Appendix 4.H

Transformer Study

Kansas City Power & Light
Product Design & Application
TSL2 Designs Single Phase

										Annual Losses (Watts)		
Stock Code	Prod	Description	Kva	Qty	DP	DT	Price	LL	NL	LL	NL	TOC
950-001	Pad	50 KVA 3.1/5.1 FD	50	2	($160)	$288	$2,925	752	105	1504	210	5793
950-002	Pad	75 KVA 3.1/5.1 FD	75	2	($225)	$0	$2,977	1027	126	2396	294	6866
950-003	Pad	100 KVA 3.1/5.1 FD	100	3	($280)	$0	$3,525	1270	161	4233	537	8342
950-004	Pad	167 KVA 3.1/5.1 FD	167	2	($130)	$186	$5,456	1794	251	3588	502	12298
950-311	Pad	25 KVA 3.1P	25	356	($70)	$173	$1,515	474	52	168586	18495	3300
950-313	Pad	50 KVA 3.1P	50	613	($115)	$360	$1,924	720	110	441120	67393	4685
950-314	Pad	75 KVA 3.1P	75	236	($120)	$177	$2,360	1009	130	237788	30637	6190
950-315	Pad	100 KVA 3.1P	100	60	($315)	$299	$2,883	1276	158	76985	9533	7717
950-432	Pad	50 KVA 4.3P	50	24	($200)	$100	$4,322	1720	268	41280	6432	10926
950-316	Pad	167 KVA 3.1P	167	2	($200)	$194	$2,190	690	116	1610	271	4853
950-513	Pad	50 KVA 5.1P	50	19	($175)	$232	$2,155	645	128	12470	2475	4675
950-514	Pad	75 KVA 5.1P	75	5	($240)	$288	$2,841	1033	125	5165	625	6749
950-515	Pad	100 KVA 5.1P	100	8	($300)	$343	$3,311	1322	148	10135	1135	8294
950-516	Pad	167 KVA 5.1P	167	9	($90)	$291	$4,651	1808	245	16875	2287	11534
				1342	($157,667)	$356,554	$2,716,678	########	140,824	**1,023,736**	**140,824**	

										Annual Losses (Watts)		
Stock Code	Prod	Description	Kva	Qty	DP	DT	Price	LL	NL	LL	NL	
951-002	OH	50 KVA 1.1/5.1	50	7	($131)	$51	$1,991	626	113	4173	753	4419
951-003	OH	75 KVA 1.1/5.1	75	6	($76)	$53	$2,944	803	149	4550	844	6065
951-004	OH	100 KVA 1.1/5.1	100	8	($190)	$70	$3,506	926	193	7717	1608	7139
951-005	OH	167 KVA 1.1/5.1	167	2	($172)	$211	$4,904	1412	264	2824	528	10395
951-008	OH	25 KVA 1.1/5.1	25	3	($94)	($102)	$1,365	358	69	1074	207	2761
951-134	OH	25 KVA 1.3	25	0	($52)	$3	$1,151	332	86	111	29	2480
951-314	OH	10 KVA 3.1	10	154	($26)	$69	$534	231	29	35651	4476	1410
951-315	OH	15 KVA 3.1	15	49	$0	$49	$707	299	42	14751	2072	1848
951-316	OH	25 KVA 3.1	25	372	($78)	$135	$809	447	60	166135	22300	2510
951-318	OH	50 KVA 3.1	50	264	($67)	$164	$1,313	602	141	158727	37177	3700
951-319	OH	75 KVA 3.1	75	28	($81)	$227	$2,175	1030	129	28840	3612	6079
951-320	OH	100 KVA 4.1	100	19	($27)	($72)	$2,665	1145	192	22137	3712	7083
951-321	OH	167 KVA 4.1	167	5	($280)	$265	$4,044	1725	271	8050	1265	10670
951-322	OH	250 KVA 4.1	250	0	$0	$1,711	$5,168	2641	329	880	110	15176
951-323	OH	333 KVA 4.1	333	0	($182)	($1,361)	$6,958	3133	435	1044	145	18901
951-412	OH	10 KVA 14.1	10	0	($32)	($207)	$953	129	38	43	13	1477
951-413	OH	15 KVA 14.1	15	0	($84)	$112	$1,151	295	43	98	14	2279
951-414	OH	25 KVA 14.1	25	0	($126)	($51)	$1,398	354	81	118	27	2798
951-415	OH	50 KVA 14.1	50	0	($87)	$66	$2,023	667	124	222	41	4616
951-416	OH	100 KVA 14.1	100	0	$0	$70	$3,617	1122	197	374	66	7960
951-417	OH	167 KVA 14.1	167	0	($342)	($476)	$4,946	1612	297	537	99	11208
951-515	OH	25 KVA 5.1	25	71	($64)	$90	$946	421	65	29751	4593	2561
951-517	OH	50 KVA 5.1	50	157	($96)	$37	$1,306	615	139	96350	21777	3736
951-518	OH	75 KVA 5.1	75	49	($72)	($1,841)	$215	1012	132	49588	6468	4059
951-524	OH	15 KVA 5.1	15	47	$0	$38	$789	292	43	13724	2021	1906
951-531	OH	10 KVA 6.3	10	7	($45)	$40	$722	206	35	1442	245	1518
951-532	OH	25 KVA 6.3	25	17	($102)	$29	$1,062	401	70	6951	1213	2614
951-534	OH	50 KVA 6.3	50	12	($96)	$30	$1,667	592	143	7104	1716	4021
951-535	OH	75 KVA 6.3	75	4	($12)	$197	$2,173	1012	135	4385	585	6022
951-536	OH	100 KVA 6.3	100	2	($167)	$447	$2,627	1283	164	2138	273	7495
951-537	OH	167 KVA 6.3	167	2	($115)	$447	$3,822	1760	266	3520	532	10566
951-538	OH	250 KVA 6.3	250	2	($298)	$1,248	$4,754	2572	350	5144	700	14547
951-539	OH	333 KVA 6.3	333	1	$0	$703	$6,577	3149	440	4199	587	18586
951-551	OH	50 KVA 6.5	50	29	($106)	$176	$1,581	643	133	18433	3813	4102
951-552	OH	75 KVA 6.5	75	9	($52)	$451	$2,158	1047	126	9772	1176	6118
951-553	OH	100 KVA 6.5	100	9	($78)	$462	$2,597	1177	186	10593	1674	7120
951-554	OH	167 KVA 6.5	167	1	($64)	$251	$3,656	1728	273	1728	273	10296
951-556	OH	333 KVA 6.5	333	3	$0	$2,199	$6,573	3187	429	9561	1287	18701
951-557	OH	500 KVA 6.5	500	0	($665)	($3,580)	$8,299	4194	594	1398	198	24306
				1342	($90,574)	$63,823	$1,494,893	733,838	128,229	**733,838**	**128,229**	
				1342			$1,494,893			1,757,573		

1,757,573

Legend
DP = Price decrease vs. Best TOC design
DT = TOC Increase vs. Best TOC design
NL = Guarantee No-Load Loss @ 20C
LL = Guarantee Load Loss @ 85C

Kansas City Power & Light
Product Design & Application
TSL4 Designs Single Phase

								Annual Losses (Watts)		
Stock Code	Prod	Description	Kva	Qty	Price	LL	NL	LL	NL	TOC
950-001	Pad	50 KVA 3.1/5.1 FD	50	2	$3,108	624	98	1248	196	5505
950-002	Pad	75 KVA 3.1/5.1 FD	75	2	$2,977	1027	126	2396	294	6866
950-003	Pad	100 KVA 3.1/5.1 FD	100	3	$3,525	1270	161	4233	537	8342
950-004	Pad	167 KVA 3.1/5.1 FD	167	2	$5,461	1747	237	3494	474	12112
950-311	Pad	25 KVA 3.1P	25	356	$1,541	416	58	147957	20629	3127
950-313	Pad	50 KVA 3.1P	50	613	$1,990	605	102	370663	62492	4325
950-314	Pad	75 KVA 3.1P	75	236	$2,398	950	128	223883	30165	6013
950-315	Pad	100 KVA 3.1P	100	60	$2,922	1181	160	71254	9653	7418
950-316	Pad	167 KVA 3.1P	167	24	$4,380	1688	241	40512	5784	10826
950-432	Pad	50 KVA 4.3P	50	2	$2,251	627	98	1463	229	4659
950-513	Pad	50 KVA 5.1P	50	19	$2,427	519	96	10034	1856	4444
950-514	Pad	75 KVA 5.1P	75	5	$2,877	940	131	4700	655	6461
950-515	Pad	100 KVA 5.1P	100	8	$3,415	1193	158	9146	1211	7951
950-516	Pad	167 KVA 5.1P	167	9	$4,701	1717	236	16025	2203	11243
				1342	$2,786,283	907,010	136,378	**907,010**	**136,378**	

								Annual Losses (Watts)		
Stock Code	Prod	Description	Kva	Qty	Price	LL	NL	LL	NL	TOC
951-002	OH	50 KVA 1.1/5.1	50	7	$2,307	530	99	3533	660	4368
951-003	OH	75 KVA 1.1/5.1	75	6	$3,069	754	148	4273	839	6013
951-004	OH	100 KVA 1.1/5.1	100	8	$3,545	902	179	7517	1492	7070
951-005	OH	167 KVA 1.1/5.1	167	2	$5,181	1277	262	2554	524	10185
951-008	OH	25 KVA 1.1/5.1	25	3	$1,425	375	57	1125	171	2862
951-134	OH	25 KVA 1.3	25	0	$1,157	333	78	111	26	2477
951-314	OH	10 KVA 3.1	10	154	$555	205	31	31638	4784	1341
951-315	OH	15 KVA 3.1	15	49	$719	283	40	13961	1973	1799
951-316	OH	25 KVA 3.1	25	372	$827	404	61	150153	22672	2375
951-318	OH	50 KVA 3.1	50	264	$1,352	557	115	146862	30322	3536
951-319	OH	75 KVA 3.1	75	28	$2,256	942	134	26376	3752	5852
951-320	OH	100 KVA 4.1	100	19	$2,726	1158	170	22388	3287	7155
951-321	OH	167 KVA 4.1	167	5	$4,231	1601	267	7471	1246	10406
951-322	OH	250 KVA 4.1	250	0	$6,764	1736	293	579	98	13465
951-323	OH	333 KVA 4.1	333	0	$11,552	2281	326	760	109	20262
951-412	OH	10 KVA 14.1	10	0	$986	178	37	59	12	1684
951-413	OH	15 KVA 14.1	15	0	$1,209	245	49	82	16	2167
951-414	OH	25 KVA 14.1	25	0	$1,427	365	70	122	23	2849
951-415	OH	50 KVA 14.1	50	0	$2,157	621	102	207	34	4550
951-416	OH	100 KVA 14.1	100	0	$3,730	1075	188	358	63	7890
951-417	OH	167 KVA 14.1	167	0	$5,196	1698	245	566	82	11684
951-515	OH	25 KVA 5.1	25	71	$958	393	64	27772	4523	2471
951-517	OH	50 KVA 5.1	50	157	$1,352	607	105	95097	16450	3699
951-518	OH	75 KVA 5.1	75	49	$2,222	967	129	47383	6321	5900
951-524	OH	15 KVA 5.1	15	47	$801	279	41	13113	1927	1868
951-531	OH	10 KVA 6.3	10	7	$741	190	34	1330	238	1478
951-532	OH	25 KVA 6.3	25	17	$1,088	388	65	6725	1127	2585
951-534	OH	50 KVA 6.3	50	12	$1,724	582	111	6984	1332	3991
951-535	OH	75 KVA 6.3	75	4	$2,238	938	137	4065	594	5825
951-536	OH	100 KVA 6.3	100	2	$2,700	1132	178	1887	297	7049
951-537	OH	167 KVA 6.3	167	2	$3,874	1622	264	3244	528	10119
951-538	OH	250 KVA 6.3	250	2	$6,594	1734	300	3468	600	13299
951-539	OH	333 KVA 6.3	333	1	$9,551	2160	361	2880	481	17883
951-551	OH	50 KVA 6.5	50	29	$1,643	587	110	16827	3153	3926
951-552	OH	75 KVA 6.5	75	9	$2,231	892	146	8325	1363	5667
951-553	OH	100 KVA 6.5	100	9	$2,622	1036	198	9324	1782	6658
951-554	OH	167 KVA 6.5	167	1	$3,727	1645	258	1645	258	10045
951-556	OH	333 KVA 6.5	333	3	$8,338	2109	370	6327	1110	16501
951-557	OH	500 KVA 6.5	500	0	$15,946	3136	426	1045	142	27886
				1342	$1,653,145	678,138	114,409	**678,138**	**114,409**	
						TSL2-4 Difference		**55,700**	**13,820**	
						Averaged Savings (KW)		**34,760**		

Legend
NL = Guarantee No-Load Loss @ 20C
LL = Guarantee Load Loss @ 85C

1,585,148

Kansas City Power & Light
Product Design & Application
KCP&L TSL2 Designs Three Phase

Stock Code	Prod	Description	Kva	Qty	DP	DT	Price	LL	NL	Annual Losses (Watts) LL	NL	TOC	Total Cost
950005	Pad	TRANSFORMER U G75KVA 15.2P 12,	75	35	($857)	($210)	$6,227	912	179	31920	6265	9787	$ 217,935
950006	Pad	TRANSFORMER U G112KVA 15.2P 12	113	23	($1,420)	$517	$6,770	1361	220	31303	5060	12008	$ 155,710
950007	Pad	TRANSFORMER U G150KVA 15.2P 12	150	26	($1,623)	($218)	$7,238	1508	303	39711	7979	13136	$ 190,591
950008	Pad	TRANSFORMER U G225KVA 15.2P 12	225	16	($2,386)	($731)	$8,492	2180	396	35607	6468	16952	$ 138,708
950009	Pad	TRANSFORMER U G300KVA 15.2P 12	300	17	($3,008)	($741)	$9,616	2685	488	46540	8459	20036	$ 166,672
950010	Pad	TRANSFORMER U G500KVA 15.2P 12	500	16	($6,799)	($1,340)	$11,427	4359	620	68291	9713	28067	$ 179,016
950014	Pad	TRANSFORMER U G75KVA 15.6P 12,	75	7	($829)	($194)	$6,614	820	202	5467	1347	9881	$ 44,092
950015	Pad	TRANSFORMER U G112KVA 15.6P 12	113	3	($798)	$93	$7,228	1132	277	3773	923	11735	$ 24,092
950016	Pad	TRANSFORMER U G150KVA 15.6P 12	150	3	($1,110)	$339	$7,684	1536	311	4608	933	13696	$ 23,053
950017	Pad	TRANSFORMER U G225KVA 15.6P 12	225	11	($1,800)	($153)	$8,219	2001	439	22011	4829	16105	$ 90,406
950018	Pad	TRANSFORMER U G300KVA 15.6P 12	300	20	($2,411)	$1,023	$8,881	2763	463	54339	9106	19541	$ 174,667
950019	Pad	TRANSFORMER U G500KVA 15.6P 12	500	17	($3,327)	($217)	$10,654	3847	735	66681	12740	25641	$ 184,677
950032	Pad	TRANSFORMER U G1500KVA 15.6R	1500	9	($2,568)	$8,652	$22,097	11459	1928	106951	17995	66320	$ 206,238
950033	Pad	TRANSFORMER U G2000KVA 15.6R 1	2000	3	($5,773)	$3,398	$31,450	15203	2194	50677	7313	89539	$ 104,833
950034	Pad	TRANSFORMER U G2500KVA 15.6R 1	2500	8	($9,230)	$8,764	$35,399	17536	2819	134443	21612	102864	$ 271,393
950111	Pad	TRANSFORMER UG 750 KVA 15.2P 1	750	4	($1,919)	$2,849	$16,909	7288	1048	26723	3843	44750	$ 62,000
950112	Pad	TRANSFORMER UG 1000KVA 12,470	1000	4	($3,688)	($195)	$19,324	8045	1505	32180	6020	50613	$ 77,296
950120	Pad	TRANSFORMER UG 750 KVA 15.6P	750	14	($1,602)	$938	$15,708	5982	1312	85742	18805	39283	$ 225,149
950131	Pad	TRANSFORMER UG 1000 KVA 15.6P	1000	13	($1,700)	$4,884	$18,026	8445	1454	106970	18417	50670	$ 228,335
950219	Pad	TRANSFORMER UG 500 KVA 15.6	500	2	($4,620)	($1,438)	$18,477	3833	735	6388	1225	33414	$ 30,795
				251	($627,367)	$209,561	$ 2,795,657			**960,324**	**169,052**		

Legend
DP = Price decrease vs. Best TOC design
DT = TOC Increase vs. Best TOC design
NL = Guarantee No-Load Loss @ 20C
LL = Guarantee Load Loss @ 85C

Kansas City Power & Light
Product Design & Application
TSL4 Design Three Phase

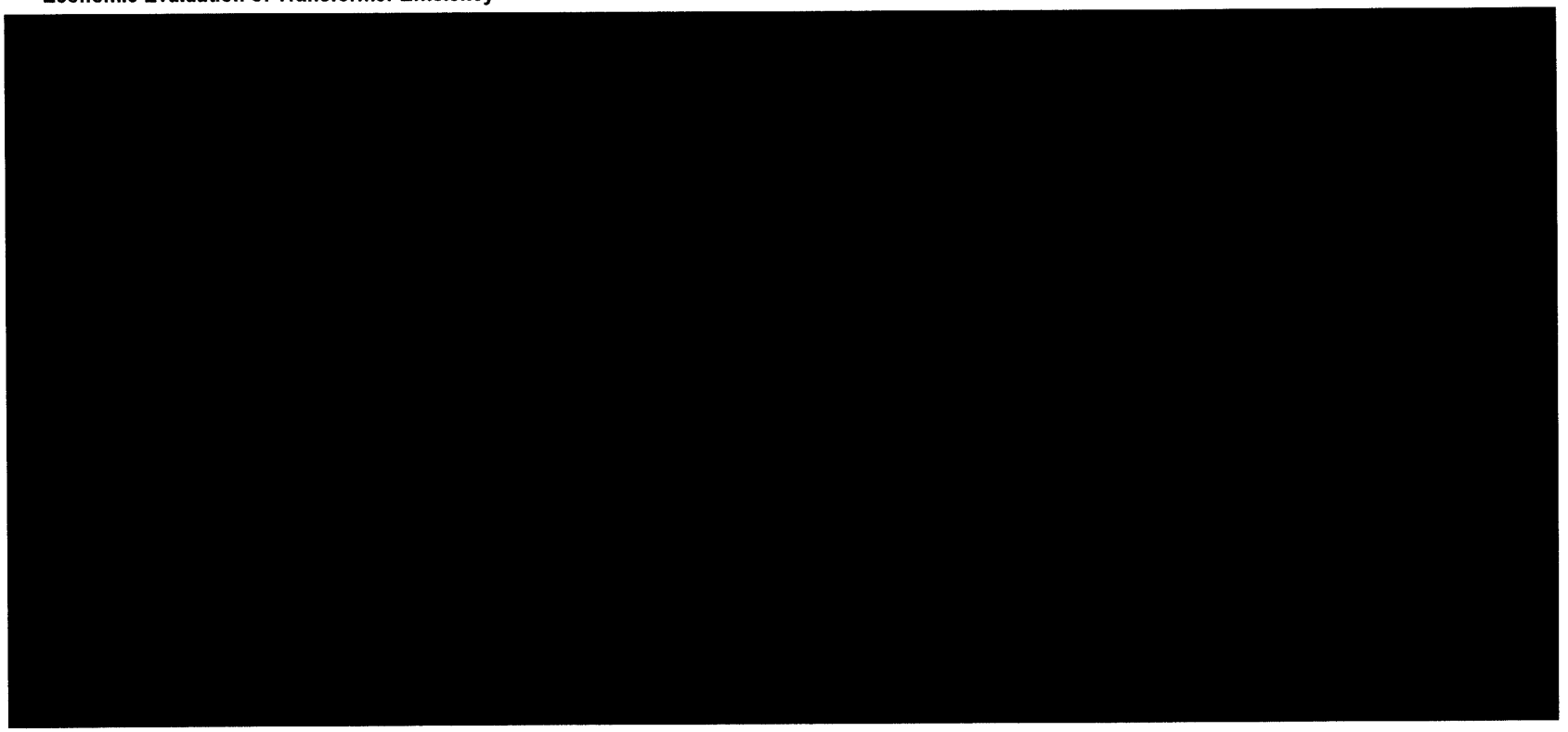
Stock Code	Prod	Description	Kva	Qty	Price	LL	NL	Annual Losses (Watts) LL	Annual Losses (Watts) NL	TOC	Total Cost
950005	Pad	TRANSFORMER L	75	35	$7,083	748	143	26180	5005	9998	247919.2
950006	Pad	TRANSFORMER L	113	23	$8,190	810	246	18630	5658	11491	188366.4
950007	Pad	TRANSFORMER L	150	26	$8,860	1131	271	29783	7136	13354	233325.8
950008	Pad	TRANSFORMER L	225	16	$10,878	1753	320	28632	5227	17684	177679.5
950009	Pad	TRANSFORMER L	300	17	$12,624	2087	413	36175	7159	20777	218808.5
950010	Pad	TRANSFORMER L	500	16	$18,225	2812	679	44055	10638	29407	285531.5
950014	Pad	TRANSFORMER L	75	7	$7,443	660	164	4400	1093	10074	49617.33
950015	Pad	TRANSFORMER L	113	3	$8,026	908	223	3027	743	11642	26752.23
950016	Pad	TRANSFORMER L	150	3	$8,795	1151	269	3453	807	13357	26384.42
950017	Pad	TRANSFORMER L	225	11	$10,019	1582	350	17402	3850	16258	110205.2
950018	Pad	TRANSFORMER L	300	20	$11,292	1798	482	35361	9479	18518	222081
950019	Pad	TRANSFORMER L	500	17	$13,982	3038	606	52659	10504	25858	242350.2
950032	Pad	TRANSFORMER L	1500	9	$24,665	8348	1896	77915	17696	57668	230207.2
950033	Pad	TRANSFORMER L	2000	3	$37,223	12874	1688	42913	5627	86141	124076.5
950034	Pad	TRANSFORMER L	2500	8	$44,629	12559	2740	96286	21007	94100	342153.6
950111	Pad	TRANSFORMER L	750	4	$18,828	6048	850	22176	3117	41901	69037.41
950112	Pad	TRANSFORMER I	1000	4	$23,012	7228	1155	28912	4620	50809	92049.44
950120	Pad	TRANSFORMER I	750	14	$17,310	5413	1001	77586	14348	38344	248110.2
950131	Pad	TRANSFORMER I	1000	13	$19,727	6708	1236	84968	15656	45786	249873.7
950219	Pad	TRANSFORMER L	500	2	$23,097	2993	631	4988	1052	34851	38494.89
				251	$3,423,024			**735,500**	**150,421**		
						TSL2-4 Difference		**224,824**	**18,632**		
						Averaged Savings (KW)		**121,728**			

Legend
NL = Guarantee No-Load Loss @ 20C
LL = Guarantee Load Loss @ 85C

Economic Evaluation of Transformer Efficiency

HC

Economic Evaluation of Transformer Efficiency



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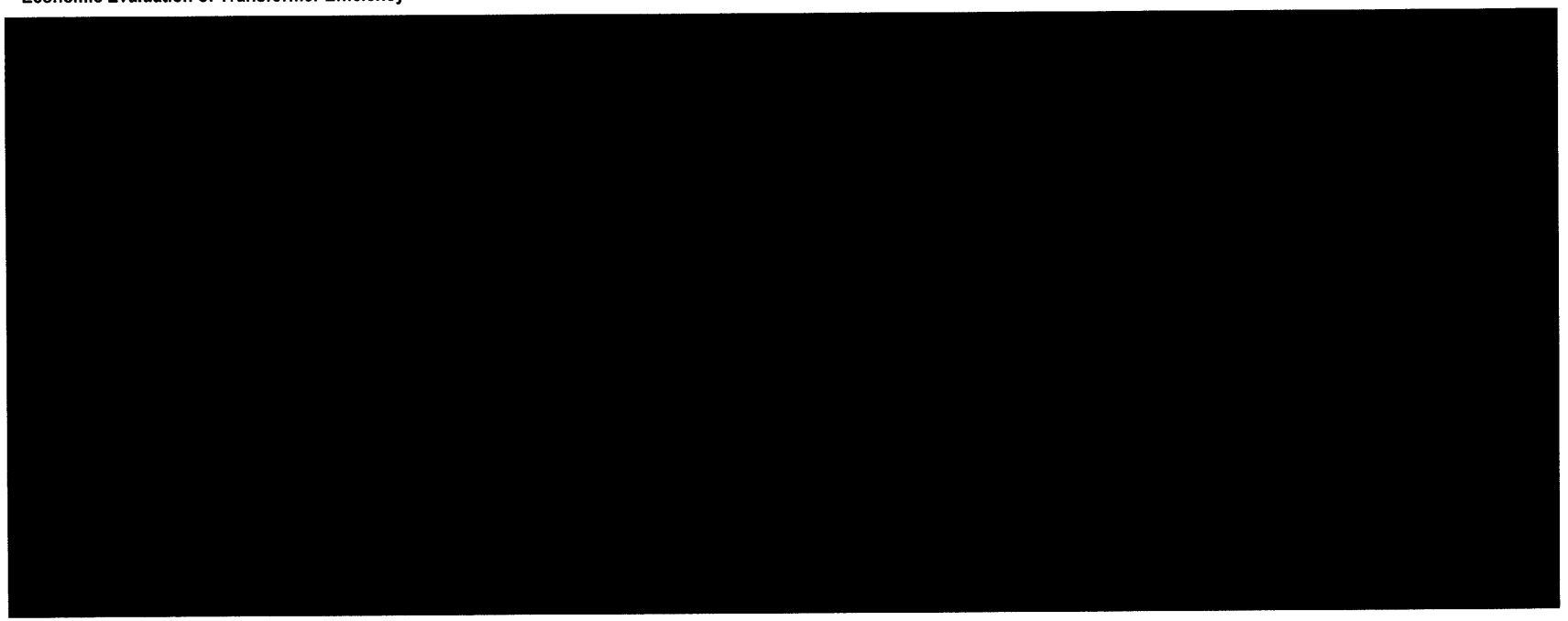
Economic Evaluation of Transformer Efficiency



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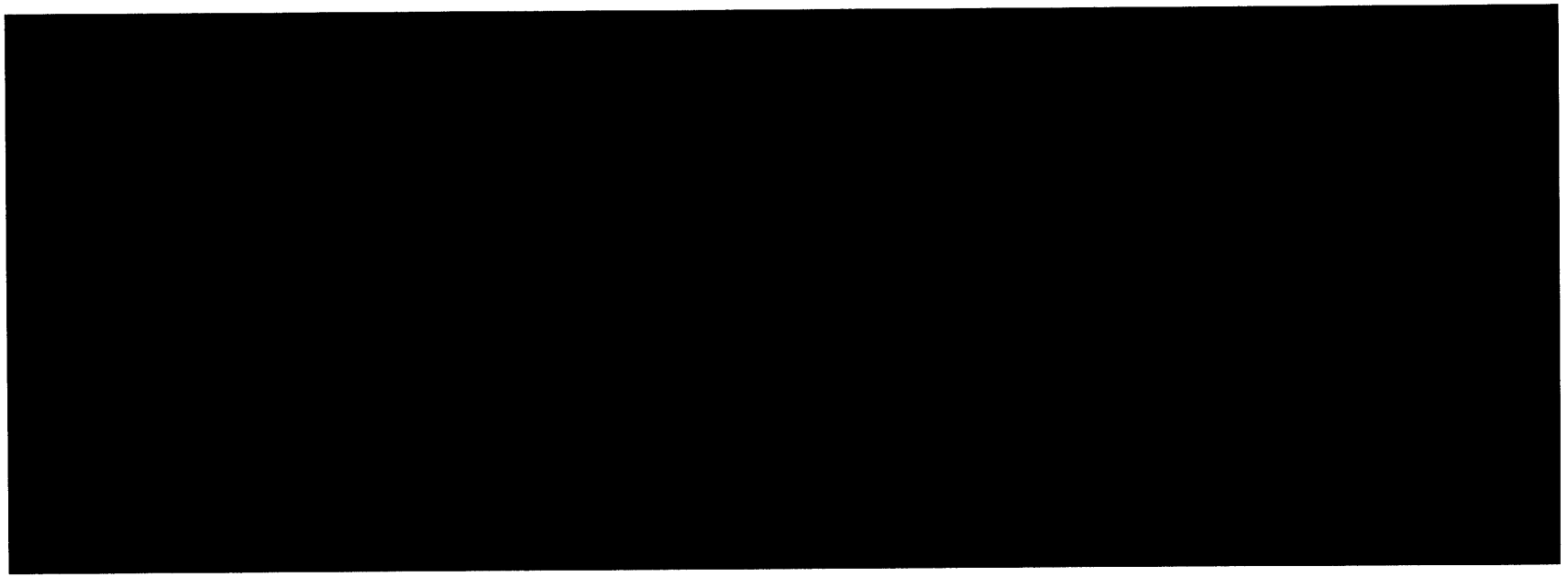

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KCPL System Savings

Year Savings	Single Phase kW	Single Phase (kWH)	Single Phase Cum (kWH)	Three Phase kW	Three Phase (kWH)	Three Phase Cum (kWH)
2008	34.76	304,498	304,498	121.7	1,066,334	1,066,334
2009	34.76	304,498	608,995	121.7	1,066,334	2,132,669
2010	34.76	304,498	913,493	121.7	1,066,334	3,199,003
2011	34.76	304,498	1,217,990	121.7	1,066,334	4,265,337
2012	34.76	304,498	1,522,488	121.7	1,066,334	5,331,672
		Savings (MWhr)	**4,567**			**15,995**
		Total kwhr saving for difference between TSL2 and TSL4			**20,562**	

Assumptions:
Assume Load Factor of 50% Year around

		1,522,488			5,331,672
2013	304,498	1,826,986	1,066,334		6,398,006
2014	304,498	2,131,483	1,066,334		7,464,341
2015	304,498	2,435,981	1,066,334		8,530,675
2016	304,498	2,740,478	1,066,334		9,597,009
2017	304,498	3,044,976	1,066,334		10,663,344
2018	304,498	3,349,474	1,066,334		11,729,678
2019	304,498	3,653,971	1,066,334		12,796,012
2020	304,498	3,958,469	1,066,334		13,862,347
2021	304,498	4,262,966	1,066,334		14,928,681
2022	304,498	4,567,464	1,066,334		15,995,015
2023	304,498	4,871,962	1,066,334		17,061,350
2024	304,498	5,176,459	1,066,334		18,127,684
2025	304,498	5,480,957	1,066,334		19,194,018
2026	304,498	5,785,454	1,066,334		20,260,353
2027	304,498	6,089,952	1,066,334		21,326,687
2028	304,498	6,394,450	1,066,334		22,393,022
2029	304,498	6,698,947	1,066,334		23,459,356
2030	304,498	7,003,445	1,066,334		24,525,690
2031	304,498	7,307,942	1,066,334		25,592,025
2032	304,498	7,612,440	1,066,334		26,658,359
2033	304,498	7,916,938	1,066,334		27,724,693
2034	304,498	8,221,435	1,066,334		28,791,028
2035	304,498	8,525,933	1,066,334		29,857,362
2036	304,498	8,830,430	1,066,334		30,923,696
2037	304,498	9,134,928	1,066,334		31,990,031

TYPE	Phase	KVA	KCPL Count	Materials	Labor
OH	1	5	469	$450	$864
OH	1	10	9989	$555	$864
OH	1	15	4653	$716	$864
OH	1	25	17214	$827	$864
OH	1	37	5791	$1,000	$864
OH	1	50	13402	$1,352	$864
OH	1	75	2843	$2,256	$864
OH	1	100	744	$2,726	$864
OH	1	167	227	$4,231	$864
OH	1	250	19	$6,764	$864
OH	1	333	4	$11,552	$864
OH	1	500	1	$15,946	$864
OH	3	15	17	$1,350	$864
OH	3	37	498	$1,665	$864
OH	3	50	650	$2,148	$864
OH	3	100	28	$3,000	$864
OH	3	112	308	$3,000	$864
OH	3	150	1400	$4,056	$864
OH	3	225	563	$6,768	$864
OH	3	300	335	$8,178	$864
OH	3	500	197	$12,693	$864
OH	3	750	48	$20,292	$864
OH	3	1000	21	$34,656	$864
UG	1	25	4199	$1,541	$864
UG	1	37	250	$1,750	$864
UG	1	50	14195	$1,990	$864
UG	1	75	5522	$2,398	$864
UG	1	100	2532	$2,922	$864
UG	1	167	1220	$4,380	$864
UG	3	75	1109	$6,614	$2,074
UG	3	112	480	$7,228	$1,382
UG	3	150	983	$7,684	$1,382
UG	3	225	770	$8,219	$1,382
UG	3	300	667	$8,881	$1,382
UG	3	500	456	$10,654	$1,382
UG	3	750	460	$16,909	$1,382
UG	3	1000	276	$19,324	$1,382
UG	3	1500	164	$22,097	$1,382
UG	3	2000	33	$31,450	$1,382
UG	3	2500	47	$35,399	$1,382

For 3-Phase Underground Transformers:

KCPL Change Out

LL MW Save	Extended Savings LL W	Cost	NL Savings	NL Extended (W)	Annual Savings MWh
160	177,440	$9,634,288	38	42142	962
224	107,520	$4,132,838	54	25920	584
385	378,455	$8,912,650	42	41286	1838
419	322,630	$7,392,847	89	68530	1713
965	643,655	$6,845,935			2819
809	368,904	$5,488,808	129	58824	1873
1240	570,400	$8,414,058	198	91080	2897
817	225,492	$5,714,937	350	96600	1411
3111	510,204	$3,850,615	32	5248	2258
2329	76,857	$1,083,468	506	16698	410
4977	233,919	$1,728,731	79	3713	1041
	3,615,476	**$63,199,175**		**450,041**	**17,807**