Appendix 5.8-1 Table 1 Loss evaluation constant on construction cost base in case of HV countermeasure

COUNTERMEASURE

Assumed total countermeasure cost	100,000 JD
depreciation periods	40 year
the rate of interest	10 %
the rate of expenses	0.10226
the rate of O&M cost	0.01000

[Annual cost of countermeasure]

year		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	TOTAL
COUNTERMEASURE COST (JD)	A	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	102,259
O&M COST (JD)	B	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	10,000
TOTAL ANNUAL COST (JD)	C=A+B	11,226	11,226	11,226	11,226	11,226	11,226	11,226	11,226	11,226	11,226	112,259
COEFFICIENT OF COMPOUND INTEREST	D=(1+0.1)^-y	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386	
PRESENT VALUE (JD)	E=C*D	10,205	9,278	8,434	7,667	6,970	6,337	5,761	5,237	4,761	4,328	68,979

100,000 JD/68,979 JD = 1.450

[Annual benefit cost] (Marginal capacity cost *1 =51.204(JD/kW/YEAR) ,Loss factor =0.5783 ,Marginal energy cost *1 =0.01969(JD/kWh))

year		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	TOTAL
GROWTH RATE OF PEAK DEMAND (%) *2	F	-	7.5	6.4	6.1	6.3	5.1	5.1	4.5	4.1	3.6	
REDUCED POWER LOSS (kW)	Gn=Gn-1*(1+F)^2	1.000	1.155	1.306	1.470	1.659	1.831	2.024	2.210	2.395	2.570	
REDUCED CAPACITY COST (JD)	H=Gn*51.204	51	59	67	75	85	94	104	113	123	132	902
REDUCED ENERGY LOSS (kWh)	I=Gn*8760*0.5783	5,066	5,851	6,618	7,446	8,406	9,277	10,253	11,196	12,131	13,017	
REDUCED ENERGY COST (JD)	J=I*0.01969	100	115	130	147	165	183	202	220	239	256	1,757
REDUCED TOTAL COST (JD)	K=H+J	151	174	197	222	250	276	305	334	361	388	2,660
COEFFICIENT OF COMPOUND INTEREST	L=(1+0.1)^-y	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386	
PRESENT VALUE (JD)	M=K*L	137	144	148	152	156	156	157	156	153	150	1,508

1,508 JD/kW * 1.450 = 2,186 JD/kW

SOURCE :*1 JEA Jordan Electricity System Strict Long Run Marginal Costs
*2 JEA Electricity Demand Forecast 1995-2010 Executive Summary(Draft) Technical Studies Section/Planning Dept. June 1995

Appendix 5.8-1 Table 2 Loss evaluation constant on construction cost base in case of MV countermeasure

COUNTERMEASURE

Assumed total countermeasure cost	100,000 JD
depreciation periods	25 year
the rate of interest	10 %
the rate of expenses	0.11017
the rate of O&M cost	0.02500

[Annual cost of countermeasure]

year		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	TOTAL
COUNTERMEASURE COST (JD)	A	11,017	11,017	11,017	11,017	11,017	11,017	11,017	11,017	11,017	11,017	110,168
O&M COST (JD)	B	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	25,000
TOTAL ANNUAL COST (JD)	C=A+B	13,517	13,517	13,517	13,517	13,517	13,517	13,517	13,517	13,517	13,517	135,168
COEFFICIENT OF COMPOUND INTEREST	D=(1+0.1)^-y	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386	
PRESENT VALUE (JD)	E=C*D	12,288	11,171	10,155	9,232	8,393	7,630	6,936	6,306	5,732	5,211	83,055

100,000 JD/83,055 JD = 1.204

[Annual benefit cost]

(Marginal capacity cost *1 =67.32(JD/kW/YEAR) ,Loss factor =0.5783 ,Marginal energy cost *1 =0.02055(JD/kWh))

year		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	TOTAL
GROWTH RATE OF PEAK DEMAND (%) *2	F	-	7.5	6.4	6.1	6.3	5.1	5.1	4.5	4.1	3.6	
REDUCED POWER LOSS (kW)	Gn=Gn-1*(1+F)^2	1.000	1.155	1.306	1.470	1.659	1.831	2.024	2.210	2.395	2.570	
REDUCED CAPACITY COST (JD)	H=Gn*67.32	67	78	88	99	112	123	136	149	161	173	1,186
REDUCED ENERGY LOSS (kWh)	I=Gn*8760*0.5783	5,066	5,851	6,618	7,446	8,406	9,277	10,253	11,196	12,131	13,017	
REDUCED ENERGY COST (JD)	J=I*0.02055	104	120	136	153	173	191	211	230	249	267	1,834
REDUCED TOTAL COST (JD)	K=H+J	171	198	224	252	284	314	347	379	410	440	3,020
COEFFICIENT OF COMPOUND INTEREST	L=(1+0.1)^-y	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386	
PRESENT VALUE (JD)	M=K*L	156	164	168	172	177	177	178	177	174	170	1,712

1,712 JD/kW * 1.204 = 2,061 JD/kW

SOURCE :*1 JEA Jordan Electricity System Strict Long Run Marginal Costs
*2 JEA Electricity Demand Forecast 1995-2010 Executive Summary(Draft) Technical Studies Section/Planning Dept. June 1995

Appendix 5.8-1 Table 3 Loss evaluation constant on construction cost base in case of MV countermeasure by Capcitor bank

COUNTERMEASURE

Assumed total countermeasure cost	100,000 JD
depreciation periods	25 year
the rate of interest	10 %
the rate of expenses	0.11017
the rate of O&M cost	0.02500

[Annual cost of countermeasure]

year		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	TOTAL
COUNTERMEASURE COST (JD)	A	11,017	11,017	11,017	11,017	11,017	11,017	11,017	11,017	11,017	11,017	110,168
O&M COST (JD)	B	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	25,000
TOTAL ANNUAL COST (JD)	C=A+B	13,517	13,517	13,517	13,517	13,517	13,517	13,517	13,517	13,517	13,517	135,168
COEFFICIENT OF COMPOUND INTEREST	D=(1+0.1)^-y	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386	
PRESENT VALUE (JD)	E=C*D	12,288	11,171	10,155	9,232	8,393	7,630	6,936	6,306	5,732	5,211	83,055

100,000 JD/83,055 JD = 1.204

[Annual benefit cost]

(Marginal capacity cost *1 =67.32(JD/kW/YEAR) ,Loss factor =0.5783 ,Marginal energy cost *1 =0.02055(JD/kWh))

year		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	TOTAL
GROWTH RATE OF PEAK DEMAND (%) *2	F	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
REDUCED POWER LOSS (kW)	Gn=Gn-1*(1+F)^2	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
REDUCED CAPACITY COST (JD)	H=Gn*67.32	67	67	67	67	67	67	67	67	67	67	673
REDUCED ENERGY LOSS (kWh)	I=Gn*8760*0.5783	5,066	5,066	5,066	5,066	5,066	5,066	5,066	5,066	5,066	5,066	
REDUCED ENERGY COST (JD)	J=I*0.02055	104	104	104	104	104	104	104	104	104	104	1,041
REDUCED TOTAL COST (JD)	K=H+J	171	171	171	171	171	171	171	171	171	171	1,714
COEFFICIENT OF COMPOUND INTEREST	L=(1+0.1)^-y	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386	
PRESENT VALUE (JD)	M=K*L	156	142	129	117	106	97	88	80	73	66	1,053

1,053 JD/kW * 1.204 = 1,268 JD/kW

SOURCE :*1 JEA Jordan Electricity System Strict Long Run Marginal Costs
*2 JEA Electricity Demand Forecast 1995-2010 Executive Summary(Draft) Technical Studies Section/Planning Dept. June 1995

Appendix 5.8-1 Table 4 Loss evaluation constant on construction cost base in case of LV countermeasure by Capcitor bank

COUNTERMEASURE

Assumed total countermeasure cost	100,000 JD
depreciation periods	25 year
the rate of interest	10 %
the rate of expenses	0.11017
the rate of O&M cost	0.02500

[Annual cost of countermeasure]

year		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	TOTAL
COUNTERMEASURE COST (JD)	A	11,017	11,017	11,017	11,017	11,017	11,017	11,017	11,017	11,017	11,017	110,168
O&M COST (JD)	B	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	25,000
TOTAL ANNUAL COST (JD) C=A+B		13,517	13,517	13,517	13,517	13,517	13,517	13,517	13,517	13,517	13,517	135,168
COEFFICIENT OF COMPOUND INTEREST	D=(1+0.1)^-y	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386	
PRESENT VALUE (JD)	E=C*D	12,288	11,171	10,155	9,232	8,393	7,630	6,936	6,306	5,732	5,211	83,055

100,000 JD/83,055 JD = 1.204

[Annual benefit cost]

(Marginal capacity cost *1 =99.6(JD/kW/YEAR) ,Loss factor =0.5783 ,Marginal energy cost *1 =0.02243(JD/kWh))

year		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	TOTAL
GROWTH RATE OF PEAK DEMAND (%) *2	F	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
REDUCED POWER LOSS (kW)	Gn=Gn-1*(1+F)^2	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
REDUCED CAPACITY COST (JD)	H=Gn*99.6	100	100	100	100	100	100	100	100	100	100	996
REDUCED ENERGY LOSS (kWh)	I=Gn*8760*0.5783	5,066	5,066	5,066	5,066	5,066	5,066	5,066	5,066	5,066	5,066	
REDUCED ENERGY COST (JD)	J=I*0.02243	114	114	114	114	114	114	114	114	114	114	1,136
REDUCED TOTAL COST (JD) K=H+J		213	213	213	213	213	213	213	213	213	213	2,132
COEFFICIENT OF COMPOUND INTEREST	L=(1+0.1)^-y	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386	
PRESENT VALUE (JD)	M=K*L	194	176	160	146	132	120	109	99	90	82	1,310

1,310 JD/kW * 1.204 = 1,577 JD/kW

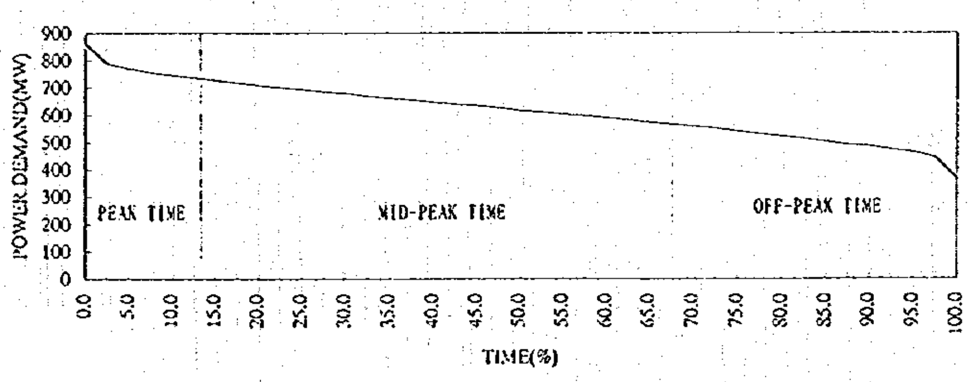
SOURCE :*1 JEA Jordan Electricity System Strict Long Run Marginal Costs
*2 JEA Electricity Demand Forecast 1995-2010 Executive Summary(Draft) Technical Studies Section/Planning Dept. June 1995

Appendix 5.8-2 Interconnected System Yearly Duration of Power Demand for 1995

(MW)

Time(%)	STEAM130	STEAM66	STEAM33	GAS	DIESEL	OTHERS	TOTAL	
0.0	258	236	43	260	31	34	862	
2.5	243	254	65	183	15	28	788	
5.0	239	237	62	183	20	29	770	PEAK TIME
7.5	247	246	61	164	13	26	757	
10.0	239	241	60	163	16	26	745	
12.5	243	231	58	161	16	27	736	
15.0	245	217	69	153	15	28	727	
17.5	229	233	61	155	14	25	717	
20.0	198	233	56	178	17	27	709	
22.5	231	235	54	142	13	26	701	
25.0	213	236	59	146	14	26	694	
27.5	207	228	62	147	15	26	685	
30.0	201	227	57	156	13	25	679	
32.5	220	221	65	125	13	25	669	
35.0	207	227	60	133	10	25	662	
37.5	224	217	59	118	12	26	656	
40.0	223	215	64	111	9	25	647	
42.5	218	207	64	114	12	25	640	MID-PEAK TIME
45.0	219	199	66	116	9	25	634	
47.5	190	209	67	124	11	25	626	
50.0	211	203	61	105	9	24	616	
52.5	224	196	57	105	7	22	611	
55.0	217	196	62	97	9	22	603	
57.5	220	195	60	91	8	23	597	
60.0	202	189	61	105	10	22	589	
62.5	223	184	55	93	6	21	582	
65.0	216	179	55	97	7	20	574	
67.5	227	180	43	95	4	17	566	
70.0	192	184	51	106	6	19	558	
72.5	214	176	46	91	5	19	551	
75.0	191	182	47	97	5	18	540	
77.5	195	174	45	94	5	18	531	
80.0	197	180	46	81	4	15	523	
82.5	187	175	41	90	4	16	513	
85.0	184	160	49	88	4	18	503	OFF-PEAK TIME
87.5	183	158	43	87	4	16	491	
90.0	206	138	46	77	3	16	486	
92.5	173	155	46	81	4	15	474	
95.0	152	150	50	94	4	14	464	
97.5	150	141	45	91	4	14	445	
100.0	0	172	64	103	12	13	364	
				Average Power Demand(MW)			616.70732	

Interconnected System Yearly Load Duration Curve for 1995



	Peak Time	Mid-Peak Time	Off-Peak Time
Periods	0% to 12.5%	12.5% to 66.6%	66.6% to 100%
Average Power Demand(MW)	776.3MW	648.5MW	500.6MW
Load Factor (f)	0.901	0.752	0.581
Loss Factor(=0.3f+0.7f^2)	0.8386	0.6214	0.4106

Average Loss Factor {=(0.8386*3+0.6214*13+0.4106*8)/24}=0.5783

Appendix 5.9-1 Countermeasure by Same Voltage Line Construction for LV Systems

No.	Name	Existing Loss(kW)	After C/M Loss(kW)	Reduction Loss(kW)	(B)Benefit (JD)	Kind of Cond.	Length (km)	(C)Line Cost(JD)	(B)-(C) (JD)	(B)/(C)
L1	N AZRAQ1	29.434	20.988	8.446	21,656	4BA120	0.470	5,288	16,368	4.10
L2	N AZRAQ2	28.242	13.658	14.584	37,393	4BA120	1.225	13,781	23,612	2.71
L3	N AZRAQ3	18.469	10.230	8.239	21,125	4BA120	0.690	7,763	13,362	2.72
L6	ARDAA2	15.667	10.714	4.953	12,699	4BA120	0.470	5,288	7,412	2.40
L8	ARDAA4	4.014	3.210	0.804	2,061	4BA120	0.130	1,463	599	1.41
L9	DEERALA1	6.672	5.335	1.337	3,428	4BA120	0.130	1,463	1,966	2.34
L10	DEERALA2	8.408	5.979	2.429	6,228	4BA120	0.280	3,150	3,078	1.98
L11	DEERALA3	10.229	6.651	3.578	9,174	4BA120	0.480	5,400	3,774	1.70
L14	N KRYIMA1	6.649	6.226	0.423	1,085	4BA120	0.070	788	297	1.38
L15	N KRYIMA2	7.967	6.972	0.995	2,551	4BA120	0.120	1,350	1,201	1.89
L16	N KRYIMA3	8.583	7.215	1.368	3,508	4BA120	0.250	2,813	695	1.25
L17	N KRYIMA4	7.519	6.820	0.699	1,792	4BA120	0.095	1,069	723	1.68
L18	KHAZMA1	13.888	9.624	4.264	10,933	4BA120	0.280	3,150	7,783	3.47
L19	KHAZMA2	7.816	6.577	1.239	3,177	4BA120	0.170	1,913	1,264	1.66
L20	KHAZMA3	20.042	8.788	11.254	28,855	4BA120	0.650	7,313	21,543	3.95
L21	S KARAMA1	40.568	11.525	29.043	74,466	4BA120	1.270	14,288	60,179	5.21
L22	S KARAMA2	14.774	11.681	3.093	7,930	4BA120	0.200	2,250	5,680	3.52
L23	S KARAMA3	16.328	12.955	3.373	8,648	4BA120	0.200	2,250	6,398	3.84
L25	LI HOUS1	11.934	7.910	4.024	10,318	4BA120	0.460	5,175	5,143	1.99
L27	LI HOUS3	15.878	7.788	8.09	20,743	4BA120	0.660	7,425	13,318	2.79
L28	LI HOUS4	7.248	6.054	1.194	3,061	4BA120	0.150	1,688	1,374	1.81
L31	JUHFIA3	7.337	4.397	2.94	7,538	4BA120	0.300	3,375	4,163	2.23
L33	RUMTHA1	14.708	9.589	5.119	13,125	4BA120	0.500	5,625	7,500	2.33
L34	RUMTHA2	6.976	6.681	0.295	756	4BA120	0.040	450	306	1.68
L35	RUMTHA3	8.944	6.978	1.966	5,041	4BA120	0.310	3,488	1,553	1.45
L36	RUMTHA4	7.780	7.095	0.685	1,756	4BA120	0.110	1,238	519	1.42
L37	RUMTHA5	8.707	7.176	1.531	3,925	4BA120	0.140	1,575	2,350	2.49
L38	H RUMTH1	6.612	5.206	1.406	3,605	4BA120	0.130	1,463	2,142	2.46
L42	H RUMTH5	6.476	5.780	0.696	1,785	4BA120	0.130	1,463	322	1.22
L43	KAZAALI1	15.239	9.275	5.964	15,292	4BA120	0.600	6,750	8,542	2.27

Appendix 5.9-1 Countermeasure by Same Voltage Line Construction for LV Systems

No.	Name	Existing	After C/M	Reduction	(B)Benefit	Kind of	Length	(C)Line	(B)-(C)	(B)/(C)
L44	KAZAALI2	10.552	8.008	2.544	6,523	4BA120	0.330	3,713	2,810	1.76
L45	KAZAALI3	7.417	6.623	0.794	2,036	4BA120	0.170	1,913	123	1.06
L46	KAZAALI4	7.918	7.052	0.866	2,220	4BA120	0.120	1,350	870	1.64
L48	DABAT NR1	9.550	8.168	1.382	3,543	4BA120	0.130	1,463	2,081	2.42
L49	DABAT NR2	9.909	7.816	2.093	5,366	4BA120	0.260	2,925	2,441	1.83
L50	DABAT NR3	12.818	10.409	2.409	6,177	4BA120	0.200	2,250	3,927	2.75
L51	DABAT NR4	9.222	7.405	1.817	4,659	4BA120	0.190	2,138	2,521	2.18
L52	DABAT NR5	10.345	8.014	2.331	5,977	4BA120	0.340	3,825	2,152	1.56
L53	RAFEED1	9.115	5.137	3.978	10,200	4BA120	0.580	6,525	3,675	1.56
L54	RAFEED2	6.924	6.048	0.876	2,246	4BA120	0.140	1,575	671	1.43
L55	RAFEED3	6.093	4.630	1.463	3,751	4BA120	0.220	2,475	1,276	1.52
L57	HNEAKEN1	29.643	16.363	13.28	34,050	WASP	1.029	11,576	22,474	2.94
L58	HNEAKEN2	28.549	15.251	13.298	34,096	WASP	0.915	10,294	23,802	3.31
L59	HNEAKEN3	25.596	13.868	11.728	30,071	WASP	0.610	6,863	23,208	4.38
L60	HNEAKEN4	19.804	12.594	7.21	18,486	WASP	0.515	5,794	12,693	3.19
L61	HNEAKEN5	21.264	16.524	4.74	12,153	WASP	0.455	5,119	7,035	2.37
L62	SAYEGH1	47.348	15.554	31.794	81,520	WASP	1.510	16,988	64,532	4.80
L63	SAYEGH2	9.576	8.535	1.041	2,669	WASP	0.150	1,688	982	1.58
L68	HUSSIEN3	8.936	8.239	0.697	1,787	WASP	0.110	1,238	550	1.44
L69	HUSSIEN4	12.318	9.573	2.745	7,038	WASP	0.310	3,488	3,551	2.02
L70	HUSSIEN5	21.766	12.224	9.542	24,466	WASP	0.772	8,685	15,781	2.82
L72	SWEFEH1	14.434	8.106	6.328	16,225	WASP	0.410	4,613	11,612	3.52
L73	SWEFEH2	10.327	7.579	2.748	7,046	WASP	0.290	3,263	3,783	2.16
L74	SWEFEH3	8.154	6.483	1.671	4,284	WASP	0.165	1,856	2,428	2.31
L77	THEHEEB2	9.025	5.319	3.706	9,502	WASP	0.440	4,950	4,552	1.92
L79	THEHEEB4	9.112	5.861	3.251	8,336	WASP	0.570	6,413	1,923	1.30
L80	ZEGHAN1	5.628	3.561	2.067	5,300	WASP	0.200	2,250	3,050	2.36
L81	ZEGHAN2	4.252	3.987	0.265	679	WASP	0.050	563	117	1.21
	TOTAL			270.695	694,062			246,274	447,788	

Appendix 5.9-2 Countermeasure by Higher Voltage Introduction for LV Systems

No	Name	Existing Loss(kW)	Loss With Project(kW)	Reduction Loss(kW)	(B)Benefit (JD)	Kind of Con. for LV-Line	Length (km)	Line Cost(JD)	Kind of Con. for HV-Line	Length (km)	Line Cost(JD)	Kind of Transformer	Transformer Cost(JD)	(C)Total Cost(JD)	(B)-(C) (JD)	(B)/(C)
L1	N AZRAO1	29.434	19.285	10.149	26,022	4BA120	0.455	5,119	1OH100	0.125	1,406	14PM250	8,518	15,043	10,979	1.73
L2	N AZRAO2	28.242	7.577	20.665	52,985	4BA120	0	0	1OH100	0.910	10,238	14PM150	7,718	17,956	35,030	2.95
L3	N AZRAO3	18.469	5.859	12.610	32,332	4BA120	0	0	1OH100	0.515	5,794	14PM150	7,718	13,512	18,820	2.39
L6	ARDAA2	15.667	5.497	10.170	26,076	4BA120	0	0	DOG	0.515	6,842	34PM150	8,863	15,705	10,371	1.66
L11	DEERALA3	10.229	4.440	5.789	14,843	4BA120	0	0	DOG	0.380	5,048	34PM150	8,863	13,911	932	1.07
L20	KHAZMA3	20.042	5.039	15.003	38,468	4BA120	0.07	788	DOG	0.390	5,181	34PM150	8,863	14,832	23,636	2.59
L21	S KARAMA1	40.568	6.965	32.603	86,158	4BA120	0	0	DOG	0.420	5,580	34PM250	9,835	15,415	70,743	5.59
L23	S KARAMA3	16.328	10.198	6.130	15,717	4BA120	0	0	DOG	0.110	1,461	34PM250	9,835	11,296	4,421	1.39
L25	LI HOUS1	11.934	5.299	6.635	17,012	4BA120	0	0	1OH100	0.330	3,713	14PM150	7,718	11,431	5,582	1.49
L27	LI HOUS3	15.878	5.546	10.332	26,491	4BA120	0.10	1,125	1OH100	0.220	2,475	14PM250	8,518	12,118	14,373	2.19
L33	RUMTHA1	14.708	6.279	8.429	21,612	4BA120	0.150	1,688	OAK	0.270	3,587	34GM250	12,125	17,399	4,213	1.24
L43	KAZAALI1	15.239	6.034	9.205	23,602	4BA120	0.170	1,913	6A150	0.290	8,120	64GM250	9,780	19,813	3,789	1.19
L57	HNEAKEN1	29.643	11.905	17.738	45,480	WASP	0.28	3,150	1AC150	0.283	7,641	14PU250	16,690	27,481	17,999	1.65
L58	HNEAKEN2	28.549	11.706	16.843	43,185	WASP	0.21	2,363	1AC150	0.175	4,725	14PU250	16,690	23,778	19,408	1.82
L59	HNEAKEN3	25.596	10.634	14.962	38,363	WASP	0.05	563	1AC150	0.295	7,965	14PU250	16,690	25,218	13,145	1.52
L60	HNEAKEN4	19.804	10.338	9.466	24,271	WASP	0.07	788	1AC150	0.235	6,345	14PU250	16,690	23,823	448	1.02
L62	SAYEGH1	47.348	9.032	38.316	98,242	WASP	0.302	3,398	1AC150	0.402	10,854	14PU400	17,690	31,942	66,301	3.08
L70	HUSSIEN5	21.766	8.579	13.187	33,811	WASP	0.32	3,600	1AC150	0.146	3,942	14PU400	17,690	25,232	8,579	1.31
	TOTAL			259.232	664.671									335.901	328.769	

Appendix 5.9-3 Summary of LV Feeder Loss Reduction Study Result

No.	Name	Tr. Cap. (kVA)	Volt. Ratio	Peak Load	Feeder num.	Length (m)	Load (A) R	Load (A) S	Load (A) T	(I) Imean (A)	Kind of Conductor	(L) Length (km)	Existing Loss(kW)	Net Benefit HV C/M	Net Benefit SV C/M	Net Benefit Maximum	Vmin Before	Vmin After
L1	N AZRAQ1	630	11/4	550.9	4	1,465	319.60	337.28	367.20	341.36	WASP2	1.47	29.4	10,979	16,368	16,368	178.16	199.46
L2	N AZRAQ2	630	11/4	550.9	4	1,250	163.20	197.20	244.80	201.73	LCU95A	1.25	28.2	35,030	23,612	35,030	130.01	221.1
L3	N AZRAQ3	630	11/4	550.9	4	760	204.00	176.80	149.60	176.80	WASP2	0.76	18.5	18,820	13,362	18,820	185.53	231.3
L4	N AZRAQ4	630	11/4	550.9	4	690	23.12	27.20	47.60	32.64	WASP2	0.69	5.0	0	0	0	226.8	
L5	ARDAA1	250	33/4	221.4	4	710	65.28	24.48	38.08	42.61	ANT	0.71	3.2	0	0	0	217.02	
L6	ARDAA2	250	33/4	221.4	4	1,280	136.00	95.20	197.20	142.80	WASP2	1.28	15.7	10,371	7,412	10,371	158.23	205.6
L7	ARDAA3	250	33/4	221.4	4	885	32.64	73.24	24.48	43.45	WASP2	0.89	3.0	0	0	0	219.17	
L8	ARDAA4	250	33/4	221.4	4	450	74.80	102.00	43.52	73.44	ANT	0.45	4.0	0	599	599	216.31	223.54
L9	DEERALA1	630	33/4	382.7	5	430	34.00	163.20	163.20	120.13	WASP2	0.43	6.7	0	1,966	1,966	208.71	217.29
L10	DEERALA2	630	33/4	382.7	5	580	136.00	163.20	204.00	167.73	WASP2	0.58	8.4	0	3,078	3,078	203.9	218.29
L11	DEERALA3	630	33/4	382.7	5	815	170.00	204.00	163.20	179.07	WASP2	0.82	10.2	932	3,774	3,774	198	215.56
L12	DEERALA4	630	33/4	382.7	5	130	34.00	34.00	20.40	29.47	WASP2	0.13	2.8	0	0	0	232.41	
L13	DEERALA5	630	33/4	382.7	5	580	32.64	27.20	19.04	26.29	WASP2	0.58	3.1	0	0	0	229.8	
L14	N KRYIMA1	250	33/4	354.1	4	370	149.60	99.28	73.44	107.44	WASP2	0.37	6.6	0	297	297	218.3	221.35
L15	N KRYIMA2	250	33/4	354.1	4	530	88.40	165.92	138.72	131.01	WASP2	0.53	8.0	0	1,201	1,201	214.51	219.47
L16	N KRYIMA3	250	33/4	354.1	4	570	95.20	134.64	133.28	121.04	WASP2	0.57	8.6	0	695	695	208.31	217.43
L17	N KRYIMA4	250	33/4	354.1	4	600	152.32	123.76	96.56	124.21	WASP2	0.60	7.5	0	723	723	216.89	220.73
L18	KHAZMA1	250	33/4	303.7	3	1,180	115.60	108.80	163.20	129.20	ANT	1.18	13.9	0	7,783	7,783	180.01	199.3
L19	KHAZMA2	250	33/4	303.7	3	670	156.40	136.00	95.20	129.20	WASP2	0.67	7.8	0	1,264	1,264	210.78	217.23
L20	KHAZMA3	250	33/4	303.7	3	860	190.40	95.20	183.60	156.40	ANT	0.86	20.0	23,636	21,543	23,636	157.21	223.3
L21	S KARAMA1	630	33/4	490.9	4	780	244.80	340.00	272.00	285.60	WASP2	0.78	40.6	70,743	60,179	70,743	149.64	230.9
L22	S KARAMA2	630	33/4	490.9	4	940	122.40	108.80	272.00	167.73	WASP2	0.94	14.8	0	5,680	5,680	179.15	192.51
L23	S KARAMA3	630	33/4	490.9	4	1,200	231.20	272.00	47.60	183.60	WASP2	1.20	16.3	4,421	6,398	6,398	167.13	180.44
L24	S KARAMA4	630	33/4	490.9	4	750	19.04	81.60	47.60	49.41	WASP2	0.75	5.1	0	0	0	219.29	
L25	LI HOUS1	630	11/4	519.4	4	630	204.00	204.00	176.80	194.93	WASP2	0.63	11.9	5,582	5,143	5,582	206.27	231.5
L26	LI HOUS2	630	11/4	519.4	4	660	81.60	81.60	74.80	79.33	WASP2	0.66	5.6	0	0	0	225.27	
L27	LI HOUS3	630	11/4	519.4	4	420	340.00	272.00	244.80	285.60	WASP2	0.42	15.9	14,373	13,318	14,373	200.29	232.4
L28	LI HOUS4	630	11/4	519.4	4	350	190.40	149.60	108.80	149.60	WASP2	0.35	7.2	0	1,374	1,374	219.77	226.19
L29	JUHFIA1	250	33/4	175.7	4	1,210	75.00	50.00	75.00	66.67	LUAL185	1.21	4.8	0	0	0	199.49	
L30	JUHFIA2	250	33/4	176	4	1,360	25.00	25.00	25.00	25.00	ANT	1.36	1.9	0	0	0	227.06	
L31	JUHFIA3	250	33/4	176	4	900	75.00	137.50	137.50	116.67	LUAL50	0.90	7.3	0	4,163	4,163	192.45	209.68

Appendix 5.9-3 Summary of LV Feeder Loss Reduction Study Result

No.	Name	Tr. Cap. (kVA)	Volt. Ratio	Peak Load	Feeder num.	Length (m)	Load (A) R	Load (A) S	Load (A) T	(I) Imean (A)	Kind of Conductor	(L) Length (km)	Existing Loss(kW)	Net Benefit HV C/M	Net Benefit SV C/M	Net Benefit Maximum	Vmin Before	Vmin After
L32	JUHFIA4	250	33/.4	176	4	900	37.50	37.50	37.50	37.50	LUAL50	0.90	2.4	0	0	0	221.1	
L33	RUMTHA1	630	33/.4	530	5	550	250.00	162.50	225.00	212.50	LBAL120	0.55	14.7	4,213	7,500	7,500	194.16	212.58
L34	RUMTHA2	630	33/.4	530	5	450	100.00	125.00	150.00	125.00	LBAL120	0.45	7.0	0	306	306	214.77	216.1
L35	RUMTHA3	630	33/.4	530	5	570	137.50	137.50	137.50	137.50	LBAL120	0.57	8.9	0	1,553	1,553	215.69	221.82
L36	RUMTHA4	630	33/.4	530	5	630	125.00	150.00	150.00	141.67	LBAL120	0.63	7.8	0	519	519	214.65	217.73
L37	RUMTHA5	630	33/.4	530	5	730	187.50	50.00	137.50	125.00	LAL95	0.73	8.7	0	2,350	2,350	194.33	203.35
L38	H RUMTH1	500	6.6/.4	354.4	5	580	100.00	162.50	100.00	120.83	LBAL120	0.58	6.6	0	2,142	2,142	206.89	215.33
L39	H RUMTH2	500	6.6/.4	354	5	640	75.00	100.00	112.50	95.83	LBAL120	0.64	5.1	0	0	0	215.7	
L40	H RUMTH3	500	6.6/.4	354	5	560	87.50	125.00	62.50	91.67	LAL295	0.56	4.4	0	0	0	214.57	
L41	H RUMTH4	500	6.6/.4	354	5	840	62.50	100.00	100.00	87.50	LBAL120	0.84	4.5	0	0	0	216.18	
L42	H RUMTH5	500	6.6/.4	354	5	950	100.00	100.00	100.00	100.00	LAL295	0.95	6.5	0	322	322	203.93	207.33
L43	KAZAALI1	500	6.6/.4	510.7	5	480	225.00	225.00	212.50	220.83	LBAL120	0.48	15.2	3,789	8,542	8,542	206.56	220.09
L44	KAZAALI2	500	6.6/.4	510.7	5	550	150.00	150.00	175.00	158.33	LBAL120	0.55	10.6	0	2,810	2,810	204.81	217.55
L45	KAZAALI3	500	6.6/.4	510.7	5	600	125.00	100.00	87.50	104.17	LBAL120	0.60	7.4	0	123	123	215.62	220.11
L46	KAZAALI4	500	6.6/.4	510.7	5	440	100.00	162.50	187.50	150.00	LBAL120	0.44	7.9	0	870	870	214.24	217.8
L47	KAZAALI5	500	6.6/.4	510.7	5	530	93.50	75.00	75.00	81.17	LBAL120	0.53	6.2	0	0	0	221.19	
L48	DABAT NR1	500	6.6/.4	480.9	5	880	87.50	187.50	112.50	129.17	LAL295	0.88	9.6	0	2,081	2,081	198.85	205.75
L49	DABAT NR2	500	6.6/.4	481	5	690	150.00	125.00	150.00	141.67	LAL295	0.69	9.9	0	2,441	2,441	206.31	216.07
L50	DABAT NR3	500	6.6/.4	481	5	890	62.50	87.50	212.50	120.83	LAL295	0.89	12.8	0	3,927	3,927	171.46	184.84
L51	DABAT NR4	500	6.6/.4	481	5	640	150.00	175.00	150.00	158.33	LAL295	0.64	9.2	0	2,521	2,521	210.97	218.33
L52	DABAT NR5	500	6.6/.4	481	5	920	87.50	118.75	162.50	122.92	LAL295	0.92	10.3	0	2,152	2,152	188.21	203.22
L53	RAFEED1	250	33/.4	217.4	4	400	75.00	100.00	75.00	83.33	ANT2	0.40	9.1	0	3,675	3,675	169.24	200.12
L54	RAFEED2	250	33/.4	217.4	4	1,070	50.00	50.00	125.00	75.00	LAL95	1.07	6.9	0	671	671	172.69	180.86
L55	RAFEED3	250	33/.4	217.4	4	1,230	75.00	100.00	62.50	79.17	ANT2	1.23	6.1	0	1,276	1,276	178.63	192.37
L56	RAFEED4	250	33/.4	217.4	4	558	50.00	75.00	75.00	66.67	LAL95	0.56	3.9	0	0	0	211.45	
L57	HNEAKEN1	1,000	11/.4	943.4	5	500	295.20	252.15	325.95	291.10	LCU70	0.50	29.6	17,999	22,474	22,474	179.01	209.54
L58	HNEAKEN2	1,000	11/.4	943.4	5	420	430.50	424.35	393.60	416.15	LCU70	0.42	28.5	19,408	23,802	23,802	191.31	214.4
L59	HNEAKEN3	1,000	11/.4	943.4	5	660	184.50	231.24	246.00	220.58	LAL295	0.66	25.6	13,145	23,208	23,208	171.47	206.66
L60	HNEAKEN4	1,000	11/.4	943.4	5	350	291.51	172.20	159.90	207.87	LCU70	0.35	19.8	448	12,693	12,693	174.89	208.72
L61	HNEAKEN5	1,000	11/.4	943.4	5	650	196.80	215.25	246.00	219.35	LCU70	0.65	21.3	0	7,035	7,035	173.93	196.41
L62	SAYEGH1	500	11/.4	553.2	4	580	479.70	473.55	479.70	477.65	LCU70	0.58	47.3	66,301	64,532	66,301	164.73	223.9
L63	SAYEGH2	500	11/.4	553.2	4	580	154.98	147.60	147.60	150.06	LCU70	0.58	9.6	0	982	982	209.52	214.03

Appendix 5.9-3 Summary of LV Feeder Loss Reduction Study Result

No.	Name	Tr. Cap.	Volt.	Peak	Feeder	Length	Load (A)			(I) Imean	Kind of	(L) Length	Existing	Net Benefit			Vmin	
		(kVA)	Ratio	Load	num.	(m)	R	S	T	(A)	Conductor	(km)	Loss(kW)	HV C/M	SV C/M	Maximum	Before	After
L64	SAYEGH3	500	11/.4	553.2	4	600	98.40	63.96	83.64	82.00	LCU70	0.60	7.9	0	0	0	205.53	
L65	SAYEGH4	500	11/.4	553.2	4	530	61.50	88.56	110.70	86.92	LCU70	0.53	7.5	0	0	0	208.14	
L66	HUSSIEN1	500	11/.4	590.3	6	220	20.91	70.11	36.90	42.64	LCU70	0.22	7.1	0	0	0	220.65	
L67	HUSSIEN2	500	11/.4	590.3	6	330	98.40	45.51	110.70	84.87	LCU70	0.33	7.7	0	0	0	215.53	
L68	HUSSIEN3	500	11/.4	590.3	6	380	62.73	137.76	147.60	116.03	LCU70	0.38	8.9	0	550	550	207.48	211.71
L69	HUSSIEN4	500	11/.4	590.3	6	480	186.96	156.21	211.56	184.91	LCU70	0.48	12.3	0	3,551	3,551	201.57	210.88
L70	HUSSIEN5	500	11/.4	590.3	6	480	356.70	302.58	334.56	331.28	LCU70	0.48	21.8	8,579	15,781	15,781	190.72	211.63
L71	HUSSIEN6	500	11/.4	590.3	6	520	88.56	61.50	110.70	86.92	LCU70	0.52	7.9	0	0	0	213.4	
L72	SWEFEH1	500	11/.4	380.5	4	500	178.35	189.42	290.28	219.35	LCU70	0.50	14.4	0	11,612	11,612	174.24	202.49
L73	SWEFEH2	500	11/.4	380.5	4	700	140.22	159.90	202.95	167.69	LCU70	0.70	10.3	0	3,783	3,783	189.84	202.08
L74	SWEFEH3	500	11/.4	380.5	4	550	159.90	135.30	184.50	159.90	LCU70	0.55	8.2	0	2,428	2,428	202.89	209.27
L75	SWEFEH4	500	11/.4	380.5	4	330	30.75	46.74	41.82	39.77	LCU70	0.33	3.5	0	0	0	232.41	
L76	THEHEEB1	250	11/.4	191.2	4	1,070	24.60	18.25	70.11	37.65	LAL295	1.07	3.1	0	0	0	200.62	
L77	THEHEEB2	250	11/.4	191.2	4	1,465	76.26	68.88	113.16	86.10	LAL295	1.47	9.0	0	4,552	4,552	158.12	186.8
L78	THEHEEB3	250	11/.4	191.2	4	760	38.13	65.19	30.75	44.69	LAL295	0.76	3.0	0	0	0	207.89	
L79	THEHEEB4	250	11/.4	191.2	4	1,310	114.39	104.55	98.40	105.78	LAL295	1.31	9.1	0	1,923	1,923	180.1	198.21
L80	ZEGHAN1	200	11/.4	114.3	4	890	135.30	39.36	34.44	69.70	LAL295	0.89	5.6	0	3,050	3,050	169.38	189.94
L81	ZEGHAN2	200	11/.4	114.3	4	625	100.86	95.94	86.10	94.30	LAL295	0.63	4.3	0	117	117	204.78	206.06
	TOTAL													328,769	447,788	483,544		

Appendix 5.9-4 Countermeasure by Same Voltage Line Construction for MV System

Independent Study by OPTEL

Utility		NEPCO				JEPCO				IDECO				Total
Line name		JV North	JV Middle	JV South	JVSBYDR	Dulcie	OAIA	MadabaA	MadabaB	Emrawa	Samma	Kufranj	Khaldia	
Send-out power P KW		18122	8220	9705	6170	12650	18550	3457	3215	14017	12923	10461	3240	120730
Q KVAR		12420	6316	7614	5083	9605	15261	2488	2390	11391	10435	8321	2442	93766
Ampere		378	178	212	140	278	420	224	210	316	291	234	71	
Out-going conductor		UG.AL 300	ACSR 100	ACSR 100	UG.AL 300	UG.AL 300	UG.AL 300	UG.AL 150	UG.AL 240	AAA 100	AAA 150	AAA 100	AAA 100	
Length of U.G. cable		3.2			0.3	1.1	0.156	Cable area						
Main conductor		ACSR 200	ACSR 100	ACSR 100	ACSR100	ACSR 150	ACSR 150	ACSR 50	ACSR 50	AAA 100	AAA 100	AAA 100	AAA 100	
Same voltage countermeasure														
Cable km		6.4				1.1	0.312	1.383						
Double ckt km		18.37					16.42			15.61	14.51	3.5		
Single ckt km		7.87	29.91	28.12	26.43	10.48	3.54	0.485		6.91	9.1	18		
Loss														
Old loss kW		1611	719.2	895.3	508.4	420.7	1157.7	119.5	68	1275.6	998.4	697.4	73.6	8544.8
New loss kW		428	319.9	288.1	210.4	209.3	232.6	92.9	68	291.7	217.7	229.4	73.6	2661.6
Loss reduction kW		1183	399.3	607.2	287.7	211.4	925.1	26.6	0	983.9	780.7	468	0	5872.9
Benefit JD (2061JD*kW)		2,438,163	822,957	1,251,439	592,950	435,695	1,906,631	54,823	0	2,027,818	1,609,023	964,548	0	12,104,047
Construction cost JD														
Item	unit cost													
33 kV CB for S/S	60,000	120,000	60,000	60,000	60,000	60,000	180,000			120,000	120,000	120,000		900,000
33 kV cable	50,000	320,000				55,000	31,200			0	0	0	0	406,200
OH 2ckt	26,570	488,091					436,279			414,758	385,531	92,995	0	1,817,654
OH 1ckt	13,285	104,553	397,354	373,574	351,123	139,227	47,029			91,799	120,894	239,130	0	1,864,683
11 kV CB	25,000							25,000						25,000
11 kV Cable	27,000							37,341						37,341
11 kV OH	13,285							6,443						6,443
Total construction cost JD		1,032,644	457,354	433,574	411,123	254,227	694,508	68,784	0	626,557	626,424	452,125	0	5,057,321
Net benefit JD(benefit-cost)		1,405,519	365,603	817,865	181,827	181,469	1,212,123	-13,962	0	1,401,261	982,599	512,423	0	7,046,726
Voltage drop	old %	17.2	13.4	13.9	14.26	7.2	12.5	8.7	8.3	17.9	15.6	15.7	6.6	
	new %	5.8	8	6.2	8.5	4.4	4.8	7.8	8.3	6.9	6.1	9.8	6.6	
Loss rate in line	old %	8.89	8.75	9.23	8.24	3.33	6.24	3.46	2.12	9.10	7.73	6.67	2.27	7.08
	new %	2.53	4.09	3.17	3.58	1.68	1.32	2.71	2.12	2.24	1.79	2.30	2.27	2.32
Multiplier		0.9*1.36	1.36	0.9*1.36	1.36	1+(2*.23)	0.93*1.23	1.23	1.23	1.25	1.25	1+(2*.25)	1+(2*.25)	
(Recent record Ampere)		248	132	144	100	220	290	178	142	218	233	182	65	

Appendix 5.9-5 Result of Loss Reduction Countermeasure by Higher Voltage Introduction for MV System

Study area		QAIA	Emrawa	Samma	JV North	TOTAL
Counter measure						
132 kV T/L km		11	15.6	12.9	22.6	62.1
132 / 33 kV S/S 2*40 MVA		1	1	1	1	4.0
33 kV Cable km						
33 kV OH 2ckt km						
33 kV OH 1ckt km		6.0	4.4	3.7	6.8	20.9
Loss						
Old loss kW		1157.7	1275.6	991.7	1611	5,036.0
New loss kW		79.2	229.1	214.2	143.4	665.9
Loss reduction kW		1078.5	1046.5	777.5	1467.6	4,370.1
Benefit JD (2061JD*kW)		2,222,789	2,156,837	1,602,428	3,024,724	9,006,776.1
Construction cost						
Item	unit cost					
132 kV T/L	84,000	924,000	1,310,400	1,083,600	1,898,400	5,216,400.0
S/S	490,000	490,000	490,000	490,000	490,000	1,960,000.0
132 kV CB	100,000	200,000	200,000	200,000	200,000	800,000.0
33 kV CB	60,000	60,000				60,000.0
33 kV Cable	50,000					
33 kV OH 2ckt	26,570					
33 kV OH 1ckt	13,285	79,710	58,454	49,155	90,338	277,656.5
Total construction costJD		1,753,710	2,058,854	1,822,755	2,678,738	8,314,056.5
Net benefit JD (benefit-cost)		469,079	97,983	-220,327	345,986	692,719.6

Appendix 5.9-6 Effect of Capacitor for Low Voltage Feeders

Substation	No	Sent Out (kW)	(I)Current (A)	Reduction (kW)	Benefit (JD)	Required Capacity (kV	Cost (JD)	Merit (JD)	B/C	Vmin. before	Vmin. after
NAZRAQ	1	197.8	341.36	5.190	8,185	52.5	210	7,974	38.9	178.2	189.3
	2	116.9	201.73	4.940	7,790	31.1	124	7,666	62.7	130.0	144.7
	3	102.4	176.80	2.890	4,558	27.2	109	4,449	41.9	185.5	192.2
	4	18.9	32.64	0.070	110	5.0	20	90	5.5	226.8	230.0
ARDAA	1	24.7	42.61	0.210	331	6.6	26	305	12.6	217.0	220.8
	2	82.6	142.80	2.830	4,463	22.0	88	4,375	50.8	158.2	162.4
	3	25.1	43.45	0.170	268	6.7	27	241	10.0	219.2	222.5
	4	42.5	73.44	0.380	599	11.3	45	554	13.3	216.3	220.2
DEERALA	1	70.6	120.13	0.830	1,309	18.8	75	1,234	17.4	208.7	215.7
	2	98.6	167.73	1.200	1,892	26.2	105	1,788	18.1	203.9	209.9
	3	105.2	179.07	1.580	2,492	28.0	112	2,380	22.3	198.0	204.5
	4	17.3	29.47	0.010	16	4.6	18	-3	0.9	232.4	232.4
	5	11.7	26.29	0.050	79	3.1	12	66	6.3	229.8	232.4
NKRYIMA	1	61.8	107.44	0.380	599	16.4	66	534	9.1	218.3	222.1
	2	75.4	131.01	0.660	1,041	20.0	80	961	13.0	214.5	218.5
	3	69.7	121.04	0.780	1,230	18.5	74	1,156	16.6	208.3	215.3
	4	71.5	124.21	0.560	883	19.0	76	807	11.6	216.9	221.0
KHAZMA	1	74.5	129.20	2.130	3,359	19.8	79	3,280	42.4	180.0	186.0
	2	74.5	129.20	0.860	1,356	19.8	79	1,277	17.1	210.8	214.6
	3	90.2	156.40	3.420	5,393	24.0	96	5,297	56.3	157.2	170.1
SKARAMAI	1	161.8	285.60	7.690	12,127	43.0	172	11,955	70.5	149.6	157.0
	2	95.0	167.73	2.270	3,580	25.2	101	3,479	35.5	179.1	184.6
	3	104.0	183.60	2.600	4,100	27.6	111	3,990	37.1	167.1	181.5
	4	28.0	49.41	0.240	378	7.4	30	349	12.7	219.3	222.1
LOW-INC	1	113.0	194.93	1.600	2,523	30.0	120	2,403	21.0	206.3	213.1
	2	46.0	79.33	0.280	442	12.2	49	393	9.0	225.3	229.0
	3	165.5	285.60	2.430	3,832	44.0	176	3,656	21.8	200.3	206.0
	4	86.7	149.60	0.620	978	23.0	92	886	10.6	219.8	223.0
JUHFIA	1	37.7	66.67	0.659	1,039	10.0	40	999	26.0	199.5	204.8
	2	14.1	25.00	0.050	79	3.8	15	64	5.3	227.1	229.1

	3	65.9	116.67	1.201	1,894	17.5	70	1,824	27.0	192.5	199.7
	4	21.2	37.50	0.173	273	5.6	23	250	12.1	221.1	223.7
RAMTHATO	1	120.2	212.50	2.116	3,337	31.9	128	3,209	26.1	194.2	200.1
	2	70.7	125.00	0.494	779	18.8	75	704	10.4	214.8	218.8
	3	77.8	137.50	0.906	1,429	20.7	83	1,346	17.3	215.7	219.2
	4	80.1	141.67	0.662	1,044	21.3	85	959	12.3	214.7	218.9
	5	70.7	125.00	0.857	1,351	18.8	75	1,276	18.0	194.3	201.5
HAYSHAM	1	68.4	120.83	0.783	1,235	18.2	73	1,162	17.0	206.9	210.0
	2	54.2	95.83	0.470	741	14.4	58	684	12.9	215.7	219.0
	3	51.9	91.67	0.311	490	13.8	55	435	8.9	214.6	218.5
	4	49.5	87.50	0.336	530	13.2	53	477	10.1	216.2	219.8
	5	56.6	100.00	0.754	1,189	15.0	60	1,129	19.8	203.9	208.6
KAZALEH	1	124.7	220.83	2.116	3,337	33.1	132	3,204	25.2	206.6	211.3
	2	89.4	158.33	1.132	1,785	23.7	95	1,690	18.8	204.8	208.9
	3	58.8	104.17	0.474	747	15.6	62	685	12.0	215.6	219.0
	4	84.7	150.00	0.579	913	22.5	90	823	10.1	214.2	218.3
	5	45.8	81.17	0.217	342	12.2	49	294	7.0	221.2	224.2
DABETNEME	1	72.9	129.17	1.009	1,591	19.4	78	1,514	20.5	198.9	203.3
	2	80.0	141.67	1.084	1,709	21.3	85	1,624	20.1	206.3	211.2
	3	68.2	120.83	1.695	2,673	18.1	73	2,601	36.9	171.5	178.9
	4	89.4	158.33	0.940	1,482	23.8	95	1,387	15.6	211.0	215.5
	5	69.4	122.92	1.176	1,855	18.4	74	1,781	25.1	188.2	195.7
RAFEED	1	47.0	83.33	1.445	2,279	12.5	50	2,229	45.6	169.2	174.5
	2	42.3	75.00	0.986	1,555	11.2	45	1,510	34.6	172.7	178.5
	3	44.7	79.17	0.812	1,281	11.9	47	1,233	27.0	178.6	184.8
	4	37.6	66.67	0.348	549	10.0	40	509	13.7	211.5	216.4
HNEAKEN	1	160.1	291.10	4.25	6,702	42.5	170	6,532	39.4	179.0	186.6
	2	228.9	416.15	4.021	6,341	60.8	243	6,098	26.1	191.3	198.4
	3	121.3	220.58	3.4	5,362	32.2	129	5,233	41.6	171.5	179.6
	4	114.3	207.87	2.185	3,446	30.4	122	3,324	28.4	174.9	180.1
	5	120.6	219.35	2.491	3,928	32.1	128	3,800	30.6	173.9	181.4
SAYEGH	1	261.6	477.65	8.637	13,621	69.5	278	13,343	49.0	164.7	176.7
	2	82.2	150.06	0.709	1,118	21.8	87	1,031	12.8	209.5	213.6
	3	44.9	82.00	0.367	579	11.9	48	531	12.1	205.5	210.5

	4	47.6	86.92	0.283	446	12.6	51	396	8.8	208.1	212.8
HUSSIN	1	23.4	42.64	0.023	36	6.2	25	11	1.5	220.7	224.0
	2	46.6	84.87	0.153	241	12.4	50	192	4.9	215.5	218.9
	3	63.8	116.03	0.405	639	16.9	68	571	9.4	207.5	212.9
	4	101.6	184.91	1.115	1,758	27.0	108	1,650	16.3	201.6	207.1
	5	182.0	331.28	3.098	4,886	48.4	193	4,692	25.3	190.7	198.1
	6	47.8	86.92	0.178	281	12.7	51	230	5.5	213.4	217.2
SWEFEYH	1	112.6	219.35	2.335	3,682	29.9	120	3,563	30.8	174.2	180.8
	2	86.1	167.69	1.473	2,323	22.9	91	2,231	25.4	189.8	196.3
	3	82.1	159.90	1.017	1,604	21.8	87	1,517	18.4	202.9	207.2
	4	20.4	39.77	0.034	54	5.4	22	32	2.5	232.4	232.4
THUHEBE	1	20.7	37.65	0.259	408	5.5	22	386	18.5	200.6	204.1
	2	47.4	86.10	1.497	2,361	12.6	50	2,310	46.8	158.1	163.6
	3	24.6	44.69	0.222	350	6.5	26	324	13.4	207.9	211.0
	4	58.3	105.78	1.515	2,389	15.5	62	2,327	38.6	180.1	184.9
ZEGHAN	1	38.4	69.70	0.942	1,486	10.2	41	1,445	36.4	169.4	173.9
	2	51.9	94.30	0.653	1,030	13.8	55	975	18.7	204.8	207.4
Total		5,236.8		88.880	140,164	1,391.3	5,565	134,599	25.2		

Appendix 5.9-7 Effect of Capacitor for Medium Voltage Feeders

Company	Feeder Name	Load at LV in D/S kW	Sent out power: Without countermeasure kW	kVar	Amp.	pf	With C.M. (kW)	Main conductor	Loss reduction kW	Benefit JD 1268*kW	Ideally distributed: Capacitor kVA	Cost JD	B-C	B/C	Minimum voltage: Without C.M. (%)	With C.M. (%)
NEPCO	JV North	15318.0	18128.0	12471.0	378.1	82.4	17865.0	ACSR200 IBIS	263.0	333,484	4,070	16,279	317,205	20.5	84.6	87.0
	JV Middle	7509.0	8234.0	6405.0	179.3	78.9	8037.0	ACSR100 DOG	197.0	249,796	1,995	7,980	241,816	31.3	88.4	90.9
	JV South	8687.0	9707.0	7667.0	212.5	78.5	9470.0	ACSR100 DOG	237.0	300,516	2,308	9,232	291,284	32.6	84.1	87.4
	JVS Bayadel	5568.0	6170.0	5083.0	137.4	77.2	6014.0	ACSR100 DOG	156.0	197,808	1,479	5,917	191,891	33.4	87.6	92.0
JEPCO	QAIA	17169.0	18529.0	15211.0	411.9	77.3	18187.0	ACSR150 DINGO	342.0	433,656	4,561	18,246	415,410	23.8	80.3	85.5
	Dulel	12168.0	12637.0	9631.0	273.0	79.5	12536.0	ACSR150 DINGO	101.0	128,068	3,233	12,931	115,137	9.9	94.8	96.1
	Madaba A	3299.4	3448.6	2463.0	222.4	81.4	3418.3	UGAL240 RABIT	30.3	38,420	877	3,506	34,914	11.0	91.4	92.7
	Madaba B	3101.0	3211.2	2376.0	209.7	80.4	3188.9	UGAL240 RABIT	22.3	28,276	824	3,295	24,981	8.6	87.8	90.5
	Madaba C	896.0	908.2	669.7	59.2	80.5	906.4	UGAL 240	1.8	2,282	238	952	1,330	2.4	97.0	97.9
	Madaba D	354.0	357.6	263.8	23.3	80.5	357.2	UGAL 240	0.4	507	94	376	131	1.3	98.4	98.9
IDECO	Emrawa	12551.0	14006.0	11371.0	310.0	77.6	13639.0	AAA100 OAK	367.0	465,356	3,335	13,338	452,018	34.9	84.1	89.5
	Samma	11732.0	12916.0	10423.0	285.2	77.8	12623.0	AAA100 OAK	293.0	371,524	3,117	12,468	359,056	29.8	86.3	91.2
	Kufranj	9648.0	10461.0	8321.0	229.7	78.3	10271.0	AAA100 OAK	190.0	240,920	2,563	10,253	230,667	23.5	86.1	89.4
	Khaldia	3120.0	3232.0	2429.0	69.5	79.9	3217.0	AAA100 OAK	15.0	19,020	829	3,316	15,704	5.7	95.7	97.1
	Total	111120.4	121945.6	94784.5		79.0	119729.8		2215.8	2,809,634	29,522	118,090	2,691,545	23.8	124.66	128.61

Calculated condition (1)Power factor at low voltage side in distribution substation to be improved from 80 % to 90 %

(2)Loss reduction was calculated only medium voltage line and distribution substation transformer's loss.

(3)Sending out voltage was assumed to be kept at same level before and after power factor improvement

(4)Capacitors are to be ideally distributed in low voltage side of distribution substations

NOTE ; C.M. means counetrmeasure

Appendix 5.9-8 Effect of Improving Unbalance Factor

Com.	Substation Name	No.	Sent Out: Load (A) R	S	T	Mean	Max-Min	Unbalance (UBF)	Sent Out kW	Loss Reduction by Improving UBF: Before kW	Before Rate %	After kW	After Rate %	Reduction kW	Reduction Rate %	Minimum Voltage (V) Before	After
NEPCO	NORTH AZRAQ	1	319.6	337.3	367.2	341.4	47.6	0.14	197.795	24.733	12.50	24.454	12.36	0.279	0.14	178.2	190.3
NEPCO	NORTH AZRAQ	2	163.2	197.2	244.8	201.7	81.6	0.40	116.891	23.541	20.14	21.893	18.73	1.648	1.41	130.0	167.9
NEPCO	NORTH AZRAQ	3	204.0	176.8	149.6	176.8	54.4	0.31	102.444	13.767	13.44	13.207	12.89	0.560	0.55	185.5	195.5
NEPCO	NORTH AZRAQ	4	23.1	27.2	47.6	32.6	24.5	0.75	18.913	0.309	1.63	0.224	1.18	0.085	0.45	226.8	232.4
NEPCO	AL ARDAA	1	65.3	24.5	38.1	42.6	40.8	0.96	24.656	0.980	3.97	0.681	2.76	0.299	1.21	217.0	229.3
NEPCO	AL ARDAA	2	136.0	95.2	197.2	142.8	102.0	0.71	82.624	13.487	16.32	10.186	12.33	3.301	4.00	158.2	192.1
NEPCO	AL ARDAA	3	32.6	73.2	24.5	43.5	48.8	1.12	25.142	0.788	3.13	0.417	1.66	0.371	1.48	219.2	231.3
NEPCO	AL ARDAA	4	74.8	102.0	43.5	73.4	58.5	0.80	42.492	1.835	4.32	1.451	3.41	0.384	0.90	216.3	227.1
NEPCO	DEER ALA	1	34.0	163.2	163.2	120.1	129.2	1.08	69.732	3.939	5.65	1.943	2.79	1.996	2.86	208.7	228.6
NEPCO	DEER ALA	2	136.0	163.2	204.0	167.7	68.0	0.41	97.361	5.676	5.83	5.109	5.25	0.567	0.58	203.9	219.2
NEPCO	DEER ALA	3	170.0	204.0	163.2	179.1	40.8	0.23	103.939	7.496	7.21	7.214	6.94	0.282	0.27	198.0	210.5
NEPCO	DEER ALA	4	34.0	34.0	20.4	29.5	13.6	0.46	17.104	0.042	0.25	0.035	0.20	0.007	0.04	232.4	232.4
NEPCO	DEER ALA	5	32.6	27.2	19.0	26.3	13.6	0.52	15.262	0.190	1.24	0.171	1.12	0.019	0.12	229.8	232.4
NEPCO	NORTH KRYIMA	1	149.6	99.3	73.4	107.4	76.2	0.71	61.848	1.800	2.91	1.337	2.16	0.463	0.75	218.3	226
NEPCO	NORTH KRYIMA	2	88.4	165.9	138.7	131.0	77.5	0.59	75.418	3.118	4.13	2.514	3.33	0.604	0.80	214.5	221.4
NEPCO	NORTH KRYIMA	3	95.2	134.6	133.3	121.0	39.4	0.33	69.677	3.734	5.36	3.422	4.91	0.312	0.45	208.3	216.8
NEPCO	NORTH KRYIMA	4	152.3	123.8	96.6	124.2	55.8	0.45	71.504	2.671	3.74	2.354	3.29	0.317	0.44	216.9	222.5
NEPCO	KHAZMA	1	115.6	108.8	163.2	129.2	54.4	0.37	74.508	10.157	13.63	9.338	12.53	0.819	1.10	180.0	199.4
NEPCO	KHAZMA	2	156.4	136.0	95.2	129.2	61.2	0.47	74.508	4.085	5.48	3.621	4.86	0.464	0.62	210.8	217.4
NEPCO	KHAZMA	3	190.4	95.2	183.6	156.4	95.2	0.61	90.194	16.311	18.08	13.681	15.17	2.630	2.92	157.2	190.8
NEPCO	SOUTH KARAMA	1	244.8	340.0	272.0	285.6	95.2	0.33	161.759	36.616	22.64	34.617	21.40	1.999	1.24	149.6	174.2
NEPCO	SOUTH KARAMA	2	122.4	108.8	272.0	167.7	163.2	0.97	95.001	10.822	11.39	6.407	6.74	4.415	4.65	179.2	214.1
NEPCO	SOUTH KARAMA	3	231.2	272.0	47.6	183.6	224.4	1.22	103.988	12.377	11.90	5.812	5.59	6.565	6.31	167.1	215.6
NEPCO	SOUTH KARAMA	4	19.0	81.6	47.6	49.4	62.6	1.27	27.987	1.152	4.12	0.573	2.05	0.579	2.07	219.3	230.3
NEPCO	LOW I. HOUSING	1	204.0	204.0	176.8	194.9	27.2	0.14	112.984	7.625	6.75	7.495	6.63	0.130	0.12	206.3	212.3
NEPCO	LOW I. HOUSING	2	81.6	81.6	74.8	79.3	6.8	0.09	45.982	1.309	2.85	1.301	2.83	0.008	0.02	225.3	226.8
NEPCO	LOW I. HOUSING	3	340.0	272.0	244.8	285.6	95.2	0.33	165.535	11.568	6.99	10.726	6.48	0.842	0.51	200.3	212.9
NEPCO	LOW I. HOUSING	4	190.4	149.6	108.8	149.6	81.6	0.55	86.709	2.938	3.39	2.452	2.83	0.486	0.56	219.8	226.8
IDECO	JUHFIA	1	75.0	50.0	75.0	66.7	25.0	0.38	37.678	3.139	8.33	2.878	7.64	0.261	0.69	199.5	210.5
IDECO	JUHFIA	2	25.0	25.0	25.0	25.0	0.0	0.00	14.129	0.236	1.67	0.236	1.67	0.000	0.00	227.1	227.7
IDECO	JUHFIA	3	75.0	137.5	137.5	116.7	62.5	0.54	65.936	5.722	8.68	4.748	7.20	0.974	1.48	192.5	211.2
IDECO	JUHFIA	4	37.5	37.5	37.5	37.5	0.0	0.00	21.194	0.823	3.88	0.823	3.88	0.000	0.00	221.1	221.7
IDECO	RUMTHA TOWN	1	250.0	162.5	225.0	212.5	87.5	0.41	120.168	10.083	8.39	9.210	7.66	0.873	0.73	194.2	208.9
IDECO	RUMTHA TOWN	2	100.0	125.0	150.0	125.0	50.0	0.40	70.687	2.351	3.33	2.179	3.08	0.172	0.24	214.8	221.1
IDECO	RUMTHA TOWN	3	137.5	137.5	137.5	137.5	0.0	0.00	77.756	4.319	5.55	4.319	5.55	0.000	0.00	215.7	216.2
IDECO	RUMTHA TOWN	4	125.0	150.0	150.0	141.7	25.0	0.18	80.112	3.155	3.94	3.093	3.86	0.062	0.08	214.7	218.1
IDECO	RUMTHA TOWN	5	187.5	50.0	137.5	125.0	137.5	1.10	70.687	4.082	5.77	2.234	3.16	1.848	2.61	194.3	219.5
IDECO	HAYALSHAMALEY	1	100.0	162.5	100.0	120.8	62.5	0.52	68.382	3.729	5.45	3.140	4.59	0.589	0.86	206.9	219.6
IDECO	HAYALSHAMALEY	2	75.0	100.0	112.5	95.8	37.5	0.39	54.234	2.242	4.13	2.056	3.79	0.186	0.34	215.7	222.4
IDECO	HAYALSHAMALEY	3	87.5	125.0	62.5	91.7	62.5	0.68	51.876	1.481	2.85	1.238	2.39	0.243	0.47	214.6	223.4

Appendix 5.9-8 Effect of Improving Unbalance Factor

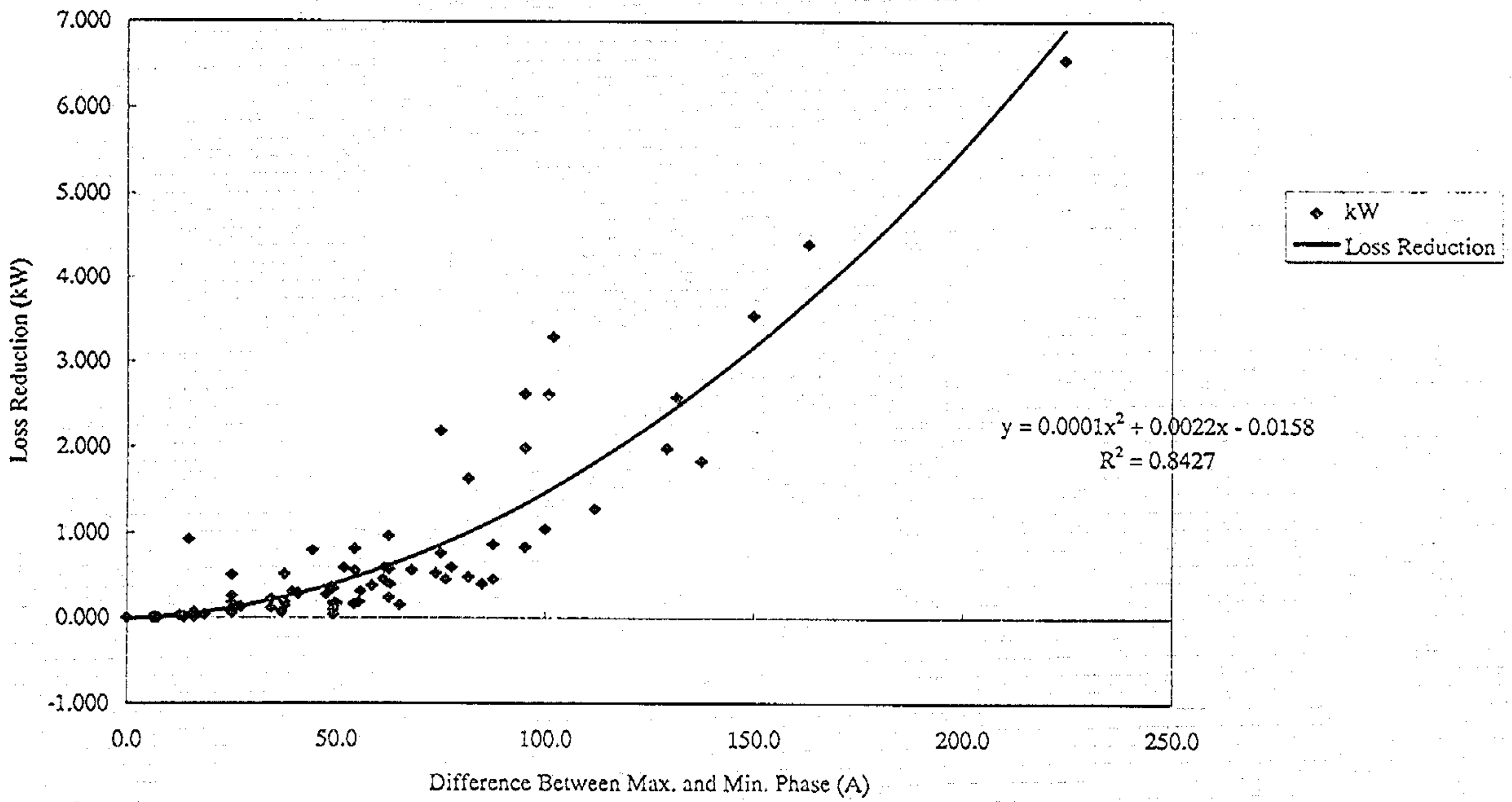
Com.	Substation Name	No.	Sent Out Load (A) R	S	T	Mean	Max-Min	Unbalance (UBF)	Sent Out kW	Loss Reduction by Improving UBF: Before kW	Before Rate %	After kW	After Rate %	Reduction kW	Reduction Rate %	Minimum Voltage (V) Before	After
IDECO	HAYALSHAMALEY	4	62.5	100.0	100.0	87.5	37.5	0.43	49.518	1.599	3.23	1.404	2.84	0.195	0.39	216.2	222.6
IDECO	HAYALSHAMALEY	5	100.0	100.0	100.0	100.0	0.0	0.00	56.592	3.593	6.35	3.593	6.35	0.000	0.00	203.9	204.9
IDECO	KAZAALI HOUSE	1	225.0	225.0	212.5	220.8	12.5	0.06	124.679	10.081	8.09	10.050	8.06	0.031	0.02	206.6	208.8
IDECO	KAZAALI HOUSE	2	150.0	150.0	175.0	158.3	25.0	0.16	89.392	5.394	6.03	5.292	5.92	0.102	0.11	204.8	210.7
IDECO	KAZAALI HOUSE	3	125.0	100.0	87.5	104.2	37.5	0.36	58.811	2.259	3.84	2.117	3.60	0.142	0.24	215.6	219.7
IDECO	KAZAALI HOUSE	4	100.0	162.5	187.5	150.0	87.5	0.58	84.687	2.760	3.26	2.296	2.71	0.464	0.55	214.2	222.5
IDECO	KAZAALI HOUSE	5	93.5	75.0	75.0	81.2	18.5	0.23	45.825	1.033	2.25	0.994	2.17	0.039	0.09	221.2	223.7
IDECO	DABAT NEMER	1	87.5	187.5	112.5	129.2	100.0	0.77	72.939	4.807	6.59	3.751	5.14	1.056	1.45	198.9	213.8
IDECO	DABAT NEMER	2	150.0	125.0	150.0	141.7	25.0	0.18	79.997	5.166	6.46	5.074	6.34	0.092	0.12	206.3	209.6
IDECO	DABAT NEMER	3	62.5	87.5	212.5	120.8	150.0	1.24	68.233	8.075	11.83	4.517	6.62	3.558	5.21	171.5	210.3
IDECO	DABAT NEMER	4	150.0	175.0	150.0	158.3	25.0	0.16	89.409	4.479	5.01	4.418	4.94	0.061	0.07	211.0	214.6
IDECO	DABAT NEMER	5	87.5	118.8	162.5	122.9	75.0	0.61	69.409	5.602	8.07	4.834	6.96	0.768	1.11	188.2	207.3
IDECO	AL RAFEED	1	75.0	100.0	75.0	83.3	25.0	0.30	47.035	6.888	14.64	6.379	13.56	0.509	1.08	169.2	193.5
IDECO	AL RAFEED	2	50.0	50.0	125.0	75.0	75.0	1.00	42.331	4.697	11.10	2.500	5.91	2.197	5.19	172.7	211.5
IDECO	AL RAFEED	3	75.0	100.0	62.5	79.2	37.5	0.47	44.683	3.866	8.65	3.347	7.49	0.519	1.16	178.6	205.4
IDECO	AL RAFEED	4	50.0	75.0	75.0	66.7	25.0	0.38	37.628	1.659	4.41	1.475	3.92	0.184	0.49	211.5	220.3
JEPCO	HNEAKEEN	1	295.2	252.2	326.0	291.1	73.8	0.25	160.109	20.250	12.65	19.717	12.31	0.533	0.33	179.0	186.0
JEPCO	HNEAKEEN	2	430.5	424.4	393.6	416.2	36.9	0.09	228.888	19.157	8.37	19.085	8.34	0.072	0.03	191.3	193.3
JEPCO	HNEAKEEN	3	184.5	231.2	246.0	220.6	61.5	0.28	121.322	16.203	13.36	15.604	12.86	0.599	0.49	171.5	186.4
JEPCO	HNEAKEEN	4	291.5	172.2	159.9	207.9	131.6	0.63	114.331	10.412	9.11	7.819	6.84	2.593	2.27	174.9	201.7
JEPCO	HNEAKEEN	5	196.8	215.3	246.0	219.4	49.2	0.22	120.645	11.871	9.84	11.515	9.54	0.356	0.30	173.9	187.9
JEPCO	AL SAYEGH	1	479.7	473.6	479.7	477.7	6.1	0.01	261.617	41.153	15.73	41.150	15.73	0.003	0.00	164.7	165.5
JEPCO	AL SAYEGH	2	155.0	147.6	147.6	150.1	7.4	0.05	82.190	3.381	4.11	3.377	4.11	0.004	0.00	209.5	210.4
JEPCO	AL SAYEGH	3	98.4	64.0	83.6	82.0	34.4	0.42	44.913	1.748	3.89	1.628	3.62	0.120	0.27	205.5	211.5
JEPCO	AL SAYEGH	4	61.5	88.6	110.7	86.9	49.2	0.57	47.608	1.349	2.83	1.190	2.50	0.159	0.33	208.1	214.4
JEPCO	AL HUSSIEN	1	20.9	70.1	36.9	42.6	49.2	1.15	23.431	0.112	0.48	0.071	0.30	0.041	0.17	220.7	222.0
JEPCO	AL HUSSIEN	2	98.4	45.5	110.7	84.9	65.2	0.77	46.637	0.728	1.56	0.570	1.22	0.158	0.34	215.5	218.4
JEPCO	AL HUSSIEN	3	62.7	137.8	147.6	116.0	84.9	0.73	63.760	1.930	3.03	1.523	2.39	0.407	0.64	207.5	214.9
JEPCO	AL HUSSIEN	4	187.0	156.2	211.6	184.9	55.4	0.30	101.611	5.312	5.23	5.120	5.04	0.192	0.19	201.6	206.4
JEPCO	AL HUSSIEN	5	356.7	302.6	334.6	331.3	54.1	0.16	182.043	14.760	8.11	14.596	8.02	0.164	0.09	190.7	195.5
JEPCO	AL HUSSIEN	6	88.6	61.5	110.7	86.9	49.2	0.57	47.764	0.851	1.78	0.751	1.57	0.100	0.21	213.4	217.1
JEPCO	SWEFEH HOUSING	1	178.4	189.4	290.3	219.4	111.9	0.51	112.564	11.125	9.88	9.831	8.73	1.294	1.15	174.2	195.7
JEPCO	SWEFEH HOUSING	2	140.2	159.9	203.0	167.7	62.7	0.37	86.054	7.018	8.16	6.615	7.69	0.403	0.47	189.8	201.7
JEPCO	SWEFEH HOUSING	3	159.9	135.3	184.5	159.9	49.2	0.31	82.056	4.846	5.91	4.662	5.68	0.184	0.22	202.9	207.9
JEPCO	SWEFEH HOUSING	4	30.8	46.7	41.8	39.8	16.0	0.28	20.409	0.163	0.80	0.152	0.74	0.011	0.05	232.4	232.4
JEPCO	WEST THEHEEBA	1	24.6	18.3	70.1	37.7	51.9	1.21	20.748	1.234	5.95	0.639	3.08	0.595	2.87	200.6	217.3
JEPCO	WEST THEHEEBA	2	76.3	68.9	113.2	86.1	44.3	0.51	47.443	7.134	15.04	6.334	13.35	0.800	1.69	158.1	184.2
JEPCO	WEST THEHEEBA	3	38.1	65.2	30.8	44.7	34.4	0.77	24.625	1.058	4.30	0.830	3.37	0.228	0.93	207.9	217.3
JEPCO	WEST THEHEEBA	4	114.4	104.6	98.4	105.8	16.0	0.15	58.287	7.220	12.39	7.151	12.27	0.069	0.12	180.1	185.4
JEPCO	ABU ZEGHAN	1	135.3	39.4	34.4	69.7	100.9	1.45	38.394	4.489	11.69	1.866	4.86	2.623	6.83	169.4	210.5

Appendix 5.9-8 Effect of Improving Unbalance Factor

Com.	Substation Name	No.	Sent Out							Loss Reduction by Improving UBF						Minimum Voltage (V)	
			Load (A)					Unbalance (UBF)	Sent Out kW	Before		After		Reduction		Before	After
			R	S	T	Mean	Max-Min			kW	Rate %	kW	Rate %	kW	Rate %		
JEPCO	ABU ZEGHAN	2	100.9	95.9	86.1	94.3	14.8	0.16	51.944	3.112	5.99	2.183	4.20	0.929	1.79	204.8	213.9

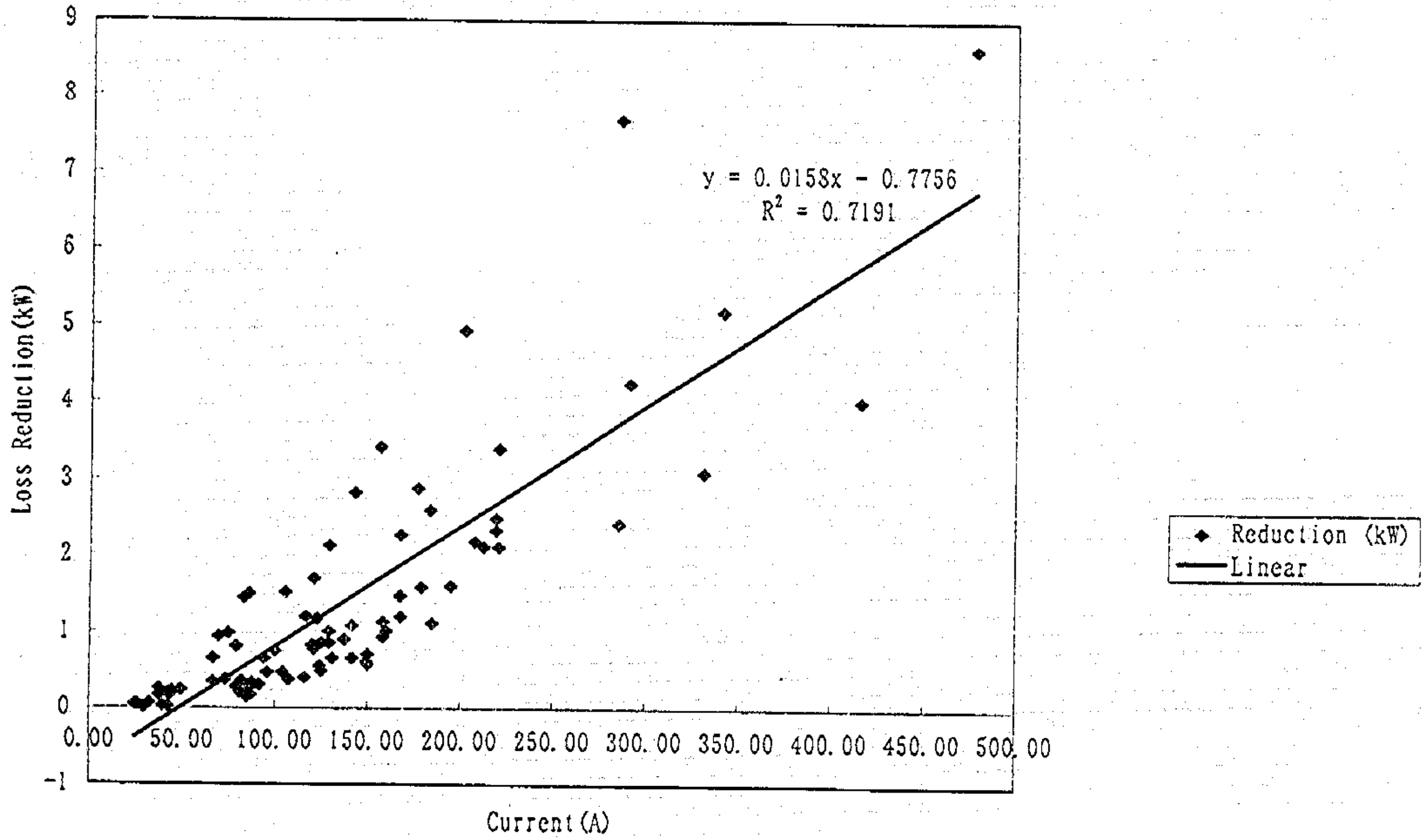
Appendix 5.10-1 Scatter Diagram (1/7)

Fig.1 Loss Reduction by Improving UBF



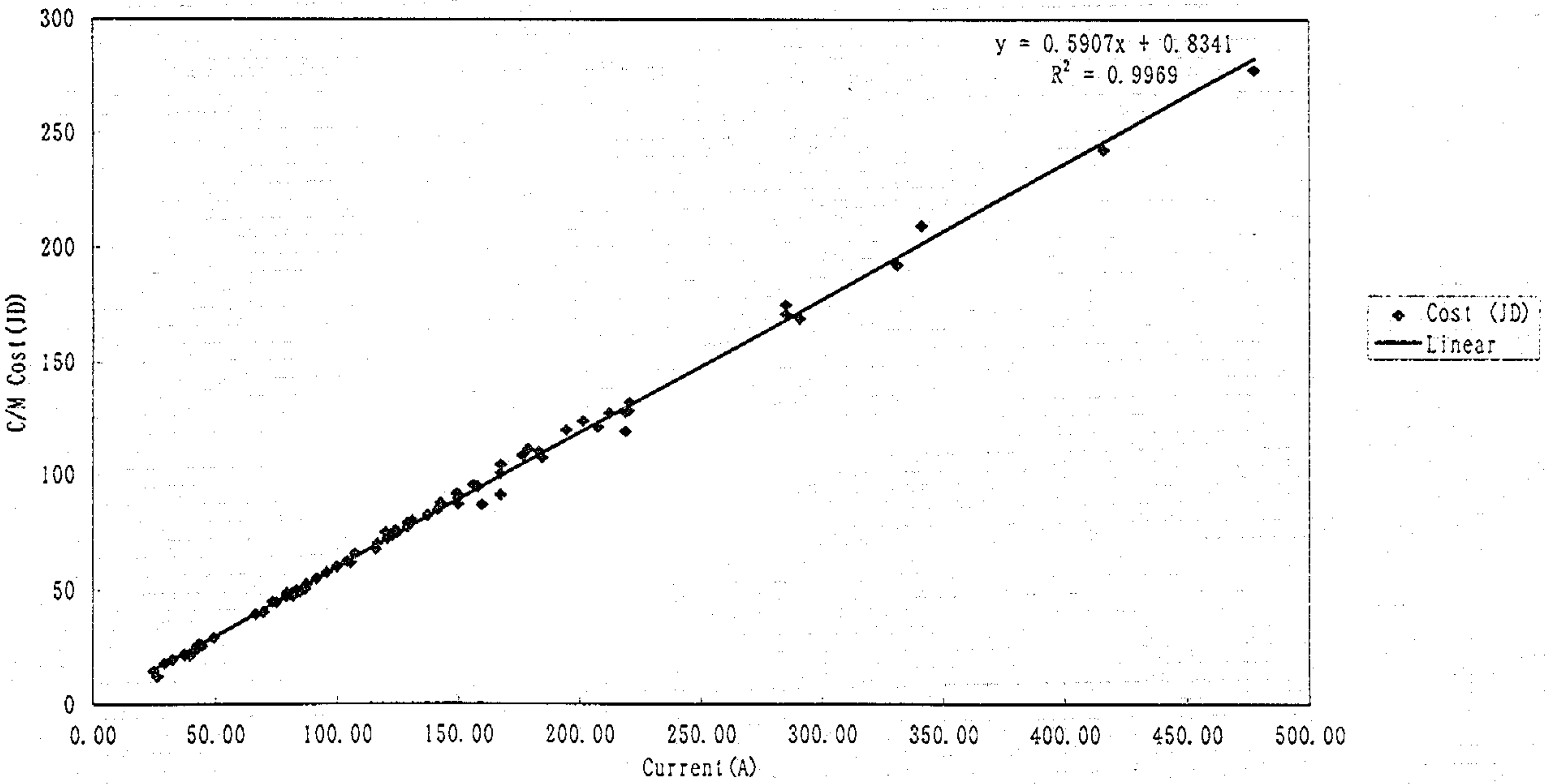
Appendix 5.10-1 Scatter Diagram (2/7)

Fig. 2 LV Feeder Capacitor Study [I:Loss Reduction] Scatter



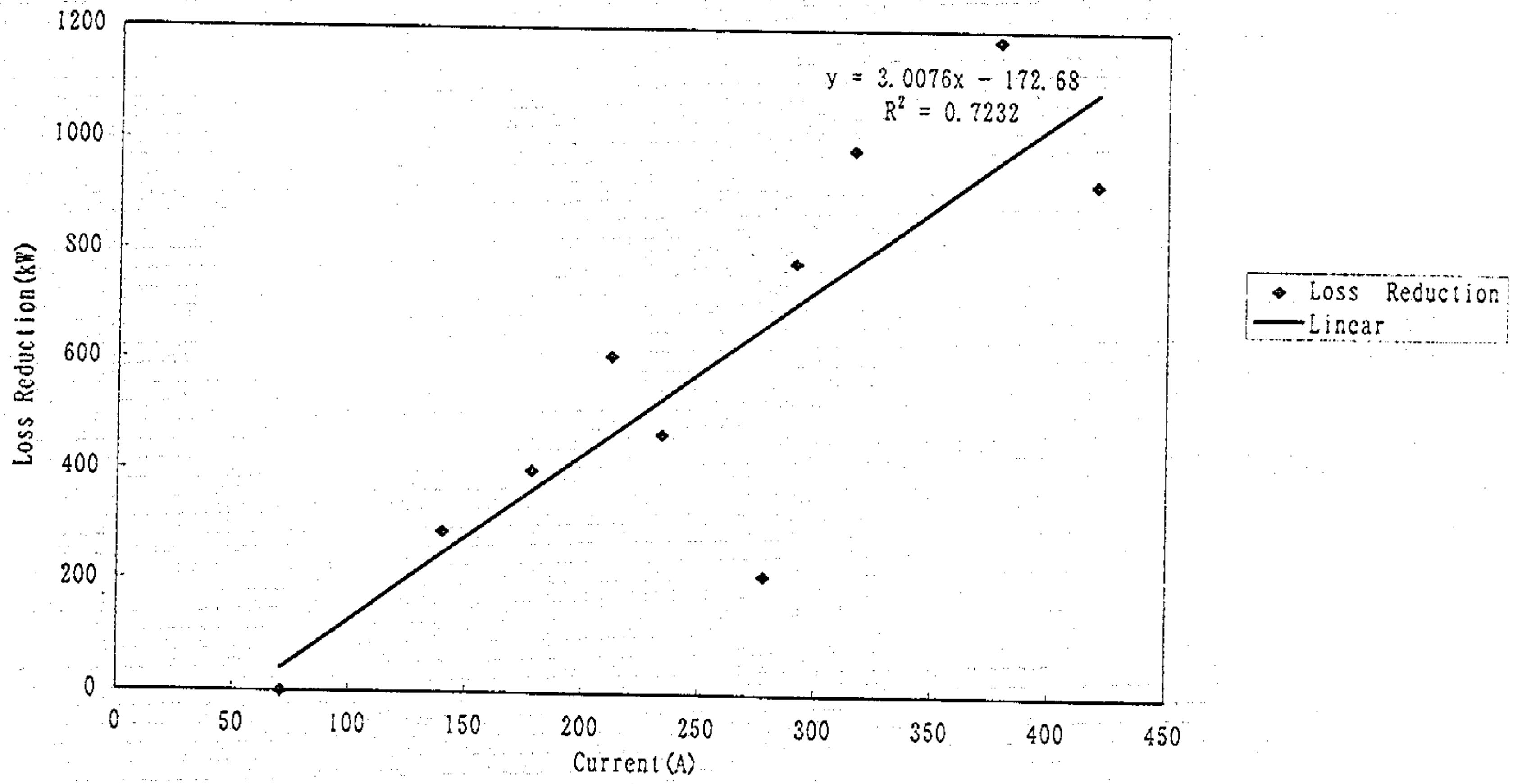
Appendix 5.10-1 Scatter Diagram (3/7)

Fig. 3 LV Feeder Capacitor Study [I:Cost] Scatter



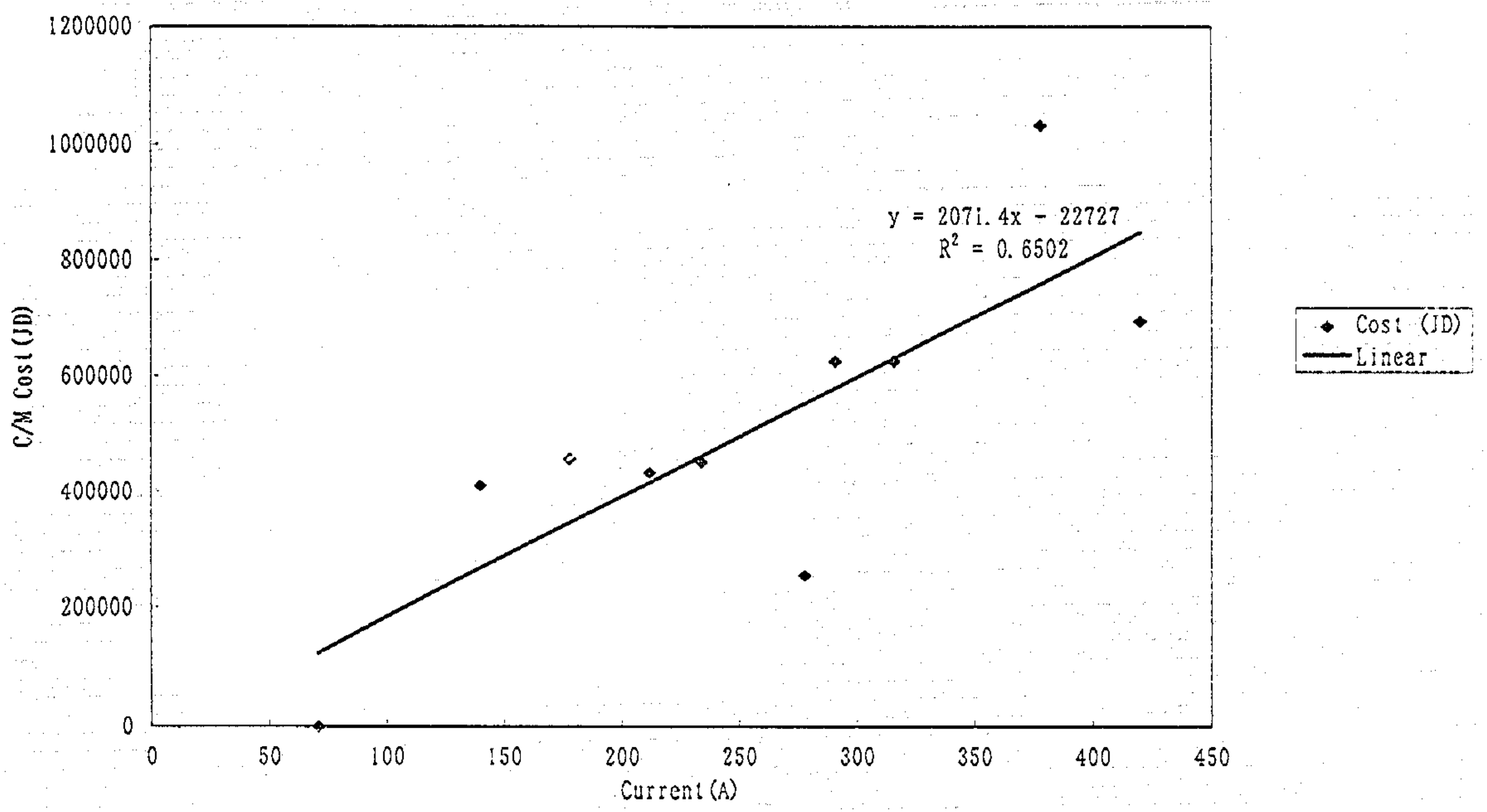
Appendix 5.10-1 Scatter Diagram (4/7)

Fig. 4 New Line Construction for MV Feeders [I:Loss-reduction] Scatter



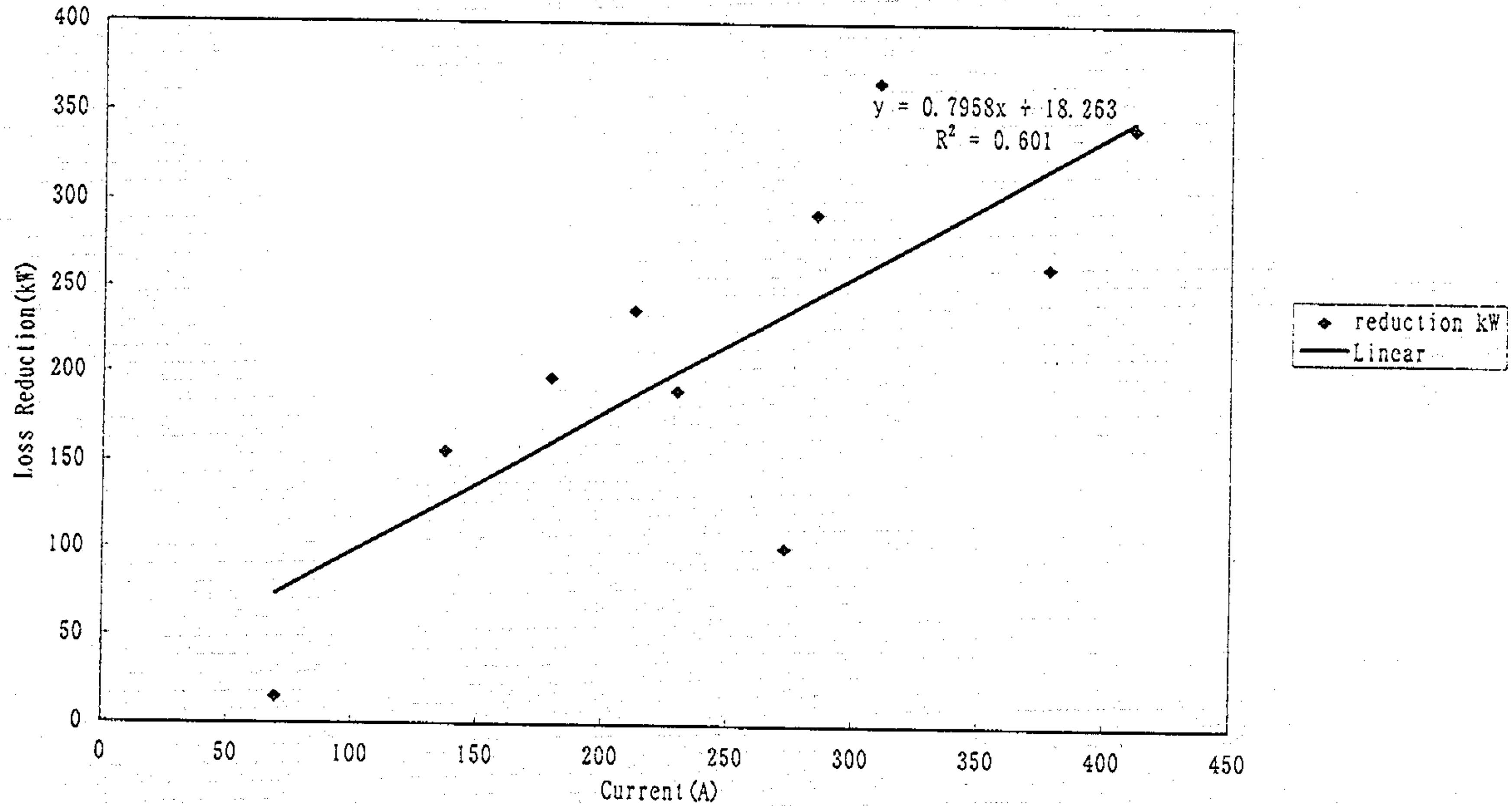
Appendix 5.10-1 Scatter Diagram (5/7)

Fig. 5 New Line Construction for MV Feeders [I:Cost] Scatter



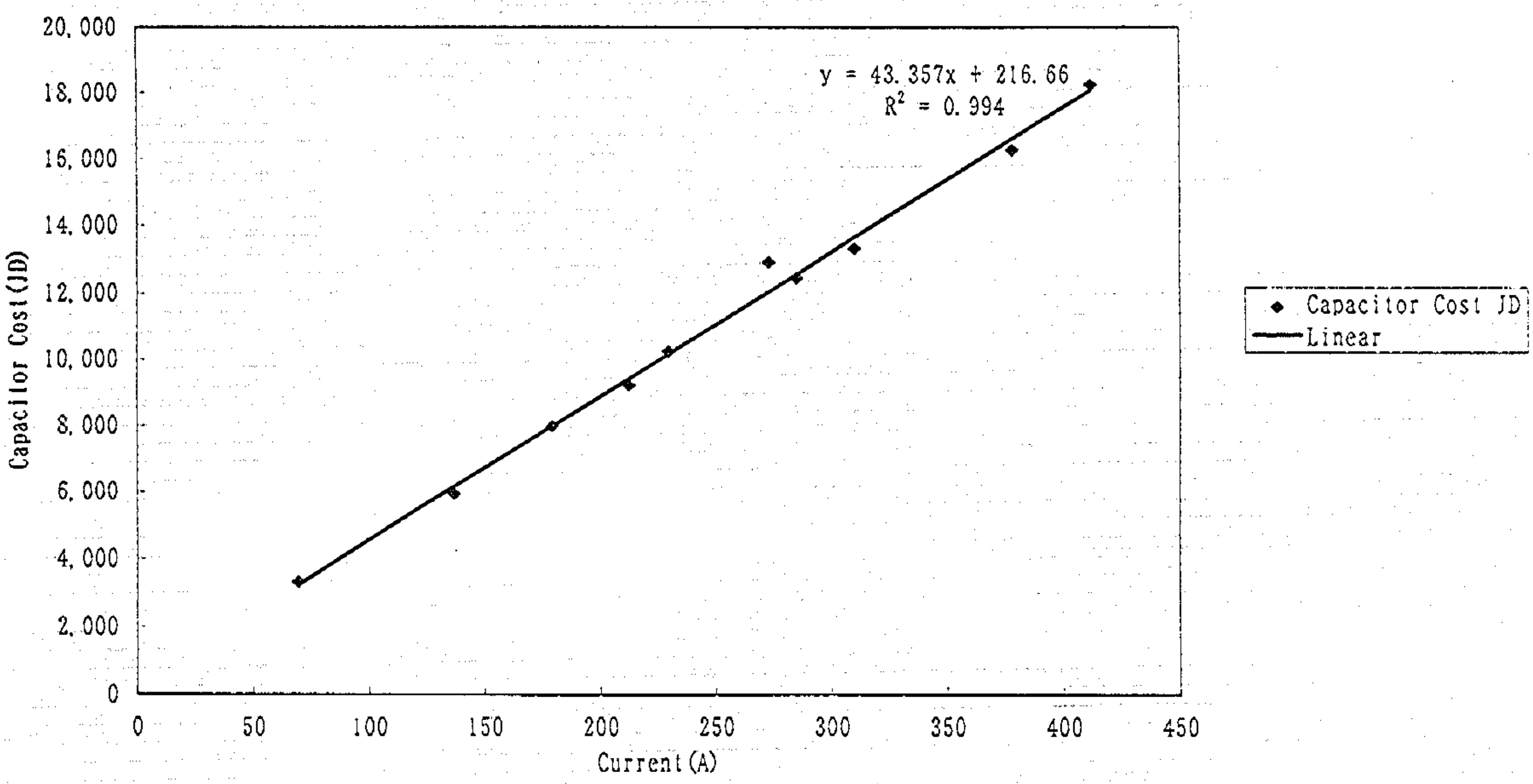
Appendix 5.10-1 Scatter Diagram (6/7)

Fig. 6 MV Feeder Capacitor Study [I:Loss Reduction] Scatter



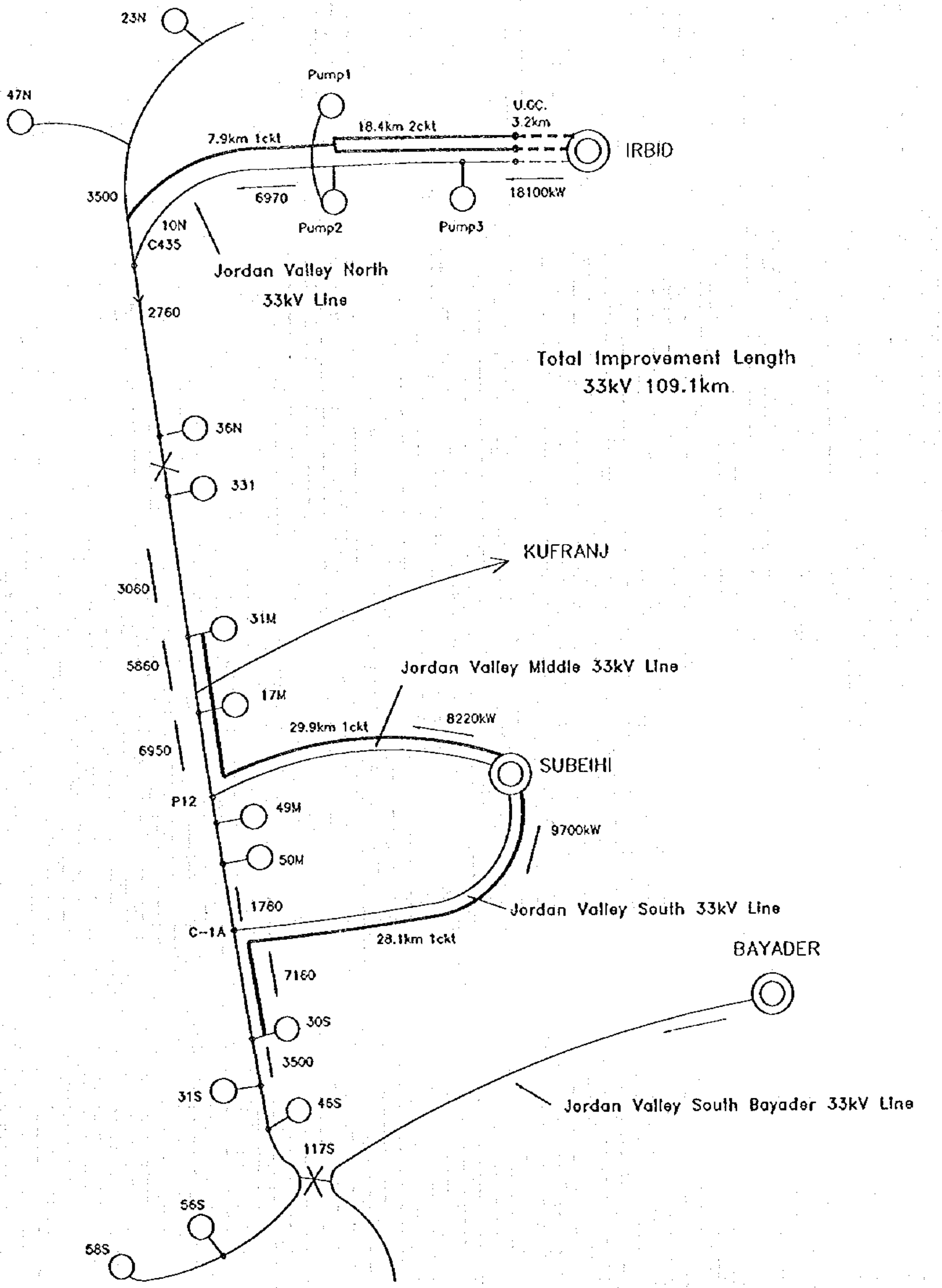
Appendix 5.10-1 Scatter Diagram (7/7)

Fig. 7 MV Feeder Capacitor Study [I:Cost] Scatter

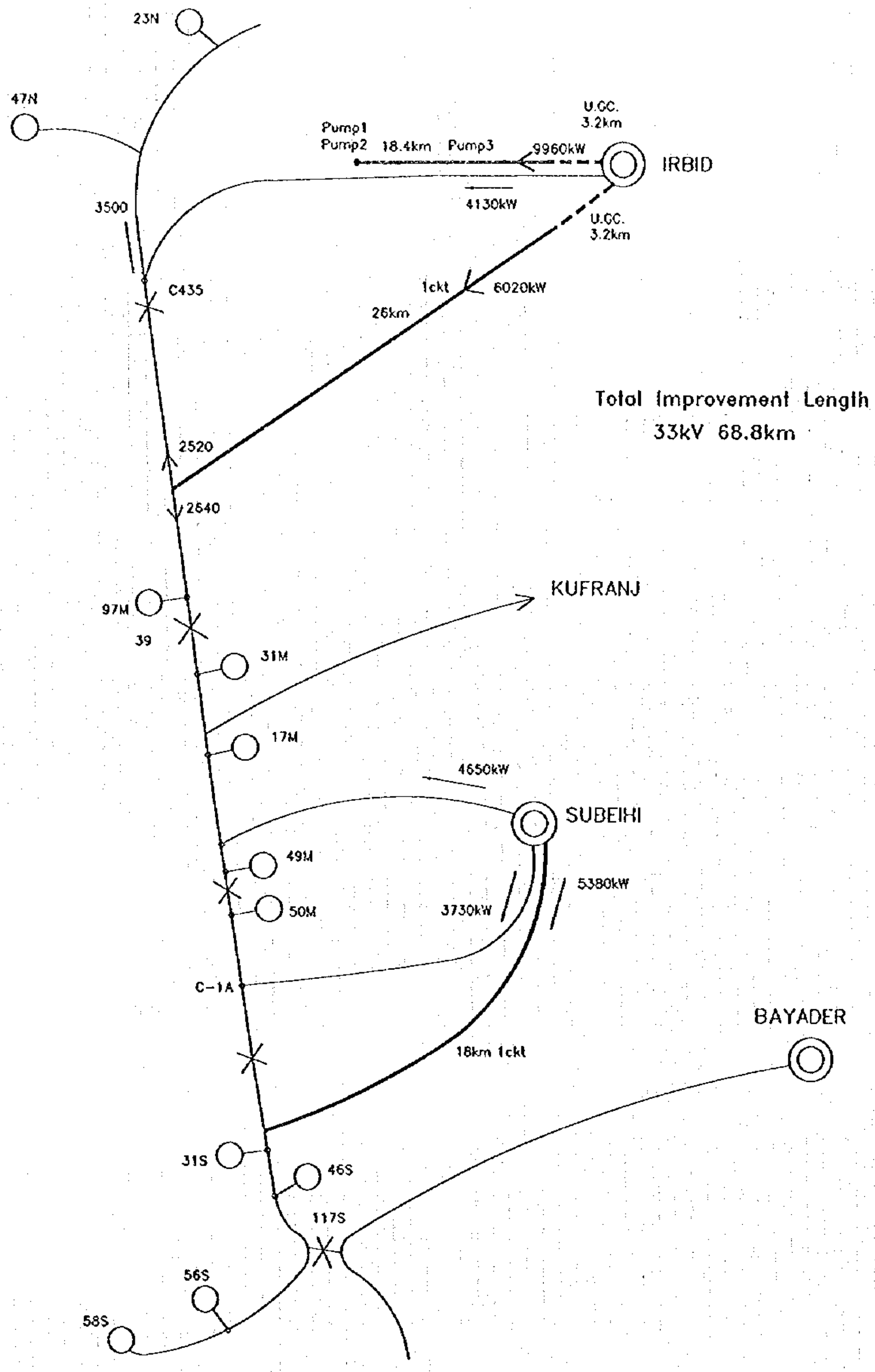


Appendix 5.11-1 Result of loss reduction countermeasure for medium voltage line
Comprehensive study by human knowledge

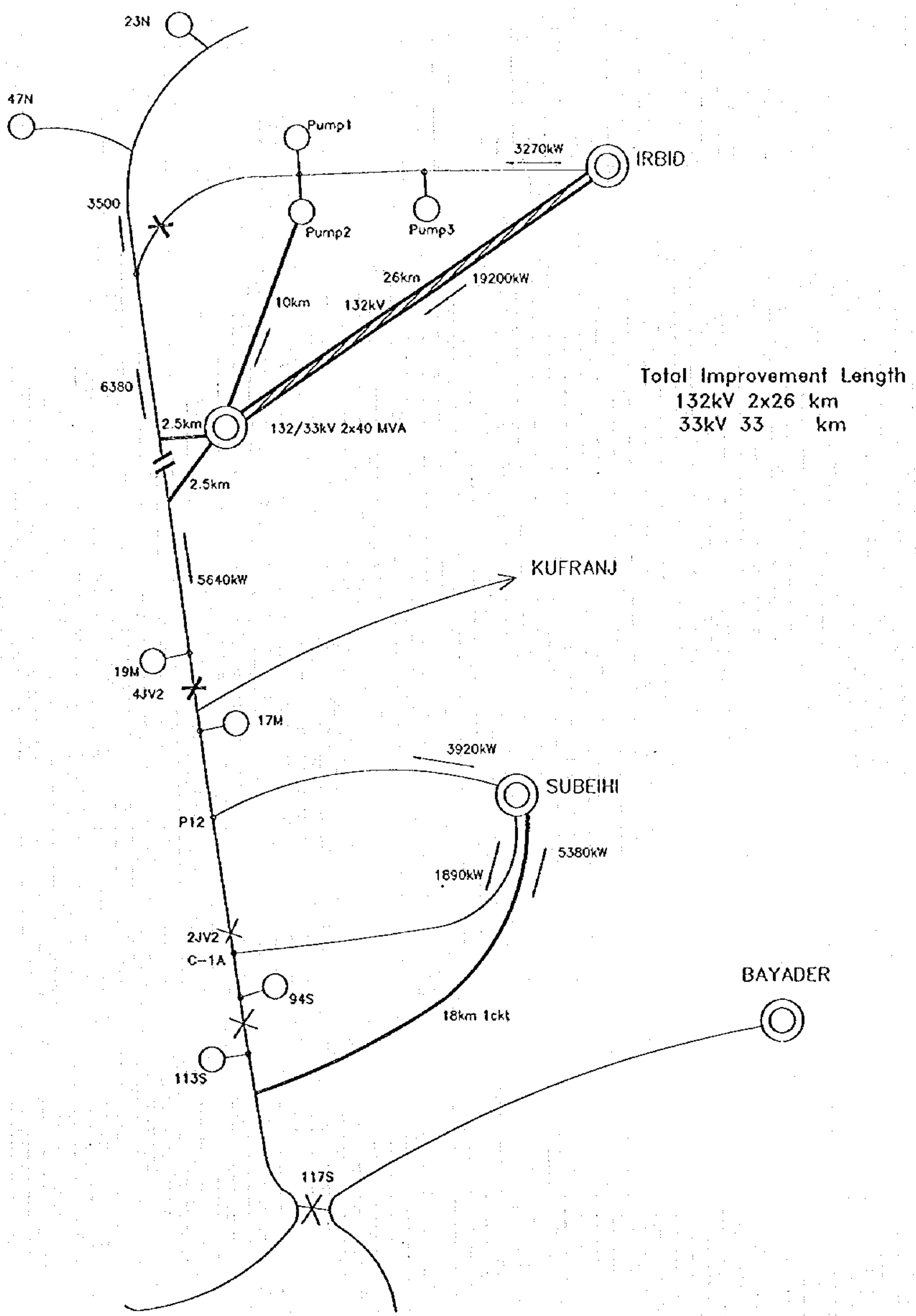
Study area		Jordan Valley							QAIA			Emrawa & Samma	
Study case		Solution by OPTEL	Alternative plan (1) Same Voltage			Alternative plan (2) 132 kV S/S construction			Solution by OPTEL	Alternative plan		Solution by OPTEL	Alternative
			North area	Middle & South	Total	North area	Middle & South	Total		Same Volt. counter measure	132 kV S/S construc tion		Effective use of existing line
Countermeasure													
132 kV T/L km						26.0		26.0			11		
132 / 33 kV S/S 2*40 MVA						1		1			1		
33 kV Cable km		6.4	6.4		6.4				0.3	0.2			
33 kV OH 2ckt km		18.4							16.4			30.1	
33 kV OH 1ckt km		65.9	45.4	18.0	63.4	15.0	18.0	33.0	3.5	20.1	6.0	16.0	38.3
Loss													
Old loss kW		3225.5	1611.0	1614.5	3225.5	1611.0	1614.5	3225.5	1157.7	1157.7	1157.7	2274.0	2274.0
New loss kW		1036.0	572.1	460.5	1032.6	453.7	321.5	775.2	232.6	261.1	79.2	509.4	536.0
Loss reduction kW		2189.5	1038.9	1154.0	2192.9	1157.3	1293.0	2450.3	925.1	896.6	1078.5	1764.6	1738.0
Effect JD (2061JD*kW)		4,512,560	2,141,173	2,378,394	4,519,567	2,385,195	2,664,873	5,050,068	1,906,631	1,847,893	2,222,789	3,636,841	3,582,018
Construction cost JD													
Item	unit												
132 kV T/L	84,000					2,184,000		2,184,000			924,000		
S/S	490,000					490,000		490,000			490,000		
132 kV CB	100,000					200,000		200,000			200,000		
33 kV CB	60,000	240,000	120,000	120,000	240,000	0	60,000	60,000	180,000	180,000	60,000	240,000	120,000
33 kV Cable	50,000	320,000	320,000		320,000				15,600	7,800			
33 kV OH 2ckt	26,570	488,091							435,748			800,288	
33 kV OH 1ckt	13,285	875,482	603,139	239,130	842,269	199,275	239,130	438,405	73,599	267,029	79,710	212,693	212,693
Total construc.costJD		1,923,572	1,043,139	359,130	1,402,269	3,073,275	299,130	3,372,405	704,947	454,829	1,753,710	1,252,981	332,693
Merit JD(effect-cost)		2,588,987	1,098,034	2,019,264	3,117,298	-688,080	2,365,743	1,677,663	1,201,684	1,393,064	469,079	2,383,859	3,249,325



Appendix 5.11-1 Fig. 1 Loss Reduction Countermeasure for Jordan Valley Area 33kV Line
(a) Solution by OPTEL

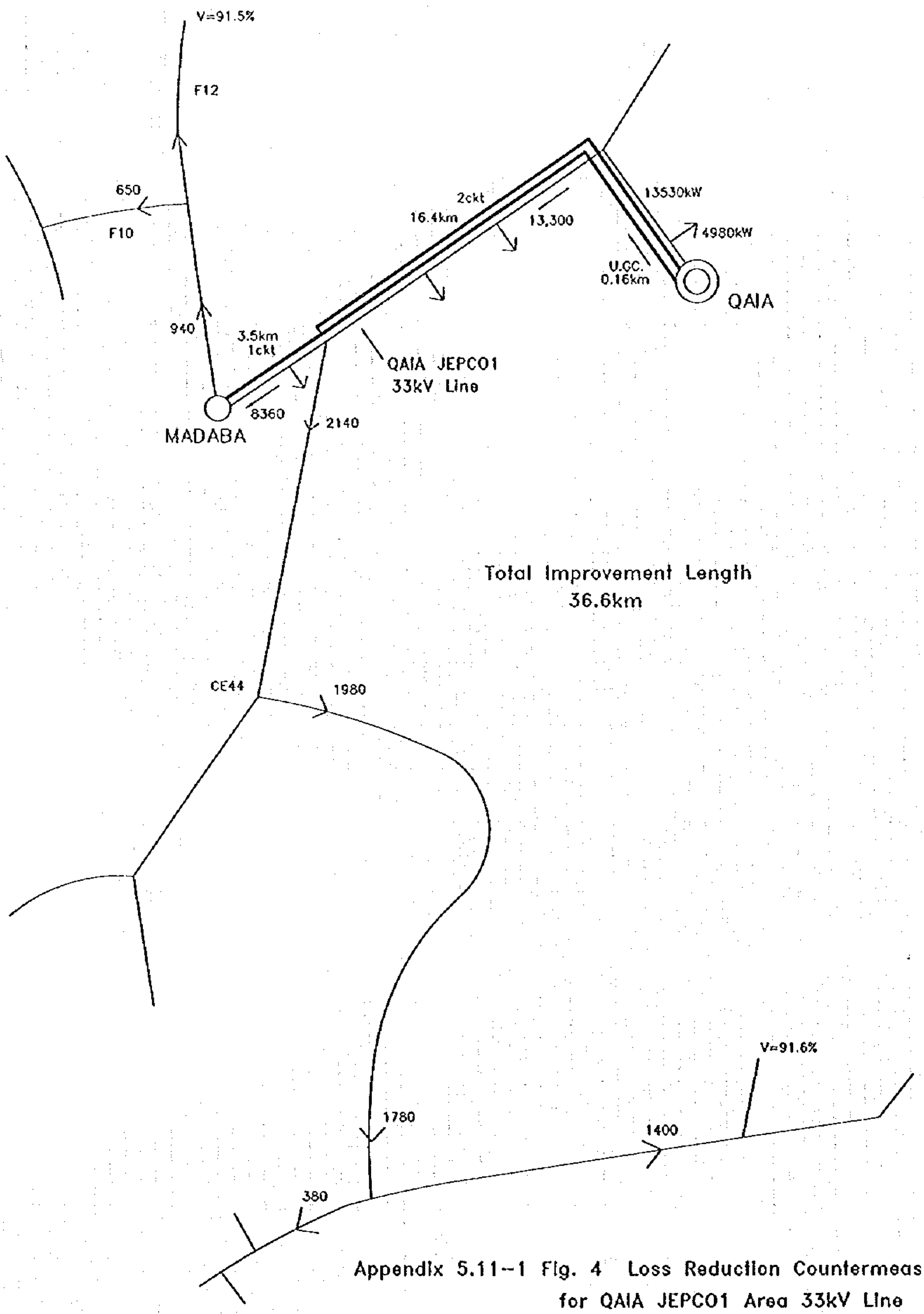


Appedix 5.11-1 Fig. 2 Loss Reduction Countermeasure
for Jordan Valley Area 33kV Line
(b) Alternative 1.(Same Voltage)



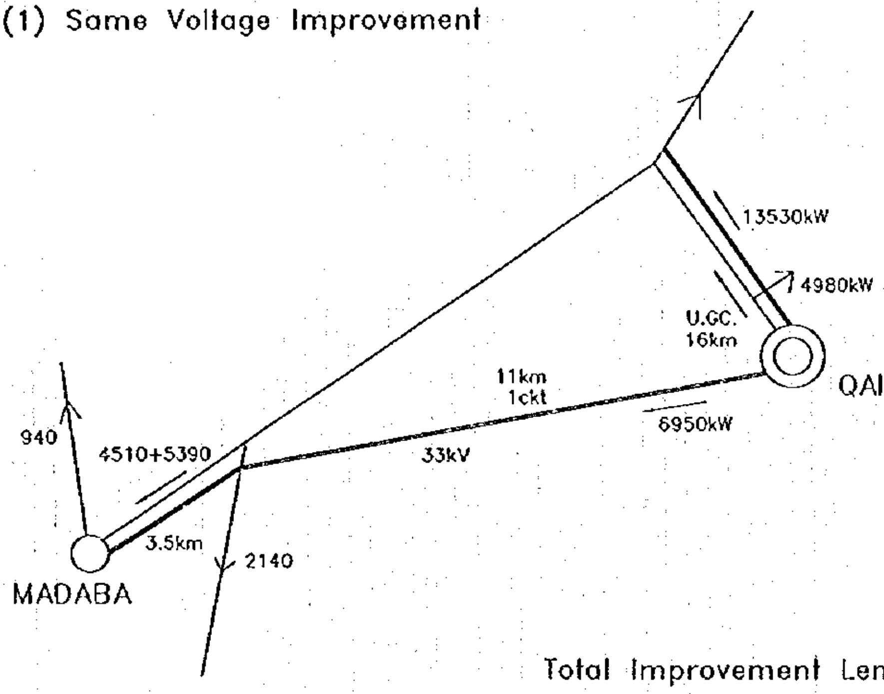
Appendix 5.11-1 Fig. 3 Loss Reduction Countermeasure for Jordan Valley Area 33kV Line (c) Alternative 2.(High Voltage)

QAIA JEPCO1



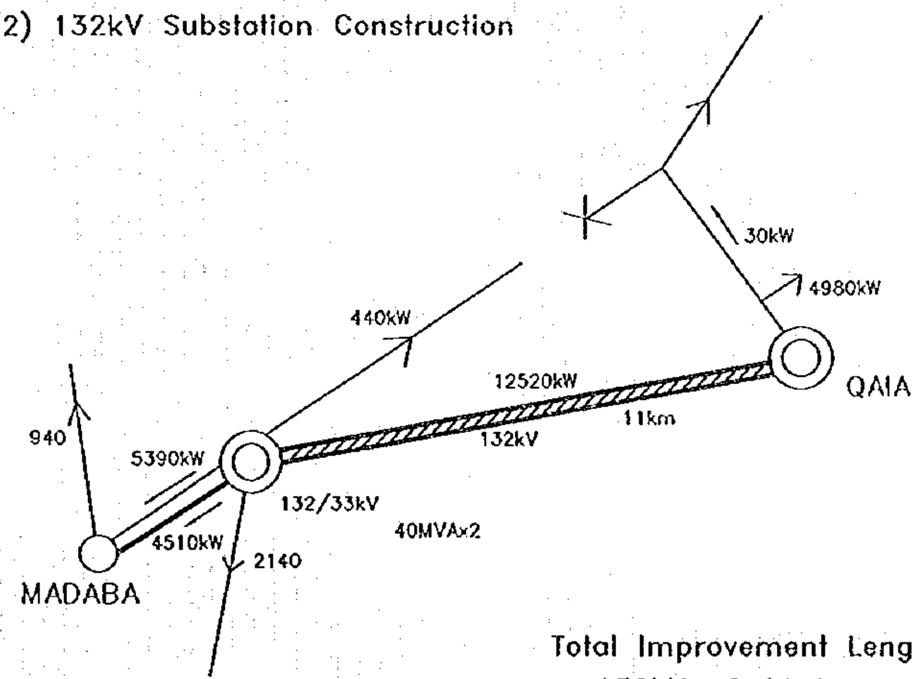
Appendix 5.11-1 Fig. 4 Loss Reduction Countermeasure for QAIA JEPCO1 Area 33kV Line (a) Solution by OPTEL

(1) Same Voltage Improvement



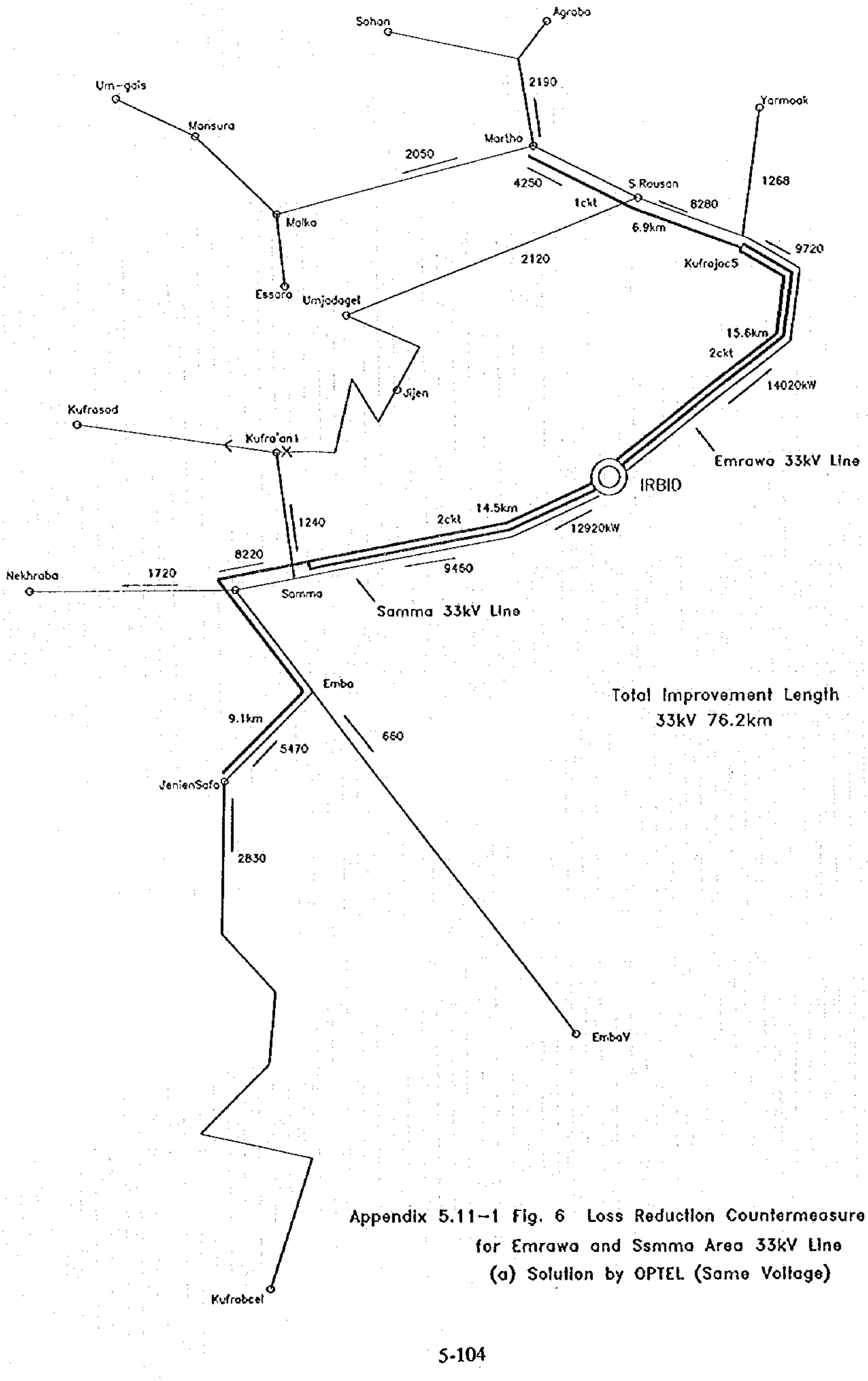
Total Improvement Length
33kV 20.3km

(2) 132kV Substation Construction

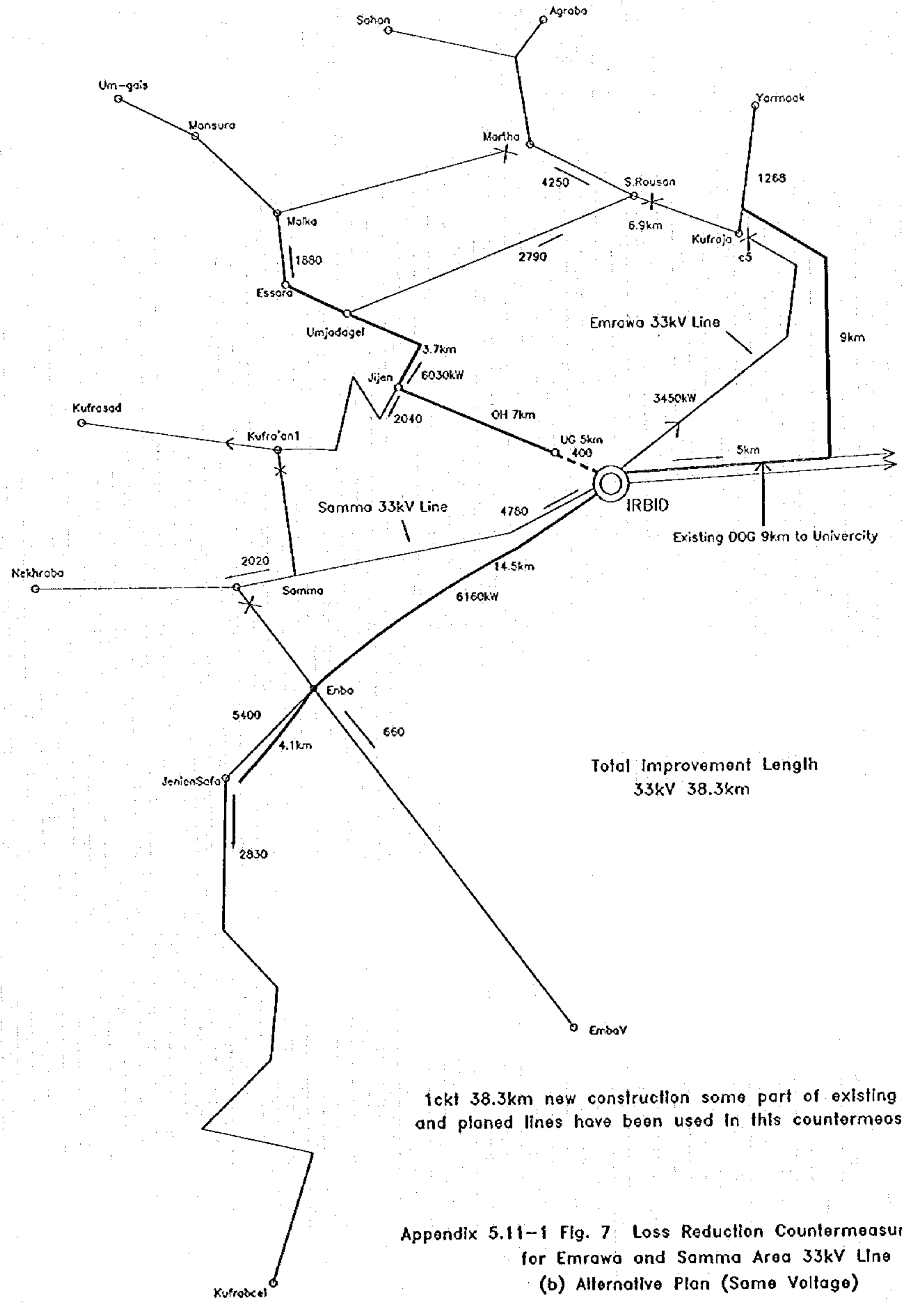


Total Improvement Length
132kV 2x11 km
33kV 6 km

Appendix 5.11-1 Fig. 5 Loss Reduction Countermeasure for QAIA JEPCO1 Area 33kV Line
(b) Alternative (1)and(2)



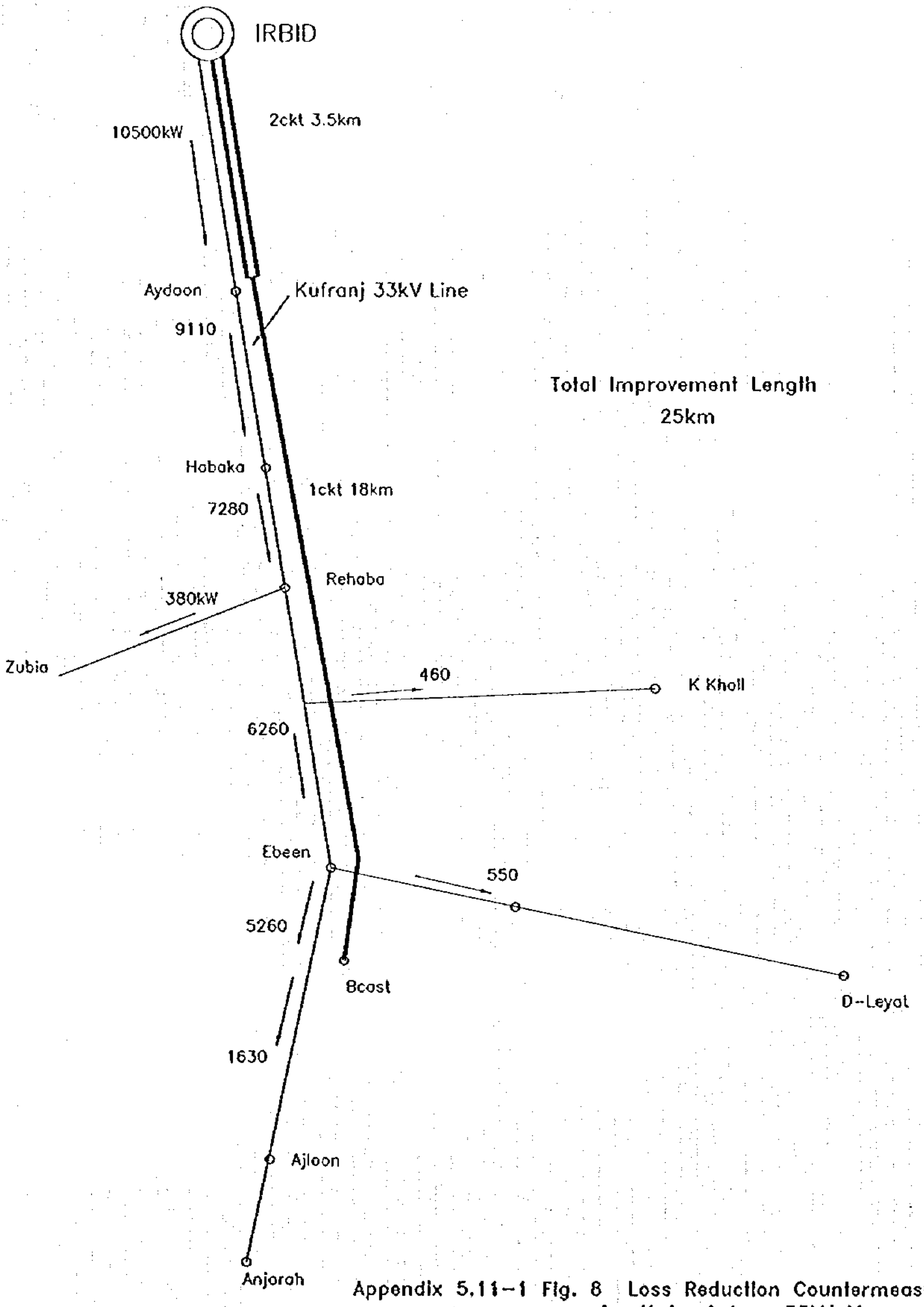
Appendix 5.11-1 Fig. 6 Loss Reduction Countermeasure for Emrawa and Ssmma Area 33kV Line (a) Solution by OPTEL (Same Voltage)



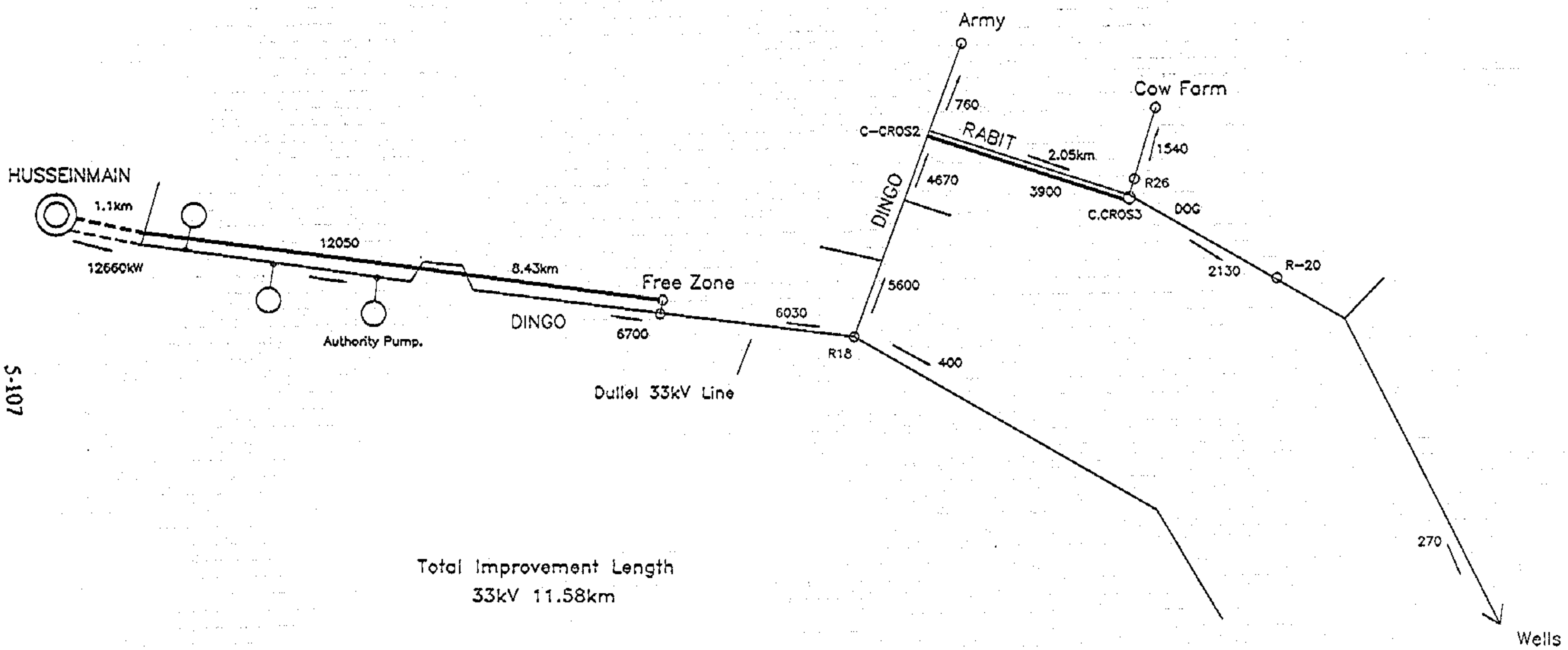
Total Improvement Length
33kV 38.3km

1ckt 38.3km new construction some part of existing and planed lines have been used in this countermeasure.

Appendix 5.11-1 Fig. 7 Loss Reduction Countermeasure for Emrawa and Samma Area 33kV Line (b) Alternative Plan (Same Voltage)



Appendix 5.11-1 Fig. 8 Loss Reduction Countermeasure for Kufranj Area 33kV Line Solution by OPTEL

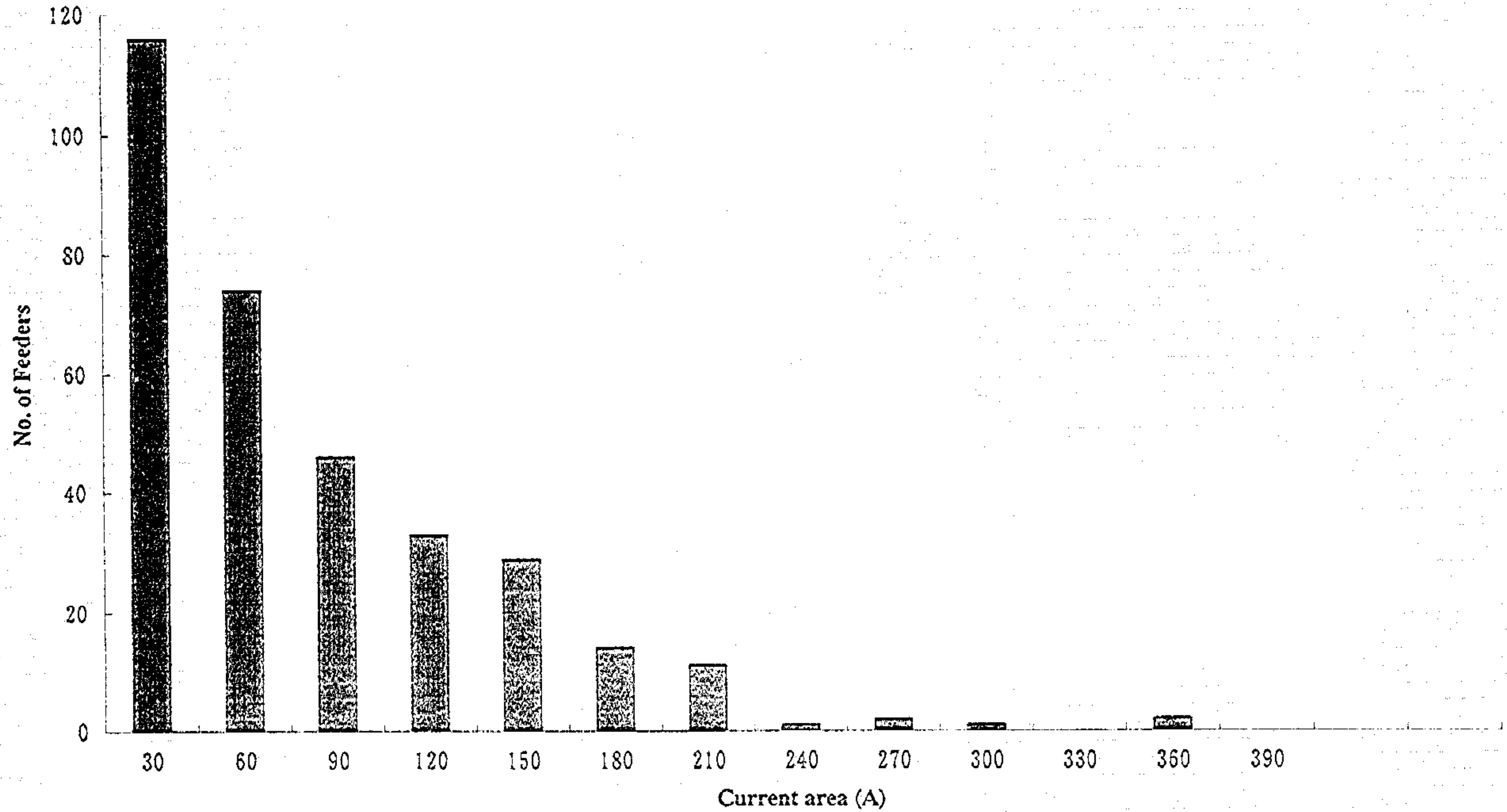


Appendix 5.11-1 Fig. 9 Loss Reduction Countermeasure
for Duliel Area 33kV Line
(a) Solution by OPTEL

第6章

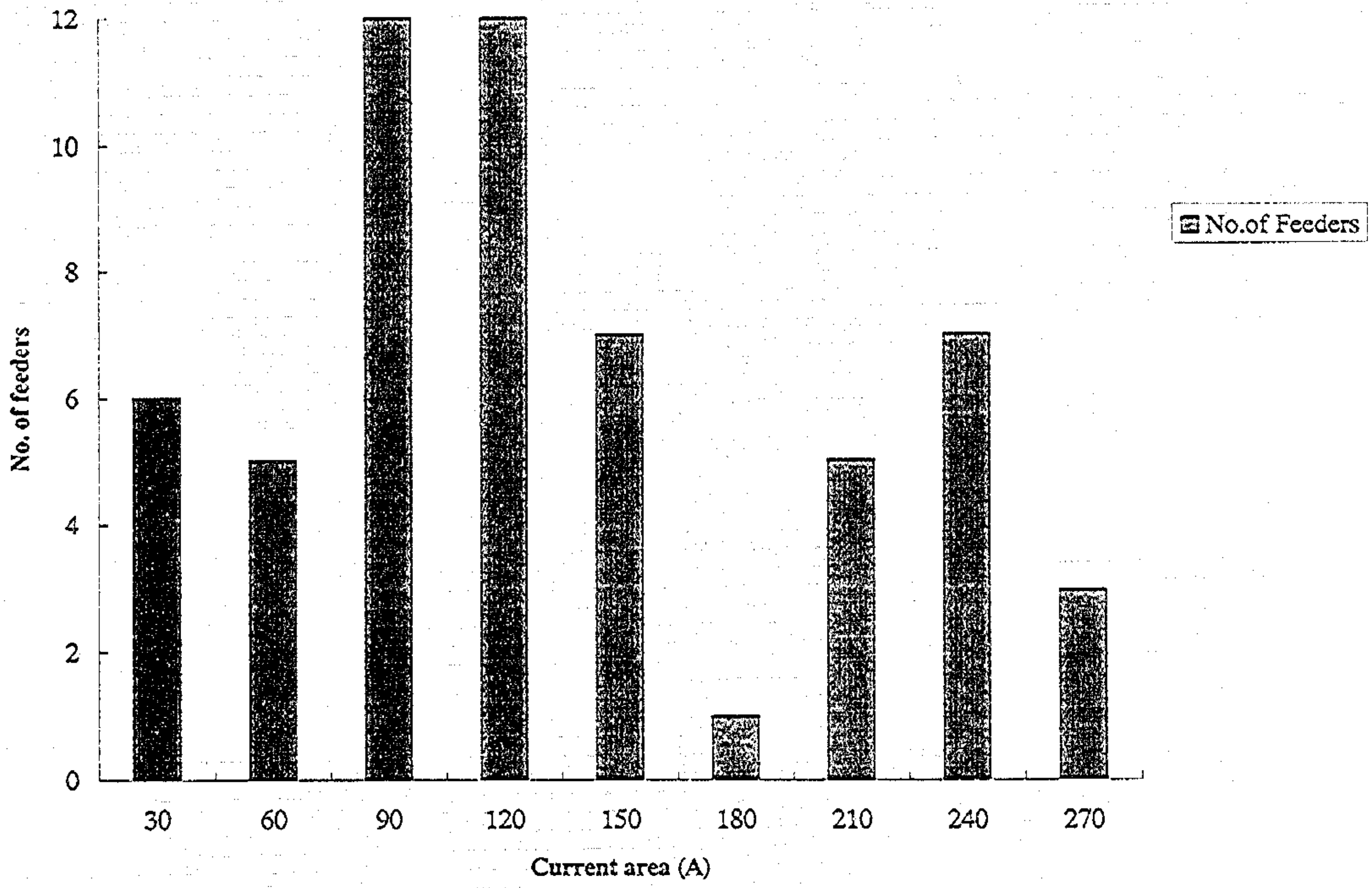
電力損失低減計画の策定

Appendix 6.1-1 Data on Sample-2 Feeders (1/4)
(1) LV Feeder Current



Appendix 6.1-1 Data on Sample-2 Feeders(2/4)

(2) MV Feeder current



Appendix 6.1-1 Data on Sample-2 Feeders (3/4)

(3) LV Sample-2 Feeders (Overhead)--1996--

Substation	F. No.	Symbol	D	E	F	G
KARAMA CAMP	1	1	17.9	17.9	17.9	17.9
	2	2	35.9	35.9	35.9	35.9
SHONA EXPAN.	1	3	9.0	9.0	9.0	9.0
AGRICULTURE D.	1	4	80.7	80.7	80.7	80.7
	2	5	35.9	35.9	35.9	35.9
	3	6	26.9	26.9	26.9	26.9
NORTHTWAL	1	7	44.8	44.8	44.8	44.8
WASYA-2	1	8	30.0	40.0	30.0	33.3
	2	9	60.0	80.0	60.0	66.7
	3	10	130.0	130.0	130.0	130.0
TANYA-1	1	11	80.0	70.0	50.0	66.7
	2	12	60.0	60.0	80.0	66.7
	3	13	30.0	30.0	40.0	33.3
MAMONYA	1	14	18.0	12.0	18.0	16.0
	2	15	15.0	22.0	25.0	20.7
NAQAA	1	16	60.0	50.0	40.0	50.0
	2	17	30.0	30.0	55.0	38.3
MANSYA-1	1	18	30.0	35.0	40.0	35.0
	2	19	100.0	100.0	90.0	96.7
	3	20	50.0	50.0	80.0	60.0
	4	21	120.0	130.0	70.0	106.7
AZRAQ-DESERT	1	22	10.0	55.0	25.0	30.0
REWISHED	1	23	5.0	3.0	3.0	3.7
	2	24	3.0	2.0	2.0	2.3
GYAATH	1	25	20.0	3.0	43.0	22.0
	2	26	17.0	7.0	45.0	23.0
QADESYIA	1	27	110.0	90.0	105.0	101.7
	2	28	63.0	60.0	70.0	64.3
QATRAA-1	1	29	100.0	120.0	80.0	100.0
	2	30	90.0	80.0	110.0	93.3
	3	31	30.0	30.0	15.0	25.0
SHALALH	1	32	140.0	115.0	85.0	113.3
	2	33	150.0	120.0	140.0	136.7
	3	34	140.0	70.0	100.0	103.3
	4	35	160.0	160.0	170.0	163.3
COMM. COMPLEX	1	36	30.0	30.0	30.0	30.0
	2	37	30.0	30.0	30.0	30.0
HANA NASER	3	38	50.0	13.0	30.0	31.0
	4	39	34.0	30.0	2.0	22.0
	5	40	43.0	40.0	36.0	39.7
HIJAZI	2	41	247.0	248.0	277.0	257.3
	3	42	103.0	95.0	89.0	95.7
	4	43	123.0	70.0	177.0	123.3
AL SOWAFEIAH T.	1	44	90.0	115.0	86.0	97.0
	2	45	60.0	48.0	44.0	50.7
	3	46	44.0	60.0	86.0	63.3
	4	47	100.0	100.0	145.0	115.0
AL SOWAFEIAH S.	2	48	100.0	70.0	135.0	101.7
	3	49	169.0	79.0	162.0	136.7
	4	50	16.0	20.0	30.0	22.0
AL-ARAB ISLAND	5	51	15.0	4.0	17.0	12.0
	7	52	0.0	0.0	13.0	4.3
AL SHAIB	2	53	105.0	17.0	22.0	48.0
	6	54	35.0	70.0	25.0	43.3
AL SOWAFEIAH	1	55	0.0	50.0	25.0	25.0
	2	56	300.0	315.0	280.0	298.3

(3) LV Sample-2 Feeders (Overhead)--1996--

Substation	F. No.	Symbol	D	E	F	G
AL SOWAFEIAH	3	57	0.0	6.0	60.0	22.0
	4	58	2.0	4.0	2.0	2.7
AL REFA'AI	2	59	9.0	39.0	7.0	18.3
	3	60	120.0	144.0	205.0	156.3
	4	61	46.0	23.0	18.0	29.0
AGHAPPI	1	62	100.0	74.0	93.0	89.0
	2	63	13.0	7.0	19.0	13.0
	3	64	185.0	207.0	165.0	185.7
JAD ALLAH	2	65	20.0	17.0	18.0	18.3
	3	66	70.0	45.0	55.0	56.7
BRINCE BASMA S.	3	67	55.0	54.0	70.0	59.7
	6	68	70.0	92.0	86.0	82.7
DAKHQAN	1	69	45.0	46.0	35.0	42.0
	2	70	57.0	112.0	82.0	83.7
	3	71	46.0	27.0	50.0	41.0
	5	72	50.0	108.0	63.0	73.7
AL-ARTHADKSI	3	73	210.0	216.0	200.0	208.7
	4	74	97.0	100.0	190.0	129.0
	5	75	148.0	113.0	143.0	134.7
	6	76	20.0	9.0	6.0	11.7
OM ODAINAH S.	1	77	78.0	89.0	140.0	102.3
	2	78	100.0	66.0	87.0	84.3
	3	79	130.0	132.0	100.0	120.7
	4	80	149.0	142.0	165.0	152.0
S of OM ODAINAH	1	81	62.0	48.0	74.0	61.3
	2	82	8.0	10.0	36.0	18.0
	3	83	60.0	75.0	68.0	67.7
	4	84	28.0	26.0	32.0	28.7

Substation	F. No.	Symbol	D	E	F	G
KANAAN & ALT.	1	85	150.0	125.0	70.0	115.0
	2	86	120.0	110.0	100.0	110.0
	3	87	6.0	36.0	23.0	21.7
	4	88	175.0	125.0	150.0	150.0
YEHYA DIAMOND	1	89	15.0	30.0	12.0	19.0
	2	90	25.0	33.0	63.0	40.3
	3	91	20.0	26.0	50.0	32.0
	4	92	205.0	210.0	181.0	198.7
ALM-ADDI	2	93	156.0	155.0	256.0	189.0
	3	94	94.0	114.0	105.0	104.3
	4	95	147.0	131.0	130.0	136.0
ZAHRAN	1	96	42.0	50.0	42.0	44.7
	2	97	14.0	26.0	27.0	22.3
	3	98	8.0	19.0	8.0	11.7
	4	99	143.0	130.0	174.0	149.0
	5	100	56.0	85.0	100.0	80.3
	6	101	0.0	4.0	0.0	1.3
DOBIAN HOUSING	1	102	19.0	15.0	36.0	23.3
	2	103	141.0	159.0	158.0	152.7
	4	104	30.0	60.0	86.0	58.7
BOTROS SWEEDAN	1	105	134.0	149.0	104.0	129.0
	2	106	85.0	63.0	40.0	62.7
	4	107	91.0	134.0	125.0	116.7
RADWAN	2	108	4.0	5.0	10.0	6.3
	4	109	22.0	32.0	13.0	22.3
ABDOUN GARDEN	1	110	138.0	160.0	190.0	162.7
	2	111	116.0	81.0	118.0	105.0
	3	112	64.0	66.0	128.0	86.0

(3) LV Sample-2 Feeders (Overhead)--1996--

Substation	F. No.	Symbol	D	E	F	G
ASFO.	2	113	80.0	75.0	78.0	77.7
	3	114	195.0	125.0	185.0	168.3
ZAHRAN GARDEN	2	115	19.0	29.0	39.0	29.0
	3	116	116.0	135.0	94.0	115.0
	4	117	210.0	266.0	312.0	262.7
	5	118	11.0	5.0	58.0	24.7
	6	119	25.0	60.0	26.0	37.0
AL TABBA'A	2	120	23.0	32.0	42.0	32.3
	3	121	190.0	195.0	222.0	202.3
	4	122	53.0	70.0	87.0	70.0
AMERICAN SCHOOL	2	123	12.0	10.0	15.0	12.3
	5	124	32.0	13.0	20.0	21.7
	6	125	16.0	35.0	32.0	27.7
ABU HUWAIG	1	126	120.0	110.0	115.0	115.0
	3	127	25.0	30.0	25.0	26.7
	5	128	90.0	80.0	82.0	84.0
	6	129	4.0	5.0	20.0	9.7
AL ORJOWANA	2	130	10.0	15.0	20.0	15.0
	3	131	22.0	23.0	18.0	21.0
	6	132	5.0	16.0	16.0	12.3
	7	133	8.0	1.0	5.0	4.7
IRSHAID	3	134	7.0	10.0	4.0	7.0
	4	135	100.0	132.0	175.0	135.7
	5	136	220.0	183.0	140.0	181.0
	6	137	57.0	25.0	40.0	40.7
AL SOWAFIAH S.	2	138	202.0	186.0	226.0	204.7
	3	139	105.0	117.0	110.0	110.7
	4	140	143.0	168.0	150.0	153.7

Substation	F. No.	Symbol	D	E	F	G
ABU SAIR	3	141	145.0	145.0	150.0	146.7
	6	142	120.0	110.0	150.0	126.7
	7	143	60.0	50.0	70.0	60.0
MARBIL HOTEL	2	144	32.0	11.0	24.0	22.3
	3	145	238.0	210.0	192.0	213.3
ZA'ID AL KILLANI	2	146	50.0	76.0	54.0	60.0
	3	147	77.0	38.0	87.0	67.3
HOUSING DOUND.	2	148	4.0	7.0	3.0	4.7
	3	149	81.0	80.0	94.0	85.0
KAMIO HOTEL	1	150	28.0	38.0	39.0	35.0
	2	151	42.0	33.0	36.0	37.0
ERECTION ASSO.	2	152	92.0	105.0	112.0	103.0
	4	153	60.0	45.0	60.0	55.0
SAIAD & MOUSE.	2	154	102.0	93.0	80.0	91.7
	4	155	67.0	87.0	96.0	83.3
AL FAIASEL	6	156	65.0	60.0	30.0	51.7
	7	157	20.0	15.0	16.0	17.0
AMRA BUILDING	4	158	17.0	12.0	16.0	15.0
	5	159	150.0	135.0	200.0	161.7
SAN ROCK HOTEL	4	160	136.0	145.0	196.0	159.0
	6	161	200.0	140.0	171.0	170.3
MAHA	2	162	15.0	5.0	50.0	23.3
OLD PRIMEIMIN.	1	163	55.0	71.0	45.0	57.0
	2	164	72.0	85.0	110.0	89.0
	3	165	30.0	61.0	62.0	51.0
	4	166	21.0	23.0	20.0	21.3
	5	167	45.0	30.0	50.0	41.7
ALZAYYAT	3	168	16.0	12.0	20.0	16.0

(3) LV Sample-2 Feeders (Overhead)--1996--

Substation	F. No.	Symbol	D	E	F	G
ALZAYYAT	4	169	120.0	110.0	92.0	107.3
	5	170	8.0	7.0	12.0	9.0
	6	171	32.0	45.0	60.0	45.7
CHILD CARING	2	172	6.0	18.0	3.0	9.0
	4	173	16.0	3.0	2.0	7.0
	6	174	30.0	40.0	50.0	40.0
	7	175	38.0	3.0	12.0	17.7
POLICE	3	176	91.0	57.0	56.0	68.0
	4	177	134.0	70.0	120.0	108.0
	5	178	95.0	114.0	174.0	127.7
	6	179	100.0	95.0	96.0	97.0
RADIAL ISOROPE	2	180	83.0	162.0	120.0	121.7
	3	181	6.0	2.0	2.0	3.3
	4	182	0.0	0.0	0.0	0.0
	5	183	0.0	0.0	0.0	0.0
AL-AHLI	2	184	100.0	95.0	105.0	100.0
	3	185	31.0	24.0	33.0	29.3
	4	186	46.0	50.0	54.0	50.0
AL-BUQA'E	1	187	30.0	33.0	60.0	41.0
	4	188	60.0	45.0	50.0	51.7
QUSHAIR	1	189	40.0	33.0	45.0	39.3
	2	190	140.0	127.0	107.0	124.7
EAST. NOR. of AB.	1	191	200.0	176.0	220.0	198.7
	2	192	111.0	51.0	89.0	83.7
	3	193	0.0	6.0	6.0	4.0
	4	194	40.0	15.0	32.0	29.0
VIOLET	1	195	44.0	25.0	34.0	34.3
	2	196	56.0	83.0	46.0	61.7

Substation	F. No.	Symbol	D	E	F	G
VIOLET	3	197	33.0	59.0	58.0	50.0
	4	198	126.0	140.0	119.0	128.3
HASHIM	1	199	10.0	30.0	20.0	20.0
	2	200	85.0	60.0	15.0	53.3
	3	201	12.0	10.0	10.0	10.7
	4	202	10.0	10.0	12.0	10.7
JEA	1	203	123.0	157.0	135.0	138.3
	2	204	140.0	163.0	216.0	173.0
	3	205	117.0	136.0	70.0	107.7
	4	206	29.0	13.0	21.0	21.0
AL-BAKHEET	1	207	25.0	28.0	6.0	19.7
	2	208	23.0	52.0	64.0	46.3
	3	209	9.0	11.0	4.0	8.0
	4	210	58.0	62.0	47.0	55.7
	5	211	64.0	90.0	52.0	68.7
	6	212	420.0	317.0	263.0	333.3
FAIDI	1	213	75.0	73.0	90.0	79.3
	2	214	30.0	37.0	41.0	36.0
	3	215	82.0	73.0	62.0	72.3
	4	216	66.0	146.0	36.0	82.7
	5	217	94.0	144.0	130.0	122.7
	6	218	38.0	78.0	90.0	68.7
THE LOCAL	3	219	52.0	33.0	85.0	56.7
	4	220	37.0	16.0	25.0	26.0
AL-MOHTASEB	1	221	15.0	20.0	36.0	23.7
	2	222	85.0	114.0	75.0	91.3
	6	223	45.0	60.0	41.0	48.7
	7	224	73.0	46.0	38.0	52.3

(3) LV Sample-2 Feeders (Overhead)--1996--

Substation	F. No.	Symbol	D	E	F	G
ABDOUN SCHOOL	1	225	136.0	184.0	120.0	146.7
	2	226	75.0	72.0	30.0	59.0
	5	227	105.0	100.0	172.0	125.7
	6	228	0.0	0.0	0.0	0.0
AL-HAIK	1	229	160.0	190.0	205.0	185.0
	2	230	180.0	125.0	105.0	136.7
	3	231	45.0	50.0	35.0	43.3
	4	232	95.0	85.0	90.0	90.0
REIFKO	1	233	25.0	30.0	30.0	28.3
	2	234	80.0	60.0	80.0	73.3
	4	235	160.0	115.0	120.0	131.7
JAWHARAT ABD.	3	236	118.0	120.0	120.0	119.3
	4	237	18.0	12.0	14.0	14.7
	8	238	110.0	136.0	130.0	125.3
	9	239	170.0	135.0	92.0	132.3
AL-SA'IGH	1	240	50.0	72.0	90.0	70.7
	2	241	80.0	52.0	68.0	66.7
	3	242	104.0	100.0	108.0	104.0
	4	243	290.0	400.0	390.0	360.0
BADRAN	1	244	33.0	31.0	47.0	37.0
	2	245	176.0	136.0	231.0	181.0
	3	246	7.0	62.0	10.0	26.3
	4	247	175.0	157.0	173.0	168.3
MUGAYER	1	248	55.0	70.0	55.0	60.0
	2	249	90.0	95.0	65.0	83.3
	3	250	60.0	75.0	95.0	76.7
	4	251	20.0	20.0	13.0	17.7
	5	252	70.0	70.0	70.0	70.0

Substation	F. No.	Symbol	D	E	F	G
SHASARA M. W.	1	253	40.0	55.0	70.0	55.0
	2	254	30.0	45.0	40.0	38.3
	3	255	20.0	10.0	30.0	20.0
ALSHAMWAY	1	256	150.0	140.0	140.0	143.3
	2	257	100.0	130.0	110.0	113.3
	3	258	50.0	50.0	50.0	50.0
	4	259	80.0	60.0	70.0	70.0
	5	260	60.0	40.0	50.0	50.0
	6	261	80.0	50.0	100.0	76.7
ALTAYAN	1	262	80.0	90.0	85.0	85.0
	2	263	80.0	70.0	90.0	80.0
HEBRAS,SAW	1	264	5.0	5.0	5.0	5.0
	2	265	70.0	65.0	45.0	60.0
BUWEDABH	1	266	3.0	3.0	3.0	3.0
	2	267	35.0	30.0	35.0	33.3
AGRICULTURE S.	1	268	3.0	3.0	5.0	3.7
KHANASRY	1	269	10.0	5.0	3.0	6.0
	2	270	30.0	10.0	15.0	18.3
SABHA	1	271	45.0	45.0	50.0	46.7
	2	272	65.0	45.0	50.0	53.3
	3	273	35.0	25.0	20.0	26.7
	4	274	25.0	35.0	55.0	38.3
FAISALEH	1	275	5.0	5.0	7.0	5.7
	2	276	2.0	14.0	7.0	7.7
ALNASEREH	1	277	20.0	5.0	3.0	9.3
AHAALHAYAL	1	278	5.0	5.0	6.0	5.3
ALRAHMANEBH	1	279	16.0	22.0	10.0	16.0
	2	280	90.0	90.0	80.0	86.7

(3) LV Sample-2 Feeders (Overhead)--1996--

Substation	F. No.	Symbol	D	E	F	G
ALRAHMANEBH	3	281	10.0	20.0	12.0	14.0
NVAYMEH P.	1	282	55.0	50.0	60.0	55.0
	2	283	85.0	90.0	85.0	86.7
	3	284	90.0	110.0	85.0	95.0
SAMMA	1	285	10.0	18.0	20.0	16.0
	2	286	25.0	20.0	45.0	30.0
	3	287	60.0	21.0	25.0	35.3
	4	288	45.0	70.0	60.0	58.3
MKALFTEH	1	289	8.0	18.0	8.0	11.3
	2	290	14.0	9.0	10.0	11.0
	3	291	10.0	25.0	20.0	18.3
	4	292	10.0	5.0	10.0	8.3
DUGMUSSA	1	293	11.0	5.0	15.0	10.3
	2	294	7.0	5.0	10.0	7.3
	3	295	5.0	7.0	5.0	5.7
	4	296	5.0	3.0	2.0	3.3
KVFERSAYES	1	297	40.0	55.0	40.0	45.0
	2	298	30.0	30.0	20.0	26.7
KRAIBEH	1	299	5.0	5.0	5.0	5.0
	2	300	20.0	20.0	22.0	20.7
	3	301	10.0	20.0	22.0	17.3
BARASHTA	1	302	12.0	12.0	20.0	14.7
SAMTA	1	303	3.0	3.0	2.0	2.7
	2	304	3.0	2.0	2.0	2.3
AJLOONGNST	1	305	55.0	60.0	80.0	65.0
	2	306	50.0	65.0	40.0	51.7
	3	307	30.0	10.0	35.0	25.0

Substation	F. No.	Symbol	D	E	F	G
SAKEB PUMP	1	308	70.0	55.0	50.0	58.3
	2	309	35.0	40.0	30.0	35.0
	3	310	35.0	30.0	40.0	35.0
	4	311	25.0	45.0	45.0	38.3
BABAMMAN J.	1	312	130.0	130.0	120.0	126.7
	2	313	10.0	80.0	50.0	46.7
	3	314	25.0	50.0	80.0	51.7
	4	315	70.0	80.0	60.0	70.0
MFARRADAT	1	316	6.0	4.0	7.0	5.7
	2	317	7.0	3.0	1.0	3.7
MUSALAT MAFRAQ	1	318	190.0	150.0	200.0	180.0
	2	319	140.0	140.0	150.0	143.3
	3	320	120.0	180.0	240.0	180.0
	4	321	50.0	50.0	20.0	40.0
	5	322	80.0	100.0	100.0	93.3
	6	323	10.0	10.0	10.0	10.0
	7	324	190.0	160.0	250.0	200.0
	8	325	20.0	20.0	20.0	20.0
ALKOOMAL A.	1	326	20.0	20.0	45.0	28.3
	2	327	20.0	20.0	45.0	28.3
	3	328	35.0	40.0	15.0	30.0
MALHASS	1	329	27.0	27.0	27.0	27.0

Appendix 6.1-1 Data on Sample-2 Feeders (4/4)

(4) MV Sample-2 Feeders (Overhead)--1996--

S/S Name	Feeder Name	Symbol	Max. Load (A)	Type of Conductor	Remarks
Hussein	Abdali 2	1	50	300 AL + 70CU(OH)	
	Abdali 1	2	100	300 AL +100 AL (OH)	
	Dulel	3	220	(150+100+50)ACSR	Sample
	Pine Mill	4	100	(100+50)ACSR	
Marka	HASHIM 1	5	262	100 ACSR + 300AL	
	Baga'a	6	215	(150 + 100 + 50)ACSR	
BAYADER	J.V South bayader	7	112	100 ACSR	Sample
	National Fair	8	130	300 AL + 100 ACSR + 50 ACSR	
Amman South	ALU 1	9	110	70 CU (OH)	
	ALU 2	10	110	70 CU (OH)	
QAIA	QAIA 1	11	64		
	QAIA 2	12	65		
	JEPCO 1	13	230	300 AL +(150+100+50)ACSR	Sample-1
	JEPCO 2	14	100	150ACSR	
SUBEIHI	J. Valley Middle	15	136	100 ACSR	Sample-1
	J. Valley South	16	144	100 ACSR	Sample-1
	Water 2	17	233		
	Water 3	18	185		
	JEPCO 1	19	169	(150 + 100 + 50) ACSR	
	JEPCO 2	20	268	(150 + 100 + 50) ACSR	
ASHRAFFIAH	Aviation	21	200	(150 + 100) ACSR	
IRBID	WADI AL ARABU	22	248	200 ACSR IBIS (+300 AL)	J.V North(Sample-1)
	KUFRANJ	23	182	100 AAA	Sample-1
	SAMMA	24	233	150 AAA +100 AAA	Sample-1
	EMRAWA	25	218	150 AAA +100 AAA	Sample-1
	DHULIL	26	132	100 AAA	
	HOSHA	27	195	100 AAA	
	YRMOK1	28	3	ACSR 150 DINGO	
	YRMOK2	29	5	ACSR 150 DINGO	
REHAB	Hasan	30	69	150 AAA	
	Um Jmal	31	108	100 AAA	
	Jarashi	32	191	100 AAA	
	Aljob	33	88	100 AAA	
	Balama	34	42	100 AAA	
	Smaia	35	67	100 AAA	
KARAK	South	36	119		
	North	37	81		
GHOR SAFI	GJEAIR	38	40	100 AAA (OAK)	
QATRANA	Swaqa	39	72	100 AAA (OAK)	
	Sultani	40	29	100 AAA (OAK)	
EL HASA	HASA	41	28	100 AAA (OAK)	
RASHADIYA	SHOUSK	42	74	100 AAA (OAK)	
	TAFILA	43	89	100 AAA (OAK)	
MAAN	Wadi Musa	44	104	100 AAA (OAK)	
	North Aqaba	45	26	100 AAA (OAK)	
QUWEIRA	Quweira	46	52	100 ACSR (DOG)	
	Quweira DISI	47	100	100 ACSR (DOG)	
AQABA(A2)	ACPS 1	48	63		
	ACPS 2	49	63		
SAAFAWI	SAFAWAI	50	3	100 ACSR	
RUWESHED	RUWESHEA	51	49		
SABHA	Boshreia	52	102	100 AAA	
	Industry	53	133	100 AAA	
	D. Kahf	54	120	100 AAA	
	Amra	55	122	100 AAA	
	Kaldia	56	65	100 AAA	Sample-1
Abdali	New Phosphate	57	235	(150 + 100 + 50) ACSR	
	Nat. Steel	58	150	(150 +100 + 50) ACSR	

Appendix 6.2-1 Estimation for Potential of LV Loss Reduction (Expressed by "Excel" Like Equation)

1. Load current

(1) D,E,F : r-phase s-phase and t-phase current(A) respectively.

1996···actual recorded current of this year *1.0

2008···actual recorded current of this year*1.88

(2) G : Three phase mean current(A) G=(D+E+F)/3

(3) H : Unbalance current(A) H=MAX(D,E,F)-MIN(D,E,F)

2. Loss reduction by current balancing

· The condition.

This countermeasure is applied only for H>30(A) feeders, and are made balance to H<=30(A).

(1) I : Loss reduction(kW) I=IF(H>30,0.0001*H^2+0.0022*H-0.0001*30^2-0.0022*30,0)

(2) J : Benefit(JD) J=I*2564

(3) K : Equivalent current(A) after balancing

We thought that the loss reduction made by current balancing is equivalent to that made by current reduction, according to equation model of existing loss. (y=ax^2+bx+c where a=0.00005 b=0.068 c=0.2748)

(a*G^2+b*G+c)-(a*K^2+b*K+c)=I

a*K^2+b*K+(I-a*G^2-b*G)=0

K=IF(H>30,(-0.068+SQRT(0.068^2-4*0.00005*(I-0.00005*G^2-0.068*G)))/(2*0.00005),G)

3. Loss reduction by improving power factor

· The condition

This countermeasure is applied only for K>=100(A) feeders. The powerfactor of consumer load is improved from pf=0.82 to pf=0.9. We expected that the effect(loss reduction) of this countermeasure is a half of the equation model actually(because the model is assuming perfect compensation).

This countermeasure produces loss reduction for medium voltage feeders too. It is studied in MV loss reduction estimation.

(1) L : Loss reduction(kW) L=IF(K>=100,(0.0158*K-0.7756)*0.5*(0.9-0.82)/(0.9-0.8),0)

(2) M : Benefit(JD) M=L*1577

(3) N : Cost(JD) N=IF(K>=100,(0.5907*K+0.8341)*(0.9-0.82)/(0.9-0.8),0)

(4) O : Net benefit(JD) O=M-N

(5) P : Current(A) at pf=0.9 P=IF(K>=100,K*0.82/0.9,K)

4. Loss reduction by system change(higher and same voltage line construction)

- The condition

This countermeasure is applied for P>=100(A) feeders.

(1) Q : Loss reduction(kW) Q=IF(P>=100, 0.0001*P^2+0.0165*P-1.2135,0)

(2) R : Benefit(JD) R=Q*2564

(3) S : Cost(JD) S=IF(P>=100,0.0591*P^2+22.751*P-920.37,0)

(4) T : Net benefit(JD) T=R-S

5. Total

(1) U : Loss reduction(kW) U=I+L+Q

(2) V : Benefit(JD) V=J+M+R

(3) W : Cost(JD) W=N+S

(4) X : Net benefit(JD) X=V-W

6. Extension for 100% feeders

We intended to pick up 2% random sample feeder. But, it seems to be gotten 2.29% sample as follows.

- Total current of these random sampled feeders is 24,768(A). It is converted to 13.815MW (pf=0.8, V=0.97)
- On the other hand the total peak load of 0.415kV is estimated by following way

  From 1994 actual record

  the generated energy=4837GWh

  the sent out energy=3083GWh

  Generation:0.415kV sent out ratio in Jordan=0.637

  Peak generation in 1996=902MW

  Total peak load of 0.415kV(at diversity factor=1.05)

  =902*0.637*1.05=603.3(MW)

- 603.3/13.815=43.7 the sampled feeders correspond to 2.29%

Loss reduction, benefit and net benefit those obtained from random sampled feeders are mutiplied by 44.

Appendix 6.2-2 Application of Equation Model for LV Sample-2 Feeders

Meaning of Head line in following Table

D	Load Current R Phase (A)	O	Net Benefit (JD)
E	Load Current S Phase (A)	P	Current (A) at Pf=90%
F	Load Current T Phase (A)	Q	Loss Reduction by New Line Construction (kW)
G	Load Current Mean Value (A)	R	Benefit by New Line Construction (JD)
H	Imax-Imin (A)	S	Cost for New Line Construction (JD)
I	Loss Reduction by Improving Unbalance Factor (UBF)	T	Net Benefit by New Line Construction (JD)
J	Benefit by Ditto (JD)	U	Total Loss Reduction (kW)
K	Equivalent Current (A) after Balancing	V	Total Benefit (JD)
L	Loss Reduction by Capacitor (Pf;from 82% to 90%)	W	Total Cost (JD)
M	Benefit by Ditto (JD)	X	Total Net Benefit (JD)

Appendix 6.2-2 Application of equation model for LV sample-2 feeders

Symbol	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
1	33.7	33.7	33.7	33.7	0.0	0.0	0	33.7	0.00	0	0	0	33.7	0.0	0	0	0	0.00	0	0	0
2	67.4	67.4	67.4	67.4	0.0	0.0	0	67.4	0.00	0	0	0	67.4	0.0	0	0	0	0.00	0	0	0
3	16.9	16.9	16.9	16.9	0.0	0.0	0	16.9	0.00	0	0	0	16.9	0.0	0	0	0	0.00	0	0	0
4	151.7	151.7	151.7	151.7	0.0	0.0	0	151.7	0.65	1,022	72	950	138.2	3.0	7,631	3,352	4,279	3.62	8,653	3,424	5,229
5	67.4	67.4	67.4	67.4	0.0	0.0	0	67.4	0.00	0	0	0	67.4	0.0	0	0	0	0.00	0	0	0
6	50.6	50.6	50.6	50.6	0.0	0.0	0	50.6	0.00	0	0	0	50.6	0.0	0	0	0	0.00	0	0	0
7	84.3	84.3	84.3	84.3	0.0	0.0	0	84.3	0.00	0	0	0	84.3	0.0	0	0	0	0.00	0	0	0
8	56.4	75.2	56.4	62.7	18.8	0.0	0	62.7	0.00	0	0	0	62.7	0.0	0	0	0	0.00	0	0	0
9	112.8	150.4	112.8	125.3	37.6	0.1	175	124.5	0.48	751	59	692	113.4	1.9	4,985	2,420	2,565	2.49	5,912	2,480	3,432
10	244.4	244.4	244.4	244.4	0.0	0.0	0	244.4	1.23	1,947	116	1,830	222.7	7.4	19,023	7,076	11,946	8.65	20,969	7,192	13,777
11	150.4	131.6	94.0	125.3	56.4	0.3	734	121.8	0.46	724	58	666	110.9	1.8	4,738	2,331	2,407	2.59	6,197	2,390	3,807
12	112.8	112.8	150.4	125.3	37.6	0.1	175	124.5	0.48	751	59	692	113.4	1.9	4,985	2,420	2,565	2.49	5,912	2,480	3,432
13	56.4	56.4	75.2	62.7	18.8	0.0	0	62.7	0.00	0	0	0	62.7	0.0	0	0	0	0.00	0	0	0
14	33.8	22.6	33.8	30.1	11.3	0.0	0	30.1	0.00	0	0	0	30.1	0.0	0	0	0	0.00	0	0	0
15	28.2	41.4	47.0	38.9	18.8	0.0	0	38.9	0.00	0	0	0	38.9	0.0	0	0	0	0.00	0	0	0
16	112.8	94.0	75.2	94.0	37.6	0.1	175	93.1	0.00	0	0	0	93.1	0.0	0	0	0	0.07	175	0	175
17	56.4	56.4	103.4	72.1	47.0	0.2	432	69.8	0.00	0	0	0	69.8	0.0	0	0	0	0.17	432	0	432
18	56.4	65.8	75.2	65.8	18.8	0.0	0	65.8	0.00	0	0	0	65.8	0.0	0	0	0	0.00	0	0	0
19	188.0	188.0	169.2	181.7	18.8	0.0	0	181.7	0.84	1,322	87	1,235	165.6	4.3	10,923	4,467	6,456	5.10	12,245	4,554	7,692
20	94.0	94.0	150.4	112.8	56.4	0.3	734	109.2	0.38	599	52	547	99.5	0.0	0	0	0	0.67	1,333	52	1,280
21	225.6	244.4	131.6	200.5	112.8	1.4	3,499	184.9	0.86	1,354	88	1,266	168.5	4.4	11,292	4,590	6,703	6.63	16,144	4,678	11,467
22	18.8	103.4	47.0	56.4	84.6	0.7	1,912	46.2	0.00	0	0	0	46.2	0.0	0	0	0	0.75	1,912	0	1,912
23	9.4	5.6	5.6	6.9	3.8	0.0	0	6.9	0.00	0	0	0	6.9	0.0	0	0	0	0.00	0	0	0
24	5.6	3.8	3.8	4.4	1.9	0.0	0	4.4	0.00	0	0	0	4.4	0.0	0	0	0	0.00	0	0	0
25	37.6	5.6	80.8	41.4	75.2	0.6	1,474	33.3	0.00	0	0	0	33.3	0.0	0	0	0	0.57	1,474	0	1,474
26	32.0	13.2	84.6	43.2	71.4	0.5	1,312	36.1	0.00	0	0	0	36.1	0.0	0	0	0	0.51	1,312	0	1,312
27	206.8	169.2	197.4	191.1	37.6	0.1	175	190.4	0.89	1,408	91	1,317	173.4	4.7	11,938	4,803	7,135	5.62	13,520	4,894	8,627
28	118.4	112.8	131.6	120.9	18.8	0.0	0	120.9	0.45	716	58	658	110.2	1.8	4,664	2,304	2,360	2.27	5,380	2,362	3,018
29	188.0	225.6	150.4	188.0	75.2	0.6	1,474	181.4	0.84	1,318	86	1,232	165.2	4.2	10,879	4,452	6,427	5.65	13,671	4,539	9,133
30	169.2	150.4	206.8	175.5	56.4	0.3	734	172.1	0.78	1,226	82	1,144	156.8	3.8	9,828	4,101	5,727	4.90	11,788	4,183	7,605

Symbol	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
31	56.4	56.4	28.2	47.0	28.2	0.0	0	47.0	0.00	0	0	0	47.0	0.0	0	0	0	0.00	0	0	0
32	263.2	216.2	159.8	213.1	103.4	1.1	2,925	200.2	0.96	1,506	95	1,411	182.4	5.1	13,136	5,196	7,940	7.22	17,567	5,291	12,276
33	282.0	225.6	263.2	256.9	56.4	0.3	734	253.9	1.29	2,041	121	1,920	231.3	8.0	20,392	7,504	12,888	9.53	23,167	7,625	15,542
34	263.2	131.6	188.0	194.3	131.6	1.9	4,783	172.7	0.78	1,232	82	1,149	157.3	3.9	9,889	4,121	5,768	6.50	15,904	4,204	11,700
35	300.8	300.8	319.6	307.1	18.8	0.0	0	307.1	1.63	2,571	146	2,425	279.8	11.2	28,794	10,071	18,723	12.86	21,365	10,216	21,148
36	56.4	56.4	56.4	56.4	0.0	0.0	0	56.4	0.00	0	0	0	56.4	0.0	0	0	0	0.00	0	0	0
37	56.4	56.4	56.4	56.4	0.0	0.0	0	56.4	0.00	0	0	0	56.4	0.0	0	0	0	0.00	0	0	0
38	94.0	24.4	56.4	58.3	69.6	0.5	1,233	51.7	0.00	0	0	0	51.7	0.0	0	0	0	0.48	1,233	0	1,233
39	63.9	56.4	3.8	41.4	60.2	0.3	867	36.7	0.00	0	0	0	36.7	0.0	0	0	0	0.34	867	0	867
40	80.8	75.2	67.7	74.6	13.2	0.0	0	74.6	0.00	0	0	0	74.6	0.0	0	0	0	0.00	0	0	0
41	464.4	466.2	520.8	483.8	56.4	0.3	734	481.3	2.73	4,308	228	4,080	438.5	25.3	64,752	20,423	44,329	28.27	69,793	20,651	49,143
42	193.6	178.6	167.3	179.9	26.3	0.0	0	179.9	0.83	1,303	86	1,218	163.9	4.2	10,706	4,395	6,311	5.00	12,009	4,480	7,529
43	231.2	131.6	332.8	231.9	201.2	4.3	11,110	183.0	0.85	1,335	87	1,248	166.8	4.3	11,075	4,518	6,553	9.50	23,520	4,605	18,915
44	169.2	216.2	161.7	182.4	54.5	0.3	670	179.3	0.82	1,298	85	1,213	163.4	4.2	10,645	4,374	6,271	5.24	12,613	4,460	8,153
45	112.8	90.2	82.7	95.3	30.1	0.0	2	95.2	0.00	0	0	0	95.2	0.0	0	0	0	0.00	2	0	2
46	82.7	112.8	161.7	119.1	79.0	0.6	1,644	111.0	0.39	617	53	564	101.1	1.5	3,790	1,985	1,805	2.51	6,051	2,038	4,013
47	188.0	188.0	272.6	216.2	84.6	0.7	1,912	207.8	1.00	1,582	99	1,483	189.4	5.5	14,094	5,507	8,587	7.25	17,589	5,606	11,983
48	188.0	131.6	253.8	191.1	122.2	1.6	4,118	172.5	0.78	1,230	82	1,148	157.2	3.8	9,871	4,115	5,756	6.24	15,219	4,197	11,022
49	317.7	148.5	304.6	256.9	169.2	3.1	7,895	223.5	1.10	1,738	106	1,632	203.6	6.3	16,132	6,162	9,970	10.47	25,765	6,268	19,496
50	30.1	37.6	56.4	41.4	26.3	0.0	0	41.4	0.00	0	0	0	41.4	0.0	0	0	0	0.00	0	0	0
51	28.2	7.5	32.0	22.6	24.4	0.0	0	22.6	0.00	0	0	0	22.6	0.0	0	0	0	0.00	0	0	0
52	0.0	0.0	24.4	8.1	24.4	0.0	0	8.1	0.00	0	0	0	8.1	0.0	0	0	0	0.00	0	0	0
53	197.4	32.0	41.4	90.2	165.4	2.9	7,551	51.0	0.00	0	0	0	51.0	0.0	0	0	0	2.95	7,551	0	7,551
54	65.8	131.6	47.0	31.5	84.6	0.7	1,912	71.6	0.00	0	0	0	71.6	0.0	0	0	0	0.75	1,912	0	1,912
55	0.0	94.0	47.0	47.0	94.0	0.9	2,396	34.0	0.00	0	0	0	34.0	0.0	0	0	0	0.93	2,396	0	2,396
56	564.0	592.2	526.4	560.9	65.8	0.4	1,081	557.5	3.21	5,067	264	4,803	507.9	33.0	84,521	25,881	58,639	36.60	90,669	26,145	64,523
57	0.0	11.3	112.8	41.4	112.8	1.4	3,499	22.2	0.00	0	0	0	22.2	0.0	0	0	0	1.36	3,499	0	3,499
58	3.8	7.5	3.8	5.0	3.8	0.0	0	5.0	0.00	0	0	0	5.0	0.0	0	0	0	0.00	0	0	0
59	16.9	73.3	13.2	34.5	60.2	0.3	867	29.7	0.00	0	0	0	29.7	0.0	0	0	0	0.34	867	0	867
60	225.6	270.7	385.4	293.9	159.8	2.7	7,049	265.3	1.37	2,154	126	2,028	241.7	8.6	22,089	8,030	14,059	12.73	31,292	8,156	23,136
61	86.5	43.2	33.8	54.5	52.6	0.2	607	51.3	0.00	0	0	0	51.3	0.0	0	0	0	0.24	607	0	607

Symbol	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
62	188.0	139.1	174.8	167.3	48.9	0.2	488	165.1	0.73	1,156	79	1,077	150.4	3.5	9,051	3,838	5,213	4.45	10,695	3,917	6,778
63	24.4	13.2	35.7	24.4	22.6	0.0	0	24.4	0.00	0	0	0	24.4	0.0	0	0	0	0.00	0	0	0
64	347.8	389.2	310.2	349.1	79.0	0.6	1,644	342.8	1.86	2,927	163	2,765	312.3	13.7	35,114	11,951	23,163	16.19	39,686	12,113	27,572
65	37.6	32.0	33.8	34.5	5.6	0.0	0	34.5	0.00	0	0	0	34.5	0.0	0	0	0	0.00	0	0	0
66	131.6	84.6	103.4	106.5	47.0	0.2	432	104.4	0.35	551	50	501	95.1	0.0	0	0	0	0.52	983	50	933
67	103.4	101.5	131.6	112.2	30.1	0.0	2	112.2	0.40	629	54	575	102.2	1.5	3,890	2,022	1,868	1.92	4,520	2,076	2,445
68	131.6	173.0	161.7	155.4	41.4	0.1	272	154.1	0.66	1,047	74	974	140.4	3.1	7,887	3,440	4,447	3.85	9,206	3,514	5,692
69	84.6	86.5	65.8	79.0	20.7	0.0	0	79.0	0.00	0	0	0	79.0	0.0	0	0	0	0.00	0	0	0
70	107.2	210.6	154.2	157.3	103.4	1.1	2,925	143.6	0.60	942	69	873	130.8	2.7	6,809	3,066	3,742	4.39	10,675	3,135	7,540
71	86.5	50.8	94.0	77.1	43.2	0.1	323	75.4	0.00	0	0	0	75.4	0.0	0	0	0	0.13	323	0	323
72	94.0	203.0	118.4	138.5	109.0	1.3	3,264	122.8	0.47	735	59	676	111.9	1.9	4,831	2,365	2,466	3.62	8,829	2,423	6,406
73	394.8	406.1	376.0	392.3	30.1	0.0	2	392.3	2.17	3,421	186	3,234	357.4	17.5	44,764	14,761	30,003	19.63	48,186	14,947	33,239
74	182.4	188.0	357.2	242.5	174.8	3.3	8,424	206.2	0.99	1,566	98	1,468	187.9	5.4	13,885	5,439	8,446	9.69	23,875	5,538	18,338
75	278.2	212.4	268.8	253.2	65.8	0.4	1,081	248.6	1.26	1,989	118	1,871	226.5	7.7	19,631	7,267	12,365	9.34	22,702	7,385	15,317
76	37.6	16.9	11.3	21.9	26.3	0.0	0	21.9	0.00	0	0	0	21.9	0.0	0	0	0	0.00	0	0	0
77	146.6	167.3	263.2	192.4	116.6	1.5	3,741	175.5	0.80	1,260	84	1,176	159.9	4.0	10,209	4,229	5,980	6.24	15,210	4,312	10,898
78	188.0	124.1	163.6	158.5	63.9	0.4	1,008	153.8	0.66	1,044	73	971	140.2	3.1	7,856	3,430	4,426	4.12	9,908	3,503	6,405
79	244.4	248.2	188.0	226.9	60.2	0.3	867	223.1	1.10	1,734	106	1,628	203.3	6.3	16,084	6,147	9,937	7.71	18,686	6,253	12,433
80	280.1	267.0	310.2	285.8	43.2	0.1	323	284.5	1.49	2,346	135	2,211	259.2	9.8	25,075	8,946	16,129	11.39	27,744	9,081	18,663
81	116.6	90.2	139.1	115.3	48.9	0.2	488	112.9	0.40	636	54	582	102.9	1.5	3,954	2,046	1,909	2.14	5,078	2,100	2,979
82	15.0	18.8	67.7	33.8	52.6	0.2	607	30.5	0.00	0	0	0	30.5	0.0	0	0	0	0.24	607	0	607
83	112.8	141.0	127.8	127.2	28.2	0.0	0	127.2	0.49	779	61	718	115.9	2.0	5,237	2,511	2,726	2.54	6,015	2,571	3,444
84	52.6	48.9	60.2	53.9	11.3	0.0	0	53.9	0.00	0	0	0	53.9	0.0	0	0	0	0.00	0	0	0
85	282.0	235.0	131.6	216.2	150.4	2.4	6,248	188.6	0.88	1,390	90	1,301	171.8	4.6	11,727	4,733	6,994	7.89	19,366	4,823	14,542
86	225.6	206.8	188.0	206.8	37.6	0.1	175	206.0	0.99	1,564	98	1,466	187.7	5.4	13,865	5,433	8,432	6.47	15,604	5,531	10,073
87	11.3	67.7	43.2	40.7	56.4	0.3	734	36.8	0.00	0	0	0	36.8	0.0	0	0	0	0.29	734	0	734
88	329.0	235.0	282.0	282.0	94.0	0.9	2,396	272.2	1.41	2,224	129	2,095	248.0	9.0	23,157	8,359	14,798	11.38	27,776	8,488	19,288
89	28.2	56.4	22.6	35.7	33.8	0.0	85	35.3	0.00	0	0	0	35.3	0.0	0	0	0	0.03	85	0	85
90	47.0	62.0	118.4	75.8	71.4	0.5	1,312	69.0	0.00	0	0	0	69.0	0.0	0	0	0	0.51	1,312	0	1,312
91	37.6	48.9	94.0	60.2	56.4	0.3	734	56.3	0.00	0	0	0	56.3	0.0	0	0	0	0.29	734	0	734
92	385.4	394.8	340.3	373.5	54.5	0.3	670	371.0	2.03	3,208	176	3,032	338.0	15.8	40,487	13,523	26,964	18.09	44,365	13,699	30,666

Symbol	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
93	293.3	291.4	481.3	355.3	189.9	3.9	9,915	317.3	1.69	2,673	151	2,522	289.1	11.9	30,542	10,595	19,948	17.47	43,131	10,745	32,336
94	176.7	214.3	197.4	196.1	37.6	0.1	175	195.4	0.92	1,458	93	1,365	178.0	4.9	12,543	5,002	7,541	5.88	14,176	5,095	9,081
95	276.4	246.3	244.4	255.7	32.0	0.0	42	255.5	1.30	2,057	121	1,936	232.8	8.0	20,632	7,579	13,053	9.37	22,732	7,700	15,031
96	79.0	94.0	79.0	84.0	15.0	0.0	0	84.0	0.00	0	0	0	84.0	0.0	0	0	0	0.00	0	0	0
97	26.3	48.9	50.8	42.0	24.4	0.0	0	42.0	0.00	0	0	0	42.0	0.0	0	0	0	0.00	0	0	0
98	15.0	35.7	15.0	21.9	20.7	0.0	0	21.9	0.00	0	0	0	21.9	0.0	0	0	0	0.00	0	0	0
99	268.8	244.4	327.1	280.1	82.7	0.7	1,821	272.7	1.41	2,229	130	2,099	248.5	9.1	23,227	8,380	14,847	11.18	27,277	8,510	18,767
100	105.3	159.8	138.0	151.0	82.7	0.7	1,821	142.4	0.59	930	68	862	129.8	2.6	6,697	3,027	3,670	3.91	9,448	3,095	6,353
101	0.0	7.5	0.0	2.5	7.5	0.0	0	2.5	0.00	0	0	0	2.5	0.0	0	0	0	0.00	0	0	0
102	35.7	28.2	67.7	43.9	39.5	0.1	222	42.7	0.00	0	0	0	42.7	0.0	0	0	0	0.09	222	0	222
103	265.1	298.9	297.0	287.0	33.8	0.0	85	286.7	1.50	2,368	136	2,232	261.2	9.9	25,430	9,054	16,376	11.45	27,883	9,190	18,693
104	56.4	112.8	161.7	110.3	105.3	1.2	3,036	95.2	0.00	0	0	0	95.2	0.0	0	0	0	1.18	3,036	0	3,036
105	251.9	280.1	195.5	242.5	84.6	0.7	1,912	234.4	1.17	1,847	111	1,735	213.6	6.9	17,618	6,634	10,984	8.79	21,377	6,745	14,632
106	159.8	118.4	75.2	117.8	84.6	0.7	1,912	108.4	0.37	591	52	539	98.8	0.0	0	0	0	1.12	2,504	52	2,452
107	171.1	251.9	235.0	219.3	80.8	0.7	1,732	211.8	1.03	1,622	101	1,521	193.0	5.7	14,600	5,670	8,929	7.40	17,953	5,771	12,182
108	7.5	9.4	18.8	11.9	11.3	0.0	0	11.9	0.00	0	0	0	11.9	0.0	0	0	0	0.00	0	0	0
109	41.4	60.2	24.4	42.0	35.7	0.1	129	41.3	0.00	0	0	0	41.3	0.0	0	0	0	0.05	129	0	129
110	259.4	300.8	357.2	305.8	97.8	1.0	2,602	295.5	1.56	2,456	140	2,315	269.2	10.5	26,859	9,487	17,371	13.05	31,916	9,627	22,289
111	218.1	152.3	221.8	197.4	69.6	0.5	1,233	191.9	0.90	1,423	91	1,332	174.8	4.7	12,124	4,864	7,260	6.11	14,780	4,956	9,825
112	120.3	124.1	240.6	161.7	120.3	1.6	3,991	143.0	0.59	936	68	868	130.3	2.6	6,751	3,046	3,705	4.78	11,677	3,115	8,563
113	150.4	141.0	146.6	146.0	9.4	0.0	0	146.0	0.61	966	70	896	133.0	2.8	7,055	3,152	3,902	3.36	8,021	3,222	4,799
114	366.6	235.0	347.8	316.5	131.6	1.9	4,783	297.6	1.57	2,477	141	2,335	271.1	10.6	27,205	9,592	17,613	14.05	34,464	9,733	24,731
115	35.7	54.5	73.3	54.5	37.6	0.1	175	53.6	0.00	0	0	0	53.6	0.0	0	0	0	0.07	175	0	175
116	218.1	253.8	176.7	216.2	77.1	0.6	1,558	209.4	1.01	1,598	100	1,498	190.8	5.6	14,292	5,571	8,721	7.19	17,448	5,671	11,777
117	394.8	500.1	586.6	493.8	191.8	3.9	10,110	459.7	2.60	4,093	218	3,875	418.9	23.2	59,593	18,978	40,615	29.78	73,796	19,196	54,600
118	20.7	9.4	109.0	46.4	99.6	1.1	2,708	31.7	0.00	0	0	0	31.7	0.0	0	0	0	1.06	2,708	0	2,708
119	47.0	112.8	48.9	69.6	65.8	0.4	1,081	63.9	0.00	0	0	0	63.9	0.0	0	0	0	0.42	1,081	0	1,081
120	43.2	60.2	79.0	60.8	35.7	0.1	129	60.1	0.00	0	0	0	60.1	0.0	0	0	0	0.05	129	0	129
121	357.2	366.6	417.4	380.4	60.2	0.3	867	377.2	2.07	3,270	179	3,091	343.7	16.3	41,710	13,878	27,831	18.68	45,847	14,057	31,790
122	99.6	131.6	163.6	131.6	63.9	0.4	1,008	126.7	0.49	774	61	713	115.5	2.0	5,193	2,495	2,698	2.91	6,975	2,555	4,419
123	22.6	18.8	28.2	23.2	9.4	0.0	0	23.2	0.00	0	0	0	23.2	0.0	0	0	0	0.00	0	0	0

Symbol	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
124	60.2	24.4	37.6	40.7	35.7	0.1	129	40.0	0.00	0	0	0	40.0	0.0	0	0	0	0.05	129	0	129
125	30.1	65.8	60.2	52.0	35.7	0.1	129	51.3	0.00	0	0	0	51.3	0.0	0	0	0	0.05	129	0	129
126	225.6	206.8	216.2	216.2	18.8	0.0	0	216.2	1.06	1,666	103	1,563	197.0	5.9	15,171	5,854	9,317	6.97	16,836	5,957	10,879
127	47.0	56.4	47.0	50.1	9.4	0.0	0	50.1	0.00	0	0	0	50.1	0.0	0	0	0	0.00	0	0	0
128	169.2	150.4	154.2	157.9	18.8	0.0	0	157.9	0.69	1,085	75	1,009	143.9	3.2	8,284	3,577	4,707	3.92	9,368	3,652	5,717
129	7.5	9.4	37.6	18.2	30.1	0.0	2	18.2	0.00	0	0	0	18.2	0.0	0	0	0	0.00	2	0	2
130	18.8	28.2	37.6	28.2	18.8	0.0	0	28.2	0.00	0	0	0	28.2	0.0	0	0	0	0.00	0	0	0
131	41.4	43.2	33.8	39.5	9.4	0.0	0	39.5	0.00	0	0	0	39.5	0.0	0	0	0	0.00	0	0	0
132	9.4	30.1	30.1	23.2	20.7	0.0	0	23.2	0.00	0	0	0	23.2	0.0	0	0	0	0.00	0	0	0
133	15.0	1.9	9.4	8.8	13.2	0.0	0	8.8	0.00	0	0	0	8.8	0.0	0	0	0	0.00	0	0	0
134	13.2	18.8	7.5	13.2	11.3	0.0	0	13.2	0.00	0	0	0	13.2	0.0	0	0	0	0.00	0	0	0
135	188.0	248.2	329.0	255.1	141.0	2.1	5,493	231.9	1.16	1,822	110	1,711	211.2	6.7	17,267	6,523	10,744	10.03	24,582	6,633	17,948
136	413.6	344.0	263.2	340.3	150.4	2.4	6,248	316.1	1.69	2,661	150	2,511	288.0	11.8	30,342	10,535	19,807	15.96	39,251	10,685	28,566
137	107.2	47.0	75.2	76.5	60.2	0.3	867	72.0	0.00	0	0	0	72.0	0.0	0	0	0	0.34	867	0	867
138	379.8	349.7	424.9	384.8	75.2	0.6	1,474	379.4	2.09	3,292	180	3,112	345.6	16.4	42,142	14,004	28,139	19.10	46,908	14,184	32,725
139	197.4	220.0	206.8	208.1	22.6	0.0	0	208.1	1.00	1,584	99	1,485	189.6	5.5	14,121	5,516	8,605	6.51	15,706	5,615	10,091
140	268.8	315.8	282.0	288.9	47.0	0.2	432	287.2	1.50	2,373	136	2,236	261.6	9.9	25,508	9,077	16,430	11.62	28,312	9,214	19,098
141	272.6	272.6	282.0	275.7	9.4	0.0	0	275.7	1.43	2,259	131	2,128	251.2	9.2	23,699	8,525	15,174	10.68	25,958	8,656	17,302
142	225.6	206.8	282.0	238.1	75.2	0.6	1,474	231.8	1.16	1,822	110	1,711	211.2	6.7	17,267	6,523	10,744	8.46	20,562	6,633	13,929
143	112.8	94.0	131.6	112.8	37.6	0.1	175	111.9	0.40	626	54	573	102.0	1.5	3,870	2,015	1,856	1.97	4,671	2,068	2,603
144	60.2	20.7	45.1	42.0	39.5	0.1	222	40.8	0.00	0	0	0	40.8	0.0	0	0	0	0.09	222	0	222
145	447.4	394.8	361.0	401.1	86.5	0.8	2,005	393.8	2.18	3,436	187	3,249	358.8	17.6	45,077	14,851	30,226	20.54	50,518	15,038	35,480
146	94.0	142.9	101.5	112.8	48.9	0.2	488	110.4	0.39	611	53	558	100.6	1.5	3,738	1,966	1,772	2.04	4,837	2,019	2,818
147	144.8	71.4	163.6	126.6	92.1	0.9	2,295	115.4	0.42	661	55	606	105.2	1.6	4,172	2,125	2,047	2.94	7,129	2,181	4,948
148	7.5	13.2	5.6	8.8	7.5	0.0	0	8.8	0.00	0	0	0	8.8	0.0	0	0	0	0.00	0	0	0
149	152.3	150.4	176.7	159.8	26.3	0.0	0	159.8	0.70	1,103	76	1,027	145.6	3.3	8,483	3,645	4,838	4.01	9,587	3,721	5,866
150	52.6	71.4	73.3	65.8	20.7	0.0	0	65.8	0.00	0	0	0	65.8	0.0	0	0	0	0.00	0	0	0
151	79.0	62.0	67.7	69.6	16.9	0.0	0	69.6	0.00	0	0	0	69.6	0.0	0	0	0	0.00	0	0	0
152	173.0	197.4	210.6	193.6	37.6	0.1	175	192.9	0.91	1,433	92	1,341	175.7	4.8	12,239	4,902	7,337	5.75	13,847	4,994	8,853
153	112.8	84.6	112.8	103.4	28.2	0.0	0	103.4	0.34	541	50	492	94.2	0.0	0	0	0	0.34	541	50	492
154	191.8	174.8	150.4	172.3	41.4	0.1	272	171.1	0.77	1,216	82	1,134	155.9	3.8	9,713	4,062	5,651	4.67	11,201	4,144	7,058

Symbol	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
155	126.0	163.6	180.5	156.7	54.5	0.3	670	153.5	0.66	1,041	73	968	139.9	3.1	7,824	3,419	4,406	3.97	9,535	3,492	6,043
156	122.2	112.8	56.4	97.1	65.8	0.4	1,081	91.7	0.00	0	0	0	91.7	0.0	0	0	0	0.42	1,081	0	1,081
157	37.6	28.2	30.1	32.0	9.4	0.0	0	32.0	0.00	0	0	0	32.0	0.0	0	0	0	0.00	0	0	0
158	32.0	22.6	30.1	28.2	9.4	0.0	0	28.2	0.00	0	0	0	28.2	0.0	0	0	0	0.00	0	0	0
159	282.0	253.8	376.0	303.9	122.2	1.6	4,118	287.5	1.51	2,376	137	2,239	261.9	10.0	25,559	9,093	16,466	13.08	32,053	9,229	22,823
160	255.7	272.6	368.5	298.9	112.8	1.4	3,499	284.9	1.49	2,350	135	2,215	259.6	9.8	25,143	8,966	16,177	12.66	30,992	9,102	21,890
161	376.0	263.2	321.5	320.2	112.8	1.4	3,499	306.5	1.63	2,565	146	2,420	279.2	11.2	28,696	10,041	18,655	14.18	34,760	10,187	24,573
162	28.2	9.4	94.0	43.9	84.6	0.7	1,912	33.5	0.00	0	0	0	33.5	0.0	0	0	0	0.75	1,912	0	1,912
163	103.4	133.5	84.6	107.2	48.9	0.2	488	104.7	0.35	555	50	504	95.4	0.0	0	0	0	0.54	1,043	50	993
164	135.4	159.8	206.8	167.3	71.4	0.5	1,312	161.3	0.71	1,118	77	1,041	146.9	3.4	8,640	3,698	4,941	4.59	11,069	3,775	7,294
165	56.4	114.7	116.6	95.9	60.2	0.3	867	91.5	0.00	0	0	0	91.5	0.0	0	0	0	0.34	867	0	867
166	39.5	43.2	37.6	40.1	5.6	0.0	0	40.1	0.00	0	0	0	40.1	0.0	0	0	0	0.00	0	0	0
167	84.6	56.4	94.0	78.3	37.6	0.1	175	77.4	0.00	0	0	0	77.4	0.0	0	0	0	0.07	175	0	175
168	30.1	22.6	37.6	30.1	15.0	0.0	0	30.1	0.00	0	0	0	30.1	0.0	0	0	0	0.00	0	0	0
169	225.6	206.8	173.0	201.8	52.6	0.2	607	199.1	0.95	1,495	95	1,400	181.4	5.1	13,000	5,151	7,848	6.26	15,102	5,246	9,856
170	15.0	13.2	22.6	16.9	9.4	0.0	0	16.9	0.00	0	0	0	16.9	0.0	0	0	0	0.00	0	0	0
171	60.2	84.6	112.8	85.9	52.6	0.2	607	82.8	0.00	0	0	0	82.8	0.0	0	0	0	0.24	607	0	607
172	11.3	33.8	5.6	16.9	28.2	0.0	0	16.9	0.00	0	0	0	16.9	0.0	0	0	0	0.00	0	0	0
173	30.1	5.6	3.8	13.2	26.3	0.0	0	13.2	0.00	0	0	0	13.2	0.0	0	0	0	0.00	0	0	0
174	56.4	75.2	94.0	75.2	37.6	0.1	175	74.3	0.00	0	0	0	74.3	0.0	0	0	0	0.07	175	0	175
175	71.4	5.6	22.6	33.2	65.8	0.4	1,081	27.3	0.00	0	0	0	27.3	0.0	0	0	0	0.42	1,081	0	1,081
176	171.1	107.2	105.3	127.8	65.8	0.4	1,081	122.6	0.46	733	59	674	111.7	1.9	4,814	2,358	2,455	2.76	6,628	2,417	4,211
177	251.9	131.6	225.6	203.0	120.3	1.6	3,991	185.2	0.86	1,357	88	1,269	168.8	4.4	11,332	4,603	6,729	6.84	16,679	4,691	11,988
178	178.6	214.3	327.1	240.0	148.5	2.4	6,094	213.8	1.04	1,642	102	1,540	194.8	5.8	14,860	5,754	9,106	9.21	22,595	5,856	16,739
179	188.0	178.6	180.5	182.4	9.4	0.0	0	182.4	0.84	1,328	87	1,241	166.2	4.3	10,996	4,491	6,505	5.13	12,324	4,578	7,746
180	156.0	304.6	225.6	228.7	148.5	2.4	6,094	202.2	0.97	1,526	96	1,430	184.2	5.2	13,384	5,277	8,107	8.56	21,003	5,373	15,630
181	11.3	3.8	3.8	6.3	7.5	0.0	0	6.3	0.00	0	0	0	6.3	0.0	0	0	0	0.00	0	0	0
182	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00	0	0	0	0.0	0.0	0	0	0	0.00	0	0	0
183	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00	0	0	0	0.0	0.0	0	0	0	0.00	0	0	0
184	188.0	178.6	197.4	188.0	18.8	0.0	0	188.0	0.88	1,384	90	1,295	171.3	4.5	11,658	4,711	6,947	5.42	13,042	4,800	8,242
185	58.3	45.1	62.0	55.1	16.9	0.0	0	55.1	0.00	0	0	0	55.1	0.0	0	0	0	0.00	0	0	0

Symbol	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
186	86.5	94.0	101.5	94.0	15.0	0.0	0	94.0	0.00	0	0	0	94.0	0.0	0	0	0	0.00	0	0	0
187	56.4	62.0	112.8	77.1	56.4	0.3	734	73.3	0.00	0	0	0	73.3	0.0	0	0	0	0.29	734	0	734
188	112.8	84.6	94.0	97.1	28.2	0.0	0	97.1	0.00	0	0	0	97.1	0.0	0	0	0	0.00	0	0	0
189	75.2	62.0	84.6	73.9	22.6	0.0	0	73.9	0.00	0	0	0	73.9	0.0	0	0	0	0.00	0	0	0
190	263.2	238.8	201.2	234.4	62.0	0.4	937	230.4	1.15	1,807	110	1,697	209.9	6.7	17,064	6,458	10,605	8.17	19,807	6,568	13,239
191	376.0	330.9	413.6	373.5	82.7	0.7	1,821	366.7	2.01	3,166	174	2,992	334.1	15.5	39,650	13,280	26,370	18.18	44,637	13,454	31,183
192	208.7	95.9	167.3	157.3	112.8	1.4	3,499	140.8	0.58	914	67	847	128.3	2.6	6,539	2,972	3,567	4.49	10,952	3,039	7,913
193	0.0	11.3	11.3	7.5	11.3	0.0	0	7.5	0.00	0	0	0	7.5	0.0	0	0	0	0.00	0	0	0
194	75.2	28.2	60.2	54.5	47.0	0.2	432	52.2	0.00	0	0	0	52.2	0.0	0	0	0	0.17	432	0	432
195	82.7	47.0	63.9	64.5	35.7	0.1	129	63.9	0.00	0	0	0	63.9	0.0	0	0	0	0.05	129	0	129
196	105.3	156.0	86.5	115.9	69.6	0.5	1,233	109.9	0.38	606	53	553	100.1	1.4	3,693	1,949	1,743	2.31	5,532	2,002	3,530
197	62.0	110.9	109.0	94.0	48.9	0.2	488	91.5	0.00	0	0	0	91.5	0.0	0	0	0	0.19	488	0	488
198	236.9	263.2	223.7	241.3	39.5	0.1	222	240.3	1.21	1,906	114	1,792	219.0	7.2	18,445	6,895	11,550	8.49	20,573	7,009	13,564
199	18.8	56.4	37.6	37.6	37.6	0.1	175	36.7	0.00	0	0	0	36.7	0.0	0	0	0	0.07	175	0	175
200	159.8	112.8	28.2	100.3	131.6	1.9	4,783	76.0	0.00	0	0	0	76.0	0.0	0	0	0	1.87	4,783	0	4,783
201	22.6	18.8	18.8	20.1	3.8	0.0	0	20.1	0.00	0	0	0	20.1	0.0	0	0	0	0.00	0	0	0
202	18.8	18.8	22.6	20.1	3.8	0.0	0	20.1	0.00	0	0	0	20.1	0.0	0	0	0	0.00	0	0	0
203	231.2	295.2	253.8	260.1	63.9	0.4	1,008	255.9	1.31	2,061	122	1,939	233.1	8.1	20,687	7,596	13,091	9.77	23,756	7,717	16,039
204	263.2	306.4	406.1	325.2	142.9	2.2	5,640	303.1	1.61	2,532	144	2,388	276.2	11.0	28,128	9,870	18,257	14.78	36,300	10,014	26,286
205	220.0	255.7	131.6	202.4	124.1	1.7	4,247	183.4	0.85	1,339	87	1,252	167.1	4.3	11,121	4,533	6,588	6.84	16,708	4,620	12,087
206	54.5	24.4	39.5	39.5	30.1	0.0	2	39.5	0.00	0	0	0	39.5	0.0	0	0	0	0.00	2	0	2
207	47.0	52.6	11.3	37.0	41.4	0.1	272	35.5	0.00	0	0	0	35.5	0.0	0	0	0	0.11	272	0	272
208	43.2	97.8	120.3	87.1	77.1	0.6	1,558	79.1	0.00	0	0	0	79.1	0.0	0	0	0	0.61	1,558	0	1,558
209	16.9	20.7	7.5	15.0	13.2	0.0	0	15.0	0.00	0	0	0	15.0	0.0	0	0	0	0.00	0	0	0
210	109.0	116.6	88.4	104.7	28.2	0.0	0	104.7	0.35	554	50	504	95.4	0.0	0	0	0	0.35	554	50	504
211	120.3	169.2	97.8	129.1	71.4	0.5	1,312	122.7	0.47	734	59	675	111.8	1.9	4,827	2,363	2,464	2.86	6,872	2,422	4,451
212	789.6	596.0	494.4	626.7	295.2	9.2	23,602	554.2	3.19	5,034	263	4,772	504.9	32.6	83,625	25,636	57,989	45.01	112,262	25,899	86,363
213	141.0	137.2	169.2	149.1	32.0	0.0	42	148.9	0.63	995	71	924	135.7	2.9	7,352	3,256	4,096	3.51	8,389	3,327	5,063
214	56.4	69.6	77.1	67.7	20.7	0.0	0	67.7	0.00	0	0	0	67.7	0.0	0	0	0	0.00	0	0	0
215	154.2	137.2	116.6	136.0	37.6	0.1	175	135.2	0.54	858	65	793	123.1	2.3	5,986	2,777	3,209	2.95	7,018	2,842	4,176
216	124.1	274.5	67.7	155.4	206.8	4.6	11,732	98.7	0.00	0	0	0	98.7	0.0	0	0	0	4.58	11,732	0	11,732

Symbol	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
217	176.7	270.7	244.4	230.6	94.0	0.9	2,396	220.3	1.03	1,706	105	1,602	200.7	6.1	15,709	6,027	9,682	8.14	19,811	6,132	13,680
218	71.4	146.6	169.2	129.1	97.8	1.0	2,602	116.5	0.43	671	56	616	106.1	1.7	4,264	2,159	2,105	3.10	7,537	2,215	5,322
219	97.8	62.0	159.8	106.5	97.8	1.0	2,602	93.5	0.00	0	0	0	93.5	0.0	0	0	0	1.01	2,602	0	2,602
220	69.6	30.1	47.0	43.9	39.5	0.1	222	47.7	0.00	0	0	0	47.7	0.0	0	0	0	0.09	222	0	222
221	23.2	37.6	67.7	44.5	39.5	0.1	222	43.3	0.00	0	0	0	43.3	0.0	0	0	0	0.09	222	0	222
222	159.8	214.3	141.0	171.7	73.3	0.5	1,392	165.3	0.73	1,158	79	1,030	150.6	3.5	9,077	3,847	5,230	4.82	11,627	3,926	7,701
223	84.6	112.8	77.1	91.5	35.7	0.1	129	90.8	0.00	0	0	0	90.8	0.0	0	0	0	0.05	129	0	129
224	137.2	86.5	71.4	98.4	65.8	0.4	1,081	92.9	0.00	0	0	0	92.9	0.0	0	0	0	0.42	1,081	0	1,081
225	255.7	345.9	225.6	275.7	120.3	1.6	3,991	259.3	1.33	2,095	123	1,972	236.3	8.3	21,195	7,754	13,442	11.15	27,281	7,877	19,404
226	141.0	135.4	56.4	110.9	84.6	0.7	1,912	101.4	0.33	522	49	473	92.4	0.0	0	0	0	1.08	2,434	49	2,385
227	197.4	188.0	323.4	236.3	135.4	2.0	5,061	214.4	1.05	1,648	102	1,546	195.4	5.8	14,943	5,781	9,162	8.85	21,652	5,883	15,769
228	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00	0	0	0	0.0	0.0	0	0	0	0.00	0	0	0
229	300.8	357.2	385.4	347.8	84.6	0.7	1,912	340.5	1.84	2,905	162	2,743	310.2	13.5	34,694	11,827	22,867	16.12	39,511	11,988	27,522
230	338.4	235.0	197.4	256.9	141.0	2.1	5,493	233.8	1.17	1,841	111	1,730	213.0	6.8	17,533	6,607	10,926	10.15	24,866	6,718	18,148
231	84.6	94.0	65.8	81.5	28.2	0.0	0	81.5	0.00	0	0	0	81.5	0.0	0	0	0	0.00	0	0	0
232	178.6	159.8	169.2	169.2	18.8	0.0	0	169.2	0.76	1,197	81	1,116	154.2	3.7	9,504	3,991	5,512	4.47	10,701	4,072	6,629
233	47.0	56.4	56.4	53.3	9.4	0.0	0	53.3	0.00	0	0	0	53.3	0.0	0	0	0	0.00	0	0	0
234	150.4	112.8	150.4	137.9	37.6	0.1	175	137.0	0.56	877	65	811	124.9	2.4	6,167	2,841	3,326	3.03	7,219	2,907	4,312
235	300.8	216.2	225.6	247.5	84.6	0.7	1,912	239.5	1.20	1,897	114	1,784	218.2	7.1	18,323	6,856	11,467	9.10	22,133	6,970	15,162
236	221.8	225.6	225.6	224.3	3.8	0.0	0	224.3	1.11	1,747	107	1,640	204.4	6.3	16,249	6,199	10,050	7.44	17,996	6,306	11,690
237	33.8	22.6	26.3	27.6	11.3	0.0	0	27.6	0.00	0	0	0	27.6	0.0	0	0	0	0.00	0	0	0
238	206.8	255.7	244.4	235.6	48.9	0.2	488	233.5	1.17	1,838	111	1,727	212.8	6.8	17,500	6,597	10,903	8.18	19,827	6,708	13,119
239	319.6	253.8	173.0	248.8	146.6	2.3	5,941	223.5	1.10	1,738	106	1,632	203.6	6.3	16,135	6,163	9,972	9.71	23,814	6,269	17,545
240	94.0	135.4	169.2	132.9	75.2	0.6	1,474	125.7	0.48	764	60	704	114.6	2.0	5,101	2,462	2,639	3.05	7,340	2,522	4,817
241	150.4	97.8	127.8	125.3	52.6	0.2	607	122.4	0.46	731	59	672	111.5	1.9	4,794	2,351	2,443	2.57	6,132	2,410	3,722
242	195.5	188.0	203.0	195.5	15.0	0.0	0	195.5	0.93	1,459	93	1,366	178.1	4.9	12,562	5,008	7,554	5.82	14,021	5,101	8,920
243	545.2	752.0	733.2	676.8	206.8	4.6	11,732	642.6	3.75	5,916	304	5,611	585.5	42.7	109,563	32,663	76,901	51.06	127,211	32,967	94,244
244	62.0	58.3	88.4	69.6	30.1	0.0	2	69.6	0.00	0	0	0	69.6	0.0	0	0	0	0.00	2	0	2
245	330.9	255.7	434.3	340.3	178.6	3.4	8,786	306.1	1.62	2,562	145	2,416	278.9	11.2	28,634	10,023	18,611	16.22	39,982	10,168	29,814
246	13.2	116.6	18.8	49.5	103.4	1.1	2,925	33.7	0.00	0	0	0	33.7	0.0	0	0	0	1.14	2,925	0	2,925
247	329.0	295.2	325.2	316.5	33.8	0.0	85	316.1	1.69	2,662	150	2,512	288.0	11.8	30,346	10,536	19,810	13.56	33,092	10,686	22,406

Symbol	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
248	103.4	131.6	103.4	112.8	28.2	0.0	0	112.8	0.40	635	54	581	102.8	1.5	3,945	2,042	1,903	1.94	4,580	2,096	2,484
249	169.2	178.6	122.2	156.7	56.4	0.3	734	153.2	0.66	1,038	73	965	139.6	3.0	7,793	3,408	4,385	3.98	9,565	3,481	6,084
250	112.8	141.0	178.6	144.1	65.8	0.4	1,081	139.0	0.57	896	66	830	126.6	2.5	6,359	2,909	3,450	2.47	8,336	2,975	5,361
251	37.6	37.6	24.4	33.2	13.2	0.0	0	33.2	0.00	0	0	0	33.2	0.0	0	0	0	0.00	0	0	0
252	131.6	131.6	131.6	131.6	0.0	0.0	0	131.6	0.52	822	63	760	119.9	2.2	5,647	2,657	2,990	2.72	6,470	2,720	3,750
253	75.2	103.4	131.6	103.4	56.4	0.3	734	99.7	0.00	0	0	0	99.7	0.0	0	0	0	0.29	734	0	734
254	56.4	84.6	75.2	72.1	28.2	0.0	0	72.1	0.00	0	0	0	72.1	0.0	0	0	0	0.00	0	0	0
255	37.6	18.8	56.4	37.6	37.6	0.1	175	36.7	0.00	0	0	0	36.7	0.0	0	0	0	0.07	175	0	175
256	282.0	263.2	263.2	269.5	18.8	0.0	0	269.5	1.39	2,196	128	2,068	245.5	8.9	22,730	8,228	14,503	10.26	24,927	8,356	16,571
257	188.0	244.4	206.8	213.1	56.4	0.3	734	209.9	1.02	1,602	100	1,502	191.2	5.6	14,351	5,590	8,761	6.90	16,687	5,690	10,997
258	94.0	94.0	94.0	94.0	0.0	0.0	0	94.0	0.00	0	0	0	94.0	0.0	0	0	0	0.00	0	0	0
259	150.4	112.8	131.6	131.6	37.6	0.1	175	130.8	0.52	814	62	752	119.1	2.2	5,568	2,629	2,939	2.76	6,557	2,691	2,865
260	112.8	75.2	94.0	94.0	37.6	0.1	175	93.1	0.00	0	0	0	93.1	0.0	0	0	0	0.07	175	0	175
261	150.4	94.0	188.0	144.1	94.0	0.9	2,396	132.7	0.53	833	63	770	120.9	2.2	5,753	2,695	3,058	3.71	8,982	2,758	6,224
262	150.4	169.2	159.8	159.8	18.8	0.0	0	159.8	0.70	1,103	76	1,027	145.6	3.3	8,483	3,645	4,838	4.01	9,587	3,721	5,866
263	150.4	131.6	169.2	150.4	37.6	0.1	175	149.6	0.64	1,002	71	930	136.3	2.9	7,416	3,278	4,138	3.60	8,593	3,349	5,243
264	9.4	9.4	9.4	9.4	0.0	0.0	0	9.4	0.00	0	0	0	9.4	0.0	0	0	0	0.00	0	0	0
265	131.6	122.2	84.6	112.8	47.0	0.2	432	110.7	0.39	614	53	561	100.8	1.5	3,762	1,975	1,787	2.02	4,807	2,028	2,779
266	5.6	5.6	5.6	5.6	0.0	0.0	0	5.6	0.00	0	0	0	5.6	0.0	0	0	0	0.00	0	0	0
267	65.8	56.4	65.8	62.7	9.4	0.0	0	62.7	0.00	0	0	0	62.7	0.0	0	0	0	0.00	0	0	0
268	5.6	5.6	9.4	6.9	3.8	0.0	0	6.9	0.00	0	0	0	6.9	0.0	0	0	0	0.00	0	0	0
269	18.8	9.4	5.6	11.3	13.2	0.0	0	11.3	0.00	0	0	0	11.3	0.0	0	0	0	0.00	0	0	0
270	56.4	18.8	28.2	34.5	37.6	0.1	175	33.5	0.00	0	0	0	33.5	0.0	0	0	0	0.07	175	0	175
271	84.6	84.6	94.0	87.7	9.4	0.0	0	87.7	0.00	0	0	0	87.7	0.0	0	0	0	0.00	0	0	0
272	122.2	84.6	94.0	100.3	37.6	0.1	175	99.4	0.00	0	0	0	99.4	0.0	0	0	0	0.07	175	0	175
273	65.8	47.0	37.6	50.1	28.2	0.0	0	50.1	0.00	0	0	0	50.1	0.0	0	0	0	0.00	0	0	0
274	47.0	65.8	103.4	72.1	56.4	0.3	734	68.3	0.00	0	0	0	68.3	0.0	0	0	0	0.29	734	0	734
275	9.4	9.4	13.2	10.7	3.8	0.0	0	10.7	0.00	0	0	0	10.7	0.0	0	0	0	0.00	0	0	0
276	3.8	26.3	13.2	14.4	22.6	0.0	0	14.4	0.00	0	0	0	14.4	0.0	0	0	0	0.00	0	0	0
277	37.6	9.4	5.6	17.5	32.0	0.0	42	17.3	0.00	0	0	0	17.3	0.0	0	0	0	0.02	42	0	42
278	9.4	9.4	11.3	10.0	1.9	0.0	0	10.0	0.00	0	0	0	10.0	0.0	0	0	0	0.00	0	0	0

Symbol	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
279	30.1	41.4	18.8	30.1	22.6	0.0	0	30.1	0.00	0	0	0	30.1	0.0	0	0	0	0.00	0	0	0
280	169.2	169.2	150.4	162.9	18.8	0.0	0	162.9	0.72	1,135	78	1,057	148.5	3.4	8,819	3,759	5,060	4.16	9,954	3,837	6,117
281	18.8	37.6	22.6	26.3	18.8	0.0	0	26.3	0.00	0	0	0	26.3	0.0	0	0	0	0.00	0	0	0
282	103.4	94.0	112.8	103.4	18.8	0.0	0	103.4	0.34	541	50	492	94.2	0.0	0	0	0	0.34	541	50	492
283	159.8	169.2	159.8	162.9	9.4	0.0	0	162.9	0.72	1,135	78	1,057	148.5	3.4	8,819	3,759	5,060	4.16	9,954	3,837	6,117
284	169.2	206.8	159.8	178.6	47.0	0.2	432	176.6	0.81	1,271	84	1,187	160.9	4.0	10,338	4,272	6,066	5.01	12,041	4,356	7,685
285	18.8	33.8	37.6	30.1	18.8	0.0	0	30.1	0.00	0	0	0	30.1	0.0	0	0	0	0.00	0	0	0
286	47.0	37.6	84.6	56.4	47.0	0.2	432	54.1	0.00	0	0	0	54.1	0.0	0	0	0	0.17	432	0	432
287	112.8	39.5	47.0	66.4	73.3	0.5	1,392	59.1	0.00	0	0	0	59.1	0.0	0	0	0	0.54	1,392	0	1,392
288	84.6	131.6	112.8	109.7	47.0	0.2	432	107.5	0.37	582	51	531	98.0	0.0	0	0	0	0.54	1,014	51	963
289	15.0	33.8	15.0	21.3	18.8	0.0	0	21.3	0.00	0	0	0	21.3	0.0	0	0	0	0.00	0	0	0
290	26.3	16.9	18.8	20.7	9.4	0.0	0	20.7	0.00	0	0	0	20.7	0.0	0	0	0	0.00	0	0	0
291	18.8	47.0	37.6	34.5	28.2	0.0	0	34.5	0.00	0	0	0	34.5	0.0	0	0	0	0.00	0	0	0
292	18.8	9.4	18.8	15.7	9.4	0.0	0	15.7	0.00	0	0	0	15.7	0.0	0	0	0	0.00	0	0	0
293	20.7	9.4	28.2	19.4	18.8	0.0	0	19.4	0.00	0	0	0	19.4	0.0	0	0	0	0.00	0	0	0
294	13.2	9.4	18.8	13.8	9.4	0.0	0	13.8	0.00	0	0	0	13.8	0.0	0	0	0	0.00	0	0	0
295	9.4	13.2	9.4	10.7	3.8	0.0	0	10.7	0.00	0	0	0	10.7	0.0	0	0	0	0.00	0	0	0
296	9.4	5.6	3.8	6.3	5.6	0.0	0	6.3	0.00	0	0	0	6.3	0.0	0	0	0	0.00	0	0	0
297	75.2	103.4	75.2	84.6	28.2	0.0	0	84.6	0.00	0	0	0	84.6	0.0	0	0	0	0.00	0	0	0
298	56.4	56.4	37.6	50.1	18.8	0.0	0	50.1	0.00	0	0	0	50.1	0.0	0	0	0	0.00	0	0	0
299	9.4	9.4	9.4	9.4	0.0	0.0	0	9.4	0.00	0	0	0	9.4	0.0	0	0	0	0.00	0	0	0
300	37.6	37.6	41.4	38.9	3.8	0.0	0	38.9	0.00	0	0	0	38.9	0.0	0	0	0	0.00	0	0	0
301	18.8	37.6	41.4	32.6	22.6	0.0	0	32.6	0.00	0	0	0	32.6	0.0	0	0	0	0.00	0	0	0
302	22.6	22.6	37.6	27.6	15.0	0.0	0	27.6	0.00	0	0	0	27.6	0.0	0	0	0	0.00	0	0	0
303	5.6	5.6	3.8	5.0	1.9	0.0	0	5.0	0.00	0	0	0	5.0	0.0	0	0	0	0.00	0	0	0
304	5.6	3.8	3.8	4.4	1.9	0.0	0	4.4	0.00	0	0	0	4.4	0.0	0	0	0	0.00	0	0	0
305	103.4	112.8	150.4	122.2	47.0	0.2	432	120.1	0.45	708	57	650	109.4	1.8	4,588	2,277	2,311	2.41	5,727	2,334	3,393
306	94.0	122.2	75.2	97.1	47.0	0.2	432	95.0	0.00	0	0	0	95.0	0.0	0	0	0	0.17	432	0	432
307	56.4	18.8	65.8	47.0	47.0	0.2	432	44.7	0.00	0	0	0	44.7	0.0	0	0	0	0.17	432	0	432
308	131.6	103.4	94.0	109.7	37.6	0.1	175	108.8	0.38	595	52	543	99.1	0.0	0	0	0	0.45	770	52	718
309	65.8	75.2	56.4	65.8	18.8	0.0	0	65.8	0.00	0	0	0	65.8	0.0	0	0	0	0.00	0	0	0

Symbol	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
310	65.8	56.4	75.2	65.8	18.8	0.0	0	65.8	0.00	0	0	0	65.8	0.0	0	0	0	0.00	0	0	0
311	47.0	84.6	84.6	72.1	37.6	0.1	175	71.2	0.00	0	0	0	71.2	0.0	0	0	0	0.07	175	0	175
312	244.4	244.4	225.6	238.1	18.8	0.0	0	238.1	1.19	1,884	113	1,771	217.0	7.1	18,137	6,798	11,339	8.27	20,022	6,911	13,110
313	18.8	150.4	94.0	87.7	131.6	1.9	4,783	63.0	0.00	0	0	0	63.0	0.0	0	0	0	1.87	4,783	0	4,783
314	47.0	94.0	150.4	97.1	103.4	1.1	2,925	82.3	0.00	0	0	0	82.3	0.0	0	0	0	1.14	2,925	0	2,925
315	131.6	150.4	112.8	131.6	37.6	0.1	175	130.8	0.52	814	62	752	119.1	2.2	5,568	2,629	2,939	2.76	6,557	2,691	3,865
316	11.3	7.5	13.2	10.7	5.6	0.0	0	10.7	0.00	0	0	0	10.7	0.0	0	0	0	0.00	0	0	0
317	13.2	5.6	1.9	6.9	11.3	0.0	0	6.9	0.00	0	0	0	6.9	0.0	0	0	0	0.00	0	0	0
318	357.2	282.0	376.0	338.4	94.0	0.9	2,396	329.2	1.77	2,792	156	2,635	299.9	12.7	32,641	11,219	21,422	15.44	37,829	11,376	26,453
319	263.2	263.2	282.0	269.5	18.8	0.0	0	269.5	1.39	2,196	128	2,068	245.5	8.9	22,730	8,228	14,503	10.26	24,927	8,356	16,571
320	225.6	338.4	451.2	338.4	225.6	5.4	13,922	283.6	1.48	2,337	135	2,203	258.4	9.7	24,940	8,905	16,036	16.64	41,200	9,039	32,161
321	94.0	94.0	37.6	75.2	56.4	0.3	734	71.4	0.00	0	0	0	71.4	0.0	0	0	0	0.29	734	0	734
322	150.4	188.0	188.0	175.5	37.6	0.1	175	174.7	0.79	1,252	83	1,168	159.1	3.9	10,115	4,197	5,918	4.81	11,541	4,280	7,261
323	18.8	18.8	18.8	18.8	0.0	0.0	0	18.8	0.00	0	0	0	18.8	0.0	0	0	0	0.00	0	0	0
324	357.2	300.8	470.0	376.0	169.2	3.1	7,895	346.4	1.88	2,963	164	2,799	315.6	14.0	35,786	12,148	23,637	18.92	46,644	12,313	34,331
325	37.6	37.6	37.6	37.6	0.0	0.0	0	37.6	0.00	0	0	0	37.6	0.0	0	0	0	0.00	0	0	0
326	37.6	37.6	84.6	53.3	47.0	0.2	432	51.0	0.00	0	0	0	51.0	0.0	0	0	0	0.17	432	0	432
327	37.6	37.6	84.6	53.3	47.0	0.2	432	51.0	0.00	0	0	0	51.0	0.0	0	0	0	0.17	432	0	432
328	65.8	75.2	28.2	56.4	47.0	0.2	432	54.1	0.00	0	0	0	54.1	0.0	0	0	0	0.17	432	0	432
329	50.8	50.8	50.8	50.8	0.0	0.0	0	50.8	0.00	0	0	0	50.8	0.0	0	0	0	0.00	0	0	0
	40,816.7	40,816.7	43,330.2	41,654.5	16,762.1	156.3	400855.8	39921.6	154.66	243898	15192	228706	37083.1	954.4	2447053	894182	1546156	1265.39	3091806	916088	2175718
Extension to 100%						6879.0	17637655	1756549	6805	10731497	668431	10063065	1631656	41993	107670326	39344008	68030876	55677	136039477	40307881	95731596

Appendix 6.3-1 Estimation for Potential of MV Loss Reduction (Expressed by "Excel' Like Equation)

1. Load current

(1) E : Initial current

1996Y F=actual recorded current of this year*1.12

2008Y F=actual recorded current of this year*1.12*1.88

The basis of 1.12 is as follows

- The summation of all 33kVfeeders current is 13,443(A). It is converted to 614.7MW ((pf=0.8, V=1p.u.)
- On the other hand, the total peak load of 33kV feeders is estimated by following way.

  From 1994 actual record

  the generated energy=4837GWh

  the sent out energy of 33kV feeders=3660GWh

  Generation: 33kV sent out ratio in Jordan=0.757

  The peak generation of this year=902(MW)

  Total peak load of 33kV(at diversity factor=1.01)=902*0.757*1.01=689.6(MW)
- 689.6/614.7=1.12

2. The effect to MV feeder by LV feeder power factor improvement

The current decreased by LV feeder power factor improvement

1996Y f1=SUM(LV_P)/SUM(LV_K)=23127.9/24319.3=0.951

2008Y f1=SUM(LV_P)/SUM(LV_K)=41379.7/44577.0=0.928

where symbol LV_K and LV_P is symbol K and P used in LV estimation respectively

Active power is not changed and average power factor is changed

so new (average) power factor x is

1996Y 0.82*1=x*0.951 x=0.862

2008Y 0.82*1=x*0.928 x=0.884

(1) F : Loss reduction(kW) F=IF((0.7958*E+18.263)*f2>0, (0.7958*E+18.263)*f2, 0)

where f2=(0.862-0.82)/(0.9-0.8)=0.42 (1996Y)

or f2=(0.884-0.82)/(0.9-0.8)=0.64 (2008Y)

(2) G : Benefit(JD) G=F*1268

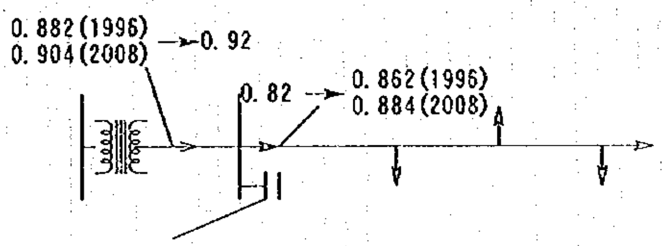
(3) H : Current(A) after LV feeder pf improvement H=E*f1

3. Loss reduction by improving power factor

・The condition

For this purpose, capacitor is installed in LV circuit of s/s or close to s/s. Average LV power factor improving limit is settled at pf=0.92 considering to avoid extremely over compensation in light load time for light load s/s or small load increase on every year. And we assumed that existing capacitor arround s/s is equivalent to 2% improvement of load factor.

The improvement of power factor is showed below(the figure is pf)



Existing 0.02 New costructed 0.038(1996Y) 0.016(2008)

(1) I : Loss reduction(kW) I=IF((0.7958*H+18.263)>0, (0.7958*H+18.263)*f3, 0)

where f3=(0.92-0.862-0.02)/(0.9-0.8)=0.38 (1996Y)

f3=(0.92-0.884-0.02)/(0.9-0.8)=0.16 (2008Y)

(2) J : Benefit(JD) J=I*1268

(3) K : Cost(JD) K=IF((43.357*H+216.66)*f3>0, (43.357*H+216.66)*f3, 0)

(4) L : Net benefit(JD) L=J-K

(5) M : Current (A) at pf=0.92 M=E*(0.82+0.02)/0.92

4. Loss reduction by system change (higher or same voltage line construction)

・The condition

Since B/C value at LV current 100A is the same to B/C value at MV current 137.37(A), this countermeasure is applied only for L>=137.37(A) feeders.

(1) N : Loss reduction (kW) N=IF(M>=137.37, 3.0076*M-172.68, 0)

(2) O : Benefit(JD) O=N*2061

(3) P : Cost(JD) P=IF(M>=137.37, 2071.4*M-22727, 0)

(4) Q : Net benefit(JD) Q=O-P

5. Total

(1) R : Loss reduction(kW) R=F+I+N

(2) S : Benefit(JD) S=G+J+O

(3) T : Cost(JD) T=K+P

(4) U : Net benefit U=S-T

Appendix 6.3-2 Application of Equation Model for MV Sample-2 Feeders

Meaning of Head line in following Table

Symbol	Feeder's Number	M	Current at pf=0.92 (A)
E	Initial Current (A)	N	Loss Reduction by New Line Construction (kW)
F	Loss Reduction by LV pf Improvement (kW)	O	Benefit by New Line Construction (JD)
G	Benefit by LV pf Improvement (JD)	P	Cost for New Line Construction (JD)
H	Current (A) after LV Feeder pf Improvement (kW)	Q	Benefit by New Line Construction (JD)
I	Loss Reduction by MV pf Improvement (kW)	R	Total Loss Reduction (kW)
J	Benefit by MV pf Improvement (JD)	S	Total Benefit (JD)
K	Cost for MV pf Improvement (JD)	T	Total Cost (JD)
L	Net Benefit by MV pf Improvement (JD)	U	Total Net Benefit (JD)

Appendix 6.3-2 Application of equation model for MV sample-2 feeders

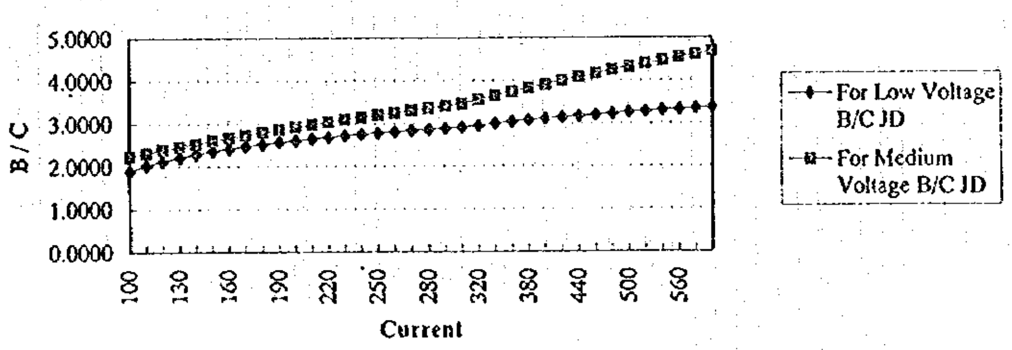
	Symbol	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
Abdali 2	1	105	65	82,811	98	15	19,479	712	18,767	96	0	0	0	0	81	102,290	712	101,578
Abdali 1	2	211	119	150,802	195	28	35,253	1,390	33,863	192	406	835,802	375,501	460,302	552	1,021,857	376,891	644,966
Dulel	3	463	248	313,980	430	58	73,110	3,017	70,093	423	1,099	2,265,837	853,374	1,412,464	1,405	2,652,927	856,390	1,796,536
Pine Mill	4	211	119	150,802	195	28	35,253	1,390	33,863	192	406	835,802	375,501	460,302	552	1,021,857	376,891	644,966
HASHIM 1	5	552	293	371,092	512	68	86,360	3,586	82,774	504	1,342	2,766,349	1,020,629	1,745,720	1,703	3,223,801	1,024,215	2,199,586
Baga'a	6	453	242	307,180	420	56	71,533	2,949	68,584	413	1,070	2,206,252	833,462	1,372,790	1,369	2,584,966	836,411	1,748,554
J.V South bayad	7	236	132	167,120	219	31	39,039	1,553	37,486	215	475	978,806	423,288	555,518	638	1,184,964	424,841	760,123
National Fair	8	274	151	191,596	254	35	44,717	1,797	42,920	250	579	1,193,311	494,969	698,342	765	1,429,625	496,766	932,859
ALU 1	9	232	130	164,400	215	30	38,408	1,526	36,882	211	463	954,972	415,323	539,649	623	1,157,780	416,849	740,931
ALU 2	10	232	130	164,400	215	30	38,408	1,526	36,882	211	463	954,972	415,323	539,649	623	1,157,780	416,849	740,931
QAIA 1	11	135	80	101,849	125	19	23,896	902	22,994	123	0	0	0	0	99	125,744	902	124,842
QAIA 2	12	137	81	103,209	127	19	24,211	916	23,295	125	0	0	0	0	100	127,420	916	126,504
JEPCO 1	13	484	258	327,578	449	60	76,265	3,152	73,112	442	1,157	2,385,007	893,196	1,491,810	1,476	2,788,849	896,349	1,892,501
JEPCO 2	14	211	119	150,802	195	28	35,253	1,390	33,863	192	406	835,802	375,501	460,302	552	1,021,857	376,891	644,966
J. Valley Middle	15	286	158	199,755	266	37	46,610	1,878	44,732	261	614	1,264,813	518,862	745,950	808	1,511,178	520,741	990,437
J. Valley South	16	303	166	210,634	281	39	49,134	1,987	47,147	277	660	1,360,148	550,721	809,428	865	1,619,916	552,707	1,067,209
Water 2	17	491	262	331,657	455	61	77,211	3,193	74,018	448	1,175	2,420,758	905,143	1,515,614	1,497	2,829,626	908,336	1,921,290
Water 3	18	390	210	266,386	361	49	62,068	2,542	59,526	356	897	1,848,744	713,994	1,134,750	1,156	2,177,198	716,536	1,460,662
JEPCO 1	19	356	193	244,629	330	45	57,021	2,325	54,695	325	804	1,658,072	650,278	1,007,795	1,042	1,959,722	652,603	1,307,119
JEPCO 2	20	564	299	379,251	524	70	88,253	3,667	84,585	515	1,377	2,837,851	1,044,523	1,793,328	1,746	3,305,355	1,048,190	2,257,164
Aviation	21	421	226	286,783	391	53	66,800	2,746	64,055	385	984	2,027,498	773,728	1,253,770	1,263	2,381,082	776,474	1,604,608
WADI ARAB	22	522	278	352,054	485	65	81,943	3,396	78,547	477	1,261	2,599,512	964,877	1,634,635	1,604	3,033,510	968,274	2,065,236
KUFRANJ	23	383	207	262,307	356	48	61,122	2,502	58,620	350	880	1,812,993	702,047	1,110,946	1,135	2,136,421	704,549	1,431,873
SAMMA	24	491	262	331,657	455	61	77,211	3,193	74,018	448	1,175	2,420,758	905,143	1,515,614	1,497	2,829,626	908,336	1,921,290
EMRAWA	25	459	245	311,260	426	57	72,479	2,990	69,489	419	1,088	2,242,003	845,409	1,396,594	1,390	2,625,742	848,399	1,777,344
DHULIL	26	278	153	194,316	258	36	45,348	1,824	43,524	254	591	1,217,145	502,933	714,212	780	1,456,809	504,757	952,052
HOSHA	27	411	221	279,984	381	51	65,223	2,678	62,545	375	955	1,967,913	753,817	1,214,097	1,227	2,313,121	756,495	1,556,626
YRMOK1	28	6	15	18,900	6	4	4,652	75	4,576	6	0	0	0	0	19	23,552	75	23,477
YRMOK2	29	11	17	21,620	10	4	5,283	102	5,180	10	0	0	0	0	21	26,902	102	26,800
Hasan	30	145	86	108,648	135	20	25,473	970	24,503	133	0	0	0	0	106	134,121	970	133,151

	Symbol	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
Um Jmal	31	227	128	161,681	211	30	37,777	1,499	36,278	208	452	931,138	407,359	523,779	609	1,130,595	408,857	721,738
Jarashi	32	402	217	274,545	373	50	63,961	2,624	61,338	367	932	1,920,245	737,888	1,182,358	1,199	2,258,752	740,511	1,518,240
Aljob	33	185	106	134,484	172	25	31,467	1,228	30,240	169	336	692,799	327,713	365,086	467	858,750	328,941	529,809
Balama	34	88	57	71,933	82	13	16,955	604	16,351	81	0	0	0	0	70	88,888	604	88,284
Smaia	35	141	84	105,928	131	20	24,842	943	23,899	129	0	0	0	0	103	130,770	943	129,827
South	36	251	139	176,638	233	33	41,247	1,648	39,599	229	515	1,062,224	451,164	611,061	687	1,280,110	452,812	827,298
North	37	171	99	124,966	158	23	29,259	1,133	28,126	156	296	609,380	299,837	309,543	417	763,604	300,970	462,635
GJEAIR	38	84	55	69,213	78	13	16,324	577	15,747	77	0	0	0	0	67	85,538	577	84,961
Swaqa	39	152	89	112,727	141	21	26,420	1,011	25,409	138	244	502,127	263,997	238,131	353	641,274	265,007	376,267
Sultani	40	61	43	54,255	57	10	12,854	428	12,426	56	0	0	0	0	53	67,109	428	66,682
HASA	41	59	42	52,896	55	10	12,539	414	12,124	54	0	0	0	0	52	65,434	414	65,020
SHOUSK	42	156	91	115,447	145	21	27,050	1,038	26,013	142	255	525,961	271,961	254,000	368	668,459	272,999	395,460
TAFILA	43	187	107	135,844	174	25	31,783	1,241	30,542	171	342	704,716	331,696	373,020	474	872,342	332,937	539,406
Wadi Musa	44	219	123	156,241	203	29	36,515	1,444	35,070	200	429	883,470	391,430	492,040	581	1,076,226	392,874	683,352
North Aqaba	45	55	40	50,176	51	9	11,908	387	11,520	50	0	0	0	0	49	62,084	387	61,696
Quweira	46	109	67	85,531	102	16	20,110	740	19,370	100	0	0	0	0	83	105,641	740	104,901
Quweira DISI	47	211	119	150,802	195	28	35,253	1,390	33,863	192	406	835,802	375,501	460,302	552	1,021,857	376,891	644,966
ACPS 1	48	133	79	100,489	123	19	23,580	889	22,692	121	0	0	0	0	98	124,069	889	123,181
ACPS 2	49	133	79	100,489	123	19	23,580	889	22,692	121	0	0	0	0	98	124,069	889	123,181
SAFAWAI	50	6	15	18,900	6	4	4,652	75	4,576	6	0	0	0	0	19	23,552	75	23,477
RUWESHEA	51	103	64	81,452	96	15	19,164	699	18,465	94	0	0	0	0	79	100,615	699	99,916
Boshreia	52	215	121	153,522	199	28	35,884	1,417	34,467	196	417	859,636	383,465	476,171	566	1,049,042	384,882	664,159
Industry	53	280	154	195,676	260	36	45,664	1,837	43,826	256	596	1,229,062	506,916	722,146	787	1,470,401	508,753	961,648
D. Kahf	54	253	140	177,998	234	33	41,562	1,661	39,901	231	521	1,074,141	455,146	618,995	694	1,293,702	456,807	836,895
Amra	55	257	143	180,718	238	33	42,193	1,688	40,505	235	533	1,097,975	463,111	634,865	709	1,320,887	464,799	856,088
Kaldia	56	137	81	103,209	127	19	24,211	916	23,295	125	0	0	0	0	100	127,420	916	126,504
New Phosphate	57	495	264	334,377	459	61	77,842	3,220	74,622	452	1,186	2,444,592	913,108	1,531,484	1,511	2,856,810	916,328	1,940,483
Nat. Steel	58	316	173	218,793	293	40	51,027	2,068	48,959	288	695	1,431,650	574,614	857,036	907	1,701,470	576,682	1,124,787
Total		14,535	8,081	10,246,392	13,488	1,887	2,392,636	95,582	2,297,054	13,271	28,479	58,696,042	23,462,446	35,233,596	38,447	71,335,069	23,558,028	47,777,042

Appendix 6.3-3 B/C Calculation

Current A	For Low Voltage: Loss Reduction kW	Benefit JD	Cost JD	B/C	For Medium Voltage: Loss Reduction kW	Benefit JD	Cost JD	B/C	MV Current for same B/C as LV Current A
100	1.437	3,683	1,946	1.8930	200	412,974	184,413	2.2394	137.37
110	1.812	4,645	2,297	2.0218	230	474,925	205,127	2.3153	154.14
120	2.207	5,657	2,661	2.1262	262	539,563	225,841	2.3891	171.41
130	2.622	6,722	3,036	2.2139	294	606,765	246,555	2.4610	189.47
140	3.057	7,837	3,423	2.2894	328	676,424	267,269	2.5309	208.64
150	3.512	9,003	3,822	2.3557	363	748,446	287,983	2.5989	229.21
160	3.987	10,221	4,233	2.4148	399	822,743	308,697	2.6652	251.56
170	4.482	11,491	4,655	2.4683	436	899,240	329,411	2.7298	276.09
180	4.997	12,811	5,090	2.5171	474	977,867	350,125	2.7929	303.30
190	5.532	14,183	5,536	2.5620	514	1,058,558	370,839	2.8545	333.80
200	6.087	15,606	5,994	2.6036	554	1,141,256	391,553	2.9147	368.38
210	6.662	17,080	6,464	2.6425	595	1,225,906	412,267	2.9736	408.04
220	7.257	18,606	6,945	2.6789	637	1,312,458	432,981	3.0312	454.13
230	7.872	20,183	7,439	2.7132	680	1,400,865	453,695	3.0877	508.50
240	8.507	21,811	7,944	2.7455	723	1,491,085	474,409	3.1430	573.74
250	9.162	23,490	8,461	2.7762	768	1,583,075	495,123	3.1973	653.61
260	9.837	25,221	8,990	2.8054	814	1,676,799	515,837	3.2506	753.83
270	10.532	27,003	9,531	2.8332	860	1,772,219	536,551	3.3030	883.49
280	11.247	28,836	10,083	2.8598	907	1,869,303	557,265	3.3544	1,058.04
290	11.982	30,721	10,648	2.8852	955	1,968,018	577,979	3.4050	1,305.93
300	12.737	32,656	11,224	2.9095	1,004	2,068,335	598,693	3.4548	1,686.09
320	14.307	36,682	12,412	2.9554	1,103	2,273,657	640,121	3.5519	3,757.64
340	15.957	40,912	13,647	2.9979	1,206	2,485,057	681,549	3.6462	
360	17.687	45,348	14,929	3.0375	1,311	2,702,341	722,977	3.7378	
380	19.497	49,989	16,259	3.0745	1,419	2,925,332	764,405	3.8269	
400	21.387	54,835	17,636	3.1093	1,530	3,153,868	805,833	3.9138	
420	23.357	59,886	19,060	3.1419	1,644	3,387,799	847,261	3.9985	
440	25.407	65,142	20,532	3.1727	1,760	3,626,986	888,689	4.0813	
460	27.537	70,604	22,051	3.2019	1,878	3,871,300	930,117	4.1622	
480	29.747	76,270	23,617	3.2295	1,999	4,120,622	971,545	4.2413	
500	32.037	82,142	25,230	3.2557	2,123	4,374,838	1,012,973	4.3188	
520	34.407	88,218	26,891	3.2806	2,248	4,633,844	1,054,401	4.3948	
540	36.857	94,500	28,599	3.3043	2,376	4,897,540	1,095,829	4.4693	
560	39.387	100,987	30,354	3.3270	2,506	5,165,832	1,137,257	4.5424	
580	41.997	107,679	32,156	3.3486	2,639	5,438,632	1,178,685	4.6142	
600	44.687	114,576	34,006	3.3693	2,773	5,715,856	1,220,113	4.6847	
368.38	(for test: MV B/C = 200Amp LV B/C)				935	1,927,570	740,335	2.6036	
for test : LV B/C at 150 A input				2.3557	output MV current at same B/C				229.22

Current and B/C Curve



Attachment of Appendix 6.3-3

Calculation method

From power loss reduction model equation (clause 5.10)

Low voltage B/C=((0.0001*I^2+0.0165*I-1.2135)*2564)/
(0.0591*I^2+22.751*I-920.37)

Medium voltage B/C=((3.0076*I-172.68)*2061)/
(2071.4*I-22727)

Now put

LBi : Low voltage (B/C) at current Ii

MBx : Medium voltage (B/C) at current Ix

Calculate Ix to become LBi = MBx

LBi = MBx = ((3.0076*Ix-172.68)*2061)/(2071.4*Ix-22727)

LBi*(2071.4*Ix-22727) = 6198.6636*Ix-355893.48

Ix(2071.4*LBi-6198.6636) = 22727*LBi-355893.48

Ix = (22727*LBi-355893.48)/(2071.4*LBi-6198.663)

Where LBi can calculate by the top formula

Appendix 6.4-1 Annual Allocation

A Alternative (JD)

Year	Capacitor	LV New Line	MV New Line	Total
1999	76,400	1,923,600	0	2,000,000
2000	76,400	1,923,600	0	2,000,000
2001	76,400	1,923,600	0	2,000,000
2002	76,400	1,923,600	0	2,000,000
2003	76,400	1,923,600	0	2,000,000
2004	76,400	1,923,600	0	2,000,000
2005	76,400	1,923,600	0	2,000,000
2006	76,400	1,923,600	0	2,000,000
2007	76,400	1,923,600	0	2,000,000
2008	76,400	1,923,600	0	2,000,000
TOTAL	764,000	19,236,000	0	20,000,000

B Alternative (JD)

Year	Capacitor	LV New Line	MV New Line	Total
1999	76,400	2,258,900	522,000	2,857,300
2000	76,400	2,258,900	1,005,000	3,340,300
2001	76,400	2,258,900	936,000	3,271,300
2002	76,400	2,258,900	963,000	3,298,300
2003	76,400	2,258,900	957,000	3,292,300
2004	76,400	2,258,900	446,000	2,781,300
2005	76,400	2,258,900	457,000	2,792,300
2006	76,400	2,258,900	456,000	2,791,300
2007	76,400	2,258,900	452,000	2,787,300
2008	76,400	2,258,900	453,000	2,788,300
TOTAL	764,000	22,589,000	6,647,000	30,000,000

C Alternative (JD)

Year	Capacitor	LV New Line	MV New Line	Total
1999	76,400	2,637,600	1,457,000	4,171,000
2000	76,400	2,637,600	1,458,000	4,172,000
2001	76,400	2,637,600	1,420,000	4,134,000
2002	76,400	2,637,600	1,419,000	4,133,000
2003	76,400	2,637,600	1,296,000	4,010,000
2004	76,400	2,637,600	1,295,000	4,009,000
2005	76,400	2,637,600	1,162,000	3,876,000
2006	76,400	2,637,600	1,163,000	3,877,000
2007	76,400	2,637,600	1,095,000	3,809,000
2008	76,400	2,637,600	1,095,000	3,809,000
TOTAL	764,000	26,376,000	12,860,000	40,000,000

D Alternative (JD)

Year	Capacitor	LV New Line	MV New Line	Total
1999	76,400	3,257,600	1,457,000	4,791,000
2000	76,400	3,257,600	1,905,000	5,239,000
2001	76,400	3,257,600	1,866,000	5,200,000
2002	76,400	3,257,600	1,845,000	5,179,000
2003	76,400	3,257,600	1,653,000	4,987,000
2004	76,400	3,257,600	1,603,000	4,937,000
2005	76,400	3,257,600	1,741,000	5,075,000
2006	76,400	3,257,600	1,690,000	5,024,000
2007	76,400	3,257,600	1,613,000	4,947,000
2008	76,400	3,257,600	1,287,000	4,621,000
TOTAL	764,000	32,576,000	16,660,000	50,000,000

E Alternative (JD)

Year	Capacitor	LV New Line	MV New Line	Total
1999	76,400	3,934,300	1,457,000	5,467,700
2000	76,400	3,934,300	2,416,000	6,426,700
2001	76,400	3,934,300	2,513,000	6,523,700
2002	76,400	3,934,300	2,471,000	6,481,700
2003	76,400	3,934,300	2,559,000	6,569,700
2004	76,400	3,934,300	2,523,000	6,533,700
2005	76,400	3,934,300	2,576,000	6,586,700
2006	76,400	3,934,300	2,588,000	6,598,700
2007	76,400	3,934,300	2,624,000	6,634,700
2008	76,400	3,934,300	1,736,000	5,746,700
TOTAL	764,000	39,343,000	23,463,000	63,570,000

Appendix 6.4-2 Outline of Construction

A Alternative

Year	Installation of Capacitor (MVA)	New Line Construction Number of Object	
		for LV	for MV
1999	19.1	63	0
2000	19.1	76	0
2001	19.1	103	0
2002	19.1	139	0
2003	19.1	149	0
2004	19.1	171	0
2005	19.1	200	0
2006	19.1	200	0
2007	19.1	200	0
2008	19.1	232	0
TOTAL	191.0	1,533	0

B Alternative

Year	Installation of Capacitor (MVA)	New Line Construction Number of Object	
		for LV	for MV
1999	19.1	76	1
2000	19.1	97	1
2001	19.1	138	1
2002	19.1	175	1
2003	19.1	190	1
2004	19.1	234	0
2005	19.1	234	1
2006	19.1	238	0
2007	19.1	291	1
2008	19.1	315	0
TOTAL	191.0	1,988	7

C Alternative

Year	Installation of Capacitor (MVA)	New Line Construction Number of Object	
		for LV	for MV
1999	19.1	90	3
2000	19.1	121	0
2001	19.1	187	3
2002	19.1	204	0
2003	19.1	269	3
2004	19.1	274	0
2005	19.1	287	3
2006	19.1	339	0
2007	19.1	395	3
2008	19.1	431	0
TOTAL	191.0	2,597	15

D Alternative

Year	Installation of Capacitor (MVA)	New Line Construction Number of Object	
		for LV	for MV
1999	19.1	114	3
2000	19.1	178	1
2001	19.1	250	3
2002	19.1	313	1
2003	19.1	338	3
2004	19.1	379	1
2005	19.1	449	4
2006	19.1	519	1
2007	19.1	616	5
2008	19.1	724	0
TOTAL	191.0	3,880	22

E Alternative

Year	Installation of Capacitor (MVA)	New Line Construction Number of Object	
		for LV	for MV
1999	19.1	143	3
2000	19.1	252	2
2001	19.1	333	4
2002	19.1	408	3
2003	19.1	452	5
2004	19.1	558	3
2005	19.1	665	6
2006	19.1	816	4
2007	19.1	1,024	10
2008	19.1	1,597	0
TOTAL	191.0	6,248	40

Appendix 6.5-1 Yearly Power Loss Reduction

A Alternative (kW)

Year	LV			MV		Total
	Unbalance	Capacitor	New line	Capacitor	New line	
1999	0.0	0.0	0.0	0.0	0.0	0.0
2000	743.4	681.0	1,077.7	997.0	0.0	3,499.1
2001	1,651.8	1,362.0	2,360.8	1,994.0	0.0	7,368.6
2002	2,752.6	2,043.0	3,879.7	2,991.0	0.0	11,666.3
2003	4,077.4	2,724.0	5,642.1	3,988.0	0.0	16,431.5
2004	4,529.8	3,405.0	7,733.8	4,985.0	0.0	20,653.6
2005	5,032.3	4,086.0	10,188.1	5,982.0	0.0	25,288.4
2006	5,590.7	4,767.0	13,046.4	6,979.0	0.0	30,383.1
2007	6,210.9	5,448.0	16,412.0	7,976.0	0.0	36,046.9
2008	6,900.0	6,129.0	20,635.5	8,973.0	0.0	42,637.5
2009	7,335.6	6,810.0	23,863.0	9,970.0	0.0	47,978.6
2010	7,682.9	6,810.0	25,201.8	9,970.0	0.0	49,664.7
2011	7,929.1	6,810.0	26,451.6	9,970.0	0.0	51,160.8
2012	8,060.0	6,810.0	27,601.1	9,970.0	0.0	52,441.1
2013	8,060.0	6,810.0	28,641.3	9,970.0	0.0	53,481.3
2014	8,060.0	6,810.0	29,555.8	9,970.0	0.0	54,395.8
2015	8,060.0	6,810.0	30,328.5	9,970.0	0.0	55,168.5
2016	8,060.0	6,810.0	30,943.3	9,970.0	0.0	55,783.3
2017	8,060.0	6,810.0	31,377.4	9,970.0	0.0	56,217.4
2018	8,060.0	6,810.0	31,575.7	9,970.0	0.0	56,415.7

B Alternative (kW)

Year	LV			MV		Total
	Unbalance	Capacitor	New line	Capacitor	New line	
1999	0.0	0.0	0.0	0.0	0.0	0.0
2000	743.4	681.0	1,261.7	997.0	0.0	3,683.2
2001	1,651.8	1,362.0	2,761.9	1,994.0	659.3	8,429.0
2002	2,752.6	2,043.0	4,512.1	2,991.0	1,403.3	13,702.1
2003	4,077.4	2,724.0	6,561.8	3,988.0	2,253.1	19,604.3
2004	4,529.8	3,405.0	8,991.6	4,985.0	3,384.2	25,295.6
2005	5,032.3	4,086.0	11,814.8	5,982.0	4,603.7	31,518.8
2006	5,590.7	4,767.0	15,154.0	6,979.0	5,114.4	37,605.0
2007	6,210.9	5,448.0	19,085.1	7,976.0	6,749.5	45,469.5
2008	6,900.0	6,129.0	23,615.2	8,973.0	7,498.3	53,115.5
2009	7,335.6	6,810.0	27,638.2	9,970.0	9,220.4	60,974.2
2010	7,682.9	6,810.0	29,186.6	9,970.0	9,802.5	63,452.1
2011	7,929.1	6,810.0	30,630.1	9,970.0	10,323.2	65,662.4
2012	8,060.0	6,810.0	31,958.7	9,970.0	10,781.0	67,579.7
2013	8,060.0	6,810.0	33,159.8	9,970.0	11,172.9	69,172.8
2014	8,060.0	6,810.0	34,214.5	9,970.0	11,474.6	70,529.0
2015	8,060.0	6,810.0	35,107.6	9,970.0	11,689.7	71,637.3
2016	8,060.0	6,810.0	35,814.4	9,970.0	11,918.5	72,573.0
2017	8,060.0	6,810.0	36,308.4	9,970.0	12,039.5	73,187.9
2018	8,060.0	6,810.0	36,569.3	9,970.0	12,168.2	73,577.5

C Alternative (kW)

Year	LV			MV		Total
	Unbalance	Capacitor	New line	Capacitor	New line	
1999	0.0	0.0	0.0	0.0	0.0	0.0
2000	743.4	681.0	1,469.4	997.0	0.0	3,890.9
2001	1,651.8	1,362.0	3,207.8	1,994.0	1,825.5	10,041.2
2002	2,752.6	2,043.0	5,213.5	2,991.0	2,028.1	15,028.2
2003	4,077.4	2,724.0	7,600.6	3,988.0	4,441.2	22,831.3
2004	4,529.8	3,405.0	10,368.5	4,985.0	4,934.0	28,222.2
2005	5,032.3	4,086.0	13,651.0	5,982.0	7,920.5	36,671.9
2006	5,590.7	4,767.0	17,517.6	6,979.0	8,799.3	43,653.5
2007	6,210.9	5,448.0	21,997.6	7,976.0	12,437.3	54,069.8
2008	6,900.0	6,129.0	27,180.5	8,973.0	13,817.1	62,999.6
2009	7,335.6	6,810.0	31,766.1	9,970.0	17,624.1	73,505.8
2010	7,682.9	6,810.0	33,542.8	9,970.0	18,736.8	76,742.5
2011	7,929.1	6,810.0	35,196.9	9,970.0	19,647.6	79,553.7
2012	8,060.0	6,810.0	36,720.1	9,970.0	20,616.0	82,176.1
2013	8,060.0	6,810.0	38,092.5	9,970.0	21,346.8	84,279.4
2014	8,060.0	6,810.0	39,300.3	9,970.0	22,123.8	86,264.1
2015	8,060.0	6,810.0	40,317.8	9,970.0	22,645.0	87,802.8
2016	8,060.0	6,810.0	41,118.3	9,970.0	23,199.1	89,157.3
2017	8,060.0	6,810.0	41,678.9	9,970.0	23,483.5	90,002.4
2018	8,060.0	6,810.0	41,974.6	9,970.0	23,785.8	90,600.4

D Alternative (kW)

Year	LV			MV		Total
	Unbalance	Capacitor	New line	Capacitor	New line	
1999	0.0	0.0	0.0	0.0	0.0	0.0
2000	743.4	681.0	1,808.9	997.0	0.0	4,230.3
2001	1,651.8	1,362.0	3,913.9	1,994.0	1,825.5	10,747.2
2002	2,752.6	2,043.0	6,361.6	2,991.0	2,643.6	16,791.9
2003	4,077.4	2,724.0	9,230.6	3,988.0	5,125.1	25,145.1
2004	4,529.8	3,405.0	12,623.9	4,985.0	6,415.4	31,959.1
2005	5,032.3	4,086.0	16,611.9	5,982.0	9,418.7	41,131.0
2006	5,590.7	4,767.0	21,242.0	6,979.0	11,237.4	49,816.0
2007	6,210.9	5,448.0	26,611.9	7,976.0	15,547.3	61,794.1
2008	6,900.0	6,129.0	32,801.8	8,973.0	18,076.7	72,880.5
2009	7,335.6	6,810.0	38,196.5	9,970.0	22,449.3	84,761.4
2010	7,682.9	6,810.0	40,326.2	9,970.0	23,866.6	88,655.8
2011	7,929.1	6,810.0	42,306.8	9,970.0	25,101.3	92,117.2
2012	8,060.0	6,810.0	44,125.0	9,970.0	26,326.2	95,291.2
2013	8,060.0	6,810.0	45,762.8	9,970.0	27,329.8	97,932.6
2014	8,060.0	6,810.0	47,194.6	9,970.0	28,302.4	100,337.0
2015	8,060.0	6,810.0	48,393.4	9,970.0	29,050.1	102,283.5
2016	8,060.0	6,810.0	49,334.6	9,970.0	29,752.4	103,926.9
2017	8,060.0	6,810.0	49,990.2	9,970.0	30,148.4	104,978.6
2018	8,060.0	6,810.0	50,332.7	9,970.0	30,481.4	105,654.0

E Alternative (kW)

Year	LV			MV		Total
	Unbalance	Capacitor	New line	Capacitor	New line	
1999	0.0	0.0	0.0	0.0	0.0	0.0
2000	743.4	681.0	2,176.1	997.0	0.0	4,597.5
2001	1,651.8	1,362.0	4,668.4	1,994.0	1,825.5	11,501.8
2002	2,752.6	2,043.0	7,584.9	2,991.0	3,357.6	18,729.1
2003	4,077.4	2,724.0	11,002.9	3,988.0	6,072.4	27,864.7
2004	4,529.8	3,405.0	15,040.6	4,985.0	8,212.9	36,173.4
2005	5,032.3	4,086.0	19,724.4	5,982.0	12,104.2	46,928.9
2006	5,590.7	4,767.0	25,152.3	6,979.0	15,163.7	57,652.6
2007	6,210.9	5,448.0	31,392.3	7,976.0	20,540.4	71,567.6
2008	6,900.0	6,129.0	38,527.4	8,973.0	24,834.6	85,364.0
2009	7,335.6	6,810.0	44,644.1	9,970.0	30,277.4	99,037.1
2010	7,682.9	6,810.0	47,123.8	9,970.0	32,188.9	103,775.6
2011	7,929.1	6,810.0	49,424.6	9,970.0	33,865.2	107,999.0
2012	8,060.0	6,810.0	51,528.5	9,970.0	35,457.7	111,826.2
2013	8,060.0	6,810.0	53,413.6	9,970.0	36,925.8	115,179.4
2014	8,060.0	6,810.0	55,049.7	9,970.0	38,295.0	118,184.7
2015	8,060.0	6,810.0	56,412.4	9,970.0	39,378.2	120,630.6
2016	8,060.0	6,810.0	57,473.5	9,970.0	40,324.5	122,638.0
2017	8,060.0	6,810.0	58,206.9	9,970.0	40,907.7	123,954.5
2018	8,060.0	6,810.0	58,586.5	9,970.0	41,306.9	124,733.4

Appendix 6.5-2 Yearly Energy Loss reduction

A Alternative (MWh)

Year	LV			MV		Total
	Unbalance	Capacitor	New line	Capacitor	New line	
1999	0	0	0	0	0	0
2000	3,160	2,895	4,581	4,513	0	15,148
2001	7,021	5,789	10,034	9,025	0	31,870
2002	11,700	8,684	16,490	13,538	0	50,412
2003	17,331	11,578	23,981	18,051	0	70,941
2004	19,253	14,473	32,872	22,564	0	89,161
2005	21,389	17,367	43,303	27,076	0	109,136
2006	23,763	20,262	55,452	31,589	0	131,066
2007	26,399	23,156	69,757	36,102	0	155,414
2008	29,328	26,051	87,709	40,614	0	183,702
2009	31,179	28,945	101,427	45,127	0	206,679
2010	32,656	28,945	107,118	45,127	0	213,846
2011	33,702	28,945	112,430	45,127	0	220,204
2012	34,258	28,945	117,316	45,127	0	225,646
2013	34,258	28,945	121,737	45,127	0	230,068
2014	34,258	28,945	125,624	45,127	0	233,954
2015	34,258	28,945	128,908	45,127	0	237,239
2016	34,258	28,945	131,521	45,127	0	239,852
2017	34,258	28,945	133,366	45,127	0	241,697
2018	34,258	28,945	134,209	45,127	0	242,540

B Alternative (MWh)

Year	LV			MV		Total
	Unbalance	Capacitor	New line	Capacitor	New line	
1999	0	0	0	0	0	0
2000	3,160	2,895	5,363	4,513	0	15,930
2001	7,021	5,789	11,739	9,025	2,984	36,559
2002	11,700	8,684	19,178	13,538	6,352	59,452
2003	17,331	11,578	27,890	18,051	10,198	85,048
2004	19,253	14,473	38,218	22,564	15,318	109,826
2005	21,389	17,367	50,218	27,076	20,838	136,888
2006	23,763	20,262	64,410	31,589	23,149	163,173
2007	26,399	23,156	81,119	36,102	30,550	197,326
2008	29,328	26,051	100,374	40,614	33,940	230,307
2009	31,179	28,945	117,473	45,127	41,734	264,459
2010	32,656	28,945	124,055	45,127	44,369	275,152
2011	33,702	28,945	130,190	45,127	46,726	284,690
2012	34,258	28,945	135,837	45,127	48,798	292,966
2013	34,258	28,945	140,943	45,127	50,572	299,845
2014	34,258	28,945	145,425	45,127	51,937	305,693
2015	34,258	28,945	149,221	45,127	52,911	310,463
2016	34,258	28,945	152,226	45,127	53,947	314,503
2017	34,258	28,945	154,325	45,127	54,495	317,150
2018	34,258	28,945	155,434	45,127	55,077	318,842

C Alternative (MWh)

Year	LV			MV		Total
	Unbalance	Capacitor	New line	Capacitor	New line	
1999	0	0	0	0	0	0
2000	3,160	2,895	6,246	4,513	0	16,813
2001	7,021	5,789	13,634	9,025	8,263	43,733
2002	11,700	8,684	22,159	13,538	9,180	65,260
2003	17,331	11,578	32,306	18,051	20,102	99,368
2004	19,253	14,473	44,070	22,564	22,333	122,692
2005	21,389	17,367	58,022	27,076	35,851	159,706
2006	23,763	20,262	74,457	31,589	39,828	189,898
2007	26,399	23,156	93,499	36,102	56,295	235,450
2008	29,328	26,051	115,528	40,614	62,540	274,061
2009	31,179	28,945	135,019	45,127	79,772	320,042
2010	32,656	28,945	142,570	45,127	84,808	334,107
2011	33,702	28,945	149,601	45,127	88,931	346,307
2012	34,258	28,945	156,075	45,127	93,314	357,720
2013	34,258	28,945	161,909	45,127	96,622	366,861
2014	34,258	28,945	167,042	45,127	100,139	375,512
2015	34,258	28,945	171,367	45,127	102,498	382,196
2016	34,258	28,945	174,769	45,127	105,006	388,106
2017	34,258	28,945	177,152	45,127	106,293	391,776
2018	34,258	28,945	178,409	45,127	107,662	394,401

D Alternative (MWh)

Year	LV			MV		Total
	Unbalance	Capacitor	New line	Capacitor	New line	
1999	0	0	0	0	0	0
2000	3,160	2,895	7,689	4,513	0	18,256
2001	7,021	5,789	16,636	9,025	8,263	46,734
2002	11,700	8,684	27,040	13,538	11,966	72,927
2003	17,331	11,578	39,234	18,051	23,198	109,391
2004	19,253	14,473	53,657	22,564	29,038	138,984
2005	21,389	17,367	70,607	27,076	42,632	179,072
2006	23,763	20,262	90,287	31,589	50,864	216,764
2007	26,399	23,156	113,111	36,102	70,372	269,140
2008	29,328	26,051	139,421	40,614	81,820	317,234
2009	31,179	28,945	162,350	45,127	101,612	369,214
2010	32,656	28,945	171,403	45,127	108,028	386,158
2011	33,702	28,945	179,821	45,127	113,616	401,211
2012	34,258	28,945	187,549	45,127	119,160	415,040
2013	34,258	28,945	194,510	45,127	123,703	426,544
2014	34,258	28,945	200,596	45,127	128,105	437,032
2015	34,258	28,945	205,691	45,127	131,489	445,511
2016	34,258	28,945	209,692	45,127	134,668	452,690
2017	34,258	28,945	212,478	45,127	136,461	457,270
2018	34,258	28,945	213,934	45,127	137,968	460,232

E Alternative (MWh)

Year	LV			MV		Total
	Unbalance	Capacitor	New line	Capacitor	New line	
1999	0	0	0	0	0	0
2000	3,160	2,895	9,249	4,513	0	19,816
2001	7,021	5,789	19,843	9,025	8,263	49,941
2002	11,700	8,684	32,239	13,538	15,197	81,358
2003	17,331	11,578	46,767	18,051	27,486	121,212
2004	19,253	14,473	63,929	22,564	37,174	157,393
2005	21,389	17,367	83,837	27,076	54,787	204,457
2006	23,763	20,262	106,907	31,589	68,635	251,156
2007	26,399	23,156	133,430	36,102	92,972	312,059
2008	29,328	26,051	163,757	40,614	112,409	372,159
2009	31,179	28,945	189,755	45,127	137,045	432,052
2010	32,656	28,945	200,295	45,127	145,697	452,720
2011	33,702	28,945	210,074	45,127	153,284	471,133
2012	34,258	28,945	219,017	45,127	160,492	487,840
2013	34,258	28,945	227,029	45,127	167,137	502,497
2014	34,258	28,945	233,983	45,127	173,335	515,649
2015	34,258	28,945	239,775	45,127	178,238	526,343
2016	34,258	28,945	244,286	45,127	182,521	535,137
2017	34,258	28,945	247,403	45,127	185,160	540,894
2018	34,258	28,945	249,016	45,127	186,967	544,314