

# CLRTP Master Transmission Infrastructure

The preliminary transmission solutions developed for regional issues are not meant to imply any specific plans or commitments by participating entities, but are meant to gain an understanding of the relative magnitude in terms of quantity and cost of the localized load-serving solutions that might ultimately be implemented, should the forecast load growth occur.

Entity	Element	Blk/Reg	S1	S2	S3	r	x	b	MVA Rating	length (mi)	Budget Item	Proxy Estimate	ISD	Facility Unit Cost (\$)	Notes	S1 Costs	S2 Costs	S3 Costs
psco	Comanche - Boone 345kV (2) Double Towers OCS	Bulk				0.00150	0.01275	0.25031	1200	26.65	no	yes	2009	\$29,300,000	Comanche SIS Study, Estimated 3/04	\$0	\$0	\$0
psco	Comanche-Boone-Corner Point 345kV (1) Double Tower OCS	Bulk	x		x	0.00797	0.08579	1.63903	1200	180.65	no	yes	2014	\$102,900,000	PSCO Engineering Estimate 4/04	\$102,900,000	\$0	\$102,900,000
psco	Boone - Corner 345kV (2) Double Towers OCS	Bulk				0.00647	0.07304	1.38872	1200	154.00	no	yes	2009	\$166,300,000	Comanche SIS Study, Estimated 3/04	\$0	\$0	\$0
psco	Corner Point - Smoky Hill 230 kV Rebuild	Bulk	x	x	x	0.00641	0.04465	0.14986	800	40.00	no	yes	2014	\$25,526,000	Comanche SIS Study, Estimated 3/04	\$25,526,000	\$25,526,000	\$25,526,000
psco	Corner Point - Daniels Park 230kV line #2 (Sectnlz. @ Smoky Hill)	Bulk	x			0.00578	0.06627	0.27373	800	64.00	no	yes	2014	\$18,000,000	PSCO Engineering Estimate 4/04	\$18,000,000	\$0	\$0
psco	Corner Point - Smoky Hill 345kV Double ckt	Bulk		x	x	0.00161	0.01841	0.34267	1200	40.00	no	yes	2009	\$30,559,000	Comanche SIS Study, Estimated 3/04	\$0	\$30,559,000	\$30,559,000
psco	Smoky Hill - Daniels Park 345kV Double ckt (includes line Terminations)	Bulk		x	x	0.00964	0.01105	0.20560	1200	24.00	no	yes	2009	\$21,271,000	Comanche SIS Study, Estimated 3/04	\$0	\$21,271,000	\$21,271,000
psco	Pawnee - Corner Pt 345kV Double ckt	Bulk		x	x	0.00228	0.02655	0.48254	1200	54.58	no	yes	2014	\$24,720,000	Pawnee Feas. Study Estimate(Jul 03')	\$0	\$24,720,000	\$24,720,000
psco	Blue Spruce - Smoky Hill 345kV	Bulk			x	0.00105	0.01610	0.04530	1200	11.00	no	yes	2014	\$5,778,432	345kV pu/mile x 1	\$0	\$0	\$5,778,432
psco	(1) 345-230kV auto at Spruce	Bulk			x	0.00010	0.01240	0.00000	560	0.00	no	no	2014	\$5,253,125	600 MVA pu/cost x 1 (115% rating)	\$0	\$0	\$5,253,125
psco	Comanche-Daniels Park 345kV project	Bulk	x		x	n/a	n/a	n/a	n/a	125.00	no	yes	2008	\$134,209,000	Comanche #3 Trans. Study 4/04 (04' Dollars)	\$134,209,000	\$0	\$134,209,000
psco	Comanche Substations (includes 2 Autos & Line Terminations)	Bulk				0.00010	0.01500	0.00000	560	0.00	no	yes	2014	\$19,034,000	Comanche SIS Study, Estimated 3/04	\$0	\$0	\$0
psco	Boone Substations (includes 2 Autos & Line Terminations)	Bulk	x		x	0.00010	0.01500	0.00000	560	0.00	no	yes	2014	\$21,096,000	Comanche SIS Study, Estimated 3/04	\$21,096,000	\$0	\$21,096,000
psco	Corner Point Substations (includes 2 Autos & Line Terminations)	Bulk	x	x	x	0.00010	0.01500	0.00000	560	0.00	no	yes	2009	\$22,501,000	Comanche SIS Study, Estimated 3/04	\$22,501,000	\$22,501,000	\$22,501,000
psco	Daniels Park Substation (includes 3 Autos & Line Terminations)	Bulk		x		0.00010	0.01500	0.00000	560	0.00	no	yes	2009	\$20,927,000	Pawnee Feas. Study Estimate(Jul 03')	\$0	\$20,927,000	\$0
psco	Pawnee Substation (includes 2 Autos & Line Terminations)	Bulk		x	x	0.00010	0.01500	0.00000	560	0.00	no	yes	2014	\$11,500,000	Pawnee Feas. Study Estimate(Jul 03')	\$0	\$11,500,000	\$11,500,000
psco	Pawnee - Ft.Lupton double-ckt 230kV	Bulk		x	x	0.00597	0.06320	0.27954	834	63.90	no	yes	2014	\$42,850,000	Pawnee Feas. Study Estimate(mar 04')	\$0	\$42,850,000	\$42,850,000
psco	Lamar HVDC Expansion (230 MW)	Bulk	x			n/a	n/a	n/a	230	0.00	no	yes	2014	\$35,050,000	OASIS Request # 80074 SIS Estimate (Oct. '0)	\$35,050,000	\$0	\$0
psco	Lamar - Boone 345kV Double ckt Operated @ 230kV	Bulk	x			0.00911	0.11066	0.37675	800	98.60	no	yes	2014	\$54,230,000	Double Ckt H, 2-230kV, \$550k/mi	\$54,230,000	\$0	\$0
psco	Greenwood - Englewood 115-230kV Line Upgragde (new)	Bulk	x	x	x	0.00078	0.00771	0.01732	495	5.55	no	yes	2014	\$1,749,288	230kV pu/mile x 1	\$1,749,288	\$1,749,288	\$1,749,288
psco	Englewood - Arapahoe 115-230kV Line Upgrade (new)	Bulk	x	x	x	0.00070	0.00585	0.01143	435	3.50	no	yes	2014	\$1,103,155	230kV pu/mile x 1	\$1,103,155	\$1,103,155	\$1,103,155
psco	2nd Boone 230-115kV auto	Bulk	x			0.00128	0.05392	0.00000	150	0.00	no	yes	2014	\$1,210,320	150 MVA pu/cost x 1	\$1,210,320	\$0	\$0
psco	3rd Comanche 230-115kV auto	Bulk	x		x	0.00060	0.03000	0.00000	280	0.00	no	no	2014	\$2,500,000	Cost of Chambers #1 auto	\$2,500,000	\$0	\$2,500,000
psco	2nd Lamar 230-115kV auto	Bulk	x		x	0.00000	0.00890	0.00000	100	0.00	no	yes	2014	\$1,210,320	150 MVA pu/cost x 1	\$1,210,320	\$0	\$1,210,320
psco	2nd Chambers 230-115kV auto	Bulk	x	x	x	0.00060	0.03000	0.00000	285	0.00	no	no	2008	\$2,500,000	Cost of Chambers #1 auto	\$2,500,000	\$2,500,000	\$2,500,000
psco	3rd Chambers 230-115kV auto	Bulk		x		0.00060	0.03000	0.00000	285	0.00	no	no	2014	\$2,500,000	From Western, Cost of Chambers #1 auto	\$0	\$2,500,000	\$0
psco	2nd Comanche - Reader 115kV line	Bulk	x		x	0.00016	0.00150	0.00016	398	0.21	no	yes	2014	\$100,800	PSCO Cost of bund-954 dc230kV tower	\$100,800	\$0	\$100,800
psco	Bancroft - Gray St. 115kV line Upgrade	Regional		x		0.00192	0.01907	0.04281	247	3.43	no	yes	2014	\$343,000	From Western Study	\$0	\$343,000	\$0
psco	Fitzsimmons - East 115kV line Upgrade	Regional		x		0.00049	0.00495	0.01110	247	0.89	no	yes	2014	\$89,000	From Western Study	\$0	\$89,000	\$0
psco	Palmer - Monument 115kV Upgrade	Regional	x		x	0.00583	0.03381	0.00549	177	6.58	no	yes	2014	\$658,000	r4 addition-Upgrade from 495 to 795ACSR	\$658,000	\$0	\$658,000
psco	Brush CPP - B. Creek PSCO 115kV line Uprate ckts 1&2 (Rate Change)	Regional	x	x	x	n/a	n/a	n/a	200	3.00	no	yes	2014	\$360,000	Rating Change Uprate \$60K/Mile	\$360,000	\$360,000	\$360,000
psco	California - North 115kV ck 2	Regional	x	x	x	0.00140	0.00480	0.08642	150	2.69	no	yes	2014	\$538,000	New 477ACSR Construction	\$538,000	\$538,000	\$538,000
psco	Shifted all of Leetsdale 115kV load to 230kV bus	Regional	x	x	x	n/a	n/a	n/a	n/a	0.00	n/a	n/a	2014	\$5,000,000	PSCO Proxy	\$5,000,000	\$5,000,000	\$5,000,000
psco	Cherokee - Federal Heights 115kV line upgrade ckts 1&2	Regional	x	x	x	0.00285	0.02466	0.00427	247	4.95	no	yes	2014	\$990,000	Upgrade from 477ACSR to 795ACSR	\$990,000	\$990,000	\$990,000
psco	Federal Heights - Broomfield 115kV line upgrade ckts 1&2	Regional	x	x	x	0.00278	0.02412	0.00418	247	4.84	no	yes	2014	\$698,000	Upgrade from 477ACSR to 795ACSR	\$698,000	\$698,000	\$698,000
psco	Quaker - Quaker Tap 115kV line Uprate (Rate Change)	Regional		x		n/a	n/a	n/a	100	3.57	no	yes	2014	\$214,200	Rating Change Uprate \$60K/Mile	\$0	\$214,200	\$0
psco	Soda Lakes - Allison 115kV Upgrade	Regional	x	x	x	0.00258	0.02558	0.01436	247	4.60	no	yes	2014	\$460,000	Upgrade from 477ACSR to 795ACSR	\$460,000	\$460,000	\$460,000
psco	Allison - Kendrick 115kV Upgrade	Regional	x	x	x	0.00335	0.03325	0.01866	247	5.98	no	yes	2014	\$598,000	Upgrade from 477ACSR to 795ACSR	\$598,000	\$598,000	\$598,000
psco	Kendrick - Bancroft 115kV Upgrade	Regional	x	x	x	0.00207	0.02057	0.01154	247	3.70	no	yes	2014	\$370,000	Upgrade from 477ACSR to 795ACSR	\$370,000	\$370,000	\$370,000
psco	ArapahoeA - Sheridan 115kV ckt 2	Regional	x	x	x	0.00710	0.05580	0.00096	159	1.12	no	yes	2014	\$224,000	New 477ACSR Construction	\$224,000	\$224,000	\$224,000
psco	Shift all Englewood 115kV loads to 230kV bus	Regional	x	x	x	n/a	n/a	n/a	n/a	0.00	n/a	n/a	2014	\$5,000,000	PSCO Proxy	\$5,000,000	\$5,000,000	\$5,000,000
psco	Shift all University 115kV load to 230kV bus	Regional	x	x	x	n/a	n/a	n/a	n/a	0.00	n/a	n/a	2014	\$5,000,000	PSCO Proxy	\$5,000,000	\$5,000,000	\$5,000,000
														<b>\$837,347,530</b>	<b>PSCO Total</b>	<b>\$443,781,883</b>	<b>\$227,590,643</b>	<b>\$477,223,120</b>
																<b>S1 Costs</b>	<b>S2 Costs</b>	<b>S3 Costs</b>
prpa	St. Vrain - Fordham 230kV line	Bulk	x	x	x	0.00460	0.03478	0.06980	378	23.75	yes	n/a	2007			\$60,000,000	\$60,000,000	\$60,000,000
prpa	Rawhide - Laporte 230kV line #2	Bulk	x	x	x	0.00380	0.02980	0.05900	378	20.20	yes	n/a	2006			\$0	\$0	\$0
prpa	Laporte Tap - Overland 115kV line Upgrade to 230kV	Bulk	x	x	x	0.00165	0.01252	0.00169	236	2.20	yes	n/a	2006			\$0	\$0	\$0
prpa	Overland - Dixon 115kV line Upgrade to 230kV	Bulk	x	x	x	0.00152	0.01149	0.00156	236	2.00	yes	n/a	2006			\$0	\$0	\$0
prpa	Laporte - Laporte Tap 115kV line Upgrade to 230kV	Bulk	x	x	x	n/a	n/a	n/a	230	5.60	yes	n/a	2006			\$0	\$0	\$0
prpa	2nd Laporte 230-115kV auto	Bulk	x	x	x	0.00110	0.05810	0.00000	168	0.00	yes	n/a	2006			\$0	\$0	\$0
prpa	2nd Timberline 230-115kV auto	Bulk	x	x	x	0.00434	0.08393	0.00000	168	0.00	yes	n/a	2008			\$0	\$0	\$0
prpa	2nd Boyd 230-115kV auto	Bulk	x	x	x	0.00110	0.05870	0.00000	168	0.00	yes	n/a	2009			\$0	\$0	\$0
prpa	3rd Longs Peak 230-115kV auto	Bulk	x	x	x	0.00150	0.04700	0.00000	168	0.00	yes	n/a	2010			\$0	\$0	\$0
prpa	(2) 230-115kV autos at Fordham	Bulk	x	x	x	0.00110	0.05870	0.00000	168	0.00	yes	n/a	2007			\$0	\$0	\$0
prpa	Richard - Linden 115kV line	Regional	x	x	x	0.00298	0.02177	0.00305	189	4.80	yes	n/a	2004			\$0	\$0	\$0
prpa	Poudre - Richard Tap 115kV line	Regional	x	x	x	0.00154	0.01127	0.00154	120	1.90	yes	n/a	2004			\$0	\$0	\$0
prpa	Richard - Richard Tap 115kV line	Regional	x	x	x	0.00085	0.00615	0.00103	236	1.10	yes	n/a	2004			\$0	\$0	\$0
prpa	Timnath - Richard Tap 115kV line	Regional	x	x	x	0.00201	0.00575	0.00075	85.1	1.00	yes	n/a	2004			\$0	\$0	\$0
prpa	Laporte - Timberline 230kV line (Rate Change)	Regional	x	x	x	0.00215	0.01661	0.03300	440	11.30	yes	n/a	2005			\$0	\$0	\$0
prpa	West - West Tap 115kV line (Rate Change)	Regional	x	x	x	n/a	n/a	n/a	170	2.50	yes	n/a	2005			\$0	\$0	\$0
prpa	Timberline - Harmony 230kV line (Rate Change)	Regional	x	x	x	n/a	n/a	n/a	620	2.80	yes	n/a	2008			\$0	\$0	\$0
prpa	Dixon - Drake 115kV line (Rate Change)	Regional	x	x	x	n/a												



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Agency	Project Description	Category	S1	S2	S3	Cost	Length (mi)	Year	Cost	Year	Cost	S1 Costs	S2 Costs	S3 Costs		
wapa	Weld - Whitney 115kV line upgrade (re-cond)	Regional	x	x	x	0.00250	0.01550	0.00220	210	5.60	yes	no	2005	\$1,400,000	\$1,400,000	\$1,400,000
wapa	WeldLM - Whitney 115kV Upgrade/Z-change	Regional	x	x	x	0.00250	0.01550	0.00220	166	5.60	yes	no	2005	\$560,000	\$560,000	\$560,000
wapa	Whitney - Bracewell 115kV Double ckt Upgrade	Regional	x	x	x	0.00209	0.00747	0.00164	120	2.10	yes	no	2005	\$210,000	\$210,000	\$210,000
											<b>\$84,757,280</b>	<b>Western Total</b>	<b>\$65,984,320</b>	<b>\$103,334,280</b>	<b>\$102,123,960</b>	
													<b>S1 Costs</b>	<b>S2 Costs</b>	<b>S3 Costs</b>	
aquila	<b>(New) Airport Tap 230kV sub, tap Comanche - Midway 230kV</b>	<b>Bulk</b>	x			Tap @ 30% from Comanche 230kV	n/a	0.00	no	yes	2014	\$3,200,000	\$3,200,000	\$0	\$3,200,000	
aquila	<b>Airport Tap 230-115kV auto</b>	<b>Bulk</b>	x	x	x	0.00000	0.08900	0.00000	100	0.00	no	yes	2014	\$6,000,000	\$6,000,000	\$6,000,000
aquila	Pueblo - Hyde Park 115kV line Upgrade	Regional	x			0.00088	0.00711	0.00372	224	2.48	no	yes	2014	\$620,000	\$620,000	\$620,000
aquila	Hyde Park - W. Station 115kV line Upgrade	Regional	x			0.00073	0.00588	0.00308	224	2.05	no	yes	2014	\$512,500	\$512,500	\$512,500
aquila	Reader - W. Station 115kV line Upgrade	Regional	x			0.00535	0.04318	0.02259	224	15.06	no	yes	2014	\$3,765,000	\$3,765,000	\$3,765,000
aquila	Pueblo - Reader 115kV line Upgrade	Regional	x			0.00182	0.01471	0.00770	224	5.13	no	yes	2014	\$1,282,500	\$1,282,500	\$1,282,500
aquila	CanyonW-Arequa Gulch 115kV Line (new)	Regional	x	x	x	0.05480	0.15340	0.01720	107	5.00	yes	yes	2008	\$4,200,000	\$4,200,000	\$4,200,000
aquila	New LS Animas 69-4kV auto (Upgrade)	Regional	x	x	x	0.08000	0.80000	0.00000	5	0.00	no	yes	2014	\$1,500,000	\$1,500,000	\$1,500,000
aquila	Stonemoore -W. Station 115kV line (Rate Change)	Regional	x	x	x	n/a	n/a	n/a	61.5	0.00	no	yes	2014	\$50,000	\$50,000	\$50,000
aquila	Manzanola 115-69kV auto (upgrade to > 25 MVA)	Regional	x	x	x	0.00000	0.11600	0.00000	25	0.00	no	yes	2014	\$4,000,000	\$4,000,000	\$4,000,000
aquila	3rd Reader 115-69kV auto	Regional	x	x	x	0.00000	0.16760	0.00000	47	0.00	no	yes	2014	\$2,000,000	\$2,000,000	\$2,000,000
aquila	3rd West Station 115-69kV auto	Regional		x		0.00268	0.16560	0.00000	42	0.00	no	yes	2014	\$2,000,000	\$2,000,000	\$2,000,000
aquila	(New) Burnt Mill 115kV sub, tap W.Station - Reader 115kV	Regional	x	x	x	Tap @ 50% from W. Station 115kV	n/a	0.00	yes	yes	2007	\$4,500,000	\$4,500,000	\$4,500,000		
aquila	Reader - Airport Memorial New 115kV line	Regional		x		0.00811	0.04429	0.01241	159.3	8.00	no	yes	2014	\$2,800,000	\$2,800,000	\$2,800,000
aquila	(New) St. Charles 115kV sub Tap of Airport-Reader 115kV	Regional	x	x	x	Tap @ 30% from Airport Mem. 115kV	n/a	0.00	no	yes	2014	\$4,500,000	\$4,500,000	\$4,500,000		
aquila	Airport-St. Charles 115kV double circuit	Regional	x			0.00406	0.02215	0.00621	159.3	2.67	no	yes	2014	\$1,735,500	\$1,735,500	\$1,735,500
											<b>\$42,665,500</b>	<b>Aquila Total</b>	<b>\$37,865,500</b>	<b>\$25,550,000</b>	<b>\$37,865,500</b>	
											<b>\$1,295,753,300</b>		<b>S1 Costs</b>	<b>S2 Costs</b>	<b>S3 Costs</b>	

**Scenario 1 Total Infrastructure Costs (Millions) -----> \$786,902,503**

**Scenario 2 Total Infrastructure Costs (Millions) -----> \$515,134,723**

**Scenario 3 Total Infrastructure Costs (Millions) -----> \$856,483,380**

**Notes**

**Items Highlighted in Yellow are indicative of Primary Bulk Transmission**

**Bold** Indicative of **Other Bulk Transmission** infrastructure for the 10-year plan.

Proxy costs are derived from a TSG&T cost estimation guide based on the Colorado Generation Project, unless otherwise noted. All costs are in 2004 dollars.

S1, S2 & S3 = Scenarios 1, 2 & 3 (X's indicate if these facilities should be in the respective cases)

345/230 Autos are 560 MVA

345kV conductor is bundled 954ACSR