CHAPTER 8

ECONOMIC EVALUATION

CHAPTER 8 ECONOMIC EVALUATION

8.1 Economic Evaluation

8.1.1 Evaluation Method

The study team concluded through technical study that there are merits of the rehabilitation project; output recovery, reliability improvement, etc. Based on these merits, the economic evaluation will be done to check if the Project would economically benefit to the society as compared with the alternatives that can provide with the same services by Malaya TPP after rehabilitation (With Project). The economic internal rate of return, EIRR, will be calculated and compared with the discount rate set forth for this type of Project in the Philippines.

It is recommended that the rehabilitation items, cost estimate of the equipment, and these assumed operating conditions be reviewed in collation with the actual operating conditions whenever the management will be required decision making concerning this rehabilitation project.

8.1.2 Operating Conditions of Malaya TPP

1) With Project Case

- The derated unit capacities can be restored to the original ones.
- Both the units will be operated at a 70% capacity factor for those project lives (up to the respective retirement year).
- The efficiency will be restored to 1988 levels, 33.27% for M-1 and 34.90% for M-2.
- Even after rehabilitation, the natural decline of the efficiency is unavoidable and so an annual decline rate of 0.08% is assumed.

2) Without Project Case

- Both the capability and efficiency will deteriorate unless rehabilitation should be carried out.
- When the rehabilitation works will be carried out in 1997 and 1998, capability and efficiency of both the units are assumed to decline 1992 levels.
- Although the deterioration will further advance, the units will be operated at the scheduled retirement year, 2005 for M-1 and 2009 for M-2.

8.1.3 Alternatives Applied

The study team applied the mixture of the above for the alternative for the economic evaluation this time; namely the cost of the With project is taken as *Cost* (project cost plus fuel cost) and the cost of Without as *Benefit* (fuel cost plus expenses for supplementary power supply/purchase). The operation and maintenance cost, interest expenses, other overhead costs are disregarded because these costs will be necessary for both With and Without cases.

8.1.4 Evaluation Conditions/Assumptions

1) Hurdle Rate: 15% set forth by NEDA for this type of project in the Philippines. Owing to the favorable economic activities with inflow of the foreign investment, the discount rate in the Philippines stays around 12% in these days.

2) Fuel Cost and Data :

Type	Cost	HV	Density
Bunker-C	15 US$/bbl.	10,240 kcal/kg	0.951

3) Energy Cost for Supplementary Supply

The purchase source of energy to supplement the deficiency between With and Without will be NPC's own source and private power plants. To equalize the conditions at Malaya TPP, the power supply cost (transmission and substation) is deducted. Because usually the IRR calculation will not consider the interest payment, both the cases (With and Without) does not consider the interest payment. The generating costs of the alternative power sources are shown in Table 8-1.

8.1.5 Result of Evaluation

1) Energy Generated and Unit Generating Cost

The following table shows comparisons of energy generated and average generating cost per kWh between With and Without cases. The generating cost of the With cases considers the levelized investment for rehabilitation works with a discount rate of 15% and both the generating costs are average values for the respective operating years.

Table 8-1 Energy Production and Unit Generating Cost

	M-1		M-2	
	With	Without	With	Without
Energy Production in GWh	12,877	8,032	25,754	18,172
Unit Gen. Cost in P/kWh*	1.3108	1.2249	1.0224	1.0383

Concerning the comparison of energy generated, the capacity factor decline greatly influence on the energy production of the Without case as a matter of course. The energy production of the Without cases will be about 62% for M-1 and 70% for M-2 as against the With case. Since the insufficiency in energy production should rely on purchase of the energy, the economic impact of the With case in this point of view is significant.

In the other hand, the unit generating cost of the With case become higher than that of the Without case because of a large amount of investment to the rehabilitation works. The generating cost of the With case, however, is still lower than the average power rate in Luzon Grid at 1.8505 peso per kWh and that of other Non-NPC power supply sources.

2) EIRR of Base Case

Table 8-2 shows the result of the calculation. Each EIRR value depending on the supplementary power sources at the base case (the capacity factor at 70% at With case and fuel oil cost at US$15/bbl) is calculated. Also EIRRs of M-1 only, M-2 only and combination thereof are calculated as summarized below.

Supplementary Power Source	M-1 Only	M-2 Only	M-1 & M-2 Combined
LUZON GRID Average	2.27%	26.65%	12.32%
Oil based	1.34%	25.47%	11.35%
Coal	3.74%	28.52%	13.86%
Geothermal	1.39%	25.53%	11.40%
Gas turbine	25.46%	58.77%	37.40%
NON NPC PLANTS Average	21.57%	52.97%	33.06%
Oil based	17.60%	47.23%	28.69%
Coal	15.29%	43.97%	26.17%
Gas Turbine	32.65%	69.94%	45.59%

3) Sensitivity Analysis

The sensitivity of the EIRR value to capacity factor of With case and to total project cost was tested. Concerning that to the fuel cost, Bunker-C oil, it was found that the higher the fuel unit cost will be, the lower the EIRR value becomes. This is reason why the With case produce much more energy with fuel than the Without case. If an efficiency factor for fuel consumption could be incorporated into the calculation, the EIRR against Oil base and Gas turbine will become higher than the base case while that against Coal will become lower owing to the relatively lower coal cost than the Oil.

The EIRR sensitivity to the capacity factor of With case in a range from 70% to 45% and to the total project cost from 1.4 times to 0.85 times was tested and the tables and figures are given in Figures 8-1 and 8-2.

4) Conclusion

Shorter economic benefit recovery period compared with the investment to M-1, seven years only, greatly gave the adverse effect to the overall economic evaluation while M-2 rehabilitation with smaller investment and the longer recovery period became competitive with most of the alternative cases except only NPC's geothermal power supply. In consideration of the fact that the republic is now concentrating the development of large scale coal-fired thermal power plant comparable to these objective units in term of output capacity, the competition with the coal-fired power units, probably combination of NPC's own source and non-NPC source, is the most probable case. In this case, the project EIRR became 13.86%, which is below NEDA's 15% but exceeds current discount rate of the Philippines at 12%. So, the report concludes that the project is economically feasible from the stand point of NPC.

As a result of sensitivity analysis, too, the sensitivity to the capacity factor is very high and a few drops of the capacity factor may jeopardize the project economy even the coal-fired thermal is selected as an alternative. From the economic view point, maintenance of the plant dependability and availability is crucial if this project should be pursued. As to the project total cost, the estimated cost still have a few margins if the first contender is considered as the coal-thermal. Should the supplementary energy in the case of Without be supplied through purchase of Non-NPC plants, this project is highly worth to pursue economically. Namely, the implementation of this rehabilitation project is much better for NPC rather than that NPC increases the purchase from Non-NPC power sources.

Project Malaya Reliability Improvement Project
Subject EIRR
File Name Basic.xls/elrr_2
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Table 8-2 Economic Internal Rate of Return

No. 1 & No. 2 Combined EIRR =	12.32%	11.35%	13.86%	11.40%	37.40%	33.06%	28.69%	26.17%	45.59%
EIRR =	2.27%	1.34%	3.73%	1.39%	25.46%	21.57%	17.60%	15.29%	32.65%

No. 1 Unit

	Year	WITH REHABILITATION								WITHOUT REHABILITATION							Supply by Other Power Sources (PMWh)									
		Project Cost	M-1 WITH Capability	Capacity Factor	Annual Energy	Efficiency	Fuel Consump.	Fuel Cost	With Total Cost	M-1 W/O Capability	Capacity Factor	Annual Energy	Efficiency	Fuel Consump.	Fuel Cost	Supplemental Energy	Luzon Grid Average	Oil Based	Coal	Geothermal	Gas Turbine	Non Oil Average	NPC Non Oil	Non Coal Average	NPC Non Coal	Non Gas T. Average	NPC Non Gas T.
		Thous $	MW	%	GWh	%	Mil. lit.	Thous $	Thous $	MW	%	GWh	%	Mil. lit.	Thous $	GWh	1.0797	1.051	1.1264	1.0525	2.088	1.878	1.6809	1.5742	2.5209	pMWh
0	1994	0							0								0	0	0	0	0	0	0	0	0	0
1	1995	1,815							1,815								-1,815	-1,815	-1,815	-1,815	-1,815	-1,815	-1,815	-1,815	-1,815	-1,815
2	1996	15,746							15,746								-15,746	-15,746	-15,746	-15,746	-15,746	-15,746	-15,746	-15,746	-15,746	-15,746
3	1997	56,315							56,315								-56,315	-56,315	-56,315	-56,315	-56,315	-56,315	-56,315	-56,315	-56,315	-56,315
4	1998	30,373							30,373								-30,373	-30,373	-30,373	-30,373	-30,373	-30,373	-30,373	-30,373	-30,373	-30,373
5	1999	1,814	300	70%	1,839.60	33.27%	488.30	48,216	50,030	300	47.50%	1,248.30	29.69%	371.30	36,663	591.30	11,188	10,535	12,250	10,569	34,119	29,343	24,861	22,434	43,964	
6	2000	0	300	70%	1,839.60	33.19%	489.48	48,332	48,332	300	46.16%	1,213.08	28.85%	371.33	36,656	626.52	14,351	13,660	15,477	13,696	38,648	33,588	28,839	26,257	49,080	
7	2001	0	300	70%	1,839.60	33.11%	490.66	48,449	48,449	300	44.86%	1,178.92	28.04%	371.30	36,663	660.68	15,650	14,921	16,837	14,959	41,272	35,935	30,927	28,216	52,272	
8	2002	0	300	70%	1,839.60	33.03%	491.85	48,566	48,566	300	43.59%	1,145.55	27.25%	371.25	36,658	694.05	16,914	16,148	18,180	16,188	43,830	38,224	32,962	30,114	55,385	
9	2003	0	300	70%	1,839.60	32.95%	493.04	48,684	48,684	300	42.36%	1,113.22	26.48%	371.26	36,659	726.38	18,139	17,338	19,444	17,379	46,309	40,442	34,935	31,955	58,403	
10	2004	0	300	70%	1,839.60	32.87%	494.24	48,802	48,802	300	41.17%	1,081.95	25.73%	371.35	36,668	757.65	19,329	18,493	20,690	18,536	48,711	42,592	36,848	33,739	61,326	
11	2005	0	300	70%	1,839.60	32.79%	495.45	48,922	48,922	300	40.01%	1,051.46	25.00%	371.42	36,675	788.14	20,482	19,612	21,898	19,658	51,047	44,681	38,706	35,472	64,169	
12	2006	0																								
13	2007	0																								
14	2008	0																								
15	2009	0																								
Total		105,063			12,877.20		3,443	339,971	445,034			8032.48		2599.21	256,652	4,644.72	12,804	7,458	21,507	7,736	200,687	161,556	124,829	104,948	281,350	

EIRR =	26.65%	25.47%	28.52%	25.53%	58.77%	52.97%	47.23%	43.97%	69.94%

No. 2 Unit

	Year	WITH REHABILITATION								WITHOUT REHABILITATION							Supply by Other Power Sources (PMWh)									
		Project Cost	M-1 WITH Capability	Capacity Factor	Annual Energy	Efficiency	Fuel Consump.	Fuel Cost	With Total Cost	M-1 W/O Capability	Capacity Factor	Annual Energy	Efficiency	Fuel Consump.	Fuel Cost	Supplemental Energy	Luzon Grid Average	Oil Based	Coal	Geothermal	Gas Turbine	Non Oil Average	NPC Non Oil	Non Coal Average	NPC Non Coal	Non Gas T. Average	NPC Non Gas T.
		Thous $	MW	%	GWh	%	Mil. lit.	Thous $	Thous $	MW	%	GWh	%	Mil. lit.	Thous $	GWh	1.0797	1.051	1.1264	1.0525	2.088	1.878	1.6809	1.5742	2.5209	pMWh
0	1994	0							0								0	0	0	0	0	0	0	0	0	0
1	1995	1,586							1586								-1,586	-1,586	-1,586	-1,586	-1,586	-1,586	-1,586	-1,586	-1,586	-1,586
2	1996	5,862							5862								-5,862	-5,862	-5,862	-5,862	-5,862	-5,862	-5,862	-5,862	-5,862	-5,862
3	1997	30,464							30464								-30,464	-30,464	-30,464	-30,464	-30,464	-30,464	-30,464	-30,464	-30,464	-30,464
4	1998	1,057	350	70%	2,146.20	34.90%	543.08	53,625	54,682	350	60.00%	1,839.60	32.33%	502.50	49,618	306.60	7,668	7,330	8,219	7,347	19,558	17,082	14,758	13,499	24,663	
5	1999	1,057	350	70%	2,146.20	34.82%	544.33	53,748	54,805	350	57.83%	1,773.07	32.11%	487.64	48,151	373.13	8,841	8,429	9,511	8,451	23,311	20,297	17,469	15,938	29,524	
6	2000	0	350	70%	2,146.20	34.74%	545.56	53,872	53,872	350	55.74%	1,708.99	31.89%	473.26	46,731	437.21	11,015	10,532	11,800	10,556	27,970	24,439	21,125	19,330	35,250	
7	2001	0	350	70%	2,146.20	34.66%	546.84	53,996	53,996	350	53.72%	1,647.06	31.67%	459.28	45,350	499.14	12,082	11,531	12,978	11,560	31,439	27,407	23,823	21,575	39,749	
8	2002	0	350	70%	2,146.20	34.58%	548.10	54,121	54,121	350	51.78%	1,587.57	31.45%	445.79	44,018	558.63	13,095	12,479	14,099	12,511	34,759	30,247	26,012	23,720	44,060	
9	2003	0	350	70%	2,146.20	34.50%	549.38	54,247	54,247	350	49.91%	1,530.24	31.24%	432.58	42,714	615.96	14,046	13,366	15,152	13,402	37,933	32,958	28,289	25,761	48,189	
10	2004	0	350	70%	2,146.20	34.42%	550.65	54,372	54,372	350	48.10%	1,474.75	31.03%	419.72	41,444	671.45	14,955	14,214	16,161	14,253	40,995	35,571	30,481	27,726	52,174	
11	2005	0	350	70%	2,146.20	34.34%	551.93	54,499	54,499	350	46.36%	1,421.40	30.82%	407.29	40,217	724.80	15,817	15,017	17,119	15,058	43,925	38,071	32,576	29,602	55,993	
12	2006	0	350	70%	2,146.20	34.26%	553.22	54,626	54,626	350	44.68%	1,369.89	30.61%	395.22	39,025	776.31	16,637	15,780	18,031	15,825	46,743	40,472	34,587	31,402	59,668	
13	2007	0	350	70%	2,146.20	34.18%	554.52	54,754	54,754	350	43.06%	1,320.22	30.40%	383.52	37,870	825.98	17,416	16,505	18,900	16,552	49,449	42,777	36,516	33,126	63,201	
14	2008	0	350	70%	2,146.20	34.10%	555.82	54,883	54,883	350	41.50%	1,272.39	30.19%	372.20	36,752	873.81	18,156	17,191	19,725	17,242	52,043	44,985	38,361	34,775	66,592	
15	2009	0	350	70%	2,146.20	34.02%	557.13	55,012	55,012	350	40.00%	1,226.40	29.98%	361.26	35,672	919.80	18,856	17,841	20,509	17,894	54,527	47,098	40,125	36,350	69,842	
Total		40,026			25,754.40		6,600.58	651,755	691,781			18,171.58		5140.26	507,562	7,583	130,672	122,303	144,292	122,741	424,740	363,492	306,010	274,892	550,993	

Figure 8-1 EIRR Sensitivity to Capacity Factor

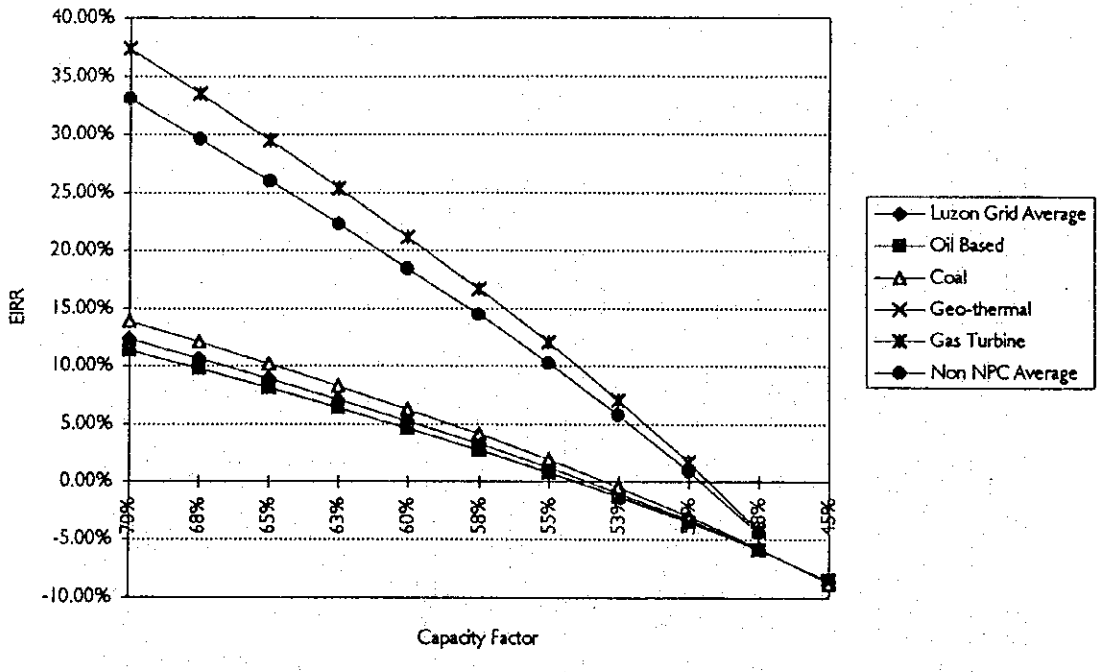
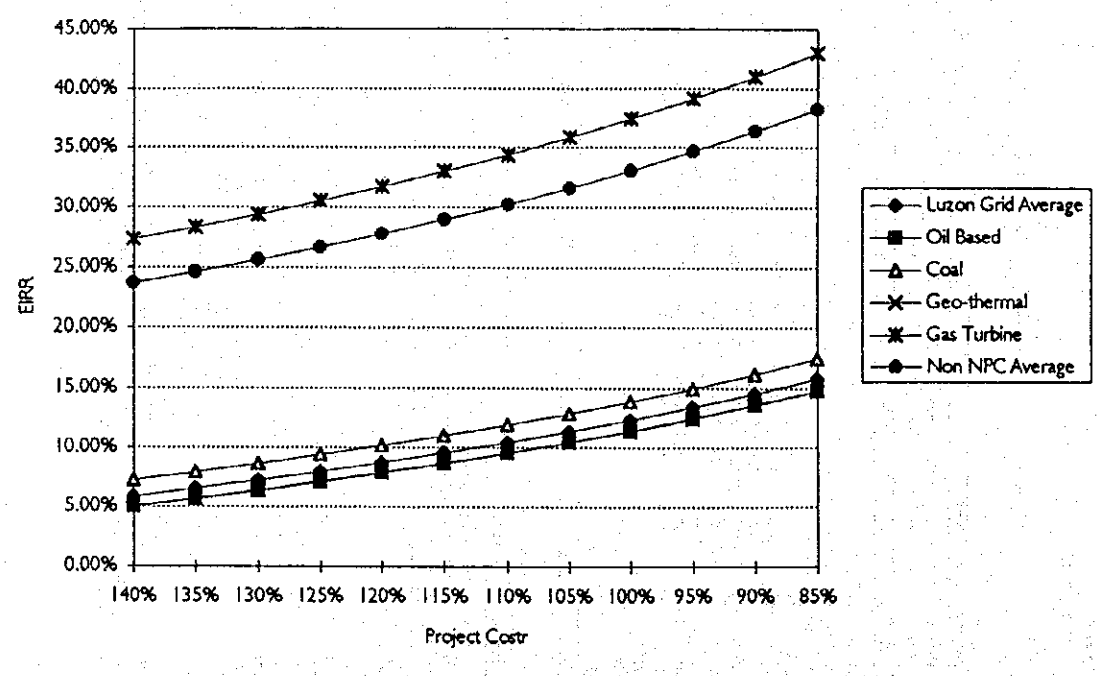


Figure 8-2 EIRR Sensitivity to Project Cost



8.2 Financial Evaluation

8.2.1 Evaluation Method

Financial soundness of Malaya thermal power station after rehabilitation, or operation of these units by NPC, will be analyzed by an internal rate of return method, and then FIRR will be compared with the opportunity cost of capital for the project. The benefit of the project will be the balance of energy production and sales between With and Without cases. In addition, the financial statements; cash flow balance, income statement and repayment schedule, will be prepared.

8.2.2 Evaluation Conditions/Assumptions

1) Opportunity Cost of Capital : Assuming that NPC will procure finance from the Export and Import Bank of Japan (EXIM Japan) as same as preceding rehabilitation project, the interest rate of EXIM Japan at 5.80% will be the opportunity capital of this Project.

2) Benefit

The operating conditions similar to those assumed in the economic evaluation are applied. In comparing with the Without Project, the benefit of the With Project, increased revenue owing to the recovered outputs, will be calculated. The power rate for energy sale uses a 1993 average power rate in Luzon Grid at 1.5726 peso per kWh after deduction of depreciation cost at 0.2086 P/kWh and interest cost at 0.0693 P/kWh, which are considered to belong to the original plant construction and off set in both the cases.

3) Fuel Price

The fuel price used for the financial evaluation is 2.3610 Peso /lit of actual price as of July 1994 and the high calorific value is one which the study team sampled at Malaya TPP during site survey and analyzed in Japan

4) Loan Term

The loan term will be an interest rate of 5.8% per annum, a commitment fee of 0.5% and repayment of 10 years without a grace period. The repayment schedule will be prepared accordingly.

8.2.3 Result of Evaluation

1) FIRR

Financial internal rates of return of the project stand at 16.06% for M-1, 46.67% for M-2 and 29.74% for the combined. As these figures well cleared the opportunity cost of capital at 5.8% and even the rate base of NPC at 8%, the project is concluded financially feasible. Those financial evaluations this time compared the balance of energy production between the With and Without cases, the financial evaluation with the actual cases taking the benefit as power sale by With case only may result in similar FIRR values since the depreciation and interest portions in the power rate were deducted in the With/Without FIRR calculations.

Should the technical and physical restoration of the equipment and facilities be attained as engineered, the project is concluded financially feasible.

2) Sensitivity Analysis

a. To Capacity Factor

Similar to the economic analysis, maintenance of a certain rate of the capacity factor is essential to attain the financial viability of the project after rehabilitation works, M-1 in particular. In the case of M-1, if the capacity factor should decline by 10% from the planned value, the FIRR value would become below the opportunity cost of capital while M-2 has a certain margin in the capacity factor decline.

b. To Project Cost

Also, because the M-1 has a shorter operation period after rehabilitation with larger investment, the investment to M-1 must be careful and should not increase by 40% from the planned value if the M-1 rehabilitation is considered independently.

c. To Fuel Cost

As far as this evaluation method concerned taking into account the benefit as balance of the energy sale between With and Without cases, the variation of fuel costs gives an adverse effect to the FIRRs. The more With case generates the power, the more With cases consume the fuel. Therefore, the higher the fuel price is assumed, the lower the FIRR

becomes. Even the fuel cost become 20 $/bbl. FIRR is maintained at more than a 10% level.

d. To Power Rate

Naturally, the higher the power rate is, the higher the revenue can be expected. The sensitivity to power rate in a range of plus and minus 25% is tested. All the cases are in favor of the financial feasibility as shown in Figure 8-6.

3) Financial Statement

Repayment schedule, income statement and cash-flow statement as against investment and benefit for M-1 and M-2 combined were prepared for this rehabilitation project only. When the project will terminate in 2009, retirement year of M-2, the net income will stand at about 289 million US$ after repayment of the loan for the project. The detail are shown in Tables 8-4, 8-5 and 8-6.

firr - 1

Project Malaya Reliability Improvement Project
Subject FIRR
File Name firr.xls
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Rev. 1/16/95

Table 8-3 Financial Internal Rate of Return

M-1 & M-2 Combined FIRR = 29.74%

No. 1 Unit

FIRR = 16.06%

Year		WITH REHABILITATION								WITHOUT REHABILITATION										
		Project Cost	M-1 WITH Capability	Capacity Factor	Annual Energy	Effici-ency	Fuel Consump	Fuel Cost	With Total Cost	M-1 W/O Capability	Capacity Factor	Annual Energy	Effici-ency	Fuel Consump	Fuel Cost	Benefit Energy With	Balance of Cost	Fuel Sale Benefit	Energy Cost Balance
		Thous $	MW	%	GWh	%	Mil. lit.	Thous $	Thous $	MW	%	GWh	%	Mil. lit.	Thous $	GWh	Thous $	Thous $	Thous $
0	1994																		
1	1995	1,815							1,815										-1,815
2	1996	15,746							15,746										-15,746
3	1997	55,315							55,315										-55,315
4	1998	30,373							30,373										-30,373
5	1999	1,814	300	70%	1,839.60	33.27%	488.30	44,346	46,160	300	47.50%	1248.3	29.69%	371.30	33,721	591.30	-10,625	35,765	23,326
6	2000		300	70%	1,839.60	33.19%	489.48	44,453	44,453	300	46.16%	1213.08	28.85%	371.33	33,723	626.52	-10,730	37,895	27,165
7	2001		300	70%	1,839.60	33.11%	490.66	44,561	44,561	300	44.86%	1178.92	28.04%	371.30	33,721	660.68	-10,840	39,961	29,121
8	2002		300	70%	1,839.60	33.03%	491.85	44,669	44,669	300	43.59%	1145.55	27.25%	371.25	33,716	694.05	-10,953	41,979	31,026
9	2003		300	70%	1,839.60	32.95%	493.04	44,777	44,777	300	42.36%	1113.22	26.48%	371.26	33,717	726.38	-11,060	43,935	32,875
10	2004		300	70%	1,839.60	32.87%	494.24	44,886	44,886	300	41.17%	1081.95	25.73%	371.35	33,725	757.65	-11,161	45,826	34,665
11	2005		300	70%	1,839.60	32.79%	495.45	44,996	44,996	300	40.01%	1051.46	25.00%	371.42	33,731	788.14	-11,265	47,670	36,405
12	2006																		
13	2007																		
14	2008																		
15	2009																		
Total		105,063			12,877.20		3,443	312,688	417,751			8032.48		2599.21	236,054	4844.72	-76,634	293,031	111,334

No. 2 Unit

FIRR = 46.67%

Year		WITH REHABILITATION								WITHOUT REHABILITATION										
		Project Cost	M-1 WITH Capability	Capacity Factor	Annual Energy	Effici-ency	Fuel Consump	Fuel Cost	With Total Cost	M-1 W/O Capability	Capacity Factor	Annual Energy	Effici-ency	Fuel Consump	Fuel Cost	Benefit Energy With	Balance of Cost	Fuel Sale Benefit	Energy Cost Balance
		Thous $	MW	%	GWh	%	Mil. lit.	Thous $	Thous $	MW	%	GWh	%	Mil. lit.	Thous $	GWh	Thous $	Thous $	Thous $
0	1994																		
1	1995	1,586							1,586										-1586
2	1996	5,862							5,862										-5862
3	1997	30,464							30,464										-30,464
4	1998	1,057	350	70%	2,146.20	34.90%	543.08	49,321	50,378	350	60.00%	1,839.60	32.33%	502.50	45,636	306.6	-3,685	18,545	13,803
5	1999	1,057	350	70%	2,146.20	34.82%	544.33	49,435	50,492	350	57.83%	1,773.07	32.11%	487.64	44,286	373.13	-5,149	22,569	16,363
6	2000		350	70%	2,146.20	34.74%	545.58	49,548	49,548	350	55.74%	1,708.99	31.89%	473.26	42,960	437.21	-6,568	26,444	19,876
7	2001		350	70%	2,146.20	34.66%	546.84	49,663	49,663	350	53.72%	1,647.06	31.67%	459.28	41,711	499.14	-7,952	30,190	22,238
8	2002		350	70%	2,146.20	34.58%	548.10	49,777	49,777	350	51.78%	1,587.57	31.45%	445.79	40,486	558.63	-9,291	33,789	24,498
9	2003		350	70%	2,146.20	34.50%	549.38	49,893	49,893	350	49.91%	1,530.24	31.24%	432.56	39,266	615.96	-10,607	37,256	26,649
10	2004		350	70%	2,146.20	34.42%	550.65	50,009	50,009	350	48.10%	1,474.75	31.03%	419.72	38,118	671.45	-11,891	40,612	28,721
11	2005		350	70%	2,146.20	34.34%	551.93	50,125	50,125	350	46.36%	1,421.40	30.82%	407.29	36,989	724.80	-13,136	43,839	30,703
12	2006		350	70%	2,146.20	34.26%	553.22	50,242	50,242	350	44.68%	1,369.89	30.61%	395.22	35,893	776.31	-14,349	46,955	32,606
13	2007		350	70%	2,146.20	34.18%	554.52	50,360	50,360	350	43.06%	1,320.22	30.40%	383.52	34,830	825.98	-15,530	49,959	34,429
14	2008		350	70%	2,146.20	34.10%	555.82	50,478	50,478	350	41.50%	1,272.39	30.19%	372.20	33,802	873.81	-16,676	52,852	36,176
15	2009		350	70%	2,146.20	34.02%	557.13	50,597	50,597	350	40.00%	1,226.40	29.98%	361.26	32,809	919.80	-17,788	55,634	37,846
Total		40,026			25,754.40		6,601	599,448	639,474			18,172		5140.26	466,826	7582.82	-132,622	458,644	285,996

sensitivity

Project	Malaya Reliability Improvement Project
Subject	Sensitivity
File Name	firr.xls
Date	11/25/94
Rev.	1/16/95

Sensitivity to Capacity Factor

	FIRR		
Capacity Factor	M-1	M-2	M-1/M-2
70%	16.06%	46.67%	29.74%
67.50%	13.56%	44.17%	27.24%
65.00%	11.06%	41.67%	24.74%
62.50%	8.56%	39.17%	22.24%
60.00%	6.06%	36.67%	19.74%
57.50%	3.56%	34.17%	17.24%
55.00%	1.06%	31.67%	14.74%
52.50%	-1.44%	29.17%	12.24%
50.00%	-3.94%	26.67%	9.74%
47.50%	-6.44%	24.17%	7.24%
45.00%	-8.94%	21.67%	4.74%

Investment to FIRR

Project Cost	M-1	M-2	M-1/M-2
140%	8.07%	36.50%	21.83%
135%	8.89%	37.50%	22.63%
130%	9.75%	38.55%	23.48%
125%	10.66%	39.68%	24.37%
120%	11.61%	40.88%	25.32%
115%	12.62%	42.17%	26.32%
110%	13.70%	43.55%	27.38%
105%	14.84%	45.05%	28.52%
100%	16.06%	46.67%	29.74%
95%	17.37%	48.45%	31.05%
90%	18.77%	50.38%	32.48%
85%	20.29%	52.52%	34.02%

Figure 8-3 FIRR Sensitivity to Capacity Factor

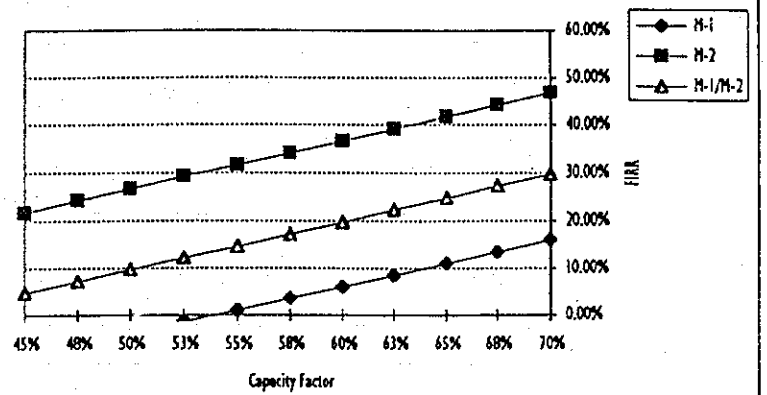
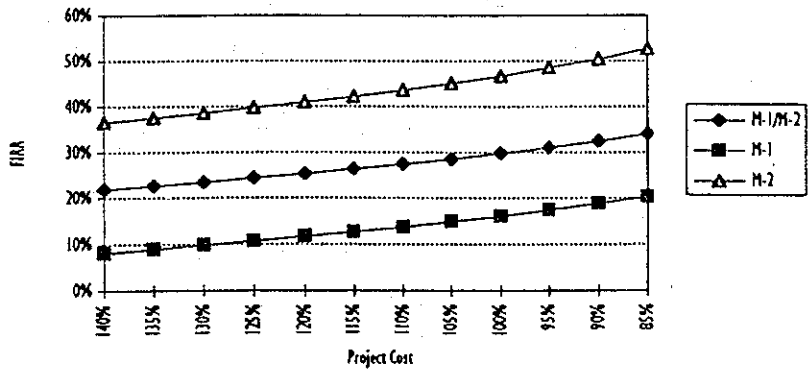


Figure 8-4 FIRR Sensitivity to Project Cost



Sensitivity to Fuel Cost

Fuel Cost [$/bbl.]	FIRR M-1	M-2	M-1/M-2
20	12.37%	42.14%	26.01%
19	13.06%	42.99%	26.71%
18	13.73%	43.82%	27.40%
17	14.40%	44.63%	28.07%
16	15.06%	45.44%	28.73%
15	15.70%	46.23%	29.38%
14	16.34%	47.02%	30.02%
13	16.97%	47.79%	30.65%
12	17.59%	48.56%	31.27%
11	18.21%	49.32%	31.89%
10	18.81%	50.07%	32.49%

Sensitivity to Power Rate

Power Rate	FIRR M-1	M-2	M-1/M-2
125%	23.92%	57.44%	37.74%
120%	22.46%	55.36%	36.23%
115%	20.94%	53.25%	34.67%
110%	19.37%	51.10%	33.08%
105%	17.75%	48.91%	31.44%
100%	16.06%	46.67%	29.74%
95%	14.30%	44.39%	27.98%
90%	12.46%	42.04%	26.14%
85%	10.53%	39.62%	24.22%
80%	8.50%	37.11%	22.19%
75%	6.35%	34.50%	20.01%

Figure 8-5 FIRR Sensitivity to Fuel Cost

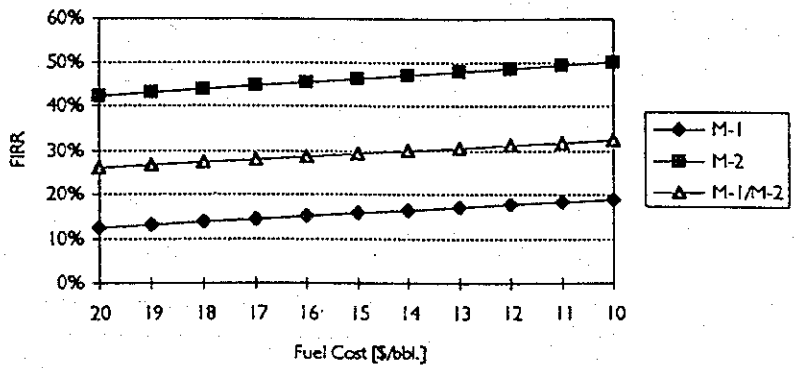


Figure 8-6 FIRR Sensitivity to Power Rate

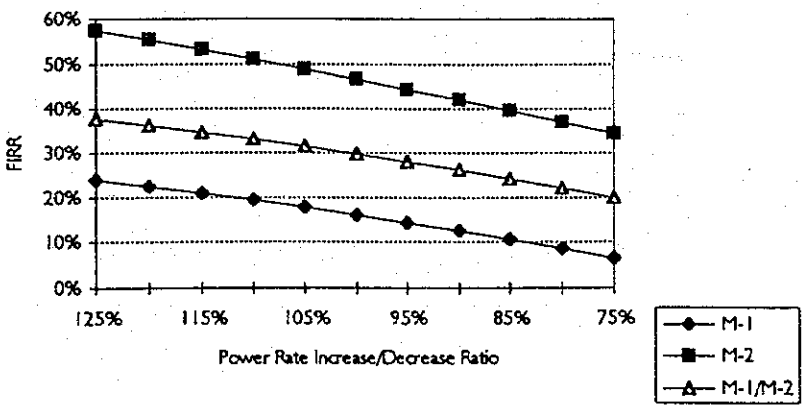


Table 8-4 Repayment Schedule

	Year	Loan	1995 loan Principal	Interest	Repay-ment	Outstand-ing Balance	1996 loan Principal	Interest	Repay-ment	Outstand-ing Balance	1997 loan Principal	Interest	Repay-ment	Outstand-ing Balance	1998 loan Principal	Interest	Repay-ment	Outstand-ing Balance	1999 loan Principal	Interest	Repay-ment	Outstand-ing Balance
0	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1995	3,401	0	0	0	3,401	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1996	21,608	261	197	458	3,140	0	0	0	21,608	0	0	0	0	0	0	0	0	0	0	0	0
3	1997	85,779	276	182	458	2,865	1,655	1253	2,908	19,953	0	0	0	85,779	0	0	0	0	0	0	0	0
4	1998	31,430	292	166	458	2,573	1,751	1157	2,908	18,202	6,569	4975	11,544	79,210	0	0	0	31,430	0	0	0	0
5	1999	2,871	309	149	458	2,264	1,852	1056	2,908	16,350	6,950	4594	11,544	72,259	2,407	1823	4,230	29,023	0	0	0	2,871
6	2000	0	327	131	458	1,937	1,960	948	2,908	14,390	7,353	4191	11,544	64,906	2,547	1683	4,230	26,476	219	167	386	2,652
7	2001	0	346	112	458	1,592	2,073	835	2,908	12,317	7,779	3765	11,544	57,126	2,694	1536	4,230	23,782	232	154	386	2,419
8	2002	0	366	92	458	1,226	2,194	714	2,908	10,123	8,231	3313	11,544	48,895	2,851	1379	4,230	20,931	246	140	386	2,173
9	2003	0	387	71	458	839	2,321	587	2,908	7,801	8,708	2836	11,544	40,186	3,016	1214	4,230	17,915	260	126	386	1,912
10	2004	0	409	49	458	431	2,456	452	2,908	5,345	9,213	2331	11,544	30,973	3,191	1039	4,230	14,724	275	111	386	1,637
11	2005	0	431	25	456	0	2,598	310	2,908	2,747	9,748	1796	11,544	21,225	3,376	854	4,230	11,348	291	95	386	1,346
12	2006	0	0	0	0	0	2,747	159	2,906	0	10,313	1231	11,544	10,911	3,572	658	4,230	7,776	308	78	386	1,037
13	2007	0	0	0	0	0	0	0	0	0	10,911	633	11,544	0	3,779	451	4,230	3,997	326	60	386	711
14	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	3,997	232	4,229	0	345	41	386	365
15	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	365	21	386	0
Total		145,089	3,401	1,174	4,575		21,608	7,471	29,079		85,779	29,665	115,444		31,430	10,869	42,299		2,871	993	3,864	

	Year	TOTAL Principal	Interest	Repay-ment	Outstand-ing Balance	Commit-ment Fee
0	1994	0	0	0	0	725
1	1995	0	0	0	3,401	708
2	1996	261	197	458	24,748	600
3	1997	1,931	1,435	3,366	108,596	172
4	1998	8,612	6,298	14,910	131,414	14
5	1999	11,518	7,622	19,140	122,767	0
6	2000	12,407	7,120	19,527	110,360	0
7	2001	13,125	6,402	19,527	97,236	0
8	2002	13,889	5,638	19,527	83,347	0
9	2003	14,693	4,834	19,527	68,655	0
10	2004	15,545	3,982	19,527	53,110	0
11	2005	16,444	3,080	19,524	36,666	0
12	2006	16,941	2,126	19,067	19,725	0
13	2007	15,016	1,144	16,160	4,708	0
14	2008	4,343	273	4,616	365	0
15	2009	365	21	386	0	0
Total		145,089	50,172	195,261		2,219

LOAN TERM		
Interest	%	5.80%
Commitment fee	%	0.50%
Grace P.	Year	0
Repayment	Years	10

Table 8-5 Income Statement

						OPERATING COST							PROFIT	FINANCIAL COST		NET INCOME
	Year	Benefit Energy			With Revenue	Add. Fuel Cost			Depreic. Cost			With Total Cost		Commit. Fee	Interest	
		M-1	M2	Total		M-1	M-2	Total	M-1	M-2	Total					
		GWH	GWH	GWH	Thous $	Thous $	Thous $	Thous $	Thous $	Thous $	Thous $	Thous $	Thous $	Thous $	Thous $	Thous $
0	1994	0	0	0	0	0	0	0			0	0	0	0	0	0
1	1995	0	0	0	0	0	0	0			0	0	0	725	0	-725
2	1996	0	0	0	0	0	0	0			0	0	0	708	197	-905
3	1997	0	0	0	0	0	0	0			0	0	0	600	1,435	-2,035
4	1998	0	306.60	306.60	18,545	3,685	3,685	7,370		3,336	3,336	10706	7839	172	6,298	1,369
5	1999	591.30	373.13	964.43	58,333	5,149	5,149	10,298	15,009	3,336	18,345	28643	29690	14	7,622	22,054
6	2000	626.52	437.21	1,063.73	64,339	6,568	6,568	13,136	15,009	3,336	18,345	31481	32858	0	7,120	25,738
7	2001	660.68	499.14	1,159.82	70,151	7,952	7,952	15,904	15,009	3,336	18,345	34249	35902	0	6,402	29,500
8	2002	694.05	558.63	1,252.68	75,768	9,291	9,291	18,582	15,009	3,336	18,345	36927	38841	0	5,638	33,203
9	2003	726.38	615.96	1,342.34	81,191	10,607	10,607	21,214	15,009	3,336	18,345	39559	41632	0	4,834	36,798
10	2004	757.65	671.45	1,429.10	86,439	11,891	11,891	23,782	15,009	3,336	18,345	42127	44312	0	3,982	40,330
11	2005	788.14	724.80	1,512.94	91,510	13,136	13,136	26,272	15,009	3,336	18,345	44617	46893	0	3,080	43,813
12	2006	0	776.31	776.31	46,955	14,349	14,349	28,698		3,336	3,336	32034	14921	0	2,126	12,795
13	2007	0	825.98	825.98	49,959	15,530	15,530	31,060		3,336	3,336	34396	15563	0	1,144	14,419
14	2008	0	873.81	873.81	52,852	16,676	16,676	33,352		3,336	3,336	36688	16164	0	273	15,891
15	2009	0	919.80	919.80	55,634	17,788	17,788	35,576		3,330	3,330	38906	16728	0	21	16,707
Total		4,844.72	7,582.82	12,428	751,676	132,622	132,622	265,244	105,063	40,026	145,089	410,333	341,343	2,219	50,172	288,952

Table 8-6 Cashflow Statement

			CASH INFLOW			CASH OUTFLOW			BALANCE	
	Year	Loan	Net Income	Depreciation	Total	Rehab. Cost	Repay (Principal)	Total	Annual Balance	Accumu. Balance
		Thous $	Thous $	Thous $	Thous $	Thous $	Thous $	Thous $	Thous $	Thous $
0	1994	0	0	0	0	0	0	0	0	0
1	1995	3,401	-725	0	2,676	3,401	0	3,401	-725	-725
2	1996	21,608	-905	0	20,703	21,608	261	21,869	-1,166	-1,891
3	1997	85,779	-2,035	0	83,744	85,779	1,931	87,710	-3,966	-5,857
4	1998	31,430	1,369	3,336	36,135	31,430	8,612	40,042	-3,907	-9,764
5	1999	2,871	22,054	18,345	43,270	2,871	11,518	14,389	28,881	19,117
6	2000		25,738	18,345	44,083		12,407	12,407	31,676	50,793
7	2001		29,500	18,345	47,845		13,125	13,125	34,720	85,514
8	2002		33,203	18,345	51,548		13,889	13,889	37,659	123,173
9	2003		36,798	18,345	55,143		14,693	14,693	40,450	163,624
10	2004		40,330	18,345	58,675		15,545	15,545	43,130	206,754
11	2005		43,813	18,345	62,158		16,444	16,444	45,714	252,468
12	2006		12,795	3,336	16,131		16,941	16,941	-810	251,658
13	2007		14,419	3,336	17,755		15,016	15,016	2,739	254,396
14	2008		15,891	3,336	19,227		4,343	4,343	14,884	269,280
15	2009		16,707	3,330	20,037		365	365	19,672	288,952
Total		145,089	268,952	145,089	579,130	145,089	145,089	290,178	288,952