

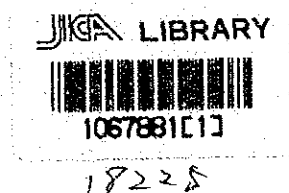
THE REPUBLIC OF THE PHILIPPINES
THE MASTER PLAN STUDY
OF
THE COAL MINING TECHNOLOGY DEVELOPMENT
FINAL REPORT

AUGUST, 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

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国際協力事業団

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PREFACE

In response to the request of the Government of the Republic of the Philippines, the Japanese Government decided to conduct a master plan study on coal mining technology development and a feasibility study on the coal mining technology development center and entrusted the survey to the Japan International Cooperation Agency (JICA). JICA sent to the Republic of the Philippines a survey team headed by Mr. Masaaki Inoue, Dia Consultants Co., Ltd. from January, 1988 to June, 1988.

The team exchanged views with the officials concerned of the Government of the Republic of the Philippines and conducted a field survey. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the coal mining in the Philippines and contribute to the promotion of friendly relations between our two countries.

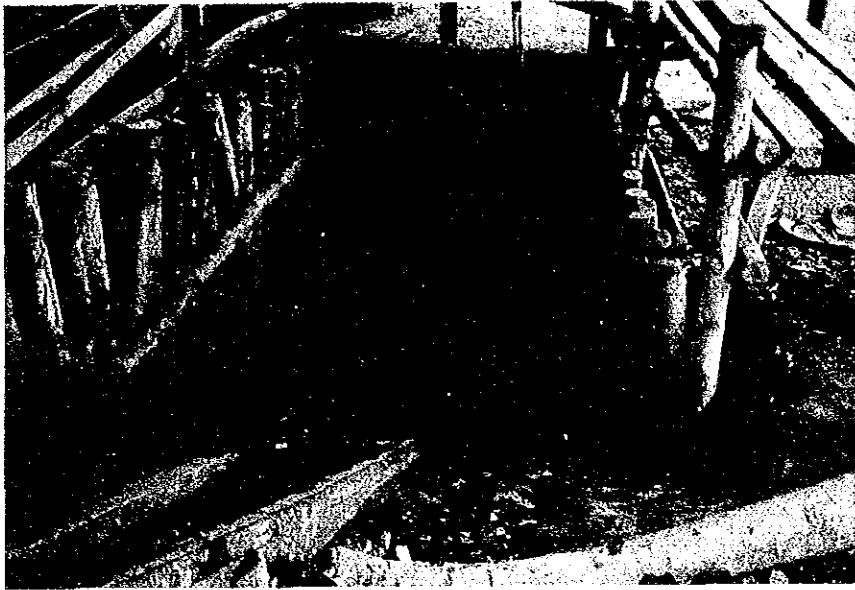
I wish to express my deep appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

August, 1988

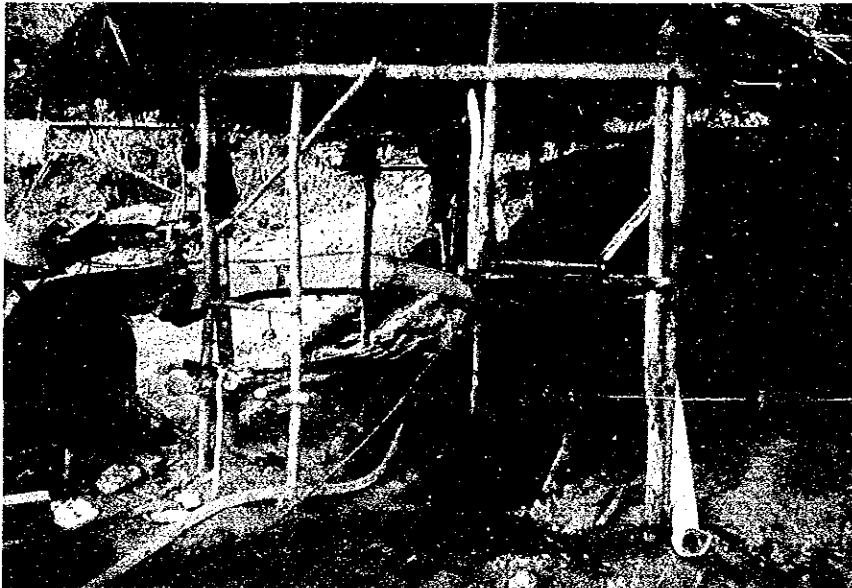


Kensuke Yanagiya
President

Japan International Cooperation Agency



An Inclined Shaft of The J.D.A. Coal Mine



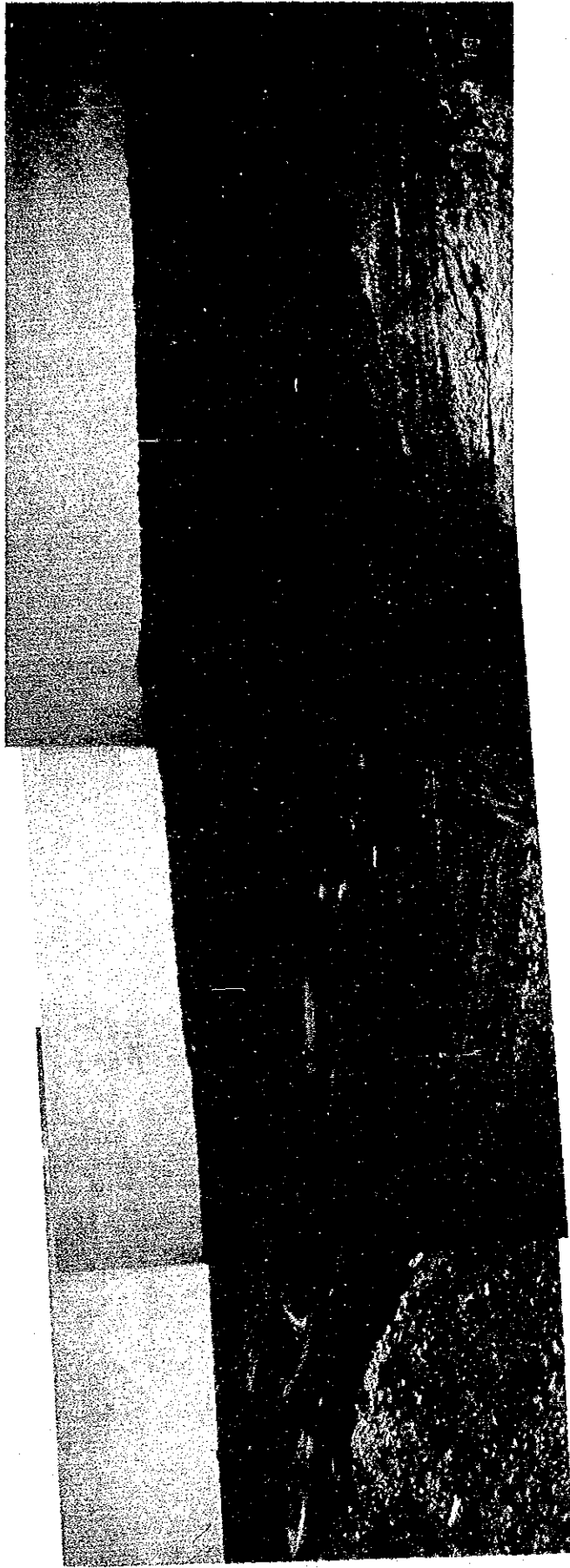
Forcing Ventilation (The Cebu Coal Mine)



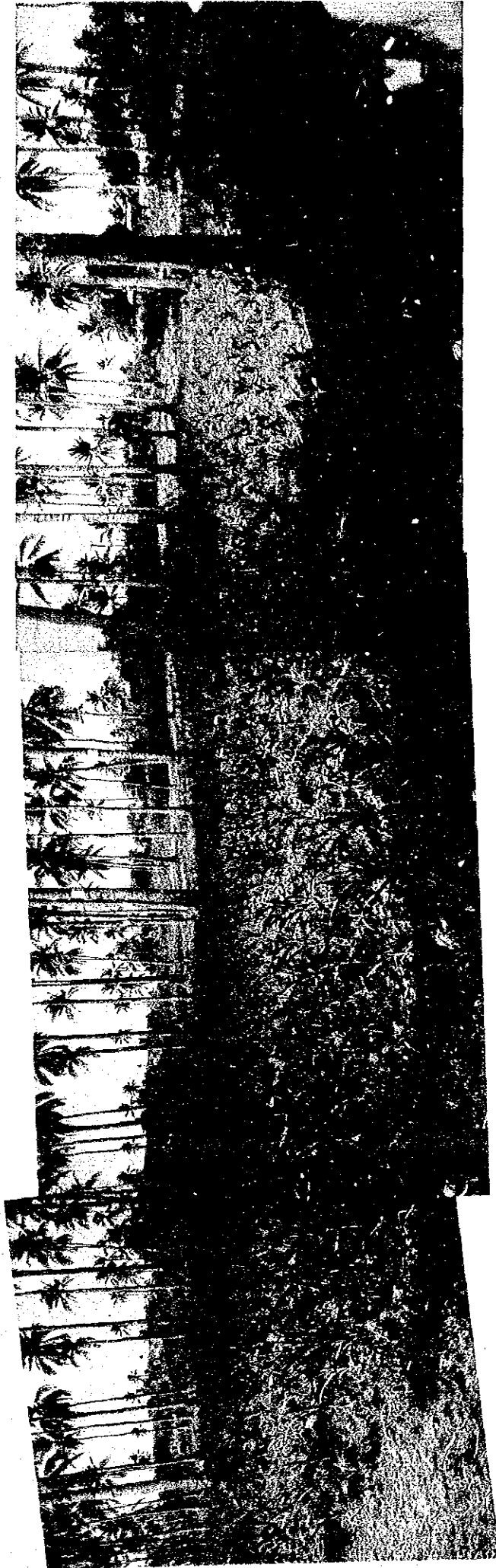
An Inclined Shaft of The Manguerra Coal Mine



A Simple Washing Equipment



Open Pit of The Semirara Coal Mine



Talisay Site for The Training Center

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ABBREVIATION

a) Organization

ADB	--	Asian Development Bank
BED	--	Bureau of Energy Development
CCA	--	Coal Council of Advisors
CIDA	--	Canadian International Development Agency
ESCAP	--	Economic and Social Commission for Asia and the Pacific
JICA	--	Japan International Cooperation Agency
MONENCO	--	Montreal Engineering Company Ltd.
NEDA	--	National Economic and Development Authority
NPC	--	National Power Corporation
OEA	--	Office of Energy Affairs
PNOC	--	Philippine National Oil Company
PNOC-CC	--	Philippine National Oil Company-Coal Corporation
SCC	--	Semirara Coal Corporation
WGBGR	--	Federal German Institute of Geoscience and Natural Resources
WGATC	--	Federal German Agency for Technical Cooperation
LDC	--	Lower Developed Countries

b) Program/Law

CMSRR	--	Coal Mine Safety Rules and Regulations
PD	--	Presidential Decree
TDP	--	Trade and Development Program
UNDP	--	United Nations Development Program
USTDP	--	United States Trade and Development Program

c) Coal Quality

BTU	--	British Thermal Unit
FC	--	Fixed Carbon
HV	--	Heating Value
IM	--	Inherent Moisture
TM	--	Total Moisture
VM	--	Volatile Matter
S	--	Sulfur

d) Currency & Exchange Rate

\$	--	U.S Dollar
P	--	Philippine Peso
¥	--	Japanese Yen

¥ 125.13/\$ (TTS Mean Value at April and May in 1988)

e) Others

BWE	--	Bucket Wheel Excavator
CIF	--	Cost, Insurance, and Freight
FOB	--	Free on Board
MT	--	Metric Ton
O.P.	--	Open Pit
ROM	--	Run of Mine
tpa	--	ton per annum
U.G.	--	Under Ground
MMBFOE	--	Million Barrels of Fuel Oil Equivalent

**CONCLUSIONS
AND
RECOMMENDATIONS**

Conclusions and Recommendations

A. Conclusions

1. Object and Background of the Study

1) Object

The purpose of this study is to clarify the position of the development and utilization of indigenous coal in the Philippines on the basis of a long-term energy program and to recommend the necessary plans and measures to be undertaken by the coal mining industries of the Philippines in order to meet the increasing coal demand (refer to Figure 2).

2) Background of the study

The Philippine government has taken a bold step to develop coal as an alternative energy source so as to reduce the country's heavy dependence on oil and will need to secure the required amount of the indigenous coal to meet the growing coal demand. For this purpose, the Philippine government requested the Japanese Government to study the "Coal Industry Technology Development Master Plan" relating to the development of coal production and manpower.

The Japan International Cooperation Agency (JICA) sent a preliminary survey team to conclude the Implementing Arrangement to the Philippines.

The study is divided into two phases consisting of the master plan for technology development in the coal mining industries as the first phase and studies of the coal mining technology development center as the second phase.

JICA sent the study team to the Philippines for the first phase study on January 25, 1988. The study team carried out the survey in cooperation with the Office of Energy Affairs (OEA) as the Philippines' counterpart. The result of the first-phase study had demonstrated the necessity to undertake the second phase study whereby it was subsequently started on April 27, 1988 by sending a study team to the Philippines.

The final report was completed by merging the results of the phases I and II studies.

2. Phase I: Study on the Master Plan

2-1 Review of the Current Status of the Coal Mining Industry

1) Current coal position of energy demand

The growth rate of the country's GNP continued to drop until 1985, but recovered in 1986 with a rise of 5.05% until 1987. The National Economic and Development Authority (NEDA) forecasts a 5.9 ~ 6.5% growth rate, until the end of 1988. The Aquino Administration also forecasts a 6.8% growth rate from 1987 to 1992.

Energy demand in the Philippines is met by various resources including oil, coal, hydro-power, and geo-thermal. In 1987, oil accounted for 61.3% of total energy and 97% of the oil used was imported. Coal occupies a 6.8% share in the total energy mix wherein 40% were imported (on a calorie basis).

The proportion of each energy source until 1992 is shown in the figure 1.

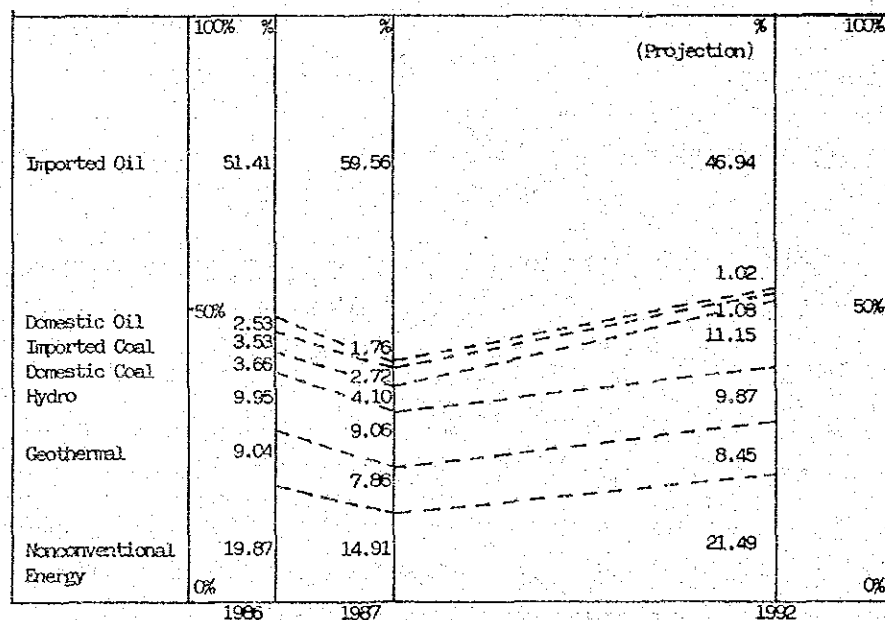


Figure 1. Consumption of energy sources in the Philippines

According to the long-term energy demand forecast (1986), the volume of oil consumed will increase by 2% in 1992, but its proportion in the total energy mix will drop to 47%. The proportion of coal, including imported coal, was 6.8% in 1987 and will increase to 12.2% in 1992. The annual growth rate of coal consumption is 9.9% which is higher than the 4.1% growth rate for the total energy, and the indigenous coal occupies 90% of the total consumption of coal. This accounts for the government's strong intention to develop indigenous coal in order to save foreign currency.

2) The current status and outlook of coal demand

The major coal users are the National Power Corporation (NPC), cement factories, and the non-ferrous industries, including Atlas and Philphos.

Electric Power Generation

Total power generation in the Philippines is equivalent to an output of 20,144 GWH, of which 13.6% come from coal-fired thermal power stations. The operating power stations are the Calaca I (300 MW in Luzon Island) and Naga I and II (50 MW and 55 MW) in Cebu Island.

Calaca power station uses coal from Unong mine in Semirara Island blended with imported coal at 60:40 ratio. Total coal consumption amounted to 913,000 tons in 1987.

The Naga power station used mainly oil in 1987, and coal consumption was only 63,000 tons. In 1988, however, coal consumption will be about 160,000 tons.

The program of coal thermal power station is given below by NPC.

- 1992 Calaca II (300 MW)
- 1995 Calaca III (300 MW)
- 1999 Cagayan Valley (300 MW)
- 2000 Cagayan Valley (300 MW)
- Mindanao (Bislig) (100 MW)

Cement factories

18 companies completed their modification program to convert the fuel feed from oil to coal in 1985. Coal consumption for the convert plants in 1985 was 678,000 tons. During 1985 to 1986 cement production dropped to 3 million

tons as a result of the economic depression. From late 1986, however, the market became active again and in 1987, cement imports of about 280,000 tons were urgently required to fill the supply gap. In 1988, about 100,000 tons of cement will be imported.

The Philippines Cement Association forecasts a 5% growth rate in cement demand.

Industrial coal consumption

Industrial coal consumption has been calculated and forecasted until the year 2000. (Table 2-1-4)

3) Coal reserves

The OEA reviewed the coal reserves in the Philippines in 1986. According to the results, the mineable reserve is about 300 million tons. Projected coal production from 1988 to 2000 is about 56 million tons. A big portion of these coal reserve is located in Semirara Island and in Cagayan Valley, followed by Malangas, Bislig, Cebu and Samar areas.

4) Status of coal production in the recent past

Coal production in the Philippines became active in the wake of the first oil crisis. The status of coal production is shown in Table 1.

Table 1 Status of Coal Production in the Philippines over the Years

(1,000 tons)

Region	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Semirara	-	-	-	-	-	5	33	13	91	326	552	568	592	595
PNOC Area	-	-	-	-	2	14	42	58	145	275	283	253	178	204
Cebu	50	91	103	238	216	198	212	213	249	323	238	313	364	242
Batan	-	-	7	27	17	19	12	8	40	34	100	101	53	55
Others	1	14	11	20	20	27	30	39	33	62	51	27	49	73
Total	51	105	121	285	255	263	329	331	558	1,020	1,216	1,262	1,236	1,169

The table shows that production reached one million tons in 1983. In 1987, production amounted to about 1.17 million tons run-of-mine (1.01 million tons as 10,000 BTU/lb base), of which 530 thousand tons were produced from the underground mines. The rest was from the open cut mines.

Semirara, Malangas and Uling mines have been developed with good mine plans and adequate equipment, but the small scale mines in Cebu and other islands have started production from the coal outcrops with minimal equipment.

5) Outlook of production

The OEA forecasts an increase in productivity (t/man-shift) from 0.23 to 0.4 from 1987 to 2000 at the underground mines. For the open cut mines, productivity will reach 1.8 from 0.75, excluding the Semirara mine. The Semirara mine will reach an output level of 3.0 t/man-shift in 2000. From the above forecasts, the OEA has projected the pattern of indigenous coal production up to the year 2000 (Table 2).

Table 2 Projection of Coal Production (1,000 tons, 10,000 BTU/lb)

Region	1988	1989	1990	1991	1992	1993	1995	2000
Semirara	630	648	720	720	1,440	1,440	2,160	2,592
PNOC Areas	353	327	293	363	402	402	402	402
Cebu	374	483	570	606	630	654	825	1,132
Batan	75	130	142	142	142	142	142	142
Others	164	271	360	370	460	464	719	2,800
Total	1,596	1,859	2,091	2,201	3,074	3,102	4,248	7,068
(Run of Mine)	(1,843)					(3,658)	(5,136)	(10,376)

At present, the areas to be developed for opencast coal mining in the near future are the Himalian and the Panian areas in Semirara island, and the Iguig coalfield in the Cagayan Valley region.

Similarly, the areas expected to be developed for underground coal mining belonging to the PNOC-CC are the Bislig Mine III in Surigao del Sur in eastern Mindanao and the Integrated Little Baguio and Lalat areas near the Malangas coal mine.

6) Subjects for expanded production of coal

In order to achieve the projected forecasts for coal production made by the OEA, increases in productivity are vital.

Each subject is explained below.

a. Exploration

Malangas and Uling mines developed by PNOC-CC carried out sufficient exploration surveys (bore holes with 100 meters space) before the development of its mines and made a long term mining plan with modern mechanized equipment. But for the small scale mines, exploration survey at the surface and drilling was generally inadequate. As they started mining from the coal outcrops, the coal reserves at the shallow level become scarce. Consequently, a drilling survey will be necessary to confirm coal reserves at the deeper levels.

b. Mining and related matters

The mine plans of PNOC-CC coal mines are modernized due to the use of tunneling methods, mining equipment, transportation, ventilation and drainage. But engineers and workers will need to learn mining technology more profoundly in order to increase the productivity of coal mining.

On the other hand, most small-scale mines produce coal from steeply dipping and thin coal beds mined at shallow levels (several 10 meters below the surface) with poor equipment.

Mining areas are limited to natural ventilation and coal is produced from small mining pits. Transportation of coal uses mine cars (hand-pushed), small boxes with sleds and barrows. The poor coal transportation system prohibits an increase in coal production.

With respect to the ventilation systems, there are many aspects to be improved. An example is a ventilation system using draft shafts with forced ventilation to disperse methane gas by compressed air.

While the mining areas are still shallow, the above problems are not so serious. When the mining areas move to a deeper level, however, the mining system must be improved in many aspects (the present status in coal mines is similar to that of Japanese coal mines after the World War II).

c. Safety

During the past ten years (1978 ~ 1987), fatal accidents have taken a death toll of 154 lives, and non-fatal accidents (serious and light injuries) have caused harm to 1,240 persons.

A comparison of the statistical data on coal mine accidents per one million tons coal production between Japan and the Philippines during the past ten years (1978 ~ 1987) is given below.

	<u>Japan</u>	<u>The Philippines</u>
Fatal accidents	2.74 persons	20.1 persons
Total accidents	56.94	181.94

The major problems observed in the investigations are as follows,

- a) Methane gas level rises to 4.5% near the roof of the tunnels due to insufficient ejection of compressed air. Moreover, there are no explosion-proof equipment used for mining.
- b) Poor roof support by timbers. Tunnels tend to yield and become narrow even under small rock pressure, causing rockfall accidents.
- c) Poor drainage for water seepage, especially in the level tunnels without gradient, causes sometime electric shock accidents.
- d) Spontaneous combustion
- e) Lack of safety equipment

d. Administration and management

Companies usually employ non-experienced workers (mostly farmers) and train them on-the-job after a one-day instruction on safety.

Engineers mostly come from the metal mines and have no adequate education on coal mining technology.

The continuous service years of regular workers are not long. According to the 1986 data, about 85% of the regular workers resign with only 2 years of service. The primary reason for the high ratio of manpower turnover is due to low wages (lowest wage P750/month - highest P

1,200/month). The coal mines belonging to PNOC show longer service years for workers due to higher wages at about P2,000/month. Therefore some companies have to consider improvements in the level of wages.

e. Coal quality

Unstable coal quality is caused by factors such as complex geology, variable quality of coal seams and poor mining technology. In some cases users tend to reject purchasing such poor-quality coal.

With the projected coal production increases in the future, it will be necessary to consider the construction of a centralized coal washing plant instead of the individual simple preparation of coal at the mine sites (BED asked Norwest to study this idea in 1983).

f. Policies and measures

The price of indigenous coal is about P750 - 830/ton (8,500 BTU/lb, CIF), that is, about P200/ton higher than that of imported coal (P600/ton, CIF tax) given the same calorific value.

The National Coal Authority, formed in 1980, controlled the price of indigenous coal and the volume of imported coal, but after the new government came into power, control over prices was rested in the Energy Regulatory Board (ERB). Presently, the Coal Council of Advisors, consisting of the representatives of producers and users with government agencies as observers, lays down a price guide and policy directives for the volume of imported coal. The policy for 1988 is that the ratio of volume between indigenous and imported coal should be 55 to 45.

NPC plans to use coal from the Semirara coal mine as much as possible, in spite of the disadvantage of its higher price and poor quality compared to imported coal.

2-2. The Master Plan for the Activation of the Coal Mining Industry

1) Object

The history of coal production in the Philippines shows that coal output has been increasing from the level of 50,000 tons in 1974, one million tons in 1983 to about 1.2 million tons last year. But this increase in production was achieved through increase in the number of laborers rather than the advancement of mining technology. This is indicative of the productivity of the various coal mines which is as low as 0.23 t/man·shift. This productivity is lower than that of the Japanese coal mines in the 1940s.

In connection with the increased production of coal in the Philippines, an energy conversion program from oil to coal was promoted in the electric power and cement industries. This helped reduce the outflow of foreign currency by the reduction of oil imports. But the coal mining industry in the Philippines should be revolutionalized to increase productivity and henceforth on coal production in order to compete with the cheaper imported coal. There is also a need to establish better standards of safety, improved working conditions and the drawing-up of a long term management plan for a more stable supply of coal in the future.

2) Measures under the Master Plan

Upon reviewing the current status in the coal mining industry in the Philippines, it seems difficult to expect an improvement of the productivity of coal mining with the current mining technology.

On the other hand, a significant level of additional production of coal will come from the areas of Semirara island and Cagayan Valley (Brown coal) by opencast mining and from Bislig III by underground mining.

As a result, the main objective for the productivity improvement program will be confined to the underground coal mines where plenty of problems have to be overcome. This is the target of the Master Plan study because it seems that only minor problems are affecting the opencast mines since most of them are already mechanized.

For open cut mining, a large part of production is from the Semirara coal mine which has skillful engineers and enough equipment to improve mine technology by itself. For the future projection of coal production from Semirara coal mine, the current productivity is used due to the scarce data to predict future productivity.

On the basis of the above conditions, the OEA projection of coal production is reviewed by JICA team as follows.

Projection of coal production in 2000 (1,000 tons)

OEA 6,376 (without 4,000 of lignite)

JICA team 3,627 (without 4,000 of lignite)

3) Measures for the improvement of coal production

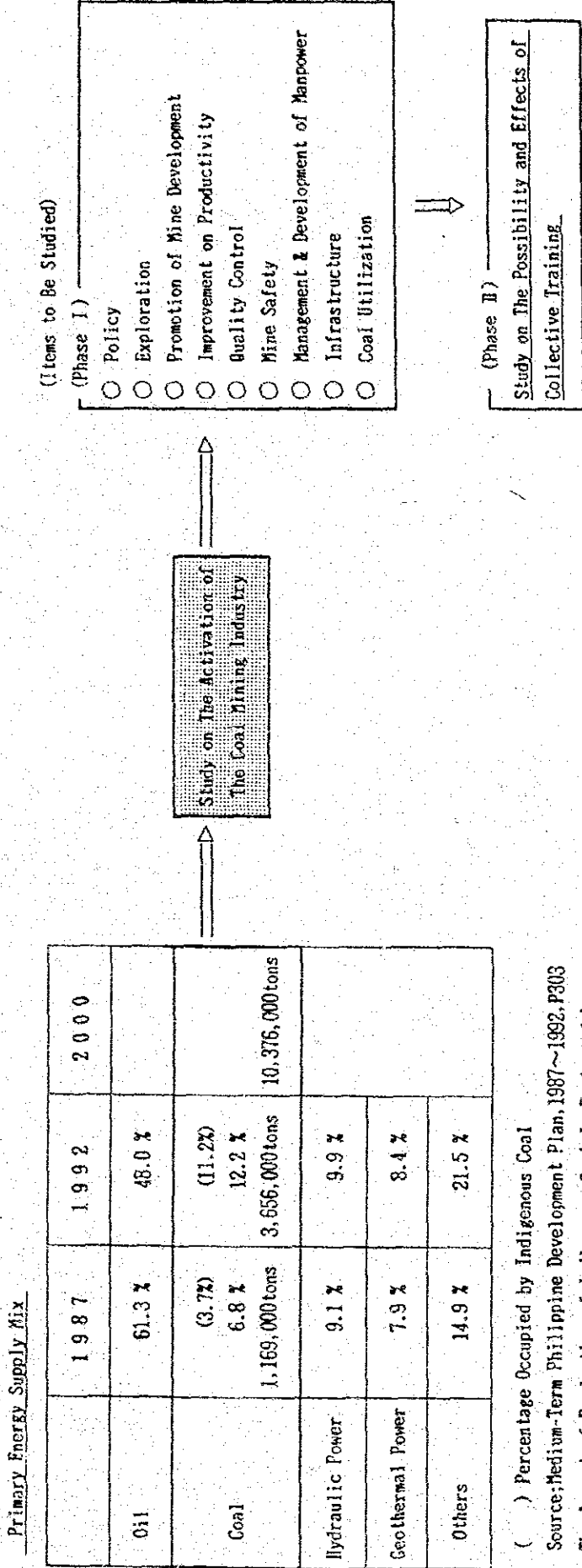
To bring about increased coal productivity (especially in underground mines), it is necessary to improve the mine facilities, mining methods, concentration of working faces, safety, transportation, ventilation and drainage.

From these improvements it is estimated that coal production from the underground mines will be about 2 million tons in the year 2000 mainly from the increase of coal productivity to 0.6 t/man-shift.

In order to achieve this goal, it will be essential that overseas specialists familiar with the mining conditions in the Philippines should impart better technology to the engineers of the small scale mines with adequate training period. On the other hand, the government should take the necessary measures to improve the coal mining industry.

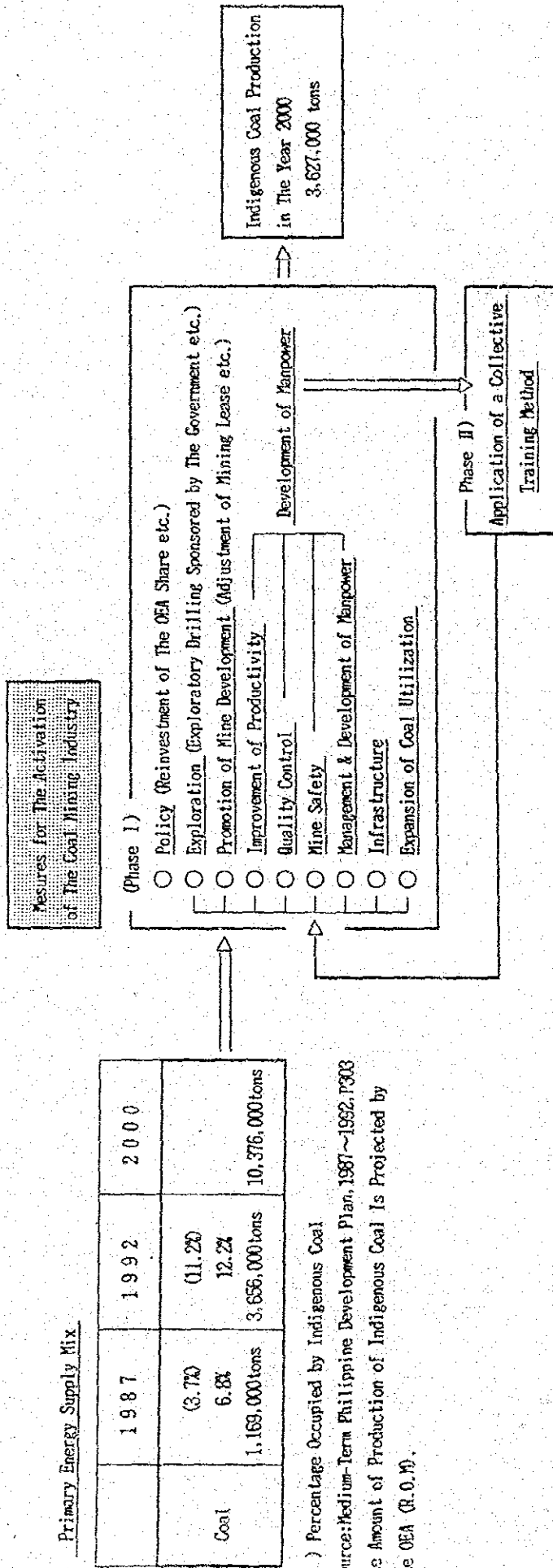
The necessary measures for the activation of the coal mining industry are summarized in Figure 3~5.

Figure 2 OBJECTIVES OF THE STUDY



() Percentage Occupied by Indigenous Coal
 Source: Medium-Term Philippine Development Plan, 1987~1992, P303
 The Amount of Production of Indigenous Coal Is Projected by
 The OEA (R.O.M).

Figure 3 RESULTS OF THE STUDY



MEASURES TO BE TAKEN FOR THE ACTIVATION OF THE COAL MINING INDUSTRY

Figure 4

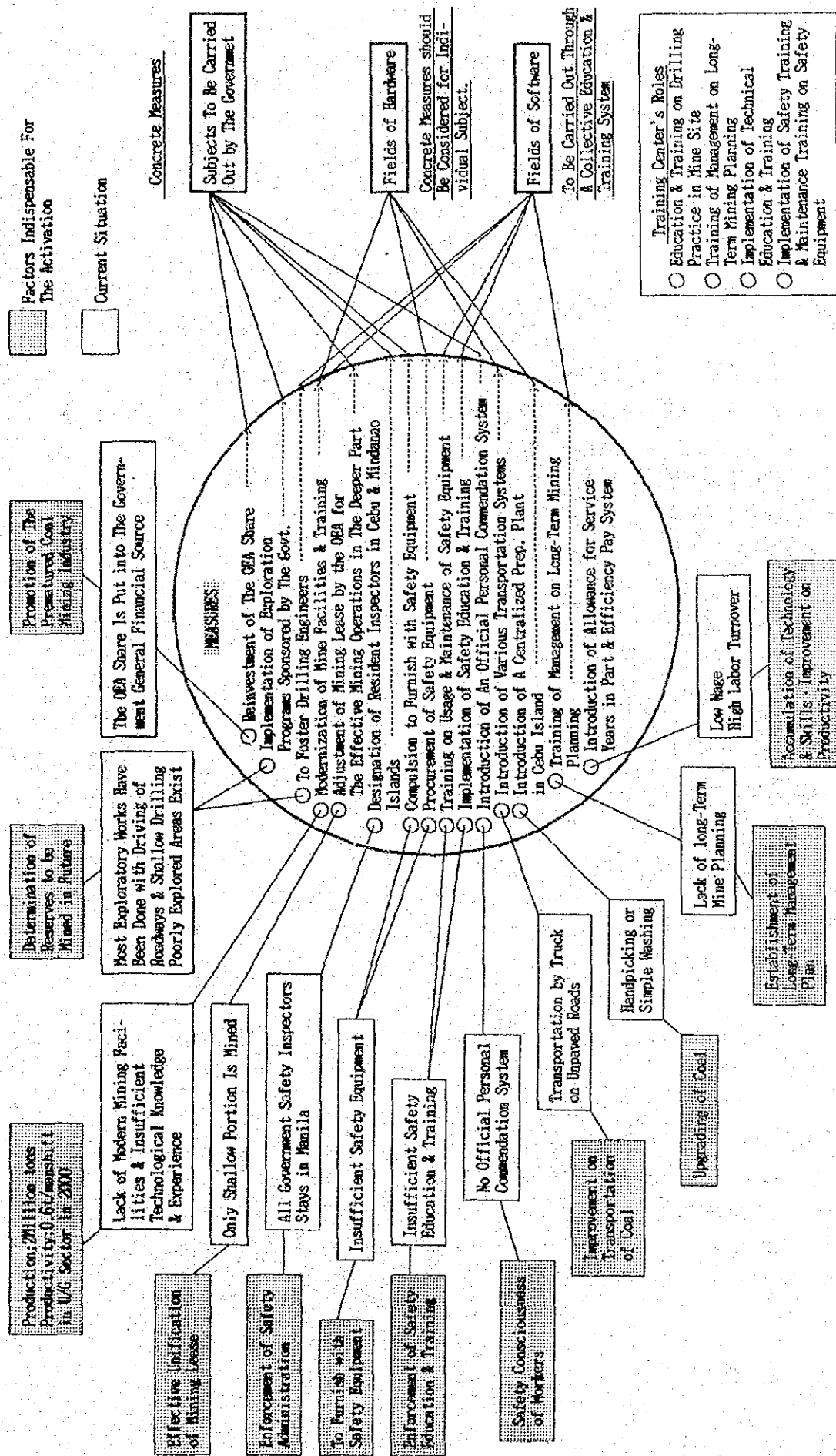


Figure 5

CONCRETE MEASURES UNDER THE MASTER PLAN

SUBJECTS TO BE CARRIED OUT
BY THE GOVERNMENT

- Reinvestment of The OEA Share in The Coal Mining Industry
- Implementation of Exploration Programs Sponsored by The Government
- Adjustment of Mining Lease by The OEA for The Effective Mining Operations in The Deep Part
- Designation of Resident Mine Inspectors in Cebu & Mindanao Islands
- Compulsion to Furnish with Safety Equipment
- Introduction of An Official Personal Commendation System

FIELDS OF SOFTWARE

Concrete Measures Should Be Considered for Individual Subject.

- Modernization of Mine Facilities and Training
- Procurement of Safety Equipment
- Introduction of Various Transportation Systems
- Introduction of A Centralized Preparation Plant in Cebu Island

FIELDS OF SOFTWARE

- To Foster Drilling Engineers
- Technical Training on Modern Mining Equipment & Facilities
- Training on Usage and Maintenance of Safety Equipment
- Implementation of Safety Education & Training
- Training of Management on Long-Term Mine Planning

To Be Carried Out Through A Collective Education & Training System

Training Center's Roles

- Education & Training on Drilling Practice in Mine Site
- Training of Management on Long-Term Mine Planning
- Implementation of Technical Education & Training
- Implementation of Safety Training & Maintenance Training on Safety Equipment

2-3. Economic Effect from the Activation of the Coal Mining Industry

Economic effect is brought to the country and the industry by the activation of the coal mining industry.

The Economic effects at the industry level are as follows.

- Production costs can be reduced to a level competitive with the imported coal by new investments to modernize existing underground mines.
- The OEA share will increase as coal output increases and will be used to activate the coal mining industry.
- The number of employee is expected to rise (about 8,000 persons/1987 -- about 13,000 persons/2000).
- A reduction in the number of accidents can be achieved by improvements in mining technology.

The economic effect at the national level will be as follows.

- Total value of increased coal production rises to a larger share of the GNP.
- Outflow of 900 million dollars can be saved for 13 years from 1988 to 2000 by limiting the volume of imported coal.
- The ratio of indigenous coal as a house-market form of energy will increase (4.1%/1987 - 11~12%/2000).

The problem, however, is whether the Philippines can supply mining machinery from own resources. If not, mining equipment will have to be imported on a major scale to match the increasing scale of coal production (refer to Figure 6, 7).

3. Phase II: Research for Coal Mining Technology Development Center

Reviewing the present status of the coal mining industry based on the programmed supply of indigenous coal, the mining technology is herein compared with the Japanese technology as it was in the 1940s. It is a fair assessment to say that the productivity of the underground mines is very low at only 0.23 t/man-shift. Therefore the industry should improve its present low productivity in order to compete with the cheaper imported coal in the future.

The comparison of the present status in the Philippines with the mining history of Japan suggests the possibility of improving productivity to 0.6t/man-shift in 2000 and to compete with imported coal.

For this purpose, concentrated and effective educational programs should be provided to the managers, engineers and workers.

It is proposed to establish a center for training and research to improve the mining technology and introduce new techniques.

Center plan

The Object of the Center is to train managers, engineers and workers on the appropriate technology, research for further innovations and the effective implementation of the technological changes..

The main purpose focuses on the improvement of the small-scale underground mines.

The Center can be established in Cebu island where many underground mines are operating. It should consist of a main center for seminars and workshops in Cebu city and an experimental mine for underground mining practices in PNOC-CC Uling mine.

The training curriculum will include three courses, one for the managers, one for the engineers, and one for the workers.

Courses for the managers will be offered several times a year which will include lectures on investment decisions, long term mine planning and management approach.

The engineers will learn trouble-shooting procedures so that they can develop and introduce new technology by themselves. The program shall be composed of 6 subjects, namely geology, exploration, mining, safety, maintenance and quality control. These courses will be held once or twice a year. Duration of each program shall be 4 to 6 weeks, with 15 trainees in each class being considered appropriate.

The training course for workers shall be composed of 4 subjects: safety, mine development works, mining and maintenance of equipment. Emphasis should be placed on practice in the workshop and the experimental mine.

These courses will be held once or twice a year, but the program for safety will be offered 4 times a year. An average of 25 trainees for each class is felt appropriate.

The total number of trainees joining the various courses is estimated at 410 persons a year, except for the manager's course.

Procurement of lecturers should be assured by employing experts in the Philippines. But in the immature fields of technology and experience, it will be necessary that foreign experts will assist in the activities of the Center. When the technology and education methods are transferred to the counter parts in the Philippines, all foreign experts will be replaced by the local counterpart.

Two locations are proposed for the center, and the most preferable site for the main center is in Lahug area (old airport near Cebu city), although no plan to utilize the Lahug area has yet been established. Therefore, the Talisay area (UP lot, 11 Km south from Cebu city) may be considered the second alternative site if the Lahug area should not be available on time.

The experimental mine shall be located in the area of PNOC-CC Uling mine (west of Talisay area).

Basic Layout of the Center shall be as follows; the main center shall consist of 4 buildings; main (950 m²), coal analysis (420 m²), workshop (700 m²) dormitory (990 m²), and a garage (100 m²). The dormitory should contain bed rooms for 60 persons at maximum.

The buildings at the experimental mine site shall consist of three buildings; main (270 m²), dining room (90m²) and workshop (140m²).

The layout of the experimental mine includes inclined shafts, level tunnels and mining faces of steeply and moderately dipped short walls.

Construction costs for the Center is estimated at 84 million pesos on a local contractor basis and 146 million pesos on an international contractor basis, including the costs for the main center and the experimental mine.

For the experimental mine, a new mine will be constructed in a coal seam at shallow depth.

Materials for education and training should contain both materials for training and buildings. The materials for training are classified based on priorities in the 1st and 2nd order. The estimated breakdown is as follows,

	1st order		2nd order		Total (Million)	
	\$	P	\$	P	\$	P
Main center	2.155	1.682	0.933	-	3.088	1.682
Experimental mine	2.605	-	-	-	2.605	-
Total	4.760	1.682	0.933	-	5.693	1.682

Exchange rate:P21.04/US\$

Management and operation of the Center should be controlled by the OEA. In the center, steering and operating committees should be formed. The steering committee headed by the Executive Director of OEA shall consist of representatives of users, producers and specialists to decide basic policy matters. The operating committee headed by the Managing Director of the Center will draw up the Center operating plans.

The total number of employees in the Center will be 33 persons, plus 4 experts from overseas, some part time lecturers, and nine contractual laborers.

The operating cost of the Center is estimated to be 4.8 million pesos annually. The OEA plans to allocate a part of the government share or to include in the annual budget of the OEA. To supplement the above two options, the PHILCOAL committed to provide the required operating expense. According to the OEA plan, about 16% of the government share (Approximately 5.0 million pesos) or 5.2 million pesos of the donation will be allocated.

For this allocation plan OEA should prepare the necessary procedures to obtain general agreement from the government and coal mining industry.

Prior to the establishment of the construction schedule of the center, the following conditions should be determined.

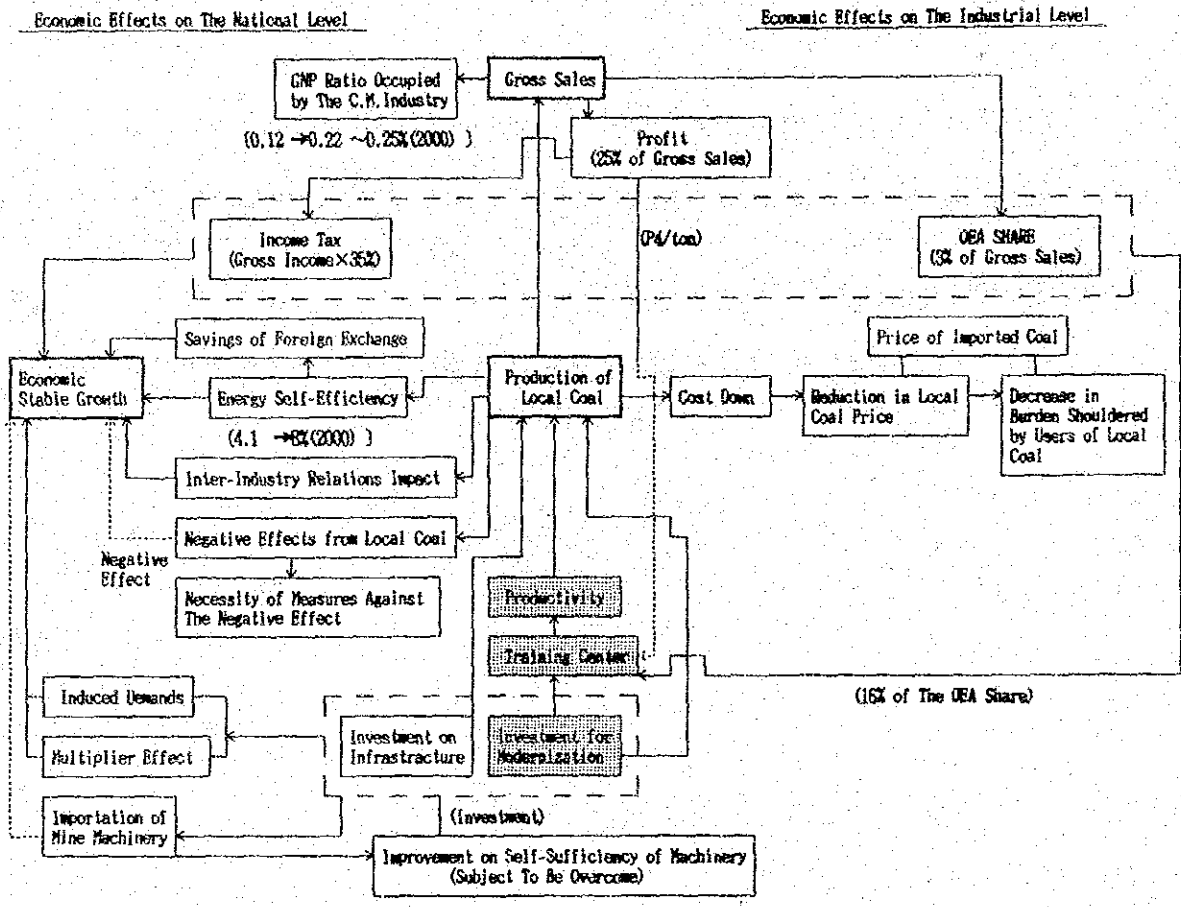
- a. A regulation should be established laying down that a part of OEA share can be used to cover the operation cost of the center.

- b. If in case condition a is not obtained, a firm undertaking should be given by coal mining companies to make a financial contribution proportional to their coal output.
- c. The land for the center should be made available free of charge.

Taking account of the necessary time to finalize the above conditions and to prepare the detailed design for the center, the commencement of the construction is likely to be May, 1989.

The time required for the construction is one year. During that period, all equipment will be installed. (Figure 3-3-1).

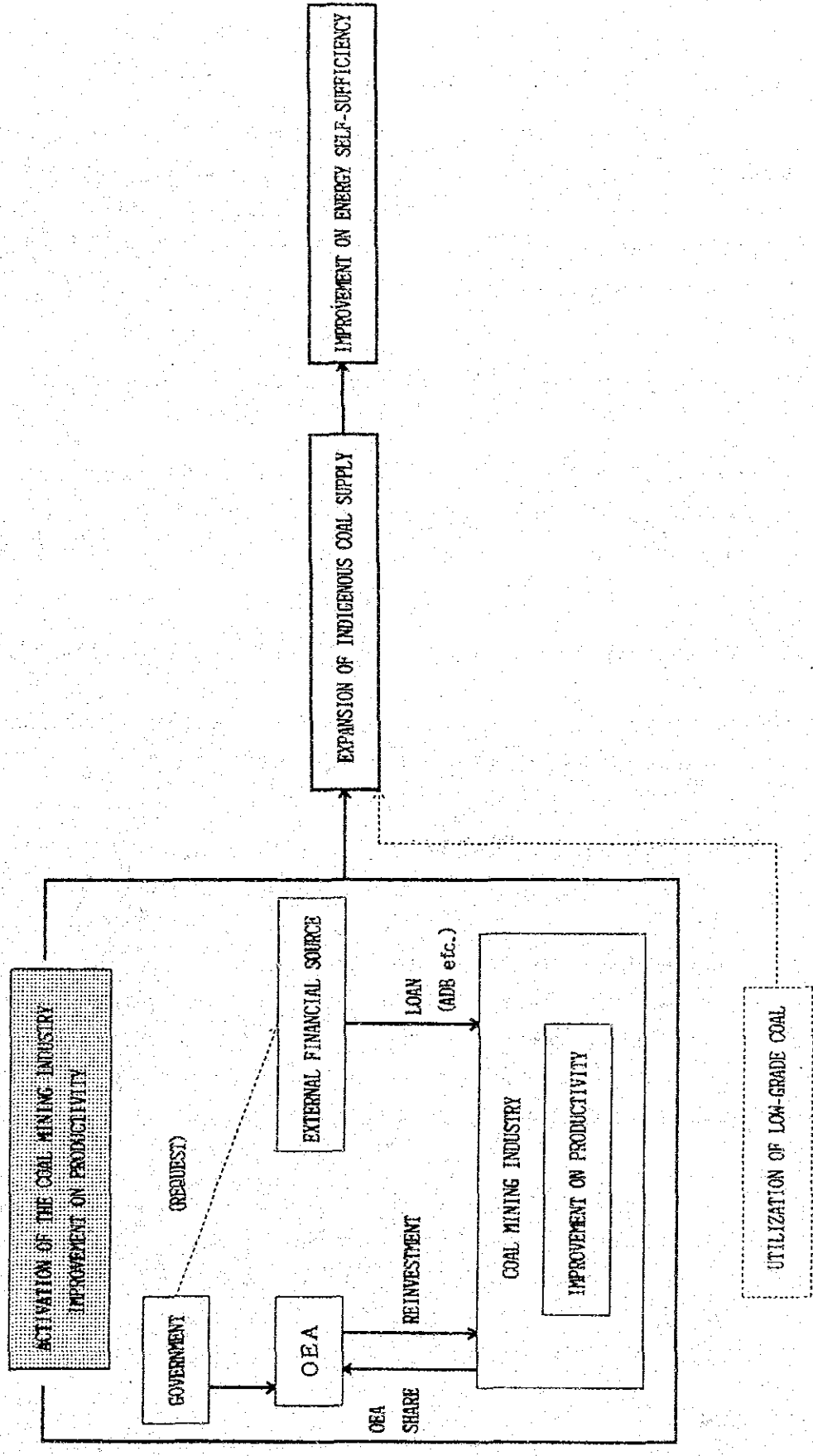
Figure 6
ECONOMIC EFFECTS FROM THE ACTIVATION OF THE COAL MINING INDUSTRY



(Reference)

	1988	2000	(IN MILLION) Total (1988~2000)
Investment for Modernization			P1,325
OEA SHARE	P29	P69	
Foreign Exchange Savings (Assuming Imported Coal Is replaced with Local Coal) ...	P37	P108	P335
Income Tax	P86	P200	
Decrease in Burden Shouldered by Users			P50

Figure 7 ENERGY SELF-SUFFICIENCY IMPROVEMENT SCHEME THROUGH UTILIZATION OF INDIGENOUS COAL



B. Recommendations

1. The life of the Philippine coal industry will be depending upon the actual feasibility of the proposed "Master plan" for its activation and improvement. As mentioned earlier, the future mine workings of most underground coal mines are getting deep whereby the following innovations or improvements have to be undertaken as early as possible.

- 1) Establishing the feasibility of the new areas to be developed.
- 2) Training of engineers and workers required for the effective adoption of new technologies.
- 3) Review or additional purchase of the required machineries and equipment including development of underground roadways for the improvement of the underground mine structure.
- 4) Promotion of exploratory works for the new areas to be developed.

The OEA is working-out a revision of the current policies specifically on the reversion of a part of the OEA share to the private sector development through investment. In case the OEA share as reverted back is still insufficient to finance the required investment, external borrowing with low interest rate is recommended.

2. Some of the existing regulations or policies should be amended to establish new systems for the proper execution of the tasks to be done by the government as provided in Figure 6. Among them, adequate measures in ensuring strict implementation of mine safety have to be employed.

In conducting exploratory drilling and necessary adjustment of mining boundaries, it is recommended that this should be studied by a committee composing of the OEA, the PNOC-CC (having enough experiences of modernized mining) and the PHILCOAL, (comprising of various companies) and shall be held at regular intervals based on the long term scheme to be prepared by the OEA.

3. On the practical items which constitutes the core of the "Master Plan", the following examples are shown below although each item has to be reviewed individually.

(Improvement of hauling measures)

In some mines, like Luvimin mine in the southern Cebu island, the production is restricted by the bad hauling road. For cases like these, external borrowings with low interest rate is recommended for the appropriate improvement of hauling facilities and infrastructures. In securing the funds, appropriate measures, such as joint undertaking between neighbouring mines and the conduct of a feasibility study, have to be carried out.

(Adoption of a centralized coal preparation)

It was recommended in the "Master Plan" to introduce centralized coal preparation plant in the center of Cebu island to stabilize the quality of coals supplied to the NPC's Naga thermal power plant. Although there are problems, one of them is who will be the operator of the proposed plant, the government or its subsidiaries, or the PHILCOAL have to be the operator by obtaining an external funding after its feasibility study.

(Development of the Bislig mine No. III)

Regarding the Bislig mine No. III, it was known that the mine site power generation project had been postponed by the year 2000 according to the NPC's power supply scheme in the Mindanao grid. However, as the coals to be produced from the Bislig mine No. III seem to be suitable for the cement plants, an earlier development scheme has to be reconsidered after a review of the previous feasibility studies.

(Utilization of low grade lignites)

The young age lignites, like the Iguig lignite deposit in the Cagayan valley region, should be developed once its combustion characteristics is established and the mining is determined to be economically feasible. In order to meet these requirements, an establishment of an examination laboratory for combustion, liquidization, gasification, and desulphurization tests is recommended.

4. As a counter measure constituting the software portion of the "Master Plan", the training of the country's own engineers required for the rehabilitation of the framework of the coal mining industry should be implemented through the proposed training center of which the possible effect has been confirmed as a concrete example of a collective training system after the Phase II study.

Chapter 1 Introduction

1. Introduction

1-1. Objective of the Study

This study aims to clarify the current position of the indigenous coal industry including such aspects as the development and utilization under the long-term energy program of the Philippines, and to indicate the necessary measures to be taken in order to meet the needs arising from the present rapid expansion of the coal demand.

For these purposes, the necessary measures to achieve various objectives, such as the promotion of coal exploration and development, an improvement in productivity, maintenance and amelioration of safety, enhanced coal utilization, etc., have to be studied and analyzed after a proper review of the coal industry. It will also be essential to clarify the necessary means for both production increases and manpower development which might be basic requirements for activating the coal industry.

Moreover, the situation of the Coal Mining Technology Development Center has to be clarified as a link in a chain of the above-mentioned master plan, and the basic plans, such as size and construction, training curriculum, operation, etc., of the Center have to be made for the development of the manpower requirements to meet expanding future coal demand. The final report will be drawn up after an analysis of the economical effects from the activation of the coal mining industry.

1-2 Progress of the Investigation

The Philippine government has been developing alternative forms of energies, with coal as the most important resource, to reduce the country's high dependence on imported oil. Especially, as the construction program for nuclear power plants was suspended, the relative importance of coal utilization seems to have increased. To meet the increasing demand for coal, the Philippine government has requested the Japanese government, at a Japanese-Philippine bilateral conference in 1987, to conduct a master plan study on coal mining technology development to secure a steady supply of domestic coal.

The JICA sent a pre-study mission on October 5, 1987 to the Philippines and concluded an Implementing Arrangement (I/A) with the OEA on October 14, 1987 as shown below.

- 1) For effective execution of the study, the OEA will act as the counterpart agency to the Japanese study team for the collection and compilation of available data, reports and other relevant information and documentation necessary for the implementation of the study by the end of this year.
- 2) The JICA will conduct the following studies based on the data collected and the results of the field survey although the studies are divided into the following two phases, i.e. Phase I for the establishment of the master plan and Phase II for the formulation of the construction schedule for the training center itself. The phase II study will be implemented only when the feasibility study for the center has provided evidence that the center is a viable proposition in the light of the results of the master plan study.

(Phase I)

- i) Review and evaluation of long-term energy demand and supply forecasts and indigenous coal production programs.
- ii) Review and evaluation of government policy and measures for national coal development.
- iii) Review of the present status of the coal mining industry.
- iv) Review and evaluation of the present status of coal utilization and schemes for expanding coal utilization.
- v) Formulation of a master plan to activate the coal mining industry:

- a) Measures to accelerate coal exploration and exploitation, to increase mine productivity and to improve coal quality.
- b) Measures to ensure the safety of coal mines.
- c) Measures to improve the management and control of coal engineers and miners and to develop manpower capability.
- d) Means for the expansion of coal utilization.
- e) Development of a basic program for the establishment of the Coal Mining Technology Development Center, if necessary.

(Phase II)

Study for the Coal Mining Technology Development Center.

- a) To determine the appropriate training curricula for the required courses.
- b) To prepare plans for recruiting instructors and trainers.
- c) To prepare fundamental engineering designs and basic drawings for the various physical facilities.
- d) To prepare technical specifications for the equipment necessary for the training and education of coal engineers and miners.
- e) To establish preliminary site layout plans.
- f) To estimate capital and operation costs broken down into foreign and local currency portions, respectively.
- g) To prepare the management and operation manual for the Center, including cashflow control schedules for the long-term operation of the Center.
- h) To conduct economic analyses of the project.

JICA sent out a survey team to the Philippines on January 25, 1988, and made a field study of the main coal mines in Cebu, Batan, and Semirara islands during the team's 27 day stay, in the presence of their local counterparts from the OEA. At the same time, a study for main coal-users in Luzon and Cebu islands was made. Based on the studies in the field and information collected by the OEA, the establishment of the master plan is carried out as the Phase I study.

As a result of the above study, it was recognized that the comprehensive and concentrated training program at the Center would be most effective in promoting coal mining technology development. Thus, the Phase II study was carried out by JICA team during 15 days from April 27, 1988. The studies comprise a field survey to select the prospective locations for the main Center and experimental mine site in Cebu island, determination of curricular details recruiting of lecturers, determination of scales and layouts of both main center and experimental mine, including all necessary equipment and facilities, estimation of construction, equipment, and operation costs, respectively, and economical analysis of the project. The final report is made in combination with Phase I and II.

1-3. Outline of the Studies

1-3-1 Composition of Survey Team

The Phase I survey team for the master plan study consisted of 8 members, i.e. one team leader each i.e., an expert each on mining, safety, operation/administration, coal beneficiation, and coal utilization engineer, geologist, and economist, to effectively respond to various items to be studied. For the Phase II field survey, a total of 6 members consisting of a team leader, mining (safety), mechanical/electrical maintenance, construction, and civil engineers, and economist was ordered to study the on-site conditions for the construction of the main center and the experimental mine, including curricular details, equipment lists, and their cost estimates, etc.

Survey teams were sent 4 times, including Phase I and II surveys as shown in the following table.

Table 1-3-1 Composition of Survey Team and Survey Period

Name	Charge	Survey Period	Original Company
M. Inoue	Leader	1st: Jan. 25 - Feb. 20	Dia Consultants
		2nd: Mar. 22 - Mar. 30	
		3rd: Apr. 27 - May 11	
		4th: June 15 - June 23	
Z. Sakiyama	Min' Eng.	1st, 2nd, 3rd, 4th	Ibid.
H. Yamazaki	Safety Eng.	1st	Ibid.
A. Minami	Admin.	1st	Ibid.
S. Yumoto	Mech. Eng.	1st, 3rd	Ibid.
T. Okazaki	Coal Util.	1st, 2nd	Ibid.
Y. Tobe	Geologist	1st	Ibid.
T. Higashi	Civil Eng.	3rd	Utec Consulting
S. Tanaka	Construct.	3rd, 4th	K. M. Engineering
N. Wada	Economist	1st, 3rd, 4th	I.E.E.

Remarks: Min' Eng. - Mining Engineer; Admin. - Administrating Engineer; Mech. Eng. - Mechanical Engineer; Util. - Utilization Engineer; Construct. - Construction Engineer; I.E.E. - The Institute of Energy Economics, Japan; 1st-1st Mission; 2nd-2nd Mission; 3rd-3rd Mission; 4th-4th Mission

1-3-2 Survey Itinerary

Four field surveys were conducted from January 25 to June 23, 1988, each survey having a special purpose to fulfill. The total number of days spent on these four surveys was 60.

Brief Itinerary of Survey Team in 1988

Teams	Expert-Period	Objectives
1st	Inoue & 7 Memb.: Jan. 25 - Feb. 20 (27 days) (Sakiyama, Yamazaki, Minami, Yumoto, Okazaki, Tobe, Wada)	Phase I (Master Plan)
2nd	Inoue & 2 Memb.: Mar. 22 - Mar. 30 (9 days) (Sakiyama, Okazaki)	Submission of Progress Report
3rd	Inoue & 5 Memb.: Apr. 27 - May 11 (15 days) (Sakiyama, Yumoto, Higashi, Tanaka, Wada)	Phase II (Design & cost estimates of the Center)
4th	Inoue & 3 Memb.: June 15 - June 23 (9 days) (Sakiyama, Tanaka, Wada)	Submission of final draft report

1-3-3 Field Survey

A. Phase I Survey

The investigation started with the OEA's checking and reviewing of the data and related information collected by the OEA. These data comprise the details on the current status of the coal industry in the Philippines, coal demand, and the forecast of the supply/demand scenario by the year of 2000. At Manila city, the surveys of the coal consumers and similar educational facilities were carried out as shown below.

Main Coal Consumers

- * National Power Corporation (NPC): Main office; Calaca power plant
- * Cement Industry: Philippines Cement Association; Hi-Cement (Factory site)
- * PNOC-Coal Corp.: Batangas coal terminal (For cement plant)

Coal Mines

- * PNOC-Coal Corp. (PNOC-CC): Main office

- * Semirara Coal Corp.: Main office; Unong mine in Semirara island
- * Carbex Incorporated: Main office; Bilbao open-cut mine at Batan island
- * Filipino Cathay Mining Corp.: Manila Office
- * FF Cruz and Co., Inc.: Manila Office

Universities and Institutions

- * University of the Philippines (UP): National Institute of Geological Science; College of Engineering; National Engineering Center
- * Mapua Technical Institute
- * Bureau of Mines & Geoscience: Geology and Chemistry
- * OEA's Laboratory

Others

- * National Steel Corp.

In Cebu island, the investigations were carried out at the major coal mines in the northern, central and southern regions and the main coal consumers, as stated below.

Major Coal Mines

- * J.D. Almendras Argo-Industrial Development Corp.:
Cebu Office; Capillahan area (Shaft No. 18, 26)
- * Cebu Coal Mines Inc.: Cebu Office; Jover Tunnel
- * PNOC-CC: Opao office; Uling Mine (NE-1 Slope area)
- * Manguerra Mining & Development Corp.: Maangtud mine
- * Luvimin Coal Mining Corp.: Cebu Office; Upper Linut-Od T-2 Adit,
Kawasan Drive

Major Coal Consumers

- * NPC: Naga power plant
- * Atlas Consolidated Mining Inc.: Power station
- * Apo Cement Corp.: Plant site

University

- * Cebu Institute of Technology

For the research work, questionnaires were used to avoid errors in collecting data and information. In particular questions regarding the possibility of sending out engineers and workers to the proposed training Center were addressed to the managers of the major coal mines. The general consensus of opinion among the managers was that they would be very willing to release them for studying at the center. After extensive and cautious studies and analyses of the data collected from both field and indoor surveys, a master plan for activating the coal mining industry was formulated. And it was concluded that there was compelling need for fundamental innovation with production systems in most of the medium to small scale underground coal mines. It is also recommended that a training center for coal mining technology development for the effective execution of the master plan should be established. Thus, the second phase survey of the training center was conducted.

B. Phase II Survey

This survey was carried out by 6 experts in concentration with the OEA counterparts to select appropriate sites for the main and experimental mines in Cebu island, and to formulate basic study programs, such as the formulation of training curricula, preparation of basic design and layout for the main center and experimental mine, selection of machineries and facilities, estimates of construction and operation costs, etc.

The reason why Cebu island was chosen as the most appropriate location for the Center is;

- a) Cebu island has virtually all of the medium- to small-scale underground coal mines to be improved.
- b) Cebu city is the most convenient traffic center in the Philippines especially for travel to the islands from the middle to south of the country.

The following survey was carried out in Cebu island.

Main Center Location

The following lots were inspected:

- * Lahug old airport (Provincial government's lot)
- * UP lot at Talisay town (About 11 km south of Cebu city)

- * UP Cebu College compound
- * Provincial lots near the Cebu Plaza hotel

Experimental mine site

- * PNOCC's Uling mine site and Cambahi area at northwestern side of the Uling mine.

Others

- * Cebu Provincial Capital (Governor Emilio N.R. Osmena)
- * Cebu City Hall (Mayor Tommy R. Osmena)
- * PAG-ASA, Weather & Radar Station, Mactan, Cebu
- * Ministry of Public Works & Highways

At Manila, the following similar institutions and laboratories were visited and studied including organizations and operations.

Institutions & Laboratories

- * National Engineering Center of NEC (UP)
- * Transport Training Center of NEC
- * National Manpower and Youth Council
- * School of Economics of UP
- * National Institute of Climatology (NIC)
- * Philippine Institute of Volcanology & Seismology
- * Petroleum Laboratory (Bureau of Mines and Geoscience)
- * PAG-ASA

Except for the above organizations, the mission visited PNOCC to discuss availability of a site for the provision of an experimental mine in the Uling mine, and also visited NEDA's Trade, Industry & Utilization Staff to check their ideas with the economical effects of the center.

Table 1-3-2 Survey Schedule

 WORK IN PHILIPPINES BY OEA
 WORK IN PHILIPPINES BY JICA & OEA
 WORK IN JAPAN



















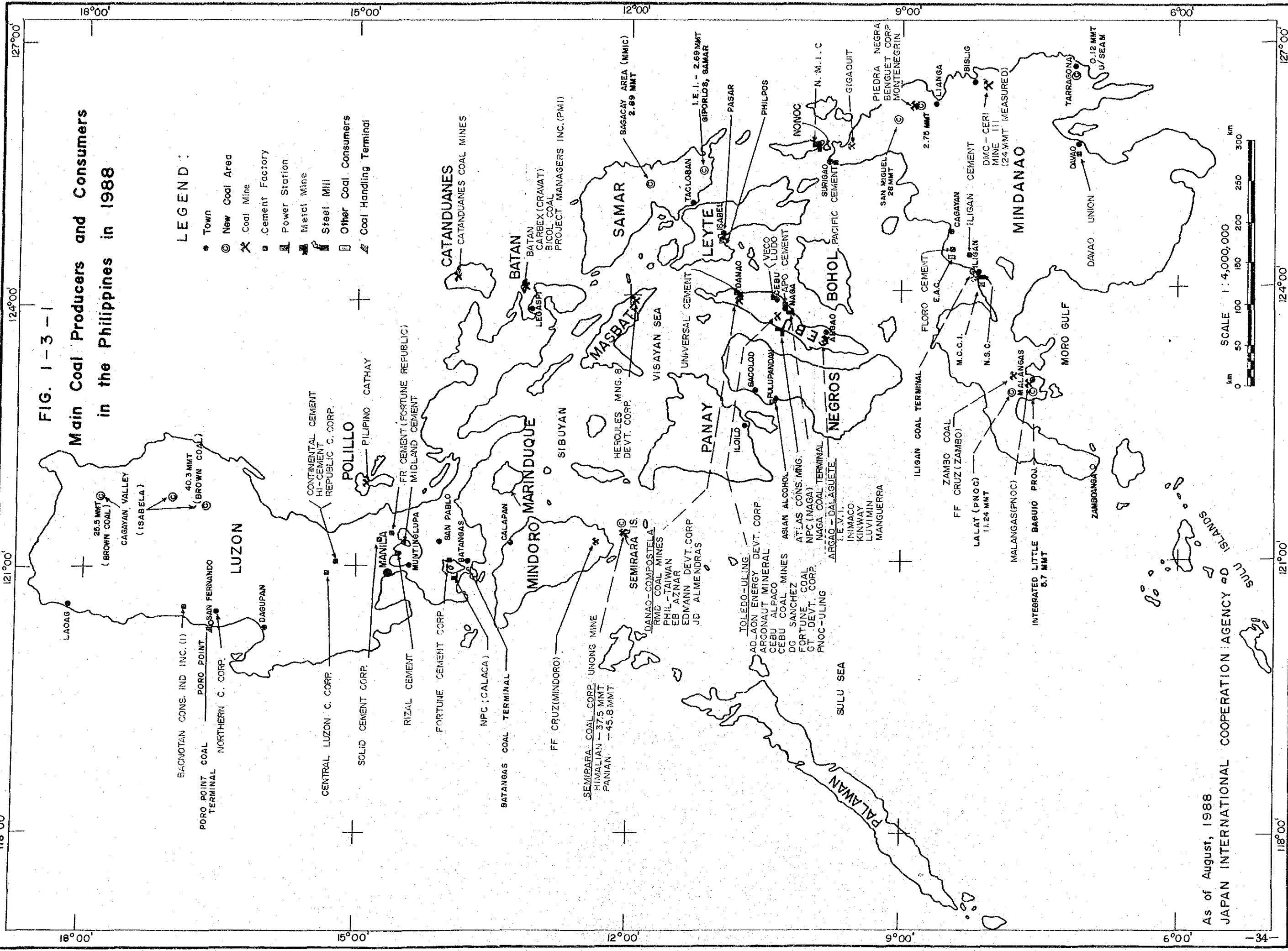
	1987			1988							
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.
(PHASE I)											
Data Collection & Compilation				1/25	2/20						
Energy Forecast & Coal Production Program											
National Policy and Measures											
Present Conditions of Coal-Mining Industry											
Coal Utilization Program											
Master Plan Formulation											
(PHASE II)											
STUDY FOR THE CENTER							4/27	5/11			
(REPORTS)											
Inception Report				1/25	1/29						
Progress Report						3/22	3/30				
Draft Final Report								6/15	6/23		
Final Report											▽

FIG. 1-3-1
Main Coal Producers and Consumers
in the Philippines in 1988

LEGEND :

- Town
- ⊙ New Coal Area
- ✕ Coal Mine
- ⊠ Cement Factory
- ⊡ Power Station
- ⊢ Metal Mine
- ⊣ Steel Mill
- ⊤ Other Coal. Consumers
- ⊥ Coal Handling Terminal



As of August, 1988
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Chapter 2
Studies on Activating
the Coal Mining Industry
and on Simulating Coal Demand (Phase I)

2. Studies on Activating the Coal Mining Industry and on Stimulating Coal Demand (Phase I)

2-1 Review of the Present Status of the Coal Mining Industry

2-1-1 The Long-Term Forecast of Energy Demand and Supply, and the Indigenous Coal Production Program

(1) Economy

The Philippine economy has been recovering after a long-term depression. The country suffered from serious economic woes from 1982 to 1986. During this period, the growth rate of real GNP per capita continued to drop, especially in 1984 and 1985, when the real GNP itself declined. Now the crisis is over, as of 1987. The GNP growth rate rose to 5.1% in 1987 after 1.5% growth in 1986.

Table 2-1-1 Economic Indicators

		1980	81	82	83	84	85	86	87
Population	Million	48.1	49.5	50.8	52.0	53.3	54.5	55.7	57.0
Population Growth Rate	%/y	2.3	2.5	2.5	2.4	2.5	2.2	2.3	2.2
GNP at Constant Prices of 1972	Billion Pesos	92.6	96.0	97.5	98.6	91.6	87.8	89.1	93.6
GNP per capita, real	Pesos	1,925	1,939	1,919	1,896	1,719	1,611	1,600	1,642
GNP Growth Rate, real	%/y	4.38	3.68	1.56	1.11	-7.07	-4.23	1.54	5.05
GNP per capita Growth Rate, real	%/y	2.4	0.7	-1.0	-1.2	-9.3	-6.3	-0.7	2.6
GDP per capita Growth Rate, real	%/y	4.9	3.8	2.9	0.9	-6.0	-4.4	1.1	4.6
Consumer Prices Increase Rate	%/y	18.2	13.1	10.2	10.0	50.3	23.1	0.8	
Public External Debt	Billion \$	6.5	7.6	8.9	10.6	11.6	13.6	19.8	
Debt Service Ratio (DSR)	%	7.2	10.0	12.6	15.9	13.9	15.9	18.3	
Exchange Rate*	Peso/Dollar	7.59	8.13	9.06	14.00	19.86	18.90	20.53	20.80

Note: Foreign exchange rate is as of December

Source: NEDA, W.B. "Investor's Guide to the Philippines"

For 1988, the National Economic and Development Authority (NEDA) forecasts 5.9 ~ 6.5% growth rate and a famous economist in the country predicts a 7.4% growth rate. Many businessmen are looking forward to a higher performance and an improved political environment.

The Aquino Administration approved a six year plan in 1986, which is the Medium-Term Philippine Development Plan 1987 ~ 1992. During the period, real GNP and GDP are targeted to increase by 6.8% and 6.9%, respectively.

With a 2.4% p.a. population growth, it is expected that the 1981 real per capita income, the highest ever achieved in the country, will be regained by 1991. The government is going to revise its economic targets in 1988. It is reported however, that the Philippine government will stick to an around 6.2% GDP growth rate and a 6.3% GNP growth rate. The major assumptions made are as follows:

	Oil Price (\$/Bbl)	Exchange Rate (P/\$)	Population (Million)
1987	17	20.60	57.4
1988	17	21.39	58.7
1992	19.89	25.02	64.5

Source: NEDA (May, 1988)

Long-term economic forecast up to year 2000 is not found in the country. Around 6.5% GDP growth rate and the same major assumptions as those in the medium-term plan are extrapolated to year 2000 for the coal demand and supply outlook by the Office of Energy Affairs (OEA).

(2) Coal Demand and Supply Outlook

A) Coal Demand

Coal is the principal energy resource in the country. Coal consumption in 1987 was 2,019,000 tons, of which a little over half, 1,168,000 tons was supplied by indigeneous production and the balance by 615,000 tons imports and 237,000 tons of stock change. Share of coal in energy consumption rose to 6.8% in 1987, from almost zero in 1974 and 1% in 1980, due to a government energy policy towards replacing oil with coal and other indigeneous energy. The above mentioned Plan aims at 12.3% share of coal in 1992. The growth rate of coal consumption is forecasted at 9.9% p.a., compared with 4.1% p.a. for total energy growth.

Table 2-1-2 Energy Supply Mix

(MMBFOE)

	1986		1987 (Actual)		1992		Growth Rate 1987~1992 (%)
	Vol.	(%)	Vol.	(%)	Vol.	(%)	
INDIGENOUS ENERGY	43.65	45.06	37.47	37.71	63.94	51.98	6.6
I. CONVENTIONAL	24.40	25.19	22.64	22.78	37.51	30.49	7.4
Oil	2.45	2.53	1.75	1.76	1.26	1.02	-10.5
Coal	3.55	3.66	4.08	4.10	13.71	11.15	25.3
Hydro	9.64	9.95	9.00	9.06	12.14	9.87	3.9
Geothermal	8.76	9.04	7.81	7.86	10.40	8.45	2.9
II. NONCONVENTIONAL	19.25	19.87	14.83	14.91	26.43	21.49	5.4
IMPORTED ENERGY	53.22	54.94	61.88	62.29	59.07	48.02	1.8
Oil	49.80	51.41	59.18	59.56	57.74	46.94	2.5
Coal	3.42	3.53	2.71	2.72	1.33	1.08	-14.6
TOTAL ENERGY	<u>96.87</u>	<u>100.00</u>	<u>99.35</u>	<u>100.00</u>	<u>123.01</u>	<u>100.00</u>	<u>4.1</u>
Growth rate, % p.a.		2.28		2.56		3.70	
Power use, % of total volume	37.08	38.28			54.29	44.13	
Oil share in power use, %	11.72	31.61			16.87	31.07	
Oil (total)	52.25	53.94	60.93	61.32	59.00	47.97	2.0
Coal (total)	6.97	7.20	6.79	6.82	15.04	12.28	9.9

Source: Medium-Term Philippine Development Plan, 1987 ~ 1992, p.303

Note: Figures for 1986 are used in the Plan.
 Figures for 1987 are actual data provided by OEA.

Major users of coal are National Power Corporation (NPC), the cement industry and non-ferrous mining companies, such as Atlas and Philphos. The mining companies consume coal mainly for inhouse power generation and processing. The principal demand for low quality coal is in power generation. In 1987, total power generation in the country by energy sources were as follows:

Table 2-1-3 Power Generation in the Philippines (1987)

(Gwh)

	Coal thermal	Oil thermal	Hydro	Geo-thermal	Total
Electr. Generated	3,097	9,815	5,220	4,532	22,664
Share (%)	13.6	43.4	23.0	20.0	100

Source: OEA, Overall Energy Balance (1987)

The state-owned NPC is the prime entity responsible for the development of generation and transmission of electricity. NPC currently supplies over 90% of electricity requirements of the country. NPC has three coal-fired power plants; Calaca I (300 MW) in Luzon, Naga I in Cebu (50 MW) and Naga II in Cebu (55 MW) as of the end of 1987.

The cement industry requires medium to high quality coal. There were 18 cement companies with the same number of plants in 1985. All of them had converted their energy source from fuel oil to coal in 1985, with most of the conversions completed in 1983. This was due to the government's incentives offered as will be discussed later. Cement production was 4.0 million tons in 1987. Many of the local cement plants are old and in need of repair. After the closing of 5 plants, the capacity has been reduced from 7.3 million tons to 4.5 million tons with 13 plants in operation in 1987.

Atlas Consolidated Mining and Development Corporation (Atlas) is one of the three largest copper producers in the world and operates a mine in Cebu. In 1983, they completed the installation of 2-40 MW coal-fired, fluidized bed combustion boilers.

The OEA has forecasted the demand and supply of coal to the year 2000 as shown in Table 2-1-4, Table 2-1-5 and Table 2-1-6. However, the OEA has not made a forecast for the total energy and supplies to 2000.

According to the OEA projection, the total demand for coal will increase by 11.3% p.a. on the average from 1988 to 2000 amounting to 7.4 million tons in 2000 from 1.8 million tons in 1987. These figures are on a 10,000 BTU/lb basis. If the average caloric value per ton of 2000 demand is the same with that of 1987 demand, the total demand in 2000 will amount to about 10.4 million tons on a run of mine basis. This forecast looks considerably optimistic, considering the low economic growth rate since 1982.

One of the reasons why the OEA is optimistic is that the coal requirements for 1988 submitted by major users are big with a 21% growth rate. For 1989~2000, each assumed growth rate of coal demand is reasonable, if the economic growth target in the Medium-Term Economic Development Plan is attained and the same level economic growth rate from 1993 to 2000 is sustained.

Table 2-1-4 Coal Demand and Supply Outlook 1988 ~ 2000
(1,000 tons, 10,000 BTU)

	Actual		Forecast					Growth Rate (%)				
	80	83	87	88	93	95	2000	88/87	93/88	95/93	2000/95	2000/87
<u>Demand</u>												
NPC			830	1,054	1,925	2,833	5,034	27.0	12.8	21.3	12.2	14.9
Cement Industry			678	774	989	1090	1392	14.2	5.0	5.0	5.0	5.7
Atlas			197	275	359	413	635	39.6	5.5	7.3	9.0	3.2
Philphos			10	14	40	40	40	40.0	23.4	0	0	11.3
Others			133	119	173	211	340	-10.5	7.8	10.4	10.0	7.5
Total			1,848	2,236	3,486	4,587	7,441	21.0	9.3	14.7	10.2	11.3
<u>Supply</u>												
Semirara			429	630	1,440	2,160	2,592	46.9	18.0	22.5	3.7	14.8
PNOC Areas			210	353	402	402	402	68.1	2.6	0	0	5.1
Cebu			233	374	654	825	1,132	60.5	11.5	12.3	6.5	12.9
Batan			52	75	142	142	142	44.2	11.8	0	0	8.0
Others			88	164	464	719	2,800	86.4	23.1	24.5	31.2	30.5
Total			1,012	1,596	3,102	4,248	7,068	57.7	14.2	17.0	10.7	16.1
Surplus (Shortfall)			(836)	(640)	(384)	(329)	(373)					

Table 2-1-5 Coal Supply Outlook 1988 ~ 2000
(1,000 tons, Run of Mine)

<u>Supply</u>												
Semirara	33	326	595	875	2,000	3,000	3,600	47.1	18.0	22.5	3.7	14.9
PNOC Areas	42	275	204	310	350	350	350	52.0	2.5	0	0	4.2
Cebu	201	323	226	374	654	804	1,104	65.5	11.8	10.9	6.5	13.0
Batan	12	34	55	284	681	982	5,322	97.2	19.1	20.0	40.2	37.0
Others	41	62	89									
Total	329	1,020	1,169	1,843	3,685	5,136	10,376	57.7	14.9	18.1	15.1	18.3

Source: OEA, Feb. 1988

Table 2-1-6 Coal Demand Outlook
Bases and Assumptions

(1,000 tons, 10,000 BTU)

	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1995</u>	<u>2000</u>
Cement Industry	774	813	854	897	942	989	1090	1392

For 1988 - Based on the industry's submitted coal requirements.

For 1989 - 2000 - A 5 % growth rate based on construction industry growth rate of 10%

Atlas	275	287	301	318	337	359	413	635
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For 1988 - Based on the submitted coal requirement projection for the year

For 1989 - 2000 - Based on the following growth rate of mining sector

4.5% 5.0% 5.5% 6.0% 6.5% 7.5% 10%

NPC

Calaca I	853	854	854	854	854	854	854	854
Calca II	-	-	-	-	846	846	846	846
New plants in Luzon	-	-	-	-	-	-	908	2750
Naga I & II	201	209	217	226	241	225	225	236
Mindanao	-	-	-	-	-	-	-	348

Based on NPC's projections (January 19, 1988)

Philphos	14	40	40	40	40	40	40	40
Other Users	119	125	134	144	158	173	211	340

Assumes on Annual Growth Rate of 5% for 1988 & 1989, 7.5% for 1990 & 1991, 10% for 1992 to 2000.

Source: OEA (Feb., 1988)

Table 2-1-7 NPC Generation Mix Program by Plant Type
(in GWH)

	<u>ACTUAL</u>										<u>PROJECTED</u>																			
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
PHILIPPINES	19263	20144	20617	21932	23174	24464	26675	28335	30093	31928	33787	35766	37843	39871	41980	19263	20144	20617	21932	23174	24464	26675	28335	30093	31928	33787	35766	37843	39871	41980
OIL-BASED	6970	7164	6039	6623	7585	7892	8016	7634	7505	6807	7288	7670	7686	7454	6857	6970	7164	6039	6623	7585	7892	8016	7634	7505	6807	7288	7670	7686	7454	6857
HYDRO	5989	6071	6976	7229	7423	7583	7745	8052	8248	8818	10101	11658	12526	12724	12855	5989	6071	6976	7229	7423	7583	7745	8052	8248	8818	10101	11658	12526	12724	12855
GEO	4586	4841	5315	5774	5841	6645	6709	8487	10219	10254	10277	10302	11592	11767	11938	4586	4841	5315	5774	5841	6645	6709	8487	10219	10254	10277	10302	11592	11767	11938
COAL	1718	2068	2287	2306	2325	2344	4205	4162	4121	6049	6121	6136	6039	7926	10330	1718	2068	2287	2306	2325	2344	4205	4162	4121	6049	6121	6136	6039	7926	10330
GEN. MIX (%)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
OIL-BASED	36.2	35.6	29.3	30.2	32.7	32.3	30.1	26.9	24.9	21.3	21.6	21.4	20.3	18.7	16.3	36.2	35.6	29.3	30.2	32.7	32.3	30.1	26.9	24.9	21.3	21.6	21.4	20.3	18.7	16.3
HYDRO	31.1	30.1	33.8	33.0	32.0	31.0	29.0	28.4	27.4	27.6	29.9	32.6	33.1	31.9	30.6	31.1	30.1	33.8	33.0	32.0	31.0	29.0	28.4	27.4	27.6	29.9	32.6	33.1	31.9	30.6
GEO	23.8	24.0	25.8	26.3	25.2	27.2	25.2	30.0	34.0	32.1	30.4	28.8	30.6	29.5	28.4	23.8	24.0	25.8	26.3	25.2	27.2	25.2	30.0	34.0	32.1	30.4	28.8	30.6	29.5	28.4
COAL	8.9	10.3	11.1	10.5	10.0	9.6	15.8	14.7	13.7	18.9	18.1	17.2	16.0	19.9	24.6	8.9	10.3	11.1	10.5	10.0	9.6	15.8	14.7	13.7	18.9	18.1	17.2	16.0	19.9	24.6

Source: NPC, "Power Development Program (1987 - 2000)", 1987.6. P.A-22.

Table 2-1-8 Coal Production Outlook
Bases and Assumptions

SEMIRARA

Based on the market demand for new plants of Calaca I and II to be open in Luzon and its power plant coal requirement.

PNOC AREAS

Based on PNOC's projection

CEBU

For 1988, based on present capabilities of the mines.

Assumes that most mines will complete their development in 1989 and will achieve full production beginning 1990.

BATAN

ACRI assumes a settlement of labor disputes and rehabilitation period of less than two years.

PMI will be fully developed in the beginning of 1989.

OTHERS

Assumes that some mine will complete their development in two years.

For year 1995 and 2000 some new mines will be developed to meet the demand of NPC's expansion.

Source: OEA, (Feb. 18, 1988)

A sustained economic growth rate is desired for the country, and this will only be possible if even effort will be made. Considering that the country's GNP had grown at a rate of 6.6% p.a. in the 1970s and that low wages make the country more competitive with the other ASEAN countries, and that Taiwan and Japan have begun to increase investment in the Philippines, the country may succeed in economic growth, following the lead of Korea, Taiwan, Hong Kong, Singapore and perhaps Malaysia and Thailand.

Major bases and assumptions for coal demand projection are shown in Table 2-1-6. It is noteworthy that NPC will install several coal-fired power plants; Calaca II in 1992, a new plant in Luzon by 1995 and additional ones in Luzon and Mindanao by 2000.

Coal demand for the cement industry for 1989~2000 is assumed to increase at a growth rate of 5% p.a. based on construction industry growth rate of 10%. In view of experiences in the period from 1971~1980, in which cement consumption increased at 5.6% p.a., construction at 13.7% p.a. and a 6.4% GNP growth, OEA assumptions are not unreasonable. To meet the cement demand projected by OEA, augmentation of cement production capacity will be needed in the future.

B) Coal Production

Coal production increased rather rapidly, from 39,000 tons in 1973 to 1,169 thousand tons in 1987 on a run-of-mine basis. The main coal producing areas are located on the islands of Semirara, Cebu, Mindanao and Batan. A half of total coal production came from Semirara in 1987. In the island, coal is produced by the open cast mining method. Except for Semirara and small open cast mines in Batan, the balance is mined through underground small scale operations which are general characteristics of the Philippine coal industry. Of the 31 coal mines, only three employ an open cast mining method. Even these open pit operations are small scale, except for that of Semirara.

The state-owned Philippine National Oil Company (PNOC) has two wholly owned subsidiaries engaged in the coal sector: PNOC Coal Corporation (PNOC-CC) and Malangas Coal Corporation (MCC). Though their present operations are not yet comparable with those in the advanced countries, they are utilizing the most mechanised underground mining

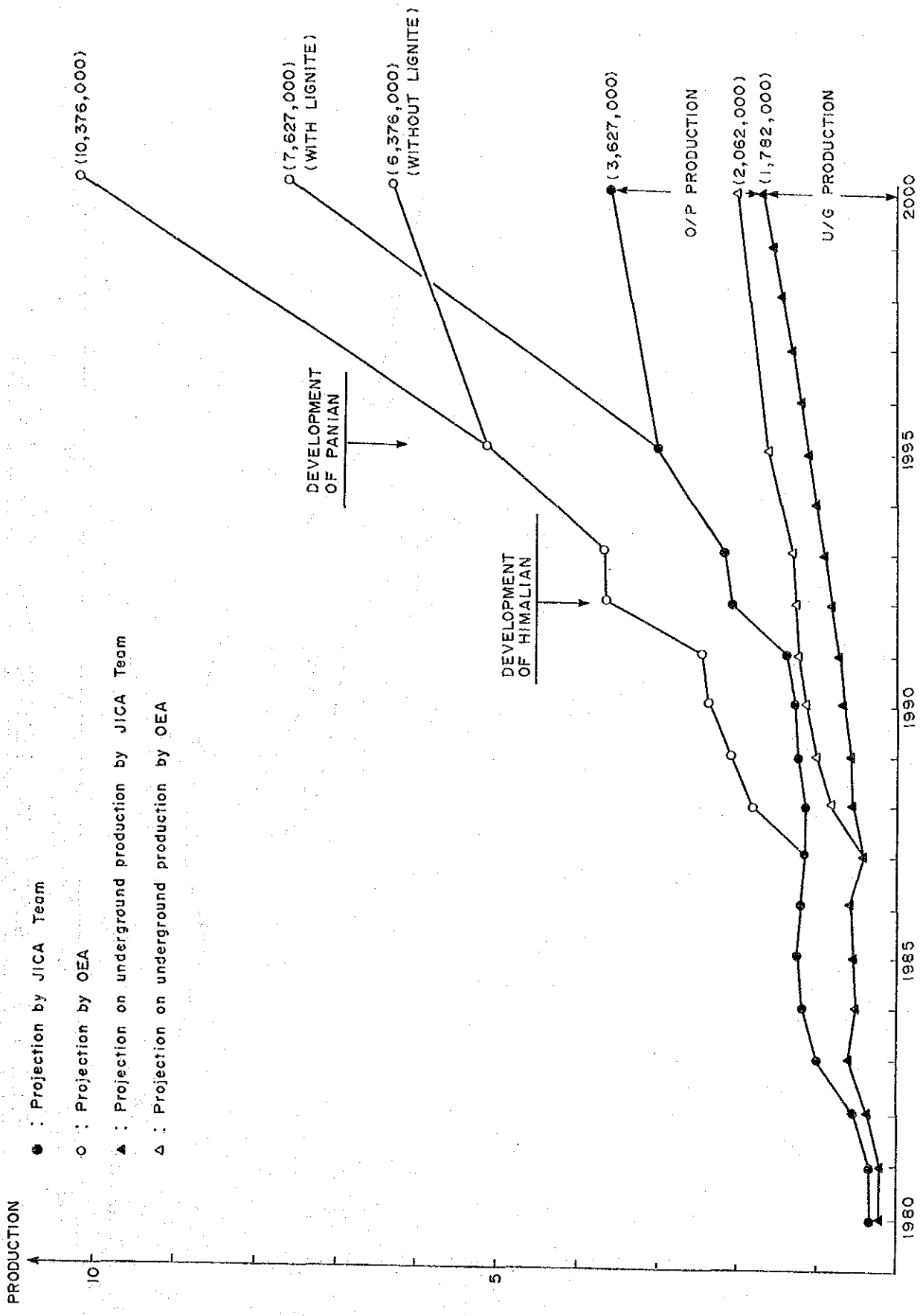


Figure 2-1-1 COAL PRODUCTION PROJECTION (Run of mine)

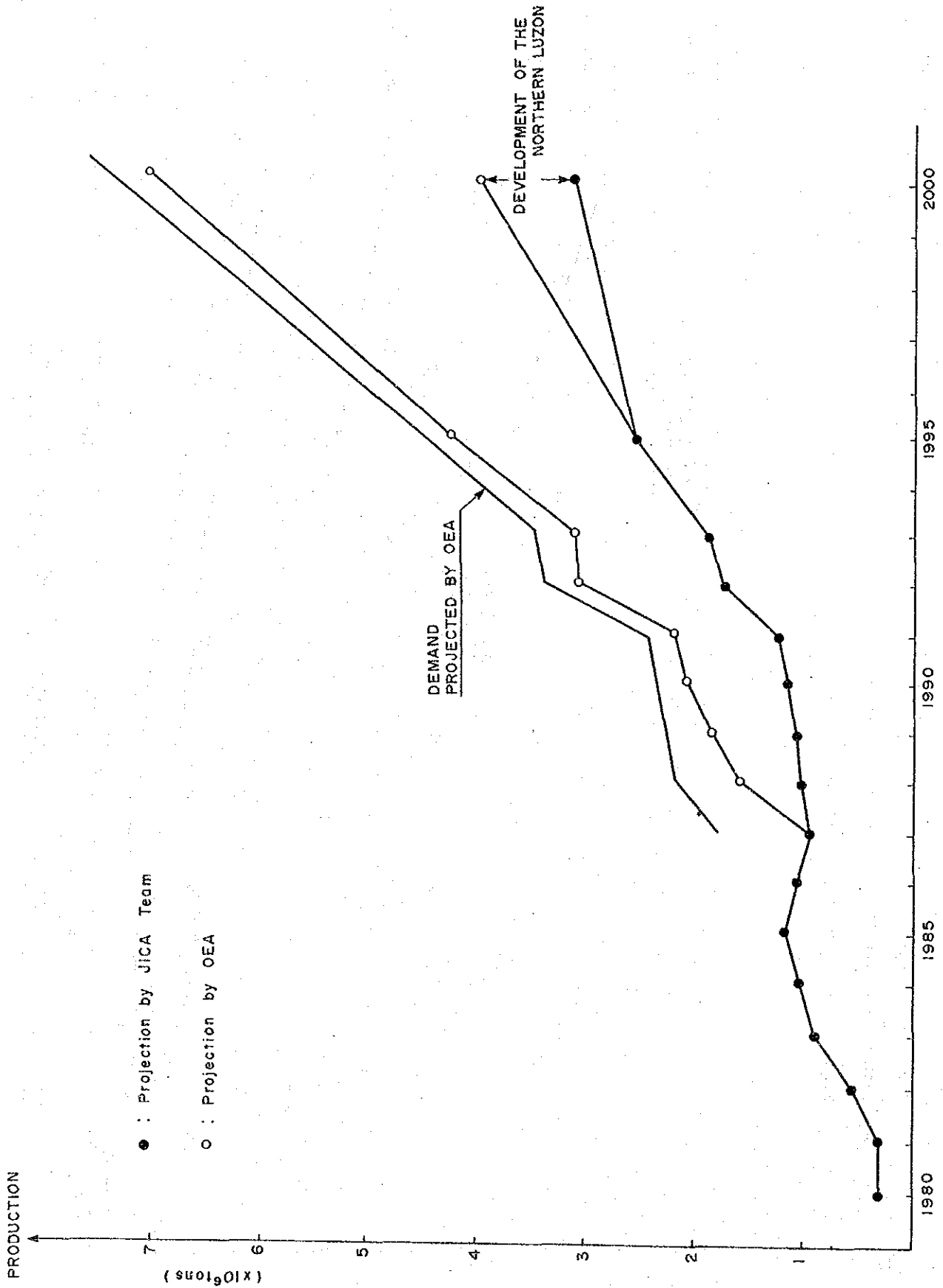
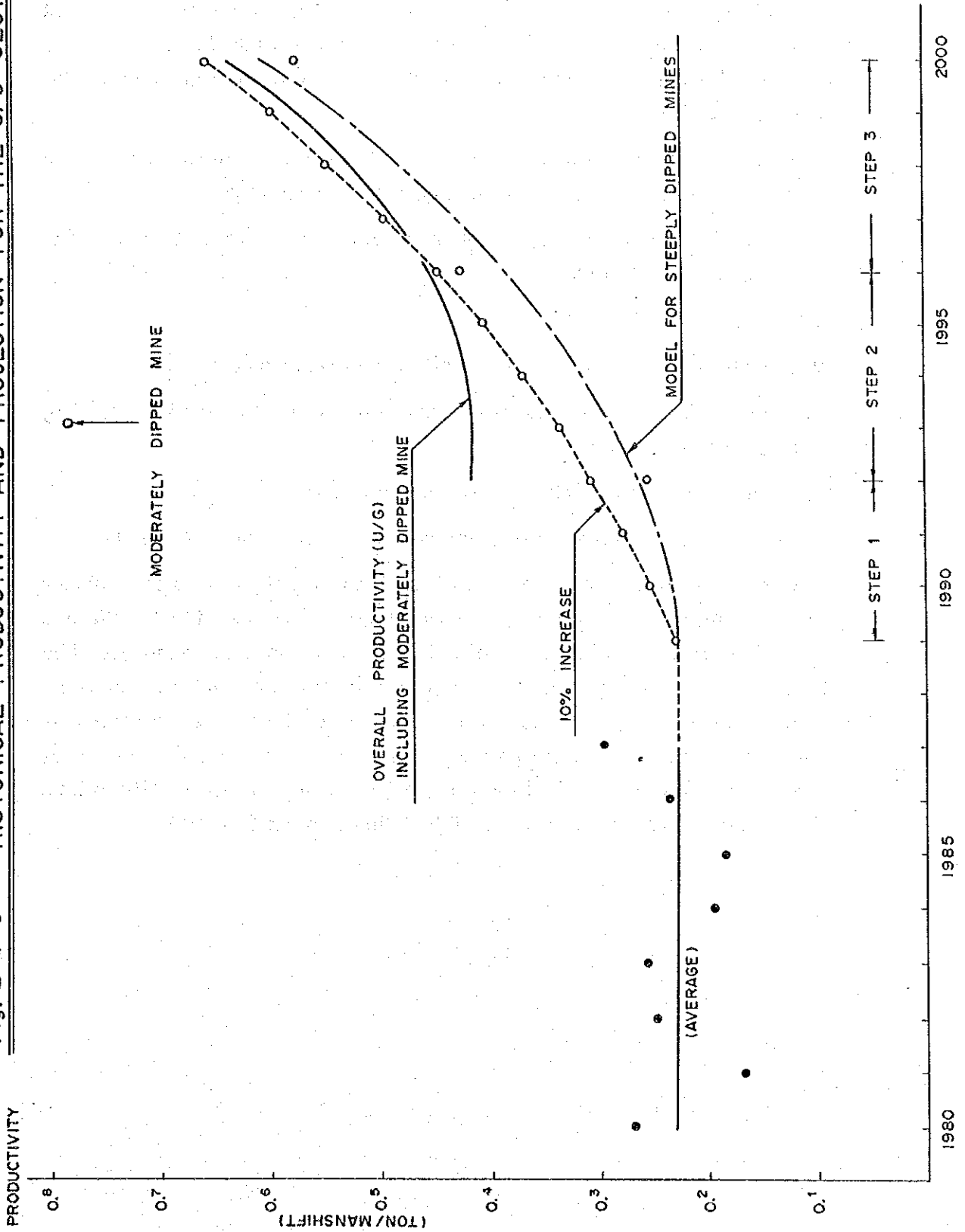


Fig.2-1-2 SUPPLY AND DEMAND PROJECTION (Incl Lignite)

Fig. 2-1-3 HISTORICAL PRODUCTIVITY AND PROJECTION FOR THE U/G SECTOR



Supply/dem and projection is shown in Figure 2-1-2. According to this figure, the demand/supply gap in 1987 is around 0.8 million tons and that in 1995 approximately 2.0 million tons on a 10,000 BTU/lb basis and gradually becomes wider thereafter. Therefore, in order to meet the demand, the country will have to import coal and develop lignite mines for power generation.

But in any case, the indigenous coal mining industry has to be competitive with the imported coal to enlarge its customers.

To realize this objective, many difficulties will have to be overcome. These objectives conclude:

- (1) to increase productivity
- (2) to protect the local coal industry with customs and other taxes
- (3) to encourage the coal industry with various incentives and pricing policies when needed
- (4) to install an infrastructure for the coal industry
- (5) to ensure users coal quality specifications designed for their plants

Coal imports amounted to 1.3 million tons in 1985, due to the inferior quality of local coal with higher prices. Imports decreased to 615,000 tons in 1987. It owes much to a resolution by the Coal Council of Advisors. The council made a policy that users should purchase at least 50% of their requirements from local coal for 1987. For 1988, the Council has determined that the local/import ratio is 55/45. The OEA forecasts that imports will fall from 0.8 million tons in 1987 to less than 0.4 million tons after 1993 through 2000 (on a 10,000 BTU/lb basis, Table 2-1-4).

2-1-2 The Government Policy and Measures for Coal Development

(1) Government and Related Organization

In 1987, the new Administration reorganized the energy-related entities, and the Ministry of Energy (MOE) was abolished. Its regulatory and adjudicatory functions were transferred to the Energy Regulatory Board (ERB) by Executive Order (EO) No. 172. The Board is responsible for regulating the business of energy resources. The Office of Energy Affairs (OEA) is responsible for the formulation, planning and coordination etc. of policies and programs in the field of energy (EO 193). The National Coal Authority (NCA) attached to MOE was abolished and its regulatory function were also transferred to the ERB.

The Philippine National Oil Company (PNOC) was created in 1973 as a wholly owned government corporation, and has been engaged in all aspects of oil business. It established two wholly-owned subsidiaries engaged in the coal sector; PNOC Coal Corporation (PNOC-CC) and Malangas Coal Corporation (MCC). MCC operates a large mine and PNOC has two smaller ones.

In 1987, there were 35 coal mines registered, of which 32 mines were contracted by private companies and the other 3 contracted by PNOC-CC and MCC.

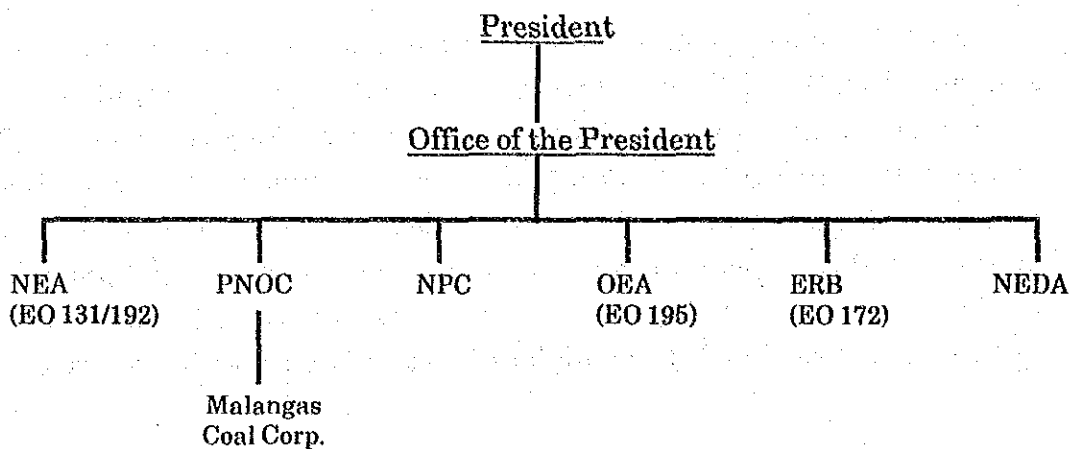
Coal producers with coal end users have created a Coal Council of Advisors (CCA). Core membership representatives are as follows:

Four members--representing the coal producers including PNOC-CC member.

Four members--representing coal end users, one member each to be nominated by the Philippine Cement Corp., Atlas, NPC and one to represent other coal users.

The CCA had been an advisory body to the NCA. It is now a self-regulatory body. The ERB and OEA send representatives to attend the meeting as advisors.

Figure 2-1-4 Government Organizations Responsible for Energy.



Note: NEA; National Electrification Authority
NEDA; National Economic and Development Authority
The NEDA co-ordinates energy policies and energy-related projects from the point of view of the Philippine economy as a whole.

(2) Legislation on Development of Coal

To stimulate the development of coal resources, the government introduced a Coal Service Contract System through the Coal Development Act of 1976 (Presidential Decree (PD) No. 972) and amended in 1977 by PD No. 1174. Under this system, ownership of the resource remains with the state and is based on a constitutional doctrine. The OEA can grant to a company the exclusive rights to explore and develop a coal mine under the terms of a Coal Operating Contract. Incentives for service contractors are determined in the Coal Development Act of 1976 (PD 972) as follows:

- (1) exemption from all taxes except income tax;
- (2) tax and duty free importation of machinery, materials, for direct and exclusive use in energy operations;
- (3) accelerated depreciation
- (4) entry of alien technical and specialized personnel;
- (5) preference in grant of government loans for coal.
- (6) remittance of foreign exchange to pay principal and interest on foreign loans;

Coal producers are subject to revenue sharing, in addition to income taxes. The government (OEA) share is calculated in a formula below;

$$\begin{aligned} \text{OEA share} &= (G-M-O) \{1-(\text{BOF} + \text{SOA})\} = (G-M-O) \{1-(0.4 + 0.4)\} \\ &= 0.2 (G-M-O) \end{aligned}$$

G : Gross Sales

M : Marketing Expenses

O : Actual Operating Expenses or 90% of Gross Sales, whichever lower

BOF : Basic Operators Fee

SOA : Special Operators Allowance

In this formula, SOA, the OEA share varies depending on the degree of Philippine ownership as shown in Table-2-1-9. The OEA share is currently about 3% of gross sales.

Table 2-1-9 Coal Operating Contract - Revenue Sharing Formulae

Ownership of Philippine (P) (%)	Contractor's Share			Government Basic Share
	BOF	SOA	Total	
A: P = 100	40	40	80	20
B: $60 \leq P < 100$	40	30	70	30
C: $40 \leq P < 60^*$	40	20	60	40

Note: *The Philippine Constitution does not allow less than 60% Philippine ownership in the coal mining industry.

Through the formation of PNOC-CC and the Malangas Coal Corporation, the government has also taken an active part in coal production.

Under the Service Contract System (through PD 972 of 1976), foreign companies are also encouraged to develop coal mines. Under the old system, foreign and foreign-owned companies could not obtain coal concessions. There are foreign investors now, as shown in Table 2-1-10.

The Omnibus Investments Code of 1987 (EO 226) consolidates the foreign investment laws and various incentive schemes. Under the law, foreign investment of 40% or less of the capital is permitted in the coal mining industry, as in most economic activities. The Philippine Constitution limits the ownership of land and the development, exploration and use of natural

Table 2-1-10 Partial List of Coal Contractors with Foreign Investors

Name of Contractor	Foreign Investor	% of investment of foreigner	Contract date	Production (1987)
Cravat Coal Mines, Inc. (CARBEX)	American	30	Jan., 1987	33,512 tons
Zambo Industrial Mining Corp. (Zamboco)	Chinese	10	Jun., 1980	No Report

resources to citizens of the Philippines and to corporations or associations at least 60% of whose capital is owned by Philippine citizens.

On the demand side, the government encourages the private sector to convert to coal through tax and other incentives, such as accelerated depreciation, tax-free imports of requisite equipment etc, which are given by PD 972. A policy of high fuel oil prices and ceiling prices of coal had been adopted to accelerate the conversion. Now, coal prices are deregulated.

(3) Taxation on Coal Production

As mentioned before, coal contractors receive the following incentives in taxation, under the Coal Development Act of 1976 (PD 972).

- a) Exemption from all taxes except income tax;
- b) Exemption from payment of tariff duties and compensating tax on importation of machinery and equipment and spare parts and materials required for the coal operations subject to some conditions;
- c) Accelerated Depreciation - At the option of the tax payer and in accordance with the procedure established by the Bureau of Internal Revenue, fixed assets may be,
 - 1) depreciated to the extent of not more than twice as fast as the normal rate of depreciation if expected life is ten years or less; or
 - 2) depreciated over any number of years between five years and the expected life if the latter is more than ten years, and the depreciation thereon is allowed as a deduction from taxable income; Provided, that the taxpayer notifies the Bureau of Internal Revenue at the beginning of the depreciation period as to which depreciation rate allowed by this section will be used by it.

Income tax on corporations

Domestic corporations including joint ventures and partnerships, whether registered or not, are taxed on their annual net taxable income from world wide sources at the rate of 35%. General professional partnerships and joint ventures formed for the purpose of undertaking construction projects or engaging in petroleum, coal, geothermal, and other energy operations pursuant to an operating or consortium agreement under a service contract with the government, are excepted from income tax.

Under existing income tax legislation, depreciation may be calculated by any method approved by custom law, but the normal rate of depreciation or expected life is not determined by the law. Tax payers can decide these figures with the approval of the Bureau of Internal Revenue. The Expected Service Life Table applicable to the U.S. is usually utilized in the Philippines also.

The Omnibus Investments Code of 1987, gives tax incentives and other incentives to enterprises registered with the Board of Investments. It introduces the concept of income tax holiday for enterprises in a preferred area of investment. Newly registered firms are fully exempt from income taxes for a period of 6 years for pioneer firms, and 4 years for nonpioneer firms. This can be extended for another year in some cases. Expanding firms will be entitled to an exemption from income tax for 3 years. It also provides a new incentive for labor-intensive enterprises in the form of a tax deduction for additional direct labor expenses. Additional incentives will be available to enterprises in less developed areas.

(4) Deregulation of Pricing and Importation

The coal market has been deregulated. Any company can import coal at any price. This was referred to as a "free market". Before, the government had adopted a ceiling price of coal as well as security of supply as an incentives for the cement industry to convert its energy needs from oil to coal. The ceiling price was set at not more than 65% of the imported fuel oil price on an equivalent heat value basis or the price of imported coal from Australia, whichever was the higher. The ceiling price has been abolished. Though there is an effort by coal producers to get an agreement for a floor price, PNOC, a major producer, purchaser and distributor of coal, began to set coal prices at import parity (plus duty, value added tax etc.) on a delivered heat, ash and

moisture equivalent basis. In this way, coal prices began to be determined on a free market basis.

The OEA forecasts of coal prices are based on free market prices, which are influenced by oil prices. It is assumed that oil prices will rise moderately from 17 \$/bbl in 1987 to 22.8 \$/bbl in 1993.

While the government does not directly regulate coal prices, there is an indirect influence on prices through import duty levies and the pricing policies for PNOC and NPC. Import charges comprise of customs duty (20% of CIF price) ERB fee (0.1% of CIF price), P 10/ton of specific tax, and value-added tax (10% of total landed cost).

Local coal is exempted from value added tax, but is still higher than imported coal in price. Semirara coal, for example, costs around two times that of imported coal CIF prices on an equivalent BTU basis.

Semirara	:	40 \$/ton CIF at 7,200 BTU/lb
Imported Coal	:	30 \$/ton CIF at 12,000 BTU/lb

Recently, the Coal Council of Advisors (CCA) has been playing an important role in the coal business. In 1987 the council determined policies such as:

- 1) only during a shortfall in local supply vs. demand, coal imports will be allowed.
- 2) for 1987, import permits were granted only after purchasing at least 50% of their requirement from domestic coal and existing inventory stock. (The actual amount of imported coal was 615,000 tons compared with 1,168,000 tons of local coal supply.)
- 3) a guiding price for local coal be set at P 709/ton at 8,500 BTU/lb., FOB Cebu.

For 1988, the import/domestic ratio is determined at 45/55, according to the guiding principle that imports will cover only shortfalls in local supply.

(5) Economic and Technical Aid by Foreign Governments and Public Organizations

The government has been asking foreign technical grant-in-aid in the field of the coal mining industry since 1979. The assistance has been in the form of grants for feasibility studies with technical assistance as well as in the form of supplier's credit as in the Semirara Coal Development Project. These grants were or are given by the ADB, the World Bank, and governments such as the U.S., Canada, Australia, the Federal Republic of Germany, Japan, etc. Major projects include those shown in Table 2-1-11.

Table 2-1-11 Major Grant-In-Aid Projects in the Field of
the Coal Mining Development

Semirara Coal Mine Development	1978	Austromineral supplier's credit (Backed by Australian Govern- ment and banks)
Himalian Area Coal Development F/S	1983	USTDP (Dames & Moore)
Semirara Coal Quality Survey	1987	CIDA (MONENCO)
Malangas Coal Mine Development T/A	1979	ADB (Dia Consultants)
Malangas Coal Mine Development	1979-83	ADB (Dia Consultants)
RP National Coal Logistic Study	1981	Australian Dev. Ass. Bureau (MacDonald Wagner & Priddler and others)
Bislig Coal Mine Development T/A (incl. Coal Logistics)	1982	ADB (Dia Consultants)
RP-German Coal Exploration Project	1982-87	WG BGR (WG Experts)
Cebu Coal Washing Study	1983-84	TDP (Norwest Resources)
North Cebu Transportation Study	1983-84	TDP (Davy McKee)
RP Coal Survey	1983-87	World Bank (JACIA, BMCL)
Asean Coal Mine Development Project	1984-85	ADB, UNDP, ESCAP (MONENCO)
RP Coal Resources Survey	1985	British ODA (Wardell Armstrong)
Private Sector Coal Mine Survey	1985-86	ADB (MONENCO)
Coal Mine Consultancy	1987-90	WG GTZ (Saarberg Interplan)