

Chapter 7

Conclusion

Tariff structures were developed under two basic approaches in order to establish an economically efficient, cost reflective tariff for the WPS of CEB. The two basic approaches were the average incremental cost based approach and the historical cost based approach. In AIC based approach, four scenarios were studied to see the effect of different parameters on the tariff and the planning period was taken as 2002 to 2009. In historical cost approach capacity related costs, consumer related costs and energy related costs were established and a tariff which differentiates prices based on voltage levels and consumer categories was evaluated. Here, the price discrimination was limited due to the lack of data. All tariff structures were compared and it was found that the AIC based tariff, differentiated with respect to voltage levels, time of usage, contribution to peak and on consumer categories gives the most appropriate, cost reflective economically efficient tariff for WPS. In deriving all these tariffs, the purchase price at the grid substation level was taken as Rs. 4.49 per kWh (a value derived from an LRMC study by CEB in 2000).



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As the generation costs of the CEB has gone up tremendously after 2000 due to hired and emergency thermal purchases, more realistic purchase price at grid substation level needs to be established to match the revenue generation with the expenditure. A realistic purchase price was derived considering the generation mix and different thermal purchase prices and it was Rs. 5.73 per kWh at the grid substation level. When adjusted to this purchase price, the newly derived tariff generates revenue equivalent to an average selling price of Rs. 7.35 per kWh for WPS. This adjusted tariff was compared with the present tariff of the CEB which generates revenue equivalent to an average selling price of Rs. 6.78 per kWh. This difference of Rs. 7.35 to Rs. 6.78 per kWh, highlights the fact that CEB today operates with short of revenue to meet its expenses. The new tariff charge higher price for domestic, LECO and street light consumers and charge lower prices for industrial and commercial consumers, compared to the present tariff. The higher price for domestic consumers is mainly due to higher losses in the LV network. Therefore, it was further studied the subsidizing the domestic tariff to include the social concerns. In order to maintain the present domestic tariff along with the newly developed tariff, a subsidy of Rs. 1.13 billion has to be provided annually to the utility.

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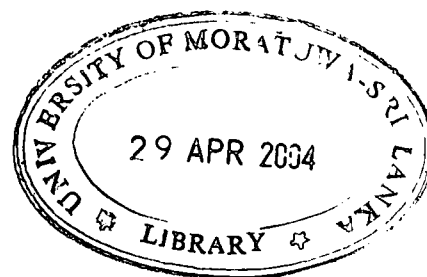
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APPENDICES



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Appendix 1

Ceylon Electricity Board

Tariff 2002

Applicable from 1st august 2002

Domestic			
Block 1 - First 30 Units	Rs	3.00	per unit
Block 2- 31 - 60 Units	Rs	3.70	per unit
Block 3 - 61 - 90 Units	Rs	4.10	per unit
Block 4 - 91 - 180 Units	Rs	10.60	per unit
Block 5 - Above 180 Units	Rs	15.80	per unit
Fixed Charge -	Rs	30.00	
Religious Purpose			
Block 1 - First 30 Units	Rs	2.50	per unit
Block 2- 31 - 90 Units	Rs	2.70	per unit
Block 3 91 - 180 Units	Rs	4.00	per unit
Block 4 - above 180 Units	Rs	7.20	per unit
Fixed charge -	Rs	30.00	
	General Purpose	Industrial	Industrial (Time of day)
Supply at 400/230V			
Contract Demand<42kVA			
Unit Charge (Rs/Unit)	10.90	7.50	15.00 (Peak) 6.90 (Off peak)
Fixed Charge (Rs/Month)			
Up to 10 kVA	30.00	30.00	30.00
Above 10kVA	230.00	230.00	230.00
Supply at 400/230V			
Contract Demand =>42kVA			
Unit Charge (Rs/Unit)	10.80	7.10	14.70 (Peak) 6.50 (Off Peak)
Demand Charge (Rs/kVA)	480.00	400.00	380.00
Fixed Charge (Rs/Month)	800.00	800.00	800.00
Supply at 11/33/132 kV			
Unit Charge (Rs/Unit)	10.70	7.00	14.00 (Peak) 6.10 (Off peak)
Demand Charge (Rs/kVA)	460.00	380.00	360.00
Fixed Charge (Rs/Month)	800.00	800.00	800.00
Bulk Supplies tp LECO/LA			
	Unit Charge Rs/Unit	Demand Charge Rs/kVA	
L1 - Supply at 400/230 V	7.20	240.00	
L2 - Supply at 11kV & above	5.40	220.00	
Street Lighting			
	Rs 7.80 per Unit		

Appendix 2

Calculation of average incremental costs

Investments in the Distribution section and Augmentation Costs

Annuity factor 30 yrs@8% 9.43
Augmentation growth rate 4

	2002	2003	2004	2005	2006	2007	2008	2009
Investments mill. Rs.	100	277	12					
Annuitised costs	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60
		29.37	29.37	29.37	29.37	29.37	29.37	29.37
			1.27	1.27	1.27	1.27	1.27	1.27
Total annuitised Investment costs	10.60	39.98	41.25	41.25	41.25	41.25	41.25	41.25
Augmentation costs	100.00	104.00	108.16	112.49	116.99	121.67	126.53	131.59
	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60
		11.03	11.03	11.03	11.03	11.03	11.03	11.03
			11.47	11.47	11.47	11.47	11.47	11.47
				11.93	11.93	11.93	11.93	11.93
					12.41	12.41	12.41	12.41
						12.90	12.90	12.90
							13.42	13.42
Annuitised Augmentation costs	10.60	21.63	33.10	45.03	57.44	70.34	83.76	97.71



Calculation of Average incremental costs

Annua-tised costs and Energy sales

Interest rate 10
Electricity Purchase price 4.49

	2002	2003	2004	2005	2006	2007	2008	2009
Investment cost mil Rs.	10.60	39.98	41.25	41.25	41.25	41.25	41.25	41.25
Aumentation costs mil Rs.	10.60	21.63	33.10	45.03	57.44	70.34	83.76	97.71
O& M costs	434.00	477.40	525.14	577.65	635.42	698.96	768.86	845.74
Losses GWH	198	216	235	256	280	305	332	362
Energy sales GWH	1524	1661	1811	1974	2151	2345	2556	2786

Incremental present worthed values

	2003	2004	2005	2006	2007	2008	2009
Investment cost mil Rs.	45.98	75.90	99.99	119.07	133.86	144.98	152.97
Aumentation costs mil Rs.	29.31	54.00	82.92	114.62	147.87	181.71	215.33
O& M costs	39.45	75.32	107.93	137.57	164.52	189.02	211.29
Losses GWH	16.20	30.79	43.90	55.67	66.23	75.69	84.15
Energy sales GWH	124.69	236.91	337.81	428.42	509.69	582.48	647.57

Calculation of Average incremental costs

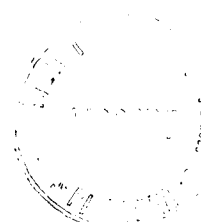
Energy sales, losses & Purchases

Energy sales growth rate% 9
% losses 11.5

	2002	2003	2004	2005	2006	2007	2008	2009
Energy sales GWH	1524	1661	1811	1974	2151	2345	2556	2786
Losses GWH	198	216	235	256	280	305	332	362
En. Purchases	1722	1877	2046	2230	2431	2650	2888	3148



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Expenditures

O & M Expenditure & others

Incremental rate 10

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Maint. Labour									
Main. Labour OT									
maint. Material									
Communication 50%									
Transport 50%									
wayleaves									
Total O & M expenditure	434.0	477.4	525.1	577.7	635.4	699.0	768.9	845.7	930.3
Oter Expenditure									
Personel									
Establishment									
Office supplies									
Insurance									
Advertisement									
Private security									
bad debt									
others									
Total	53.0	58.3	64.1	70.5	77.6	85.4	93.9	103.3	113.6
Total Expenditure	487.0	535.7	589.3	648.2	713.0	784.3	862.8	949.0	1043.9

Iverage Incremental costs at LV end, No consumer categories, No voltage levels

Electricity purchase price 4.49

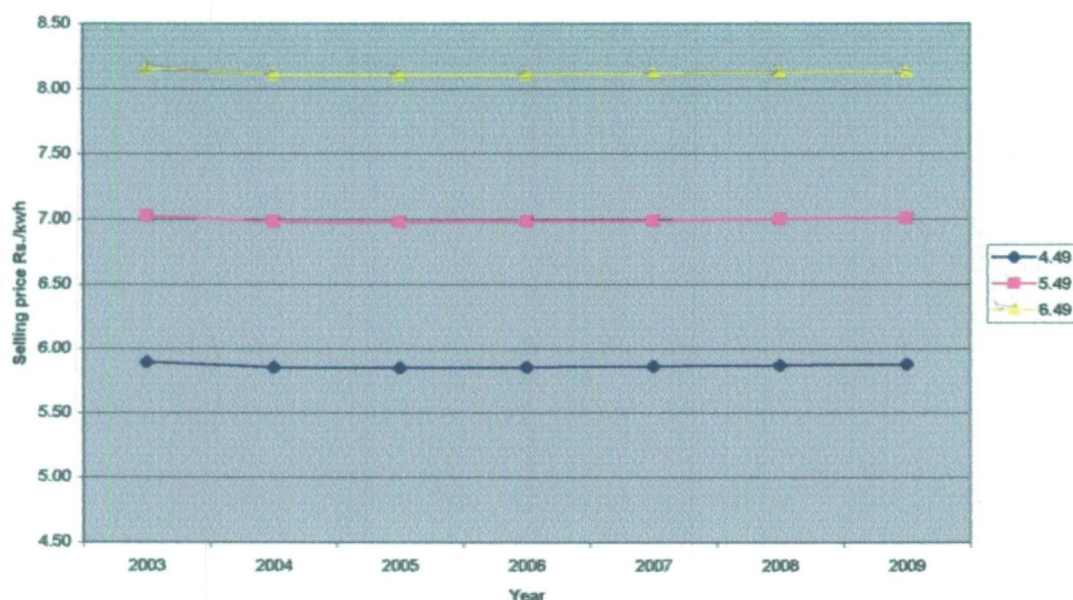
	2003	2004	2005	2006	2007	2008	2009
Investment cost mil Rs.	45.98	75.90	99.99	119.07	133.86	144.98	152.97
Aumentation costs mil Rs.	29.31	54.00	82.92	114.62	147.87	181.71	215.33
O& M costs	39.45	75.32	107.93	137.57	164.52	189.02	211.29
Losses GWH	16.20	30.79	43.90	55.67	66.23	75.69	84.15
Energy sales GWH	124.69	236.91	337.81	428.42	509.69	582.48	647.57
Total incremental cost Rs.	187.50	343.44	487.94	621.22	743.63	855.55	957.41
Total incremental cost Rs./kwh	1.50	1.45	1.44	1.45	1.46	1.47	1.48
Selling Price Rs./kWH	5.99	5.94	5.93	5.94	5.95	5.96	5.97

	2003	2004	2005	2006	2007	2008	2009
4.49	5.90	5.85	5.85	5.85	5.86	5.87	5.88
5.49	7.03	6.98	6.98	6.98	6.99	7.00	7.01
6.49	8.16	8.11	8.11	8.11	8.12	8.13	8.14



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Selling Price



Appendix 3

Annuitised values of Investment & augmentation

Annuitised for 30 yrs @ 10% 9.43

At 33kV distribution								
	2002	2003	2004	2005	2006	2007	2008	2009
Investment	100	277	12					
	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60
		29.37	29.37	29.37	29.37	29.37	29.37	29.37
			1.27	1.27	1.27	1.27	1.27	1.27
Annuitised Investment	10.60	39.98	41.25	41.25	41.25	41.25	41.25	41.25
Augmentation								
	41.6	43.264	44.99456	46.79434	48.66612	50.61276	52.63727	54.74276
	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41
		4.59	4.59	4.59	4.59	4.59	4.59	4.59
			4.77	4.77	4.77	4.77	4.77	4.77
				4.96	4.96	4.96	4.96	4.96
					5.16	5.16	5.16	5.16
						5.37	5.37	5.37
							5.58	5.58
								5.81
	4.41	9.00	13.77	18.73	23.89	29.26	34.84	40.65
At LV transformer level								
Augmentation	20.8	21.632	22.49728	23.39717	24.33306	25.30638	26.31864	27.37138
	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21
		2.29	2.29	2.29	2.29	2.29	2.29	2.29
			2.39	2.39	2.39	2.39	2.39	2.39
				2.48	2.48	2.48	2.48	2.48
					2.58	2.58	2.58	2.58
						2.68	2.68	2.68
							2.79	2.79
								2.90
	2.21	4.50	6.89	9.37	11.95	14.63	17.42	20.32
At LV consumer end								
Augmentation	41.6	43.264	44.99456	46.79434	48.66612	50.61276	52.63727	54.74276
	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41
		4.59	4.59	4.59	4.59	4.59	4.59	4.59
			4.77	4.77	4.77	4.77	4.77	4.77
				4.96	4.96	4.96	4.96	4.96
					5.16	5.16	5.16	5.16
						5.37	5.37	5.37
							5.58	5.58
								5.81
	4.41	9.00	13.77	18.73	23.89	29.26	34.84	40.65

Energy and cash flows at different voltages

Annuitised for 30 yrs at 10% interest rate

Annuitised Present worth Incremental costs

Interest rate% 10

Electricity purchase price 4.49

	2003	2004	2005	2006	2007	2008	2009
Energy at GSS level	141	268	382	484	576	659	732
Investment	45.98	75.90	99.99	119.07	133.86	144.98	152.97
Augmentation	12.19	22.46	34.50	47.68	61.51	75.59	89.58
O&M cost	13	25	36	45	54	62	70
Losses	3	5	8	10	12	13	15
Total ncremental cost	84	147	204	256	301	342	378
Incremental cost Rs/kwh	0.61	0.56	0.55	0.54	0.53	0.53	0.53
Electricity selling price Rs/kwh	5.10	5.05	5.04	5.03	5.02	5.02	5.02
Energy at ub distribution level	138	262	375	475	565	646	718
	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Augmentation	6.10	11.23	17.25	23.84	30.76	37.80	44.79
O&M cost	4	8	12	15	18	21	23
Losses	0.74	1.40	2.00	2.54	3.02	3.45	3.84
Incremental cost Rs/kwh	0.28	0.28	0.29	0.30	0.31	0.32	0.33
Electricity selling price Rs/kwh	5.38	5.33	5.32	5.33	5.33	5.34	5.35
Energy at transformer LV	51	96	137	173	207	237	263
Augmentation	12.19	22.46	34.50	47.68	61.51	75.59	89.58
O&M cost	26	50	71	91	109	125	139
Losses	13	24	35	43	52	60	66
Incremental cost Rs/kwh	2.83	2.76	2.82	2.82	2.88	2.93	2.96
Electricity selling price Rs/kwh	8.21	8.09	8.14	8.15	8.22	8.27	8.31
Energy at LV consumer end	38	72	103	130	155	177	197

INCREMENTAL COSTS(Rs./kwh) AT LV CONSUMER END

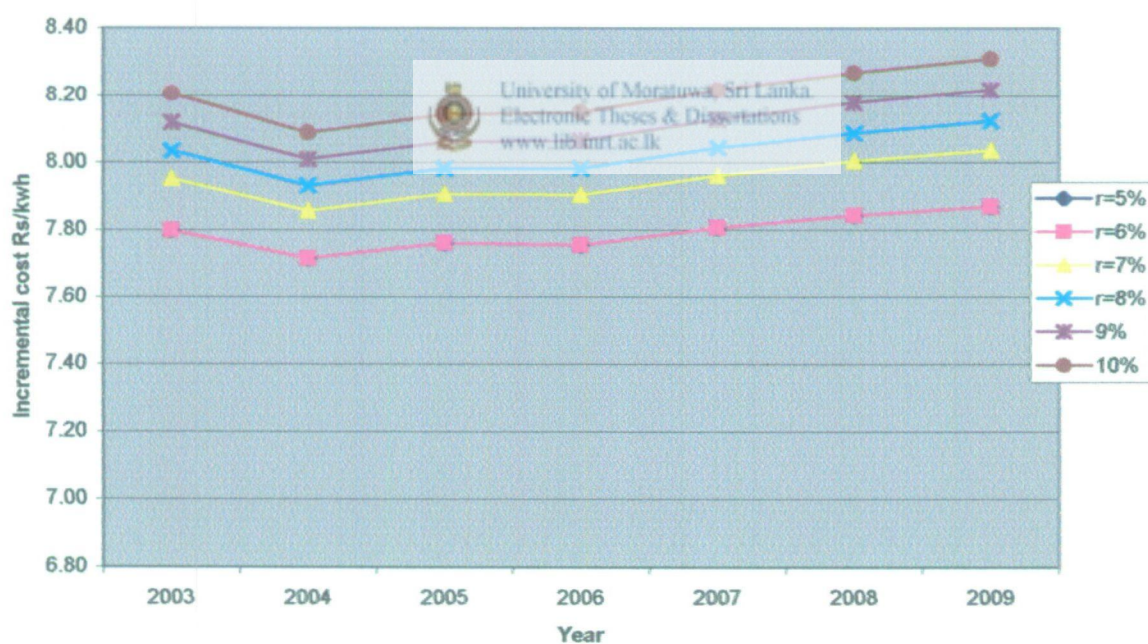
	INTEREST RATE 5%						
	2003	2004	2005	2006	2007	2008	2009
4.49	7.80	7.71	7.76	7.75	7.81	7.84	7.87
4.99	8.49	8.40	8.45	8.44	8.50	8.53	8.56
5.49	9.18	9.09	9.15	9.13	9.19	9.23	9.25
5.99	9.88	9.78	9.84	9.82	9.88	9.92	9.94
6.49	10.57	10.47	10.53	10.51	10.57	10.61	10.64



Selling price for different interest rates

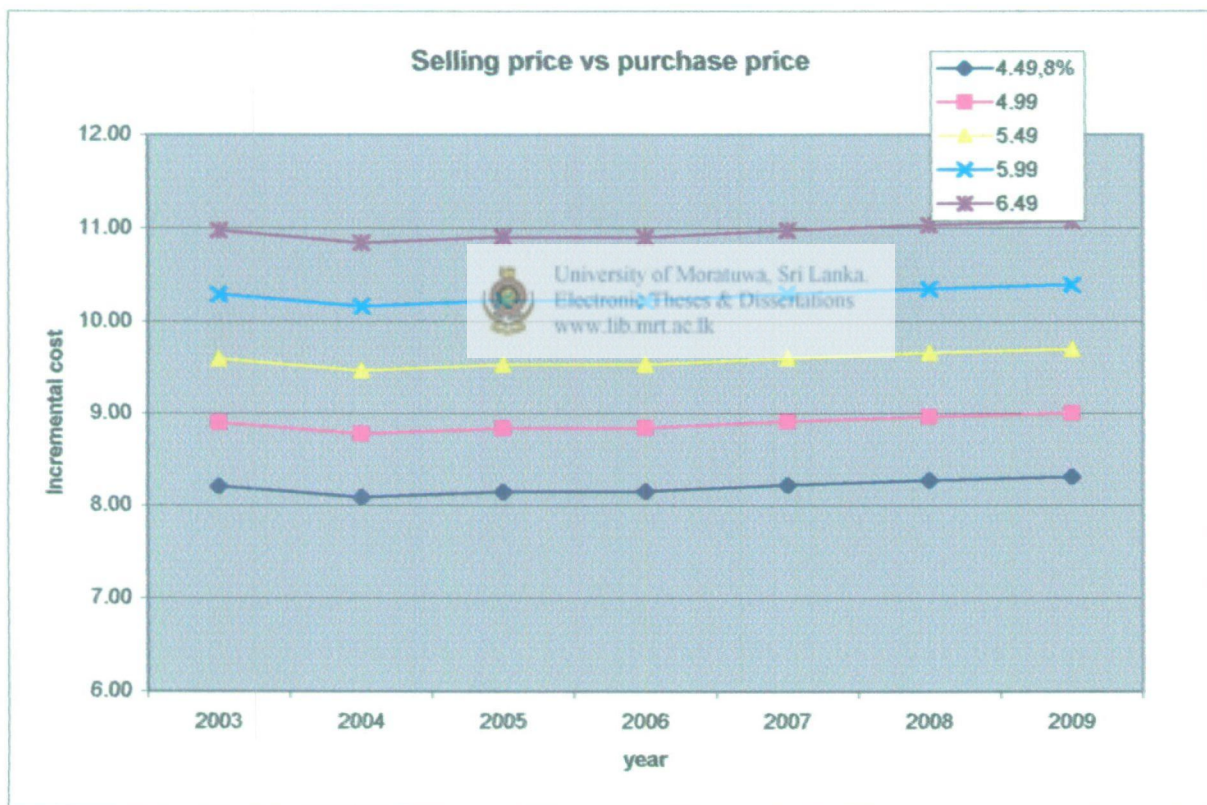
Interest rate	Purchase price Rs/kwh 4.49						
	2003	2004	2005	2006	2007	2008	2009
5.00	7.80	7.71	7.76	7.75	7.81	7.84	7.87
6.00	7.80	7.71	7.76	7.75	7.81	7.84	7.87
7.00	7.95	7.86	7.91	7.90	7.96	8.00	8.04
8.00	8.03	7.93	7.98	7.98	8.04	8.09	8.12
9.00	8.12	8.01	8.06	8.07	8.13	8.18	8.22
10.00	8.21	8.09	8.14	8.15	8.22	8.27	8.31

Selling price Vs Interest rate



INCREMENTAL COSTS(Rs./kwh) AT LV CONSUMER END

	Interest rate 10%						
	2003	2004	2005	2006	2007	2008	2009
4.49	8.21	8.09	8.14	8.15	8.22	8.27	8.31
4.99	8.90	8.78	8.84	8.84	8.91	8.96	9.00
5.49	9.59	9.47	9.53	9.53	9.60	9.65	9.69
5.99	10.28	10.16	10.22	10.22	10.29	10.34	10.39
6.49	10.98	10.84	10.91	10.90	10.98	11.04	11.08



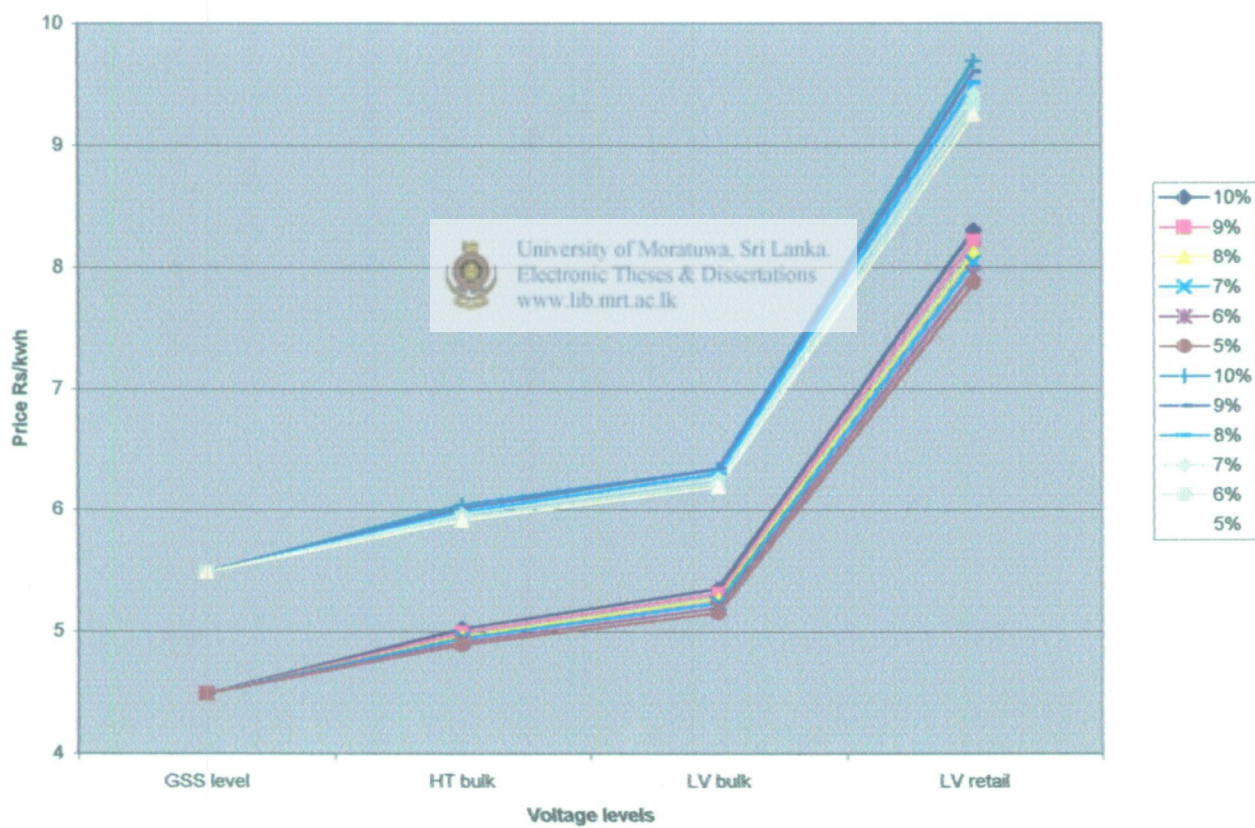
Energy and cash flows at different voltages
 Annuatised for 30 yrs at 10% interest rate
Annuatised Present worth Incremental costs
 Interest rate% 10

	2003	2004	2005	2006	2007	2008	2009
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Investment	45.98	75.90	99.99	119.07	133.86	144.98	152.97
Augmentation	12.19	22.46	34.50	47.68	61.51	75.59	89.58
O&M cost	13	25	36	45	54	62	70
Losses	3	5	8	10	12	13	15
Energy at ub distribution level	138	262	375	475	565	646	718
Augmentation	6.10	11.23	17.25	23.84	30.76	37.80	44.79
O&M cost	4	8	12	15	18	21	23
Losses	0.74	1.40	2.00	2.54	3.02	3.45	3.84
Energy at transformer LV	51	96	137	173	207	237	263
Augmentation	12.19	22.46	34.50	47.68	61.51	75.59	89.58
O&M cost	26	50	71	91	109	125	139
Losses	13	24	35	43	52	60	66
Energy at LV consumer end	38	72	103	130	155	177	197

Interest rate	Price			
	GSS level	HT bulk	LV bulk	LV retail
10	4.49	5.02	5.35	8.31
9	4.49	4.99	5.31	8.22
8	4.49	4.96	5.27	8.12
7	4.49	4.94	5.23	8.04
6	4.49	4.91	5.19	7.95
5	4.49	4.89	5.15	7.87

Interest rate	Price			
	GSS level	HT bulk	LV bulk	LV retail
10	5.49	6.04	6.34	9.69
9	5.49	6.01	6.34	9.6
8	5.49	5.98	6.3	9.51
7	5.49	5.96	6.26	9.42
6	5.49	5.93	6.22	9.33
5	5.49	5.91	6.19	9.25

Price at different Voltage levels



Appendix 4

Calculation of Average incremental costs

Annua-tised costs and Energy sales

Interest rate 10
Electricity Purchase price 4.49

	2002	2003	2004	2005	2006	2007	2008	2009
Investment cost mil Rs.	10.60	39.98	41.25	41.25	41.25	41.25	41.25	41.25
Aumentation costs mil Rs.	10.60	21.63	33.10	45.03	57.44	70.34	83.76	97.71
O& M costs	434.00	477.40	525.14	577.65	635.42	698.96	768.86	845.74
Losses GWH	198	216	235	256	280	305	332	362
Energy sales GWH	1524	1661	1811	1974	2151	2345	2556	2786

Incremental present worthed values

	2003	2004	2005	2006	2007	2008	2009
Investment cost mil Rs.	45.98	75.90	99.99	119.07	133.86	144.98	152.97
Aumentation costs mil Rs.	29.31	54.00	82.92	114.62	147.87	181.71	215.33
O& M costs	39.45	75.32	107.93	137.57	164.52	189.02	211.29
Losses GWH	16.20	30.79	43.90	55.67	66.23	75.69	84.15
Energy sales GWH	124.69	236.91	337.81	428.42	509.69	582.48	647.57

**Incremental cost based TOD tariff without considering voltage levels
(Peak cost based on contribution to the peak by each consumer category)**

Electricity Purchase price 4.49
Interest rate % 10

	2002			2005			2009		
	yerly	peak	offpeak	yerly	peak	offpeak	yerly	peak	offpeak
Domestic	343.06	91.68	251.38	444.35	105.49	338.86	627.14	130.42	496.72
Small I&C	102.51	13.54	88.97	132.77	17.66	115.11	187.39	25.11	162.28
Bulk	458.90	46.99	411.91	594.40	65.47	528.94	838.91	98.81	740.10
LECO	601.84	100.14	501.69	779.55	124.38	655.17	1100.21	168.10	932.11
West south Av	1506.30	252.35	1253.95	1951.07	313.00	1638.08	2753.64	422.44	2331.20
Street light Av	17.70	5.08	12.62	22.93	5.79	17.13	32.36	7.08	25.28
West south Nett	1524.00	257.43	1266.57	1974.00	318.79	1655.21	2786.00	429.52	2356.48
Lossess Av	198.00	48.16	149.84	256.00	56.06	199.94	363.00	70.66	292.34
System	1722.00	305.59	1416.41	2230.00	374.86	1855.14	3149.00	500.18	2648.82

Incremental Present worthd values from 2002

	Peak Price	Peak cost	Contri to peak	2005			2009		
				yerly	peak	offpeak	yerly	peak	offpeak
Domestic	6.55	130.24	0.31	76.11	10.38	65.73	145.78	19.88	125.90
Small I&C	4.24	25.21	0.06	22.74	3.10	19.64	43.56	5.94	37.62
Bulk	3.48	92.43	0.22	101.80	13.88	87.92	195.00	26.59	168.41
LECO	4.70	163.85	0.39	133.51	18.21	115.31	255.74	34.87	220.87
West south Av				334.17	45.57	288.60	640.08	87.28	552.80
Street light Av	8.19	8.40	0.02	3.93	0.54	3.39	7.52	1.03	6.50
West south Nett			100	338.09	46.10	291.99	647.61	88.31	559.30
Lossess Av				43.58	5.94	37.63	84.67	11.55	73.13
System				381.67	52.05	329.62	732.28	99.86	632.42

Incremental investment cost	99.99	152.97
Incremental Augmentation cost	82.92	215.33
Incremental O&M cost For 2002 to 2009	107.93	211.29
Incremental cost for energy	539.62	
The Incremental energy cost	0.83	
Incremental cost for capacity	420.14	

Incremental cost based TOD tariff without considering Voltage levels
 (Peak cost based on contribution to peak by each consumer category)

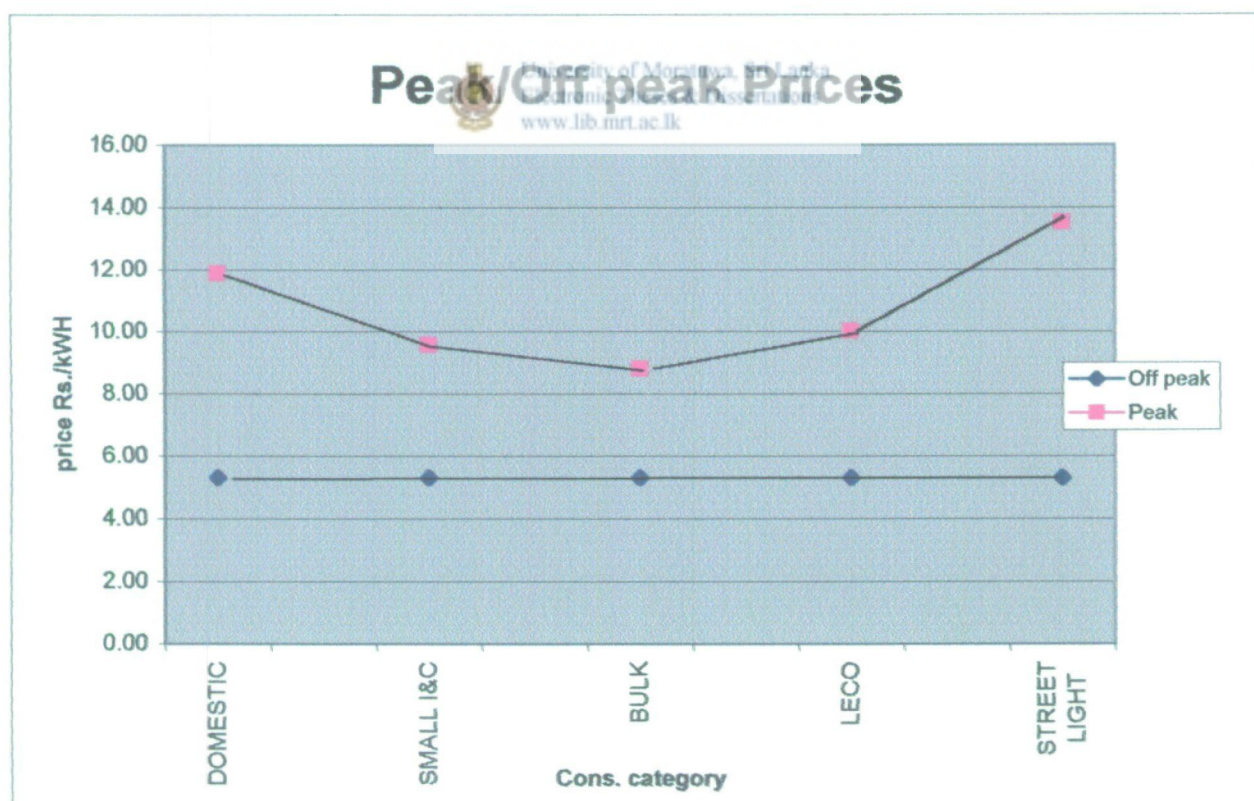
Electricity purchase price

4.49

Interest rate

10

Consumer Category	Incremental off peak		Purchase Price Rs/kwh	Selling Tariff	
	Charge Rs/kwh	Peak charge Rs/kwh		OFF Peak Rs/kwh	Peak Rs/kwh
DOMESTIC	0.83	6.55	4.49	5.32	11.88
SMALL I&C	0.83	4.24	4.49	5.32	9.57
BULK	0.83	3.48	4.49	5.32	8.80
LECO	0.83	4.70	4.49	5.32	10.02
STREET LIGHT	0.83	8.19	4.49	5.32	13.52



Appendix 5

Annuitised values of Investment & augmentation

Annuitised for 30 yrs Ann factor

9.43

At 33kV distribution								
	2002	2003	2004	2005	2006	2007	2008	2009
Investment	100	277	12					
	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60
		29.37	29.37	29.37	29.37	29.37	29.37	29.37
			1.27	1.27	1.27	1.27	1.27	1.27
Annuitised Investment	10.60	39.98	41.25	41.25	41.25	41.25	41.25	41.25
Augmentation	41.60	43.26	44.99	46.79	48.67	50.61	52.64	54.74
	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41
		4.59	4.59	4.59	4.59	4.59	4.59	4.59
			4.77	4.77	4.77	4.77	4.77	4.77
				4.96	4.96	4.96	4.96	4.96
					5.16	5.16	5.16	5.16
						5.37	5.37	5.37
							5.58	5.58
								5.81
	4.41	9.00	13.77	18.73	23.89	29.26	34.84	40.65
At LV transformer level								
Augmentation	20.80	21.63	22.50	23.40	24.33	25.31	26.32	27.37
	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21
		2.29	2.29	2.29	2.29	2.29	2.29	2.29
			2.39	2.39	2.39	2.39	2.39	2.39
				2.48	2.48	2.48	2.48	2.48
					2.58	2.58	2.58	2.58
						2.68	2.68	2.68
							2.79	2.79
								2.90
	2.21	4.50	6.89	9.37	11.95	14.63	17.42	20.32
At LV consumer end								
Augmentation	41.60	43.26	44.99	46.79	48.67	50.61	52.64	54.74
	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41
		4.59	4.59	4.59	4.59	4.59	4.59	4.59
			4.77	4.77	4.77	4.77	4.77	4.77
				4.96	4.96	4.96	4.96	4.96
					5.16	5.16	5.16	5.16
						5.37	5.37	5.37
							5.58	5.58
								5.81
	4.41	9.00	13.77	18.73	23.89	29.26	34.84	40.65

Incremental Energy and cost
Western province south
Annua-tised Investment & Augmentation

	2002	2003	2004	2005	2006	2007	2008	2009
Energy at GSS level	1722	1877	2046	2231	2431	2650	2889	3149
Investment	10.60	39.98	41.25	41.25	41.25	41.25	41.25	41.25
Augmentation	4.41	9.00	13.77	18.73	23.89	29.26	34.84	40.65
O&M cost	143.22	157.54	173.30	190.63	209.69	230.66	253.72	279.10
Losses	34.44	37.54	40.92	44.62	48.62	53.00	57.78	62.98
Energy at ub distribution level	1687.56	1839.46	2005.08	2186.38	2382.38	2597.00	2831.22	3086.02
Augmentation	2.21	4.50	6.89	9.37	11.95	14.63	17.42	20.32
O&M cost	47.74	52.51	57.77	63.54	69.90	76.89	84.57	93.03
Losses	9.02	9.83	10.72	11.69	12.73	13.88	15.14	16.50
Energy at transformer LV	617.80	673.53	733.87	800.79	871.81	950.94	1037.05	1130.40
Augmentation	4.41	9.00	13.77	18.73	23.89	29.26	34.84	40.65
O&M cost	286.44	315.08	346.59	381.25	419.38	461.31	507.45	558.19
Losses	154.54	168.63	183.36	200.69	217.65	238.12	260.08	283.52
Energy at LV consumer end	463.26	504.91	550.50	600.10	654.16	712.83	776.97	846.88
Total energy metered	1524	1661	1811	1974	2152	2345	2556	2786

Incremental cost based TOD tariff at different voltage levels

Electricity Purchase price 4.49
Interest rate % 10

	2002			2005			2009		
	yerly	peak	offpeak	yerly	peak	offpeak	yerly	peak	offpeak
Domestic	343.06	91.68	251.38	444.35	105.49	338.86	627.14	130.42	496.72
Small I&C	102.51	13.54	88.97	132.77	17.66	115.11	187.39	25.11	162.28
Bulk	458.90	46.99	411.91	594.40	65.47	528.94	838.91	98.81	740.10
LECO	601.84	100.14	501.69	779.55	124.38	655.17	1100.21	168.10	932.11
West south Av	1506.30	252.35	1253.95	1951.07	313.00	1638.08	2753.64	422.44	2331.20
Street light Av	17.70	5.08	12.62	22.93	5.79	17.13	32.36	7.08	25.28
West south Nett	1524.00	257.43	1266.57	1974.00	318.79	1655.21	2786.00	429.52	2356.48
Lossess Av	198.00	48.16	149.84	256.00	56.06	199.94	363.00	70.66	292.34
System	1722.00	305.59	1416.41	2230.00	374.86	1855.14	3149.00	500.18	2648.82

Incremental Present worth values from 2002

	Contri to peak	2005			2009		
		yerly	peak	offpeak	yerly	peak	offpeak
Domestic	0.31	76.11	10.38	65.73	145.78	19.88	125.90
Small I&C	0.06	22.74	3.10	19.64	43.56	5.94	37.62
Bulk	0.22	101.80	13.88	87.92	195.00	26.59	168.41
LECO	0.39	133.51	18.21	115.31	255.74	34.87	220.87
West south Av	100	334.17	45.57	288.60	640.08	87.28	552.80
Street light Av	0.02	3.93	0.54	3.39	7.52	1.03	6.50
West south Nett	100	338.09	46.10	291.99	647.61	88.31	559.30
Lossess Av		43.58	5.94	37.63	84.67	11.55	73.13
System		381.67	52.05	329.62	732.28	99.86	632.42



Energy and Cash flows at different voltage levels

Annuitised for 30 yrs at 10*% interest rate

Annuitised Present worth Incremental costs

Interest rate% 10

		2003	2004	2005	2006	2007	2008	2009
Energy at GSS level		141	268	382	484	576	659	732
Investment		45.98	75.90	99.99	119.07	133.86	144.98	152.97
Augmentation		12.19	22.46	34.50	47.68	61.51	75.59	89.58
O&M cost		13	25	36	45	54	62	70
Losses		3	5	8	10	12	13	15
Energy at ub distribution level		138	262	375	475	565	646	718
Augmentation		6.10	11.23	17.25	23.84	30.76	37.80	44.79
O&M cost		4.34	8.29	11.87	15.13	18.10	20.79	23.24
Losses		0.74	1.40	2.00	2.54	3.02	3.45	3.84
Energy at transformer LV		50.67	95.92	137.48	173.49	206.86	236.65	263.04
Augmentation		12.19	22.46	34.50	47.68	61.51	75.59	89.58
O&M cost		26.04	49.71	71.23	90.80	108.58	124.75	139.45
Losses		12.81	23.82	34.67	43.10	51.89	59.58	66.19
Energy at LV consumer end		37.86	72.10	102.81	130.39	154.96	177.08	196.86

Incremental cost based TOD tariff for different consumer categories at different voltage levels

Electricity Purchase price 4.49
Interest rate% 10

	yearly	peak	offpeak
GSS Level	732.28	99.86	632.42

Losses % 2 5.17 1.5
Losses GV 14.65 5.16 9.49
Investment 152.97
Augmentation 89.58
O&M costs 70

O&M	Inv+Aug	PEAK	off PEAK
0.10	2.81		
LOSSES		0.24	0.07
		3.15	0.17
Selling price to Trf		7.64	4.66

			LECO			HT Bulk 40%		
yerly	peak	offpeak	yerly	peak	offpeak	yerly	peak	offpeak
717.63	94.70	622.93	255.74	34.87	220.87	78.00	10.64	67.37

In+Aug+losses cost (F 265.71
peak cost to LECO/HT 127.70
(34.87+10.64)*265.71/94.7
Peak cost to tf 138.01
(265.71*49.19/94.7)

	contrib	peak cost	peak units	peak unit price	off peak unit price
LECO	0.81	103.44	34.87	2.97	0.17
40% HT	0.19	24.26	10.64	2.28	0.17
Selling prices					
				peak	off peak
LECO				7.46	4.66
40% HT				6.77	4.66

Transformer HT side

383.89	49.19	334.70
--------	-------	--------

Losses % 1 4.40 0.5
Losses G 3.84 2.17 1.67
Augmentation 44.79
O&M costs 23.24

O&M	Inv+Aug	PEAK	off PEAK
0.06	0.95		
Losses		0.35	0.02
		1.37	0.08
Selling price LV bulk		9.00	4.74

yearly	peak	offpeak
380.05	47.02	333.03

yearly	peak	offpeak
117.00	15.95	101.05

Transformer LV side

Transformer LV side

263.04	31.07	231.98
--------	-------	--------

			O&M cost per unit	0.71
			Off peak loes	1.73
			Total off pak unit cost	2.44
Losses%	25.16	13.59	26.71	
Losses GV	66.19	4.22	61.97	
Aggmentation		89.58		
O & M cost:	139			

	yerly	2009	
		peak	offpeak
Domestic	145.78	19.88	125.90
Small I&C	43.56	5.94	37.62
Street light	7.52	1.03	6.50
Total	196.86	26.84	170.01

	Contri to peak	Contrib factor
Domestic	0.31	0.79
Small I&C	0.06	0.15
Street light Av	0.02	0.05
Bulk	0.22	
40% bulk	0.09	0.18
LECO	0.39	0.81
West south Av		
West south Nett		
Lossess Av		
System		

Total peak 127.5836 (at the LV end)

	peak units	Peak cost Inv + Loss	per unit	O & M cost	Total peak unit cost	Off peak units	Total off peak cost	
Domestic	19.88	101.41	5.10	0.71	5.81	125.90	2.44	2.90
Small I&C	5.94	19.63	3.30	0.71	4.01	37.62	2.44	2.65
Street light	1.03	6.54	6.38	0.71	7.09	6.50	2.44	3.07

	Selling prices	
	Peak	Off peak
Domestic	14.81	7.18
Small I&C	13.02	7.18
Street ligh	16.09	7.18

If a flat tariff is offered

Domestic	8.22
Small I&C	7.98
Street light	8.40

LV End

TOD tariff for different Consumer categories and at different Voltage levels

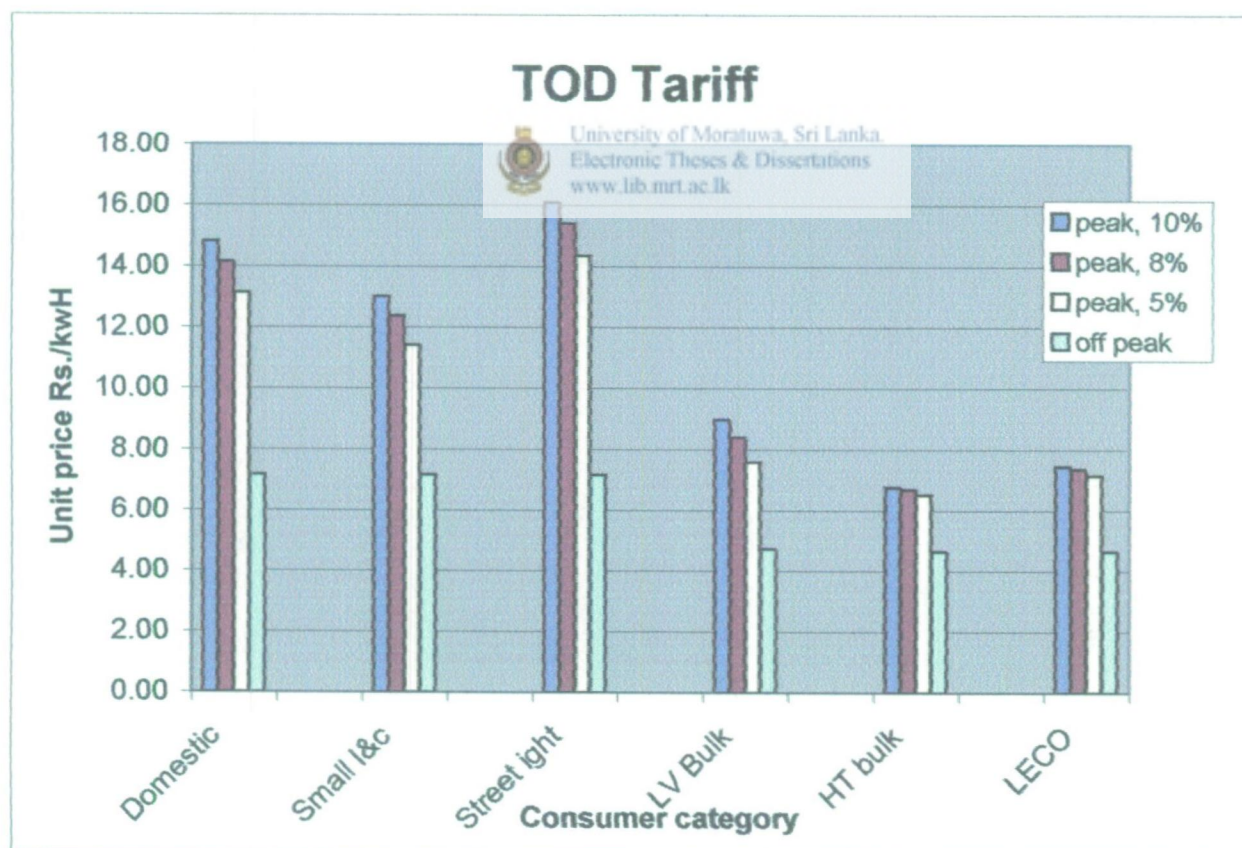
Consumer category	Interest rate					
	r=10%		r=8		r=5	
	Peak	Off peak	Peak	Off peak	Peak	Off peak
Domestic	14.81	7.18	14.15	7.18	13.13	7.18
Small I&c	13.02	7.18	12.38	7.18	11.43	7.18
Street ight	16.09	7.18	15.41	7.18	14.34	7.18
LV Bulk	9.00	4.74	8.41	4.74	7.60	4.74
HT bulk	6.77	4.66	6.70	4.66	6.53	4.66
LECO	7.46	4.66	7.36	4.66	7.15	4.66

Purchase price

4.49

4.49

4.49



Appendix 6

Depreciation

Net assets, Rs Mil	7000
rate of depreciation	2
Revaluation rate	15
New assets/year, Rs. Million	300
Growth of new assets/year	10

Year	Fixed assets	New assets	Other assets	Total assets	Revalued assets	Depreciation	Axxumilated depreciation
2000	7000	300		7300.0	7300.0	146.0	146
2001	7000	330		7330.0	8395.0	167.9	313.9
2002	7000	363		7363.0	9654.3	193.1	507.0
2003	7000	399.3		7399.3	11102.4	222.0	729.0
2004	7000	439.2		7439.2	12767.7	255.4	984.4
2005	7000	483.2		7483.2	14682.9	293.7	1278.0
2006	7000	531.5		7531.5	16885.3	337.7	1615.8
2007	7000	584.6		7584.6	19418.1	388.4	2004.1
2008	7000	643.1		7643.1	22330.9	446.6	2304.7
2009	7000	707.4		7707.4	25680.5	513.6	2650.4

Average Electricity Costs by Voltage levels

Annual costs 2001

	Capacity related	Consumer related	Total
Distribution MV			
Depreciation	67	0	67
Interest	0	0	0
Operation & Maintenance	109	0	109
Administration	49	1	50
Sub Total	225	1	226
Distribution LV Bulk			
Depreciation	30	3	33
Interest	0	0	0
O& M	55	18	73
Administration	12.5	12.5	25
Sub total	97.5	33.5	131
Distribution LV retail			
Depreciation	60	7	67
Interest	0	0	0
O& M	91	91	182
Administration	25	25	50
Sub total	176	123	299
Total cost (before profit & Tax)	498.5	157.5	656
Revenue from sales			

Note O & M 364 30% to HV - 100% Capacity related
 20 % - 75% capa related, 25% consumer related
 50% - 50% cap related, 50% Cons. Related

Depreciation 143 40% MV, cap related 100%
 20% LV bulk -90% cap, 10% cons
 40% LV 90% cap, 0% Cons

Administration 124 40% MV
 20% LV bulk 50% cap, 50% cons
 40% LV 50% cap, 50% cons

Actual cost of Electricity to consumers at at different voltage levels 2001

Buying price at GSS Rs./kWh 4.49

	MV	LV bulk	LV	All
Energy at GSS level	735	260	585	1580
Energy cost	3300.2	1167.4	2626.7	7094.2
Capacity related costs				
MV distribution cost	110	36	79	225
LV bulk cost		66	31.5	97.5
LV retil cost			176	176
Total capaacity cost	110	102	286.5	498.5
Max. demand				
Average cost Rs./kW				
Consumer related costs	MV	LV bulk	LV	All
Total cons. Cost	15.4	69	73.1	157.5
No. of consumers	3106	27719	305761	336586
Average cost Rs./consumer				
	MV	LV bulk	LV	All
Total Electricity cost	125.4	171	359.6	656
Energy cost+Elect. Cost	3425.6	1338.4	2986.3	7750.2
Energy	720	252	426	1398
Total avrage costafter GSS	0.17	0.68	0.84	0.47
Average Elect. Cost	4.76	5.31	7.01	5.54

Capacity related costs

MV costs are distributed among LV 35%,16% to LV bulk, and 49% to HV based on the energy usage

LV bulkcost - 68% to LV and 32% to LV bulk based on energy usage

Consumer related costs

MV LECO cost Rs. 20,000, 3080 HT consumers(40% of total Bulk cons.) @ Rs.5000 per consumer

LV bulk - 27719(60% of total bulk) @ Rs. 2500 per consumer

Energy and losses at different voltage levels - 2001

GSS level		1580		GSS metering	
	LV 585	LV bulk 260	HV HT 172	LECO 563	
2 % loss					HV Distribution
	573	255	168	552	HT bulk metering
1 % loss					LV Transformer
	568	252			LV bulk metering
25.6 % loss					LV network
	422				LV reatail metering

(Billed 1398 with 11.6% averge losses)

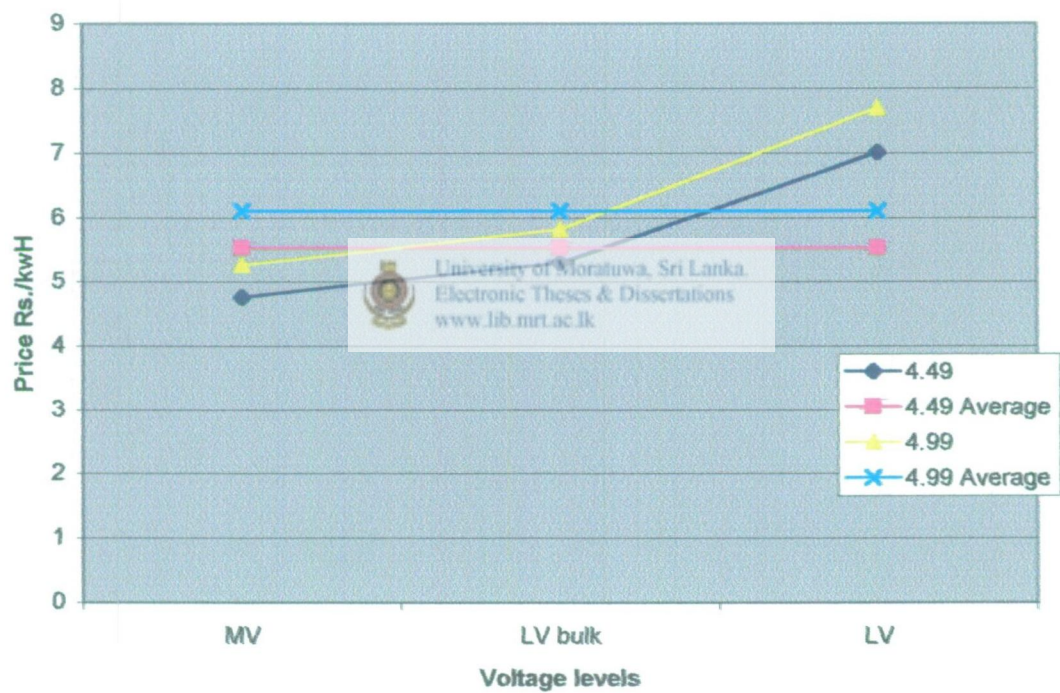


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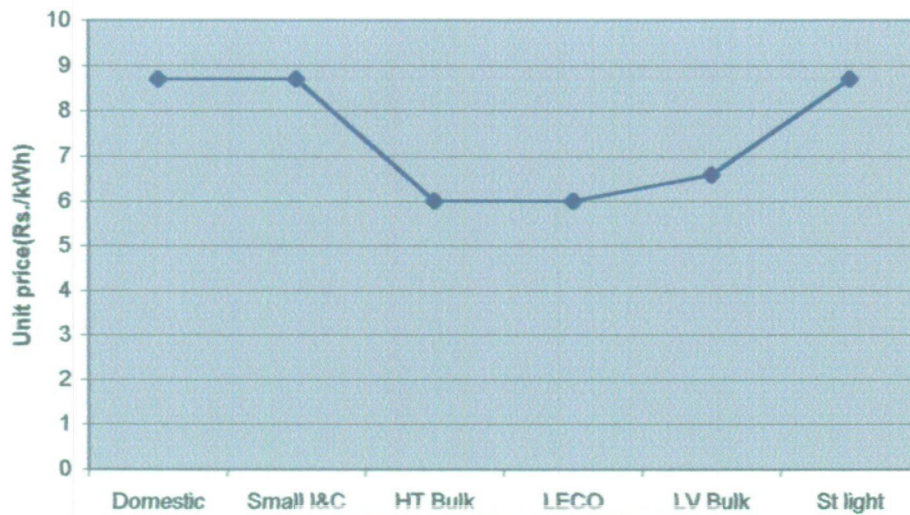
Purchase price Rs./kWH		Price at different voltage levels		
		MV Rs./kWH	LV bulk Rs./kWH	LV Rs./kWH
4.49	Av. price	4.76	5.31	7.01
		5.54	5.54	5.54
4.99	Av. price	5.27	5.83	7.7
		6.11	6.11	6.11

Average Costs



Domestic	Small I&C	HT Bulk	LECO	LV Bulk	St light
5.73	8.71	8.71	6.02	6.02	6.59
					8.71

Accounting Cost based tariff



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Energy Flow

Appendix 7

Consumer Category	Energy Demand							
	2002	2003	2004	2005	2006	2007	2008	2009
Domestic	343.06	373.90	407.66	444.15	484.42	527.87	575.36	627.14
Small I&C	102.51	111.72	121.81	132.26	144.75	157.73	171.92	187.39
Bulk	458.90	500.15	545.32	594.17	648.00	706.12	769.65	838.91
LECO	601.84	655.94	715.18	779.73	849.84	926.06	1009.38	1100.21
West south Av	1506.30	1641.71	1789.97	1950.31	2127.01	2317.77	2526.32	2753.64
Street light Av	17.70	19.29	21.03	23.69	24.99	27.23	29.68	32.36
West south Net	1524	1661	1811	1974	2152	2345	2556	2786
Lossess Av	198.00	216.00	235.00	257.00	279.00	305.00	333.00	363.00
System	1722	1877	2046	2231	2431	2650	2889	3149

[illegible]

WPS Energy Demand Peak & Off peak under different consumer categories

Consumer Category	Year 2002			Year 2003			Year 2004		
	Annual Energy	Peak Energ	Off peak Energy	Annual Energy	Peak Energ	Off peak Energy	Annual Energy	Peak Energ	off peak Energy
Domestic	343.06	112.92	230.13	373.90	118.53	255.36	407.66	124.67	282.99
Small I&C	102.51	19.18	83.33	111.72	20.85	90.87	121.81	22.69	99.12
Bulk	458.90	65.32	393.58	500.15	72.82	427.33	545.32	81.04	464.28
LECO	601.84	131.70	470.14	655.94	141.54	514.40	715.18	152.31	562.87
West south Av	1506.30	329.13	1177.17	1641.71	353.75	1287.96	1789.97	380.70	1409.26
Street light Av	17.70	5.69	12.01	19.29	5.98	13.31	21.03	6.30	14.73
West south Nett	1524	335	1189	1661	360	1301	1811	387	1424
Lossess Av	198.00	60.31	137.69	216.00	63.58	152.42	235.00	67.03	167.97
System	1722	395	1327	1877	423	1454	2046	454	1592

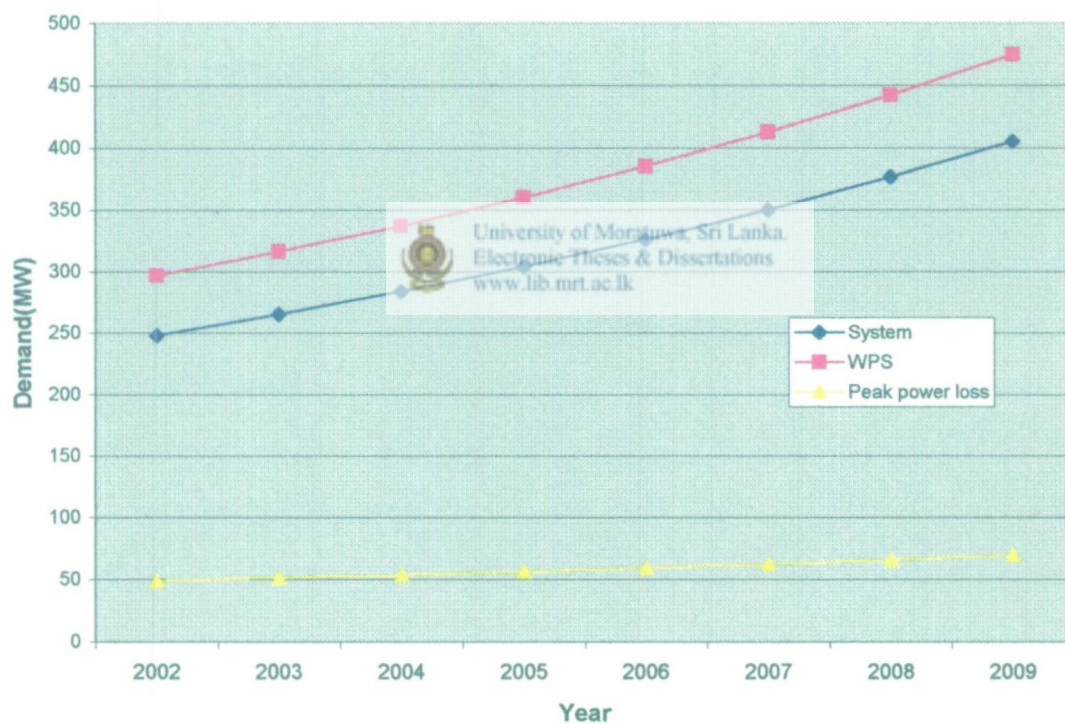
Consumer Category	Year 2005			Year 2006			Year 2007		
	Annual Energy	Peak Energ	Off peak Energy	Annual Energy	Peak Energ	Off peak Energy	Annual Energy	Peak Energ	Off peak Energy
Domestic	444.15	131.31	312.84	484.42	138.63	345.79	527.87	146.53	381.34
Small I&C	132.26	24.59	107.67	144.75	26.86	117.89	157.73	29.22	128.51
Bulk	594.17	89.92	504.25	648.00	99.70	548.30	706.12	110.27	595.84
LECO	779.73	164.05	615.68	849.84	176.79	673.05	926.06	190.65	735.41
West south Av	1950.31	409.86	1540.45	2127.01	441.98	1685.02	2317.77	476.67	1841.10
Street light Av	23.69	6.78	16.91	24.99	7.02	17.97	27.23	7.43	19.81
West south Nett	1974	417	1557	2152	449	1703	2345	484	1861
Lossess Av	257.00	71.03	185.97	279.00	75.03	203.97	305.00	79.76	225.24
System	2231	488	1743	2431	524	1907	2650	564	2086

Consumer Category	Year 2008			Year 2009		
	Annual Energy	Peak Energ	Off peak Energy	Annual Energy	Peak Energ	Off peak Energy
Domestic	575.36	155.16	420.20	627.14	164.58	462.56
Small I&C	171.92	31.80	140.12	187.39	34.61	152.78
Bulk	769.65	121.82	647.83	838.91	134.42	704.49
LECO	1009.38	205.80	803.58	1100.21	222.32	877.90
West south Av	2526.32	514.59	2011.73	2753.64	555.92	2197.73
Street light Av	29.68	7.87	21.81	32.36	8.36	24.00
West south Nett	2556	522	2034	2786	564	2222
Lossess Av	333.00	84.85	248.15	363.00	90.31	185.97
System	2889	607	2282	3149	655	2408

WPS Peak power demand 2002 - 2009

Year	2002	2003	2004	2005	2006	2007	2008	2009
WPS peak(MW)	247.9	264.9	283.6	303.9	326.1	350.1	376.4	405
System peak(MW)	296.8	316.1	337.2	360.2	385.1	412.4	442.2	474.5
Peak power loss(MW)	48.9	51.2	53.6	56.3	59	62.3	65.8	69.5

Peak Power Demand



WPS Energy Demand Peak & Off peak

Year	2002	2003	2004	2005	2006	2007	2008	2009
WPSSystem demand	1722	1877	2046	2231	2431	2650	2889	3149
Peak	395	423	454	488	524	564	607	655
Off peak	1327	1454	1592	1743	1907	2086	2282	2408
WPS Load	1524	1661	1811	1974	2152	2345	2556	2786
Peak	335	360	387	417	449	484	522	564
Off peak	1189	1301	1424	1557	1703	1861	2034	2222
Losses	198.00	216	235	257	279	305	333	363
Peak	60.31	63.58	67.03	71.03	75.03	79.76	84.85	90.31
Off peak	137.69	152.42	167.97	185.97	203.97	225.24	248.15	185.97

WPS Energy Demand 2002 - 2009

