

ERCOT Independent Review AEPTCC Western Region Project June 2, 2006

Project Submitted

In January 2006, American Electric Power Texas Central Company (AEPTCC) and Medina Electric Cooperative (MEC) submitted a project with two alternatives to increase the reliability of the transmission system in the Uvalde – Del Rio – Pearsall area (Western Region). This area includes transmission operators South Texas Electric Co-op (STEC) and City Public Service Energy (CPSE) in addition to AEPTCC and MEC.

Roughly two-thirds of each alternative submitted included the common elements shown below:

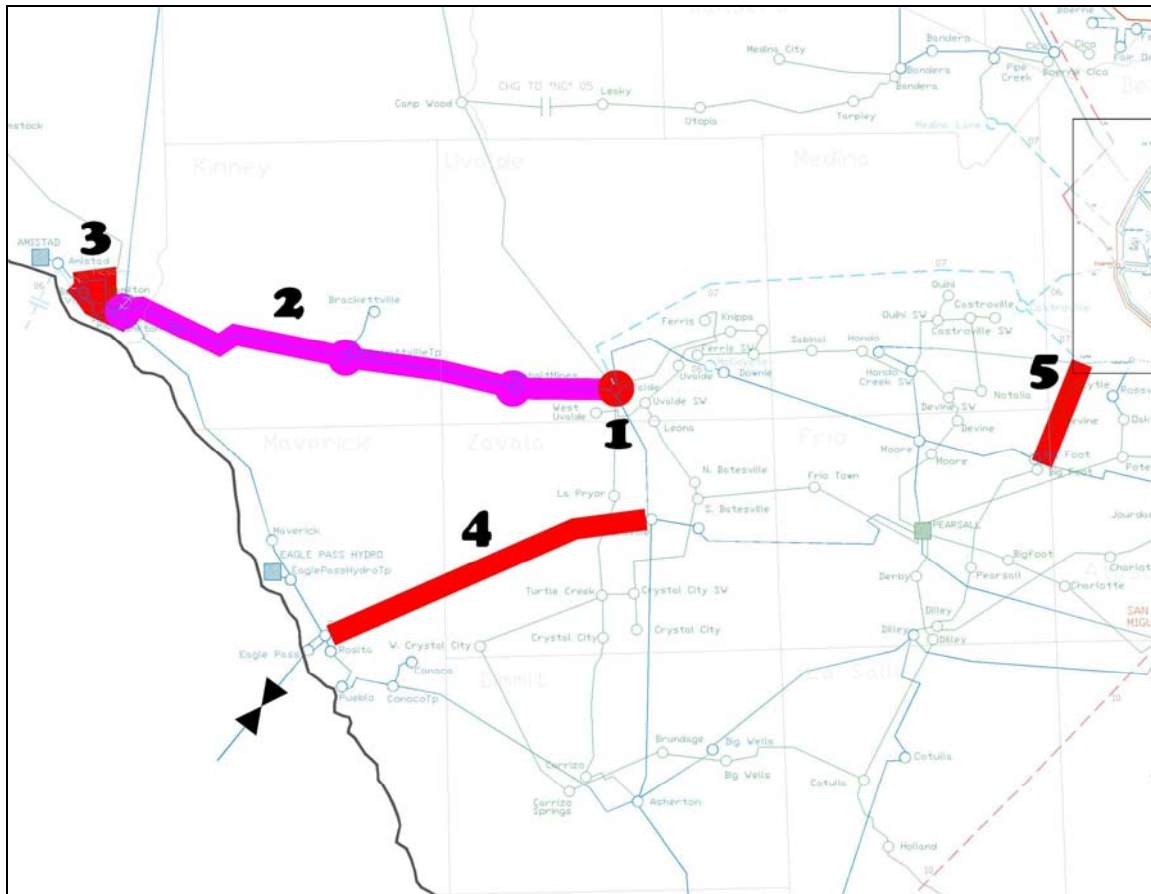


Figure 1: Elements Common to both Alternatives

Group	Description	MILES	Dollars
1	Uvalde Substation new 138 kV terminal		\$4,220,000
2	Hamilton Road to Uvalde 138 kV 138 kV rebuild	67.6	\$35,025,000
	Hamilton Road Substation upgrade		\$384,000
	Brackettville Substation upgrade		\$75,000
	Asphalt Substation upgrade		\$155,000
	Total Group 2		\$35,639,000
3	Del Rio 138 kV loop reconductor	17.1	\$5,402,000
	Picacho to CFE 138 kV line	8.4	\$3,503,000
	Total Group 3		\$8,905,000
4	Escondido to West Batesville 138 kV	50	\$32,000,000
	Escondido Substation new 138 kV terminal		\$1,000,000
	West Batesville Substation new 138 kV terminal		\$1,000,000
	West Batesville to Asherton 138 kV line upgrade		\$300,000
	Total Group 4		\$34,300,000
5	CPSE Lytle to AEPTCC Lytle 138 kV	4	\$2,100,000
	Lytle Substation 138/69 kV auto upgrade		\$2,506,000
	Big Foot to AEPTCC Lytle 69 kV rebuild	13.1	\$5,895,000
	Devine Substation upgrade		\$350,000
	Big Foot Substation upgrade		\$3,350,000
	CPSE Lytle Substation new 138 kV terminal		\$1,700,000
	Total Group 5		\$15,901,000
	Sum of Common Elements Cost		\$98,965,000

Table 1: Elements Common to Both Alternatives Submitted by AEPTCC

The projects listed in Table 1 have been arranged into Groups to signify that all elements within a group must be built to realize benefit to the transmission system.

Group 1 is a new 138 kV terminal at Uvalde which will be needed for either the Sonora (Alt 1) or Castroville (Alt 2) line.

Group 2 is the upgrade of the 138 kV path from Uvalde to Hamilton Rd. which has already been approved by ERCOT and will begin construction in the fall of 2006 to be in-service by June 2007.

Group 3 is work within the Del Rio area, upgrading the conductor and establishing a new emergency tie to CFE.

Group 4 is a proposed new line from Escondido (in-service Spring 2006) to West Batesville.

Group 5 is a proposed new 138 kV tie with CPSE from the CPSE Lytle to AEPTCC Lytle substations. This option makes necessary the 138/69 kV autotransformer and the upgrade of the 69 kV circuits and stations from Lytle – Devine - Big Foot.

The elements unique to Alternative 1 are:

Group	Description	MILES	Dollars
6	Sonora to Uvalde 138 kV	111.1	\$72,215,000
	Moore to Uvalde 138 kV	53.7	\$27,578,000
	Campwood 138 kV Substation and 138/69 kV Auto		\$3,000,000
	Fries Substation upgrade		\$100,000
	Rocksprings 138/69 kV Auto and Substation upgrade		\$3,350,000
	KCoop Rocksprings Substation		\$1,000,000
	Friess Substation		\$500,000
	Sonora Substation bus and new 138 kV terminal		\$1,000,000
7	MEC Pearsall to Derby to MEC Dilley 138/69 kV	22.7	\$12,485,000
	MEC Pearsall new 138 kV terminal		\$1,000,000
	Dilley Switching Station new 138 kV terminal		\$1,000,000
Sum for Alt 1 Unique Elements			\$123,228,000
Total Common and Alt 1 only			\$222,193,000

Table 2: Elements Unique to Alternative 1 in AEP Submittal

Group 6 is one proposed new source to Uvalde that includes conversion of the 69 to 138 kV path from Sonora to Uvalde and all associated substation upgrades and transformer additions.

Group 7 is one proposed alternative to relieving the 69 kV path from Pearsall to Dilley under contingency and creating a 138 kV path from Pearsall to Dilley.

The elements unique to Alternative 2 are:

Group	Description	MILES	Dollars
8	CPSE Castroville to Uvalde 138 kV Sec 1	47	\$30,550,000
	CPSE Castroville to Uvalde 138 kV Sec 2	23.1	\$15,015,000
	New CPSE Castroville Substation (Tie into existing CPSE line from Cagnon to Lytle)		\$4,000,000
	Knippa Substation upgrade		\$350,000
	Sabinal Substation		\$350,000
9	Dilley to Palo Duro 138 kV line	9	\$4,725,000
	Palo Duro 138 kV substation		\$4,000,000
	Dilley Switching Station new 138 kV terminal		\$1,000,000
Sum for Alt 2 Unique Elements			\$59,990,000
Total Common and Alt 2 only			\$158,955,000

Table 3: Elements Unique to Alternative 2 in AEP Submittal

Group 8 is another proposed new source to Uvalde that includes a line from CPSE Castroville to AEPTCC Uvalde 138 kV stations. This proposal also includes the upgrade of the 69 kV circuits from Sabinal to Uvalde as both circuits will share the same towers along this section.

Group 9 is another proposed method of relieving the Pearsall to Dilley 69 kV circuits under contingency and creating a 138 kV path from Pearsall to Dilley.

The two sets of projects unique to each alternative consist of one source into Uvalde and one 138 kV path from Pearsall to Dilley. Another method of grouping these projects could be:

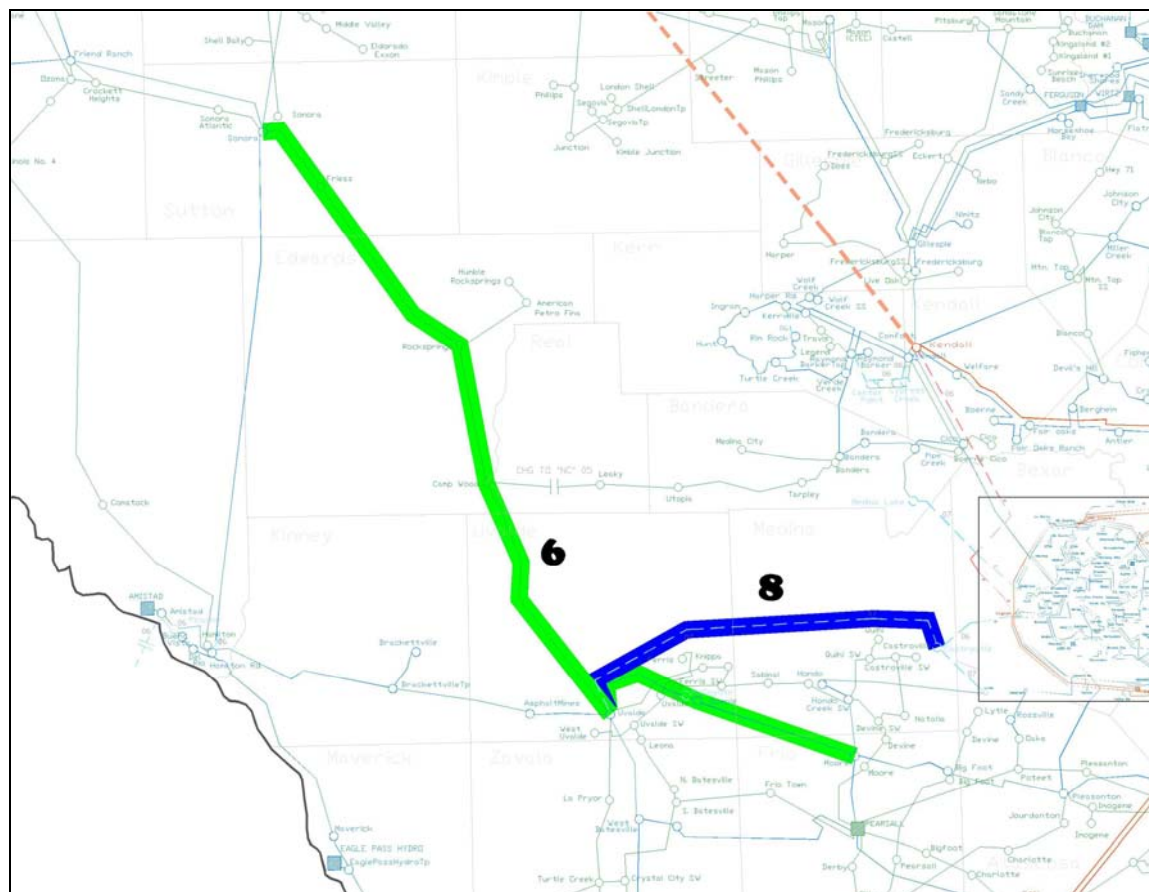


Figure 2: Alternatives for new source into Uvalde

Group	Description	MILES	Dollars
6	Sonora to Uvalde 138 kV	111.1	\$72,215,000
	Moore to Uvalde 138 kV	53.7	\$27,578,000
	Campwood 138 kV Substation and 138/69 kV Auto		\$3,000,000
	Fries Substation upgrade		\$100,000
	Rocksprings 138/69 kV Auto and Substation upgrade		\$3,350,000
	KCoop Rocksprings Substation		\$1,000,000
	Friess Substation		\$500,000
	Sonora Substation bus and new 138 kV terminal		\$1,000,000
	Total Group 6		\$108,743,000
8	CPSE Castroville to Uvalde 138 kV Sec 1	47	\$30,550,000
	CPSE Castroville to Uvalde 138 kV Sec 2	23.1	\$15,015,000

New CPSE Castroville Substation (Tie into existing CPSE line from Cagnon to Lytle)	\$4,000,000
Knippa Substation upgrade	\$350,000
Total Group 8	\$49,915,000

Table 4: Alternatives for new source into Uvalde

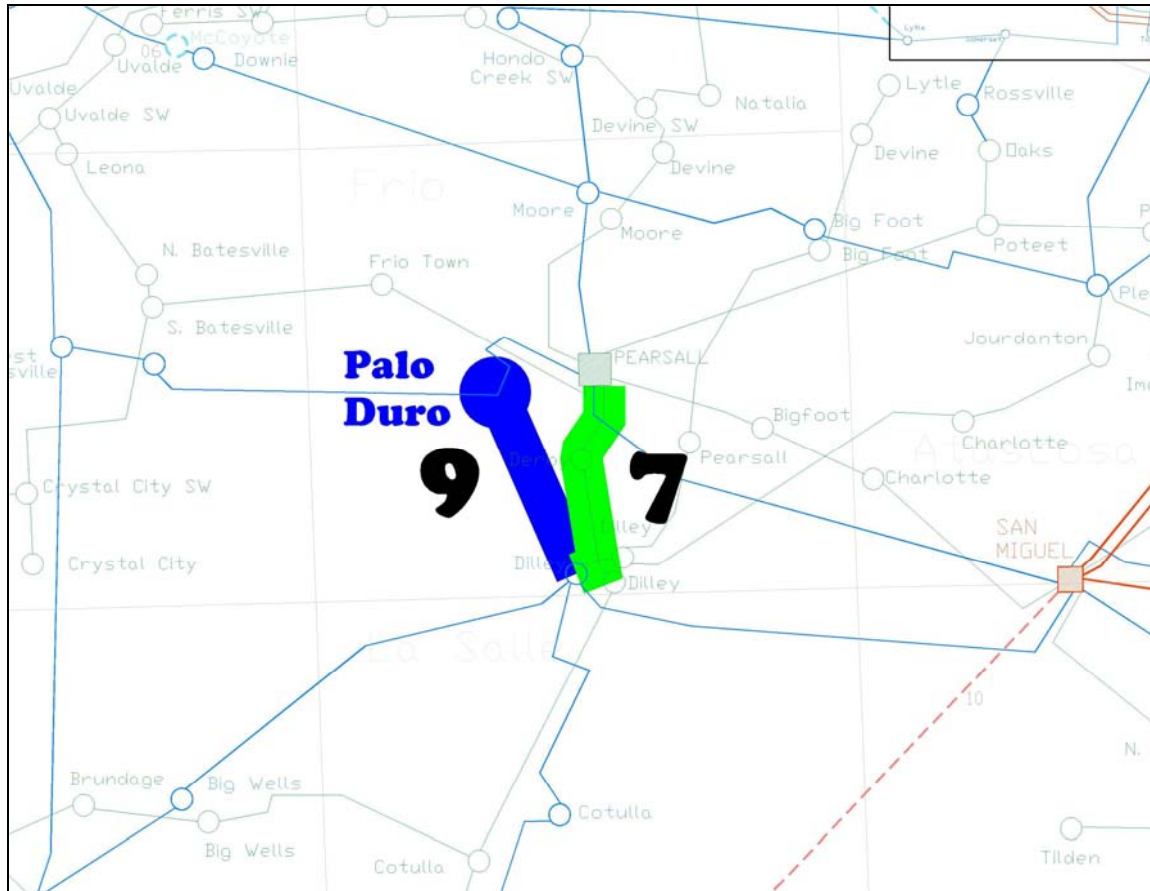


Figure 3: Alternatives for 138 kV path from Pearsall to Dilley

Group	Description	MILES	Dollars
7	MEC Pearsall to Derby to MEC Dilley 138/69 kV	22.7	\$12,485,000
	MEC Pearsall new 138 kV terminal		\$1,000,000
	Dilley Switching Station new 138 kV terminal		\$1,000,000
	Total Group 7		\$14,485,000
9	Dilley to Palo Duro 138 kV line	9	\$4,725,000
	Palo Duro 138 kV substation		\$4,000,000
	Dilley Switching Station new 138 kV terminal		\$1,000,000
	Total Group 9		\$9,725,000

Table 5: Alternatives for 138 kV path from Pearsall to Dilley

Looking at it in this manner it can be seen that the projects can be mixed and matched. A new source into Uvalde could be chosen between groups 6 and 8. Independent of that choice, a new 138 kV path from Pearsall to Dilley could be chosen between groups 7 and 9.

Steady State AC Analysis Using SSWG 2010 Base Case

Base Case Preparation

The 2010 Steady State Working Group (SSWG) base case, ss10sum1eco03012006.sav, was used for all analysis. Some of the proposed projects were already included in this base case and they were identified and removed prior to the start of the analysis. Other projects that were included in the base case but not yet approved by the Regional Planning Group (RPG) process outside the area of study were left in the case.

Hydro units at Amistad, Eagle Pass, and Falcon were turned off since they may not be able to provide generation whenever they are needed during peak periods due to water restrictions and international agreements. The Laredo units were turned off in the since they may be retired when they are no longer required for RMR. The San Miguel to Lobo 345 kV line in conjunction with the Laredo asynchronous tie to CFE are both in service in 2010 and satisfy the RMR exit conditions for all three Laredo units.

Base Case Contingency Analysis

The Base Case was subjected to various single line and single fault multiple element (Cat. B) contingencies in combination with loss of either the Eagle Pass DC tie (36 MVA) or the San Miguel (390 MW) unit. Most of the contingencies studied were in the immediate study area.

These contingencies were run with three different non-security constrained generation dispatches. Most if not all of the available generation, except the units listed above, is on-line in the area south of San Antonio to the Rio Grande Valley.

Reliability Must Run (RMR) generating units that were on-line in the base case due to lack of modeled generation to meet the 2010 load were turned off and future generation that may or may not be built was used to make up the difference. Units turned off included all units at Bates, La Palma, Lon Hill and Barney Davis.

With the removal of the RMR units, an assumption was made that generation would have to be imported into the Uvalde area from either the West ERCOT wind farms or the new generation in the north and northeast portions of the system. Generation from San Antonio would also be likely in either case. The three dispatches were:

D1	The original SSWG 2010 dispatch with the removal of the Laredo units and the Hydro units at Amistad, Eagle Pass, and Falcon. This dispatch includes RMR units at Bates, La Palma, Lon Hill and Barney Davis.
D2	High wind generation from McCamey and Abilene area and San Antonio to replace removed RMR units.
D3	High dispatch from San Antonio and units north of San Antonio to replace removed RMR units.

Initial contingency analysis of the base case showed the following overloads under several contingencies:

	Overloaded Element	Dispatch	
		W Pearsall	No Pearsall
1	69 kV circuits from Pearsall to Dilley ranging from 113% to 146% of rate B.	D1, D2,D3	D1,D2,D3
2	138 kV circuits in the Del Rio area ranging from 100% to 106% of rate B.	D1, D2,D3	D1,D2,D3
3	Hondo Creek 138/69 autotransformer from 100% to 163% of rate B.	D1, D2,D3	D1,D2,D3
4	Big Foot 138/69 kV autotransformer from 106% to 107% of rate B.	D2,D3	D1,D2,D3
5	Pearson 138/69 kV autotransformer from 100% to 146% of rate B.	D1, D2,D3	D1,D2,D3
6	Pleasanton to Jourdanton 69 kV circuit from 103% to 121% of rate B.	D1, D2,D3	D1,D2,D3
7	Pleasanton 138/69 kV autotransformer from 101% to 105% of rate B.	D2	D2,D3
8	San Miguel bus tie loading to 117%	D2,D3	D1,D3
9	San Miguel 345/138 kV autotransformer loading to 108%	D3	D2,D3

Table 6: Overloaded Element and Dispatch

Four contingencies involving the loss of the Eagle Pass DC tie and circuits from Asherton to Escondido or Miguel to Lobo resulted in no solution. This is a possible indication of voltage collapse.

Initial Solution to Base Case Violations

To solve the Pearsall to Dilley overloads, the Palo Duro to Dilly (Group 9) option was added to the base case. This option is less expensive the Pearsall to Dilly (Group 7) option which would also solve this problem. The initials PD were added to the name of the base case.

To eliminate the overloads in the Del Rio area, Group 3 was added to the base case. The initials DR were added to the name of the base case.

To relieve the Hondo Creek auto, Big Foot auto, Pearson auto, Pleasanton auto, and Pleasanton to Jourdanton 69 kV line overloads, the CPSE Lytle to AEPTCC Lytle (Group 5) set of projects was added to the base case. The initials LL_BL were added to the name of the base case.

For the four contingencies that resulted in no solution, the Escondido to West Batesville 138 kV line (Group 4) projects were added to the base case. The initials EWB were added to the name of the base case.

The resulting base case was named ss10sum1eco03012006_DR_PD_LL_BL_EWB.sav.

Second Round of Contingency Analysis

The projects added to the base case solved the problems they were added to address except the Lytle to Lytle projects did not eliminate all contingency overloads on the Pearson and Hondo Creek 138/69 kV autotransformers. Problems in the San Miguel area still remained and a new problem from Moore to Coyote 138 kV surfaced.

	Overloaded Element	Dispatch	
		W Pearsall	No Pearsall
1	San Miguel 345/138 kV autotransformer loading to 106%.	D3	D2,D3
2	San Miguel bus tie loading to 120%.	D1,D2,D3	D1,D2,D3
3	Moore – Downie – Coyote 138 kV circuits loading to 106%.	D1,D2,D3	D1,D2,D3
4	Pearson 138/69 kV autotransformer loading to 133%	D2,D3	D1,D2,D3
5	Hondo Creek 138/69 kV autotransformer loading to 151%	D1,D2,D3	D1,D2,D3

Table 7: Overloaded Element and Dispatch

The cause of the overloads on the Moore to Coyote circuits was the flow of power from San Miguel to Uvalde. To solve these problems a new source of power into Uvalde was added to the new base case.

The Castroville to Uvalde (Group 8) projects were added to the base case next since it is a great deal less expensive than the other alternative, Group 6. The initials CU were added to the name of the base case with the new name being ss10sum1eco03012006_DR_PD_LL_BL_EWB_CU.sav.

Results of Second Round of Contingency Analysis

	Overloaded Element	Dispatch	
		W Pearsall	No Pearsall
1	Downie 138/69 kV autotransformer loading to 102%.	D1	D1,D2,D3
2	San Miguel bus tie loading to 108%.	D3	D2,D3
3	Pearson 138/69 kV autotransformer loading to 105%	None	D2,D3

Table 8: Overloaded Element and Dispatch

Adding the Castroville to Uvalde circuit eliminated all but the three overloads in the area listed in Table 8. With Pearsall generation on-line the loadings on the Downie auto and San Miguel bus tie were 100% and 102% respectively and the Pearson auto did not overload.

If new projects are not proposed to deal with these problems then Special Protection Schemes (SPS) or Remedial Action Plans (RAP) will need to be developed.

Summary of Steady State AC Analysis

Almost all elements of the proposed Alternative 2 by AEPTCC and MEC were needed to obtain a reliable transmission system with the absence of RMR and possibly unavailable hydro units with most problems occurring in all three dispatches studied. The one part of Alternative 2 that

was not used in this study was the West Batesville to Asherton 138 kV line upgrade. This was not used for two reasons; one, its need was not seen during contingency analysis; two, AEPTCC may determine that they can not increase the rating of this line. If AEPTCC determines that they can increase the rating of this line, then its low \$300K price tag would make it worthwhile.

Economic Analysis

The case with the Castroville to Uvalde circuits (Group 8) was compared to the case with the Sonora to Uvalde circuits (Group 6) to see if the Group 6 projects resulted in a production cost savings to make up for the increased capital cost. Group 1, 2,3,4,5 and 9 projects were in both cases.

This analysis showed that the Castroville to Uvalde (Group 8) circuits resulted in lower production cost with or without San Miguel available. Generator revenues' followed the same trend. The analysis shown in the table below is for a complete calendar year and includes San Miguel and Pearsall.

Economic Comparison

Scenario	Total Cost(M\$)
Sonora to Uvalde	12,383.89
Castroville to Uvalde	12,378.65
Difference	5.24

Alternative 1 Notes

AEPTCC/MEC's Alternative 1 was studied in the Steady State analysis. The much higher cost and sheer length of the transmission segment to be converted from 69 kV to 138 kV keeps it from being a viable option. It did solve many problems in the Sonora to Uvalde and Campwood to Bandera areas that Medina Electric Cooperative (MEC), Pedernales Electric Cooperative (PEC) and Bandera Electric Cooperative (BEC) were concerned about in their comments on this project. However it did introduce new problems north and west of Sonora.

AEPTCC will be leading an effort with the three Co-ops and the Lower Colorado River Authority (LCRA) to come up with a solution to these concerns.

Study Summary

ERCOT's Independent Review determines that the following sets of projects proposed by AEPTCC/MEC are necessary to ensure the reliability of this part of the transmission system. All of these projects should be in service by summer peak 2010. In addition to the projects listed below, solutions should be determined for the Pearson and Downie autotransformers and the San Miguel bus tie overloads discussed above.

Designated Providers of Transmission Facilities

In accordance with ERCOT's Power System Planning Charter and Processes, the following transmission providers are designated the default transmission providers. These providers can

agree to provide or delegate the new facilities or inform ERCOT they do not elect to provide them. In the cases where two providers are designated, they should decide and agree between themselves on what they will provide or ERCOT will determine responsibilities.

Group	Description	MILES	Owner/Builder
1	Uvalde Substation new 138 kV terminal		AEPTCC
2	Hamilton Road to Uvalde 138 kV 138 kV rebuild	67.6	AEPTCC
	Hamilton Road Substation upgrade		AEPTCC
	Brackettville Substation upgrade		AEPTCC
	Asphalt Substation upgrade		AEPTCC
3	Del Rio 138 kV loop reconductor	17.1	AEPTCC
	Picacho to CFE 138 kV line	8.4	AEPTCC
4	Escondido to West Batesville 138 kV	50	AEPTCC
	Escondido Substation new 138 kV terminal		AEPTCC
	West Batesville Substation new 138 kV terminal		AEPTCC
	West Batesville to Asherton 138 kV line upgrade		AEPTCC
5	CPSE Lytle to AEPTCC Lytle 138 kV	4	AEPTCC/CPSE
	Lytle Substation 138/69 kV auto upgrade		AEPTCC
	Big Foot to AEPTCC Lytle 69 kV rebuild	13.1	AEPTCC
	Devine Substation upgrade		AEPTCC
	Big Foot Substation upgrade		AEPTCC
	CPSE Lytle Substation new 138 kV terminal		CPSE
8	CPSE Castroville to Uvalde 138 kV Sec 1	47	AEPTCC/CPSE
	CPSE Castroville to Uvalde 138 kV Sec 2	23.1	AEPTCC
	New CPSE Castroville Substation (Tie into existing CPSE line from Cagnon to Lytle)		CPSE
	Knippa Substation upgrade		AEPTCC
	Sabinal Substation		AEPTCC
9	Dilley to Palo Duro 138 kV line	9	AEPTCC/MEC
	Palo Duro 138 kV substation		MEC
	Dilley Switching Station new 138 kV terminal		AEPTCC

Table 9: List of Recommended Projects