7	0	82	72.3	82
59652 L2G382	9.7	0	82	72.3	82
59653 L3G382	4.7	0	55	50.3	55
59658 S4G439	18.9	0	205	168.3	187.2
59795 S2G EDE	--	0	75	47.6	
59797 S3G EDE	27.4	0	75	47.6	75
59687 JECU1EDE	--	0	162	148.2	
59689 IATG1EDE	--	0	80	73.2	

2006 Winter Peak

Generator Adjustments For Limiting Constraint Number 14

96089 5JAMESV to 96673 2JAMESV (2) XFMR

Generator bus	Worst Redispatch	Pmin	Pmax	Porig	Pnew
59644 R7G167	--	0	38	19.7	
59645 R8G167	--	0	54	35.9	
59648 OZD312	--	0	18	14.4	
59649 A1G349	26.1	0	192	165.9	192
59650 A2G349	6.5	0	20	13.5	20
59651 L1G382	--	0	115	44.8	
59652 L2G382	34.9	0	115	44.8	79.8
59655 S1G439	--	0	120	89.7	
59658 S4G439	--	0	230	134.5	
59795 S2G EDE	--	0	75	44.8	
59797 S3G EDE	--	0	75	44.8	
59687 JECU1EDE	16.7	0	162	145.3	162
59689 IATG1EDE	8.2	0	80	71.8	80

5. Conclusion

Facility VOLTAGE AND THERMAL restrictions exist in SPP that limit the requested Network Integration Transmission Service by Empire District Electric Company; therefore, a Facility Study is required to determine details and cost of upgrade.

Appendix A

PSS/E CHOICES IN RUNNING LOAD FLOW PROGRAM AND ACCC

BASE CASES:
Solutions - Fixed slope decoupled Newton-Raphson solution (FDNS)
1. Tap adjustment – Stepping
2. Area interchange control – Tie lines only
3. Var limits – Apply immediately
4. Solution options - X Phase shift adjustment
   _ Flat start
   _ Lock DC taps
   _ Lock switched shunts

ACCC CASES:
Solutions – AC contingency checking (ACCC)
1. MW mismatch tolerance –1.0
2. Contingency case rating – Rate B
3. Percent of rating – 100
4. Output code – Summary
5. Min flow change in overload report – 1mw
6. Excld cases w/ no overloads form report – YES
7. Exclude interfaces from report – NO
8. Perform voltage limit check – YES
9. Elements in available capacity table – 60000
10. Cutoff threshold for available capacity table – 99999.0
11. Min. contng. case Vltg chng for report – 0.02
12. Sorted output – None

Newton Solution:
1. Tap adjustment – Stepping
2. Area interchange control – Tie lines only
3. Var limits - Apply automatically
4. Solution options - X Phase shift adjustment
   _ Flat start
   _ Lock DC taps
   _ Lock switched shunts