



 **SPP** *Southwest  
Power Pool*



# Engineering Analysis on Cost Allocations

Bruce Rew  
**Director, Engineering**

**CAWG Meeting**

**August 31, 2004  
Dallas, TX**

## The Problems...

- ❖ **Determine appropriate allocation of transmission upgrade costs to region-wide rate.**
- ❖ **Determine zonal benefits of upgrades for cost allocation of portion assigned to zones**





# Region Wide Allocation

- ❖ **Studied different methods for allocating costs regionally**
  - ◆ **Expansion Planning Evaluation Method**
  - ◆ **Transmission investment allocation**
  - ◆ **Transmission impacts to native load**
  - ◆ **MW-mile allocation using regional impacts to serve native load**
  - ◆ **AEP proposal**





# Evaluation of Expansion Planning Evaluation method

- ❖ **Facilities 230 kV and above were considered regional in function for Transmission Plan**
  - ◆ **Number of projects at regional level were 6%**
  - ◆ **Cost of regional facilities were 27%**
  - ◆ **20% of total miles were regional**
- ❖ **Also reviewed impacts by transactions with those having 3% or greater being regional**
  - ◆ **24% of the projects had regional impacts**
  - ◆ **Costs of those projects were 15% of total**
- ❖ **Approximated to be Previous SPP proposal of 25% regional and 75% zonal**





# Exhibit I

Exhibit 1

SPP Planned Transmission Lines

Year	Voltage	New Construction			Rebuilds/Conversions			Totals					
		# projects	# miles	\$(millions)	# projects	# miles	\$(millions)	# projects	%	# miles	%	\$(millions)	%
2004	69kV	6	24.5	\$ 7.3	5	51.1	\$ 6.0	11	27%	75.6	20%	\$ 13.3	9%
	115-161kV	16	99.0	\$ 57.9	10	75	\$ 14.3	26	63%	174	45%	\$ 72.3	48%
	230kV +	4	138.0	\$ 64.2	0	0	\$ -	4	10%	138	36%	\$ 64.2	43%
	<b>Totals</b>	<b>26</b>	<b>261.5</b>	<b>\$ 129.4</b>	<b>15</b>	<b>126.1</b>	<b>\$ 20.3</b>	<b>41</b>		<b>387.6</b>		<b>\$ 149.8</b>	
2005	69kV	1	13.5	\$ 4.6	2	8.3	\$ 1.5	3	23%	21.8	14%	\$ 6.1	15%
	115-161kV	6	86.8	\$ 28.5	4	42.6	\$ 6.5	10	77%	129.4	86%	\$ 35.0	85%
	230kV +	0	0	\$ -	0	0	\$ -	0	0%	0	0%	\$ -	0%
	<b>Totals</b>	<b>7</b>	<b>100.3</b>	<b>\$ 33.1</b>	<b>6</b>	<b>50.9</b>	<b>\$ 8.0</b>	<b>13</b>		<b>151.2</b>		<b>\$ 41.1</b>	
2007	69kV	0	0	\$ -	0	0	\$ -	0	0%	0	0%	\$ -	0%
	115-161kV	9	90.5	\$ 32.0	0	0	\$ -	9	100%	90.5	100%	\$ 32.0	100%
	230kV +	0	0	\$ -	0	0	\$ -	0	0%	0	0%	\$ -	0%
	<b>Totals</b>	<b>9</b>	<b>90.5</b>	<b>\$ 32.0</b>	<b>0</b>	<b>0</b>	<b>\$ -</b>	<b>9</b>		<b>90.5</b>		<b>\$ 32.0</b>	
2010	69kV	0	0	\$ -	0	0	\$ -	0	0%	0	0%	\$ -	0%
	115-161kV	15	91.3	\$ 31.6	6	81.5	\$ 9.6	21	95%	172.8	85%	\$ 41.2	82%
	230kV +	1	31.5	\$ 9.0	0	0	\$ -	1	5%	31.5	15%	\$ 9.0	18%
	<b>Totals</b>	<b>16</b>	<b>122.8</b>	<b>\$ 40.6</b>	<b>6</b>	<b>81.5</b>	<b>\$ 9.6</b>	<b>22</b>		<b>204.3</b>		<b>\$ 50.2</b>	
TOTALS	69kV	7	38.0	\$ 11.9	7	59.4	\$ 7.5	14	16%	97.4	12%	\$ 19.4	7%
	115-161kV	46	367.6	\$ 150.0	20	199.1	\$ 30.4	66	78%	566.7	68%	\$ 180.4	66%
	230kV +	5	169.5	\$ 73.2	0	0	\$ -	5	6%	169.5	20%	\$ 73.2	27%
	<b>Totals</b>	<b>58</b>	<b>575.1</b>	<b>\$ 235.1</b>	<b>27</b>	<b>258.5</b>	<b>\$ 37.9</b>	<b>85</b>		<b>833.6</b>		<b>\$ 273.0</b>	



# Exhibit 2

Year	Impacted by > 3%		
	<u>&gt;3% projects</u>	<u>All Projects</u>	<u>% Impacted</u>
2005	5	26	19.2%
2010	6	19	31.6%
<b>Totals</b>	<b>11</b>	<b>45</b>	<b>24.4%</b>

	Estimated Costs		
	<u>&gt;3% Projects</u>	<u>All Projects</u>	<u>% of Cost</u>
2005	\$ 5,089,000	\$ 56,339,000	9.0%
2010	\$ 9,601,000	\$ 40,792,000	23.5%
<b>Totals</b>	<b>\$ 14,690,000</b>	<b>\$ 97,131,000</b>	<b>15.1%</b>

Note: This analysis was done using the summer peak model and does not include all upgrades during the year.



## Transmission Investment

- ❖ **Considered allocation based on transmission investment**
- ❖ **Total Transmission investment is skewed because of inflation**
- ❖ **Larger number of lower kV facilities and increases investment at voltage level for lower cost construction**
- ❖ **Bright line Assumption has to be made on what is a regional facility**







## Transmission Impacts to serve native load on new lines

- ❖ **Evaluated response factor on new lines to serve native loads**
- ❖ **Results provided very small response**
- ❖ **NW Arkansas upgrades for example were less than 2% for AEP**
- ❖ **Results may not provide a reflection of the regional/zonal use of the system**





# Example: AEP

## Chamber Springs to Tontitown 345 kV

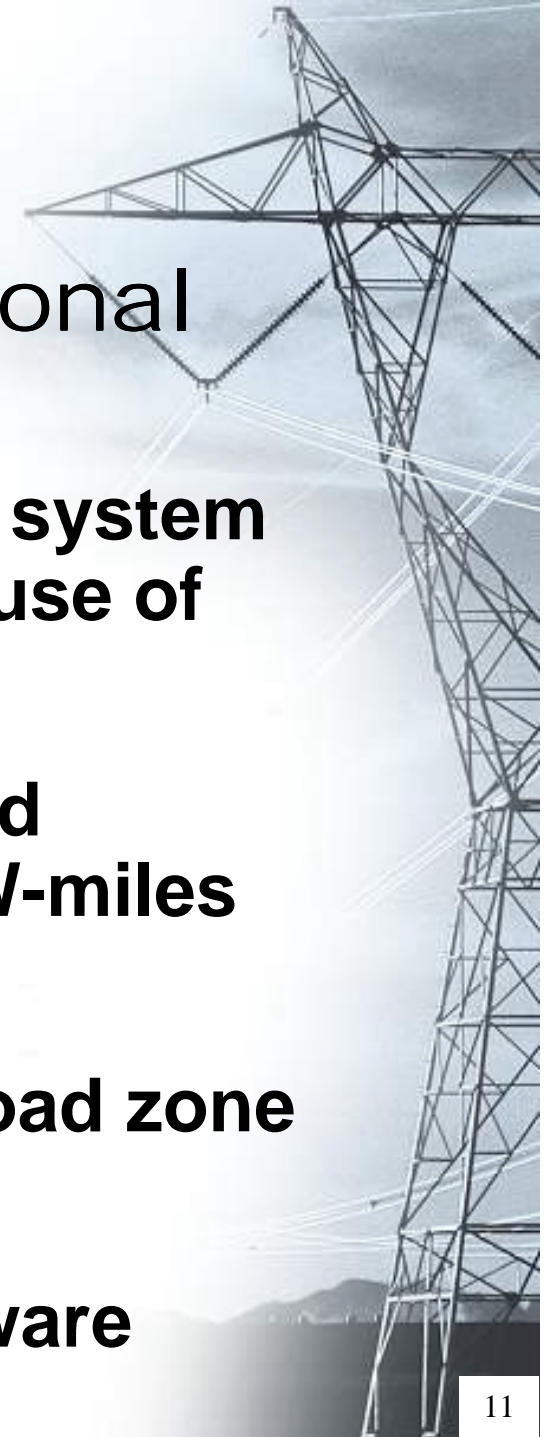
Zone	PTDF
CSWS	-0.01840
OKGE	-0.00990
EDE	-0.00935
CLEC	-0.00115
MPS	-0.00114
KCPL	-0.00070
SECI	-0.00052
KACY	-0.00001
SPS	0.00007
WFEC	0.00017
SPRM	0.00037
WR	0.00083
SPA	0.00131
WPEK	0.00311
GRDA	0.01173





## Explanation of MW-mile regional

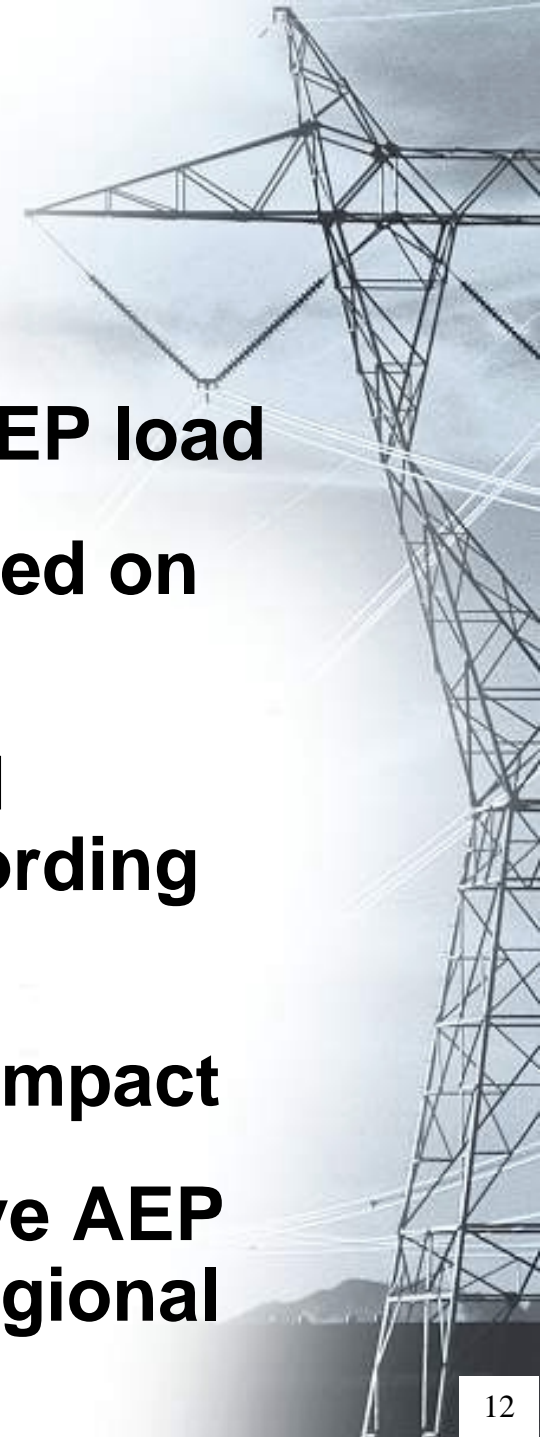
- ❖ **Assess the current use of the system regarding zonal and regional use of facilities to serve zonal load**
- ❖ **Each zone's generation to load impacts are determined in MW-miles and considered local impacts**
- ❖ **MW-mile impacts outside of load zone are considered regional**
- ❖ **Done using PowerWorld software**





## MW-mile Example

- ❖ **Transfer AEP gens to serve AEP load**
- ❖ **Power flows over all lines based on path of least resistance**
- ❖ **Measure the flow on lines and multiple it by the mileage recording impact by TO**
- ❖ **AEP zone usage vs. regional impact**
- ❖ **71% of AEP lines used to serve AEP load and 29% other TO's or regional**





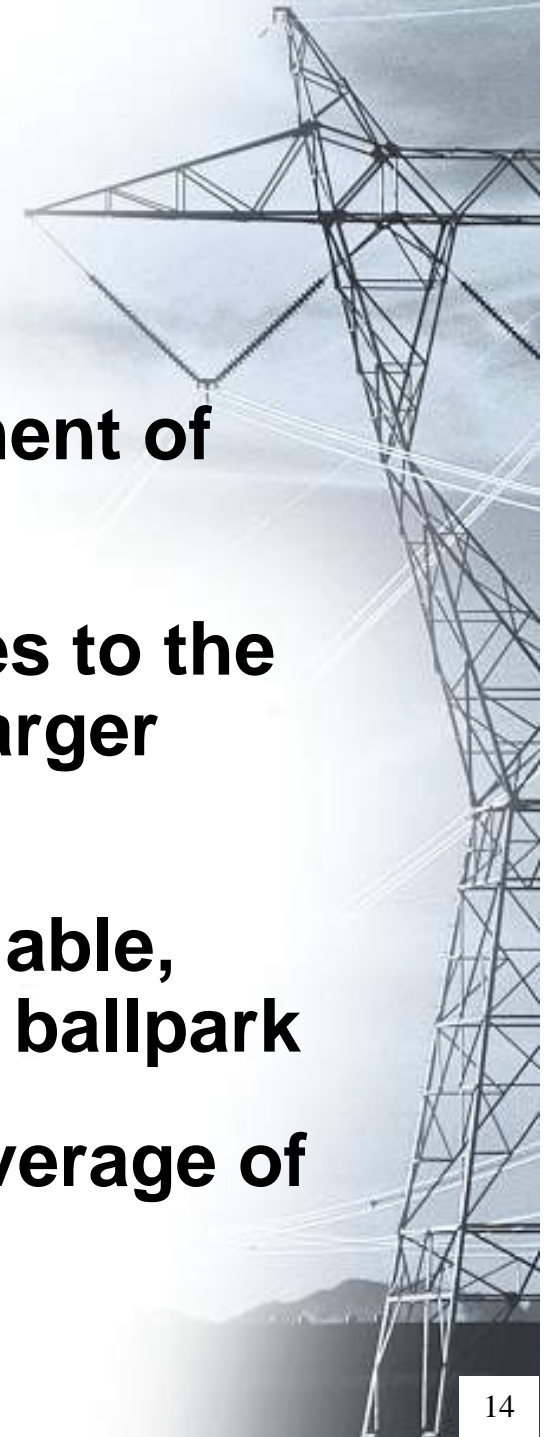
# Peak Load MW-mile results

Zone	Zonal MWM	Total MWM	Zonal %
CLECO	10,908	17,347	62.8
SWPA	5,389	15,091	35.7
AEP	109,298	153,725	71.0
GRDA	4,453	16,798	26.5
OKGE	68,093	98,210	69.3
WFEC	15,796	35,996	43.8
SPS	64,000	66,122	96.7
MIDW	4,177	19,747	21.1
SUNF	3,872	6,846	56.5
WESTAR	67,550	83,568	80.8
WEPL	6,313	13,533	46.6
MIPU	11,829	18,000	65.7
KACP	26,548	49,394	53.7
EMDE	7,699	16,198	47.5
SPRM	2,090	2,200	94.9
<b>SPP totals</b>	<b>408,022</b>	<b>612,783</b>	<b>66.6%</b>



## MW-mile discussion

- ❖ **Provides reasonable assessment of regional use of transmission**
- ❖ **Will have changes as upgrades to the system are made, higher kV larger regional impact**
- ❖ **Variations of method are available, results should be in the same ballpark**
- ❖ **For example; non-weighted average of zones is 58%**





## AEP Methodology review

- ❖ **SPP Staff attempted to perform AEP proposed analysis**
- ❖ **Analysis needs additional review with AEP to ensure detailed assumptions are correct and reflects their proposed methodology**





# Zonal Allocation

- ❖ **Studied different methods for allocating costs between multiple zones for zonal allocation**
  - ◆ **100% to constructing zone**
  - ◆ **Transmission Impact response**
  - ◆ **MW-mile allocation**







## Transmission Impacts to serve native load on new lines

- ❖ **Evaluated response factor on new lines to serve native loads**
- ❖ **Results provided very small response that could be used to allocate costs**
- ❖ **Would need to make assumptions on how factors would be used in allocation**





# Example: AEP

## Chamber Springs to Tontitown 345 kV

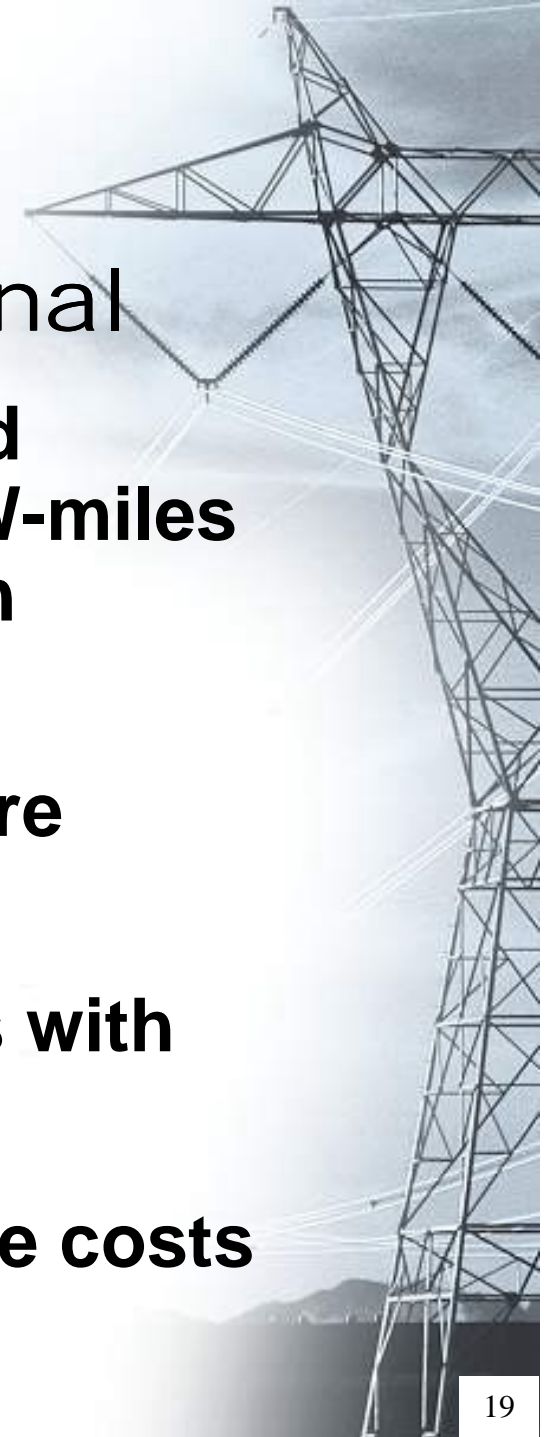
Zone	PTDF
CSWS	-0.01840
OKGE	-0.00990
EDE	-0.00935
CLEC	-0.00115
MPS	-0.00114
KCPL	-0.00070
SECI	-0.00052
KACY	-0.00001
SPS	0.00007
WFEC	0.00017
SPRM	0.00037
WR	0.00083
SPA	0.00131
WPEK	0.00311
GRDA	0.01173





## Explanation of MW-mile zonal

- ❖ **Each zones generation to load impacts are determined in MW-miles with and without transmission upgrades**
- ❖ **MW-mile impact differences are determined for each zone**
- ❖ **Adjustments to remove zones with increased MW-mile impacts**
- ❖ **Reduced MW-mile zones share costs**





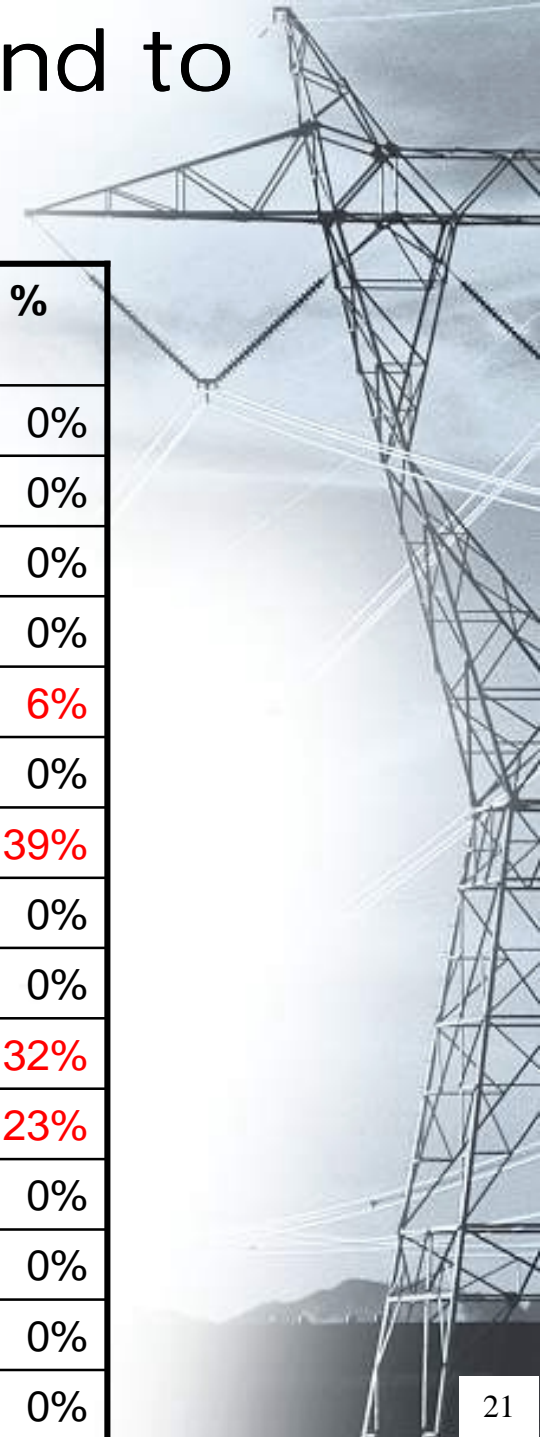
# NW Arkansas Upgrades both 345 kV and 161 kV

Zone	Base Case	With Lines	Diff	%	Adjusted %
CLECO	10,741	10,741	0.0	0%	0%
SWPA	5,389	5,388	1.1	0%	0%
<b>AEP</b>	109,299	109,053	245.3	47%	<b>54%</b>
<b>GRDA</b>	4,453	4,450	3.3	1%	<b>1%</b>
<b>OKGE</b>	68,094	67,931	162.7	31%	<b>36%</b>
WFEC	15,797	15,797	0.1	0%	0%
SPS	64,001	64,001	0.1	0%	0%
MIDW	4,177	4,177	0.1	0%	0%
SUNF	3,873	3,873	0.1	0%	0%
WESTAR	67,550	67,605	-54.5	-10%	0%
WEPL	6,313	6,313	0.1	0%	0%
MIPU	11,830	11,830	0.4	0%	0%
KACP	26,548	26,564	-16.0	-3%	0%
<b>EMDE</b>	7,700	7,656	43.2	8%	<b>9%</b>
SPRM	2,091	2,091	0.0	0%	0%



# Spearville to Mooreland to Potter 345 kV

Zone	Base Case	With Lines	Diff	Adjusted %
CLECO	10,741	10,741	-0.0	0%
SWPA	5,388	5,388	-0.3	0%
AEP	109,053	109,500	-446.9	0%
GRDA	4,450	4,450	0.0	0%
<b>OKGE</b>	67,931	67,914	16.5	<b>6%</b>
WFEC	15,797	15,798	-0.9	0%
<b>SPS</b>	64,001	63,899	101.4	<b>39%</b>
MIDW	4,177	4,177	0.0	0%
SUNF	3,873	3,900	-27.4	0%
<b>WESTAR</b>	67,605	67,520	84.6	<b>32%</b>
<b>WEPL</b>	6,313	6,253	60.2	<b>23%</b>
MIPU	11,830	11,830	0.0	0%
KACP	26,564	26,564	-0.2	0%
EMDE	7,656	7,656	0.0	0%
SPRM	2,091	2,091	0.0	0%





## MW-mile zonal allocation results

- ❖ **Benefiting zones can be determined and cost assigned based on new transmission line zonal impacts**
- ❖ **Zonal portion of two NW Arkansas upgrades would be AEP 54%, OGE 36%, EDE 9% and GRDA 1%**
- ❖ **Zonal portion of two lines in Kansas and the Panhandle would be SPS 39%, Westar 32%, WEPL 23%, OGE 6%**





## Economic Assessment of NW Arkansas upgrades

- ❖ **Staff worked with Henwood model to evaluate economic impacts of upgrades**
- ❖ **Results showed a production cost savings to SPP of \$230,000 for 2005 Summer**
- ❖ **Weighted nodal prices savings shown but need more assessment!**





# NW Arkansas Upgrades both 345 kV and 161 kV

Zone	Nodal price savings
CLECO	\$210,000
SWPA	\$150,000
AEP	\$2,285,000
GRDA	\$318,000
OKGE	\$746,000
WFEC	\$155,000
SPS	\$790,000
MIDW	\$88,000
SUNF	\$137,000
WESTAR	\$2,900,000
WEPL	\$221,000
MIPU	\$1,040,000
KACP	\$2,110,000
EMDE	\$467,000
SPRM	\$181,000





**Bruce Rew**  
**brew@spp.org**



*Lighting the past...powering the future!*

**<http://www.spp.org>**

**General Inquiries: 501-614-3200**

