SPP Southwest Power Pool

Addendum to the Kansas/Panhandle Sub-Regional Transmission Study

SPP ENGINEERING DEPARTMENT,
PLANNING SECTION

November 4, 2005

Draft No. 2: Revised January 26, 2006

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1. EXECUTIVE SUMMARY

A third workshop was held for a wide variety of stakeholders in June 2005, to discuss transmission expansion alternatives in the Kansas/Panhandle sub-region of Southwest Power Pool (SPP). This was precipitated mainly due to growth in wind farms in the sub-region, and the proposed addition of the Sand Sage coal fired unit at Holcomb. The parties requested several more runs be made as sensitivities to Plan A, and that study assumptions be updated. As before, Phase I of the study would entail a more traditional transfer analysis approach, while Phase II would be a market analysis. Results favored Plan A with the addition of the Potter-Tolk-Tuco 345 kV line for both increased transfer capability and greater economic benefit. A framework for allocating Plan A (with and without Potter-Tolk-Tuco 345 kV) to its beneficiaries was also developed.

2. INTRODUCTION

On June 2, 2005, stakeholders convened at the DFW Hyatt for the Kansas/Panhandle Workshop III to discuss results of the just completed Kansas/Panhandle Sub-Regional Transmission Study (Draft No. 4: Revised May 24, 2005, as posted to the password protected SPP eRoom site at 'https://project1.eroom.net'). After reviewing the findings, several requests for further analysis featuring Plan A (see description below) and various options were made of SPP staff, as follows:

- Make runs with wind, but without Sand Sage
- Conduct more detailed analysis of the modified-X plan
- Update wind data
- Add Expansion Plan committed projects
- Add CLEC/Entergy Wells Substation
- Add Entergy area to first-tier
- Update flowgate definitions
- Review additional underlying upgrades
- Add study of Potter-Tolk-Tuco 345 kV line

As before, the study was to be divided into two segments. Phase I would identify rough cost estimates and rank expansion alternatives based on their ability to export wind power and Sand Sage from SPP to the outside world. Initial analysis would not focus on commercial or market benefits. Phase II would consist of a market driven economic benefits evaluation. Results were to be completed as soon as practicable and posted to the SPP eRoom.

Reruns were to focus on Plan A and variations thereof to address the transmission expansion needs of the Kansas/Panhandle sub-region. Each option was designed to provide multiple paths across the sub-region from north to south, as well as from east to west. A brief description of plan items and costs, as well as a diagram, may be found below. These costs do not include any upgrades to the underlying transmission system identified during Phase I analysis.

Plan A (a.k.a. X-Plan) (est. $419.0 million)

- Spearville-Knoll-Pauline 345 kV line
- Knoll 345/230 kV transformer
- Spearville-Mooreland 345 kV line
- Potter-Mooreland 345 kV line
- Mooreland-Wichita 345 kV line
- Mooreland-Northwest 345 kV line
- Mooreland 345/138 kV transformer

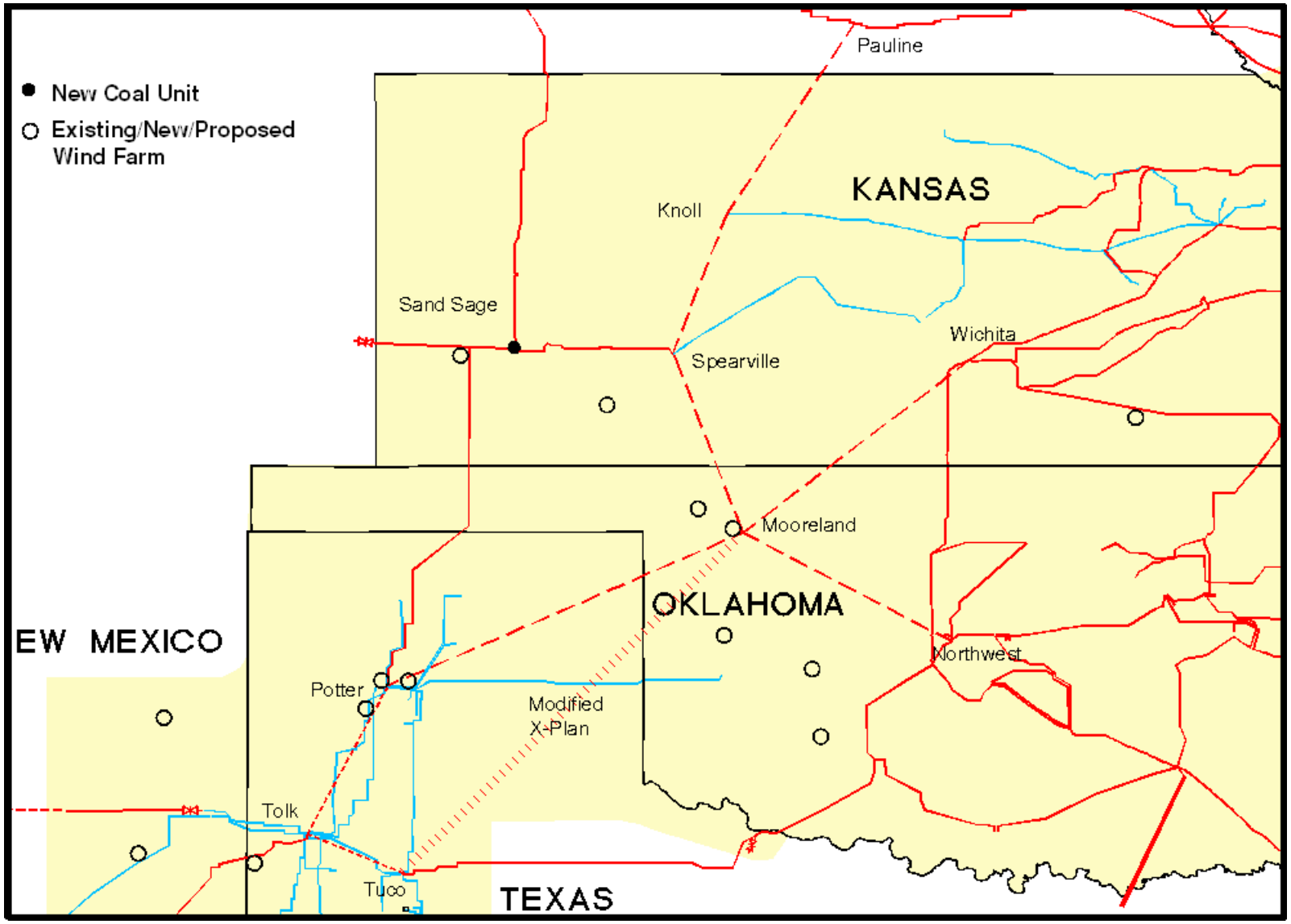
Plan A – modified-X (est. $449.0 million)

- Substitute Mooreland-Tuco 345 kV line for Mooreland-Potter 345 kV line

Plan A – add Potter-Tolk-Tuco (est. additional $69.4 million)

- Add Potter-Tolk 345 kV line
- Add Tolk-Tuco 345 kV line

Plan A – also showing Modified-X and Potter-Tolk-Tuco 345 kV options



3. STUDY METHODOLOGY

A. Phase I

The latest SPP Model Development Working Group (MDWG) 2006 Spring Peak model was used for the Phase I analysis. For inclusion into the analysis, the location and size of proposed wind farm projects were derived from reviewing the SPP Generation Interconnection Queue on the SPP OASIS web site, with additional input from stakeholders and SPP member queues encompassed by the study area. These wind farms were incorporated into Phase I of the study as export points as detailed below. The test level was selected to best reflect expected wind farm output during conditions represented in the Spring load flow model. The proposed Sand Sage unit was also included in the analysis as an export point.

- Sand Sage (Holcomb No. 2) 600 MW
- Wind Generation (Test Spring @ 80% of Max MW nameplate levels) at the following locations:

Area Name of Bus	Location	BusNo	BusName	ID	Max MW
OKGE	Sleeping Bear	55920	FTSUPLY4	1	96
SWPS	White Deer 1	50842	WIND G 3	1	80
WEPL	Gray County 1	58867	HAGGARD2	1	110
WFEC	Blue Canyon 1	56103	BLUCAN14	1	45
Existing Wind Subtotal					331
WindSPP	Blue Canyon 2	56104	BLUCAN	2	129
WindSPP	CapRock	51071	CapRock	1	80
WindSPP	Elk River 345 kV	56795	ElkRiver	1	200
WindSPP	Holcomb 345 kV	50858	FINNEY7	1	500
WindSPP	Mooreland 345 kV (new)	55819	MOORLND	1	200
WindSPP	OK Wind Energy	55787	FPL_WIND	1	102
WindSPP	Potter 345 kV	50888	POTTRC7	1	700
WindSPP	Red Hills	54309	RedHills	1	114
WindSPP	San Juan Mesa	52500	SanJuan	1	180
WindSPP	Tolk 345 kV	51440	TOLK7	1	250
WindSPP	Weatherford	54199	WEATHTP4	1	120
WindSPP	Wildorado	50993	BUSHLND6	1	240
New Wind Subtotal					2815
Total Wind					3146

Notes:
Proposed wind at Holcomb 345 kV (Finney) is also proxy for Setab and Spearville
Proposed wind at Potter is also proxy for Nichols 230 kV
Proposed wind at Mooreland is also proxy for central Oklahoma

Options were screened using PTI's MUST program (see Appendix A – MUST Solution Settings) via calculation of FCITC (First Contingency Incremental Transfer Capability) DC export capability for Sand Sage and Wind Generation, Wind Generation alone, and Sand Sage alone (for FCITC comparison purposes only).

For the MUST runs, all new generation was exported beyond the SPP system (i.e., no displacement of existing SPP resources). Import points were selected via scale for import (i.e., Pgen-Pmin). Generators excluded by the NERC IDC (e.g., nuclear units) were excluded from import. Only generators 100 MW or larger were called on for import. A 2% or 1 MVA cut-off was used to eliminate noise and focusing on local area problems. All facilities 100 kV and above for SPP and first tier control areas were monitored. Selected multi-terminal outages and single 100 kV and above and contingencies for SPP and 1st tier control areas were simulated.

B. Phase II

For Phase II analysis Henwood's (now Global Energy) ProSYM/MarketSYM package was used, in conjunction with PowerWorld's OPF package (Version 11.0). Runs were made in AC mode so that the effect of losses would be accurately captured. SPP IPPs and new wind farms were assigned into two separate areas. They were not included in the results of the host control area. As before, the four existing wind farms were left in their original host control area. SPP and first tier 100 kV and above elements under normal conditions and flowgates taken from the SPP Available Flowgate Capacity (AFC) process were monitored. Entergy was included in the first tier companies. Several flowgate ratings were adjusted upwards due to scheduled upgrades approved within the SPP Attachment AA process. Additional flowgates identified in Phase I were also monitored, as appropriate. Full runs were made for 2010 Spring, 2010 Summer, 2010 Fall and 2010/11 Winter. For Phase II purposes, the seasons are defined as four equal periods of three months each (e.g., Summer is June, July and August). Production Cost Savings (i.e., Production Cost = Dispatch Cost + Violation Cost) for plan variations were compared. Violation Costs are used as a surrogate for Transmission Loading Relief.

Wind farm profiles were created for Phase II analysis using actual data provided by the Alternative Energy Institute at West Texas A&M University, Canyon, Texas. An average hourly wind speed for each month was calculated from 1995-2000 data from three test sites: Amarillo, Dalhart, and White Deer. These wind speed values were then translated into MW values. Ultimately, they were translated into percent of nameplate output values to be prorated against different sized wind farms.

Every other hour of a typical week representing each month of interest was used for the ProSYM run. A base MarketSYM run was made for each month or season of interest. The Optimal Power Flow area for the run included SPP and first tier companies. Then a change case was created for each plan. A MarketSYM run was made for each change case. Comparing the base to the change case, the total production cost savings was extracted. A ten-year savings estimate was then made by calculating the savings over the period. The present worth of the future savings over a ten-year period was then calculated using an 8% discount rate. Annual total fixed charges were also calculated using a 15% carrying charge rate. Then benefit/cost ratios were computed on both a ten-year and annual basis.

4. RESULTS OF ANALYSIS

A. Phase I

a. Transfer Analysis

Summary tables of the Spring 2006 export FCITC results and underlying upgrade costs for the various plans follow. Three sets of runs are featured: with Sand Sage and 80% Wind Generation, 80% Wind Generation only, and Sand Sage only. It should be noted that all FCITC tables in this document exclude non-SPP facilities and limits at the receiving end of the simulated transfer. Costs for Expansion Plan committed projects are not included. During Spring conditions with higher levels of wind output (2,516.8 MW of export), significant underlying system upgrades are required for any of the plans. The cost associated with these common underlying upgrades is approximately $4.6 million. However, fewer underlying upgrades were found than previously ($34.6 million) due to increased wind farm granularity and the addition of committed projects.

Spring 2006 FCITC Results
Sand Sage and 80% Wind (3116.8 MW Test Level)

Limiting Element	Plan A	Cost	Plan A - modified X	Cost	Plan A - Potter-Tolk-Tuco	Cost	Plan A - modified X - Potter-Tolk-Tuco	Cost	Comment
Holcomb-Plymell 115 kV	1916	-	1447	-	-	-	1700	-	Planned upgrade June 2008
Tuco 230/345 kV Trf.	-	-	1644	5,000,000	-	-	2707	5,000,000	
Manning Tap-Dighton 115 kV	2092	-	1667	-	2144	-	1919	-	Planned upgrade June 2008
Potter 345/230 kV Trf.	-	-	1671	5,000,000	-	-	-	-	
Plymell-Pioneer Tap 115 kV	2221	-	1689	-	-	-	1979	-	Planned upgrade June 2008
Ness City-Alexander 115 kV	2152	2,975,000	1697	2,975,000	2207	2,975,000	1965	2,975,000	
Elk City 230/138 kV Trf.	2872	300,000	1707	300,000	3100	300,000	2639	300,000	
Alexander-Nekoma 115 kV	2206	1,075,000	1742	1,075,000	2263	1,075,000	2015	1,075,000	
Judson Large-Greensburg 115 kV	1888	153,000	1775	153,000	1910	153,000	1855	153,000	
N. Cimarron-Cimarron 115 kV	2354	25,000	1778	25,000	2403	25,000	2089	25,000	
Dighton-Beeler 115 kV	2277	-	1821	-	2334	-	2092	-	Planned upgrade June 2008
Beeler-Ness City 115 kV	2381	-	1907	-	2439	-	2188	-	Planned upgrade June 2008
Shamrock 115/69 kV Trf.	-	-	2039	1,500,000	-	-	-	-	
Grapevine-Elk City 230 kV	-	-	2169	185,000	-	-	-	-	
Sun City-Medicine Lodge 115 kV	2340	100,000	2204	100,000	2366	100,000	2299	100,000	
Medicine Lodge 115/138 kV Trf.	3074	1,500,000	2318	1,500,000	-	-	2996	1,500,000	
Shamrock 69/138 kV Trf.	-	-	2396	1,500,000	-	-	-	-	
Medicine Lodge-Harper 138 kV	-	-	2632	6,080,000	-	-	-	-	
Kirby-McClellan Pump 115 kV	-	-	2706	143,000	-	-	-	-	
McClellan Pump-McClellan Rural 115 kV	-	-	2791	4,405,000	-	-	-	-	
Colby-Hoxie 115 kV	-	-	2867	5,200,000	-	-	-	-	
Scott City-Manning 115 kV	-	-	2869	-	-	-	-	-	Planned upgrade June 2008
Ross Beach-Redline 115 kV	-	-	2935	1,600,000	-	-	-	-	
McClellan-Shamrock 115 kV	-	-	2946	8,053,000	-	-	-	-	
Pioneer Tap-CTU Sublette 115 kV	-	-	2974	3,000,000	-	-	-	-	
Redline-Knoll 115 kV	-	-	3028	4,750,000	-	-	-	-	
Elk City-Clinton Jct. 138 kV	-	-	3062	100,000	-	-	-	-	
		$ 6,128,000		$ 52,644,000		$ 4,628,000		$ 11,128,000	

Notes:
FCITC limits based on 2% distribution factor cutoff.
'-' indicates FCITC for limiting element higher than test level, or did not meet cutoff level criteria.
'Spearville & Setab Sensitivity' refers to shift from Finney injection point to Spearville (150 MW) and Setab (100 MW).
'Modified' refers to change from Mooreland-Potter 345 kV line to Mooreland-Tuco 345 kV line.
'Potter-Tolk-Tuco' refers to addition of said 345 kV line.

Spring 2006 FCITC Results
80% Wind Only (2516.8 MW Test Level)

Limiting Element	Plan A	Cost	Plan A - modified	Cost	Plan A - Potter-Tolk-Tuco	Cost	Plan A - modified - Potter-Tolk-Tuco	Cost	Comment
Tuco 230/345 kV Trf.	-	-	1296	5,000,000	-	-	2441	5,000,000	
Potter 345/230 kV Trf.	-	-	1321	5,000,000	-	-	-	-	
Elk City 230/138 kV Trf.	-	-	1505	300,000	-	-	2105	300,000	
Judson Large-Greensburg 115 kV	1845	153,000	1729	153,000	1864	153,000	1807	153,000	
Shamrock 115/69 kV Trf.	-	-	1824	1,500,000	-	-	-	-	
Grapevine-Elk City 230 kV	-	-	1876	185,000	-	-	-	-	
Shamrock 69/138 kV Trf.	-	-	2121	1,500,000	-	-	-	-	
Sun City-Medicine Lodge 115 kV	2287	100,000	2147	100,000	2309	100,000	2240	100,000	
Manning Tap-Dighton 115 kV	-	-	2232	-	-	-	-	-	Planned upgrade June 2008
Ness City-Alexander 115 kV	-	-	2307	2,975,000	-	-	-	-	
Alexander-Nekoma 115 kV	-	-	2368	1,075,000	-	-	-	-	
Kirby-McClellan Pump 115 kV	-	-	2380	143,000	-	-	-	-	
Dighton-Beeler 115 kV	-	-	2438	-	-	-	-	-	Planned upgrade June 2008
McClellan Pump-McClellan Rural 115 kV	-	-	2450	4,405,000	-	-	-	-	
Tolk-Tuco 230 kV	-	-	2486	20,370,000	-	-	-	-	
		$ 253,000		$ 42,706,000		$ 253,000		$ 5,553,000	

Notes:
FCITC limits based on 2% distribution factor cutoff.
'-' indicates FCITC for limiting element higher than test level.
'Modified' refers to change from Mooreland-Potter 345 kV line to Mooreland-Tuco 345 kV line.
'Potter-Tolk-Tuco' refers to addition of said 345 kV line.

Spring 2006 FCITC Results
Sand Sage Only (600 MW Test Level)

Limiting Element	Plan A	Plan A - modified	Plan A - Potter-Tolk-Tuco	Plan A - modified - Potter-Tolk-Tuco	Comment
Holcomb-Plymell 115 kV	576	545	563	551	Planned upgrade June 2008

Notes:
FCITC limits based on 2% distribution factor cutoff.
'-' indicates FCITC for limiting element higher than test level.
'Modified' refers to change from Mooreland-Potter 345 kV line to Mooreland-Tuco 345 kV line.
'Potter-Tolk-Tuco' refers to addition of said 345 kV line.

b. Sensitivity Runs

Several sensitivity FCITCs were made to help further evaluate Plan A and its options. These included running Sand Sage at 500 MW in the load flow base case (exporting remaining 100 MW to the outside world), and shifting half of Holcomb (Finney) wind export to Setab and Spearville Substations. The findings of these sensitivities are that the previously identified constraints to reach the targeted transfer level were largely unaffected, although they did appear at slightly different FCITC levels. The results of these sensitivities are also posted to the SPP eRoom.

B. Phase II

a. Market Analysis

The following table illustrates the benefit/cost ratio for the various options. Two sets of runs are featured: with Sand Sage and Wind Generation, and Wind Generation only. The savings comparisons are for each change case of interest minus the appropriate base case.

As can be seen, lower benefit results were found in the new runs for comparable scenarios in the original study for two reasons. Firstly, the new runs include committed Expansion Plan items. Secondly, higher load levels in 2010 cause more economical units to be fully utilized, whereas they were not in 2005.

Benefit/Cost Ratios:

Plan	Plan Cost	Additional Upgrades	Total Cost	2010 Spring Production Cost Savings[1]	2010 Summer Production Cost Savings	2010 Fall Production Cost Savings	2010 Winter Production Cost Savings	2010 Annual Production Cost Savings	Annual Total Fixed Charge @ 15% Rate	B/C Ratio	Estimated 10 Year Benefit @ 8% Rate	B/C Ratio
Wind and Sand Sage:												
Plan A	$ 419,000,000	$ 6,128,000	$ 425,128,000	$ 14,994,405	$ 22,670,526	$ 11,307,990	$ 7,497,174	$ 56,470,095	$ 63,769,200	0.89	$ 378,918,934	0.89
Plan A - 765 kV	$ 595,900,000	$ 6,128,000	$ 602,028,000	$ 19,309,345	$ 27,432,751	$ 15,509,565	$ 10,479,520	$ 72,731,181	$ 90,304,200	0.81	$ 488,032,145	0.81
Plan A - modified[2]	$ 449,000,000	$ 52,644,000	$ 501,644,000	$ 15,877,419	$ 25,152,661	$ 12,971,058	$ 8,017,065	$ 62,018,203	$ 75,246,600	0.82	$ 416,147,193	0.83
Plan A - with Potter-Tolk-Tuco 345 kV line	$ 488,400,000	$ 4,628,000	$ 493,028,000	$ 21,364,342	$ 32,043,967	$ 16,622,512	$ 10,380,810	$ 80,411,631	$ 73,954,200	1.09	$ 539,568,589	1.09
Plan A - modified with Potter-Tolk-Tuco 345 kV line	$ 518,400,000	$ 11,128,000	$ 529,528,000	$ 21,438,486	$ 32,181,776	$ 16,723,809	$ 10,859,571	$ 81,203,642	$ 79,429,200	1.02	$ 544,883,048	1.03
Wind Only:												
Plan A	$ 419,000,000	$ 253,000	$ 419,253,000	$ 6,269,249	$ 12,058,897	$ 5,212,613	$ 3,521,162	$ 27,061,921	$ 62,887,950	0.43	$ 181,587,694	0.43
Plan A - modified[2]	$ 449,000,000	$ 42,706,000	$ 491,706,000	$ 7,169,664	$ 13,114,375	$ 2,621,939	$ 3,607,959	$ 26,513,937	$ 73,755,900	0.36	$ 177,910,676	0.36
Plan A - with Potter-Tolk-Tuco 345 kV line	$ 488,400,000	$ 253,000	$ 488,653,000	$ 10,262,984	$ 16,188,957	$ 8,014,995	$ 5,496,289	$ 39,963,225	$ 73,297,950	0.55	$ 268,156,490	0.55
Plan A - modified with Potter-Tolk-Tuco 345 kV line	$ 518,400,000	$ 5,553,000	$ 523,953,000	$ 10,513,468	$ 16,458,360	$ 8,460,283	$ 5,571,509	$ 41,003,620	$ 78,592,950	0.52	$ 275,137,625	0.53

1 - Production Costs Savings = Violation Costs + Dispatch Cost Reduction. Values are calculated from 3 (peak) week per runs to calcuate a season

2 - Modified means Mooreland-Potter 345 kV line is replaced by Mooreland-Tuco 345 kV line

b. Sensitivity Runs

High Fuel Cost:
A sensitivity run for Plan A for high fuel cost was made using 2010 Summer data as a proxy for the entire year. For the analysis the price for natural gas was changed from about $5 to $8 per million BTU. Fuel oil No. 2 was changed from about $6 to $8 per million BTU. A 37.5% increase was seen in the Summer season (1 week simulation only) production cost savings for the high fuel cost scenario over the original ($28.7 million vs. $20.9 million), making the plan more attractive. It is expected that these results would hold for other plan options.

765 kV instead of 345 kV:
A sensitivity run for Plan A whereby the 345 kV lines would be replaced with 765 kV lines (and appropriate transformers) was also made. Refer to the table on the previous page for results. The benefit/cost ratio for this run was found to be lower than that of original Plan A.

C. Economic Benefit Analysis

The following two figures provide a possible framework for allocating the costs of Plan A (with and without the Potter-Tolk-Tuco 345 kV option) to its beneficiaries. The violation cost savings have been prorated via the sum of generator benefits. The total allocation is done on generator benefit and violation cost savings. Benefits to Nebraska have been considered because of the 345 kV tie to Pauline Substation in Nebraska from Knoll Substation in Kansas.

Plan A (with Sand Sage and Wind):

Company	Projected Annual Benefits to Generators	Projected Share of Annual Violation Cost Savings	Total Annual Benefits	Allocation %	Allocation $
CELE	$ 164,617	$ 116,214	$ 280,831	0.8%	$ 3,334,047
EMDE	$ 69,157	$ 48,822	$ 117,979	0.3%	$ 1,400,659
GRRD	$ 3,460	$ 2,443	$ 5,903	0.0%	$ 70,084
INDN	$ 29,447	$ 20,789	$ 50,236	0.1%	$ 596,408
KACP	$ 34,356	$ 24,254	$ 58,611	0.2%	$ 695,831
KACY	$ 15,364	$ 10,846	$ 26,210	0.1%	$ 311,172
LAFA	$ 31	$ 22	$ 52	0.0%	$ 620
LEPA	$ 47	$ 33	$ 80	0.0%	$ 949
MIDW	$ -	$ -	$ -	0.0%	$ -
MIPU	$ 26,296	$ 18,564	$ 44,860	0.1%	$ 532,579
NEBR	$ 49,942	$ 35,257	$ 85,199	0.2%	$ 1,011,491
OKGE	$ 386,905	$ 273,140	$ 660,045	1.8%	$ 7,836,110
PSOK	$ 409,934	$ 289,398	$ 699,332	2.0%	$ 8,302,526
SOEP	$ 561,429	$ 396,348	$ 957,777	2.7%	$ 11,370,807
SPPIPP	$ 59,817	$ 42,228	$ 102,045	0.3%	$ 1,211,487
SPRM	$ 28,576	$ 20,174	$ 48,750	0.1%	$ 578,760
SUNC	$ 7,087,442	$ 5,003,461	$ 12,090,902	33.8%	$ 143,544,174
SWPA	$ 24,396	$ 17,223	$ 41,618	0.1%	$ 494,097
SWPS	$ 2,170,634	$ 1,532,384	$ 3,703,019	10.3%	$ 43,962,538
WEPL	$ 12,027	$ 8,491	$ 20,517	0.1%	$ 243,585
WERE	$ 2,365,753	$ 1,670,130	$ 4,035,883	11.3%	$ 47,914,327
WFEC	$ 165,791	$ 117,042	$ 282,832	0.8%	$ 3,357,808
WINDSPP	$ 7,325,120	$ 5,171,252	$ 12,496,372	34.9%	$ 148,357,941
Total	$ 20,990,541	$ 14,818,513	$ 35,809,054	100.0%	$ 425,128,000

Note: Negative Generator Benefits are zeroed out

Plan A (with Sand Sage and Wind, plus addition of Potter-Tolk-Tuco 345 kV):

Company	Projected Annual Benefits to Generators	Projected Share of Annual Violation Cost Savings	Total Annual Benefits	Allocation %	Allocation $
CELE	$ 184,668	$ 90,700	$ 275,368	0.5%	$ 2,315,755
EMDE	$ 78,489	$ 38,550	$ 117,039	0.2%	$ 984,264
GRRD	$ 209	$ 103	$ 311	0.0%	$ 2,618
INDN	$ 47,393	$ 23,277	$ 70,670	0.1%	$ 594,313
KACP	$ 58,234	$ 28,602	$ 86,835	0.1%	$ 730,257
KACY	$ 24,013	$ 11,794	$ 35,806	0.1%	$ 301,120
LAFA	$ 11	$ 6	$ 17	0.0%	$ 143
LEPA	$ 73	$ 36	$ 108	0.0%	$ 911
MIDW	$ -	$ -	$ -	0.0%	$ -
MIPU	$ 38,840	$ 19,076	$ 57,916	0.1%	$ 487,056
NEBR	$ 73,027	$ 35,867	$ 108,894	0.2%	$ 915,767
OKGE	$ 236,717	$ 116,264	$ 352,982	0.6%	$ 2,968,465
PSOK	$ 282,908	$ 138,951	$ 421,859	0.7%	$ 3,547,699
SOEP	$ 429,491	$ 210,946	$ 640,436	1.1%	$ 5,385,865
SPPIPP	$ 62,077	$ 30,489	$ 92,566	0.2%	$ 778,450
SPRM	$ 13,525	$ 6,643	$ 20,167	0.0%	$ 169,601
SUNC	$ 8,379,330	$ 4,115,530	$ 12,494,860	21.3%	$ 105,077,778
SWPA	$ 17,889	$ 8,786	$ 26,675	0.0%	$ 224,329
SWPS	$ 17,271,934	$ 8,483,157	$ 25,755,091	43.9%	$ 216,592,084
WEPL	$ 11,373	$ 5,586	$ 16,959	0.0%	$ 142,616
WERE	$ 140,731	$ 69,120	$ 209,852	0.4%	$ 1,764,785
WFEC	$ 169,518	$ 83,259	$ 252,777	0.4%	$ 2,125,777
WINDSPP	$ 11,795,611	$ 5,793,446	$ 17,589,057	30.0%	$ 147,918,349
Total	$ 39,316,059	$ 19,310,188	$ 58,626,247	100.0%	$ 493,028,000

Note: Negative Generator Benefits are zeroed out

5. RECOMMENDATIONS AND CONCLUSIONS

Plan A does not pay for itself in ten years with either Wind only or with Sand Sage only (see previous study results). As before, higher fuel costs showed increased plan benefits.

Plan A with the addition of the Potter-Tolk-Tuco 345 kV line is the recommended transmission expansion alternative for the Kansas/Panhandle sub-region. It is the clear economic choice, as it exhibits the highest benefit/cost ratio. With Wind and Sand Sage, Plan A shows a ratio of 0.89, versus a previous ratio of 1.07. Plan A with the addition of the Potter-Tolk-Tuco 345 kV line has a ratio of 1.09. Benefits shift to SPS with the addition of this line. Without Sand Sage, corresponding ratios are nearly halved.

The results of the Kansas/Panhandle Sub-regional Transmission Study and its Addendum will be incorporated into the SPP Regional Transmission Organization Expansion Plan, as appropriate. The allocation of project costs will be determined separate from this study. It must be noted that analysis results are subject to change as other expansion plan items are included.

Appendix A – MUST Solution Settings

MUST CHOICES IN RUNNING FCITC DC ANALYSIS

CONSTRAINTS/CONTINGENCY INPUT OPTIONS

1. AC Mismatch Tolerance – 2 MW
2. Base Case Rating – Rate A
3. Base Case % of Rating – 100%
4. Contingency Case Rating – Rate B
5. Contingency Case % of Rating – 100%
6. Base Case Load Flow – PSS/E
7. Convert branch ratings to estimated MW ratings – Yes
8. Contingency ID Reporting – Labels
9. Maximum number of contingencies to process - 50000

MUST CALCULATION OPTIONS

1. Phase Shifters Model for DC Linear Analysis – Constant flow for Base Case and Contingencies
2. Report Base Case Violations with FCITC – Yes
3. Maximum number of violations to report in FCITC table - 50000
4. Distribution Factor (OTDF and PTDF) Cutoff – 0.02
5. Maximum times to report the same elements – 1 {eliminate voluminous repeats}
6. Apply Distribution Factor to Contingency Analysis – Yes
7. Apply Distribution Factor to FCITC Reports – Yes
8. Minimum Contingency Case flow change – 1 MW
9. Minimum Contingency Case Distribution Factor change – 0.0
10. Minimum Distribution Factor for Transfer Sensitivity Analysis – 0.0