14.6 Financial Analysis

14.6.1 Method of Financial Analysis

The financial analysis described in this chapter was carried out by using the same method as used in the financial analysis described in Chapter 13. Namely, for each of the planned projects, an income statement and a cash-flow table were prepared with the increase in supply of electricity by execution of the project regarded as revenue and with the investment cost and operation/administration cost incurred by the project regarded as expense. In addition, before-tax and after-tax FIRROI and FIRROE were calculated by using discounted cash flow (DCF) method.

In the expansion plan (Case-B') discussed in this chapter, most of the projects that were planned to be carried out in 2002/2003 in Case-B discussed in Chapters 12 and 13 have been deferred until 2004. Therefore, in 2002 and 2003, in which the total amount of planned investments is not so large, there is the possibility that the revenue should exceed the amount of investment, making the cash flow positive. In such case, the cash flow that is positive in the first two years, negative in the following two to five years and positive again after that. With such a cash flow, it can happen that the DCF method cannot be applied to calculate FIRROI/FIRROE or that the DCF method gives more than one mathematical solution. In this financial analysis, therefore, it was decided to use the following expedients for the years 2002 and 2003.

- The income statement shall be prepared by using the ordinary method.
- The cash-flow table (source of fund, application of fund, cash surplus) shall be prepared by using the ordinary method.
- The cash flow for calculation of FIRROI and FIRROE shall be obtained from the amount of investment alone: sales revenue, operation/administration cost, taxes, etc. shall be left out of consideration.

By using the above expedients, it is possible to correctly assess cash balance in each year. Although the calculated values of FIRROI and FIRROE are somewhat smaller than when the expedients are not applied, the differences are negligibly small.

14.6.2 Premises

As the cost of construction, the amount shown in Table 14.5.1 was used. As the cost of operation/administration, the amount shown in Table 14.5.2 was used. The terms of financing assumed in the base case were: interest rate, 3% per annum; grace period, 7 years; and repayment period, 25 years. In addition, as reference cases, the terms shown in Table 14.6.1 were applied. As for other conditions, the same terms as described in Chapter 13 "Financial Analysis" were used.

Table 14.6.1 Terms of financing in reference cases

	Dar es Salaam	Arusha, Kilimanjaro
Interest	8% p.a.	1% p.a.
Grace Period	5 Years	10 Years
Repayment	20 Years	30 Years

14.6.3 Financial Analysis Results

The financial statements prepared based on the terms and conditions described above are attached hereto. The calculated FIRROI and FIRROE are as shown in Table 14.6.2.

Table 14.6.2 Calculated FIRROI and FIRROE (Case-B')

	FIRROI (b/Tax)	FIRROE (a/Tax)
Dar es Salaam (Finance Condition: Base Case)	9.0%	45.2%
Dar es Salaam (Finance Condition: Reference Case)	9.0%	6.4%
Arusha, Kilimanjaro (Finance Condition: Base Case)	2.3%	No Return
Arusha, Kilimanjaro (Finance Condition: Reference Case)	2.3%	24.8%

As is evident from the financial statements, in the expansion plan for Dar es Salaam (base case), shortage of funds does not occur at all. On the other hand, in the reference case in which the terms of financing are severer than in the base case, shortage of funds begins to occur in 2006 when the repayment of the long-term loan starts. At the time when the financial condition is severest, the shortage of funds exceeds US$9.5 million. Looking at the expansion plan in Arusha/Kilimanjaro, in the base case, shortage of funds begins to occur in the year following 2012 when the repayment of the long-term loan starts, and thereafter, the amount of short-term loans expands year by year. By contrast, in the reference case in which the terms of financing are much less severe than in the base case, shortage of funds does not occur at all. The results of a sensitivity analysis, in which the power rates and construction cost were varied to study their effects on FIRROI and FIRROE, are as shown in Table 14.6.3.

Table 14.6.3 Summary of sensitivity analysis results (Case-B')

	Dar es Salaam		Arusha, Kilimanjaro	
	FIRROI (b/Tax)	FIRROE (a/Tax)	FIRROI (b/Tax)	FIRROE (a/Tax)
Construction Cost				
+20%	6.9%	30.6%	0.9%	No Return
+10%	7.9%	37.3%	1.6%	No Return
± 0%	9.0%	45.2%	2.3%	No Return
-10%	10.2%	55.1%	3.2%	4.8%
-20%	11.8%	68.1%	4.3%	15.5%
Sales Revenue				
+20%	11.5%	63.6%	4.2%	12.0%
+10%	10.2%	54.2%	3.3%	3.6%
± 0%	9.0%	45.2%	2.3%	No Return
-10%	7.6%	36.4%	1.3%	No Return
-20%	6.3%	27.4%	No Return	No Return

14.6.4 Summary of Financial Analysis Results

The power rates in Tanzania are at such levels that they are sufficient to cover the cost of operation but insufficient to secure the funds required for equipment expansion/rehabilitation. Namely, with an ordinary financing plan, respectable FIRROI/FIRROE cannot be hoped for. The results of the present financial analysis can be

summarized as follows. As already mentioned in Chapter 13, the calculated values of FIRROE are appreciably high. It should be noted, however, that this is due simply to the fact that the small amount of owned funds brings about a leverage effect.

- In Dar es Salaam, applying favorable terms of financing is the key to successful execution of the projects.
- In Arusha/Kilimanjaro, the projects can hardly be executed unless the necessary devices are offered gratuitously.

Dar es Salaam: Case-B' (Base) (1/2)

FIRROI (before Tax) = 9.0% FIRROE (before Tax) = 71.2%
FIRROI (after Tax) = 6.5% FIRROE (after Tax) = 45.2%

(Unit: Thousand US$)

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
< Profit & Loss Statement >															
Energy Sold (GWh)	111.9	210.8	316.8	426.4	534.8	640.7	750.9	865.6	985.2	985.2	985.2	985.2	985.2	985.2	985.2
Sales Revenue	2,244	4,230	6,356	8,555	10,729	12,852	15,064	17,366	19,764	19,764	19,764	19,764	19,764	19,764	19,764
Cost & Expense															
Operation & Maintenance Cost	27	109	283	843	1,197	1,365	1,412	1,463	1,486	1,510	1,510	1,510	1,510	1,510	1,510
Depreciation	0	97	298	1,530	2,796	3,116	3,347	3,382	3,479	3,555	3,555	3,555	3,555	3,555	3,555
Interest on Long-term Loan	0	101	341	1,852	3,222	3,609	3,878	3,923	4,022	4,116	4,042	3,913	3,768	3,613	3,456
Interest on Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	27	307	921	4,224	7,215	8,090	8,637	8,768	8,986	9,180	9,106	8,977	8,833	8,678	8,521
Net Profit before Tax	2,217	3,922	5,434	4,330	3,514	4,762	6,427	8,598	10,777	10,583	10,657	10,786	10,930	11,086	11,243
Income Tax	665	1,177	1,630	1,299	1,054	1,429	1,928	2,579	3,233	3,175	3,197	3,236	3,279	3,326	3,373
Net Profit after Tax	1,552	2,745	3,804	3,031	2,460	3,333	4,499	6,018	7,544	7,408	7,460	7,550	7,651	7,760	7,870
< Cashflow Table >															
Source of Fund															
Profit after Tax	1,552	2,745	3,804	3,031	2,460	3,333	4,499	6,018	7,544	7,408	7,460	7,550	7,651	7,760	7,870
Depreciation	0	97	298	1,530	2,796	3,116	3,347	3,382	3,479	3,555	3,555	3,555	3,555	3,555	3,555
Equity	289	811	6,550	7,272	1,398	739	177	243	472	0	0	0	0	0	0
Long-term Loan	3,373	7,990	50,354	45,697	12,895	8,941	1,531	3,409	3,591	0	0	0	0	0	0
Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	5,213	11,644	61,006	57,530	19,549	16,129	9,554	13,052	15,086	10,963	11,015	11,105	11,206	11,315	11,424
Application of Fund															
Investment (Foreign Portion)	3,373	7,990	50,354	45,697	12,895	8,941	1,531	3,409	3,591	0	0	0	0	0	0
Investment (Local Portion)	289	811	6,550	7,272	1,398	739	177	243	472	0	0	0	0	0	0
Increase in Account Receivable	224	423	636	855	1,073	1,285	1,506	1,737	1,976	1,976	1,976	1,976	1,976	1,976	1,976
Repayment of Long-term Loan	0	0	0	0	0	0	0	135	455	2,469	4,297	4,812	5,170	5,231	5,368
Repayment of Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	3,886	9,224	57,540	53,825	15,366	10,965	3,215	5,523	6,494	4,445	6,273	6,789	7,146	7,208	7,344
Cash Surplus	1,328	2,420	3,466	3,706	4,183	5,164	6,340	7,529	8,592	6,518	4,742	4,316	4,060	4,107	4,081
Cashflow (ROI before Tax)	▲ 3,662	▲ 8,801	▲ 51,467	▲ 46,113	▲ 5,834	522	10,437	10,515	12,238	16,277	16,277	16,277	16,277	16,277	16,277
Cashflow (ROI after Tax)	▲ 3,662	▲ 8,801	▲ 53,097	▲ 47,412	▲ 6,888	▲ 907	8,509	7,935	9,005	13,102	13,080	13,041	12,998	12,952	12,904
Cashflow (ROE before Tax)	▲ 289	▲ 811	▲ 1,454	▲ 2,267	3,839	5,854	8,091	9,865	11,353	9,693	7,939	7,552	7,339	7,433	7,453
Cashflow (ROE after Tax)	▲ 289	▲ 811	▲ 3,084	▲ 3,567	2,784	4,425	6,162	7,286	8,120	6,518	4,742	4,316	4,060	4,107	4,081
Outstanding Loan	3,373	11,363	61,717	107,414	120,309	129,250	130,781	134,055	137,191	134,722	130,426	125,613	120,443	115,212	109,844

Dar es Salaam: Case-B' (Base) (2/2)

(Unit: Thousand US$)

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
< Profit & Loss Statement >																
Energy Sold (GWh)	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	14,777.4
Sales Revenue	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	296,454
Cost & Expense																
Operation & Maintenance Cost	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	22,650
Depreciation	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	53,321
Interest on Long-term Loan	3,295	3,130	2,965	2,799	2,634	2,469	2,303	2,138	1,973	1,807	1,642	1,477	1,311	1,146	981	32,070
Interest on Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	8,360	8,195	8,029	7,864	7,699	7,533	7,368	7,203	7,037	6,872	6,707	6,541	6,376	6,211	6,045	108,040
Net Profit before Tax	11,404	11,569	11,734	11,900	12,065	12,230	12,396	12,561	12,726	12,892	13,057	13,222	13,388	13,553	13,718	188,414
Income Tax	3,421	3,471	3,520	3,570	3,619	3,669	3,719	3,768	3,818	3,867	3,917	3,967	4,016	4,066	4,115	56,524
Net Profit after Tax	7,982	8,098	8,214	8,330	8,445	8,561	8,677	8,793	8,908	9,024	9,140	9,256	9,371	9,487	9,603	131,890
< Cashflow Table >																
Source of Fund																
Profit after Tax	7,982	8,098	8,214	8,330	8,445	8,561	8,677	8,793	8,908	9,024	9,140	9,256	9,371	9,487	9,603	212,576
Depreciation	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	3,555	92,693
Equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,952
Long-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	137,780
Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	11,537	11,653	11,769	11,884	12,000	12,116	12,232	12,347	12,463	12,579	12,695	12,810	12,926	13,042	13,157	461,001
Application of Fund																
Investment (Foreign Portion)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	137,780
Investment (Local Portion)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,952
Increase in Account Receivable	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	51,219
Repayment of Long-term Loan	5,511	5,511	5,511	5,511	5,511	5,511	5,511	5,511	5,511	5,511	5,511	5,511	5,511	5,511	5,511	110,604
Repayment of Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	317,555
Cash Surplus	4,050	4,165	4,281	4,397	4,513	4,628	4,744	4,860	4,976	5,091	5,207	5,323	5,438	5,554	5,670	143,446
Cashflow (ROI before Tax)	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	259,658
Cashflow (ROI after Tax)	12,856	12,807	12,757	12,707	12,658	12,608	12,559	12,509	12,459	12,410	12,360	12,311	12,261	12,211	12,162	170,395
Cashflow (ROE before Tax)	7,471	7,636	7,801	7,967	8,132	8,297	8,463	8,628	8,793	8,959	9,124	9,289	9,455	9,620	9,785	211,010
Cashflow (ROE after Tax)	4,050	4,165	4,281	4,397	4,513	4,628	4,744	4,860	4,976	5,091	5,207	5,323	5,438	5,554	5,670	121,747
Outstanding Loan	104,333	98,822	93,311	87,800	82,288	76,777	71,266	65,755	60,244	54,732	49,221	43,710	38,199	32,687	27,176	-/-

Arusha, Killimanjaro: Case-B' (Base) (1/2)

FIRROI (before Tax) = 2.3% FIRROE (before Tax) = 5.7%
FIRROI (after Tax) = 1.6% FIRROE (after Tax) = No Return

(Unit: Thousand US$)

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
< Profit & Loss Statement >															
Energy Sold (GWh)	39.5	76.4	111.4	144.7	176.5	205.9	236.6	268.6	301.8	301.8	301.8	301.8	301.8	301.8	301.8
Sales Revenue	793	1,533	2,235	2,903	3,540	4,131	4,747	5,388	6,055	6,055	6,055	6,055	6,055	6,055	6,055
Cost & Expense															
Operation & Maintenance Cost	12	174	221	482	538	726	774	809	810	810	810	810	810	810	810
Depreciation	0	61	309	952	1,463	1,979	2,063	2,146	2,180	2,180	2,180	2,180	2,180	2,180	2,180
Interest on Long-term Loan	0	51	297	1,150	1,593	2,081	2,171	2,267	2,298	2,287	2,241	2,177	2,094	2,007	1,916
Interest on Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	46	98	154
Total	12	287	826	2,584	3,594	4,787	5,008	5,222	5,288	5,276	5,230	5,167	5,083	4,997	4,906
Net Profit before Tax	781	1,246	1,408	319	▲ 54	▲ 656	▲ 261	166	767	779	825	889	972	1,059	1,149
Income Tax	234	374	423	96	0	0	0	50	230	234	247	267	292	318	345
Net Profit after Tax	546	872	986	223	▲ 54	▲ 656	▲ 261	116	537	545	577	622	680	741	805
< Cashflow Table >															
Source of Fund															
Profit after Tax	546	872	986	223	▲ 54	▲ 656	▲ 261	116	537	545	577	622	680	741	805
Depreciation	0	61	309	952	1,463	1,979	2,063	2,146	2,180	2,180	2,180	2,180	2,180	2,180	2,180
Equity	129	306	3,719	3,160	3,675	216	256	35	0	0	0	0	0	0	0
Long-term Loan	1,714	8,172	28,439	14,766	16,291	2,994	3,196	1,110	0	0	0	0	0	0	0
Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	579	1,219	1,927	2,615
Total	2,390	9,412	33,453	19,101	21,376	4,534	5,253	3,407	2,717	2,725	2,757	3,381	4,080	4,848	5,600
Application of Fund															
Investment (Foreign Portion)	1,714	8,172	28,439	14,766	16,291	2,994	3,196	1,110	0	0	0	0	0	0	0
Investment (Local Portion)	129	306	3,719	3,160	3,675	216	256	35	0	0	0	0	0	0	0
Increase in Account Receivable	79	153	223	290	354	413	475	539	606	606	606	606	606	606	606
Repayment of Long-term Loan	0	0	0	0	0	0	0	69	395	1,533	2,124	2,775	2,895	3,023	3,067
Repayment of Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	579	1,219	1,927
Total	1,922	8,631	32,381	18,216	20,321	3,623	3,926	1,752	1,001	2,139	2,729	3,381	4,080	4,848	5,600
Cash Surplus	467	780	1,071	885	1,055	911	1,327	1,654	1,716	587	28	0	0	0	0
Cashflow (ROI before Tax)	▲ 1,843	▲ 8,478	▲ 30,368	▲ 15,795	▲ 17,319	▲ 218	47	2,895	4,640	4,640	4,640	4,640	4,640	4,640	4,640
Cashflow (ROI after Tax)	▲ 1,843	▲ 8,478	▲ 30,790	▲ 15,891	▲ 17,319	▲ 218	47	2,845	4,410	4,406	4,392	4,373	4,348	4,322	4,295
Cashflow (ROE before Tax)	▲ 129	▲ 306	▲ 2,226	▲ 2,179	▲ 2,620	695	1,071	1,669	1,946	820	276	267	292	318	345
Cashflow (ROE after Tax)	▲ 129	▲ 306	▲ 2,648	▲ 2,275	▲ 2,620	695	1,071	1,619	1,716	587	28	0	0	0	0
Outstanding Loan	1,714	9,887	38,326	53,092	69,383	72,377	75,573	76,614	76,218	74,685	72,562	69,786	66,891	63,868	60,801

Arusha, Killimanjaro: Case-B' (Base) (2/2)

(Unit: Thousand US$)

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
< Profit & Loss Statement >																
Energy Sold (GWh)	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	4,527.6
Sales Revenue	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	90,830
Cost & Expense																
Operation & Maintenance Cost	810	810	810	810	810	810	810	810	810	810	810	810	810	810	810	12,150
Depreciation	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	32,698
Interest on Long-term Loan	1,824	1,732	1,640	1,548	1,456	1,364	1,272	1,180	1,088	996	904	812	720	628	536	17,698
Interest on Short-term Loan	209	259	304	344	378	407	431	450	464	473	476	475	468	456	439	6,035
Total	4,814	4,722	4,630	4,538	4,446	4,354	4,262	4,170	4,078	3,986	3,894	3,802	3,710	3,618	3,526	62,546
Net Profit before Tax	1,241	1,334	1,426	1,518	1,610	1,702	1,794	1,886	1,978	2,070	2,162	2,254	2,346	2,438	2,530	28,284
Income Tax	372	400	428	455	483	510	538	566	593	621	649	676	704	731	759	8,485
Net Profit after Tax	869	933	998	1,062	1,127	1,191	1,256	1,320	1,384	1,449	1,513	1,578	1,642	1,706	1,771	19,799
< Cashflow Table >																
Source of Fund																
Profit after Tax	869	933	998	1,062	1,127	1,191	1,256	1,320	1,384	1,449	1,513	1,578	1,642	1,706	1,771	26,081
Depreciation	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180	56,930
Equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11,496
Long-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76,682
Short-term Loan	3,239	3,799	4,294	4,725	5,091	5,393	5,630	5,803	5,912	5,956	5,936	5,851	5,702	5,489	0	79,160
Total	6,288	6,912	7,472	7,967	8,397	8,764	9,066	9,303	9,476	9,585	9,629	9,609	9,524	9,375	3,951	250,349
Application of Fund																
Investment (Foreign Portion)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76,682
Investment (Local Portion)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11,496
Increase in Account Receivable	606	606	606	606	606	606	606	606	606	606	606	606	606	606	606	15,849
Repayment of Long-term Loan	3,067	3,067	3,067	3,067	3,067	3,067	3,067	3,067	3,067	3,067	3,067	3,067	3,067	3,067	3,067	61,891
Repayment of Short-term Loan	2,615	3,239	3,799	4,294	4,725	5,091	5,393	5,630	5,803	5,912	5,956	5,936	5,851	5,702	5,489	79,160
Total	6,288	6,912	7,472	7,967	8,397	8,764	9,066	9,303	9,476	9,585	9,629	9,609	9,524	9,375	9,162	245,078
Cash Surplus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	▲ 5,211	5,271
Cashflow (ROI before Tax)	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	30,998
Cashflow (ROI after Tax)	4,267	4,240	4,212	4,185	4,157	4,129	4,102	4,074	4,047	4,019	3,991	3,964	3,936	3,909	3,881	20,012
Cashflow (ROE before Tax)	372	400	428	455	483	510	538	566	593	621	649	676	704	731	▲ 4,452	3,513
Cashflow (ROE after Tax)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	▲ 5,211	▲ 7,473
Outstanding Loan	57,734	54,666	51,599	48,532	45,465	42,397	39,330	36,263	33,195	30,128	27,061	23,993	20,926	17,859	14,792	-/-

Dar es Salaam: Case-B' (Reference) (1/2)

FIRROI (before Tax) = 9.0% FIRROE (before Tax) = 14.5%
FIRROI (after Tax) = 7.4% FIRROE (after Tax) = 6.4%

(Unit: Thousand US$)

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
< Profit & Loss Statement >															
Energy Sold (GWh)	111.9	210.8	316.8	426.4	534.8	640.7	750.9	865.6	985.2	985.2	985.2	985.2	985.2	985.2	985.2
Sales Revenue	2,244	4,230	6,356	8,555	10,729	12,852	15,064	17,366	19,764	19,764	19,764	19,764	19,764	19,764	19,764
Cost & Expense															
Operation & Maintenance Cost	27	109	283	843	1,197	1,365	1,412	1,463	1,486	1,510	1,510	1,510	1,510	1,510	1,510
Depreciation	0	38	186	1,458	2,776	3,096	3,335	3,370	3,496	3,572	3,572	3,572	3,572	3,572	3,572
Interest on Long-term Loan	0	270	909	4,937	8,593	9,611	10,281	10,157	10,000	9,806	9,289	8,766	8,229	7,678	7,127
Interest on Short-term Loan	0	0	0	0	0	24	22	121	287	379	495	589	666	728	760
Total	27	417	1,378	7,239	12,566	14,072	15,029	14,989	14,982	14,888	14,371	13,848	13,311	12,760	12,209
Net Profit before Tax	2,217	3,813	4,978	1,316	▲ 1,837	▲ 1,220	35	2,376	4,782	4,876	5,393	5,916	6,453	7,004	7,555
Income Tax	665	1,144	1,493	395	0	0	11	713	1,435	1,463	1,618	1,775	1,936	2,101	2,266
Net Profit after Tax	1,552	2,669	3,485	921	▲ 1,837	▲ 1,220	25	1,663	3,347	3,413	3,775	4,141	4,517	4,903	5,288
< Cashflow Table >															
Source of Fund															
Profit after Tax	1,552	2,669	3,485	921	▲ 1,837	▲ 1,220	25	1,663	3,347	3,413	3,775	4,141	4,517	4,903	5,288
Depreciation	0	38	186	1,458	2,776	3,096	3,335	3,370	3,496	3,572	3,572	3,572	3,572	3,572	3,572
Equity	289	811	6,550	7,272	1,398	739	177	243	472	0	0	0	0	0	0
Long-term Loan	3,373	7,990	50,354	45,697	12,895	8,941	1,531	3,409	3,591	0	0	0	0	0	0
Short-term Loan	0	0	0	0	303	280	1,512	3,586	4,734	6,188	7,357	8,329	9,106	9,496	9,501
Total	5,213	11,508	60,575	55,349	15,535	11,836	6,580	12,271	15,641	13,173	14,704	16,042	17,194	17,971	18,362
Application of Fund															
Investment (Foreign Portion)	3,373	7,990	50,354	45,697	12,895	8,941	1,531	3,409	3,591	0	0	0	0	0	0
Investment (Local Portion)	289	811	6,550	7,272	1,398	739	177	243	472	0	0	0	0	0	0
Increase in Account Receivable	224	423	636	855	1,073	1,285	1,506	1,737	1,976	1,976	1,976	1,976	1,976	1,976	1,976
Repayment of Long-term Loan	0	0	0	0	169	568	3,086	5,371	6,015	6,463	6,539	6,709	6,889	6,889	6,889
Repayment of Short-term Loan	0	0	0	0	0	303	280	1,512	3,586	4,734	6,188	7,357	8,329	9,106	9,496
Total	3,886	9,224	57,540	53,825	15,535	11,836	6,580	12,271	15,641	13,173	14,704	16,042	17,194	17,971	18,362
Cash Surplus	1,328	2,284	3,035	1,524	0	0	0	0	0	0	0	0	0	0	0
Cashflow (ROI before Tax)	▲ 3,662	▲ 8,801	▲ 51,467	▲ 46,113	▲ 5,834	522	10,437	10,515	12,238	16,277	16,277	16,277	16,277	16,277	16,277
Cashflow (ROI after Tax)	▲ 3,662	▲ 8,801	▲ 52,960	▲ 46,508	▲ 5,834	522	10,427	9,802	10,804	14,815	14,659	14,502	14,341	14,176	14,011
Cashflow (ROE before Tax)	▲ 289	▲ 811	▲ 2,022	▲ 5,353	▲ 1,398	▲ 739	▲ 167	470	962	1,463	1,618	1,775	1,936	2,101	2,266
Cashflow (ROE after Tax)	▲ 289	▲ 811	▲ 3,515	▲ 5,748	▲ 1,398	▲ 739	▲ 177	▲ 243	▲ 472	0	0	0	0	0	0
Outstanding Loan	3,373	11,363	61,717	107,414	120,140	128,513	126,958	124,996	122,571	116,109	109,570	102,860	95,971	89,082	82,193

Dar es Salaam: Case-B' (Reference) (2/2)

(Unit: Thousand US$)

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
< Profit & Loss Statement >																
Energy Sold (GWh)	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	985.2	14,777.4
Sales Revenue	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	19,764	296,454
Cost & Expense																
Operation & Maintenance Cost	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	22,650
Depreciation	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	53,582
Interest on Long-term Loan	6,575	6,024	5,473	4,922	4,371	3,820	3,269	2,718	2,167	1,615	1,078	572	268	146	76	43,095
Interest on Short-term Loan	760	730	668	576	453	299	114	0	0	0	0	0	0	0	0	3,600
Total	11,658	11,106	10,555	10,004	9,453	8,902	8,351	7,800	7,249	6,697	6,160	5,654	5,350	5,228	5,159	119,326
Net Profit before Tax	8,106	8,657	9,208	9,759	10,310	10,862	11,413	11,964	12,515	13,066	13,604	14,109	14,414	14,535	14,605	177,127
Income Tax	2,432	2,597	2,762	2,928	3,093	3,258	3,424	3,589	3,754	3,920	4,081	4,233	4,324	4,361	4,382	53,138
Net Profit after Tax	5,674	6,060	6,446	6,832	7,217	7,603	7,989	8,375	8,760	9,146	9,523	9,877	10,090	10,175	10,224	123,989
< Cashflow Table >																
Source of Fund																
Profit after Tax	5,674	6,060	6,446	6,832	7,217	7,603	7,989	8,375	8,760	9,146	9,523	9,877	10,090	10,175	10,224	160,632
Depreciation	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	3,572	92,769
Equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,952
Long-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	137,780
Short-term Loan	9,120	8,353	7,201	5,663	3,738	1,429	0	0	0	0	0	0	0	0	0	95,895
Total	18,366	17,985	17,219	16,066	14,528	12,604	11,561	11,947	12,333	12,718	13,095	13,449	13,662	13,747	13,796	505,028
Application of Fund																
Investment (Foreign Portion)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	137,780
Investment (Local Portion)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,952
Increase in Account Receivable	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	51,219
Repayment of Long-term Loan	6,889	6,889	6,889	6,889	6,889	6,889	6,889	6,889	6,889	6,720	6,321	3,803	1,518	874	427	137,251
Repayment of Short-term Loan	9,501	9,120	8,353	7,201	5,663	3,738	1,429	0	0	0	0	0	0	0	0	95,895
Total	18,366	17,985	17,219	16,066	14,528	12,604	10,294	8,865	8,865	8,697	8,297	5,780	3,495	2,850	2,403	440,097
Cash Surplus	0	0	0	0	0	0	1,267	3,081	3,467	4,022	4,797	7,669	10,167	10,897	11,393	64,931
Cashflow (ROI before Tax)	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	16,277	259,658
Cashflow (ROI after Tax)	13,845	13,680	13,515	13,349	13,184	13,019	12,853	12,688	12,523	12,357	12,196	12,044	11,953	11,917	11,896	191,315
Cashflow (ROE before Tax)	2,432	2,597	2,762	2,928	3,093	3,258	4,691	6,671	7,222	7,941	8,879	11,902	14,491	15,257	15,774	111,711
Cashflow (ROE after Tax)	0	0	0	0	0	0	1,267	3,081	3,467	4,022	4,797	7,669	10,167	10,897	11,393	43,368
Outstanding Loan	75,304	68,415	61,526	54,637	47,748	40,859	33,970	27,081	20,192	13,472	7,151	3,348	1,830	956	529	-/-

Arusha, Killimanjaro: Case-B' (Reference) (1/2)

FIRROI (before Tax) = 2.3% FIRROE (before Tax) = 34.0%

FIRROI (after Tax) = 0.9% FIRROE (after Tax) = 24.8%

(Unit: Thousand US$)

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
< Profit & Loss Statement >															
Energy Sold (GWh)	39.5	76.4	111.4	144.7	176.5	205.9	236.6	268.6	301.8	301.8	301.8	301.8	301.8	301.8	301.8
Sales Revenue	793	1,533	2,235	2,903	3,540	4,131	4,747	5,388	6,055	6,055	6,055	6,055	6,055	6,055	6,055
Cost & Expense															
Operation & Maintenance Cost	12	174	221	482	538	726	774	809	810	810	810	810	810	810	810
Depreciation	0	17	264	863	1,375	1,891	1,974	2,057	2,091	2,091	2,091	2,091	2,091	2,091	2,091
Interest on Long-term Loan	0	17	99	383	531	694	724	756	767	767	767	766	763	750	732
Interest on Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	12	208	584	1,729	2,444	3,310	3,472	3,622	3,668	3,668	3,668	3,667	3,664	3,651	3,634
Net *Profit before Tax*	781	1,325	1,651	1,174	1,097	821	1,275	1,766	2,387	2,387	2,387	2,388	2,391	2,404	2,422
Income Tax	234	398	495	352	329	246	383	530	716	716	716	716	717	721	727
Net Profit after Tax	546	928	1,156	822	768	574	893	1,236	1,671	1,671	1,671	1,672	1,674	1,683	1,695
< Cashflow Table >															
Source of Fund															
Profit after Tax	546	928	1,156	822	768	574	893	1,236	1,671	1,671	1,671	1,672	1,674	1,683	1,695
Depreciation	0	17	264	863	1,375	1,891	1,974	2,057	2,091	2,091	2,091	2,091	2,091	2,091	2,091
Equity	129	306	3,719	3,160	3,675	216	256	35	0	0	0	0	0	0	0
Long-term Loan	1,714	8,172	28,439	14,766	16,291	2,994	3,196	1,110	0	0	0	0	0	0	0
Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	2,390	9,422	33,578	19,611	22,109	5,675	6,318	4,438	3,762	3,762	3,762	3,763	3,765	3,774	3,786
Application of Fund															
Investment (Foreign Portion)	1,714	8,172	28,439	14,766	16,291	2,994	3,196	1,110	0	0	0	0	0	0	0
Investment (Local Portion)	129	306	3,719	3,160	3,675	216	256	35	0	0	0	0	0	0	0
Increase in Account Receivable	79	153	223	290	354	413	475	539	606	606	606	606	606	606	606
Repayment of Long-term Loan	0	0	0	0	0	0	0	0	0	0	57	330	1,278	1,770	2,313
Repayment of Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1,922	8,631	32,381	18,216	20,321	3,623	3,926	1,684	606	606	663	935	1,883	2,375	2,918
Cash Surplus	467	791	1,196	1,395	1,788	2,052	2,392	2,754	3,157	3,157	3,100	2,828	1,882	1,399	868
Cashflow (ROI before Tax)	▲ 1,843	▲ 8,478	▲ 30,368	▲ 15,795	▲ 17,319	▲ 218	47	2,895	4,640	4,640	4,640	4,640	4,640	4,640	4,640
Cashflow (ROI after Tax)	▲ 1,843	▲ 8,478	▲ 30,863	▲ 16,148	▲ 17,647	▲ 464	▲ 336	2,365	3,924	3,924	3,924	3,923	3,922	3,919	3,913
Cashflow (ROE before Tax)	▲ 129	▲ 306	▲ 2,028	▲ 1,412	▲ 1,558	2,082	2,519	3,249	3,873	3,873	3,816	3,544	2,599	2,120	1,595
Cashflow (ROE after Tax)	▲ 129	▲ 306	▲ 2,523	▲ 1,765	▲ 1,887	1,836	2,136	2,719	3,157	3,157	3,100	2,828	1,882	1,399	868
Outstanding Loan	1,714	9,887	38,326	53,092	69,383	72,377	75,573	76,682	76,682	76,682	76,625	76,296	75,018	73,248	70,936

Arusha, Kilimanjaro: Case-B' (Reference) (2/2)

(Unit: Thousand US$)

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
< Profit & Loss Statement >																
Energy Sold (GWh)	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	301.8	4,527.6
Sales Revenue	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	6,055	90,830
Cost & Expense																
Operation & Maintenance Cost	810	810	810	810	810	810	810	810	810	810	810	810	810	810	810	12,150
Depreciation	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	31,368
Interest on Long-term Loan	709	685	660	634	609	583	558	532	507	481	456	430	404	379	353	7,981
Interest on Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	3,611	3,586	3,561	3,536	3,510	3,485	3,459	3,433	3,408	3,382	3,357	3,331	3,306	3,280	3,255	51,499
Net Profit before Tax	2,445	2,469	2,494	2,520	2,545	2,571	2,596	2,622	2,647	2,673	2,699	2,724	2,750	2,775	2,801	39,331
Income Tax	733	741	748	756	764	771	779	787	794	802	810	817	825	833	840	11,799
Net Profit after Tax	1,711	1,728	1,746	1,764	1,782	1,800	1,817	1,835	1,853	1,871	1,889	1,907	1,925	1,943	1,961	27,532
< Cashflow Table >																
Source of Fund																
Profit after Tax	1,711	1,728	1,746	1,764	1,782	1,800	1,817	1,835	1,853	1,871	1,889	1,907	1,925	1,943	1,961	46,191
Depreciation	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	2,091	54,447
Equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11,496
Long-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76,682
Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	3,803	3,819	3,837	3,855	3,873	3,891	3,909	3,927	3,944	3,962	3,980	3,998	4,016	4,034	4,052	188,816
Application of Fund																
Investment (Foreign Portion)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76,682
Investment (Local Portion)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11,496
Increase in Account Receivable	606	606	606	606	606	606	606	606	606	606	606	606	606	606	606	15,849
Repayment of Long-term Loan	2,413	2,519	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	43,907
Repayment of Short-term Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	3,018	3,125	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162	147,934
Cash Surplus	784	695	675	693	711	729	747	765	783	801	819	836	854	872	890	40,882
Cashflow (ROI before Tax)	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	4,640	30,998
Cashflow (ROI after Tax)	3,906	3,899	3,892	3,884	3,876	3,869	3,861	3,853	3,846	3,838	3,830	3,823	3,815	3,807	3,800	11,833
Cashflow (ROE before Tax)	1,518	1,435	1,424	1,449	1,475	1,500	1,526	1,552	1,577	1,603	1,628	1,654	1,679	1,705	1,730	47,292
Cashflow (ROE after Tax)	784	695	675	693	711	729	747	765	783	801	819	836	854	872	890	28,128
Outstanding Loan	68,523	66,004	63,448	60,892	58,336	55,780	53,224	50,668	48,111	45,555	42,999	40,443	37,887	35,331	32,775	-/-

CHAPTER 15

TASKS TO TACKLE IN THE FUTURE

CHAPTER 15 TASKS TO TACKLE IN THE FUTURE

15.1 Tasks Relating to Transmission Lines

15.1.1 Employing More Angle Towers

In the large cities of Dar es Salaam, Arusha, and Moshi that are covered by the present study, the population has been increasing year by year, making it difficult to secure a route suitable for construction of a new transmission line. Therefore, it has become increasingly difficult to adopt the traditional method: "First, decide a suitable transmission line route. Then, pay a reasonable amount of compensation money to the people living on the route and get them to go away."

One solution to the above problem is employing more angle towers. Compared with the conventional method of "using suspension towers as far as possible and selecting the shortest possible route for transmission lines," the proposed method helps to reduce the influence on the local people and environment. However, this pushes up the cost of construction, but it should be compared with compensation cost. In addition, it requires surveying the planned route more accurately than when the conventional method is adopted.

15.1.2 Putting Equipment Ledgers in Order

The recent study revealed that TANESCO has insufficient equipment drawings and ledgers about the positions and types (suspension/tension) of transmission line supports, the heights and spans of towers, etc. From the viewpoint of allowing for quick response to emergencies, implementation of regular rounds and inspections, and planned procurement/storage of spare parts, the company should organize maps and equipment ledgers for the individual transmission lines as soon as possible.

15.1.3 Measuring Insulator Contamination by Using Pilot Insulators

In the present detail design, the equivalent salt deposit density of the planned 132 kV transmission line between the survey point P14A and New Oyster Bay S/S was assumed to be 0.35mg/cm^2. In order to determine the equivalent salt deposit density accurately, it is advisable to install pilot insulators on wooden poles at the planned site for New Oyster Bay S/S (within the grounds of Kinondoni North Regional Office) and Msasani S/S. Then insulator contamination should be measure periodically.

15.1.4 Introducing Concrete Poles

Most of the supports used for the existing 33 kV transmission lines are wooden poles. In those districts which are subject to frequent floods during the rainy season or which are poorly drained, the wooden poles need to be replaced earlier than those in other districts because their roots tend to rot easily. Besides, in the urban areas where the houses stand close together, the work of replacing wooden poles is not always easy to do. Therefore, in the Dar es Salaam power supply expansion project carried out recently, the steel pipe pole

that has better weather resistance than the wooden pole was adopted. In the present expansion project too, it has been decided to use steel pipe poles in certain areas.

Considering that the steel pile pole is very expensive, it would be better to adopt the reinforced concrete (RC) pole which is less expensive. However, since the RC pole is much heavier than the steel pipe pole (1,200 kg/14 m vs. 550 kg/14 m), it requires a heavy construction machine. Besides, like steel pipe poles, RC poles are not manufactured in Tanzania, hence will have to be imported. Because of all this, it is difficult to introduce the RC pole for the moment. In the future, however, it is expected that TANESCO will introduce the RC pole which has superior weather resistance and which is less expensive than the steel pipe pole.

15.2 Tasks Relating to Substations

Concerning the substations in Tanzania, there are two major tasks to tackle in the future. One is to establish a system for maintaining the functions of substations, that is, a system for maintenance and inspection of substations. The other is to determine a basic configuration of distribution substations (33 kV/11 kV) in order to operate them in a flexible manner.

15.2.1 Maintenance of Substation Functions

Methods for grasping the conditions of substation devices can largely be divided into routine inspection and periodical diagnosis. In the former, the soundness of each device under load and under no load is checked by patrol inspection. In the former, each device is put out of operation as required or periodically (once in several years) and subjected not only to thoroughgoing appearance inspection but also to confirmation of its basic electrical performance (insulation resistance, etc.) and operating characteristics of the switches, etc. with the aid of exclusive instruments and meters.

Thus, in order to grasp the conditions of a substation accurately, it is indispensable not only to grasp the conditions of the individual devices of the substation by routine patrol inspection but also to analyze them periodically.

(1) Implementing periodical patrol inspection

In the patrol inspection of each substation to be carried out every two weeks or so, it is necessary to visually check the condition of the entire substation while walking through the inspection route, etc. and record the number of times the tap changer has been operated. The points of patrol inspection are as follows.

Table 15.1 Points of patrol inspection of substation

Item		Point of inspection	Remarks
1	Substation	Check for traces of unauthorized entry into the substation and unidentified objects having come flying. Check for unusual sound/smell.	
2	Main transformers	Check appearance of transformers for abnormal conditions. Check for unusual sound/smell. Check conditions of bushings and insulating tubes. Check for oil leak or increase of leak rate. Check indication of oil level/oil temperature. Check and record number of times of tap changer operation.	Record it as required or once in a month.
3	Circuit breakers	Check appearance of circuit breakers for abnormal conditions. Check for unusual sound/smell. Check conditions of bushings and insulating tubes. Check oil level and gas pressure. Check for oil leak. Check condition of operating box interior. Check for oil leak from operating mechanisms.	Oil circuit breakers.
4	Disconnecting switches	Check appearance of disconnecting switches for abnormal conditions. Check condition of insulating tubes. Check conductive parts for discoloration. Check condition of operating mechanisms.	
5	Instrument transformers	Check appearance of instrument transformers for abnormal conditions. Check condition of insulating tubes. Check for unusual smell. Check for oil leak or increase of leak rate.	
6	Cubicles	Check appearance of cubicles for abnormal conditions. Check for unusual sound/smell. Record voltage, current, and electric energy. Check for traces of entry of small animals.	During patrol inspection.
7	Switchboards	Check appearance of switchboards for abnormal conditions. Record voltage, current, and electric energy.	During patrol inspection.
8	DC power supplies	Check appearance of DC power supplies for abnormal conditions. Check for unusual sound/smell. Check condition of battery chargers. Check condition of battery liquid. Record voltage, current, and electric energy.	During patrol inspection.
9	Outdoor buses	Check conditions of insulators and cables. Check for unidentified objects having come flying. Check for unusual sound and traces of overheating.	

(2) Implementing periodical inspection/diagnosis

Among the substation devices, there are devices which show a tendency to deteriorate in insulation as they are operated for a long period of time, devices which wear through repeated switching operations, and devices which gradually deteriorate in operating characteristics. For those devices, it is necessary to implement a thoroughgoing inspection based on the frequency of switching operation or the length of service.

Typical examples of such devices are the main transformers and switches. For other devices, the results of the patrol inspection described above and careful examinations of conditions of devices out of operation will have to be used to judge whether or not they are capable of operation any longer.

Examples of periodical inspection/analysis of transformers and circuit breakers are given below.

Table 15.2 Methods of periodical inspection of substation devices

Item		Method of periodical inspection/diagnosis	Remarks
1	Main transformers	Gas-in-oil analysis: A small amount of sample of the insulating oil is subjected to analysis of the oil properties and qualitative and quantitative analysis of the flammable gas contained in the oil. If the transformer is leaking a substantial amount of oil, it needs to be overhauled.	When an oil-immersed devices, such as the transformer, is opened for inspection, the insulating oil and other insulators deteriorate markedly through moisture absorption and oxidation. The gas-in-oil analysis that permits a transformer to be diagnosed even during operation is, therefore, the most effective method to early detect internal anomalies of the transformer.
2	Circuit breakers	Circuit breakers which have interrupted a fault current 10 times or more or which have been used for six years or more need to be subjected to thoroughgoing inspection by the manufacturer. If necessary, circuit breakers shall be subjected to overhaul and measurement of interrupting characteristic.	Overhaul of a circuit breaker shall be entrusted to the manufacturer.

If TANESCO installs a gas-in-oil analyzer in the TANELEC plant in Arusha (TANELEC is an electrical device maker affiliated to TANESCO), it will be able to have all the main transformers of its facilities analyzed efficiently and economically. We consider that the company should discuss this plan in earnest as a means of maintaining its expensive electrical facilities.

15.2.2 Proposal on Method of Expanding Substations in the Future

Concerning the standardization of substation devices, it has been described in "Conceptual Design of Substations" (Chapter 7). Here, the basic concept of substation

expansion shall be discussed.

The basic requirements of any substation are as follows.

- Under normal condition, the substation shall be capable of operating at 100% of its installed capacity.
- In the case of an accident, the substation shall be capable of being restored in a reasonably short period of time. In an emergency, it shall be capable of putting out demanded power by means of circuit switching, etc.
- Even if the substation takes much time to recover, it shall be capable of meeting the peak demand and shall not cause fatal damage to any of the substation devices.

In order to meet the above requirements,

- It is necessary that the current capacity of series-connected devices, such as the circuit breaker, disconnecting switch, and current transformer, should be such that those devices can completely withstand a short-time overload operation of the main transformer.
- Generally speaking, if the transformer is operated at 150% or more of its capacity, its life expectancy decreases sharply. Therefore, even in an emergency, the transformer should not be operated under 150% load for more than two hours.

Concretely, the method of expanding a substation should be as follows.

- Install one transformer in the first stage.
- Install an additional transformer in the second stage.
- Install a third transformer in the final stage (total: 3 transformers).

At present, most of the transformers have only two transformers in the final stage. From the viewpoint of meeting the above condition too, it is recommended that in the future, every substation be provided with a total of three transformers in the final stage.

We propose, therefore, that when constructing a new substation, consideration should be given to securing a site which has sufficient space for installation of three transformers, main circuits allowing for split-bus configuration, and other necessary devices.

15.2.3 Requirements for SCADA system in Dar es Salaam

Power system reliability is guaranteed by not only high performance main power facilities but also power system operational environment, including load dispatching system. According to expanding power system, the system configuration will be more complicated and the SCADA system also will be certainly indispensable for load dispatching.

By the way, the SCADA system that has full functions of supervisory control and data acquisition had never introduced to Tanzanian power network.

As the basic condition, full-scale SCADA system will require high reliable telecommunication system, suitable computer system and also suitable load dispatching management and organization.

For applying SCADA system to power network in Tanzania, at least major fundamental structure described below will be required.

- Build the reliable telecommunication using microwave or optical telecommunication system instead of VHF telecommunication system used for existing data acquisition system. VHF telecommunication system is not suitable for SCADA system due to poor reliability.
- SCADA system installed in Ilala substation should be replaced to completely new facilities. However the activity of this SCADA system shall be changed from just data acquisition to full scale SCADA system.
- Concretize the future SCADA system plan that to be coordinated system operation management, adequate technology and acceptable technologies to engineers.
- There are many difficult problems to be solved to apply the SCADA System to existing substations. Therefore the scope of the first step of constructing SCADA should be among new substations.
- For remote control, additional operation circuit to switchgears at least circuit breakers installed in each substation. Simplified programmable controller will be useful to each end substation.

15.3 Tasks Relating to Distribution Lines

Striving to reduce the power loss in electrical facilities leads to effective utilization of valuable electric energy and produces substantial economic effect. From the viewpoint of efficiently operating the facilities too, it is an important task that must never be neglected. Any rehabilitation work that helps to reduce voltage fluctuations also serves to reduce the power loss. Therefore, implementing the various measures proposed in the present plan will dramatically reduce the power loss in the distribution facilities. The things TANESCO should strive to carry out in the future so as to reduce the power loss in its distribution facilities are described below.

15.3.1 Measures to Improve Distribution Lines

(1) 11 kV feeder

From a theoretical point of view, decreasing the line resistance is naturally the most effective method of reducing the power loss in a distribution line. For the existing 11 kV feeders, TANESCO still uses various types of wires, HDCC 35 mm^2, ACSR 100 mm^2, ACSR 50 mm^2, etc. All these wires should be unified to ACSR 100 mm^2, which is the company's standard wire. By so doing, the power loss will decrease significantly. During the replacement work, defective wire connections can be repaired completely. This will also contribute to the reduction of power loss.

(2) Low-voltage distribution line

From the length of the low-voltage distribution lines, the average current value per line, etc., it is judged that the low-voltage lines account for a very large proportion of the power loss in the distribution facilities in the regions under consideration. Therefore, much of the effort to reduce the power loss should be focused on the low-voltage lines.

Replacing the deteriorated wires of varying type and size with PVC-insulated aluminum wire 100 mm^2 or 50 mm^2 will contribute much to the reduction of forced power stoppage, the stabilization of voltages, and the reduction of power loss.

(3) Distribution transformer

Concerning the existing distribution transformers, the power loss shall be reduced by improving the conditions they are operated. For distribution transformers which are to be newly purchased to meet demand increases in the future, it is necessary to consider adopting a transformer of low power loss if it is warranted by economic evaluation.

15.3.2 Measures to Improve Operation of Distribution Lines

(1) Eliminating unbalanced current

It is extremely difficult to completely dissolve the problem of unbalanced current with the 3-phase, 4-conductor, low-voltage trunk distribution line. However, it is possible to appreciably reduce the unbalanced current by periodically measuring the current of each phase and properly chose the phase to connect of the single-phase branch lines and service lines as required. The unbalanced current not only causes the power loss to increase. It also causes an unbalanced 3-phase voltage to occur at many points of the distribution line (due to non-uniform voltage drops, etc.), which in turn causes the load devices to decline in efficiency. Thus, it prevents smooth operation of the distribution line. If the unbalanced current of the low-voltage trunk line can be reduced significantly, the unbalanced current of the 11 kV feeders will decrease at the same time. This will also have a favorable effect on the higher-order systems.

(2) Eliminating feeders under heavy load

It is necessary to equalize loads of the feeders as far as possible by dividing the loads with utilizing section switches.

(3) Optimizing operation of distribution transformers

From the viewpoint of improving the availability and total efficiency of distribution transformers, it is effective to interchange existing transformers having an excessively large or small capacity with the ones having a suitable capacity. Generally speaking, the distribution transformer is capable of operating under an overload of up to about 120% of capacity. Therefore, by reviewing the performance of each individual transformer and clarifying its overload capacity, it will become possible to defer the planned investment in distribution transformers.

(4) Installing low-voltage capacitor for improvement of power factor

For inductive loads whose power factor is smaller than a certain value, it is effective to obligate the user to install a capacitor of suitable capacity as a prerequisite for power supply to them. In this case, however, it will become necessary to offer the users suitable incentives, such as the reduction of load factors in the power tariff schedule.

(5) Controlling watt-hour meters

(a) Making electricity supply fair

TANESCO should establish a watt-hour meter certification system and supply electricity within the tolerance of watt-hour meters.

(b) Abolishing electricity supply to users without meter

As far as possible, TANESCO should stop supplying electricity to users without a supply meter. If this is impossible, the company should apply reasonable commercial power rates and strive to prevent electricity from being stolen.

(c) Eliminating meter error

The meters should be checked at prescribed intervals to eliminate meter error completely.

(d) Rationalizing contracts

In order to rationalize each supply contract, it is recommended that the company install a current limiter appropriate to the contracted capacity.

(6) Clarifying techniques to control power loss

Actually, the power loss in and after the distribution line is ascribable in a surprisingly large measure to the watt-hour meter error due to mechanical aging, stolen electricity, leakage current, etc. In many cases, therefore, it is more important to try reducing this type of power loss than the physically caused power loss. In order to effectively carry out measures to reduce the power loss in the distribution system, it is more important than anything else to make sure that the electric energy put out from the distribution substation is correctly measured with the prescribed accuracy. Then, it is important to clarify techniques to control the power loss on certain premises, such as by reviewing whether or not the flat-rate electric energy demand in electric energy sold is converted on a rational basis. TANESCO should use those techniques to identify purely physical factors in power loss and work out measures to eliminate them in the future.

15.4 Tasks Relating to Maintenance

In order for TANESCO to be able to continue providing the consumer with quality electricity safely, the company must operate, maintain, and improve its electrical facilities on a consistent basis. Since the distribution facilities are complicated ones distributed over a wide area, grasping their conditions accurately takes much time and labor. However, neglecting it will prevent proper operation and maintenance of the facilities and will eventually lead to their devastation.

In order to operate and control the distribution facilities rationally and efficiently, it is necessary to establish the standards and procedures described below and consistently apply unified operation/control techniques based on them. Making ceaseless efforts to properly operate and control the facilities by using those techniques paves the way for preventive maintenance of the facilities.

(1) Safety standard

Specifies safety requirements of the facilities, such as insulation resistance of the lines including the indoor wiring, height of the line above the ground, clearance between the line and trees, buildings, etc., and grounding resistance of electrical devices.

(2) Maintenance rules

Clearly state such basic matters as the assignment of persons responsible for maintenance, distribution of maintenance jobs, implementation of patrol inspection, maintenance work to prevent accidents, and restoration of failed equipment, in order to ensure smooth execution of maintenance jobs.

(3) Patrol inspection procedure

Specifies period, method, points, etc. of patrol inspection. During patrol inspection, the person in charge shall take a Patrol Inspection Card with him and enter necessary items in the card. Patrol Inspection Cards collected from the workshops shall be classified according to contents, "immediate repair required," "repair required within 10 days," "scheduled repair required," and so on. They provide important data for maintenance/repair work that must be executed.

(4) Maintenance/repair work execution procedure

Provides for planning for execution of emergency work and scheduled maintenance/repair work, a line of command for work execution, persons in charge of maintenance/repair work, and so on.

(5) Measurement of distribution line voltage/current

(a) Measuring voltage of power supplied to consumers

The supply voltage to the consumer nearest to the distribution transformer and the consumer farthest from it, respectively, shall be measured and recorded for 24 hours, once a year or as required, to obtain basic data for planning improvement of the transmission lines.

(b) Measuring load current

The load current of transformers and low-voltage lines shall be measured once a year or as required to obtain data for proper load control.

(6) Distribution line drawing (distribution system diagram)

TANESCO should prepare and maintain a distribution line drawing (scale: 1/5,000 or so) showing the positions of poles, pole numbers, spans, types and sizes of wires/cables, positions and capacities of transformers, positions of section switches, locations, names, etc. of large users, and so on.

Since the drawing is to be used for switching operation of the ring circuit of the distribution system and restoration of a failed system, it must always be kept up-to-date so that it shows the current conditions of the facilities.

(7) Equipment control cards

The distribution facilities include many different equipment or devices. Besides, the system's configuration is changed frequently. Therefore, it is desirable to control those facilities by using the following cards.

(a) Transformer Card

This card is used to control each transformer's history, supply area of low-voltage line section, tap position, voltage, load current, grounding resistance, etc. By entering the load equipment of each consumer in this card, it becomes possible to know the load at each of the poles and calculate voltage drop of the low-voltage line. Thus, this card is indispensable for load/voltage control.

(b) Card for recording peripheral equipment

This card is used to record the nameplates, locations, inspection/repair history, etc. of the peripheral equipment (section switches, lightning arresters, etc.) and underground line devices, for equipment control of those devices.

(8) Guidelines for restoration of line faults

These guidelines set forth matters to be attended to during initial action taken, investigation made, and restoration work done for line faults in order to minimize the duration of service interruption.

(9) Service reliability control procedure

For each of the distribution lines, the rate of attainment of proper voltage, the number of times of service interruption at each user, the number of times of scheduled power stoppage, the duration of service interruption, etc. shall be recorded for the facility's improvement planning in the future.

15.5 Tasks Relating to Management

TANESCO has been a sole supplier of electricity in Tanzania. It has been controlled, regulated and protected by the government. The basic policy of the government on the electric power sector has been a supply of electricity at low cost and a promotion of rural electrification. Thus, making a reasonable profit from the supply of electricity has not been the first consideration. Due in part to these circumstances, as both the government and TANESCO are aware, there is much room for improvement about the way TANESCO is managed.

The major problem that has direct bearing on the management of TANESCO is that the tariff rate has not been set at such level that is enough to cover capital investment cost. However, this problem is one, which the government has to consider from the standpoint of both national welfare and electric power business administration: it is not a problem TANESCO can solve for itself. The government is supposed to deliberate on the matter, along with the planned restructuring of the electric power sector.

Another major problem is a revenue collection. This problem consists mainly of 'non-technical' energy loss and arrearages. As mentioned in Chapter 11, the non-technical energy loss, which is sharply increasing in recent years, is ascribed to "inaccurate reading of meters," "defective meters," "billing based on inaccurate estimate" and "illegal acts—stealing electricity, tampering with the meter, by-passing the meter, etc." In this respect, there are a good number of measures TANESCO should take. First of all, the company should reeducate the meter readers and calibrate, repair, and replace meters as required. Concerning the issuance of bills based on inaccurate estimate, it is due chiefly to the understaffing of meter readers. To solve this problem, therefore, the company will have to increase the personnel or cover the shortage by providing some convenient means of traveling, such as bicycles or motorcycles. The issuance of inaccurate bills has been not only a cause a delay of cash receipt but also a pretext for not paying the bill. Therefore, such measures as increasing the meter reader or providing convenient means of traveling will help to improve the bill collection rate too. To prevent such illegal acts as stealing electricity, it is considered necessary for the company not only to urge the government to make the penalties severer but also to reinforce its surveillance. Before taking any improvement measure, the company should measure its cost-effectiveness. It is important that for those measures which are judged valid and cost-effective, the company should secure the necessary budget and carry them out in a planned manner.

In addition to the measures mentioned above, TANESCO should implement the *following measures.*

- Keeping records of operation and accidents such as power failure to reflect them in financial management.
- Preparing realistic budget and implementing financial management based on it.
- Managing cash, accounts receivable, accounts payable, inventories, etc. properly.
- Building a workable system of reporting from the operation departments to the administrative departments.
- Reinforcing education/training of personnel of all departments and at all levels.
- Striving to control/cut costs, particularly, fuel costs, general administrative expenses, and transportation costs.

As already mentioned, Netgroup Solutions (Pty) Ltd. of South Africa has been employed as a management consultant during a transition phase before restructuring of TANESCO. Netgroup Solutions has already begun consulting services for an improvement of the management of TANESCO, including a collection of account receivables.

ANNEX 1 Member List of Study Team and Work Assignment

Name	Firm	Assignment	Remark
KODANI, Hiroshi	J-Power	Team Leader	
SAKAI, Takehisa	J-Power	Substation Planner	
HONJO, Nobuyuki	J-Power	Substation Planner	
YAMANAKA, Tetsuya	J-Power	Transmission Planner	
NOGUCHI, Hisaya	J-Power	Distribution Planner	
MORI, Masaki	J-Power	Distribution Planner	
TOMABECHI, Tatsuo	J-Power	Demand & Supply Planner	
OMORI, Yoshiyuki	J-Power	Cost Estimator	
IMAEDA, Yoshitaka	E&E Solutions	Economist	
SATO, Tadao	J-Power	System Maintenance Planner	
NAKAKUMA, Seigo	J-Power	Environmentalist	
TOKI, Masahiro	J-Power	Coordinator	1st, 3rd On-site Survey
IMAIZUMI, Takahiro	J-Power	Coordinator	5th On-site Survey

ANNEX 2 Study Period and Items

Name of Study	Study Period	Major Items
Preparatory Work	February 2～February 7 in 2001	Inception Report Preparation Preparation of On-site Survey
Work in Japan 1st Stage	February 8～March 19 in 2001	Inception Report Explanation, *Data Collection*
On-site Survey 1st Stage	June 7～August 17 in 2001	Master Plan Study, Contract Preparation with Local Consultant
On-site Survey 2nd Stage	June 12～June 30 in 2001	DAMP Investigation, Contract with Local Consultant
On-site Survey 3rd Stage	August 25～October 23 in 2001	Master Plan Study, Feasibility Study、Model Case Study of DAMP, Investigation of Power Sector Restructuring and Privatization of TANESCO
Work in Japan 2nd Stage	November 1 in 2001～February 13 in 2002	Drawing up Interim Report
On-site Survey 4th Stage	February 18～March 3 in 2002	Explanation of Interim Report. Investigation of Restructuring of Power Sector in Tanzania
Work in Japan 3rd Stage	June 26～July 16 in 2002	Preparation of Draft Final Report
On-site Survey 5th Stage	July 16～August 5 in 2002	Explanation of Draft Final Report. Workshop
Final Report Preparation	August 6～September 6 in 2002	Report Finalization

ANNEX 3 Personnel Interviewed by the JICA Study Team

List of the Personnel interviewed by the JICA Study Team
on the 1st On-site Survey

Name	Title and Position
(1) Japan Embassy	
Mr. Keitaro Sato	Ambassador Extraordinary and Plenipotentiary
Mr. Hiroyuki Kashimura	Second Class Secretary
(2) JICA Tanzania Office	
Mr. Sumio Aoki	Resident Representative
Mr. Mitsuaki Furukawa	Deputy Resident Representative
Mr. Kaoru Suzuki	Assistant Resident Representative
Mr. Fabian M. Chilumba	Chief Programme Officer
(3) Ministry of Energy and Minerals	
Mr. Bashir J. Mrindoko	Commissioner for Energy and Petroleum
Mr. Theophillo Bwakea	Assistant Commissioner for Electricity
(4) TANESCO	
Mr. Baruany Elijah A. T. Luhanga	Managing Director
Mr. B. Msowoya	Deputy Managing Director(Technical Service)
Mrs. E. M. Masunzu	Director Operations
Mr. M.M.Fazal	Manager Distribution & Commercial
Mr. Cosmas Masawe	Manager Rural Electrification
Mr. Mayila	Manager Planning
Mrs. Mercy S. Baregu	Chief Distribution & Commercial Engineer
Mr. Makala E.Kingu	Chief Rural Electrification Engineer
Mr. A.Feresh	Chief Transmission Line Engineer
Mr. Bengiel Msofe	Senior Electrification Engineer
Mrs. Sophia S. Mgonja	Senior Distribution Engineer
Mr. Lebbi Changullah	Senior Planning Engineer
Mr. Elton Mwakaburi	Senior Surveyor
Mr. Sanibella Mahenge	Commercial Engineer
Mr. James Mwalilino	Supplies Oversea
Mr. Robert Semsella	Electrical Engineer Rural Electrification
Mr. Ayoub Nghasha	Mechanical Engineer Rural Electrification
Mr. Changi	Transmission Line Engineer
Mr. W.H.Chambo	Draftsman
Mr. James Bendict Diu	Directorate of Corporate Planning and Research
Mr. Mbawala	Manager Project Construction
Mr. Mikina	Project Construction
Mr. John Sangiwa	Safety Engineer
Mr. John E. Lazimah	Research & Investigation Unit
Mr. Martin Kalokola	Regional Manager-Ilala
Mr. Ephraim N.Kaali	Senior Engineer-Ilala
Mrs. E.G. Fumbuka	Regional Manager-Kinondoni (North)
Mr. Mmari Goodluck	Senior Engineer-Kinondoni (North)

Mr. John B.Mwakipesile	Regional Manager-Kinondoni (South)
Mr. Theodory F.Bayona	Planning Engineer-Kinondoni (South)
Mr. Nsajigwa J.Mwaisaka	Regional Manager-Temeke
Mrs. Fatuma I. Chungu	Senior Engineer-Temeke
Mr. Thomas Uiso	Planning Engineer-Temeke
Mr. Joel Lukumai	Regional Manager-Kilimanjaro
Mr. Maclean Mbonile	Senior Engineer-Kilimanjaro
Mr. Innocent G. Luoga	Planning Engineer-Kilimanjaro
Mr. Francis Maze	Custmer Service Engineer -Kilimanjaro
Mr. Gasper Msigwa	Construction and Maintenance Engineer-Kilimanjaro
Mr. Fawstin Antony	Electrical Workshop Engineer-Kilimanjaro
Mr. Christopher J. Masasi	Regional Manager-Arusha
Mr. Ng'erere Makoye	Sinior Engineer-Arusha
Mr. Amosy Maganga	Construction Engineer-Arusha
Mrs. Dinah Msuya	Maintenance Engineer-Arusha
Mr. Stanley Hunphrey	Customer Service Engineer-Arusha
Mr. Paschal Kibassa	Transmission Engineer-Arusha
Mr. Oscar Muhamba	Surveyor-Tanga
Mr. Dezideri R. Rutta	Njiro S/S
Mr. Miwitaji Sarum	Njiro S/S
Mr. Jafari A. Mpina	Project Engineer – DAMP
Mr. Saady Julius Kateti	Maintenance Engineer - DAMP
Mr. H. Moshy	Maintenance Supervisor - DAMP
Mr. Nicepitory Ngonyani	DAMP
Mr. Mwingizi	Manager of Manpower Development & Training
Mr. Yabaya Ali	Manager, TANESCO Training Center
Mr. R. Luteganya	TANESCO Training Center
Mr. Sipendeki J. Lugata	Mikocheni S/S
Mr. Mallale	Ubungo S/S
Mrs. Rukia Mpako	Ubungo S/S
Mr. Bakari Mkytenda	Ubungo S/S
Mrs. Grace H.Ndibalema	Ubungo Office
Mr. Tumaini Sembuche	Electrical Workshop Department - Ubungo Workshop
Mr. Ombeni Minja	Ilala
Mr. Frank S. Mwatuka,	Ilala S/S
Mr. Joseph Manene	Ilala S/S
Mr. Mafuko J. Chinganga	FZ III S/S
Mr. Yohani Sheao	Same S/S
Mr. Emanuel Mosi	Usa River District Office

(5) Pricewaterhouse Coopers

Mr. Simon Lapper	Management Consultant
Mr. Sandip D. Rughani	Consultant
Mr. Jeremiah Lima	Consultant

(6) Deloitte Touche Tohmatsu

Mr. Simon C. Mponji	Partner
Mr. Jones Ackor	Associate Director

(7) Others

Mr. Rawson P. Yonazi	Assistant Director, Division of Environment, Vice President Office
Ms. Ruth Lugwisha	Senior Pollution Control Officer, National Environmental Management Council
Mr. RN. Muheto	Director Natural Resources, Ministry of Natural Resources & Tourism
Mr. G. P. Mashurano	Assistant Director, Forest Utilization & Extension, Ministry of Natural Resources & Tourism
Mr. Juma A. Kayera	Assistant Director Resources Utilization, Wildlife Division, Ministry of Natural Resources & Tourism
Mr. Ulinyelusya K. Jenende	Assistant Director, Macro Economy Division, President's Office Planning Commision
Mr. R. A. Monyo	Factory Inspectorate, Ministry of Labor
Ms. Tillya DMr. George	Department of ArtiquitiesNational Museum
Mr. Peter Sumbi	Forest Projects Officer, WWF
Mr. Simon Milledge	Senior Programme Officer, TRAFIC, WWWF
Ms. Nadhi Sadiki	Water Laboratories Unit, Ministry of Water
Mr. Ph. D. Yanda	IRA, Dar es Salaam University
Dr. Ludwig Siege	Wildlife Division, Selous Conservation Programme (GTZ)

List of the Personnel interviewed by the JICA Study Team on the 2nd On-site Survey

Name	Title and Position
(1) Japan Embassy	
Mr. Keitaro Sato	Ambassador Extraordinary and Plenipotentiary
Mr. Hiroyuki Kashimura	Second Class Secretary
(2) JICA Tanzania Office	
Mr. Sumio Aoki	Resident Representative
Mr. Hiroyuki Kinomoto	Deputy Resident Representative
Mr. Kaoru Suzuki	Assistant Resident Representative
(3) TANESCO	
Mr. B.E.A.T. Luhanga	Managing Director
Mrs. E. M. Masunzu	Director Operations
Mr. M.M.Fazal	Manager Distribution & Commercial
Mrs. Mercy S. Baregu	Chief Distribution & Commercial Engineer
Mr. Bengiel Msofe	Senior Electrification Engineer
Mrs. Sophia S. Mgonja	Senior Distribution Engineer
Mr. Cosmas Masawe	Manager Rural Electrification
Mr. Sanibella Mahenge	Commercial Engineer
Mr. W.H.Chambo	Draftsman
Mr. Martin Kalokola	Regional Manager-Ilala
Mrs. E.G. Fumbuka	Regional Manager-Kinondoni (North)
Mr. Mmari Goodluck	Senior Engineer-Kinondoni (North)
Mr. John B.Mwakipesile	Regional Manager-Kinondoni (South)
Mr. Theodory F.Bayona	Planning Engineer-Kinondoni (South)
Mr. Nsajigwa J.Mwaisaka	Regional Manager-Temeke
Mrs. Fatuma I. Chungu	Senior Engineer-Temeke
Mr. Joel Lukumai	Regional Manager-Kilimanjaro
Mr. Maclean Mbonile	Senior Engineer-Kilimanjaro
Mr. Innocent G. Luoga	Planning Engineer-Kilimanjaro
Mr. Francis Maze	Customer Service Engineer-Kilimanjaro
Mr. Gasper Msigula	Construction and Maintenance Engineer-Kilimanjaro
Mr. Christopher J. Masasi	Regional Manager-Arusha
Mr. Ng'erere Makoye	Senior Engineer-Arusha
Mr. Amosy Maganga	Construction Engineer-Arusha
Mr. Stanley Humphrey	Customer Service Engineer-Arusha
Mr. Jafari A. Mpina	Project Engineer-DAMP
Mr. Saady Julius Kateti	Maintenance Engineer-DAMP
Mr. H. Moshy	Maontenance Supervisor-DAMP
(4) Pricewaterhouse Coopers	
Mr. Bob Hawkins	Director, Management Consulting Services
Mr. Mark Appleby	Senior Manager, Assurance and Business Advisory Service
Mr. Sandip D. Rughani	Consultant

Mr. Jeremiah Lima	Consultant

(5) Deloitte Touche Tohmatsu

Mr. Simon C. Mponji	Partner
Mr. Jones Ackor	Associate Director
Mr. Issac M. Kiwango	Director

List of the Personnel interviewed by the JICA Study Team on the 3rd On-site Survey

Name	Title and Position
(1) Japan Embassy	
Mr. Hiroyuki Kashimura	Second Class Secretary
(2) JICA Tanzania Office	
Mr. Sumio Aoki	Resident Representative
Mr. Kaoru Suzuki	Assistant Resident Representative
Mr. Shinichiro Futami	Assistant Resident Representative
(3) JETRO DAR ES SALAAM	
Mr. Takashi Oku	President
(4) TANESCO	
Mr. B.E.A.T. Luhanga	Managing Director
Mr. B. Msowoya	Deputy Managing Director(Technical Service)
Mrs. E. M. Masunzu	Director Operations
Mr. M.M.Fazal	Manager Distribution & Commercial
Mr. Cosmas Masawe	Manager Rural Electrification
Mr. Felician N.Mayila	Assistant Manager Corporate Planning
Mrs. Mercy S. Baregu	Chief Distribution & Commercial Engineer
Mrs. Sophia S. Mgonja	Senior Distribution Engineer
Mr. A.Feresh	Chief Transmission Line Engineer
Mr. Lebbi Changullah	Senior Planning Engineer
Mr. Obay Sigala	Distribution Engineer
Mr.Fadhili Kalissa	Distribution Engineer
Mr. Benedict Lyaruu	Distribution Engineer
Mr. Gilbert S. Mrosso	Land Surveyor
Mr. Mwalongo A. M.	Land Surveyor
Mr. W.H.Chambo	Draftsman
Mr. Martin Kalokola	Regional Manager-Ilala
Mr. Ephraim N.Kaali	Senior Engineer-Ilala
Mr. Ombeni Minja	Senior Engineer-Ilala
Mr. Frank S. Mwatuka	Ilala S/S
Mr. Joseph Manene	Ilala S/S
Mrs. E.G. Fumbuka	Regional Manager-Kinondoni (North)
Mr. Mmari Goodluck	Senior Engineer-Kinondoni (North)
Mr. Benas Bwire	Technician-Kinondoni(North)
Mr. Saidi Msuya	Engineer-Tegeta S/S
Mr. Sadiki S. Rupia	Ras Kilomoni
Mrs. S. C. Assey	District Manager-Bagamoyo
Mr. John B.Mwakipesile	Regional Manager-Kinondoni (South)
Mr. Theodory F.Bayona	Planning Engineer-Kinondoni (South)
Mrs. Margareth M. Kabadi	Senior Engineer-Kinondoni (South)
Mr. Kingunza F.Gallus	Technician-Kinondoni(South)
Mr. Nsajigwa J.Mwaisaka	Regional Manager-Temeke

Mrs. Fatuma I. Chungu	Senior Engineer-Temeke
Mr. George Mtunda	Supervisor-Planning-Temeke
Mr. Jerome Alfrede	Technician-Temeke
Mr. Wilson Shayo	Superintendent-Temeke
Mr. Jafari A. Mpina	Project Engineer - DAMP
Mr. Richard E. Nsulau	Regional Manager-Kilimanjaro
Mr. Maclean Mbonile	Senior Engineer-Kilimanjaro
Mr. Innocent G. Luoga	Planning Engineer-Kilimanjaro
Mr. Laban R. Mampagwa	Area Manager-Same
Mr. Augustino G. Kamanga	NYM Hydropower Station
Mr. Christopher J. Masasi	Regional Manager-Arusha
Mr. Amosy Maganga	Construction Engineer-Arusha
Mr. Paschal Kibassa	Transmission Engineer-Arusha
Mr. Emanuel Mosi	District Manager-Usa River
Mr. Matei Alex Mshana	District Manager-Monduli
Mr. Dezideri R. Rutta	Njiro S/S
Mr. Oscar Muhamba	Surveyor-Tanga

(5) Deloitte Touche Tohmatsu

Mr. Simon C. Mponji	Partner
Mr. Jones Ackor	Associate Director
Mr. Issac M. Kiwango	Consultant
Mr. Parga Shiswawala	Consultant

(6) Others

Mr. Emmanuel Mbisse	TOL Electrical Engineer
Mr. Kusungulwa J. Mitto	TANELEC Production Engineer
Dr. Emilion Urassa	Monduli District Hospital
Dr. A. S. Swai	Monduli District Hospital

List of the Personnel interviewed by the JICA Study Team on the 4th On-site Survey

Name	Title and Position
(1) Japan Embassy	
Mr. Akio Egawa	Minister
Mr. Hiroyuki Kashimura	Second Class Secretary
(2) JICA Tanzania Office	
Mr. Hiroyuki Kinomoto	Deputy Resident Representative
Mr. Tomoki Kobayashi	Assistant Resident Representative
Mr. Fabian M. Chilumba	Chief Programme Officer
(3) TANESCO	
Mr. B. Msowoya	Deputy Managing Director(Technical Service)
Ms. E. M. Masunzu	Director Operations
Mr. M.M.Fazal	Manager Distribution & Commercial
Ms. Mercy S. Baregu	Distribution & Transmission Specialist
Mrs. Sophia S. Mgonja	Chief Distribution & Commercial Engineer
Mr. Patrick O. Songa	Senior Engineer-HQ
Mr. Benedict Lyaruu	Distribution Engineer
Mr. Sanibella Mahenge	Commercial Engineer
Ms. Rukia Mpako	System Development Engineer
Mr. S. E. Shayo	Transmission Engineer
Mr. J. Sakia	Senior Engineer-Transmission
Mr. Gilbert S. Mrosso	Land Surveyor
Mr. Mwalongo A. M.	Land Surveyor
Mr. James Bendict Diu	Directorate of Corporate Planning and Research
Mr. M. T. Mallale	Chief System Control Engineer
Mr. Chibate A. Makali	Senior Engineer (System Control)
Mr. Christian Msyani	Senior System Control Engineer (O)
Mr. Martin Kalokola	Regional Manager-Ilala
Mr. Ombeni Minja	Senior Engineer-Ilala
Mr. Mmari Goodluck	Senior Engineer-Kinondoni (North)
Ms. Stella Manyanya	Planning Engineer-Kinondoni North
Mr. John B.Mwakipesile	Regional Manager-Kinondoni (South)
Ms. Margareth M. Kabadi	Senior Engineer-Kinondoni (South)
Mr. Theodory F.Bayona	Planning Engineer-Kinondoni (South)
Mr. Nsajigwa J.Mwaisaka	Regional Manager-Temeke
Ms. Fatuma I. Chungu	Senior Engineer-Temeke
Mr. Thomas Uiso	Planning Engineer-Temeke
Mr. Richard E. Nsulau	Regional Manager-Kilimanjaro
Mr. Maclean Mbonile	Senior Engineer-Kilimanjaro
Mr. Gasper Msigwa	Construction and Maintenance Engineer-Kilimanjaro
Mr. Christopher J. Masasi	Regional Manager-Arusha
Mr. Ng'erere Makoye	Senior Engineer-Arusha
Mr. Amosy Maganga	Construction Engineer-Arusha
Mr. Paschal Kibassa	Transmission Engineer-Arusha

Ms. Dinah Msuya	Maintenance Engineer-Arusha

(4) Deloitte Touche Tohmatsu

Mr. Simon C. Mponji	Partner
Mr. Jones Ackor	Associate Director
Mr. Issac M. Kiwango	Consultant
Mr. Parga Shiswawala	Consultant

List of the Personnel interviewed by the JICA Study Team on the 5th On-site Survey

Name	Title and Position
(1) Japan Embassy	
Mr. Kazumi Dekiba	Ambassador Extraordinary and Plenipotentiary
Mr. Hiroyuki Kashimura	Second Class Secretary
(2) JICA Tanzania Office	
Mr. Sumio Aoki	Resident Representative
Mr. Tomoki Kobayashi	Assistant Resident Representative
(3) Ministry of Energy and Minerals	
Mr. M. Mbwambo	Senior Executive Engineer
Mr. Theophillo Bwakea	
(4) TANESCO	
Mr. Rudy Huysen	Managing Director
Mr. Steve Van Staden	Deputy Managing Director
Mr. Cosmas Masawe	Acting Director Operations
Mr. M.M.Fazal	Manager Distribution
Mr. Kingu, M.E.	Acting Manager Rural Electrification
Mrs. Mercy S. Baregu	Distribution and Transmission Specialist
Mr. S.Saidi Ngoma	Senior Distribution Engineer
Ms. Stella Manyanya	Planning Engineer
Mr. Johnson Mwigune	Commecial Engineer
Mr. Simon B. Kihiyo	Acting Chief Engineer Distribution
Mr. Benedict Lyaruu	Distribution Engineer
Mr. Martin Kalokola	Regional Manager-Ilala
Mr. Ephraim N.Kaali	Senior Engineer-Ilala
Mr. Ombeni Minja	Senior Engineer-Ilala
Mrs. E.G. Fumbuka	Regional Manager-Kinondoni (North)
Mr. Mmari Goodluck	Senior Engineer-Kinondoni (North)
Mr. John B.Mwakipesile	Regional Manager-Kinondoni (South)
Mr. Samwel M. Mollel	Acting Planning Engineer-Kinondoni (South)
Mr. Theodory F.Bayona	Acting Senior Engineer-Kinondoni (South)
Mr. Nsajigwa J.Mwaisaka	Regional Manager-Temeke
Mrs. Fatuma I. Chungu	Senior Engineer-Temeke
Mr. Thomas Uiso	Planning Engineer-Temeke
Mr. Richard E. Nsulau	Regional Manager-Kilimanjaro
Mr. Maclean Mbonile	Senior Engineer-Kilimanjaro
Mr. Innocent G. Luoga	Planning Engineer-Kilimanjaro
Mr. Christopher J. Masasi	Regional Manager-Arusha
Mr. Ng'erere Makoye	Senior Engineer-Arusha
Mr. Paschal Kibassa	Transmission Engineer-Arusha
Mr. Amosy Maganga	Construction Engineer-Arusha
Mr. Paschal Kibassa	Transmission Engineer-Arusha
Ms. Dinah Msuya	Maintenance Engineer-Arusha

(4) Deloitte Touche Tohmatsu

Mr. Simon C. Mponji	Partner
Mr. Jones Ackor	Associate Director
Mr. Issac M. Kiwango	Consultant
Mr. Parga Shiswawala	Consultant

ANNEX 4 List of Collected Drawings and Documents

List of Drawings and Documents collected during 1st On-site survey

No.	Name of Documents
Documents submitted as the answer for Questionnaire	
A1	Organization Chart Head Office
A2	HIGH VOLTAGE TRANSMISSION LINES
A3	GENERATOR & GEN. TRANSFORMER
A4	ELECTRICAL PARAMETERS FOR 220kV AND 132kV GRID
A5	220/132/33/11kV DIAGRAM OF UBUNGO CONTROL COMPLEX CENTRE
A6	GRID SUBSTATIONS
A7	System of dispatching operation and maintenance(existing)
A8	Topographical and Geological Data
A9	Import Duties and Exchange Rate
A10	Currency and Customs Clearance
A11	Department directly and indirectly Concerned with the implementation Of M/P on the Project
A12	The general climatic condition of Dar es Salaam, Kilimanjaro and Arusha regions.
A13	EXISTING WORKSHOP FACILITIES FOR OPERATION AND MAINTENANCE
A14	PRESENT METHOD OF OPERATION AND MAINTENANCE 1. POWER STATIONS
A15	Maintenance of Power Station & TL, 55
A16	WATT-HOUR METERS ON SS
A17	Standard For Planning And Designing
A18	RELAYS SYSTEM
A19	Summary and Recommendation Answer for P6 Q7
A20	Asset classification and useful economic lives
A21	Map of West Hai (1:50,000)
A22	Map of Sanya Chini (1:50,000)
A23	Map of Himo (1:50,000)
A24	Map of Rongai (1:50,000)
A25	Map of Oloitokitok (1:50,000)
A26	Map of Mwanga (1:50,000)
A27	Map of Same (1:50,000)
A28	Map of Arusha (1:50,000)
A29	Map of Monduli (1:50,000)
A30	Map of Usa River (1:50,000)
A31	Map of Dar Es Salaam 1 (1:10,000)
A32	Map of Dar Es Salaam 2 (1:10,000)
A33	Map of Dar Es Salaam 3 (1:10,000)
A34	Map of Dar Es Salaam 4 (1:10,000)
A35	Map of Dar Es Salaam 5 (1:10,000)
A36	Map of Dar Es Salaam 6 (1:10,000)
A37	Map of Dar Es Salaam 7 (1:10,000)
A38	Map of Dar Es Salaam 7 J15-2 (1:10,000)
A39	Map of Dar Es Salaam 8 (1:10,000)
A40	Map of Dar Es Salaam 9 (1:10,000)
A41	Map of Arusha Municipality 1 (1:10,000)
A42	Map of Arusha Municipality 2 (1:10,000)

A43	Map of Arusha Municipality 3 (1:10,000)
A44	Map of Arusha Municipality 4 (1:10,000)
A45	Map of Moshi Municipality 1 (1:10,000)
A46	Map of Moshi Municipality 3 (1:10,000)
A47	Ilala S/S CB Specification
A48	TANESCO ILALA REGION FEEDER'S FAULT RECORDS FOR THE YEAR 1996
A49	*SINGLE LINE DIAGRAM ILALA S/S*
A50	SINGLE LINE DIAGRAM FACTORY ZONE-III S/S
A51	SINGLE LINE DIAGRAM KARIAKOO S/S
A52	ONE LINE DIAGRAM CITY CENTER S/S
A53	ONE LINE DIAGRAM SOKOINE S/S
A54	POWER SUPPLY AND DEMAND IN 10 YEARS
A55	POWER FACILITIES - SUBSTATIONS
A56	Organization Data - Ilala Region
A57	ORGANIZATION CHART - ILALA REGION - DAR ES SALAAM
A58	Peak Load of Ilala Region
A59	MAGOMENI SUBSTATION SINGLE LINE DIAGRAM
A60	UNDERCONSTRUCTION AND PLANNED(DISTRIBUTION LINES) 33KV/11KV
A61	KINONDONI SOUTH REGION NUMBER OF CUSTOMERS FROM YEAR 1991 TO 2000
A62	*Kinondoni South Regional Office Information*
A63	Kinondoni South Organization Chart
A64	Feeders and demand of Tandale S/S and Ubungo S/S
A65	TEMEKE REGIONAL ORGANIZATIONAL CHART
A66	PRESENT SITUATION OF TANESCO
A67	POWER FACILITIES
A68	PEAK LOAD
A69	TEMEKE REGION UNPLANNED OUTAGES IN 1999
A70	TEMEKE REGION PROPOSALS
A71	NUMBER OF EMPLOYEES BY JOB CLASSIFICATIONS IN EACH OFFICE(PRESENT SITUATION)KINONDONI NORTH REGIONAL OFFICE)
A72	BAGAMOYO DISTRICT NUMBER OF EMPLOYEES BY JOB CLASSIFICATION(PRESENT SITUATION)
A73	KINONDONI NORTH REGION ORGANIZATION CHART
A74	ORGANIZATION CHART - BAGAMOYO DISTRICT
A75	Answer Sheets - Kinondoni North
A76	Data of Tegeta S/S
A77	TANESCO ARUSHA REGIONAL OFFICE ORGANIZATION CHART
A78	PRESENT SITUATION OF TANESCO
A79	*ELECTRIC POWER SITUATION AND POWER FACILITIES*
A80	ORGANIZATION CHART FOR KILIMANJARO REGION
A81	Answer Sheets for Questionnaire
A82	SUPPLEMENTARY DATA
A83	KILIMANJARO REGION NUMBER OF EMPLOYEES BY JOB CLASSIFICATIONS IN EACH OFFICE
A84	SINGLE LINE DIAGRAM MWANGA S/S
A85	LAYOUT OF MWANGA S/S
A86	SINGLE LINE DIAGRAM NYUMBA YA MUNG S/S
A87	LAYOUT OF NYUMBA YA MUNG S/S

A88	COMMUNICATION DIAGRAM IN KILIMANJARO REGION
A89	KIYUNGI 132/66/33kV TRANSMISSION SUBSTATION EXISTING AND PROPOSED DESIGNS SINGLE LINE DIAGRAM
A90	KIYUNGI 132/66/33kV TRANSMISSION SUBSTATION EXISTING AND PROPOSED DESIGNS PLAN
A91	KIYUNGI 132/66/33kV TRANSMISSION SUBSTATION CONTROL BUILDING NEW PANEL LOCATIONS PLAN AND ELEVATIONS
A92	SINGLE LINE DIAGRAM MACHAME & SANYA JUU
A93	ARRANGEMENT MACHAME & SANYA JUU S/S
A94	SINGLE LINE DIAGRAM GONJA
A95	ARRANGEMENT GONJA S/S

Documents compiled during the site survey or interview from TANESCO

A102	SINGLE LINE DIAGRAM OF UBUNGO SUBSTATION
A103	SINGLE LINE DIAGRAM OF ILALA SUBSTATION
A104	SINGLE LINE DIAGRAM OF MIKOCHENI SUBSTATION
A105	SINGLE LINE DIAGRAM OF OYSTERBAY SUBSTATION
A106	SINGLE LINE DIAGRAM OF FACTORY ZONE III SUBSTATION
A107	SINGLE LINE DIAGRAM OF MSASANI SUBSTATION
A108	SINGLE LINE DIAGRAM OF SOKOINE SUBSTATION
A109	SINGLE LINE DIAGRAM OF FACTORY ZONE II SUBSTATION
A110	SINGLE LINE DIAGRAM OF FACTORY ZONE I SUBSTATION
A111	SINGLE LINE DIAGRAM OF KURASINI SUBSTATION
A112	SINGLE LINE DIAGRAM OF WAZO HILL SUBSTATION
A113	SINGLE LINE DIAGRAM OF KIGAMBONI SUBSTATION
A114	*SINGLE LINE DIAGRAM OF MBEZI SUBSTATION*
A115	SINGLE LINE DIAGRAM OF CITY CENTRE SUBSTATION
A116	KIGAMBONI 33/11KV SUB-STATION ELECTRICAL GENERAL LAYOUT AND BLOCK PLAN
A117	LAYOUT OF FACTORY ZONE I SUBSTATION
A118	LAYOUT OF FACTORY ZONE II 33KV SUBSTATION
A119	LAYOUT OF KURASINI SUBSTATION
A120	LAYOUT OF MIKOCHENI SUBSTATION
A121	LAYOUT OF MSASANI SUBSTATION
A122	LAYOUT OF SOKOINE SUBSTATION
A123	LAYOUT OF UBUNGO SUBSTATION
A124	LAYOUT OF UBUNGO SUBSTATION
A125	LAYOUT OF ILALA SUBSTATION
A126	LAYOUT OF ILALA SUBSTATION
A127	LAYOUT OF OYSTERBAY SUBSTATION
A128	LAYOUT OF OYSTERBAY SUBSTATION
A129	LAYOUT OF FACTORY ZONE III SUBSTATION
A130	LAYOUT OF FACTORY ZONE III SUBSTATION
A131	*LAYOUT OF MBEZI SUBSTATION*
A132	LAYOUT OF MBEZI SUBSTATION
A133	LAYOUT OF CITY CENTRE SUBSTATION
A134	LAYOUT OF CITY CENTRE SUBSTATION
A135	DAR ES SALAAM POWER MASTER PLAN 220kV, 132kV AND 33kV SINGLE LINE DIAGRAM

A136	TANZANIA ELECTRIC SUPPLY COMPANY LIMITED ELECTRICITY TARIFF WITH EFFECT FROM JANUARY 1999 BILLING
A137	TANZANIA POWER SYSTEM MASTER PLAN UPDATE REDUCED LOAD 2010
A138	GRID GENERATION SUMMARY 1990 - 2000
A139	NAMES OF COUNTERPARTS
A140	TANESCO-220,132,AND 33KV NETWORK OF DAR ES SALAAM REGION
A141	THE NATIONAL GRID SYSTEM
A142	220/132/33/11kV DIAGRAM OF UBUNGO CONTROL COMPLEX CENTRE
A143	Load Shedding Schedule for Kilimanjaro Region
A144	Single Line Diagram of Kilimanjaro Region
A145	Proposal for the Reinforcement of Power Distribution Network in Kilimanjaro Region
A146	Review of the Proposed Distribution Network Works under the Requested Kilimanjaro Electrification (Phase III Project)
A147	Additional Submission
A148	*Problems Facing distribution Networks-Arusha Tanzania as at February 19,2001*
A149	Proposed Transmission Line route from FZ III to Ilala
A150	SCHEMATIC REPRESENTATION OF TANESCO TRANSMISSION NETWORK(FOR 66KV, 132KV, 220KV)
A151	TEMEKE REGION PEAK LOAD DATA
A152	Price List of Wooden Pole
A153	TANZANIA DAESUNG CABLE CO.,LTD BUILDING WIRES PRICE LIST
A154	ABB Tanelec Ltd. TRANSFORMER PRICE LIST
A155	Proposed 66kV Route from Kiyungi S/S to Marangu
A156	Transmission Lines (66kV and 132kV) to Arusha side
A157	MOSHI MASTER PLAN 1995-2015
A158	Transmission Line Map in Arusha
A159	Transmission Line Map in Oldonyo Sambu
A160	Transmission Line Map in Monduli
A161	SYSTEM DIAGRAM FOR ARUSHA REGION
A162	Transmission Line Map in Nyumba Ya Mungu
A163	Transmission Line Map in Kihurio
A164	Transmission Line Map in Mkomazi
A165	Transmission Line Map in Sanya Chini
A166	Transmission Line Map in Kisiwani
A167	Transmission Line Map in Lembeni
A168	Transmission Line Map in Hedaru
A169	Transmission Line Map in Makanya
A170	Transmission Line Map in Rombo
A171	Transmission Line Map in Mwanga
A172	Transmission Line Map in West Hai
A173	Transmission Line Map in Same
A174	Transmission Line Map in Himo
A175	Transmission Line Map in Arusha Chini
A176	Transmission Line Map in Moshi
A177	Power System Master Plan, 2000 Update, Draft Final Report, Nov. 2000 Acres International
A178	Tanzania Power System Master Plan, Demand Forecast Update, May.2000 Planning Dept.

A179	Annual Report & Accounts 1998
A180	Annual Report & Accounts 1997
A181	Annual Report & Accounts 1995
A182	Annual Report & Accounts 1993
A183	DAMP – Organization Chart 2001
A184	TANESCO Training Centre
A185	TANESCO Training CentreProgrammes conducted from November,1999 to October,2000
A186	Topographic Maps (1/50,000)[14 sheets; original]
A187	TANZANIA; Districts and Protected Areas
A188	List of Tanzanian trees from The World List of Threatened Trees [copies]
A189	"ARCHAEOLOGY" from "Tanzania in Maps"[Map of Historical Ruins; copies]
A190	DAR ES SALAAM (1/1,000,000)[Map of Historical Ruins; copy]
A191	ARUSHA: ZONE H (1/500,000)[Map of Historical Ruins; copy]
A192	"Temporary Standards for Receiving Waters"[copies]
A193	Land Cover and Land Use[Maps; 3 sheets]
A194	NEMC: Organization Chart
A195	Eastern Arc Mountains [copy]
A196	An Act to Provide for the establishment of the National Environment Management Council
A197	National Environmental Policy
A198	Report on Existing Legislation Pertaining to Environment
A199	Tanzania Environmental Impact Assessment Procedure Volume1 EIA Procedure & General Information
A200	Tanzania Environmental Impact Assessment ProcedureVolume2 Screening and Scoping Guidelines
A201	Tanzania Environmental Impact Assessment ProcedureVolume3 Report Writing Guidelines
A202	Tanzania Environmental Impact Assessment ProcedureVolume4 Review Guidelines
A203	Tanzania Environmental Impact Assessment ProcedureVolume5 General Checklist of environmental Characteristics
A204	Status on Ratification/Accession to Conventions [copies]
A205	"Coastal Forests" and "Mid-elevation Forests" [copies]from "East African Ecosystems and their Conservation"
A206	1994 Indicator Monitoring Survey (IMS) Volume1 Preliminary Report
A207	Developing a Poverty Basement in Tanzania
A208	Updating the Poverty Baseline in Tanzania
A209	The Economic Survey 1999
A210	An Act to provide for the Preservation and Protection of Sites and Articles of Palaeontological, Archaeological, Historical, or Natural Interest and for matters connected therewith and incidental thereto
A211	An act to amend the Antiquities Act, 1964
A212	Annual Report of the Antiquities Division for the years 1976 and 1977
A213	SERA YA UTAMADUNI(National Cultural Policy)
A214	Forests Chapter 389 of the Laws (Principal Legislation)
A215	Tanzania Electricity Supply Company(TANESCO) Electricity Tariff Study Final Report(Volume2) Main Report
A216	Topographic Maps (1/50,000)[MWANGA]
A217	Topographic Maps (1/50,000)[WEST HAI]

A218	Topographic Maps (1/50,000)[LEMBENI]
A219	Topographic Maps (1/50,000)[MBALAMO]
A220	Topographic Maps (1/50,000)[OL MOLOG]
A221	Topographic Maps (1/50,000)[KIHURIO]
A222	Topographic Maps (1/50,000)[MAKANYA]
A223	Topographic Maps (1/50,000)[SAME]
A224	Topographic Maps (1/50,000)[KISIWANI]
A225	Topographic Maps (1/50,000)[ARUSHA]
A226	Topographic Maps (1/50,000)[MOSHI]
A227	Topographic Maps (1/50,000)[DAR ES SALAM]
A228	Topographic Maps (1/50,000)[KISIWARE]
A229	TANZANIA VEGETATION COVER TYPES
A230	LAND COVER AND LAND USE [DAR-ES-SALAAM]
A231	LAND COVER AND LAND USE [ARUSHA]
A232	LAND COVER AND LAND USE [VOI]
A233	TELECOMMUNICATION
A234	KINONDONI SOUTH PEAK LOAD(KW) TANDALE S/S
A235	Singida-Arusha Transmission Line Table of Financial Position
A236	FINANCIAL BUDGET SEPTEMBER 2000
A237	Operation and Maintenance Yearly Cost
A238	Data for Cost Estimates
A239	Currency Customs Clearance Import Duty Exchange Rate
A240	Price List of materials
A241	Transportation Charges
A242	Construction Cost for Electric Work
A243	UNPLANNED POWER INTERRUPTIONS IN DAR ES SALAAM 1996
A244	11kV LINE DATA(AUGUST 1998) DAR-ES-SALAAM POWER DISTRIBUTION SYSTEM MAINTENANCE PROJECT(DAMP)
A245	EARTH RESISTANCE
A246	F.23 FEEDER
A247	CITY CENTRE SUBSTATION(Feeder and Max Load)
A248	DSM POWER DISTRIBUTION SYSTEM MAINTENANCE PROJECT (DAMP)
A249	DAMP(Dar es salaam Power Distribution System Maitenance Project)
A250	LOWER KIHANSI HYDROPOWER PROJECT ENVIROMENTAL IMPACT ASSESSMENT MAIN VOLUME DECEMBER 1995
A251	ZAMBIA-TANZANIA 330kV TRANSMISSION INTERCONNECTION
A252	Map of Moshi Municipality 2 (1:10,000)
A253	Map of Moshi Municipality 5 (1:10,000)
A254	Map of Moshi Municipality 6 (1:10,000)
A255	Map of Kisarawe (1:50,000)
A256	Map of Moshi (1:50,000)

List of Drawings and Documents collected during 2nd On-site survey

No.	Name of Documents
Documents compiled during the site survey or interview from TANESCO	
B1	BENEFICIARIES OF THE PROPOSED 132/33KV OYSTERBAY SUBSTATION
B2	SUBSTATIONS AND FEEDERS MAXIMUM DEMAND -ARUSHA REGION

List of Drawings and Documents collected during 3rd On-site survey

No.	Name of Documents
Documents compiled during the site survey or interview from TANESCO	
C1	STRATEGIC URBAN DEVELOPMENT PLAN (SUDP) INCEPTION REPORT COMMENTS ON THE REPORT
C2	ADDITION OF ONE EXTRA SITE FOR A PROPOSED SUB-STATION AT NJIRO B
C3	PROPOSALS FOR REHABILITATION AND RECONDUCTORING OF HT LINES - ARUSHA
C4	PROPOSALS FOR REHABILITATION AND RECONDUCTORING OF HT LINES - KILIMANJARO REGION
C5	HT LINE DETAILS - MOSHI
C6	Kiyungi to Marangu Proposed 66kV O/H Line
C7	TOOLS, EQUIPMENTS, MACHINEREIS AND VEHICLES NEEDED FOR DAMP USE
C8	Estimated number of engineers and technicians for distribution in twenty two region
C9	Single Line Drawing - M1 Feeder
C10	Single Line Drawing - M2 Feeder
C11	Single Line Drawing - M3 Feeder
C12	LV Line Improvement Drawing - Umbwe
C13	LV Line Improvement Drawing - Uru Kisavio
C14	LV Line Improvement Drawing - Nkomongo
C15	DAR ES SALAAM 1:2500 MAP H13-1
C16	DAR ES SALAAM 1:2500 MAP H12-3
C17	DAR ES SALAAM 1:2500 MAP H12-2
C18	DAR ES SALAAM 1:2500 MAP H11-4
C19	DAR ES SALAAM 1:2500 MAP J11-3
C20	DAR ES SALAAM 1:2500 MAP J11-3
C21	DAR ES SALAAM 1:2500 MAP J12-2
C22	General Foundationplan 145kV Switchyard Kunduchi Substation
C23	Arrangement 145kV Linebay Ubungo Plan and section Kunduchi Substation
C24	Arrangement 145kV Transf.bay T1&T2 Plan and section Kunduchi Substation
C25	Arrangement 145kV Linebay Zansibar Plan and section Kunduchi Substation
C26	Arrangement 145kV Switchyard Section Kunduchi Substation
C27	Arrangement 145kV Busbar Plan and Section Kunduchi Substation
C28	1:50,000 Map HIMO
C29	1:50,000 Map MOSHI
C30	1:50,000 Map NYUMBA YA MUNGU
C31	1:50,000 Map USA RIVER
C32	1:50,000 Map MONDULI
C33	1:50,000 Map SANYA CHINI
C34	1:50,000 Map SAME
C35	1:50,000 Map WEST HAI
C36	1:50,000 Map MWANGA
C37	1:50,000 Map DAR ES SALAAM
C38	1:50,000 Map BAGAMOYO
C39	1:50,000 Map KISARAWE
C40	1:50,000 Map KAWE

C41	TARIFF BOOK OF HARBOUR DUES AND CHARGES
C42	APPLICATION FOR UTILIZATION OF CUSTOMS DUTY AND VAT REMISSION GRANTED TO TECHNICAL ASSISTANCE PROJECT MATERIALS AND EQUIPMENT
C43	APPLICATION FOR UTILIZATION OF CUSTOMS DUTY AND SALES TAX REMISSION GRANTED TO TECHNICAL ASSISTANCE PROJECT MATERIALS AND EQUIPMENTS
C44	Material cost in Dar es Salaam
C45	TANELEC TRANSFORMER PRICE LIST
C46	TANZANIA TAESUNG PRICE LIST
C47	JAMHURI YA MUUNGANO WA TANZANIA
C48	The Single Bill of Entry
C49	Special Bill Supplement No.1
C50	PROPOSED 132kV LINE ROUTES UBUNGO S/S - NEW OYSTERBAY S/S SEPTEMBER 5, 2001
C51	Moshi & Arusha Feeder Data (1990)