CHAPTER 9

ESTIMATED CONSTRUCTION COST

Chapter 9 Estimated Construction Cost

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CHAPTER 9 ESTIMATED CONSTRUCTION COST

9.1 General

The construction cost of the Zambales Coal-Fired Power Project is estimated as a after due consideration cost of similar project. The estimated construction cost is shown as follows:

US$ x 1,000

	1U		2U		Total		
	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C+L.C
Direct cost	288,642	100,333	177,359	30,722	466,001	131,055	597,056
In-direct consideration cost	24,156	15,868	14,070	6,193	38,226	22,061	60,287
I.D.C.	22,228	49,471	11,148	11,973	33,376	61,444	94,820
Total	335,026	165,672	202,577	48,888	537,603	214,560	752,163

The Breakdown of Capital Cost and Disbursement Schedule are given in Table 9.3-1 and Table 9.3-2, respectively.

9.2 Estimation Methods of Construction Cost

Prior to the estimation of the construction cost, NAPOCOR and JICA study team confirmed the following conditions.

(1) The construction cost is estimated into in local and foreign currency. The cost in local currency include wages for domestic workers, cost of construction materials that can be supplied in the Philippines, value-added tax (VAT), etc., and the balance is included in the foreign currency component.

(2) The construction cost is based on the present cost as of September, 1989. The cost refers to the recent tendency of power plant cost and is not expected to escalate.

(3) The direct construction cost includes the necessary expenses for construction of power generation facilities, including the necessary environmental facilities, mentioned in Chapter 6 & 7. The items which have been considered are as follows:

i) The expenses for temporary facilities for construction are not allocated for those facilities to be prepared by NAPOCOR.

ii) The expenses are not allocated for necessary fuel in commissioning since they are considered to be offset against power rates in commissioning.

iii) The cost for electric power and water used for construction are not included.

iv) The expenses for NAPCOR's loan arrangement are not included.

v) Total 3% of the cost for each product consisting of export insurance and ocean freight is added to payment in foreign portion.

vi) The cost for transmission facilities are allocated for equipment up to Hermosa Substation that initially receives electric power from the Zambales power plant.

vii) The expenses of P61,544,737 for land acquisition and compensation is estimated by NAPOCOR and is to be paid in local currency.

(4) 2.5% of the direct construction cost is allocated for engineering fees. This amount consists of expenses (personal expenses, overhead expenses, technological fees, traveling expenses, communication expenses, etc.) to enable NAPOCOR to employ consultants and assist design, construction and management.

(5) 1.5% of the direct construction costs are allocated for administrative cost. This amount is used for the necessary expenses (traveling expenses for previous arrangements with foreign companies, traveling expenses for factory inspections, personnel

training expenses, etc.) to enable NAPOCOR to carry out this project.

(6) 5% of the direct construction cost for the foreign portion and 10% of the direct construction cost for the local portion are allocated for physical contingency. This amount will be used in cases where design changes take place owing to circumstances.

(7) NAPOCOR shall pay value-added tax in accordance with the laws and ordinances of the Philippines. And 10% of the cost for imported equipments (CIF) is allocated for value-added tax. Import taxes are assumed to be exempted.

(8) Interest during construction are allocated based on disbursement schedule at the rate of 2.9% per year for foreign portion and 17% per year for local portion. This interest is estimated for scheduled expenditure up to taking over.

(9) The required fund for each year is estimated according to the following payment terms.

1) Importation of Equipment (machine and others)

15% at the time of contract, 75% at the time of shipment, 10% at the time of completion

2) Construction Expenses for Civil Works

15% at the time of contract, 75% progress payment, 10% at the time of completion

3) Administrative Expenses and Engineering Fees

Estimated according to work volume each year

4) Value Added Taxes (VAT)

100% at the time of landing import products

Table 9.3-1 Breakdown of Capital Cost US$ x 1000

Item	Unit No. 1			Unit No. 2			Total		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
Direct Cost									
1. Electrical & Mechanical Equipment									
a. Boiler and its accessory	91,300	5,550	96,850	88,514	5,550	94,064	179,814	11,100	190,914
b. Turbine and its accessory	66,371	2,579	68,950	64,979	2,579	67,558	131,350	5,158	136,508
c. Generator and its accessory	12,779	514	13,293	12,114	514	12,628	24,893	1,028	25,921
d. Coal Handling Equipment	55,714	4,264	59,978	0	0	0	55,714	4,264	59,978
Sub Total	226,164	12,907	239,071	165,607	8,643	174,250	391,771	21,550	413,321
2. Civil and Architectural Works									
a. Harbour Facilities	11,950	6,879	18,829	0	0	0	11,950	6,879	18,829
b. Cooling Water Facilities	11,157	7,650	18,807	0	0	0	11,157	7,650	18,807
c. Power House and Stack	10,186	7,029	17,215	6,243	3,543	9,786	16,429	10,572	27,001
d. Other Facilities	11,421	29,321	40,742	343	800	1,143	11,764	30,121	41,885
Sub Total	44,714	50,879	95,593	6,586	4,343	10,929	51,300	55,222	106,522
3. Transmission Line	9,357	4,886	14,243	0	0	0	9,357	4,886	14,243
4. Insurance and Ocean Freight	8,407	0	8,407	5,166	0	5,166	13,573	0	13,573
6. Land and Compensation	0	2,797	2,797	0	0	0	0	2,797	2,797
Total of Construction Cost	288,642	71,469	360,111	177,359	12,986	190,345	466,001	84,455	550,456
7. Value Added Tax (VAT)	0	28,864	28,864	0	17,736	17,736	0	46,600	46,600
Total of Direct Cost	288,642	100,333	388,975	177,359	30,722	208,081	466,001	131,055	597,056
Indirect Cost									
1. Physical Contingency	14,432	10,033	24,465	8,868	3,072	11,940	23,300	13,105	36,405
2. Administration Cost	0	5,835	5,835	0	3,121	3,121	0	8,956	8,956
3. Engineering Fee	9,724	0	9,724	5,202	0	5,202	14,926	0	14,926
Total of Indirect Cost	24,156	15,868	40,024	14,070	6,193	20,263	38,226	22,061	60,287
Interest During Construction	22,228	49,471	71,699	11,148	11,973	23,121	33,376	61,444	94,820
Grand Total	335,026	165,672	500,698	202,577	48,888	251,465	537,603	214,560	752,163

Table 9.3-1 Breakdown of Capital Cost

million Y

Item	Unit No. 1			Unit No. 2			Total		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
Direct Cost									
1. Electrical & Mechanical Equipment									
a. Boiler and its accessory	12,782	777	13,559	12,392	777	13,169	25,174	1,554	26,728
b. Turbine and its accessory	9,292	361	9,653	9,097	361	9,458	18,389	722	19,111
c. Generator and its accessory	1,789	72	1,861	1,696	72	1,768	3,485	144	3,629
d. Coal Handling Equipment	7,800	597	8,397	0	0	0	7,800	597	8,397
Sub Total	31,663	1,807	33,470	23,185	1,210	24,395	54,848	3,017	57,865
2. Civil and Architectural Works									
a. Harbour Facilities	1,673	963	2,636	0	0	0	1,673	963	2,636
b. Cooling Water Facilities	1,562	1,071	2,633	0	0	0	1,562	1,071	2,633
c. Power House and Stack	1,426	984	2,410	874	496	1,370	2,300	1,480	3,780
d. Other Facilities	1,599	4,105	5,704	48	112	160	1,647	4,217	5,864
Sub Total	6,260	7,123	13,383	922	608	1,530	7,182	7,731	14,913
3. Transmission Line	1,310	684	1,994	0	0	0	1,310	684	1,994
4. Insurance and Ocean Freight	1,177	0	1,177	723	0	723	1,900	0	1,900
6. Land and Compensation	0	392	392	0	0	0	0	392	392
Total of Construction Cost	40,410	10,006	50,416	24,830	1,818	26,648	65,240	11,824	77,064
7. Value Added Tax (VAT)	0	4,041	4,041	0	2,483	2,483	0	6,524	6,524
Total of Direct Cost	40,410	14,047	54,457	24,830	4,301	29,131	65,240	18,348	83,588
Indirect Cost									
1. Physical Contingency	2,021	1,405	3,426	1,242	430	1,672	3,263	1,835	5,098
2. Administration Cost	0	817	817	0	437	437	0	1,254	1,254
3. Engineering Fee	1,361	0	1,361	728	0	728	2,089	0	2,089
Total of Indirect Cost	3,382	2,222	5,604	1,970	867	2,837	5,352	3,089	8,441
Interest During Construction	3,112	6,926	10,038	1,561	1,676	3,237	4,673	8,602	13,275
Grand Total	46,904	23,195	70,099	28,361	6,844	35,205	75,265	30,039	105,304

Table 9.3-2 Disbursement Schedule US$ x 1,000

Item	1992			1993			1994			1995			1996			Total		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1. Direct Cost																		
a. Elecrical and Mechanical Equipment	58,766	3,232	61,998	0	0	0	236,008	13,843	249,851	57,820	2,320	60,140	39,177	2,155	41,332	391,771	21,550	413,321
b. Civil and Architectural Works	7,695	8,283	15,978	0	0	0	38,475	41,417	79,892	0	0	0	5,130	5,522	10,652	51,300	55,222	106,522
c. Transmission Line	1,404	733	2,137	0	0	0	7,017	3,664	10,681	0	0	0	936	489	1,425	9,357	4,886	14,243
d. Land and Compensation	0	2,797	2,797	0	0	0	0	0	0	0	0	0	0	0	0	0	2,797	2,797
e. Insurance and Ocean Freight	0	0	0	0	0	0	11,260	0	11,260	2,313	0	2,313	0	0	0	13,573	0	13,573
f. Value Added Tax	0	0	0	0	0	0	0	38,659	38,659	0	7,941	7,941	0	0	0	0	46,600	46,600
Total of Direct Cost	67,865	15,045	82,910	0	0	0	292,760	97,583	390,343	60,133	10,261	70,394	45,243	8,166	53,409	466,001	131,055	597,056
2. Indirect Cost																		
a. Physical Contingency	0	0	0	0	0	0	0	0	0	0	0	0	23,300	13,105	36,405	23,300	13,105	36,405
b. Administration Cost	0	600	600	0	2,400	2,400	0	2,402	2,402	0	2,384	2,384	0	1,170	1,170	0	8,956	8,956
c. Engineering Fee	999	0	999	3,995	0	3,995	3,984	0	3,984	3,984	0	3,984	1,964	0	1,964	14,926	0	14,926
Total of Indirect Cost	999	600	1,599	3,995	2,400	6,395	3,984	2,402	6,386	3,984	2,384	6,368	25,264	14,275	39,539	38,226	22,061	60,287
3. Interest during Construction	330	435	765	2,051	2,847	4,898	5,352	12,219	17,571	12,080	21,559	33,639	13,563	24,384	37,947	33,376	61,444	94,820
Grand Total	69,194	16,080	85,274	6,046	5,247	11,293	302,096	112,204	414,300	76,197	34,204	110,401	84,070	46,825	130,895	537,603	214,560	752,163

Table 9.3-2 Disbursement Schedule

million ¥

Item	1992			1993			1994			1995			1996			Total		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1. Direct Cost																		
a. Elecrical and Mechanical Equipment	8,227	453	8,680	0	0	0	33,041	1,937	34,978	8,095	325	8,420	5,485	302	5,787	54,848	3,017	57,865
b. Civil and Architectural Works	1,077	1,159	2,236	0	0	0	5,387	5,799	11,186	0	0	0	718	773	1,491	7,182	7,731	14,913
c. Transmission Line	197	103	300	0	0	0	982	513	1,495	0	0	0	131	68	199	1,310	684	1,994
d. Land and Compensation	0	392	392	0	0	0	0	0	0	0	0	0	0	0	0	0	392	392
e. Insurance and Ocean Freight	0	0	0	0	0	0	1,576	0	1,576	324	0	324	0	0	0	1,900	0	1,900
f. Value Added Tax	0	0	0	0	0	0	0	5,412	5,412	0	1,112	1,112	0	0	0	0	6,524	6,524
Total of Direct Cost	9,501	2,107	11,608	0	0	0	40,986	13,661	54,647	8,419	1,437	9,856	6,334	1,143	7,477	65,240	18,348	83,588
2. Indirect Cost																		
a. Physical Contingency	0	0	0	0	0	0	0	0	0	0	0	0	3,263	1,835	5,098	3,263	1,835	5,098
b. Administration Cost	0	84	84	0	336	336	0	338	338	0	336	336	0	160	160	0	1,254	1,254
c. Engineering Fee	144	0	144	569	0	569	564	0	564	548	0	548	264	0	264	2,089	0	2,089
Total of Indirect Cost	144	84	228	569	336	905	564	338	902	548	336	884	3,527	1,995	5,522	5,352	3,089	8,441
3. Interest during Construction	47	61	108	287	398	685	748	1,710	2,458	1,691	3,019	4,710	1,900	3,414	5,314	4,673	8,602	13,275
Grand Total	9,692	2,252	11,944	856	734	1,590	42,298	15,709	58,007	10,658	4,792	15,450	11,761	6,552	18,313	75,265	30,039	105,304

CHAPTER 10

ECONOMIC EVALUATION

Chapter 10 Economic Evaluation

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CHAPTER 10 ECONOMIC EVALUATION

10.1 General

The economic performance of the proposed coal-fired power plant project was analyzed by using three methods of analysis:

1) "Benefit/cost" analysis,
2) "Equalizing discount rate (so-called "Economic internal rate of return - EIRR) analysis and
3) "Screening curves" (Time-cost curves) analysis.

The most important factor which influences economic analysis of thermal power development project is fuel prices. The proposed project is designed to use Semirara coal for a half of the fuel and imported coal for the other half of the fuel, and the average cost of those coals is estimated at US$47.68/ton (CIF) based on prices in 1989 as described in Section 10.2.2. On the other hand, price of heavy oil which has 1.0% of sulfur content equivalent to average sulfur content (0.55%) of coal (Bunker C) is estimated at US$137/kl in 1989.

However, range of fluctuation of heavy oil price has been around 60% for the last 4 years, for example heavy oil price which has 1.0% of sulfur content was US$207/kl.

Heavy oil price, which has wider range of fluctuation than coal price, is expected to become steadily higher. Considering the above situation, the following two kinds of heavy oil prices are adopted for the economic analysis.

		Base Analysis	Sensitivity Analysis
Coal Price	(US$/t)	47.68	10% up
Heavy Oil Price	(US$/kl)	137	207

Based on this evaluation, following conclusion was obtained.

(1) The equalizing discount rate between the proposed project and the alternative thermal power plant is 11.0% in the case of the Base Analysis and is from 25.5% - 27.3% in the case of the Sensitivity Analysis as shown in Section 10.2.

(2) As stated in Section 10.3, the break even point of coal fired thermal plant to oil fired thermal plant is 5,171 hours/year (59.0%) in the base analysis. This means that as the proposed coal fired thermal plant is designed for a plant factor of 70%, it is far more economic than the alternative oil fired thermal plant. At a plant factgor of 70%, the cost of energy at the sending end of the proposed coal fired thermal plant is 5.30 cents US per kWh. If the plant factor drops to 65% or the price of coal increases by 10%, then the cost of energy will become 5.53 cents US per kWh.

(3) Under the base analysis, the optimum scale of development of a coal fired thermal power plant in 1997 will be 888 MW.

From the foregoing analysis, it is concluded that the proposed project with an installed capacity of 600 MW is feasible.

10.2 Benefit/Cost and Equalizing Discount Rate Analysis

10.2.1 Methodology

The equalizing discount rate analysis is to calculate a discount rate which equalizes total costs of the project, incurred from beginning of construction through the end of service life to the corresponding total costs of an alternative thermal power development project.

The equalizing discount rate thus calculated is compared with a social rate of discount which reflects opportunity cost of the capital in the country. If the equalizing discount rate is higher than the social rate of discount the project is judged to be economical and vice versa if the reverse.

The benefit/cost analysis is to calculate a ratio of total costs of the alternative project (Benefit) to the corresponding total costs of the proposed coal-fired power plant project (Cost), both converted to present values applying the social rate of discount.

The above two analysis are essentially the same because for both analysis the social rate of discount is used as the basis for making an economic judgment.

10.2.2 Conditions Adopted for Analysis

Conditions adopted for this economic analysis are as follows:

(1) Cost Estimate

All items including investment cost, operation and maintenance cost and fuel cost are expressed in real terms of 1989.

(2) Sensitivity Analysis

Consistent with the principles of economic evaluation, "Base" evaluation of the project is made on real terms of 1989, i.e excluding any future inflation. But, in order to measure the influence of price rise, sensitivity analysis is made for the following cases:

- 10% price rise for coal
- 65% plant factor (Base: 70%)

(3) Alternative Project

The alternative to the proposed coal-fired power plant is an oil-fired thermal power plant which generates, at the sending-end, the same output and energy as that of the proposed coal-fired power plant. The alternative power plant is assumed to be constructed at the same site as that of the proposed coal-fired power plant.

(4) Annual Disbursement of Investment Cost

Annual disbursement of investment cost (excluding import taxes and all kinds of other duties) of the proposed coal-fired power plant is shown in Chapter 9. Proportions of annual disbursement of the alternative oil-fired power plant were estimated taking into account various similar projects. These disbursements are as follows;

Year	Proposed coal-fired (%)	(1,000 US$)	Alternative oil-fired (%)
1st year (1992)	13.8	(84,509)	13
2nd year (1993)	1.0	(6,395)	1
3rd year (1994)	58.6	(358,070)	60
4th year (1995)	11.3	(68,821)	11
5th year (1996)	15.3	(92,948)	15
Total	100.0	(610,743)	100

(5) Investment Cost of Alternative Oil-fired Power Plant

The investment cost of the alternative oil-fired power plant is assumed to be US$720 per kW installed.

(6) Fuel Prices

The CIF fuel prices, excluding taxes and subsidies, as of the end of 1989 presented by NAPOCOR were used for the economic evaluation. In actual evaluation, however, the following adjusted figures were used.

(Coal Price)

An average price of $52.96/t for Semirara coal and $45.05/t for overseas coal was employed for the coal price. But moisture adjustment was made to Semirara coal according to the item on Moisture (weight) Adjustment included in the data, "Price Adjustment for Selectively-mined Coal" received from NAPOCOR. As a result, the coal price used is $47.68/t.

The price of imported coal made available by NAPOCOR was checked with the price statistics compiled in "Australian Coal Report", and it was found that the price (CIF) given by NAPOCOR is reasoneble.

(Heavy Oil Price)

There are some matters that should be considered for heavy oil price. First, the prices of heavy oil are governed by the sulfur content. Considering environmental problems, the price

should be that of heavy oil having equivalent sulfur content (1.0%) to coal (0.55%) used in this study. Second, fluctuation of coal price is moderate, but for oil price it is considerably great. To be precise, the fluctuation of oil price has been over 60% in these 4 to 5 years. For this reason, the study has been carried out on the fluctuations in the past together with data showing the highest price in recent years.

The heavy oil prices presented by NAPOCOR were P3.6278/l for 1985 and P2.6622/l for 1989. These prices were converted into US dollar using foreign exchange rates in the respective years, and sulfur content adjustment was made by examining the tendency of prices in Southeast Asia. As a result, the price of heavy oil for 1985 was $207/kl (sulfur content adjustment rate 6%) and that for 1989 was $137/kl (sulfur content adjustment rate 13%). These two oil prices were adopted for sensitivity analysis.

(7) Other Parameters

Values of other parameters are as follows:

Parameters	Proposed coal-fired	Alternative oil-fired
* Auxiliary power consumption factor:		
Power	6.0%	4.5%
Energy	7.5%	6.0%
* Thermal efficiency	36.0%	38.0%
* Non-availability of power plant due to:		
- Scheduled maintenance	40 days	40 days
- Forced outage	8.0%	7.0%
* Economic service life	30 years	30 years
* Ratio of operation & maintenance cost to investment cost	4.5%	4.5%
* Plant factor (base)	70.0%	70.0%

(8) Social Rate of Discount

For development projects to be evaluated using the discounted cash-flow analysis, NAPOCOR adopts a discount rate of 15% as the basis for economic judgment. Therefore, for economic justification of the proposed coal-fired power plant project, 15% discount rate is used.

10.2.3 Results of Analysis

Results of the economic analysis carried out under the above-mentioned conditions are shown in the following tables:

- Base analysis	Tables 10.1 (1) to (4)
- Sensitivity analysis:	
* Oil price as US$207/kl	Tables 10.2 (1) to (4)
* 10% price rise for coal	Tables 10.3 (1) to (4)
* 65% plant factor	Tables 10.4 (1) to (4)

Three results are summarized below.

Oil Price (US$/kl)	Plant Factor (%)	Coal Price (US$/t)	Benefit/Cost Ratio at 15% Discount Rate	Equalizing Discount Rate (%)
Base analysis				
137	70.0	47.68	0.950	11.0
Sensitivity analysis				
207	70.0	47.68	1.207	27.3
207	70.0	10% price rise	1.166	25.5
207	65.0	47.68	1.182	25.8

10.3 Screening Curves Analysis

10.3.1 Methodology

Power generation cost per kWh varies with plant factor or annual operation hours. To select the optimum type of power plant which is best adopted for load pattern of power system, it is appropriate to use the so-called "screening curves" method. This method consists of drawing screening curves (time-cost curves) of energy supply cost to be generated by net 1 kW at sending-end for different types of power plants to obtain break-even point for economic operation of these power plants and projecting these break-even points on a forecasted annual load duration curve(*) for the future in order to determine the optimum scale of their development. The break-even point for economic operation can be calculated in the following manner:

(1) For each type of power plant, annual fixed cost including annualized capital cost and operation and maintenance cost per kW, and fuel cost per kWh, both at sending-end of power plant, are calculated.

The annualized capital cost "I" is calculated as follows:

$$I = C \times R \times (1 + R)^N / ((1 + R)^N - 1)$$

Where: C: Investment cost including interest during construction
R: Interest rate
N: Service life (Years)

(2) For each type of power plant, screening curves (time-cost curves) which varies with plant factor is plotted on a graph by using the above fixed cost per kW and fuel cost per kWh.

(3) The intersecting point of time-cost curves of two power plants represents a break-even point for economic operation of these two power plants. If the annual operation hours which correspond to the break-even point of power plants A and B is "H", "H" can be obtained from the following equation:

(Fixed cost per kW of A) + (Fuel cost per kWh of A) x H
= (Fixed cost per kW of B) + (Fuel cost per kWh of B) x H

Therefore:

$$H = \frac{\text{(Difference of fixed costs per kW between A and B)}}{\text{(Difference of fuel cost per kWh between A and B)}}$$

(*) The annual load duration curve used in this economic analysis was estimated from some examples in the countries of Southeast Asia.

10.3.2 Additional Conditions Adopted for Analysis

In addition to the conditions described in Section 10.2.2, the following conditions were used:

(1) Required Capacity of the Luzon Power System in 1997 (Next year of planned commissioning of the project)

To cover any reduction of the generating capacity of power plants due to scheduled maintenance and forced outage or to meet unforeseen sudden increase of power demand, any power system must have a reserve capacity. In this analysis, it was estimated that a capacity equivalent to 15% of peak load should be assured as the reserve capacity. As for peak load of the Luzon system, it is forecasted to be 5,595 MW in 1997, the year of the planned commissioning of the proposed coal-fired power plant, as described in Chapter 3. Therefore, required capacity of the power system in 1997 will be:

$$5,595 \times (1 + 0.15) = 6,434 \text{ MW}$$

(2) Capacity of Existing Base Load Power Plants Immediately before Commissioning of the Project

The base load of the Luzon power system is to be supplied by hydro, geothermal and coal-fired power plants. From the economic view point it is appropriate to operate oil-fired power plants including gas turbine power plants to supply middle

load and peak load. The capacity of existing base load power plants immediatley before commissioning of the proposed coal-fired power plant is estimated as follows:

- Capacity of existing base load power plants (1988)

* Hydro power plants	1,226 MW
* Geothermal power plants	660 MW
* Coal-fired power plants	300 MW
Total	2,186 MW

- Capacity of base load power plants to be newly constructed before commissioning the project

* Mak-Ban (Geothermal)	55 MW
* Small Luz (Geothermal)	40 MW
* Bac-Man I (Geothermal)	110 MW
* Bac-Man II (Geothermal)	110 MW
* Calaca II (Coal-fired)	300 MW
* Coal III	300 MW
Total	915 MW
Grand total	3,101 MW

(3) Interest Rate

Economic evaluation made by screening curves method consists of calculating actual supply cost of energy to be generated by net 1 kW at sending-end for different types of power plant. Therefore, to estimate these supply costs of energy it is necessary to use the prevailing interest rate in the financial market. To evaluate the proposed project, an interest rate of 9%, which is slightly higher than that of usual commercial financial institutions (i.e. Export Import Bank, ADB, Commercial Banks, etc.), is used.

10.3.3 Results of Analysis

The results of analysis made on the above-mentioned conditions are shown in the following tables:

(1) Base analysis using oil price of US$137/kl:

* At interest rate of 9.0% — Table 10.5 (1) and Fig. 10.1 (1)

(2) Sensitivity analysis using oil price of US$207/kl, interest rate of 9.0% and plant factor of 70%:

* Coal price not changed — Table 10.5 (2) and Fig. 10.2 (1) to (2)

* 10% increase for coal price — Table 10.5 (3) and Fig. 10.3 (1) to (2)

(3) Sensitivity analysis using oil price of US$207/kl, interest rate of 9% and plant factor of 65%:

* Coal price not changed — Table 10.5 (4) and Fig. 10.4 (1) to (2)

These results are summarized as follows:

Interest rate (%)	Plant Factor (%)	Oil Price (US$/kl)	Coal Price (US$/t)	Energy cost of coal-fired PP at sending end (US Cent/kWh)	Break-even time (h) (point plant factor) (%)	Optimum scale of coal-fired PP (in 1997)
- Base analysis						
9	70	137	47.68	5.30	5,171 (59.0)	888 MW
- Sensitivity analysis						
9	70	207	47.68	5.30	1,989 (22.7)	1,885 MW
9	70	207	10% increase	5.53	2,166 (24.7)	1,821 MW
9	65	207	47.68	5.53	1,989 (22.7)	1,885 MW

Table 10.1.(1) BASIC DATA OF ALTERNATIVES

Discount rate: 15.0%
Oil price: 137.0 US$/kl
Price rise for coal: 0.0%
Plant factor: 70.0%

Item	Coal-fired	Oil-fired
Installed capacity (MW)	600.0	583.5
Annual generation (GWh)	3679.2	3620.5
Investment cost (1000 US$)	610743	420092
O & M cost (1000 US$)	27483	18904
Fuel cost (1000 US$)	79641	115133

Table 10.1.(2) BENEFIT/COST RATIO & EQUALIZING DISCOUNT RATE

Discount rate: 15.0%
Oil price: 137.0 US$/kl
Price rise for coal: 0.0%
Plant factor: 70.0%

Item	Coal-fired	Oil-fired
PV-Investment cost (1000 US$)	428222	293988
PV-O & M cost (1000 US$)	96212	66178
PV-Fuel cost (1000 US$)	278801	403049
PV-Total cost (1000 US$)	803235	763215
Surplus benefit (1000 US$)	-40020	
Benefit/cost ratio	0.950	

Table 10.1.(3) BENEFIT/COST RATIO & EQUALIZING DISCOUNT RATE

Discount rate: 10.9%
Oil price: 137.0 US$/kl
Price rise for coal: 0.0%
Plant factor: 70.0%

Item	Coal-fired	Oil-fired
PV-Investment cost (1000 US$)	468453	321797
PV-O & M cost (1000 US$)	151186	103991
PV-Fuel cost (1000 US$)	438101	633341
PV-Total cost (1000 US$)	1057740	1059130
Surplus benefit (1000 US$)	1389	
Benefit/cost ratio	1.001	

Table 10.1.(4) BENEFIT/COST RATIO & EQUALIZING DISCOUNT RATE

Discount rate: 11.0%
Oil price: 137.0 US$/kl
Price rise for coal: 0.0%
Plant factor: 70.0%

Item	Coal-fired	Oil-fired
PV-Investment cost (1000 US$)	467400	321069
PV-O & M cost (1000 US$)	149392	102757
PV-Fuel cost (1000 US$)	432903	625826
PV-Total cost (1000 US$)	1049700	1049650
Surplus benefit (1000 US$)	-42	
Benefit/cost ratio	1.000	

Table 10.2.(1) BASIC DATA OF ALTERNATIVES

Discount rate: 15.0%
Oil price: 207.0 US$/kl
Price rise for coal: 0.0%
Plant factor: 70.0%

Item	Coal-fired	Oil-fired
Installed capacity (MW)	600.0	583.5
Annual generation (GWh)	3679.2	3620.5
Investment cost (1000 US$)	610743	420092
O & M cost (1000 US$)	27483	18904
Fuel cost (1000 US$)	79641	173959

Table 10.2.(2) BENEFIT/COST RATIO & EQUALIZING DISCOUNT RATE

Discount rate: 15.0%
Oil price: 207.0 US$/kl
Price rise for coal: 0.0%
Plant factor: 70.0%

Item	Coal-fired	Oil-fired
PV-Investment cost (1000 US$)	428222	293988
PV-O & M cost (1000 US$)	96212	66178
PV-Fuel cost (1000 US$)	278801	608986
PV-Total cost (1000 US$)	803235	969152
Surplus benefit (1000 US$)	165917	
Benefit/cost ratio	1.207	

Table 10.2.(3) BENEFIT/COST RATIO & EQUALIZING DISCOUNT RATE

Discount rate: 27.3%
Oil price: 207.0 US$/kl
Price rise for coal: 0.0%
Plant factor: 70.0%

Item	Coal-fired	Oil-fired
PV-Investment cost (1000 US$)	336129	230304
PV-O & M cost (1000 US$)	33952	23354
PV-Fuel cost (1000 US$)	98386	214905
PV-Total cost (1000 US$)	468468	468563
Surplus benefit (1000 US$)	95	
Benefit/cost ratio	1.000	

Table 10.2.(4) BENEFIT/COST RATIO & EQUALIZING DISCOUNT RATE

Discount rate: 27.4%
Oil price: 207.0 US$/kl
Price rise for coal: 0.0%
Plant factor: 70.0%

Item	Coal-fired	Oil-fired
PV-Investment cost (1000 US$)	335519	229882
PV-O & M cost (1000 US$)	33710	23187
PV-Fuel cost (1000 US$)	97683	213369
PV-Total cost (1000 US$)	466911	466437
Surplus benefit (1000 US$)	-474	
Benefit/cost ratio	0.999	

Table 10.3.(1) BASIC DATA OF ALTERNATIVES

Discount rate: 15.0%
Oil price: 207.0 US$/kl
Price rise for coal: 10.0%
Plant factor: 70.0%

Item	Coal-fired	Oil-fired
Installed capacity (MW)	600.0	583.5
Annual generation (GWh)	3679.2	3620.5
Investment cost (1000 US$)	610743	420092
O & M cost (1000 US$)	27483	18904
Fuel cost (1000 US$)	87605	173959

Table 10.3.(2) BENEFIT/COST RATIO & EQUALIZING DISCOUNT RATE

Discount rate: 15.0%
Oil price: 207.0 US$/kl
Price rise for coal: 10.0%
Plant factor: 70.0%

Item	Coal-fired	Oil-fired
PV-Investment cost (1000 US$)	428222	293988
PV-O & M cost (1000 US$)	96212	66178
PV-Fuel cost (1000 US$)	306681	608986
PV-Total cost (1000 US$)	831115	969152
Surplus benefit (1000 US$)	138037	
Benefit/cost ratio	1.166	

Table 10.3.(3) BENEFIT/COST RATIO & EQUALIZING DISCOUNT RATE

Discount rate: 25.5%
Oil price: 207.0 US$/kl
Price rise for coal: 10.0%
Plant factor: 70.0%

Item	Coal-fired	Oil-fired
PV-Investment cost (1000 US$)	347446	238132
PV-O & M cost (1000 US$)	38740	26647
PV-Fuel cost (1000 US$)	123485	245208
PV-Total cost (1000 US$)	509670	509986
Surplus benefit (1000 US$)	315	
Benefit/cost ratio	1.001	

Table 10.3.(4) BENEFIT/COST RATIO & EQUALIZING DISCOUNT RATE

Discount rate: 25.6%
Oil price: 207.0 US$/kl
Price rise for coal: 10.0%
Plant factor: 70.0%

Item	Coal-fired	Oil-fired
PV-Investment cost (1000 US$)	346800	237685
PV-O & M cost (1000 US$)	38451	26448
PV-Fuel cost (1000 US$)	122565	243382
PV-Total cost (1000 US$)	507817	507516
Surplus benefit (1000 US$)	-302	
Benefit/cost ratio	0.999	

Table 10.4.(1) BASIC DATA OF ALTERNATIVES

Discount rate: 15.0%
Oil price: 207.0 US$/kl
Price rise for coal: 0.0%
Plant factor: 65.0%

Item	Coal-fired	Oil-fired
Installed capacity (MW)	600.0	583.5
Annual generation (GWh)	3416.4	3361.9
Investment cost (1000 US$)	610743	420092
O & M cost (1000 US$)	27483	18904
Fuel cost (1000 US$)	73952	161534

Table 10.4.(2) BENEFIT/COST RATIO & EQUALIZING DISCOUNT RATE

Discount rate: 15.0%
Oil price: 207.0 US$/kl
Price rise for coal: 0.0%
Plant factor: 65.0%

Item	Coal-fired	Oil-fired
PV-Investment cost (1000 US$)	428222	293988
PV-O & M cost (1000 US$)	96212	66178
PV-Fuel cost (1000 US$)	258886	565487
PV-Total cost (1000 US$)	783320	925653
Surplus benefit (1000 US$)	142333	
Benefit/cost ratio	1.182	

Table 10.4.(3) BENEFIT/COST RATIO & EQUALIZING DISCOUNT RATE

Discount rate: 25.8%
Oil price: 207.0 US$/kl
Price rise for coal: 0.0%
Plant factor: 65.0%

Item	Coal-fired	Oil-fired
PV-Investment cost (1000 US$)	345516	236797
PV-O & M cost (1000 US$)	37883	26057
PV-Fuel cost (1000 US$)	101935	222657
PV-Total cost (1000 US$)	485334	485511
Surplus benefit (1000 US$)	177	
Benefit/cost ratio	1.000	

Table 10.4.(4) BENEFIT/COST RATIO & EQUALIZING DISCOUNT RATE

Discount rate: 25.9%
Oil price: 207.0 US$/kl
Price rise for coal: 0.0%
Plant factor: 65.0%

Item	Coal-fired	Oil-fired
PV-Investment cost (1000 US$)	344876	236354
PV-O & M cost (1000 US$)	37603	25865
PV-Fuel cost (1000 US$)	101181	221011
PV-Total cost (1000 US$)	483661	483230
Surplus benefit (1000 US$)	-431	
Benefit/cost ratio	0.999	

Table 10.5.(1) GENERATION COST PER KWH (SENDING-END)

Interest rate: 9.0%
Oil price: US$ 137/kl
Coal price increase: 0.0%
Plant factor: 70.0%

Type of P.Plant	Capital cost (US$/kW)	O & M cost (US$/kW)	Fuel cost (US$/kW)	Total cost (US$/kW)	Unit fuel cost (Cent/kWh)	Sending-end cost (Cent/kWh)
Coal-fired	122.11	45.81	132.73	300.65	2.16	5.30
Oil-fired	83.90	31.51	191.89	307.30	3.18	5.42

Crossover-point for economic operation (Coal/Oil): 5171 hours
Plant factor of the above: 59.0%

Fig. 10.1.(1) SCREENING CURVES (TIME-COST CURVES)

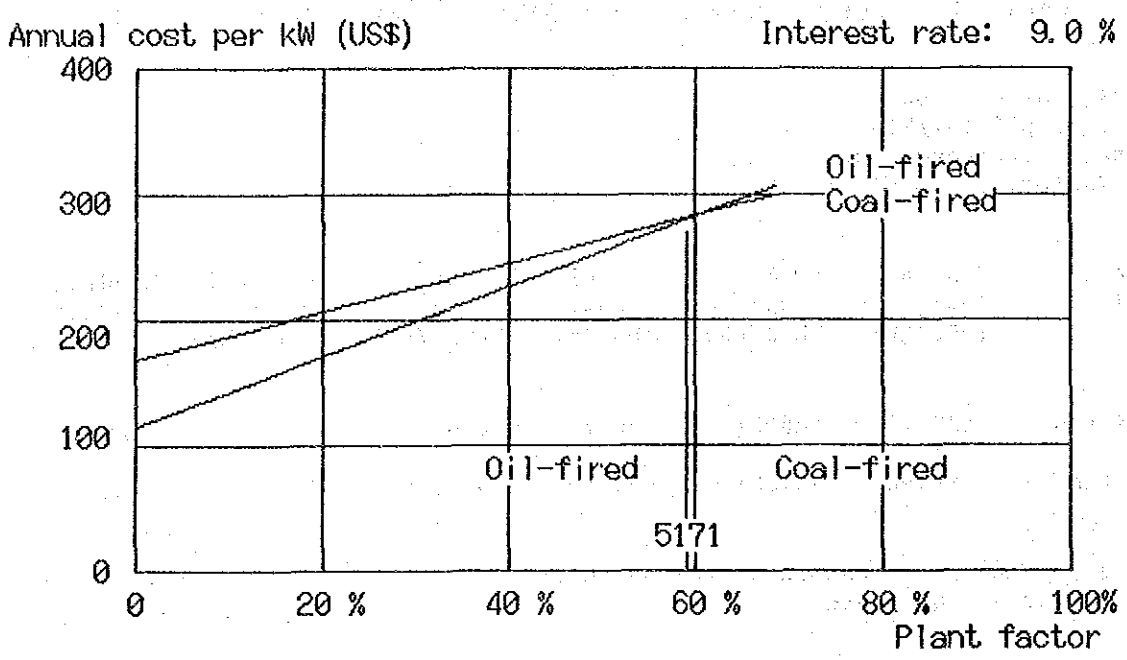


Fig. 10.1.(2) OPTIMUM POWER SOURCE STRUCTURE
(Target year: 1997)

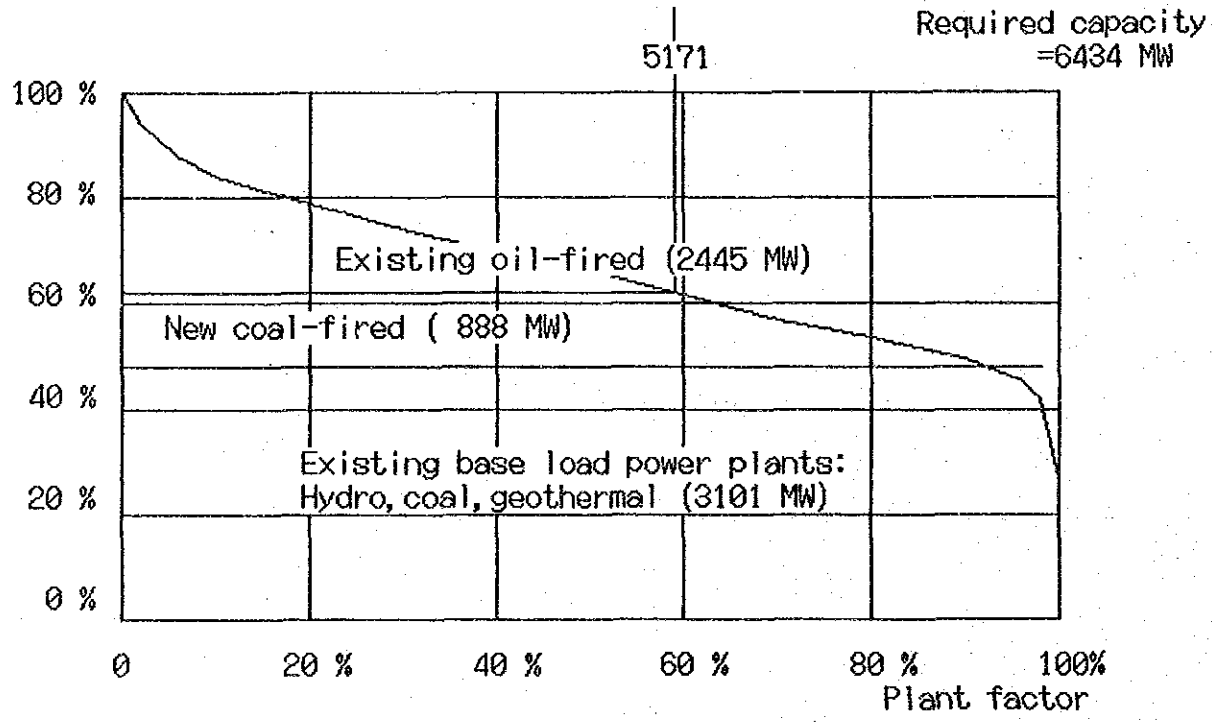


Table 10.5.(2) GENERATION COST PER KWH (SENDING-END)

Interest rate: 9.0%
Oil price: US$ 207/kl
Coal price increase: 0.0%
Plant factor: 70.0%

Type of P.Plant	Capital cost (US$/kW)	O & M cost (US$/kW)	Fuel cost (US$/kW)	Total cost (US$/kW)	Unit fuel cost (Cent/kWh)	Sending-end cost (Cent/kWh)
Coal-fired	122.11	45.81	132.73	300.65	2.16	5.30
Oil-fired	83.90	31.51	289.93	405.34	4.80	7.15

Crossover-point for economic operation (Coal/Oil): 1989 hours
Plant factor of the above: 22.7%

Fig. 10.2.(1) SCREENING CURVES (TIME-COST CURVES)

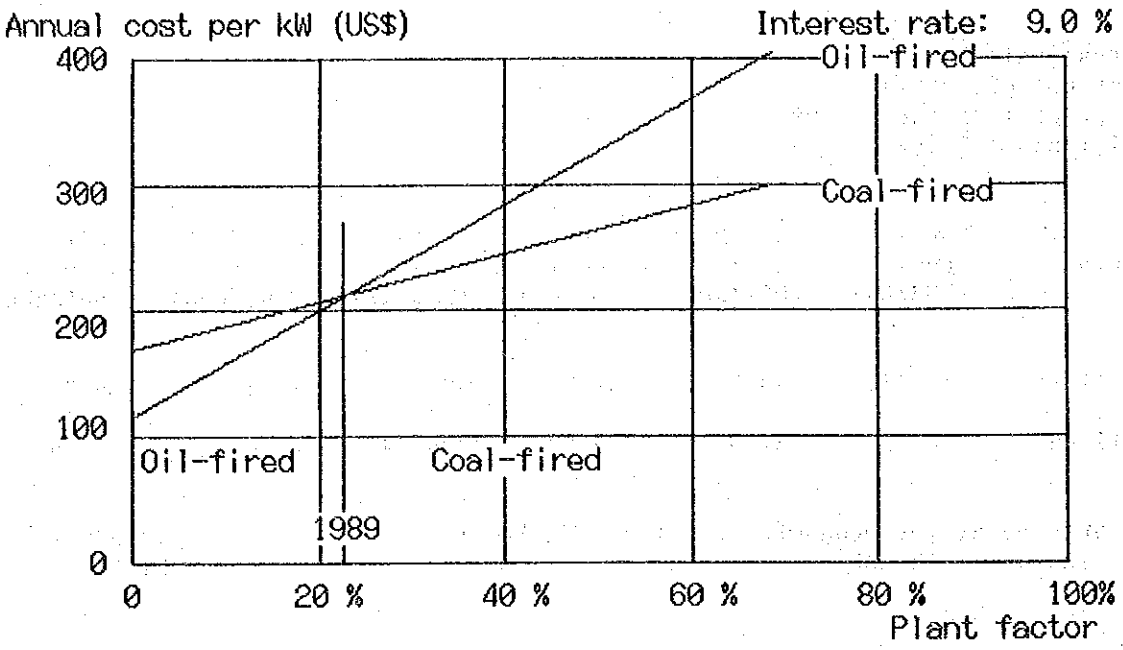


Fig. 10.2.(2) OPTIMUM POWER SOURCE STRUCTURE
(Target year: 1997)

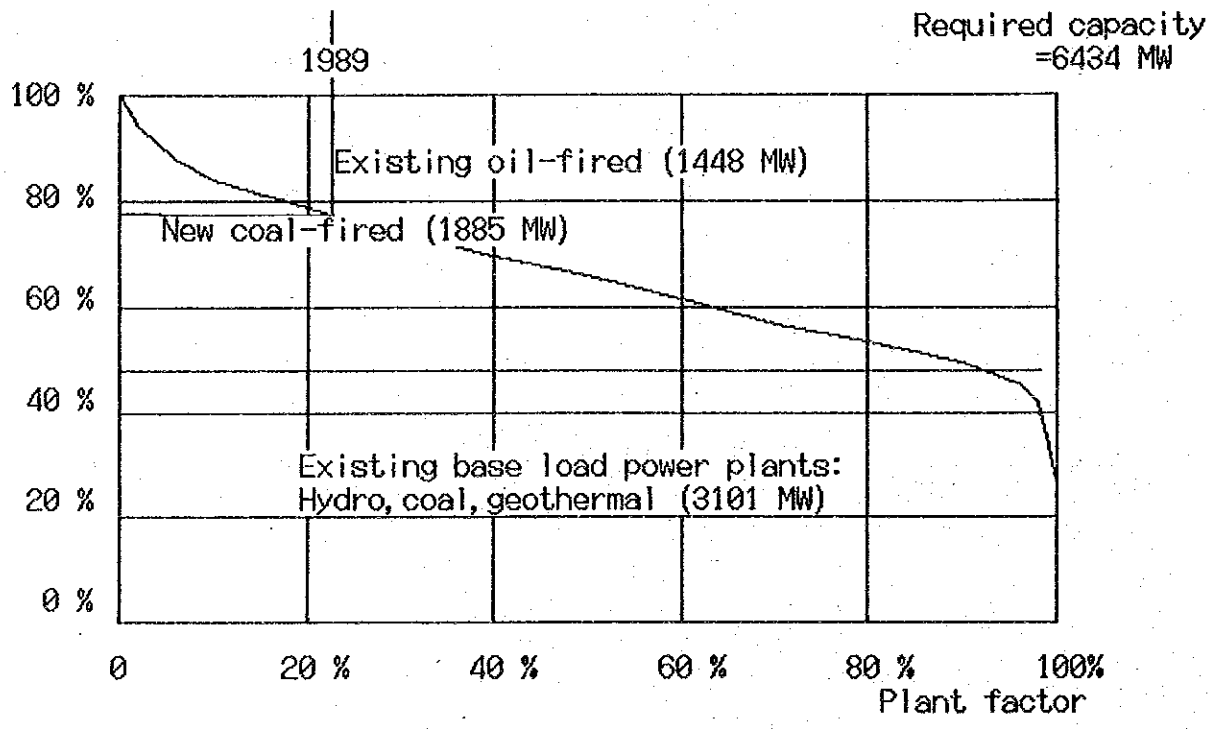


Table 10.5.(3) GENERATION COST PER KWH (SENDING-END)

Interest rate: 9.0%
Oil price: US$ 207/kl
Coal price increase: 10.0%
Plant factor: 70.0%

Type of P.Plant	Capital cost (US$/kW)	O & M cost (US$/kW)	Fuel cost (US$/kW)	Total cost (US$/kW)	Unit fuel cost (Cent/kWh)	Sending-end cost (Cent/kWh)
Coal-fired	122.11	45.81	146.01	313.92	2.38	5.53
Oil-fired	83.90	31.51	289.93	405.34	4.80	7.15

Crossover-point for economic operation (Coal/Oil): 2166 hours
Plant factor of the above: 24.7%

Fig. 10.3.(1) SCREENING CURVES (TIME-COST CURVES)

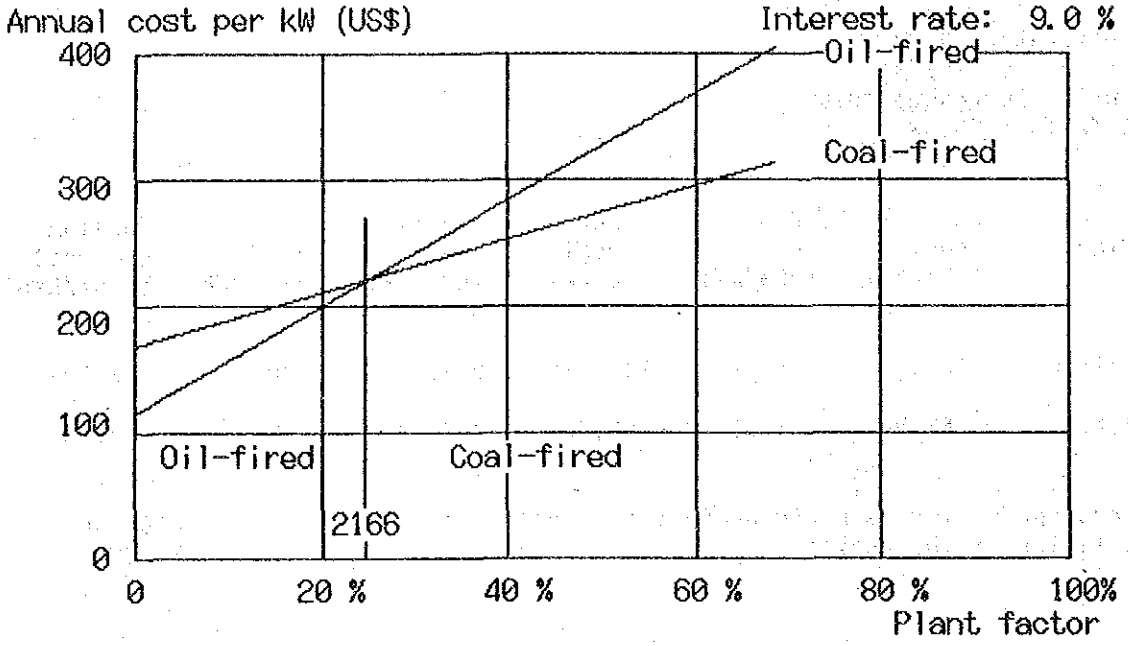


Fig. 10.3.(2) OPTIMUM POWER SOURCE STRUCTURE
(Target year: 1997)

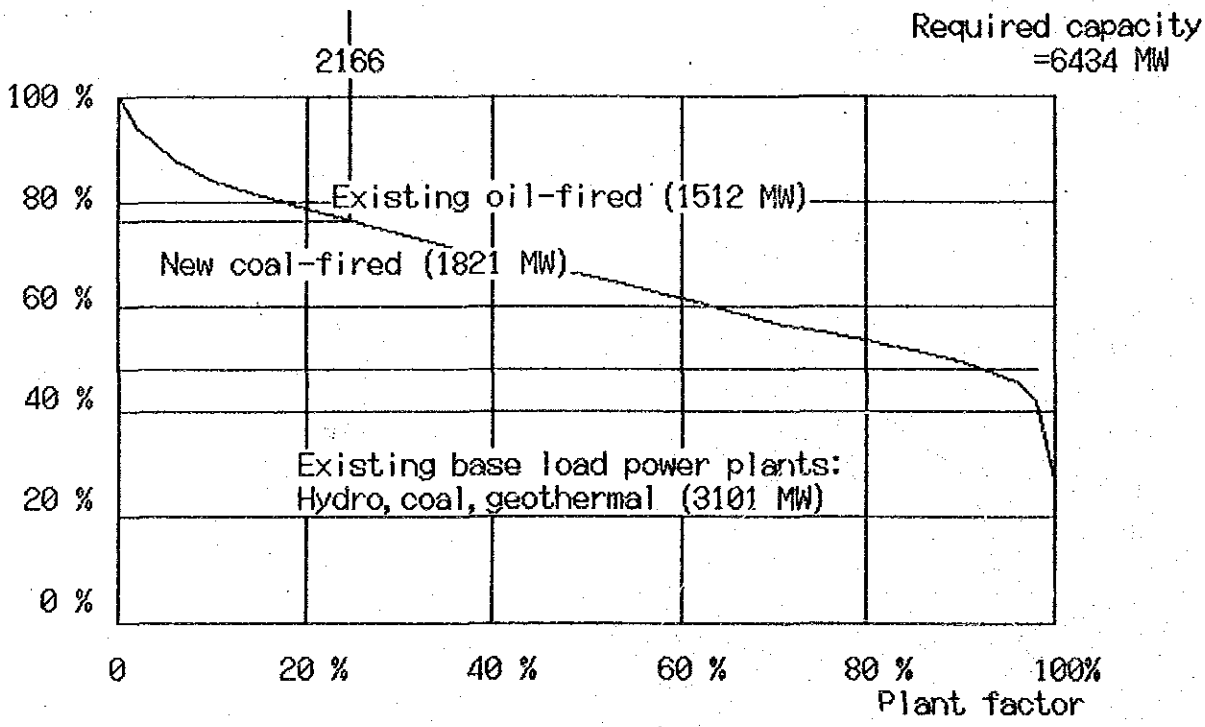


Table 10.5.(4) GENERATION COST PER KWH (SENDING-END)

Interest rate: 9.0%
Oil price: US$ 207/kl
Coal price increase: 0.0%
Plant factor: 65.0%

Type of P.Plant	Capital cost (US$/kW)	O & M cost (US$/kW)	Fuel cost (US$/kW)	Total cost (US$/kW)	Unit fuel cost (Cent/kWh)	Sending-end cost (Cent/kWh)
Coal-fired	122.11	45.81	123.25	291.17	2.16	5.53
Oil-fired	83.90	31.51	269.22	384.63	4.80	7.30

Crossover-point for economic operation (Coal/Oil): 1989 hours
Plant factor of the above: 22.7%

Fig. 10.4.(1) SCREENING CURVES (TIME-COST CURVES)

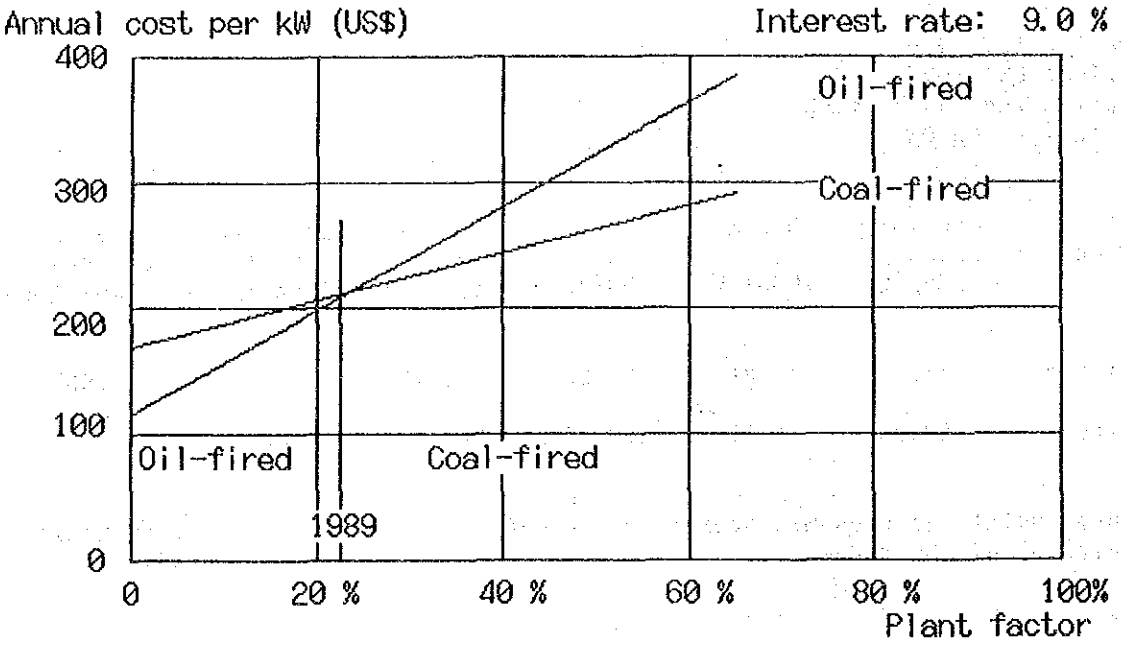
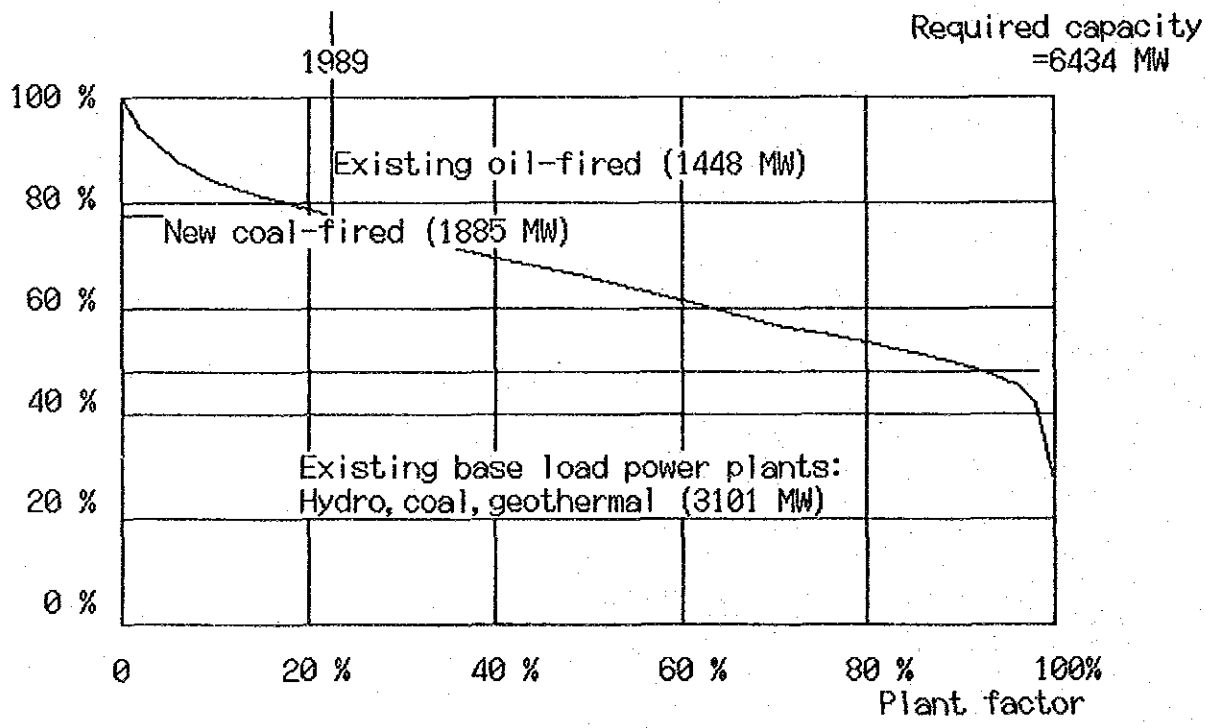


Fig. 10.4.(2) OPTIMUM POWER SOURCE STRUCTURE
(Target year: 1997)



CHAPTER 11

FINANCIAL ANALYSIS

Chapter 11 Financial Analysis

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CHAPTER 11 FINANCIAL ANALYSIS

11.1 General

The results of financial analysis for the project are as follows:

a) The Rate of Return (ratio of operating income to average net fixed assets in operation) will be 0.96% in average for the first 10 years from commissioning and 3.72% in average for the whole service life of 30 years.

b) The yearly cash balance will be influenced by amortization of principal and operating & maintenance costs, therefore, surplus and deficit are presented in the yearly cash balance.

c) The financial internal rate of return will be about 3.37%.

11.2 Methodology

The financial analysis of the project is made by using the following two methods:

(1) Preparation of profit and loss statement and calculation of rate of return, that is:

- Preparation of amortization schedule of borrowings based on assumed loan conditions which are deemed reasonable.

- Preparation of profit and loss statement and calculation of rate of return (ratio of operating income to average net fixed assets in operation).

- Preparation of cash flow sheet and calculation of yearly cash balance.

(2) Calculation of financial internal rate of return (FIRR), that is:

Calculation of discount rate which equalizes the present worth of revenue obtained from sales of energy to the present worth of

total expenses incurred during the whole service life of the power station.

11.3 Conditions for Analysis

Conditions used for this financial analysis of the project are the following:

(1) Loan Conditions

The following loan conditions are assumed for this project:

For construction cost in foreign currency

Overall interest rate	2.9%
Loan period	30 years (after Loan Agreement)
Grace period	10 years (")
Amortization period	20 years

For construction cost in local currency

Overall interest rate	17%
Amortization period	10 years (after commissioning)

(2) Exchange Rates

Exchange rates are assumed to be:

US$1 = P22.0
US$1 = ¥140

(3) Prices of Other Expenses and Revenue

The commissioning is scheduled to commence from May 1996 for unit No. 1 and from October 1996 for unit No. 2. Therefore, operating revenue and expenses are estimated to arise from 1997 and calculated at 1989 prices.

i) Selling price of electricity as the basis of operating revenue

The selling price of electricity in 1989 is estimated to be P1.08/kWh.

ii) Fuel price

a. Coal price is estimated on the basis of 1989 landed cost. For indigenous coal, total moisture is adjusted based on "Price Adjustments for Selectively-mined Coal".

b. Fuel price is calculated at an arithmetic average price of indigenous coal and imported coal, as 50 wt% each of coal planned to be used for fuel.

Coal price in 1989

Indigenous coal	
(Before total moisture adjusted)	US$52.96/ton
(After total moisture adjusted)	US$50.30/ton
Imported coal	US$60.00/ton
Average	US$55.15/ton

iii) Operation, maintenance and administration costs

a. Operation and maintenance cost

The ratio of expenses, including costs for prevention of equipment deterioration and for the extension and improvement in the future based on our experience, to the direct construction cost excluding VAT is estimated as follows:

For the first years after commissioning	1.5%
For the 15th year after commissioning	4.5%

b. Administration cost

Administration cost is calculated based on the results of NAPOCOR's coal-fired power stations in 1989.

[(Generation Overhead) + (TL/SS/RO/HO Overhead)]
= (0.05155 + 0.008156)
= P0.06/kWh

iv) Depreciation cost

Depreciation cost is calculated by Sum-of-the Year's-Digit Method for a depreciation period of 30 years from the total construction cost including interest during construction.

11.4 Calculation of Profit, Loss and Rate of Return

11.4.1 Annual Disbursement Schedule and Interest during Construction

Annual disbursement schedule of capital cost including VAT and interest during construction are as shown below:

(Unit: US$ x 1,000)

	Construction Cost			Interest during Construction			Total Construction Cost		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1992	68,864	15,645	84,509	330	435	765	69,194	16,080	85,274
1993	3,989	2,400	6,389	2,051	2,847	4,898	6,040	5,247	11,287
1994	296,744	99,985	396,729	5,351	12,219	17,570	302,095	112,204	414,299
1995	64,110	12,656	76,766	12,080	21,560	33,640	76,190	34,216	110,406
1996	70,503	22,445	92,948	13,562	24,386	37,948	84,065	46,831	130,896
Total	504,210	153,131	657,341	33,374	61,447	94,821	537,584	214,578	752,162

11.4.2 Operating Revenue (Revenue from Sales of Energy)

The rate per unit sold of electricity in 1989 is estimated to be P1.08/kWh.

Annual output of electricity for sales is calculated, with the ratios of auxiliary power consumption at 7.5% and transmission loss at 3%, as follows:

At generating-end	600 MW x 8,760 h x 0.7	= 3,679,200 MWh/year
At sending-end	3,679,200 x (1-0.075)	= 3,403,260 MWh/year
At receiving-end	3,403,260 x (1 - 0.03)	= 3,301,162 MWh/year

Therefore, annual revenue from sales of electricity is estimated to be:

$3,301,162 \times 10^3 \times$ P1.08/kWh / P22.0/US$
= US$162,057 $\times 10^3$/year

11.4.3 Operating Expenses

(1) Operation, Maintenance and Administration Costs

a. Operation and maintenance cost is calculated based on direct construction cost excluding VAT as follows:

$$F = 0.2143 (n - 1) + 1.5\%$$

where, F = Ratio of operation and maintenance cost
n = any year after commissioning

b. Administration cost can be obtained by multiplying annual output of electricity at generating-end by the ratio of administration cost at P0.06/kWh.

$3,679,200 \times 10^3$ kWh/year x P0.06/kWh / P22.0/US$
= US$10,034 $\times 10^3$/year

c. Direct construction cost (excluding VAT)

US$551,451 $\times 10^3$

Therefore, operation and administration costs in n-year will be:

$$US\$551,451 \times 10^3 \ (0.2143\ (n-1) + 1.5) \times 10^{-2} + 10,034 \times 10^3 \text{ /year}$$

(2) Fuel Cost

As shown in section 11.3 (3) ii), the unit fuel cost in 1989 is estimated to be US$55.15/ton.

Annual consumption of fuel will be:

$$\frac{600 \times 10^3 \text{ kW} \times 860 \text{ kcal/kWh} \times 8,760 \text{ h/y} \times 0.7}{5,262 \text{ kcal/kg} \times 0.36} \times 10^{-3}$$

$$= 1,670,315 \text{ ton/year}$$

Therefore, annual fuel cost is estimated to be:

$$1,670,315 \text{ ton/year} \times US\$55.15/\text{ton}$$
$$= US\$92,118 \times 10^3 \text{ /year}$$

(3) Depreciation Cost

Depreciation cost is calculated based on the total construction cost including interest during construction US$753,680 x 10^3.

Using Sum-of-the Year's-Digit Method with a depreciation period of 30 years, the annual ratio of depreciation cost is calculated as follows:

For the first year

$$\frac{n}{n\ \frac{(n+1)}{2}} \qquad n: \text{ Years of depreciation period}$$

For the second year and thereafter, numerator will be (n-1), (n-2), (n-3) ..... (n-29), while the denominator shall remain unchanged.

11.4.4 Amortization Schedule of Borrowings

Table 11.3-1 shows the amortization schedule of borrowings in accordance with the conditions stated in section 11.3 (1).

11.4.5 Profit and Loss Calculation

The above-mentioned operating revenue, operating expenses and financial expenses (interest) calculated in Table 11.3-2 are the basis to prepare the profit and loss statement given in table 11.3-2.

11.4.6 Rate of Return

From the profit and loss statement given in Table 11.3-2, the overall average rate of return (ratio of operating income to average net fixed assets in operation) and the rate of net income (ratio of net income to average net fixed assets in operation) for the first 10 years and for the whole service life of 30 years are calculated as follows:

a) For the first 10 years

- Accumulated amount of average net fixed assets in operation — US$5,325,795.5 x 10^3
- Accumulated amount of operating income — US$50,922 x 10^3
- Rate of Return — 50,922/5,325,795.5 = 0.96%

b) For the whole service life of 30 years

- Accumulated amount of average net fixed assets in operation — US$7,646,975.5 x 10^3
- Accumulated amount of operating income — US$284,144 x 10^3
- Rate of Return — 284,144/7,646,975.5 = 3.72%

11.4.7 Cash Flow and Cash Balance

Table 11.3-1 and Table 11.3-2 gives the cash flow from the starting year of the project to the end of its service life given in Table 11.3-3. From this, it is concluded that:

- Yearly cash balance shows surplus and deficit, however, accumulated cash balance will be US$103,435.5 in the red.

11.5 Calculation of Financial Internal Rate of Return (FIRR)

So-called "Financial Internal Rate of Return (FIRR)" is the discount rate which equalizes the present worth of total revenue of the project to the present worth of total expenses incurred from the beginning of the project to the end of its service life. Such an equalizing discount rate is obtained by the following discount calculations.

11.5.1 Cash Flow

For the discount calculation, interest and depreciation must be excluded from cash flow. The cash flow of the project to be used for this purpose is given in Table 11.4-1.

11.5.2 Financial Internal Rate of Return (FIRR)

The discount rate which makes ± 0 the accumulated total of the balance between revenue and expenses during the service life of 30 years after the commissioning converted into present worth in the starting year of the project is calculated to be about 3.37%.

Table 11.3-1 Procurement Fund and Amortization Schedule US$ x 1,000

No.	Year	Fund Procurement			Amortization Schedule							
					Foreign Currency				Local Currency			
		Foreign Currency	Local Currency	Total	Interest	Principal	Total	Outstanding Balance	Interest	Principal	Total	Outstanding Balance
	1992	68,864	15,645	84,509	330.0			68,864.0	435			15,645
	1993	3,995	2,400	6,395	2,051.0			72,859.0	2,847			18,045
	1994	296,744	99,985	396,729	5,352.0			369,603.0	12,219			118,030
	1995	64,117	12,645	76,762	12,080.0			433,720.0	21,559			130,675
	1996	70,507	22,441	92,948	13,563.0			504,227.0	24,384			153,116
1	1997				14,622.6		14,622.6	504,227.0	26,030	6,838	32,868	146,278
2	1998				14,622.6		14,622.6	504,227.0	24,867	8,001	32,868	138,277
3	1999				14,622.6		14,622.6	504,227.0	23,507	9,361	32,868	128,916
4	2000				14,622.6		14,622.6	504,227.0	21,916	10,952	32,868	117,964
5	2001				14,622.6	25,211.3	39,833.9	479,015.6	20,054	12,814	32,868	105,150
6	2002				13,891.5	25,211.3	39,102.8	453,804.3	17,876	14,992	32,868	90,158
7	2003				13,160.3	25,211.3	38,371.6	428,592.9	15,327	17,541	32,868	72,617
8	2004				12,429.2	25,211.3	37,640.5	403,381.6	12,345	20,523	32,868	52,094
9	2005				11,698.1	25,211.3	36,909.4	378,170.2	8,856	24,012	32,868	28,082
10	2006				10,966.9	25,211.3	36,178.2	352,958.9	4,774	28,082	32,856	0
11	2007				10,235.8	25,211.3	35,447.1	327,747.5				
12	2008				9,504.7	25,211.3	34,716.0	302,536.2				
13	2009				8,773.5	25,211.3	33,984.8	277,324.8				
14	2010				8,042.4	25,211.3	33,253.7	252,113.5				
15	2011				7,311.3	25,211.3	32,522.6	226,902.1				
16	2012				6,580.2	25,211.3	31,791.5	201,690.8				
17	2013				5,849.0	25,211.3	31,060.3	176,479.4				
18	2014				5,117.9	25,211.3	30,329.2	151,268.1				
19	2015				4,386.8	25,211.3	29,598.1	126,056.7				
20	2016				3,655.6	25,211.3	28,866.9	100,845.4				
21	2017				2,924.5	25,211.3	28,135.8	75,634.0				
22	2018				2,193.4	25,211.3	27,404.7	50,422.7				
23	2019				1,462.3	25,211.3	26,673.6	25,211.3				
24	2020				731.1	25,211.3	25,942.4	0.0				
25	2021											
26	2022											
27	2023											
28	2024											
29	2025											
30	2026											
Total		504,227	153,116	657,343	212,027.5	504,227	716,254.5		175,552	153,116	328,668	

Table 11.3-2 Profit and Loss Statement US$ x 1,000

No.	Year	Operating Revenue	Operating Expenses				Operating Income	Financial Expenses		Net Income	
			O&M, Administration	Fuel Cost	Depreciation	Total		Interest during Const.	Interest	Yearly Amount	Accumulated Amount
	1992							765.0		-765.0	-765.0
	1993							4,898.0		-4,898.0	-5,663.0
	1994							17,571.0		-17,571.0	-23,234.0
	1995							33,639.0		-33,639.0	-56,873.0
	1996							37,947.0		-37,947.0	-94,820.0
1	1997	162,057	18,291	92,118	48,527	158,936	3,121		40,652.6	-37,531.6	-132,351.6
2	1998	162,057	19,470	92,118	46,909	158,497	3,560		39,489.6	-35,929.6	-168,281.2
3	1999	162,057	20,650	92,118	45,292	158,060	3,997		38,129.6	-34,132.6	-202,413.8
4	2000	162,057	21,830	92,118	43,674	157,622	4,435		36,538.6	-32,103.6	-234,517.4
5	2001	162,057	23,009	92,118	42,056	157,183	4,874		34,676.6	-29,802.6	-264,320.0
6	2002	162,057	24,189	92,118	40,439	156,746	5,311		31,767.5	-26,456.5	-290,776.5
7	2003	162,057	25,369	92,118	38,821	156,308	5,749		28,487.3	-22,738.3	-313,514.8
8	2004	162,057	26,548	92,118	37,204	155,870	6,187		24,774.2	-18,587.2	-332,102.0
9	2005	162,057	27,728	92,118	35,586	155,432	6,625		20,554.1	-13,929.1	-346,031.1
10	2006	162,057	28,907	92,118	33,969	154,994	7,063		15,740.9	-8,677.9	-354,709.0
11	2007	162,057	30,087	92,118	32,351	154,556	7,501		10,235.8	-2,734.8	-357,443.8
12	2008	162,057	31,267	92,118	30,734	154,119	7,938		9,504.7	-1,566.7	-359,010.5
13	2009	162,057	32,446	92,118	29,116	153,680	8,377		8,773.5	-396.5	-359,407.0
14	2010	162,057	33,626	92,118	27,498	153,242	8,815		8,042.4	772.6	-358,634.4
15	2011	162,057	34,806	92,118	25,881	152,805	9,252		7,311.3	1,940.7	-356,693.7
16	2012	162,057	35,985	92,118	24,263	152,366	9,691		6,580.2	3,110.8	-353,582.9
17	2013	162,057	37,165	92,118	22,646	151,929	10,128		5,849.0	4,279.0	-349,303.9
18	2014	162,057	38,345	92,118	21,028	151,491	10,566		5,117.9	5,448.1	-343,855.8
19	2015	162,057	39,524	92,118	19,411	151,053	11,004		4,386.8	6,617.2	-337,238.6
20	2016	162,057	40,704	92,118	17,793	150,615	11,442		3,655.6	7,786.4	-329,452.2
21	2017	162,057	41,883	92,118	16,176	150,177	11,880		2,924.5	8,955.5	-320,496.7
22	2018	162,057	43,063	92,118	14,558	149,739	12,318		2,193.4	10,124.6	-310,372.1
23	2019	162,057	44,243	92,118	12,940	149,301	12,756		1,462.3	11,293.7	-299,078.4
24	2020	162,057	45,422	92,118	11,323	148,863	13,194		731.1	12,462.9	-286,615.5
25	2021	162,057	46,602	92,118	9,705	148,425	13,632			13,632.0	-272,983.5
26	2022	162,057	47,782	92,118	8,088	147,988	14,069			14,069.0	-258,914.5
27	2023	162,057	48,961	92,118	6,470	147,549	14,508			14,508.0	-244,406.5
28	2024	162,057	50,141	92,118	4,853	147,112	14,945			14,945.0	-229,461.5
29	2025	162,057	51,320	92,118	3,235	146,673	15,384			15,384.0	-214,077.5
30	2026	162,057	52,500	92,118	1,617	146,235	15,822			15,822.0	-198,255.5
Total		4,861,710	1,061,863	2,763,540	752,163	4,577,566	284,144	94,820	387,579.5	-198,255.5	

Table 11.3-3 Cash Flow US$ x 1,000

No.	Year	Cash Inflow				Cash Outflow				Balance	
		Fund Procurement	Net Income	Depreci-ation	Total	Repayment of Principal				Yearly Amount	Acuumlated Amount
						Construc.	F.C.	L.C.	Total		
	1992	84,509	-765.0		83,744.0	84,509.0			84,509.0	-765.0	-765.0
	1993	6,395	-4,898.0		1,497.0	6,395.0			6,395.0	-4,898.0	-5,663.0
	1994	396,729	-17,571.0		379,158.0	396,729.0			396,729.0	-17,571.0	-23,234.0
	1995	76,762	-33,639.0		43,123.0	76,762.0			76,762.0	-33,639.0	-56,873.0
	1996	92,948	-37,947.0		55,001.0	92,948.0			92,948.0	-37,947.0	-94,820.0
1	1997		-37,531.6	48,527	10,995.4			6,838	6,838.0	4,157.4	-90,662.6
2	1998		-35,929.6	46,909	10,979.4			8,001	8,001.0	2,978.4	-87,684.2
3	1999		-34,132.6	45,292	11,159.4			9,361	9,361.0	1,798.4	-85,885.8
4	2000		-32,103.6	43,674	11,570.4			10,952	10,952.0	618.4	-85,267.4
5	2001		-29,802.6	42,056	12,253.4		25,211.35	12,814	38,025.3	-25,771.9	-111,039.3
6	2002		-26,456.5	40,439	13,982.5		25,211.35	14,992	40,203.3	-26,220.8	-137,260.2
7	2003		-22,738.3	38,821	16,082.7		25,211.35	17,541	42,752.3	-26,669.6	-163,929.8
8	2004		-18,587.2	37,204	18,616.8		25,211.35	20,523	45,734.3	-27,117.5	-191,047.4
9	2005		-13,929.1	35,586	21,656.9		25,211.35	24,012	49,223.3	-27,566.4	-218,613.8
10	2006		-8,677.9	33,969	25,291.1		25,211.35	28,082	53,293.3	-28,002.2	-246,616.1
11	2007		-2,734.8	32,351	29,616.2		25,211.35		25,211.3	4,404.8	-242,211.2
12	2008		-1,566.7	30,734	29,167.3		25,211.35		25,211.3	3,955.9	-238,255.3
13	2009		-396.5	29,116	28,719.5		25,211.35		25,211.3	3,508.1	-234,747.1
14	2010		772.6	27,498	28,270.6		25,211.35		25,211.3	3,059.2	-231,687.9
15	2011		1,940.7	25,881	27,821.7		25,211.35		25,211.3	2,610.3	-229,077.5
16	2012		3,110.8	24,263	27,373.8		25,211.35		25,211.3	2,162.4	-226,915.1
17	2013		4,279.0	22,646	26,925.0		25,211.35		25,211.3	1,713.6	-225,201.4
18	2014		5,448.1	21,028	26,476.1		25,211.35		25,211.3	1,264.7	-223,936.7
19	2015		6,617.2	19,411	26,028.2		25,211.35		25,211.3	816.8	-223,119.8
20	2016		7,786.4	17,793	25,579.4		25,211.35		25,211.3	368.0	-222,751.8
21	2017		8,955.5	16,176	25,131.5		25,211.35		25,211.3	-79.8	-222,831.6
22	2018		10,124.6	14,558	24,682.6		25,211.35		25,211.3	-528.7	-223,360.4
23	2019		11,293.7	12,940	24,233.7		25,211.35		25,211.3	-977.6	-224,338.0
24	2020		12,462.9	11,323	23,785.9		25,211.35		25,211.3	-1,425.4	-225,763.5
25	2021		13,632.0	9,705	23,337.0					23,337.0	-202,426.5
26	2022		14,069.0	8,088	22,157.0					22,157.0	-180,269.5
27	2023		14,508.0	6,470	20,978.0					20,978.0	-159,291.5
28	2024		14,945.0	4,853	19,798.0					19,798.0	-139,493.5
29	2025		15,384.0	3,235	18,619.0					18,619.0	-120,874.5
30	2026		15,822.0	1,617	17,439.0					17,439.0	-103,435.5
Total		657,343	-198,255.5	752,163	1,211,250.5	657,343	504,227	153,116	1,314,686	-103,435.5	

Table 11.3-4 Fixed Assetes in Operation and Rate of Return US$ x 1,000

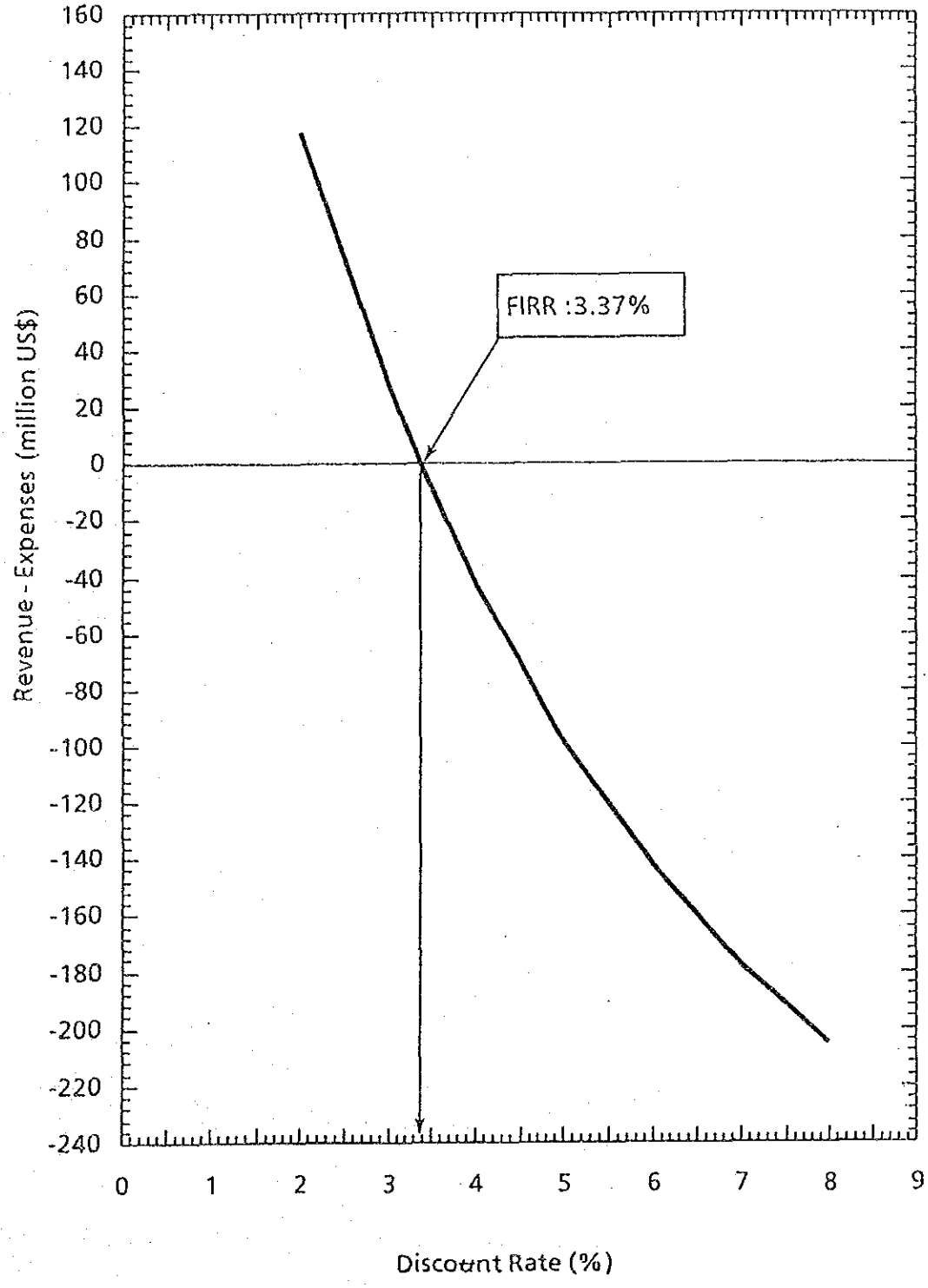
No.	Year	Fixed Assetes in Opearation					Operating Income		Rate of Return
		Balance of Bigining of Year	Depreci-ation	Balance of End of Year	Yearly Average	Yearly Average Acuumlated	Yearly Amount	Accumlated Amount	
	1992					(A)		(B)	(B)/(A)
	1993								
	1994								
	1995								
	1996								
1	1997	752,163	48,527	703,636	727,899.5	727,899.5	3,121	3,121	
2	1998	703,636	46,909	656,727	680,181.5	1,408,081.0	3,560	6,681	
3	1999	656,727	45,292	611,435	634,081.0	2,042,162.0	3,997	10,678	
4	2000	611,435	43,674	567,761	589,598.0	2,631,760.0	4,435	15,113	
5	2001	567,761	42,056	525,705	546,733.0	3,178,493.0	4,874	19,987	0.63
6	2002	525,705	40,439	485,266	505,485.5	3,683,978.5	5,311	25,298	
7	2003	485,266	38,821	446,445	465,855.5	4,149,834.0	5,749	31,047	
8	2004	446,445	37,204	409,241	427,843.0	4,577,677.0	6,187	37,234	
9	2005	409,241	35,586	373,655	391,448.0	4,969,125.0	6,625	43,859	
10	2006	373,655	33,969	339,686	356,670.5	5,325,795.5	7,063	50,922	0.96
11	2007	339,686	32,351	307,335	323,510.5	5,649,306.0	7,501	58,423	
12	2008	307,335	30,734	276,601	291,968.0	5,941,274.0	7,938	66,361	
13	2009	276,601	29,116	247,485	262,043.0	6,203,317.0	8,377	74,738	
14	2010	247,485	27,498	219,987	233,736.0	6,437,053.0	8,815	83,553	
15	2011	219,987	25,881	194,106	207,046.5	6,644,099.5	9,252	92,805	1.4
16	2012	194,106	24,263	169,843	181,974.5	6,826,074.0	9,691	102,496	
17	2013	169,843	22,646	147,197	158,520.0	6,984,594.0	10,128	112,624	
18	2014	147,197	21,028	126,169	136,683.0	7,121,277.0	10,566	123,190	
19	2015	126,169	19,411	106,758	116,463.5	7,237,740.5	11,004	134,194	
20	2016	106,758	17,793	88,965	97,861.5	7,335,602.0	11,442	145,636	1.99
21	2017	88,965	16,176	72,789	80,877.0	7,416,479.0	11,880	157,516	
22	2018	72,789	14,558	58,231	65,510.0	7,481,989.0	12,318	169,834	
23	2019	58,231	12,940	45,291	51,761.0	7,533,750.0	12,756	182,590	
24	2020	45,291	11,323	33,968	39,629.5	7,573,379.5	13,194	195,784	
25	2021	33,968	9,705	24,263	29,115.5	7,602,495.0	13,632	209,416	2.75
26	2022	24,263	8,088	16,175	20,219.0	7,622,714.0	14,069	223,485	
27	2023	16,175	6,470	9,705	12,940.0	7,635,654.0	14,508	237,993	
28	2024	9,705	4,853	4,852	7,278.5	7,642,932.5	14,945	252,938	
29	2025	4,852	3,235	1,617	3,234.5	7,646,167.0	15,384	268,322	
30	2026	1,617	1,617	0	808.5	7,646,975.5	15,822	284,144	3.72
Total		8,023,057		7,270,894			284,144		

Table 11.4-1 Cashflow for Calculation of FIRR

US$ x 1,000

No.	Year	Cash Inflow	Cash Outflow				Balance	Net Present Value				
								Discount Rate (%)				
		Operating Revenue	Construction Cost	O&M, Administration Cost	Fuel Cost	Total		2	3	3.36897014	4	5
1	1,992		84,509			84,509	-84,509	-82,851.96	-82,047.57	-81,754.70	-81,258.65	-80,484.76
2	1,993		6,395			6,395	-6,395	-6,146.67	-6,027.90	-5,984.94	-5,912.54	-5,800.45
3	1,994		396,729			396,729	-396,729	-373,846.60	-363,063.24	-359,189.29	-352,690.64	-342,709.43
4	1,995		76,762			76,762	-76,762	-70,916.22	-68,202.04	-67,233.46	-65,616.48	-63,152.29
5	1,996		92,948			92,948	-92,948	-84,185.87	-80,177.76	-78,756.98	-76,396.48	-72,827.19
6	1,997	162,057		18,291	92,118	110,409	51,648	45,861.95	43,254.39	42,336.24	40,818.16	38,540.53
7	1,998	162,057		19,470	92,118	111,588	50,469	43,936.30	41,035.92	40,021.50	38,352.29	35,867.38
8	1,999	162,057		20,650	92,118	112,768	49,289	42,067.69	38,909.19	37,811.89	36,014.99	33,360.74
9	2,000	162,057		21,830	92,118	113,948	48,109	40,255.46	36,871.54	35,703.81	33,800.75	31,011.49
10	2,001	162,057		23,009	92,118	115,127	46,930	38,498.95	34,920.33	33,693.69	31,704.23	28,810.95
11	2,002	162,057		24,189	92,118	116,307	45,750	36,795.03	33,050.77	31,775.98	29,718.33	26,749.08
12	2,003	162,057		25,369	92,118	117,487	44,570	35,143.14	31,260.50	29,947.48	27,838.29	24,818.24
13	2,004	162,057		26,548	92,118	118,666	43,391	33,542.65	29,547.16	28,205.07	26,059.51	23,011.17
14	2,005	162,057		27,728	92,118	119,846	42,211	31,990.66	27,906.44	26,543.79	24,375.80	21,319.42
15	2,006	162,057		28,907	92,118	121,025	41,032	30,487.38	26,336.88	24,961.45	22,783.61	19,737.09
16	2,007	162,057		30,087	92,118	122,205	39,852	29,030.02	24,834.45	23,453.46	21,277.31	18,256.66
17	2,008	162,057		31,267	92,118	123,385	38,672	27,618.09	23,397.20	22,017.26	19,853.17	16,872.47
18	2,009	162,057		32,446	92,118	124,564	37,493	26,251.08	22,023.19	20,650.31	18,507.60	15,579.12
19	2,010	162,057		33,626	92,118	125,744	36,313	24,926.36	20,708.80	19,348.55	17,235.69	14,370.29
20	2,011	162,057		34,806	92,118	126,924	35,133	23,643.50	19,452.29	18,109.70	16,034.24	13,241.26
21	2,012	162,057		35,985	92,118	128,103	33,954	22,402.03	18,251.95	16,931.55	14,900.16	12,187.53
22	2,013	162,057		37,165	92,118	129,283	32,774	21,199.50	17,104.50	15,810.48	13,829.17	11,203.79
23	2,014	162,057		38,345	92,118	130,463	31,594	20,035.52	16,008.42	14,744.50	12,818.52	10,286.10
24	2,015	162,057		39,524	92,118	131,642	30,415	18,909.66	14,962.16	13,731.66	11,865.54	9,430.72
25	2,016	162,057		40,704	92,118	132,822	29,235	17,819.63	13,962.80	12,768.74	10,966.54	8,633.18
26	2,017	162,057		41,883	92,118	134,001	28,056	16,765.68	13,009.42	11,854.43	10,119.50	7,890.49
27	2,018	162,057		43,063	92,118	135,181	26,876	15,745.63	12,099.28	10,985.74	9,321.04	7,198.69
28	2,019	162,057		44,243	92,118	136,361	25,696	14,759.13	11,231.12	10,161.08	8,569.04	6,554.89
29	2,020	162,057		45,422	92,118	137,540	24,517	13,805.82	10,403.70	9,378.89	7,861.41	5,956.31
30	2,021	162,057		46,602	92,118	138,720	23,337	12,883.68	9,614.54	8,636.53	7,195.23	5,399.66
31	2,022	162,057		47,782	92,118	139,900	22,157	11,992.39	8,862.52	7,932.59	6,568.67	4,882.50
32	2,023	162,057		48,961	92,118	141,079	20,978	11,131.63	8,146.53	7,265.70	5,979.95	4,402.57
33	2,024	162,057		50,141	92,118	142,259	19,798	10,299.49	7,464.37	6,633.53	5,426.52	3,957.08
34	2,025	162,057		51,320	92,118	143,438	18,619	9,496.21	6,815.39	6,035.17	4,907.08	3,544.22
35	2,026	162,057		52,500	92,118	144,618	17,439	8,719.98	6,197.53	5,468.45	4,419.31	3,161.52
Total		4,861,710	657,343	1,061,863	2,763,540	4,482,746	378,964.00	118,066.92	28,124.77	0.00	-42,753.14	-98,738.98

Fig. 11.5-1 Financial Internal Rate of Return (FIRR)



CHAPTER 12

CONSIDERATIONS FOR FUTURE EXTENSION

Chapter 12 Considerations for Future Extension

Contents

Chapter 12 CONSIDERATIONS FOR FUTURE EXTENSION

If NAPOCOR has an intention of installing units No. 3 and 4 at the Masinloc site in the future, the following issues should be taken carefully into consideration at the time of actual design stage of this project.

1) Regarding the coal unloading facility, about 5,000 DWT new coal unloading jetty and off-shore conveyor shall be constructed besides the 60,000 DWT facility. It is difficult to extend the 60,000 DWT facility because it would interfere with the operation of No. 1 and No. 2 units.

2) Regarding the condenser cooling facility, all relevant facilities for No. 3 and No. 4 units shall be planned as new one. In this connection, the location and layout shall be considered carefully to avoid interference of circulating water pipes and diffusion of thermal effluent of sea water with No. 1 and No. 2 units.

3) Regarding the volume of fresh water, the total amount of fresh water from the Masinloc river might not be enough for the project after completion of the additional units. Therefore, a new water source shall be secured separately.

4) Regarding the ash disposal area, off-shore ash disposal should be studied since the capacity of inland ash disposal area is not sufficient for No. 3 and No. 4 units.

5) Regarding the environmental facility, DeSOx facility would not be required if industrialization adjacent to the project site remains in the present condition.

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(Applid Program)

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2. Analyzing Program of Heated Effluent (EPDC, KCC)
3. Noise Level Prediction Program for Personal Computer
   (Industrial Pollution Control Assciation of JAPAN)
4. Short Term Diffusion Prediction Program of Stack-gas for Personal Computer
   (Industrial Pollution Control Assciation of JAPAN)
5. Long Term Deffusion Prediction Program of Stack-gas for Personal Computer
   (Industrial Pollution Control Assciation of JAPAN)
6. Simulation Program of Coal-handling system for Coal-fired Power Plant
   (EPDC, KCC)

APPENDIX

CONTENTS

(Appendix 5-1)

CURRENT STATUS OF INDIGENOUS COAL

1. Outline of Semirara Coal Field

Semirara Island, located approximately 300 km south of Manila, has three coal pits; Unong, Himalian and Panian. Operation of Unong pit was started in 1979, the accumulated production reaches 3,455,315 t at the end of 1988.

All of these coal seams have similar coal qualities; subbituminous coal with high moisture content and low heating value, belonging to Sub-Bituminous-C of ASTM classification. The minable quantity on Semirara Island is regarded to be about a hundred million tons, as follows:

(unit: 10^3 t)

Unong	pit	16,700
Himalian	pit	37,500
Panian	pit	45,800
Total		100,000

(1) Current Status of Unong Pit

1) Coal Mine Operation Company

This mine is operated by the Semirara Coal Corporation (SCC) owned by the National Development Corp. owned by the Department of Trade and Industry. The mine started its production, most of which is delivered to the Calaca I coal-fired thermal power plant of NAPOCOR, in 1979. Its production in 1988 was 670,000 t.

2) Pit

The pit is in a small flat area of 1.6 km^2 and less than 20 m above sea level, ranging 1.3 km east-west and 1.2 km north-south on the southeast coast of Semirara Island.

3) Coal Reserves

There have been made several estimation of minable reserves, ranging from ten to twelve million tons.

(a)	Definite/estimated reserve	17,220,000 t
(b)	SCC estimated minable reserve	16,700,000 t (97% of (a))
(c)	Actual minable reserve	12,400,000 t ((b)x0.8x0.9)
(d)	Selected minable reserve at the end of 1988	6,700,000 t (as yield of Main seam: 82%)

4) Mining Method

Open cut mining with the principal use of bucket-wheel excavator (BWE) in both stripping and production of coal. Also, a shovel & truck system is used on a supplemental manners.

The actual strip ratio is as follows:

(Unit: m^3/t)

Year	1979	1980	1981	1982	1983	1984	1985	1986	Average
Strip Ratio	9.2	21.3	88.8	12.5	3.4	10.5	15.2	11.3	11.6

Though whole seem mining was attempted at the beginning (shipped as ROM), the very poor quality of coal made it necessary to produce "Select coal" as at present.

5) Coal Cleaning Method

The washable coal is selected by the Pilot Washery.

The planned quality is 6,100 BTU/lb for raw coal, from which 8,100 BTU/lb of clean coal is produced at 64% yield.

6) Production Record

The production record from the start in 1979 to 1988 is as follows:

(Unit: t/a)

Year	1979	1980	1981	1982	1983	1984
Production	5,250	32,697	13,222	90,808	325,702	551,890

Year	1985	1986	1987	1988	Total
Production	568,042	592,491	605,032	670,181	3,455,315

The customers for the coal are listed below:

Sales Record

(Unit: 1,000 t)

Year	1980	1981	1982	1983	1984	1985
NAPOCOR	-	-	-	-	152	343
PNOC-CC	-	-	-	1	103	-
Biophil	33	12	2	-	-	-
Atlas	-	-	68	173	264	227
Philphos	-	-	-	-	5	22
MMIC	-	-	-	-	29	-
Others	-	-	-	-	11	2
Total	33	12	70	174	564	594

The initial contract with NAPOCOR was to produce 900 - 960 thousand tons annually; it was later reduced to approximately 600,000 t/y because the coal needed blending with imported coal. The present annual production is estimated to be 700,000 - 800,000 tons, including the portion for other consumers.

7) Coal Quality

Unong coal pit was developed with the main purpose of supplying coal to Calaca I power plant.

The design coal for Calaca I was as follows:

T.M (AR)	H.V (AR)	Ash (AR)	$Na_2O + K_2O$
19%	8,585 BTU/lb (4,770 Kcal/kg)	6.72%	4% (mean 2.57%)

The coal quality specified in the sales contract (December, 1980) between NAPOCOR and SCC was as follows:

Proximate Analysis (ASTM method, ADB)

Ash	F.C	V.M	S	I.M	H.V
16 - 22%	24 - 30%	38 - 44%	0.4 - 1.3%	11 - 15%	8,300 - 9,300 BTU/lb

H.G.I.	Ash fusion temperature		Size	T.M
	Soft	Flow		
40 - 50	1,350°C	1,410°C	-200 mm	Max. 20%

Unong coal pit started delivery to Calaca power plant in July, 1984. The coal, however, was rejected by the plant in October because of poor quality due to the whole seem mining method (ROM).

The quality of coal received by NPC from July to October, 1984, which amounted to 147,403 t, was as follows (average):

Ash	F.C	V.M	S	I.M	H.V	T.M
19.9%	30.3%	33.4%	0.7%	16.4%	7;804 BTU/lb	25.8%

As stated previously, delivery of select coal was started in February, 1985, it's quality is as follows:

Period	Vessels	Ash(%)	F.C(%)	V.M(%)	S(%)	I.M(%)	H.V(%)	T.M(%)	Production (t)
1985/2-6	27	10.7 (3.55)	33.2 (2.26)	38.9 (2.35)	0.7 (0.11)	17.1 (1.77)	9,004 (282)	25.4 (1.19)	168,493
1985/7-12	27	11.6 (2.08)	34.4 (2.10)	35.5 (1.29)	0.6 (0.10)	18.5 (2.20)	8,717 (366)	25.9 (1.18)	169,675
1986/1-6	30	10.8 (1.96)	36.9 (1.53)	36.0 (0.76)	0.6 (0.09)	16.4 (2.07)	8,918 (292)	24.0 (1.46)	151,277
1986/7-12	40	10.0 (2.16)	36.1 (1.18)	36.3 (0.90)	0.6 (0.08)	17.7 (1.22)	8,913 (232)	27.1 (1.63)	201,721
1987/1-6	53	12.2 (2.33)	36.9 (1.66)	36.4 (0.88)	0.7 (0.15)	14.5 (1.10)	9,070 (311)	24.5 (1.97)	267,837

Note: basis except for T.M. parentheses for the standard deviation

The producer's record of coal quality is as follows:

	Requirement	Result
Ash	16 - 22%	10 - 20%
F.C.	24 - 30%	33 - 37%
V.M.	38 - 44%	35 - 39%
S	0.4 - 1.3%	0.6 - 0.7%
I.M.	11 - 15%	14 - 19%
H.V.	8,300 - 9,300 Btu/lb	8,700 - 9,100 Btu/lb
T.M.	Max. 20%	24 - 27%

The quality of coal used at Calaca I power plant is as follows: (This figures are analized at the P/S.)

		Design Coal	Semirara Select Coal	Imported Coal
T.M. (%)	ARB	19	27.92	8.58
H.V. (Btu/lb)	ARB	8,585	7,982	11,073
Ash (%)	ARB	6.72	8.10	16.67
Na_2O+K_2O (%)	DB	2.57	8.14	0.50

Coal cleaning process is only partly done in Semirara mine. Even if coal cleaning process will be adopted, the total moisture would increase while alkaline content would remain the same. Consequently, ash content will be reduced and heat value will be increased.

8) Shipping Facilities

Coal is transported by overland belt conveyors from the pit to a coal storage yard in the west part of the island.

The storage yard has two lots, each being 600 m long and 400 m width, with a total capacity of 300,000 t.

The wharf has a 10 m-width and 1,100 m-long causeway, accommodating up to 20,000 DWT vessels. Coal to Calaca I is usually shipped by 5,000 DWT class vessels.

(2) Development Plan for Himilian and Panian Pit.

1) History and Current Status of the Development Plan

Unong coal pit was developed and is operating with the purpose of supplying coal to Calaca I power plant. Its reserves are rather limited and expansion of operation seems unlikely.

Semirara Island has two other coal pits, Himilian and Panian. Both of them are suited to open cut mining and are planned to be the source for Calaca II power plant, which is now being built, and for the forthcoming Luzon thermal power plant.

The major points of the survey conducted hitherto are as follows:

- In 1981, Austromineral Co., Australia, had a preliminary feasibility study on Panian pit.
- In 1983 to 1984, Dames & Moore, Australia, had a preliminary feasibility study on Himalian pit.
- In 1986 to 1987, MONENCO, Canada, had a preliminary study about coal quality and economic feasibility of the two pits.

SCC now needs a feasibility study for the development, and recently decided to have it done by MONENCO, Canada, in cooperation with Mitsubishi Mining & Cement Co., Ltd.

The feasibility study will have additional boring tests to make the most economical mining plan to produce steam coal to meet the quality requirements by NAPOCOR Calaca II or other power plants. It will decide which of Himilian or Panian is to be developed. The planned annual production is 1.0 to 1.2 million tons.

2) Outline of Himilian Pit

This pit is located in the hill area on the west half of Semirara Island, 3 km from the airport. It ranges 2.3 km east-west and 1.5 km north-south, with a total area of 3.5 km^2.

The definite coal reserve of the pit is 60 million tons including the deep part in the southwest area; with a depth limitation for mining of 300 m, the minable quantity is 37.5 million tons.

Open cut mining will be adopted after the completion of soil stripping. The strip ratio is 11.3 m^3/t.

The coal has the lowest heating value of those from the three pits on Semirara.

The quality of clean coal is estimated to be as follows:

	T.M(%)	Ash(%)	V.M(%)	F.C(%)	S(%)	H.V Btu/lb
As Delivered basis	29	12.0	30.2	28.8	0.6	7,300
Dry basis	-	17.65	43.39	38.92	0.9	10,101

The alkaline content of ash is the lowest of the coals of three pits, as follows:

Na_2O 3.29% K_2O 1.61%

3) Outline of Panian Pit

This pit is located in gently-sloping grassland along the north coast of Semirara Island.

Its minable reserve is estimated to be 45.8 million tons with a strip ratio of 8.4 m^3/t, which may be subject to change in future surveys.

The mining will be done by ordinary open cut method. There is concern about flooding with sea water because of the porous sandy soil on the coast side.

The coal has higher heat value than that of Himilian, but higher alkaline content.

The coal quality is estimated as follows:

	T.M(%)	Ash(%)	V.M(%)	F.C(%)	S(%)	H.V Btu/lb
As Delivered basis	25	12.7	31.7	30.6	0.6	7,600
Dry basis	-	15.93	43.12	40.97	0.8	10,191

Na_2O 4.05% K_2O 1.38%

4) Summary of Coal Quality

The specification of Himilian/Panial coal proposed by SCC for Calaca II is as follows:

(Unit: %)

	Worst "Design" (90% Worst)	Average	Best "Design" (90% Best)
T.M.	27.0	29.0	26.0
Ash	24.9	12.0	5.1
V.M.	28.6	30.0	35.0
F.C.	19.5	29.0	33.9
S	0.6	0.6	1.5
H.V. (Btu/lb)	5,690	7,300	8,660
Na_2O in Ash	2.3	5.5	9.3

The ash composition (average) is as follows:

(Unit: %)

	Na_2O	K_2O	TiO_2	SO_3	P_2O_5	BaO	SrO	SiO_2	Al_2O_3
Ave.	5.45	1.34	0.87	6.68	0.25	0.15	0.18	45.53	20.01

	Fe_2O_3	CaO	MgO	Total
Ave.	7.49	7.49	4.16	99.60

The ash fusion temperatures are as follows:

(Unit: °C)

		Initial Deformation	Spherical Deformation	Hemisph Deformation	Flow
Range	Reducting Atm	1,050 - 1,560+	1,110 - 1,560+	1,110 - 1,560+	1,110 - 1,560+
	Oxdizing Atm	1,080 - 1,560+	1,150 - 1,560+	1,180 - 1,560+	1,190 - 1,560+

5) Summary of Coal Supply

(a) The five-year production plan (ROM-base) of OEA is as follows:

(Unit: 1,000 t)

Year	1989	1990	1991	1992	1993
For Calaca I	700	700	700	700	850
For Calaca II				900	1,200
Total	700	700	700	1,600	2,050

Thus, total production of 1.2 million tons is planned after 1993 for Calaca II.

(b) The potential of the Semirara mine is estimated as:

Minable quantity 93 million tons

By assuming:

Average heating value : 7,000 BTU/lb
Heat Rate : 9,500 BTU/kWh
Plant Life : 30 years
Plant Factor : 70%

the maximum supply will be approximately 800 MW equivalent.

Thus, it is theoretically possible for the Semirara mines to provide 90% of fuel for the total need of 900 MW of Calaca I and Calaca II. The mines, however, require selective mining as stated in the section on minable reserve of Unong pit. This reduces the minable quantity from 16.7 million tons to 10.16 million tons (including previous production), 60% of SCC's initial estimate. Therefore, a more realistic figure for the annual production of Semirara mines would be about 1.9 million tons/year, corresponding to some 60% of the need of the three power plants stated above.

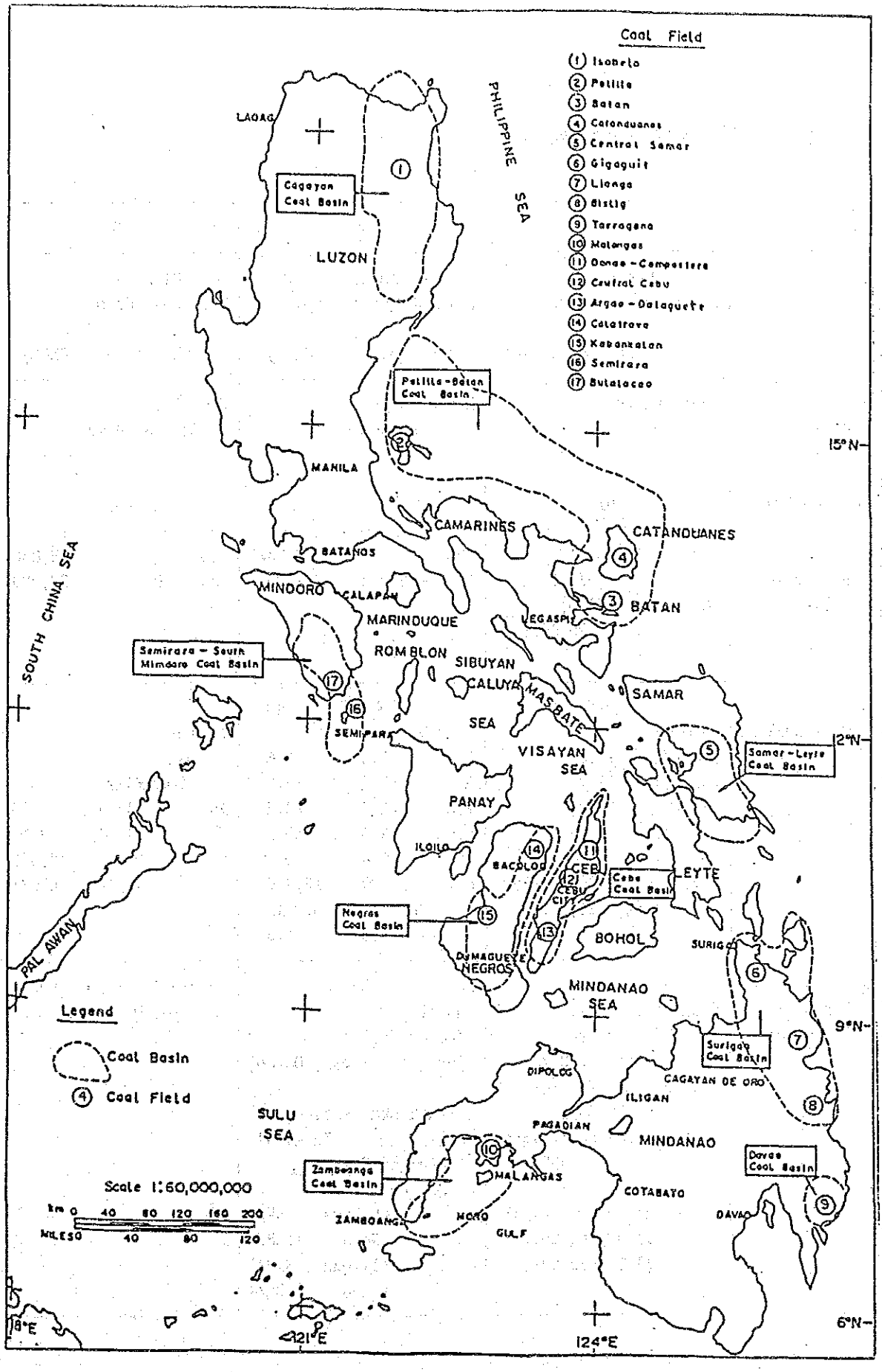


Fig. 5－A－1 Coal Basin in the Philippines

2. Present Status of Indigenous Coal

Items \ No.	1	2	3
1 Coal Mines	Unong Semirara Coal Corp. (B.T.I. Under Controle)	Malangas Malangas Coal Corp. (Subsidiary of PNOC)	Uling PNOC Coal Corp. (Subsidiary of PNOC)
2 Area	Semirara Is.	Mindanao Is. Zamboanga Area	Cebu Is. Central Area
3 Mining System	O/C	U/G	U/G
4 Production (MT)(ROM)	'88 (Actual) 670,181t '89 ~ '93 (Plan) 700,000t	'88 210,932t '89 ~ '93 212,000t	'88 18,836t '89 ~ '93 28,000t
5 Coal Quality	Clean Coal (a.d.b) I.M.(%) 13.6 Ash (%) 11.7 V.M.(%) 37.7 F.C.(%) 37.0 S (%) 1.1 H.V. 9,270 BTU/lb (TM (%) 26)	ROM Processed (a.d.b) I.M. 1.6 1.6 Ash 19.2 16.2 V.M. 21.2 23.2 F.C. 58.0 59.1 S 0.6 0.6 H.V. 11,990 BTU/lb 12,410 BTU/lb (TM 3.5 4.6)	(a.d.b) Dona Margarita N6 Ash 11.1 16 S 1.01 3.14 H.V. 9,496 BTU/lb 9,368 BTU/lb
6 Consumers Price, etc.	Mainly for Calaca Power Plant 1 and Atlas →Calaca 265 km →Atlas 370 km 1988 750P/t FOB (8,700BTU/lb) Semirara-Calaca Freight 38P/t Batangas Coal Terminal Discharging Cost 33.5 ~39.5P/t	Mainly for Cement Industry (Luzon Is. and Surigao, Iligan, Davao) Truck 8km →Malangas Terminal Freight Rate Malangis →Calaca 95P/t →Naga 115P/t →Iligan 91P/t →Davao 103P/t	Mainly for Atlas, Ludo & Luym, Unicemco

Items \ No.	4	5	6
1 Coal Mines	DMC-CERI (Bislig) David M.Consungi Inc.-Construction Equipment Resources Inc. (Leasehold from PNOC-CC and Atlas)	BCI-Diversified Benquet Corp-Diversified Mining Corp. (Ieasehold from PNOC-CC and Atlas)	Piedra Negra Piedra Negpa Mining Corp,
2 Area	Mindanao Is. Bislig Area	Mindanao Is. Lianga Area	Mindanao Is. Lianga Area
3 Mining System	U/G	O/C	O/C on going fufure U/G Using Jointly
4 Production (MT)(ROM)	'88 77,870t '89 ~ '93 93,000t	After '90 36,000t	'88 2,384t '89 12,000t '90 24,000t '91 36,000t After '92 45,000t
5 Coal Quality	(a.d.b) K H No.5 I.M. 12.0 11.1 10.3 Ash 23.3 24.5 18.1 V.M. 34.7 33.7 36.7 F.C. 30.1 30.6 34.9 S 0.8 0.7 1.4 H.V. 8,120 8,080 9,120 (BTU/1b)	I.M. 5.4 Ash 5.3 V.M. 47.0 F.C. 42.3 S 1.0 H.V. 11,800 BTU/1b (T.M. 14.2)	Sample 1 Sample 2 I.M. 24.4 16.2 Ash 4.5 4.2 V.M. 35.2 38.1 F.C. 35.8 41.5 S 1.9 0.5 H.V. 8,005 9,273 (BTU/1b)
6 Consumers Price, etc.	Mainly for ATLAS, NPC Naga Power Plant Truck 34km → Bislig Terminal '88 Price FOB Islig 600~750P/t (Expectaion) Freight Rate Bislig → Calaca 220P/t → Naga 120P/t → Toledo 140P/t	Mainly for Cement Indutuy (Surigao, Luzon) Truck 25km → Lianga Bay Term.	Truck 23km → Lianga Bay Term. Operating Cost 430 ~450P/t

Items \ No.	7	8	9
1 Coal Mines	Montenegrin Montenegrin Mining Corp.	ZAMBOCO ZAMBO Industrial Mining Corp.	FF CRUZ (ZAMBO) F.F. Cruz & Co.,Inc.
2 Area	Mindanao Is. Lianga Area	Mindanao Is. Zamboanga Area	Mindanao Is. Zamboanga Area
3 Mining System	O/C	U/G	U/G, O/C
4 Production (MT)(ROM)	Up to '86 year befor 80,000/y wereproduced. OEA'S 5 years projection dosen't show the production plan	'88 4,558t '89 4,000t After '90 24,000t	'88 7,563t '89 12,000t '90 18,000t After '91 24,000t
5 Coal Quality	(a.d.b) I.M. 13.9 Ash 15.1 V.M. 48.4 F.C. 22.9 S 3.0 H.V. 7.650 BTU/lb	H.V. more than 11,000 BTU/lb	H.V. more than 11,000 BTU/lb
6 Consumers Price, etc.	To MMIC MONOC Truck 40km →Lianga Bay Term. FOB Lianga Plan Price 600 P/t (1988)	10% (Chinese Capital)	Forecasted Operating Cost is 340 ~ 470P/t

Items \ No.	10	11	12
1 Coal Mines	DMC-CERI (ZAMBO) David M. Consungi Inc.-Construction Equipmen t Resources Inc.	ACRI-BATAN Batan Mining Company-Asian Cogeneration Resources Corp.	BICOL BICOL COAL Develop.
2 Area	Mindanao Is. Zamboanga	Batan Is.	Batan Is.
3 Mining System	U/G	O/C, U/G	U/G
4 Production (MT)(ROM)	'88 0 '89 4,000t After '90 12,000t (Details are not clear OEA 5 year projection stated though)	'88 6,710t '89 12,000t '90 24,000t '91 36,000t	'88 19,879t After '89 18,000t
5 Coal Quality	H.V. more than 11,000 BTU/lb	(a.d.b) I.M. 11.6 Ash. 14.6 V.M. 36.3 F.C. 47.5 S 1.0 H.V. 10,730 BTU/lb	H.V. more than 8,500 BTU/1
6 Consumers Price, etc.		Mainly for Surigao Cement Truck 2km → Linguan Pier	Mainly for MMIC etc. Truck 2km →Pier

Items \ No.	13	14	15
1 Coal Mines	PMI Project Managers, Inc.	CARBEX CARBEX Incorporated	Pilipino Cathay Pilipino Cathay Mining Corp.
2 Area	Batan Is.	Batan Is.	Polillo Is.
3 Mining System	O/C	O/C (U/G)	U/G
4 Production (MT)(ROM)	'88 15,655t '89 12,000t After '90 24,000t	'88 27,432t '89 35,000t After '90 40,000t	'88 9,888t After '89 12,000t
5 Coal Quality		(a.d.b) Middle seam / Lower seam I.M. 10.14 / 10.56 Ash 6.81 / 5.73 V.M. 43.16 / 42.55 F.C. 39.39 / 41.16 S 2.12 / 0.94 H.V. 10,826 / 10,827 (TM 16.03)	(a.d.b) I.M. 5.8 Ash 14.5 V.M. 35.2 F.C. 44.7 S 0.62 H.V. 10,680 BTU/lb (TM 8.4)
6 Consumers Price, etc.	Mainly for LUDO, MMIC, etc.	Mainly for Atlas, Rizal Cement, Solid Cement, PHINMA, NPC Price (plan) 850P/t 30% (U.S. Capital)	Mainly for APOCEMCO, Atlas, MMIC, LUDO, etc. Truck 2~138 km→ Pier

Items \ No.	16	17	18
1 Coal Mines	Ermitanto Ermitanto Magnesia	Candoni Tindaro Minerals and Develop. Corp.	Hercules Hercules Coal Mining and Develop, Corp.
2 Area	Catanduanes Is.	Negros Is.	Masbate Is.
3 Mining System	U/G	U/G	U/G
4 Production (MT)(ROM)	'89 7,000t After '90 24,000t	'88 4,975t '89 4,000t '90 15,000t '91 20,000t '92 25,000t '93 30,000t	'88 11,802t After '90 12,000t
5 Coal Quality	(a.d.b) I.M. 3.1 Ash 18.8 V.M. 20.1 F.C. 57.9 S 1.4 H.V. 11,800 BTU/lb	(a.d.b) East West I.M. 9.3 9.3 Ash 10.3 15.1 V.M. 33.2 39.8 F.C. 37.7 35.8 S 3.9 4.0 H.V. 8,940 9,500 BTU/lb BTU/lb (TM 18.9)	(a.d.b) I.M. 6.4 Ash 10.2 V.M. 41.9 F.C. 41.5 S 1.72 H.V. 11,120 BTU/lb (TM 8.7)
6 Consumers Price, etc.	Mainly for Cement Campany		Mainly for Atlas, Asean Alcohol and Cement Industries Truck 12km → Terminal 1988 Atlas Price 760 P/t (8,500 BTU/lb) 883 P/t (9,600 BTU/lb)

Items \ No.	19	20	
1 Coal Mines	F.F. CRUZ(MINDORO) F.F. Cruz & Co, Inc	MMIC Marinduque Mining & Industrial Corp.	
2 Area	Mindoro Is.	Samar Is.	
3 Mining System	U/G	O/C	
4 Production (MT)(ROM)	'88 3,584t '89 12,000t '90 24,000t After'91 36,000t	'88 0 '89 12,000t '90 18,000t '91 24,000t After'91 36,000t	
5 Coal Quality	(a.d.b) I.M. 16.4 Ash 5.0 V.M. 41.2 F.C. 37.4 S 3.15 H.V. 8,900 BTU/lb (TM 24.4)	(a.d.b) I.M. 25.1 Ash 7.9 V.M. 35.3 F.C. 31.8 S 2.5 H.V. 8,250 BTU/lb	
6 Consumers Price, etc.	Mainly for LUDO etc.		

Items \ No.	21	22	23
1 Coal Mines	Aznar EB AZNAR	Phil-Taiwan	Edmann Edmann Devt. Corp.
2 Area	Cebu Is. North	Cebu Is. North	Cebu Is. North
3 Mining System	U/G	U/G	U/G
4 Production (MT)(ROM)	'88 9,393t After '91 12,000t	'88 1,391t '89 12,000t '90 24,000t After '91 36,000t	'88 3,460t After '89 12,000t
5 Coal Quality	(a.d.b) I.M. 14.3 Ash 9.0 V.M. 41.3 F.C. 35.4 S 1.0 H.V. 9,840 BTU/1b (TM 15.4)		(a.d.b) Upper Seam / Lower Seam I.M. 16.36 / 15.24 Ash 7.77 / 5.45 V.M. 35.63 / 40.19 F.C. 40.24 / 39.12 S 2.43 / 2.51 H.V. 9,100 BTU/1b / 10,046 BTU/1b
6 Consumers Price, etc.	Mainly for APOCEMCO, UNICEMCO,LUDO & LUYM Guidline price OF Cebu-Coal at 1987 709 P/t FOB (8,500 BTU/1b) Forecasted Ope. Cost. 230~290P/t	Freight Rate Northern Cebu → Calaka 170P/t → Naga 80P/t → Toledo 100P/t → Iligan 150P/t	

Items \ No.	24	25	26
1 Coal Mines	IL Rey'C Il Rey'C Coal Mining Corp.	I.D. Almendras I.D. Almendras Agro Industrial Development Corp.	RADSON Radson's Enterprise Inc.
2 Area	Cebu Is North	Cebu Is North	Cebu Is North
3 Mining System	U/G	U/G	U/G
4 Production (MT)(ROM)	'88 0 '89 4,000t After '90 2,000t	'88 47,854t After '89 36,000t	'88 7,000t '89 18,000t '90 18,000t '91 24,000t After '92 36,000t
5 Coal Quality	(a.d.b) I.M. 11.2 Ash 12.5 V.M. 44.5 F.C. 31.9 S 1.99 H.V. 9.270 BTU/lb (TM 15.2)	(a.d.b) Sample1 Sample2 I.M. 17.1 13.41 Ash 12.7 13.13 V.M. 42.3 49.12 F.C. 27.9 24.34 S 0.4 0.93 H.V. 8,550 9,050 BTU/lb BTU/lb (TM 20.7 28.29)	
6 Consumers Price, etc.	Mainly for POCEMCO, UNICEMCO,LUDO & LUYM Forecasted operating cost. 540 ~ 640 P/t	Mainly for NPC Naga, Atlas, LUDO, APOCEMCO, UNICEMCO Forecasted Cost at Mine-Site 500~550P/t	Forecasted Operating Cost 450~ 490P/t

Items \ No.	27	28	29
1 Coal Mines	MANTO AGRO (MAIC) Manto Agro - Industrial Corp.	Fortune Fortune Exploration	R.M. Durano R.M. Durano Coal Mining Corp.
2 Area	Cebu Is. North	Cebu Is. North	Cebu Is. North
3 Mining System	U/G	U/G	U/G
4 Production (MT)(ROM)	'88 640t '89 6,000t	'88 1,160t '89 0t	'88 8,997t
5 Coal Quality	(a.d.b) I.M. 11.7 Ash 15.7 V.M. 35.4 F.C. 37.4 S 1.23 H.V. 8.900 BTU/lb		H.V. more then 10,000 BTU/lb
6 Consumers Price, etc.			For Cement Industries in Cebu Is.

Items \ No.	30	31	32
1 Coal Mines	Adlaon Adlaon Energy Devt. Corp	ARGONEX Angonaut Mineral Exploration.	Cebu Alpaco Cebu Alpaco Mining Corp.
2 Area	Cebu Is. Central	Cebu Is. Central	Cebu Is. Central
3 Mining System	U/G	U/G	U/G
4 Production (MT)(ROM)	'88 17,183t '89, '90 12,000t After '90 0	'88 4,289t '89 6,000t	'88 14,195t '89 6,000t
5 Coal Quality		(a.d.b) I.M. 13.1 Ash 15.3 V.M. 42.9 F.C. 28.7 S 2.01 H.V. 9.060 BTU/lb (TM 15.6)	H.V.9,000 ~9,500 BTU/lb
6 Consumers Price, etc.	Atlas, etc.	Atlas, etc.	

Items \ No.	33	34	35
1 Coal Mines	G T D GT Devt. Corp.	Cebu Coul Cebu Coal Mines Inc.	Jetson (before IEVI) Jetson Mining and Development Corp.
2 Area	Cebu Is. Central	Cebu Is. Central	Cebu Is. South
3 Mining System	U/G	U/G	U/G
4 Production (MT)(ROM)	'88 2,012t After '90 6,000t	'88 26,291t After '89 36,000t	'88 3,570t After '89 6,000t
5 Coal Quality		(a.d.b) I.M. 2.1 Ash 7.3 V.M. 39.8 F.C. 50.8 S 3.38 H.V. 12.920 BTU/lb	(a.d.b) I.M. 6.6 Ash 4.3 V.M. 42.2 F.C. 46.9 S 1.0 H.V. 11.890 BTU/lb (TM 8.4)
6 Consumers Price, etc.		For Naga, APOCEMCO, LUDO, Atlas	

Items \ No.	36	37	38
1 Coal Mines	INIMACO Filcarbon (Inimaco)	Kinway Kinway Mining Corp.	Luvimin Luvimin Cebu Mining Corp.
2 Area	Cebu Is. South	Cebu Is. South	Cebu Is. South
3 Mining System	U/G	U/G	U/G
4 Production (MT)(ROM)	'88 17,687t '89 18,000t After '90 24,000t	'88 14,639t '89 12,000t '90 12,000t '91 18,000t After '92 24,000t	'88 45,196t '89 50,000t After '90 60,000t
5 Coal Quality	(a.d.b) I.M. 5.9 Ash 11.3 V.M. 39.6 F.C. 43.2 S 2.5 H.V. 11,000 BTU/lb	H.V. 11,000 BTU/lb	(a.d.b) I.M. 3.06 Ash 15.76 V.M. 38.91 F.C. 42.27 S 1.35 H.V. 11,319 BTU/1 (TM 8.42)
6 Consumers Price, etc.	Freight Rate Southern Cebu → Calaca 170P/t → Toledo 100P/t → ILIGAN 150P/t	UNICEMCO, APOCEMCO, LUDO.	Atlas, Pacific Cement, UNICEMCO, LUDO.

C.

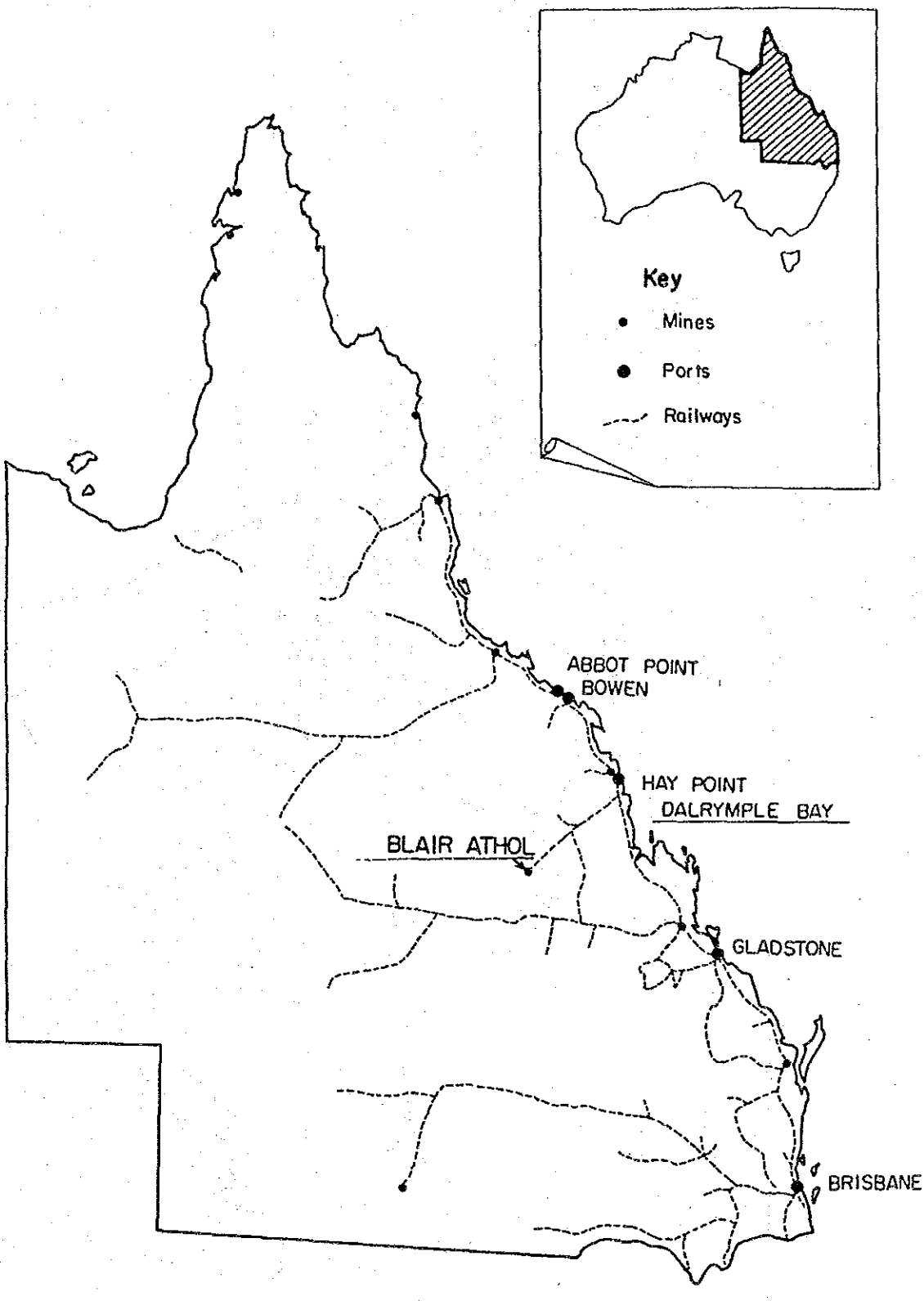
Items \ No.	39		
1 Coal Mines	Manguerra Manguerra Mining and Development Corp.		
2 Area	Cebu Is. South		
3 Mining System	U/G		
4 Production (MT)(ROM)	'88 25,481t After '89 36,000t		
5 Coal Quality	(a.d.b) I.M. 4.3 Ash 11.2 V.M. 46.2 F.C. 38.3 S 0.95 H.V. 11,930 BTU/lb		
6 Consumers Price, etc.	Atlas, LUDO, UNICEMCO, APOCMCO.		

(Appendix 5-2)

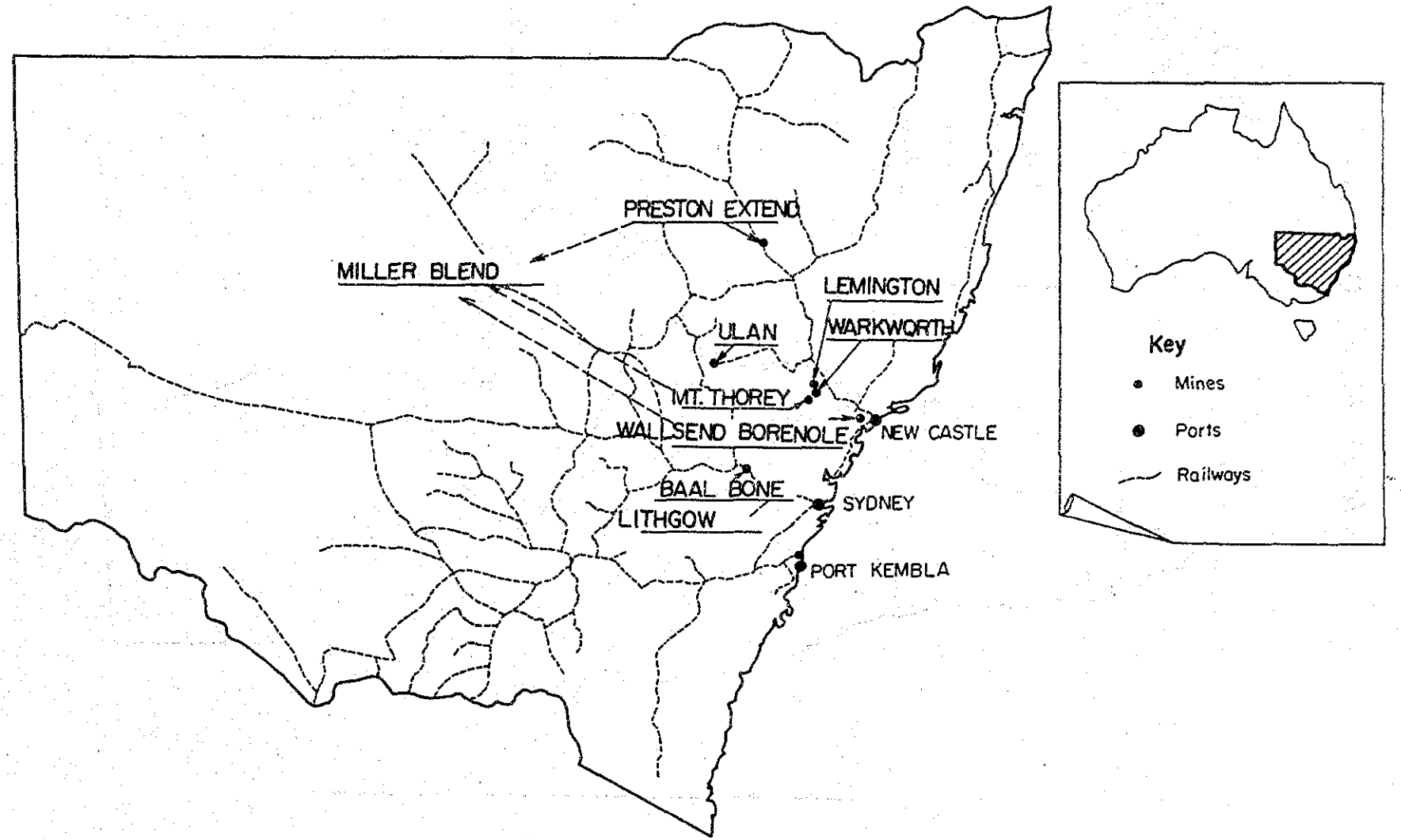
INFORMATION OF OVERSEAS COALS

CONTENTS

AUSTRALIA, Queensland



AUSTRALIA N.S.W.



1. AUSTRALIA

(1) WARKWORTH COAL

Name of Mine : Warkworth No. 1

Location : 80 km northwest of Newcastle (port of loading) in NSW, Australia, and 15 km southwest of Singleton.

Business Entity : Warkworth Associates (unincorporated J/V)

Costain Australia Ltd.	25%
T & G Mutual Life Society Ltd.	20%
Mitsubishi Corporation	19%
Mitsubishi Mining & Cement	6%
Others	30%

Production Results : 3,200,000t in fiscal 1987/88
(Note) Fiscal 1987/88 lasted from July 1987 to June 1988.

Classification : Coking coal and steam coal

Quality (steam coal a.d.b) :

	Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Size (mm)	$Na_2O + K_2O$
Total	8	9-18	29-35	6,550-7,300	0.5	-50	0.37 +0.41
Steam coal for Japan	8	15 max	29.0	6,850	0.6 max	-40	

Destination : Japan, Europe, Australia and others
(Main export contracts)

Mitsubishi Mining & Cement	500,000t a year
EPCD	300,000t a year
Hokuriku Electric Power	220,000t a year
Steel Mills in Japan	200,000t a year (Soft-coking coal)
Mitsubishi Chemical Industries	60,000t a year (Soft-coking coal)

Geological Condition : There are 30 seams of Late Permian Wittingham coal measures within the mining area.

Geological structure is stabilized, and coal seams are in a mild slope of 4° on the west side. The ground is flat and therefore suitable for open-cut mining.

Coal Reserve : Minable coal reserve -- 93,000,000t

Mining Method : Open-cut mining

Overburden is stripped by dragline and shovel/truck. Mining is carried out by means of the loader/truck. The main equipment used is as follows:

1 x BE 1,370W	Dragline	(46 m^3, 99 m)
2 x BE 295B	Electric Shovel	(21 m^3)
4 x CAT 992C	Front End Louder	(9.2 m^3)
14 x Unit Rig	MK 36 Dump Truck	(170t)
10 x CAT 785	Rear Dump Truck	(170t)

Coal-cleaning Method : 750 t/H

H.M. cyclone (+2 mm), Wright spiral separators (-2 mm), and others are used.

Coal Storate Yard : Storage capacity is 130,000t for raw coal, 200,000t for clean coal

Transportation : Coal is transported to a freight-car loading station of a state-operated railroad by belt conveyor, then to the shipping port, Newcastle, over a distance of 80 km.

No. of Employees : 420

Shipping Port : Newcastle port

Loader	Annual Loading Capacity (in 10,000t)	Loader (t/M)	Coal Storage Capacity (in 10,000 t)	Maximum Ship Size (DWG)
Kooragang	1,500	10,500	120	140,000
PWCS		3 x 2,500		140,000
Basin				55,000

(2) LEMINGTON COAL

Name of Mine : Lemington (O/C), Lemington No. 1 & No. 2 (U/G)

Location : 85 km northwest of Newcastle (loading port) in NSW, Australia, and 12 km west of Singleton. Singleton.

Owner : Exxon 100%

Production Result : 2,893,000t (U/G 1,250,000t, O/C 1,643,000t) in fiscal 1985/86 3,046,000t in fiscal 1986/1976)

Classification : Coking coal and steam coal

Quality of steam coal :

Brand	Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Size (mm)	Na_2O + K_2O
LEM.LOW ASH	9	.12	33	7,040	0.4	-38	0.3 + 0.7
LEM.MEDI ASH	9	14	32	6,800	0.4	-38	
Grade of coal for the Japanese market	8	14	31	6,700	0.8	-40	

Destination : Japan, South Korea, Taiwan, Europe, and others

(Export contracts with Japan)

To EPDC	120,000t a year
To Kyushu Electric Power	300,000t a year
To Onoda Cement	200,000t a year
To Steel Mills in Japan	470,000t a year (soft-coling coal)

Geological Conditions	:	With several mining-target coal seams within the Upper Permian Wittingham Coal Measures, the ground is stabilized geologically. The mine is therefore suitable for both open-cut and underground mining.
Coal Reserve	:	Minable coal reserve --- raw coal 91,000,000t, 66,000,000t
Mining Methods	:	Open-cut and underground mining Open-cut mining is conducted under the shovel/truck manner. The main machinery used is as follows: 2 x P & H Electric Shovel (23 m^3 & 26 m^3) 3 x CAT 992C Front End Louder (9 m^3) 15 x Rear Dump Truck (5 x 154t, 10 x 160t) Underground mining is carried out with room and pillar system. The main machinery used is as follows: 7 x Less North Continuous Miner 14 x Noyes Hydrocar
Coal-cleaning Methods	:	560 t/H H.M. cyclone (+0.5 mm), froth flotation (-0.5 mm), and others.
Transportation	:	The coal is transported by truck to the Mt. Thorey loading station (19 km). It is then carried with unit train to Newcastle (80 km).
No. of employees	:	730
Shipping port	:	Newcastle

(2) ULAN COAL

Name of Mine : Ulan (O/C), Ulan Extended (U/G)

Location : 220 km northwest of Sydney in NSW, Australia, and 30 km northeast of Mudgee

Owner : Ulan Coal Mines Ltd.

Mitsubishi Corporation	49%
White Industry Ltd. (Exxon)	36%
State Superannuation Board	15%

Production Result : 7,100,000t (O/C 6,000,000t, U/G 1,100,000t) in fiscal 1986/87

6,300,000t (O/C 4,500,000t, U/G 1,800,000t) in fiscal 1986/87

Classification : Steam coal

Quality of steam coal (A.D.B.):

Brand	Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Size (mm)	$Na_2O + K_2O$
OPENCUT	9-10	17	29.5	6,500	0.7	- 50	0.1 + 0.3
UNDER-GROUND	9-10	12	29.5	6,950	0.8	- 50	0.1 + 0.4

(Note) Open-cut coal is washed and is obtained by mining throughout the coal seams (average width 12.5 m).
Underground coal is unwashed being mined from the 3-meter-wide lower part of the seams (the pure coal part).

Destinations : Japan, South Korea, the Philippines, Indonesia, Europe, and others
(Principal export contracts)

Chugoku Electric Power	400,000t a year
Kyushu Electric Power	200,000t a year
Hokkaido Electric Power	200,000t (+100,000t) a year
Mitsubishi Mining & Cement	100,000t a year
Korea Electric Power Company	600,000t a year
European Electric Power Industries	200,000t a year

Geological Condition : The Upper Permean Ulan Seam is thick and relatively stabilized geologically. With its inclination almost nil, the seam is nearly flat.

Coal Reserve : Minable coal reserve -- 5,500 million t; clean coal 300 million t

Mining Methods : Open-cut mining and underground mining:
Open-cut mining is conducted for the whole of the 12-meter seam, with the shovel-and-truck method employed for prestripping, the dragline method for stripping, and the shovel/in-pit crusher/belt conveyor manner for coal mining. The main equipment used is as follows:

1 x Marion 8050	Dragline
1 x P & H 2300	Shovel
1 x O & K Mobile	In-Pit Crusher

In underground mining, coal in the 3-meter-wide lower part of the seam with the highest quality is extracted with a stroke.

As for the mining manner, the longwall method is adopted. The main equipment used is as follows:

200 m x Dowty Longwall Support (3.2 m 700 t)

1 x Eickoff Shearer

200 m x Douty Meco Conveyor (1,050 mm, 2,200 t/H)

2 x Joy HM/g Continuous Miner

1 x Jeffrey Heliminer

8 x Noyes Shuttle Car

Coal-cleaning Method	:	(Open-cut mining) 1,200 t/H H.M. cyclone and bath, water cyclone, and other methods are adopted. (Underground mining) Crushing (less than 50 mm) and screening
Transportation	:	Coal is transported 275 km to Newcastle over a state-operated railroad.
No. of Employees	:	411 (Underground 134, open-cut pit 239, and others 38)
Shipping Port	:	Newcastle

(4) R.W. MILLER BLEND COAL

Company : R.W. Miller & Co. Pty., Ltd.

Coal extracted from three mines -- Wallsend Borehole, Preston Extend, and Mt. Thorley -- owned by the company is blended and sold under its own brand, "Miller Coal," or of Coal & Allid Inc., a brother company engaged in sales, "NSW Washed Thermal Coal."

Coal Mine	Wallsend	Preston	Mt. Thorey
Location	17 km west of Newcastle in NSW, Australia	305 km northwest of Newcastle and 15 km south of Gunnedah	85 km northwest of Newcastle and 10 km southwest of singleton
Production (fiscal 1986/87)	670,000 t	274,856 t	4,600,000 t
Classification	Coking coal and steaming coal	Same as left	Same as left
Quality of Each Brand	Ash 14% to 18%, calorific value 6,250 to 7,000 kcal/kg	11% - 12% 7,010-7,070 kcal/kg	15.5% 6,650 kcal/kg
Minable	Raw coal -- 31,600,000 t Clean coal -- 22,500,000 t	Raw coal -- 2,000,000 t	Raw coal -- 540,000,000 t clean coal -- 350,000,000 t
Minable Coal Seam	Young Wallsend Seam (2.4 m)	Hoskinssons Seam (2.5 m)	5 seams are currently being mined.
	Room and pillar method for underground mining, 4 x joy 12 CM cont. Miner, and others	Room and pillar system for underground mining, 1 x lee Norse 60 M cont. Miner 2 x Jefferary 120 Hz Heliminer, and others	Open-cut mining Marson 55 m^3 dragline P & H 26 m^3 Shovel
Coal-cleaning Method	275 Bam Jig. t/H H.M Cyclons	200 Crusher t/H Screen	1,100 H.H Drums t/H M.M. Cyclons flotation
No. of Employees	190		

Quality of Miller Blend Coal:

Brand	Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Size (mm)	Na_2O + K_2O
C & A NSW WASHED	9	20	30	6,300	1.0	- 50	0.4 + 1.4
Miller Blend for the Japanese market	8	20 max	30-35	6,350	1.0 max	- 40	

Destination : (Principal export contracts)

To EPDC 180,000 t a year (contract volume) with option.

Shipping Port : Newcastle

(5) LITHGOW COAL

Name of Mine : Ball Bone

Location : 200 km northwest of Sydney in NSW, Australia, and 24 km northwest of Lithgow

Owner : The Wallerawang Colliery Co., Ltd.

Coalex Pty., Ltd.	80%
Sumitomo Metal Industries	15%
Sumitomo Corporation	5%

Production Results: 817,900 t in fiscal 1985/86

Classification : Steaming coal and semisoft coking coal

Quality
(steam coal a.d.b) :

Brand	Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Size (mm)	$Na_2O + K_2O$
Lith.Low ASH	8	10	32.5	7,260	0.6	- 38	0.1 + 3.2
" 6,900	8	13.7	30.5	6,900	0.6	- 38	"
" 6,700	8	16	30.5	6,700	0.6	- 38	"

Destinations : Mainly Japan and also shipped to the U.K. and France. (Principal export contracts)

EPDC	180,000 t a year
Kyushu Electric Power	200,000 t "
Chugoku Electric Power	400,000 t "
Hokkaido Electric Power	100,000 t "
Sumitomo Metal Industries	300,000 t " (Semisoft coking coal)

Geological Conditon	:	The mining target is the Lithgow Seam (2.4 m thick) of Upper Permian Illawarra Coal Measures. The coal seam is stablized, has solid underground and upper bases, and is subjected to weak ground pressure. Thus, the mine is suitable for underground mining (longwall mining).
Minable Coal Reserve	:	Raw Coal 40,000,000 t, clean coal 34,000,000 t
Mining Method	:	Underground mining The longwall method was adopted in November 1985. Simultaneously employing the conventional continuous mining/method, the company intends to produce 2,000,000 t of raw coal and 1,700,000 t of clean coal. The main equipment used is as follows: 200 m x Gullik Self-advancing Support (2.5 m, 632 t) 1 x Eickhoff Searer 200 m x A.L.M. Conveyor (834 mm, 1,500 t/H, 375kW) 4 x Jeffrey Hz Continuous Miner 8 x Joy 15 S/C Shuttle Car
Coal Cleanaing Method	:	700 t/H Bradford breaker, Batac Jig, H.M. Cyclone, Spiral Separator, and others are used.
Coal Storage Yard	:	A storage yard capable of keeping 50,000 t of coal and 900,000 t of clean coal is owned near the mine.
Transportation	:	Coal is transported to Sydney (200 km) or port Kembla (277 km) over a state-operated railroad.
No. of Employees	:	250

Shipping Port :

Loader	Annual Loading Capacity (in 10,000t)	Loader (t/M)	Coal Storage Capacity (in 10,000 t)	Maximum Ship Size (DWG)
Sydney, Balmain	450	1,250	55	PANAMAX
Port Kembla	1,400	5,000	80	150,000

(6) BLAIR ATHOL COAL

Name of Mine : Blair Athol

Location : 230 km southwest of Mackay, Queensland, Australia, and 22 km northwest of Clermont

Equity Participants: Blair Athol Coal Pty. Ltd.

CRA	50.22%
Anaconda	27.58%
EPDC	7.0%
JCD	3.0%
Others	12.2%

Production Results : 5,500,000 t in fiscal 1986/87

Classification : Steam coal

Quality (steam coal a.d.b) :

	Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Size (mm)	Na_2O + K_2O
	16	8.0	27.2	6,520	0.3	- 40	0.21 + 0.3

Destinations : Japan, Indonesia, Denmark, France, the Philippines, Chile, South Korea, Hong Kong, and ohters. (Most of the output is taken over by EPDC and JCD.)

Geological Condition : The extraction coal seam is mainly the big seam (about 29 m thick) of the Lower Permain Blair Athol Coal Measures. Overburden is 15 m to 30 m thick, and the strip ratio is small at 1.3 m^3/t.

Coal Reserve : Minable coal reserve -- 2,400 million t

Mining Method : Open-cut mining

The main machinery used is as follows:

1 x BE	1,370	Dragline
2 x P & H	2,100	Shovel
6 x Komatsu	120t	Rear Dump Truck
3 x CAT	77t	Rear Dump Truck

The company plans to increase coal output to 8,000,000 t/year, from 5,500,000 t/year.

Coal-cleaning Method : No cleaning is currently enforced (only crushing and screening are now carried out).

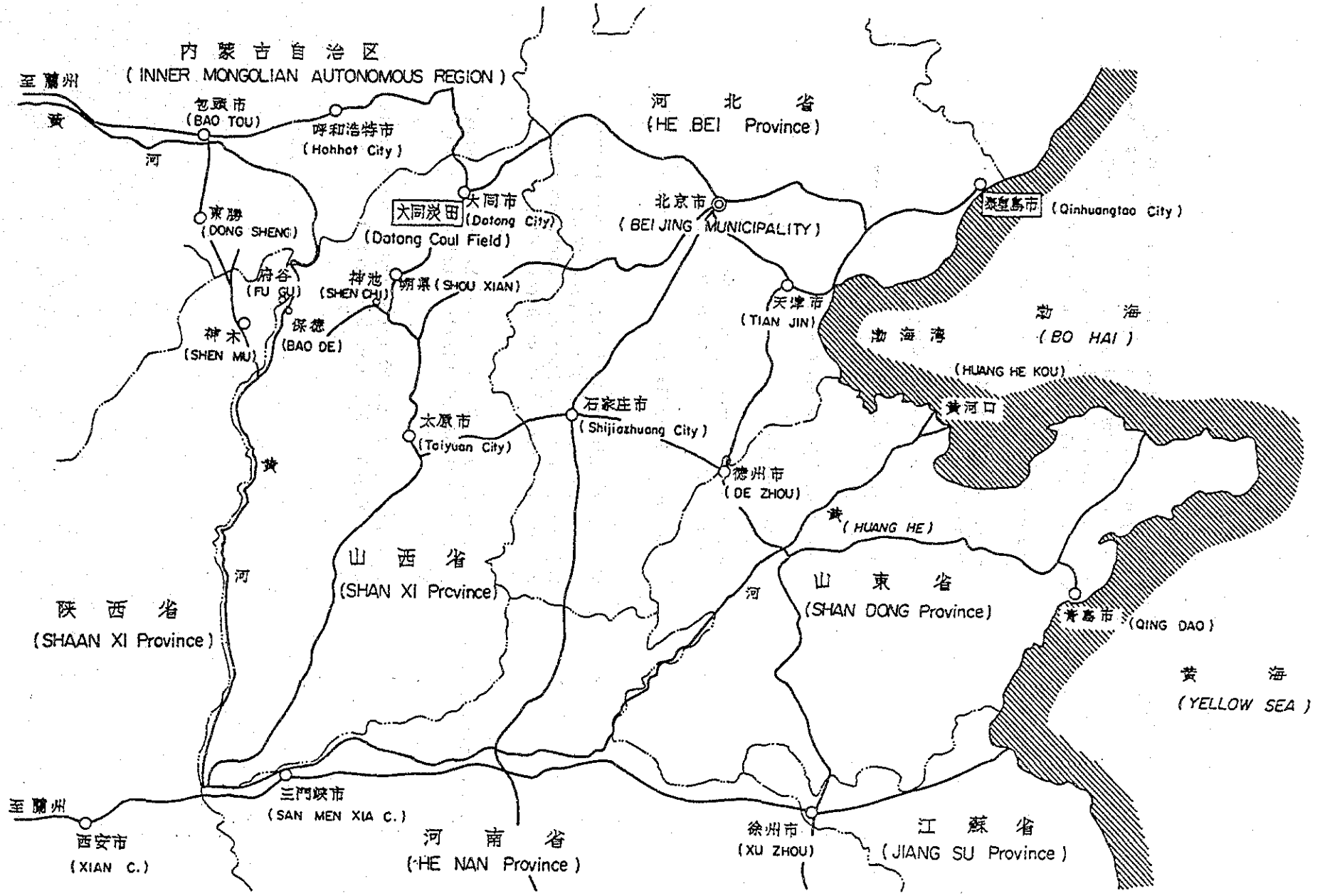
Coal Storage Yard : Capacity 800,000 t

Coal Transport : Coal is carried from the mine to Darlrymple Bay, the port of loading, a distance of 280 km over a state-operated railroad.

No. of Employees : 300

Shipping Port :

Loader	Annual Loading Capacity (in 10,000t)	Loader (t/M)	Coal Storage Capacity (in 10,000 t)	Maximum Ship Size (DWG)
Darlymple Bay	1,500	7,250	150	200,000


内蒙古自治区
(INNER MONGOLIAN AUTONOMOUS REGION)
至蘭州
黄
河
包頭市
(BAO TOU)
呼和浩特市
(Hohhot City)
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(FU GU)
神池
(SHEN CHI)
朔県 (SHOU XIAN)
神木
(SHEN MU)
保德
(BAO DE)
天津市
(TIAN JIN)
渤海湾
渤海
(BO HAI)
(HUANG HE KOU)
黄河口
太原市
(Taiyuan City)
石家庄市
(Shijiazhuang City)
德州市
(DE ZHOU)
黄
(HUANG HE)
山西省
(SHAN XI Province)
陝西省
(SHAAN XI Province)
山東省
(SHAN DONG Province)
青島市 (QING DAO)
黄海
(YELLOW SEA)
至蘭州
三門峡市
(SAN MEN XIA C.)
西安市
(XIAN C.)
河南省
(HE NAN Province)
徐州市
(XU ZHOU)
江蘇省
(JIANG SU Province)

2. CHINA

(7) DATONG COAL

Name of Mine : Datong coal handled by China National Import and Export Corporation (steam coal for exports to Japan) is produced of 10 mines (28 mines are now being operated) in the Datong Mine area. Names of the 10 mines are as follows:

- State-owned

Meiyukou, Tongjialiang, Silaogou	3 mines

- Owned by the Datong City

Qingciyao, Tangshangou Xingergou	3 mines

- Owned by Zuoyun Prefecture

Makou, Dianwan	2 mines

- Local mines owned by town or village in Zuoyun Prefecture

Douziwan, Zhangjiafen	2 mines

Location : 400 km of Peking (Beijing), in Shanxi Province and 700 km west of Qinhuangdao (Port of loading). The 10 mines are scattered in the Datong Mine area west of Datong City.

Production Resulsts: A total of 221,900,000 t in the entire Shanxi Province (24.8% of China's total coal output in 1986)

10 mines -- 12,880,00 t (in 1987, and of this total, 6,700,000 t were exported.)

Quality
(steam coal a.d.b) : (Example of coal for Japan)

	Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Size (mm)
Contract Value	8 max	10 - 20	25 min	6,800 (ADB)	1 max	- 30 80% min
Achievement Value	11.36	8.80	30.85	7.318 (DB)	0.76	--

(Example of sample survey results for respective mines in 1985)
(on a air dried basis)

	Inherent Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	$Na_2O + K_2O$
Meiyukou	3.2	7.1	26.7	7,340	0.6	0.1+0.5
Tongjialiang	3.0	10.3	27.0	7,040	1.0	0.2+1.0
Silaogou	4.4	9.3	25.9	6,920	0.7	0.3+1.1
Qingciyao	3.0	5.6	28.0	7,470	0.8	0.3+0.4
Tangshangou	5.5	7.7	27.2	6,970	1.7	0.3+0.5
Xingergou	5.5	5.5	30.0	7,130	0.3	0.3+0.5
Makou	7.6	4.1	29.7	6,760	0.3	0.4+0.2
Dianwan	7.0	5.3	29.2	6,800	0.6	0.3+0.4
Douziwan	4.7	5.0	30.5	7,140	0.2	0.2+0.4
Zhangjiafen	5.2	5.3	30.3	7,010	0.2	0.2+0.3

(Notable matters)

Since it is uncleaned coal from 10 mines, the quality of products are diversified. Also, since it includes many contaminations such as metal pieces, rock debris, and wood chips, it is necessary to remove about 1 t of these contaminants from every 10,000 t of coal in the importing country.

Destinations : (10 mines of Datong Coal) Production in 1987:

Coal output volume 12,880,000 t, export volume 6,700,000 t

(Exports to Japan: 2,400,000 t)

(China's total output) Production in 1985:

Coal output 872,280,000 t,
export volume 7,570,000 t

Export Destinations	Volume	Rate
Japan	3,550,000 t	47%
North Korea	1,750,000 t	23%
Hong Kong	1,140,000 t	15%
The Philippines	790,000 t	10%
Others	340,000 t	5%
Total	757,000 t	100%

Geological Condition : A total of 15 coal seams (each about 26 m thick) are within the Jurrasic in Datong. These seams form a mild syncline and are stabilized, with few apparent big dislocations or folds. The pitch is extensive, ranging from 3° to 7°, and the minable seam depth is relatively small for China, ranging from 200 m to 250 m below the ground surface.

Coal Reserve : The reserve in the Datong Mine is estimated at 35,800 million t.

As for each of the 10 mines concerned, the reserve is expected to surpass 100 million t, except in the case of the two local mines owned by town or village in Zuoyun Prefecture.

Mining Method : Underground mining. A slope or shaft is adopted at the opening of the mines.

The longwall system separating the target seam into blocks is adopted for many of the mines. The mechanizing rate is estimated to be about 50% to 60%.

Coal-cleaning Method : Only crushing and screening are enforced.

Transportation : Coal is loaded onto unit train on a railroad siding or at the nearest station and transported about 800 km to Qinhuangdao.

Number of Employees : About 110,000 for the entire Dating Mine area.

Port of Loading : Qinhuangdao

Loader	Annual Loading Capacity (in 10,000t)	Loader (t/M)	Coal Storage Capacity (in 10,000 t)	Maximum Ship Size (DWG)
Old Port	1,500	about 3,000	80,000	25,000
Port in 1st Phase (1984)	1,000	6,000	500,000	65,000
Port in 2nd Phase (1985)	2,000	12,000	1,000,000	65,000
Planned Port in 3rd Phase (1990)	3,000	18,000	1,500,000	(100,000)

(8) PING SHUO COAL

Name of Mine : Ping Shuo (An Tai Bao)

Location : Ping Shuo area, Shanxi province

Owner of Mining Property : The Government of Peoples' Republic China

Business Entity : Island Creek of China 52.49% (Occidental Petroleum 26.245%)

Bank of China Trust and Consultancy Company 26.245%)

Ping Shuo First Coal Company Ltd. 47.51%

Classification : Steam coal

* Following numbers are concerning with steam coal.

Scale of Development : 15,000,000 t production per annum is planned after 1988.

Scale of Development : 15,000,000 production per annum is planned after 1988.

Standard Quality (A.D.B.) :

Use	Total Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Grinda-bility
For Exports	Max 8.0	13.3	32.3	6586 kcal/kg	1.13	55 HGI

Export Contract to Japan : Nothing yet

Coal Reserve : Minable coal reserve: 450,000,000 t

Mining Method : Open-cut mining

Coal-cleaning Capacity	:	3,000 raw coal ton/g
Coal Storage Volume in Port	:	1,000,000 t at 2nd term additional berth. Additional expansion will be carried out till 3rd term.
Transportation	:	An dedicated 18 km spur line has been built to connect the Mine to the main line. Coal is transported from the Mine to Qinhuangdao by unit train.
No. of Employees	:	1619 (at full scale operation after 1988)
Port of Loading	:	Qinhuangdao
Notes	:	The Mine will begin its production in September, 1987.

(9) SHENMU COAL

Name of Mine : Shenmu

Location : Shaanxi province

Owner of Mining Property : The Government of Peoples' Republic China

Business Entity : Huaneng Fine Coal Co.

Classification : Coking coal and Steam coal

* Following numbers are concerning with steam coal.

Scale of Development (partly achievements) : 1,100,000 t in 1985. Planned values are as follows: 10,000,000 t in 1992, 30,000 t in 1995, 60,000 t in 2000.

Standard Quality (A.D.B.) :

Use	Total Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Grindability
For Exports	Max 12	5.95	32.69	7113 kcal/kg	AR 0.27	51 HGI

Export Contract to Japan : Nothing yet

Coal Reserve : Minable coal reserve: Approximately 27,000,000 t

Mining Method : Open-cut mining and Underground ming

Coal-cleaning Capacity : Not required.

Coal Storage Volume in Port : 1,000,000 t at 2nd term additional berth. Additional expansion will be carried out till 3rd term.

Transportation	:	The 171 km railway link between the mine area and Baotou is to be completed in 1988. Coal is transported from Baotou to Qinhuangdao (1184km) by freight cars.
No. of Employees	:	Not determined.
Port of Loading	:	Qinhuangdao

POTENTIALITY OF INDONESIAN COAL

(1) The Indonesian Government is now proceeding with the strategy of substituting coal for its domestic oil consumption. The domestic demand for coal will be more than 10 million tonnes in 1990 accordingly.

(2) In order to cater for this increasing demand, P.N. Tambang Batubara (a public company) has been setting forward the expansion programme of Ombilin Mine and Bukit Asam Mine in Sumatra; on the other hand they invited international tenders for the eight mining areas in East Kalimantan in 1978, and have entered into the development and collaboration agreements with several international mining companies since November 1978. The local subsidiaries of successful mining companies have obtained permits or leases on a product sharing basis. The locations of leases and names of consortia are shown in the attached map.

(3) Most of leases have identical terms and conditions except certain issues specific to the individual area. The key conditions are outlined below:

(a) The lessee shall provide funds and technology.

(b) Ownership of products (under product sharing method)

86.5%: Lessee in compensation for the above contribution

13.5%: P.N. Tambang Batubara

(c) Development schedule and liability to renounce mining area.

General Survey	:	1 - 2 years. After general survey, 50% of the initial area is kept and the remainder is renounced.
Exploration	:	3 years. After exploration, 40% of the initial area is kept and the remainder is renounced.
Feasibility study	:	1 year

Construction : 3 years

Production : 30 years

(4) As a result of exploration activity conducted to date, total amount of coal reserves in East Kalimantan is estimated to be 1,100 - 1,500 million tonnes. Types of coal vary from bituminous to sub-bituminous. The range of caloric value is between 5,000 kcal/kg and 7,500 kcal/kg.

In No. 5 mining area (P.T. Arutimin - ARCO/UTAH), which has most advanced in exploration, feasibility studies have been already completed. Upon entering into purchase contracts with consumers, it could produce within 18 months at the initial production rate of 2 million tonnes per year. Its projected production rates is up to 5 million tonnes per year.

In addition, in No. 4 mining area (P.T. Utah- UTAH), engineering studies at the production rate of 1 million tons per year have been completed. P.T. Utah limits the marketing area to Indonesian soil, and has already obtained a letter of intent from P.T. Semen Gresik (Surabaya).

The next active mining areas are No. 2 (RTZ-BP) and No. 7 (KIDECO). According to Batubara, quality of No. 2 area is as high as Ombilin coal (7,000 kcal/kg). The abovementioned four areas are ready to go into production scheme depending on the market. The pesimistic mining areas are No. 1 (ENADIMSA) and No. 6 (AGIP-CONSOL). Especially, No. 6 is nearly hopeless because of high sulphur content.

(5) On account of such reasons as positive coal policy of the Indonesian government, huge reserves, variety of coal quality, reputable companies and their current positive activities, it is anticipated that in the future Indonesia will have high potentiality of coal export mainly from East Kalimantan. However, the timing of the sizeable and commercial development would entirely depend on the future world coal demand - probably in 1990's.

(10) KALTIM PRIMA

Name of Mine : Kaltim Prima

Location : 100 km north of Samarinda, and 20 km north of Bontang

Owner of Mining Property : P.T. Tambang Batubara

Business Entity : P.T.Kaltim Prima Coal (CRA Ltd. 50%, BP Coal Ltd. 50%)

Classification : Steam coal

* Following numbers are concerning with steam coal.

Scale of Development (partly achievements) : 120,000 t in 1987. 500,000 t in 1990. 1,600,000 t in 1991. Expansion plan to 6,000,000 t (according to market condition).

Standard Quality (A.D.B.) :

Use	Total Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Grinda-bility
	9.5	4	39	7100 kcal/kg	0.5	50 HCI

Importer to Japan : Mitsubishi Co. to E.P.C., and not determined to the rest.

Export Contract to Japan : To Chugoku E.P.C.: 370,000 t (for trial)

Coal Reserve : Minable coal reserve: 190,000,000 t

Mining Method : Open-cut mining. Overburden is stripped by truck/shovel.

Coal-cleaning Capacity	:	200 t/h
Coal Storage Volume in Port	:	500,000 t
Transportation	:	Coal is transported from the Mine to the port of loading (12.7 km) by belt conveyers. Largest ship: 150,000 DWT
No. of Employees	:	Between 1500 to 2000 (planned, at full scale operation)
Port of Loading	:	Tanjung Bara

(11) BELAU COAL

Name of Mine : Belau Coal

Location : East Kalimantan

Owner of Mining Property : P.T. Tambang Batubara

Business Entity : P.T.Belau Coal (Mobil Oil 60%, Nisho-Iwai Co. 40%)

Classification : Steam coal

** Following numbers are concerning with steam coal.*

Scale of Development : 2500 km^2 blocks are under exploration. Finally (in 2000), the mine scale will be expanded to 5,000,000 t production per annum.

Standard Quality (A.D.B.) :

	Total Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Grinda-bility
	23.9	1.8	38.6	5790 kcal/kg	1.28	50 HGI

Importer to Japan : Nisho-Iwai Co.

Export Contract to Japan : Nothing yet.

Coal Reserve : Minable coal reserve: 300,000,000 t

Mining Method : Open-cut mining. Overburden is stripped by truck/shovel/loader.

Coal-cleaning Capacity	:	Not required.
Coal Storage Volume in Port	:	Not required.
Transportation	:	Coal is transported from the Mine to barges (8 km) by trucks, then to Belau river-mouth by barges, and is re-stacked to ocean ship. When the mine scale reaches at 1,000,000 t production per annum, belt conveyers will be installed in place of trucks.
No. of Employees	:	Not determined yet.
Port of Loading	:	Not used.

(12) SKYLINE COAL

Name of Mine : Skyline Coal

Location : In Utah State, 25 miles (40 km) W-NW of Price

Owner of Mining Property : Coastal States Energy Co.

Business Entity : Coastal States Energy Co.

Classification : Steam coal

* Following numbers are concerning with steam coal.

Scale of Development (partly achievements) : 1,650,000 t in 1987. 2,030,000 t in 1988. 2,270,000 t in 1989. After that, planned between 2,270,000 t and 2,720,000 t.

Standard Quality (A.D.B.) :

	Total Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Grinda-bility
	9.5	8.5	40.6	6950 kcal/kg	1.0	48 HGI

Importer to Japan : Itoh-chu Co.

Export Contract to Japan : 60,000 t to E.P.D.C.

Coal Reserve : Minable coal volume: Between 90,000,000 t and 100,000,000 t

Mining Method : Underground mining

Coal-cleaning Capacity : Not required.

Coal Storage Volume in Port	:	40,000 t in Long Beach. 200,000 t in Los Angeles.
Transportation	:	Coal is directly loaded on unit train with belt conveyers, and then transported 850 miles (1,360 km) to the ports.
No. of Employees	:	230 (in 1988)
Port of Loading	:	Long Beach/Los Angles

(13) PINADE COAL

Name of Mine : Pinnacle

Location : In Utah State, 10 miles (16 km) northeast of Price

Owner of Mining Property : Andalex Resource (paying mining lease to Federal Government and owners)

Business Entity : Andalex Resources, Tower Division

Classification : Steam coal

* Following numbers are concerning with steam coal.

Scale of Development (partly achievements) : 800,000 t/yr in 1987 and 88. (max)1,500,000 t/yr in 1989 and 90. (max)1,800,000 t/yr in 1991 and 92.

Standard Quality (A.D.B.) :

Use	Total Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Grindability
Gilson Seam	6.75	10.41	38.49	6779 kcal/kg	0.53	44 HGI
Lower Sunnyside	7.01	10.69	36.77	6789 kcal/kg	0.56	45 HGI

Export Contract to Japan : 30,000 t to Kansai E.P.C. in 1981. 120,000 t to E.P.D.C. in 1984 and 86. 520,000 t to cement industries.

Coal Reserve : Minable coal volume: 30,800,000 t (Between 45,000,000 t and 46,000,000 t when includes next mining block)

Mining Method : Underground mining

Coal-cleaning Capacity	:	Not required.
Coal Storage Volume in Port	:	50,000 t in Long Beach. 170,000 t in Los Angeles. (expansion plan to 600,000 t)
Transportation	:	Coal is transported from Wildcat (33.6 km distance from the Mine) to ports by railway (1,300 km distance).
No. of Employees	:	65 (in 1988)
Port of Loading	:	Long Beach/Los Angles

(14) BULL MOUNTAIN COAL

Name of Mine : Bull Mountain

Location : In Montana State, 30 miles (48 km) north of Billings

Owner of Mining Property : Meridian Minerals Company (paying mining leases to the owners below)

Ownership: Meridian Minerals 52.3%, Federal Government 42.0%, Montana State 3.3%, Individual ownership 2.4%

Business Entity : Meridian Minerals Company

Classification : Steam coal

* Following numbers are concerning with steam coal.

Scale of Development (partly achievements) : 200,000 t in 1988. 500,000 t/yr in 1989 and 90, 1,000,000 t in 1991, 2,000,000 t in 1992.

Standard Quality (A.D.B.) :

Use	Total Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Grindability
	13.24	6.64	35.02	6358 kcal/kg	0.57	45 HGI

Coal Reserve : Minable coal volume: 186,000,000 t

Mining Method : Underground mining

Coal-cleaning Capacity : 900 t/h

Coal Storage Volume in Port	:	1,500,000 t
Transportation	:	Coal is transported from Huntley to the port (1,870 km), and will be from the Mine in the future.
No. of Employees	:	Not determined.
Port of Loading	:	Roberts Bank port, Westshore Terminals (Canada)

(15) COAL VALLEY

Name of Mine : Coal Valley

Location : In Alberta State, 50 km southeast of Hinton city.

Owner of Mining Property : Luscar Sterco Ltd. (paying royality to Alberta State)

Business Entity : Coal Valley JV (Luscar Sterco Ltd. 75%, Alberta Energy 25%)

Kind of Coal : Steam Coal

Scale of Development (partly achievements) : 1,800,000 t in 1987. Planned between 1,900,000 t and 2,300,000 t per annum after 1988.

Standard Quality (A.D.B.) :

Use	Total Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Grinda-bility
	10.0	10	35	6350 kcal/kg	0.25	54 HGI

Export Contract to Japan : 150,000 t to Chugoku E.P.C., 200,000 t to Hokkaido E.P.C. Both are long-term contracts.

Coal Reserve : Minable coal volume: 67,000,000 t

Mining Method : Open-cut mining. Overburden is stripped by truck/shovel/dragline.

Coal-cleaning Capacity : 1,000 t/h

Coal Storage Volume in Port : 1,500,000 t in Roberts Bank.
600,000 t in Neptune Terminals.

Transportation	:	Coal is transported from the Mine to ports by railways (1,091 km).
No. of Employees	:	312 (in 1986)
Port of Loading	:	Roberts Bank/Neptune Terminals

(16) QUINSAM COAL

Name of Mine : Quinsam

Location : In British Colombia State, Vancouver Island

Owner of Mining Property : Brinco Coal Corporation

Business Entity : Brinco Coal Corporation

Classification : Steam coal

* Following numbers are concerning with steam coal.

Scale of Development (partly achievements) : 20,000 t in 1987. 150,000 t in 1988. 250,000 t in 1989. 400,000 t in 1990. 500,000 t in 1991. 1,000,000 t in 1992.

Standard Quality (A.D.B.) :

Use	Total Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Grinda-bility
Not cleaned	< 9.0	< 13.5	36.5	> 6500 kcal/kg	< 1.0	> 45HGI
Cleaned	< 10.0	< 12.0	38.5	> 6800 kcal/kg	< 1.0	> 45HGI

Export Contract to Japan : 25,000 t to Nippon Steel, 300,000 t to Chugoku E.P.C. in 1988.

Coal Reserve : Minable coal volume: 23,000,000 t

Mining Method : Open-cut mining. Overburden is stripped by truck/shovel.

Coal-cleaning Capacity	:	The equipment will be installed in 1991 or 92. Planned capacity: 270 t/h
Coal Storage Volume in Port	:	1,500,000 t in Roberts Bank. Additional plan of 70,000 t in Middle Bay.
Transportation	:	Coal is transported by trucks to Middle Bay, then by barges to Roberts Bank. Under planning as for post 1991.
No. of Employees	:	229 (in 1985)
Port of Loading	:	Middle Bay/Roberts Bank

POTENTIALITY OF COLOMBIAN COAL

(1) Colombia is believed to have the largest coal reserves among the South American countries, of which amount is estimated to be about 16,000 million tons, though sufficient exploration has not yet been completed. However, notwithstanding such abundant coal reserves, Colombian coal had not become to attract any attention from the world for a long time before El Cerrejon was found.

It stood in the spotlight at a bound after huge amount of coal reserves were proved to be deposited just below the surface of the earth in El Cerrejon area near the Caribbean Sea by vigorous exploration activities conducted from early 1970's. The Colombian government, which recognised such large coal reserves, started out to development aiming at acquiring hard currency by exporting this coal.

(2) In 1976, the government established CARBOCOL (Carbones de Colombia S.A.) for the purpose of developing and exporting coal in El Cerrejon area. At present, there are two projects in process in this area; the Central Project solely conducted by CARBOCOL, and the North Project proceeded with both by CARBOCOL and INTERCOR (International Resources Corp.-EXXON's 100% owned subsidiary) under 50/50 equity. The locations of mining areas are shown in the attached map.

The Central Project is designed to produce a maximum of 1.5 million tonnes/year, of which 0.7 million tonnes/year will be used at Termo Guajird Thermal P/S newly constructed on the Caribbean coast near the mine-site. Consequently, a margin of coal for export is as small as less than 0.8 million tonnes/year.*

* According to the latest news, it is reported that CARBOCOL will cut the coal production of the Central Project significantly in order to improve the profitability of the Project.

(3) On the other hand, the North Project is very large in scale and its whole production is designed to be exported abroad.

In 1975, the Government invited international tenders for development, production and export of coal in the North Block.

As a result, INTERCOR (EXXON's 100% owned subsidiary) was found to be the successful bidder from the view point that they offered the best conditions, and that EXXON had rendered great services in the past to the exploitation of oil in Colombia. The Association Contract was concluded between CARBOCOL and INTERCOR in December 1976. An outline of the North Project is listed below.

Gross Required Fund:	About U.S.$3,200 million (equally shared by both companies)	
Reserves:	3,000 million tonnes	
Mining:	Open cut	
Mining Contractor:	INTERCOR	
Marketing Agency:	CARBOCOL (50%) INTERCOR (50%)	
Quality (As Received):	Moisture	9.2%
	Ash	8.0
	Volatile Matter	34.9
	Fixed Carbon	47.9
	Sulfur	0.6
	Calorific Value	6,610 kcal/kg
	HGI	48
	FSI	1 - 2
	AFT Oxidizing	1,400°C
	Reducing	1,350°C
Development Schedule:	Exploration Phase 1976 - 1979 (4 years)	
	Construction Phase 1980 - 1985 (6 years)	
	Production Phase 1984 - 2008 (25 years)	

Plan for Production and Export:

Year	Production	Export
	(million tonnes)	
1984	2.0	-
1985	3.0	2.0
1986	5.0	6.0
1987	9.0	9.0
1988	12.0	12.0
1989	15.0	15.0
|	|	|
2008	15.0	15.0

(4) Coal from the Cerrejon North Project has good qualities in terms of high calorific value, low ash and low sulfur. In addition, there is no misgiving in coal supply ability, since INTERCOR, consistently takes all risks and responsibilities covering from production to ship loading. Furthermore, as for two years of 1985 and 1986, all coal has been already sold out by EXXON's powerful marketing activities.

However, the projected main markets of this coal would be European countries, the U.S. Gulf states and East Coast on account of the geographical condition.

Part of this coal would come into the Far Eastern and Southeast Asian market, but it is likely that this coal is less competitive in price on a delivered basis than the other sources closer to the Asian market unless favourable freight rates are applied.

Therefore, the advantage of this coal in the Southeast Asian market including Malaysia would not be a direct effect through actual delivery of this coal, but an indirect effect which could be caused by the increasing coal inflow into Asian market from South Africa and Australia that must be shut out from the European and American market by the advent of Colombian coal. This increasing coal inflow from South Africa and Australia into Asian market would cause a roundabout price reduction in the Asian market.

(17) CERREJON COAL

Name of Mine : El Cerrejon

Location : In Guajira State, northeastern part of Colombia

Owner of Mining Property : CARBOCOL

Business Entity : Cerrejon JV (CARBOCOL 50%, Intercor 50%)

Kind of coal : Steam coal

* Following numbers are concerning with steam coal.

Scale of Development (partly achievements) : 7,700,000 t in 1987, 9,400,000 t in 1988, 12,000,000 t in 1989. 15,000,000 t/yr after 1990.

Standard Quality (A.D.B.) :

Use	Total Moisture (%)	Ash (%)	Volatile Matter (%)	Calorific Value (kcal/kg)	Total Sulphur (%)	Grinda-bility
	11	8.25	33.8	AR 6500 kcal/kg	0.7	48 HGI

Export Contract to Japan : 30,000 t to Chugoku E.P.C. in 1986. Other contract with Mazda Co., Idemitsu Co., Sumitomo Metal Co., etc.

Coal Reserve : Minable coal volume: 2,400,000,000 t (counted upper -300 m)

Mining Method : Open-cut mining. Overburden is stripped by truck/shovel.

Coal-cleaning Capacity	:	Not required (sizing and screening only).
Coal Storage Volume in Port	:	1,700,000 t
Transportation	:	Coal is transported from the Mine to the port (150 km) by unit train. The port has the capacity of 150,000 DWT.
No. of Employees	:	4,500 (in 1987)
Port of Loading	:	Puerto Bolivar