Figure 4.1   Relocation Roads in and around the Reservoir Area

REPUBLIC OF KENYA
MAGWAGWA   HYDROELECTRIC
POWER   DEVELOPMENT   PROJECT
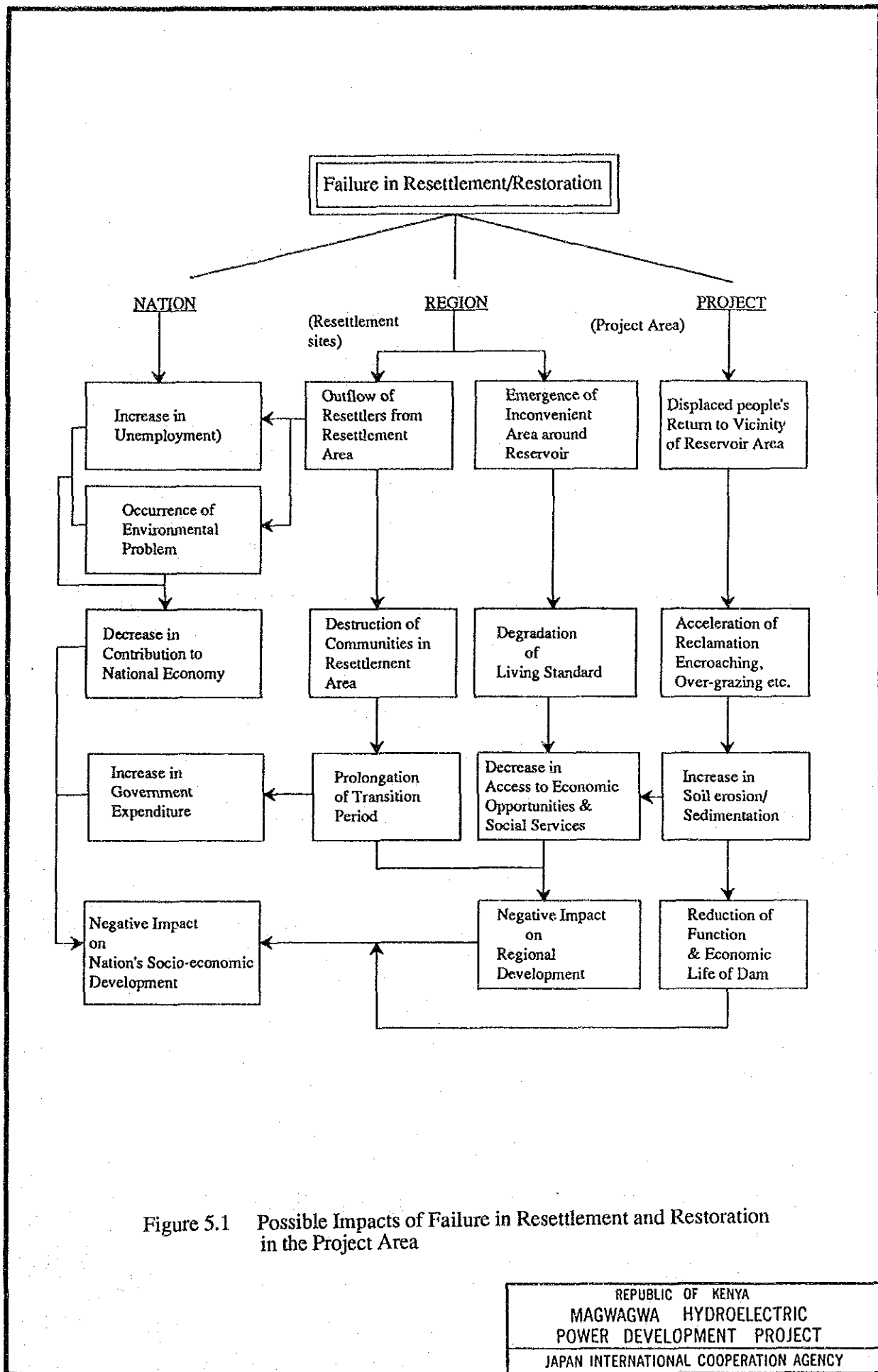JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 5.1   Possible Impacts of Failure in Resettlement and Restoration
in the Project Area

Inundated
areas

Resettlement
areas

Preparation of Resettlement

Transfer (Uprooting)
of
Displaced People

Transition
for
Resettlement

Necessity of
Government's
Provisions/
Assistance

Self-sustenance (Rerooting)
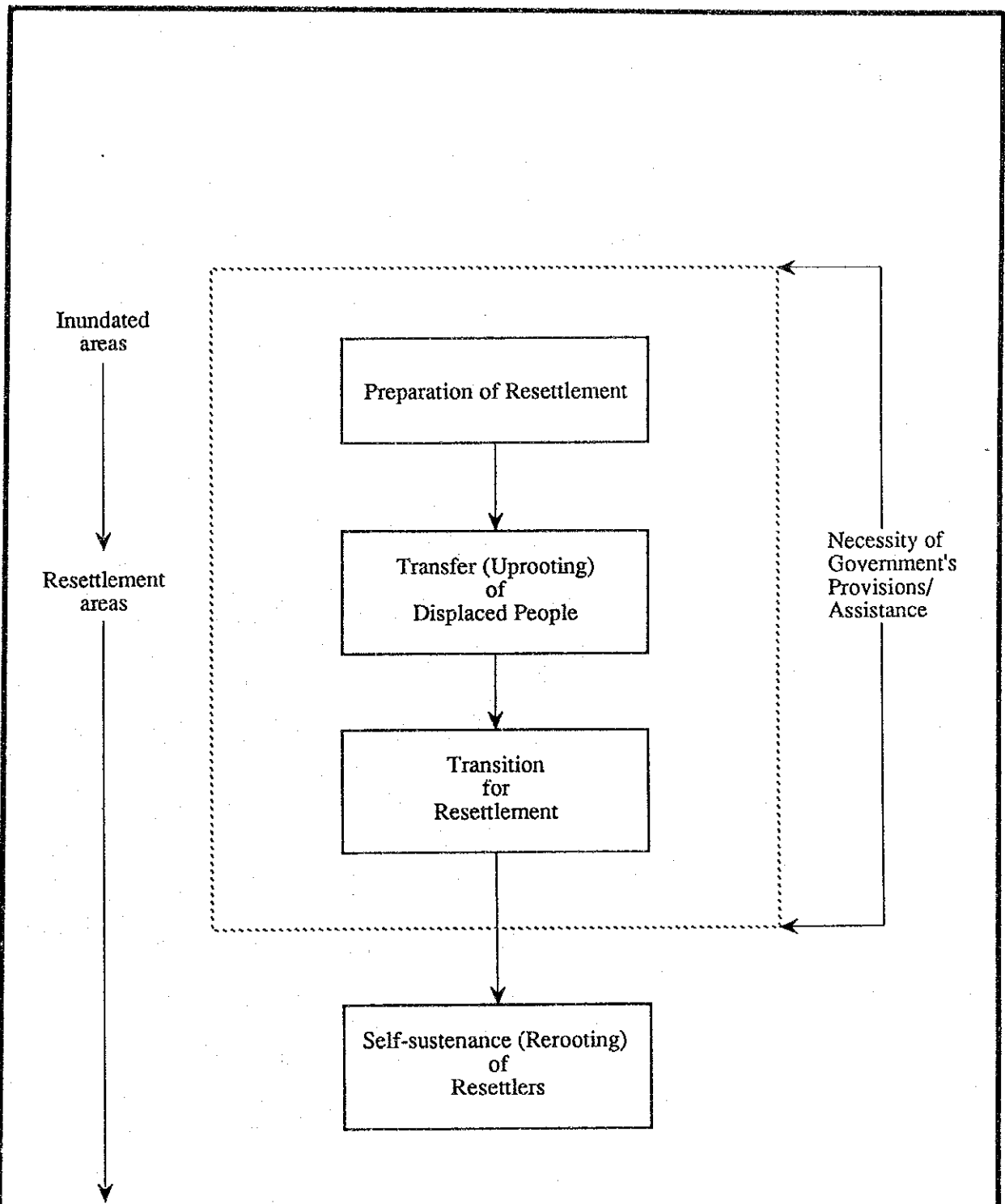of
Resettlers

Figure 5.2   Phases of Involuntary Resettlement

REPUBLIC OF KENYA
MAGWAGWA   HYDROELECTRIC
POWER DEVELOPMENT PROJECT
JAPAN INTERNATIONAL COOPERATION AGENCY

APPENDIX VII.

PARAMETERS FOR
THE ECONOMIC EVALUATION

APPENDIX VII   PARAMETERS FOR THE ECONOMIC EVALUATION

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I. INTRODUCTION

As discussed in Chapter 5 of the Main Report, Plan Formulation, main objectives of this study are to search for the optimal development scale of this Magwagwa hydropower development project as well as to assess the economic and financial viability of the project including its optimal installation timing added to the power supply system.

Economic evaluation of the project first of all requires to assess the values of parameters to be used in its evaluation. This Annex VII deals with the assessment for those parameters. Willingness-to-pay, being one of recommendable parameters to assess unit benefit value of power projects as well as long-run marginal cost, is discussed and used for comprehensive economic evaluation of this Magwagwa hydropower project.

The Magwagwa reservoir has functions not only to give stable water supply throughout the year for power generation at Magwagwa itself and Sondu/Miriu located downstream of it, but also to release water so as to meet the water requirements of the Kano irrigation project. In evaluating the Magwagwa and Sondu/Miriu hydropower schemes and irrigated agriculture development in the Kano plain as an integrated project, required is the assessment of irrigation benefits and costs, which are also briefed, even if detailed discussions for them are referred to the feasibility study report of the Kano irrigation project.

II. PARAMETERS TO EVALUATE ECONOMIC COSTS

2.1 Opportunity Cost of Capital (OCC)

Opportunity cost of capital represents the average economic rate of return of projects in Kenya. The OCC for Kenya used by IBRD is 10%, which is applied as a hurdle rate for assessing the economic viability of the Magwagwa hydropower project.

2.2 Internal Transfer

Internal transfer, which is just a shift of money from one party to another and is not related with substantial economic activities, should be excluded in converting the construction cost to the economic cost of the project. The internal transfer portion consists of excise and sales taxes out of outlays for the local currency portion of the project cost, whilst the foreign currency portion of the project cost represents its economic cost, since the cost estimate for the foreign currency portion is based on the CIF price (Cost, insurance and freight).

The internal transfer for the local portion of the project cost can be estimated as a ratio between the sum of excise and sales taxes and the GDP. Table 2.1 shows the ratios over a period of 1978 to 1988, varying in a range of 9.43% to 7.26%. The internal transfer of the local portion is thus assumed at 8% for the project evaluation.

2.3 Shadow Wage Rate (SWR)

Labour costs sharing considerable parts of the local portion of the project cost are estimated on basis of wages to be actually paid at the 1990 fixed price level. Economic analysis suggests that expenditure paid to unemployed and underemployed labour be excluded from economic cost, since employment of unemployed labour does not sacrifice other economic activities. That is to say, the economic cost for labour depends on its shadow price.

The shadow wage of unskilled labour was calculated to be 60% of the wage in the Sondu River Multipurpose Development Project. Drastic change for unemployment and underemployment has unlikely been observed in the project area since 1986, so that the SWR of 60% is applied for evaluating the economic cost.

And there also are a substantial number of skilled labour such as operators, drivers and so on. According to the analysis made by Ewbank Preece, share of the skilled labour

occupies about 50% of the total labour in the power construction project. The figure will be adopted to our project analysis.

In terms of wages of these skilled labour, IBRD and Ewbank Preece consider that their market prices reflect their real economic value, thus the SWR for the skilled labour is defined at 1.00.

Based on practices of power construction, it can be assumed that firstly the skilled labour can be employed not only near the project area but also from other regions, which means that it should be analysed at the national level, secondly the most available education levels for them are secondary one (to some extent including college), and thirdly the most possible age distribution is from 20 to 50. According to the newest Economic Survey (1990 edition), in 1986 the unemployment rate between 20 and 49 age level was 16% - 19.8%, and the rate for secondary level (including college) from 16.2% to 20% over. If underemployment of the skilled labour is added to the analysis, the rate will obviously grow. It can be concluded that these skilled labour may have alternative employment opportunity even if they are not employed in the project, but not all of them can find new jobs. From the above analysis, a shadow wage rate of 80% is assumed for these skilled labour.

2.4 Shadow Price of Cement

Cement, being among important project inputs, is exportable goods, indeed exporting, and able to be procured in the local market. Its production, consumption and price are shown in Table 2.2. A fact can be read from this Table that the production of cement shown in past 10 years has not increased, but that domestic consumption has been increasing at 4% annually. At the same time, export decreased with a rate of 2.7% per year, which implies that growth of domestic consumption was achieved at the expense of reducing its export but not its production scale. Therefore, the sacrificed export price (F.O.B. price) should be taken as its shadow price.

The F.O.B. price of cement since 1982 has been KShs.580 per ton on an average, but reached KShs.591 per ton in 1988. The F.O.B. price can be defined as KShs.600 per ton. Adding the transportation costs to the project site, which is estimated to be about KShs.300 per ton, the total cost is estimated at KShs.900 per ton. The price in domestic markets in 1988 was around KShs.1,760 per ton, implying that the economic cost of cement is only 51% of its financial cost.

2.5 Standard Conversion Factor (SCF)

In terms of non-tradable goods except for labour, a standard conversion factor should be applied so as to transform them into international market prices which will reflect their real costs. As shown in Table 2.3, the SCF was calculated based on the data of total exports and imports and their duties in a period of 1978 to 1987, resulting in 92% on an average. Thus, the economic cost of non-tradable goods except for labour is assumed to be 92% of its financial cost.

2.6 Shadow Exchange Rate (SER)

In order to make the economic cost expressed in both foreign and local currencies comparable, an exchange rate has to be applied. The exchange rate used for economic evaluation has to reflect the real economic value of foreign exchange, which can be assessed by using the following formula:

$$SER = (Vim + Vex + Tim - Tex) / (Vim + Vex) \times R$$

where : Vim : total import value

Vex : total export value

Tim : total value of import duties

Tex : total value of export taxes subtracting subsidies

R : the official exchange rate.

The official exchange rate as shown in Table 2.4 is US$ 1.00 = KShs. 21.00 as of February, 1990. The data of external trade and taxes can be referred to Table 2.5. Based on this table and formula given above, a relation of SER = 1.1R was obtained. In other words, a shadow exchange rate is 110% of the official exchange rate. Attention has been drawn on a IBRD report where the shadow exchange rate was defined to be 115%. There being difference of 5% in both estimates, 110% of the official exchange rate will be applied to the economic analysis of this Magwagwa scheme.

2.7 Conversion to Economic Cost

Project cost is assumed to be composed of respective weights of following inputs:

		Foreign currency	Local currency	Total
1.	Materials	0.031	0.262*	0.293
2.	Equipment	0.339	0.0340	0.373
3.	Engineering	0.050	—	0.050
4.	Labour	—	0.284	0.284
	- Skilled		0.142	
	- Unskilled		0.142	
5.	Total	0.420	0.580	1.000

* Share of cement is around 40% of material cost in the local currency portion, which means the share of cement cost is 0.105.

Equipment such as turbine-generators, heavy machines for construction, steel and so forth is in principle assumed to be procured abroad, sharing over 34% of total cost. Whilst, materials such as embankment rocks, concrete aggregates, cement and so on as well as labour are presumed to be available at the local market by giving the almost same weight to their costs, i.e. 26% for material cost and 28% for labour cost. Engineering services for the detailed design and the supervision of construction are assumed to be undertaken by a foreign consultant.

Conversion from the construction costs of the project to economic costs is made by the following procedures:

a) Foreign currency portion of construction costs, because of use of international prices, is used as the economic cost without adjustment.

b) For local currency portion, firstly the internal transfer costs have to be excluded from material and equipment costs.

c) Secondly, the fact that the shadow price of cement is 51% of its financial price is to be applied to the estimate of economic price of cement.

d) Thirdly, non-tradable part of local currency should utilize the standard conversion factor (92%) so as to be transferred into international prices.

e)   Forthly, applying 80% and 60% of shadow wage rate to financial cost of skilled and unskilled labour respectively, economic costs of labour are estimated.

f)   The result of the above conversion is that the economic costs of the Magwagwa project is equal to 82.9 percent of its construction costs as given in Table 2.6.

III. PARAMETERS TO EVALUATE ECONOMIC BENEFITS

3.1 Long-run Marginal Cost (LRMC)

It has been suggested in recent years that the long-run marginal costs, LRMC, for power development in the future be calculated as a guideline for setting economically more efficient prices for power. In this study an attempt was made to estimate LRMC as a proxy of unit power benefit.

A pre-condition of calculating the LRMC is to prepare a long-term least-cost generation expansion plan. A recent power study by Acres, Kenya National Power Development Plan 1986 - 2006, proposed a long-term least cost generation plan as given in Table 3.1. Based on it, the LRMC was computed to be US$0.0922/kWh as given in Tables 3.2 to 3.6.

The conditions and assumptions to be applied for the computation are as follows:

(1) The price level is adjusted from January, 1986 to January, 1990 applying a price escalation rate of 7.5% a year.

(2) An investment horizon is 16 years between year 1990/91 and 2005/06.

(3) An evaluation horizon is 50 years between year 1990/91 and 2039/40.

(4) The project life of respective types of plant is as follows :

Gas turbine	:	20 years
Geothermal	:	25 years
Coal-fired	:	25 years
Hydro	:	50 years

The replacement of the above plants is not considered of in the evaluation horizon.

3.2 Irrigation Benefit

The net benefit of crop is estimated applying their prevailing market prices to the difference of crop yield on the condition of with-and-without project (The Interim Report of Feasibility Study on Kano Plain Irrigation Project, March 1991). Following are the estimated unit net benefit of the respective crops and cropping patterns on the condition of the with-and-without project:

Crops	Net production value per ha (Kshs/crop)
Paddy	22,230
Maize	8,280
Beans	1,310
Greengram	6,970
Groundnuts	9,520
Cotton	10,190
Vegetable	38,500
Sugarcane	31,100

Combination of Crops		Annual net production value (Kshs/ha)
Long rainy	Short rainy	
Paddy	Beans	23,540
Paddy	Greengram	29,200
Maize	Paddy	30,510
Maize	Groundnuts	17,800
Maize	Beans	9,590
Maize	Greengram	15,250
Vegetable	Vegetable	77,000
Maize	Cotton/Greengram	16,860
Sugarcane	Sugarcane	31,100

Tables

Table 2.1   Data of the Government Revenue in 1978- 87 Fiscal Year

(Unit: 1000 K£)

	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88	Average
Total Indiret Tax	267,984	341,448	410,336	475,034	471,489	545,084	572,081	708,507	867,676	963,164	
(1) Excise	49,023	59,453	60,240	63,964	73,953	79,428	78,784	89,642	106,270	118,600	
(2) Sale tax	99,769	154,907	179,388	194,795	195,875	253,719	273,554	303,293	397,520	477,900	
(3) = (1) + (2)	148,792	214,360	239,578	258,759	269,828	333,147	352,338	392,935	503,790	569,500	
GDP	2,050,000	2,272,000	2,632,000	3,039,000	3,410,800	3,820,200	4,389,300	4,914,300	5,831,800	6,560,800	
Internal Transfer =Ratio of indire (3) to GDP in %	7.26	9.43	9.10	8.51	7.91	8.72	8.03	7.99	8.64	8.68	8.427

Note:
GDP is at market prices.
This table show the value varies in the range of 9.4% to 7.3%. thus,the internal transfer is assumed at 8%.

Sources:
(1) The portion of taxes is from Statistical Abstract 1982,1983, 1986. 1987 and 1988.
(2) For GDP in 1978 - 82 Statistical Abstract 1983, for GDP in 1983 - 1988 from Economic Survey 1986 and 1988.

Table 2.2 Production, Consumption and Prices of Cement

(unit: 1000 ton)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	Annual Ave. Growth Rate
1 Production	1148	1279.9	1280.3	1312.3	1187.0	1133.8	1097.3	1178.1	1243.3	1200.8	0.70%
2 Domestic Consumption	631.0	691.2	652.5	579.3	511.0	542.5	610.0	702.5	901.2	832.8	4.00%
3 Export	510	530.4	661.0	737.4	736.3	602.9	485.8	495.6	353.2	352.1	-2.70%
4 Price of Domestic Market (Ksh/t)	721.0	1017.0	1357.0	1357.0	1357.0	1377.0	1763.0	1763.0	1763.0		11.40%
5 Price of Export (Ksh/t)	327.0	383.0	439.0	524.0	591.0	581.0	635.0	540.0	559.0	591.0	7.30%

Sources: 1 Monthly Statistical Bulletin March-May 1984, Oct.-Dec.1988 for production and consumption of cement.

2 Price of domestic market in 79-82 and 85-88 calculated from construction cost index (end-of-year figures) in Statistical Abstract 1983.

3 Prices in 83-84 from Kencem.

4 Export prices were calculated from export statistics in Monthly statistical Bulletin March-May 1984, Oct.-Dec. 1988.

Table 2.3 Determination of Standard Conversion Factor

(Unit : 1000 K£)

		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1978-87
1	Total Exports	369,965	385,533	487,644	513,863	545,737	633,078	754,813	785,098	957,970	753,450	618,711
2	Total Imports	661,125	620,187	959,030	932,406	900,305	905,621	1,097,206	1,196,000	1,337,893	1,430,881	1,004,065
3	Import Duties	101,274	90,304	120,387	150,440	158,572	152,261	188,093	166,182	221,868	246,187	159,557
4	Export Duties	2,084	7,025	3,131	5,295	6,825	10,049	27,037	39,640	33,877	21,210	15,616
5	=1+2	1,031,090	1,005,720	1,446,674	1,446,269	1,446,042	1,538,699	1,852,023	1,981,098	2,295,863	2,184,331	1,622,781
6	=1+2+3-4	1,130,280	1,088,999	1,563,930	1,591,414	1,597,784	1,680,911	2,013,079	2,107,640	2,483,854	2,409,318	1,766,721
7	=5/6	0.912	0.924	0.925	0.909	0.905	0.915	0.920	0.940	0.924	0.907	0.918

Note: Export du Export Duties in 81-87 are given by fiscal year
Sources: Statistical Abstract 1982, 1983, 1986, 1987 and 1988.

Table 2.4 Official Average Exchange Rate (per US$)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989.4	1990.2	1991
Ksh.	7.42	9.05	10.92	13.31	14.41	16.43	16.23	16.45	17.75	19.10	21.60	23.00
K£	0.37	0.45	0.55	0.67	0.72	0.82	0.81	0.83	0.89	0.96	1.08	

Sources:
(1) 1980 - 1988: IMF, In IMF, International Financial Statistics
(2) 1989.4: Trade Bulletin, May 15, 1989.
(3) 1990.2 and 1991: market investigation.

Table 2.5 External Trade and Taxes (1978 - 1987) and Definition of Shadow Exchange Rate

(Unit 1000 K£)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	Total 1978-87
1 Total Exports	369,965	385,533	487,644	513,863	545,737	633,078	754,813	785,098	957,970	753,450	6,187,151
2 Total Imports	661,125	620,187	959,030	932,406	900,305	905,621	1,097,206	1,196,000	1,337,893	1,430,881	10,040,654
3 Import Duties	101,274	90,304	120,387	150,440	158,572	152,261	188,093	166,182	221,868	246,187	1,595,568
4 Export Duties	2,084	7,025	3,131	5,295	6,825	10,049	27,037	39,640	33,877	21,210	156,173

Note:
Export duties in 81-87 are given by fiscal year.
$SER = (Vim+Vex+Tim-Tex)/(Vim+Vex)R$

Vex = total export value
Vim = total import value   Tex = total value of export taxes subtracting sudsidies
Tim = total value of import duties
R = official exchange rate

Based on this table, a relation of SER = 1.1R was obtained.

Sources: Statiscal Abstract 1982, 1983, 1986, 1987 and 1988.

Table 2.6   Ratio of Economic Costs

	Foreign Portion	Local Portion	Exclusion of Internal Transfer	Shadow Price of Cement	Standard Conversion Factor	Shadow wage	Result of Conversion	Ratio of Economic Cost
Materials	0.031	0.262						
Cement		0.105 a)	0.105*0.92 = 0.097	0.097*0.51 = 0.049			0.049	
Others		0.157	0.157*0.92 = 0.144		0.144*0.92 = 0.132		0.132	
Equipment	0.339	0.034	0.034*0.92 = 0.031		0.031*0.92 = 0.029		0.029	
Engineering	0.050							
Labor		0.284						
Skilled		0.142				0.142*0.8 = 0.114	0.114	
Unskilled		0.142				0.142*0.6 = 0.085	0.085	
Total	0.420						0.409	0.829

a) Share of cement is around 40% of material cost in the local currency portion, which means that its share is 0.1048.

Table 3.1   Incremental Generation Capacity

Unit: MW

	INSTALLED CAPACITY	NAME OF INCREMENT PLANTS	INCREMENT CAPACITY	NET INCREMENT CAPACITY	DISCOUNT FACTOR	DISCOUNTED INCREMENT CAPACITY
1986/1987	488		0			
1987/1988	518	C.T	30	30		
1988/1989	704	REHABILITATION	42	186		
		KIAMBERE	144			
1989/1990	725	C.T	30	21	1.000000	21.00
1990/1991	725		0	0	0.909091	0.00
1991/1992	831	TURKWEL	106	106	0.826446	87.60
1992/1993	861	C.T	30	30	0.751315	22.54
1993/1994	909	C.T	60	48	0.683013	32.78
1994/1995	914	GEOTHE	29	5	0.620921	3.10
1995/1996	973	GEOTHE	29	59	0.564474	33.30
		C.T	30			0.00
1996/1997	1022	MIRIU	49	49	0.513158	25.14
1997/1998	1022		0	0	0.466507	0.00
1998/1999	1074	GEOTHE	53	52	0.424098	22.05
1999/2000	1134	COAL	60	60	0.385543	23.13
2000/2001	1194	COAL	60	60	0.350494	21.03
2001/2002	1247	GEOTHE	53	53	0.318631	16.89
2002/2003	1277	COAL	60	30	0.263331	7.90
2003/2004	1330	GEOTHE	53	53	0.239392	12.69
2004/2005	1390	COAL	60	60	0.217629	13.06
2005/2006	1443	GEOTHE	53	53	0.197845	10.49
TOTAL			1029	955.00		352.71

Sources:
Kenya National Power Development Plan 1986-2006 prepared by ACRES, main report Tab.9.1

Table 3.2   Generation and Transmission & Substation Costs

Unit: M US$

Year	DISCOUNTED GENERATION CAPACITY	DISCOUNTED GENERATION COST a)	DISCOUNTED GENERATION COST US$/KW	DISCOUNTED TRANSMISSION & SUBSTATION COST	DISCOUNTED TRANSMISSION & SUBSTATION b)	DISCOUNTED T&S COST	DISCOUNTED T&S COST US$/KW
1986/1987	21.00			0.00			
1987/1988	0.00			Committed			
1988/1989	87.60	16.74	797.14	Committed	9.28	9.28	441.90
1989/1990	22.54	0.00	0.00	Committed	15.61	14.19	40.23
1990/1991	32.78	0.00	0.00	16.74	8.86	7.32	83.58
1991/1992	3.10	10.15	450.33	Committed	0.3	0.23	10.00
1992/1993	33.30	20.66	630.21	13.51	0.6	0.41	12.50
1993/1994	0.00	35.75	11514.00	30.25	3.01	1.87	602.00
1994/1995	25.14	32.06	962.71	57.57	9.7	5.48	164.41
1995/1996	0.00	9.45	314.98	56.80	6.49	0.00	0.00
1996/1997	22.05	51.40	2044.29	16.74	14.63	7.51	298.57
1997/1998	23.13	0.00	0.00	100.17	0	0.00	0.00
1998/1999	21.03	48.18	2184.62	113.60	2.23	0.95	42.88
1999/2000	16.89	39.71	1716.67	103.00	4.72	1.82	78.67
2000/2001	7.90	20.33	966.67	58.00	0.6	0.21	10.00
2001/2002	12.69	28.96	1715.09	90.90	8.94	2.85	168.68
2002/2003	13.06	20.93	2650.00	79.50	24.51	6.45	817.00
2003/2004	10.49	27.19	2143.40	113.60	8.97	2.15	169.25
2004/2005		12.62	966.67	58.00	0.3	0.07	5.00
2005/2006		17.98	1715.09	90.90	0.8	0.16	15.09
TOTAL	352.71	392.13	1111.75			60.93	172.75

a) Baesd on the ACRES's main report Table 9.3.
b) Based on the ACRES's main report Table 9.3 and Table 10.1.

Table 3.3   Operating and Maintenance Costs

Unit: M US$

	DISCOUNTED CAPACITY	O&M COST a)	INCREMENT O&M COST	DISCOUNTED O&M COST	DISCOUNTED O&M COST US$/KW
1986/1987		5.6	0		
1987/1988		6.4	0.8		
1988/1989		7.1	0.7		
			0		
1989/1990	21.00	7.7	0.6	0.60	28.57
1990/1991	0.00	8.2	0.5	0.45	0.00
1991/1992	87.60	8.9	0.7	0.58	6.60
1992/1993	22.54	9.6	0.7	0.53	23.33
1993/1994	32.78	10.7	1.1	0.75	22.92
1994/1995	3.10	11.1	0.4	0.25	80.00
1995/1996	33.30	12.3	1.2	0.68	20.34
	0.00		0	0.00	0.00
1996/1997	25.14	13.1	0.8	0.41	16.33
1997/1998	0.00	13.7	0.6	0.28	0.00
1998/1999	22.05	14.2	0.5	0.21	9.62
1999/2000	23.13	15.6	1.4	0.54	23.33
2000/2001	21.03	17.1	1.5	0.53	25.00
2001/2002	16.89	17.9	0.8	0.25	15.09
2002/2003	7.90	19.6	1.7	0.45	56.67
2003/2004	12.69	20.4	0.8	0.19	15.09
2004/2005	13.06	22.1	1.7	0.37	28.33
2005/2006	10.49	22.8	0.7	0.14	13.21
TOTAL	352.71			7.21	20.43

a) Based on the ACRES's main report Table 9.3.

Table 3.4   A Summary of Capacity Costs of Generation, Transmission and O&M

Year	DISCOUNTED CAPACITY US$/KW	DISCOUNTED GENERATION US$/KW	DISCOUNTED T&S COST US$/KW	DISCOUNTED O&MC US$/KW	ANNUITY FACTOR FOR GENERATION	DISCOUNTED GENERATION US$/KW/YR	ANNUITY FACTOR FOR TRANSMISSION	DISCOUNTED T&S US$/KW/YR	DISCOUNTED O&MC US$/KW/YR	PLANT FACTOR	OPERATION TIME	GENERATION COST US$/KWH	T&S COST US$/KWH	O&M COST US$/KWH
1986/1987					0.117460					0.25				
1987/1988					0.110168					0.8				
1988/1989					0.100859					0.5				
1989/1990	21.00	797.14	441.90	28.57	0.117460	93.63	0.110168	48.68	28.57	0.25	2190	0.0428	0.0222	0.0130
1990/1991	0.00	0.00	40.23	0.00	0.000000	0.00	0.110168	4.43	0.00		0	0.0000	0.0000	0.0000
1991/1992	87.60	0.00	83.58	6.60	0.000000	0.00	0.110168	9.21	6.60	0.29	2540.4	0.0000	0.0036	0.0026
1992/1993	22.54	450.33	10.00	23.33	0.117460	52.90	0.110168	1.10	23.33	0.25	2190	0.0242	0.0005	0.0107
1993/1994	32.78	630.21	12.50	22.92	0.117460	74.02	0.110168	1.38	22.92	0.25	2190	0.0338	0.0006	0.0105
1994/1995	3.10	11514.00	602.00	80.00	0.110168	1268.48	0.110168	66.32	80.00	0.95	8322	0.1524	0.0080	0.0096
1995/1996	33.30	962.71	164.41	20.34	0.110168	106.06	0.110168	18.11	20.34	0.95	8322	0.0127	0.0022	0.0024
	0.00	314.98	0.00	0.00	0.117460	37.00	0.110168	0.00	0.00	0.25	2190	0.0169	0.0000	0.0000
1996/1997	25.14	2044.29	298.57	16.33	0.100859	206.18	0.110168	32.89	16.33	0.27	2365.2	0.0872	0.0139	0.0069
1997/1998	0.00	0.00	0.00	0.00	0.000000	0.00	0.110168	0.00	0.00		0	0.0000	0.0000	0.0000
1998/1999	22.05	2184.62	42.88	9.62	0.110168	240.67	0.110168	4.72	9.62	0.95	8322	0.0289	0.0006	0.0012
1999/2000	23.13	1716.67	78.67	23.33	0.110168	189.12	0.110168	8.67	23.33	0.8	7008	0.0270	0.0012	0.0033
2000/2001	21.03	966.67	10.00	25.00	0.110168	106.50	0.110168	1.10	25.00	0.8	7008	0.0152	0.0002	0.0036
2001/2002	16.89	1715.09	168.68	15.09	0.110168	188.95	0.110168	18.53	15.09	0.95	8322	0.0227	0.0022	0.0018
2002/2003	7.90	2650.00	817.00	56.67	0.110168	291.95	0.110168	90.01	56.67	0.8	7008	0.0417	0.0128	0.0081
2003/2004	12.69	2143.40	169.25	15.09	0.110168	236.13	0.110168	18.65	15.09	0.95	8322	0.0284	0.0022	0.0018
2004/2005	13.06	966.67	5.00	28.33	0.110168	106.50	0.110168	0.55	28.33	0.8	7008	0.0152	0.0001	0.0040
2005/2006	10.49	1715.09	15.09	13.21	0.110168	188.95	0.110168	1.66	13.21	0.95	8322	0.0227	0.0002	0.0016
TOTAL	352.71	30771.86	2959.77	384.44		3387.03		326.07	384.44		91629.6	0.5717	0.0706	0.0811
AVERAGE		1111.75	172.75	20.43					384.44			0.0336	0.0042	0.0048

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Table 3.5   A Summary of Energy Cost

Year	INSTALLED CAPACITY MW	NAME OF PLANTS	INCREMENT CAPACITY MW	GEOTHER	KIAMBERE	TURKWEL	SONDU/MIR	COAL	C.T.	TOTAL INCREMENT ENERGY GWH	DISCOUNT FACTOR	DISCOUNTED INCREMENT ENERGY GWH	FEUL COST M.US$	DISCOUNTED FEUL COST	FEUL COST US$/KWH	PEAK COST US$/KWH b)	OFF-PEAK COST US$/KWH	WEIGHTED ENERGY COST US$/KWH
							INCREMENTAL ENERGY GWH a)						M.US$		US$/KWH			
1986/1987	488		0						109.3	109.3			11.8					
1987/1988	518	C.T	30						0.0	0.0			20.3					
1988/1989	704	REHABILITA.	42						0.0				7.1					
		KIAMBERE	144		433.7					433.7								
1989/1990	725	C.T	30		489.7				0.0	489.7	1.000000	489.70	10.3	10.30	0.02103			
1990/1991	725		0		546.0				31.9	577.9	0.909091	525.36	14.9	13.55	0.02578			
1991/1992	831	TURKWEL	106		593.0	192.9			0.0	785.9	0.826446	649.50	12.6	10.41	0.01603			
1992/1993	861	C.T	30		639.0	209.0			46.3	894.3	0.751315	671.90	17.9	13.45	0.02002			
1993/1994	909	C.T	60		682.2	239.0			137.2	1058.4	0.683013	722.90	23.9	16.32	0.02258			
1994/1995	914	GEOTHE	29	219.6	672.5	234.2			194.0	1320.3	0.620921	819.80	23.4	14.53	0.01772			
1995/1996	973	GEOTHE	29	442.5	666.4	233.4				1342.3	0.564474	757.69	23.4	13.21	0.01743			
		C.T	30						184.2	184.2		0.00		0.00	0.00000			
1996/1997	1022	KONDU/MIRIU	49	442.5	631.4	211.9	263.1		218.0	1766.9	0.513158	906.70	26.1	13.39	0.01477			
1997/1998	1022		0	442.5	675.9	245.0	263.7		333.9	1961.0	0.466507	914.82	34.9	16.28	0.01780			
1998/1999	1074	GEOTHE	53	845.2	644.9	225.3	259.9		239.4	2214.7	0.424098	939.25	29.9	12.68	0.01350			
1999/2000	1134	COAL	60	845.2	685.8	263.9	265.2	255.3	156.7	2472.1	0.385543	953.10	31.5	12.14	0.01274			
2000/2001	1194	COAL	60	845.2	720.1	301.5	258.9	534.8	105.6	2766.1	0.350494	969.50	35.2	12.34	0.01273			
2001/2002	1247	GEOTHE	53	1253.8	698.4	294.7	259.7	504.6	65.3	3076.7	0.318631	980.33	30.9	9.85	0.01004			
2002/2003	1277	COAL	60	1253.8	714.9	319.9	261.3	806.3	92.7	3448.9	0.263331	908.20	35.5	9.35	0.01029			
2003/2004	1330	GEOTHE	53	1659.5	714.6	312.9	259.3	773.8	65.3	3785.4	0.239392	906.19	32.3	7.73	0.00853			
2004/2005	1390	COAL	60	1659.5	741.8	333.6	255.7	1078.8	37.5	4106.9	0.217629	893.78	37.6	8.19	0.00916			
2005/2006	1443	GEOTHE	53	2065.2	732.1	333.0	262.5	1034.8	25.5	4453.1	0.197845	681.02	35.3	6.98	0.00793			
TOTAL			1029							13889.77				200.70	0.01445	0.084997	0.017441	0.02893

a) Based on the ACRES' main report Table 9.2.

b) Based on the ACRES' analysis, the share of marginal peak energy is 17% of the total, and base energy 83%.

Table 3.6　A Summary of Long-run Marginal Costs

Unit: US$/KWH

SUPPLY VOLTAGE	KILOWATT COST						KILOWATT-HOUR COST			
	GENERATION COST	T & S COST	DISTRIBUTION COST a)	O & M COST	CONSUMER RELATED COST b)	TOTAL CAPACITY COST	PEAK COST	OFF-PEAK COST	WEIGHTED TOTAL ENERGY COST	LRMC
HV (66000 & OVER) MV (11000/33000) LV (240/415)	0.03360	0.0042	0.0048				0.0850	0.0174	0.0289	
FACTOR OF NETWORK LOSS	16.20%		16.20%				16.20%	16.20%	16.20%	
COST TO FINAL CONSUMER	0.03904	0.00770	0.00488	0.0014	0.00558	0.05860	0.0988	0.0202	0.0336	0.0922

a) Distribution cost to final consumer was 0.11 ksh/kwh at the price in November 1984 (the Sondu River Multipurpose Development Project Vol.VI). The price escalation is averagely defined 8% between 1985 and 1988, based on the Economic Survey 1989.

b) Consumer-related cost was 0.02 ksh/kwh, the price is adjusted as above.

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