JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
DIRECTORATE OF COAL
REPUBLIC OF INDONESIA

MASTER PLAN STUDY ON HUMAN RESOURCES DEVELOPMENT PLAN FOR COAL MINING IN THE REPUBLIC OF INDONESIA

FINAL REPORT

SUMMARY REPORT

MARCH 1997

Japan Technical Cooperation Center for Coal Resources Development
Mitsui Mining Engineering CO., LTD

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General Summing-up and Recommendations

In its long-term demand and supply scenario currently presented by the Indonesian government, coal production for 2008/09 has been estimated as reaching 120 million tons, and demand is forecast to reach 95.83 million tons, leaving a remainder of approximately 24 million tons for export.

As the sharp rise in coal demand is estimated to continue in the future the Japanese government has been approached with the request to review the demand forecast by extending it over a longer period, namely, up to 2020/21, and to draw up a master plan for Indonesia's personnel development to accord with the reviewed forecast.

The important issues in connection with coal production are the transition by a certain part of the 1st-generation contractors from open-pit to underground mining as well as the extent to which the 2nd- and 3rd-generation contractors will be successful in their development efforts and the way in which this will affect the forecasts for coal production. The crucial factor for personnel forecasts will be the rate at which underground coal mining will increase. We have conducted studies and analyses in close coordination with the authorities of the Indonesian government responsible for coal.
To throw light on the present situation of Indonesian coal mining and of the future vision for the collieries, we also conducted site surveys, questionnaire studies and face-to-face interviews to examine all aspects of this sector, including production, transport, management operations such as quality control, organizational issues, job classification, the status of in-house training offered by companies, and the level of technology in the various fields.

We have also made a study of the schools providing the necessary human resources and the training facilities conveying coal technology.

In view of the above, we have made the following review of the long-term demand prognosis up until 2020/21.

1. Long-Term Coal Supply and Demand Forecast

In our base scenario, annual coal production output in 2020/21 is estimated at approximately

189 million tons. This output level will be matched by a (domestic) demand volume in the region of approximately 176 million tons, leaving 13 million tons for export.

These forecasts were made by taking the following factors into consideration.

1) Three scenarios were examined (Base, High, and Low)

2) Coal production output from the 1st-generation contractors was based on the results of the present study.

3) Coal production output from the 2nd-generation contractors (18 companies) was based on the following assumptions:
   - Success ratio: 50%
   - Production output: 2 million tons each

4) Coal production output from the 3rd-generation contractors (91 companies) was based on the following assumptions:
   - Success ratio: 50%
   - Production output: 1.5 million tons each

(Million tons)

	2000	2010	2020
Consumption	39	105	176
-Electricity	25	76	127
-Industry	11	19	33
-Household	3	10	16
Production	97	149	189
-PTBA	15	16	12
-CCOW	78	128	172
-KP	4	5	5
-KUD	-	-	-

2. Long-Term Personnel Program

Based on some of the site surveys and questionnaire studies that were carried out, we have

made our estimates for the existing coal companies after consultation with the Indonesian government authorities responsible for the coal sector. In our personnel calculations, we have examined the critical productivity data for each colliery wherever possible and made reference to open-pit and underground operation and to the technical potential and scale of individual companies.

As a result, we have come to the conclusion that a total of approximately 110,000 personnel will be required in 2020/21. The situation at present is that apart from MDCM on Java, a member organization of the Directorate General of Mines which covers the mining sector in general, the only facility available is LPPT on Sumatra. To meet the training needs for the rapidly increasing number personnel required, it will therefore be necessary to establish a new training center in East Kalimantan, a region with many collieries and a high coal production output.

In the future, coal mining development will also go ahead in South Kalimantan so that the need will arise for a new training center to be established also in this region.

(1,000)

	2000	2010	2020
Management	-	-	1
Professional	2	3	5
Supervisor	2	3	5
Operator	13	29	40
Administration	2	3	5
Sub-Total	19	38	56
Sub-Contractor	23	40	56
Grand-Total	42	78	112

3. Training Center Plan for Manpower Development

	Outline of Training Centers
Name	Coal Mining Training Center
Objective	1) Manpower resources development in response to rapid increase coal production. 2) Training for U/G mining technology to cope with the increase in U/G mining system (mostly O/C mining at present) 3) Training for unskilled technology to cope with the mechanization of mining method
Location	East Kalimantan & South Kalimantan
Trainee	U/G Supervisors O/P Supervisors U/G Skilled Operators 2000 1,000 /year → 2018 5,000 /year
Curriculum	① Geology & Drilling Exploration ② Safety ③ Mining & Driving ④ Equipment Maintenance ⑤ Coal Quality Control 2 to 5 weeks/course
Investment & Operation Cost (Million Rp.)	Investment 12,145 /center (including equipment 6,085) Operation Cost 4,031 /center
Fund Raising	Construction Indonesian Government Operation Cost The subsidy out of the Royalty (RP. 29/ton)
Competent Authority	Directorate General of Mines (DGM)
Organization	Expatriate Experts 5/center Indonesian Instructors 8/center Others staff
Promotion	For 5 years Transfer from expatriate experts to Indonesian instructors

Effects of Training Center

1) Raising mining technique → Improve productivity
2) Raising safety technique → Reduce accident frequency
3) Raising exploration technique → Increase estimated coal reserve
4) Raising quality control technique → Enlarge marketplace
5) Raising environment conservation → Improve working condition & reduce mine pollution

↓

Growth of Coal Industry

↓

Create & promotion of employment

↓

Attainment of Long-term demand/supply plan

4. Coal-Related Manpower Development Action Plan

	Main Trainees	Action Plan	Task Allocation		Action to be Taken	Effects
			Government	Private Enterprises		
School Education	Prospective manager & professional classes	1) Instructor training	1) Universities invite capable trainees from enterprises in the coal industry.	1) Dispatch capable trainees to universities.	1) -1 Invite expatriate instructors from foreign countries. -2 Invite prospective instructors from the coal industry. -3 Full use of study-abroad system. -4 Training is supported with the Institute of Technology Bandung taking a leading part in it.	1) Rise in the level of knowledge of coal-related university students.
		2) Implementation of joint research	2) -1 Ministry of Energy & Mines requests Ministry of Education & Culture to plan out the joint research system. -2 MTRDC grasps the needs of the industry & universities, select research subjects & make request to universities for execution. -3 MTRDC helps universities with their joint research expenses.	2) -1 Enterprises make request to MTRDC for a joint research. -2 Furnish subjects of research with respect to the job-site, and competent research workers.	2) Technical challenges to be solved after due study, which are involved in operation of coal mines. - High-speed driving - Soft soil zone driving - Thick layer mining system - Selection & management of mining areas - Central monitor system - Gas vent & utilization - Rock pressure control in deep underground mining - Measures against mine waste water	2) -1 Enhancement of productivity & safety of coal mines. -2 An incentive is given to students to participate in the development of the coal industry.
Training Center	Supervisor & skilled operator classes or over	1) Reinforcement of LPPT	1) Under reconstruction, a Foundation to be established.	1) Help the LPPT with its financing and expenses.	1) Under reconstruction by JBT (Expected capacity extension: 50 → 2,000)	1) Rise in the technical level of coal mine located in Sumatra region to the most part.
		2) Reinforcement of MDCM	2) DGM provides guidance.		2) -1 Increase the manager class training course. -2 Newly open an accident prevention technical course.	2) -1 Improvement in business management capability. -2 Improvement in safety supervisory capability.
		3) Establishment of Coal Mining Training Center	3) -1 Establish & operate the center -2 Secure instructors -3 Make a request for dispatch of trainees. -4 Request coal enterprises to furnish funds. -5 Establish (Foundation) Coal Association of Indonesia & temporarily transfer capable personnel to it.	3) -1 Furnish funds and bear expenses. -2 Establish (Foundation) Coal Association of Indonesia & temporarily transfer capable personnel to it. -3 Send instructors.	3) -1 Government undertakes the operation at thebeginning. -2 (Foundation) Coal Association of Indonesia undertakes the operation in due course in future. -3 To be newly established in Samalinda, East Kalimantan. (Capacity extension: 1,000 → 3,000/year) -4 To be newly established in Banjarmasin, West Kalimantan. (Capacity extension: 1,000 → 2,000/year)	3) Rise in the technical level of coal mines located in Kalimantan region in the most part
In-Company Training	Middle & unskilled operator classes	1) Increase & improvement in training sections	1) DOC provides guidance.	1) -1 Increase and improve training sections. -2 Reinforce on-the-job training. -3 Improve training equipment & teaching materials.	1) -1 Establish in-house training sections -2 Purchase training equipment & teaching materials	1) -1 Thoroughgoing training up to the rank & file -2 Fully increased capability to carry out the job-site work at each coal mine. -3 Execution of periodic training
		2) Training of full-time instructors	2) DOC provides guidance.	2) Instructor training by sending trainees to training centers.	2) Training for full-time instructors	2) Substantially increased & improved the training sections
		3) Completion of curricula	3) Gives guidance in drawing out a common curriculum for the newly-hired employees.	3) Prepare curriculum for operators & newly-hired employees & standard work procedures.	3) Prepare standard work procedures for mining , driving, transportation & blasting works.	3) Increase in work efficiency & decrease in accident frequency rate by standardizing the work procedures.
System		1) Introduction of qualification system	1) -1 Amends the Safety Regulations -2 Draft & plan put the qualifying system for the required qualifications	1) -1 Strictly observe the qualification system. -2 Amends the in-house rules. -3 Give preferential treatment to qualified personnel.	1) -1 Examination system for underground, surface, mechanical & electrical technician -2 Qualification system for mining machinery , driving machinery, large-size winding machine, vehicle-categorized machinery, electric equipment & appliances. -3 Preferential treatment in such a way as increase in pay & promotion	1) -1 Rise in the production & safety level because of rise in the technical level & standardization -2 Rise in the level of each occupational category -3 An incentive is given to promote production.
		2) Establishment of (Foundation) Coal Association of Indonesia	2) -1 Gives guidance in establishment -2 Temporary transfer of personnel to the Foundation.	2) Invest in the Foundation & transfer personnel temporarily.	2) Establish (Foundation) Coal Association of Indonesia.	2) Development of the industry is supported
		3) Establishment of scholarship system		3) Provide funds requested from the Foundation.	3) Compulsory service for 5 years in coal enterprises	3) A certain number of graduates are secured who join the coal industry.

5. Recommendations

1) The Comprehensive Technology Transfer Program for Coal Resources Development in Indonesian currently being executed by the Japanese government should be promoted further.

2) In view of the future escalation of personnel costs, it will be absolutely imperative to upgrade production efficiency in order to achieve the operation of collieries that will be competitive on the international market. For this purpose it will be essential to secure favorable mining districts through appropriate exploration activities, and to inculcate greater cost awareness and consistent TQM.

3) In terms of the use of coal extraction systems suited to the natural conditions prevailing in Indonesia, it will be important to provide training in semi-mechanized coal extraction, seeing that the districts capable of fully automated mining in underground operations are limited.
In conjunction with the future economic development, it will be of critical significance to enhance productivity. For this reason, it will be essential to promote research and development in the areas of coal extraction and safety technology suited to the conditions prevailing in Indonesia. The government should therefore provide financial support for research to the research institutions.

4) With regard to the establishment of a safety system, it will be necessary to:

- adopt a system of Safety Qualifications
  .... Safety Supervisor, Technical Staff, Qualified Operator
- reinforce the system of Safety Supervisors
  .... Training and Increasing the number of Inspector Officer (Government)
- develop a monitoring system
  ... Central monitoring control system, installation of underground communication equipment
- reinforce the rescue teams
  .... Reorganization of the rescue teams and provision of rescue equipment, including oxygen respirators.

5) It will be necessary to reinforce environmental monitoring to meet the needs for environmental protection and to promote the reuse of reclamation sites and of environmental monitoring.

6) The development of low-grade coal which accounts for about half of Indonesia's coal reserves will be extremely important in view of the nation's energy balance. It will therefore be essential to promote the utilization of low-grade coal for mine-mouth power generation. And also in the future, it will need to promote the research & Development into coal gasification and liquefaction.

7) Long-Term Recommendations for the Establishment of New Training Centers
The curricular details offered by the training centers need to be modified and improved on an on-going basis by monitoring the requirement at the site. It may thus be necessary to review the curriculum in the light of appraisals considering it effective to introduce new technology to improve the efficiency of site operation in response to escalating personnel costs. In this sense, it would be desirable to organize discussion meetings with manager class staff at the collieries in the areas concerned at a rate of about twice a year in order to establish the operational situation at the site and the level of knowledge of the trainees as well as the effectiveness of training. If necessary, lecturers should then be assigned to overseas seminars to keep abreast with progress in technology.

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5. Proposed Conceptual Action Plan

6. Proposed Action Plan

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FIGURES

1. General

1-1 Objectives of the Study

The objectives of the Study are :

1) to conduct a study on the present situation of coal mining industry in response to the required coal production expansion
2) to forecast country's future coal demand / supply scenario
3) to analyze the quantity and quality of the manpower needed for development of new coal mines
4) to propose plans for training measures and quantities of manpower
5) to prepare the final report after drawing up an action plan for executing such proposed plans
6) to make practical proposals for introduction of technology on underground mining and safety

1-2 Outline of the Study

The Republic of Indonesia has potential coal reserves estimated at approximately 36 billion tons. The demand for coal in the country and Asia-Pacific region is expected to increase rapidly in the future. The Indonesian government therefore plans to enlarge its coal production from the present 40 million tons to 200 million tons per annum by the year 2020.

In order to attain this target production level, it is essential not only improve the productivity of the existing coal mines but also to speed up the development of new coal mines, including underground mines. It is also essential to educate / train specialists on coal mining technology and related fields. The government of Indonesia already has a program for advancing training programs system in coal mining technology through both the existing training institutions and new training center to be established in future.

However, no comprehensive studies for formulating such future programs and proposals have yet been conducted. It is thus essential to establish a master plan by studying the present condition of the coal mining industry in Indonesia and the actual state of its long-term production plans, estimating the demand for coal in

relation to domestic coal consumption, and formulating a master plan for the training of thr manpower necessary to increase production in the existing coal mines and new coal mines to be developed.

2. Review of Present Status of Coal Mining Industry

2-1 Historical Review of Coal Industry

Under the new National Coal Policy, the government established PT. Tambang Batubara Bukit Asam (PTBA), a state-owned coal company. In 1981, the first coal contract agreement based on the regulations as detailed in Presidential Decree No.49 of 1981 was signed between PTBA and contractors. The contract was based on the role of Production Sharing. 11 contracts had been signed by 9 foreign contractors and 2 domestic contractors as the First Generation contractors by 1987.

Among these 11 contractors, 9 have already started production. One is planning to start production from March, 1997. The remaining one contractor has completed exploration work and is making a feasibility study.

The government of Indonesia announced its new policy in 1992 to open new coal mines operated by Contract of Work. Following this policy the government issued the Presidential Decree No.21 in 1993. Based on this, the second contracts were signed between PTBA and 19 contractors (21 concessions). These contractors are at the exploration or feasibility study stage. It is estimated that some of the companies will start production in this century, and the others will start production from early next century. As PT.Supra Blakindo Mineral has dropped out due to financial problems, 18 contractors remain.

A total of 132 companies are nominated as the 3rd Generation. 53 of them have already signed the basic agreement. Among them, 19 companies have received the exploration license for one year. Locations of the 1st and 2nd Generation contractors are shown in Figure 2-1. Locations of the 3rd Generation contractors are partly shown in Figure 2-2.

Coal Cooperation Contract (CCC) was amended and Coal Contract of Work (CCOW) will be effective from 25 September, 1996.

As shown in Figure 2-3, major producers are PTBA mines located in Sumatera and CCOW mines located in South and East Kalimantan.

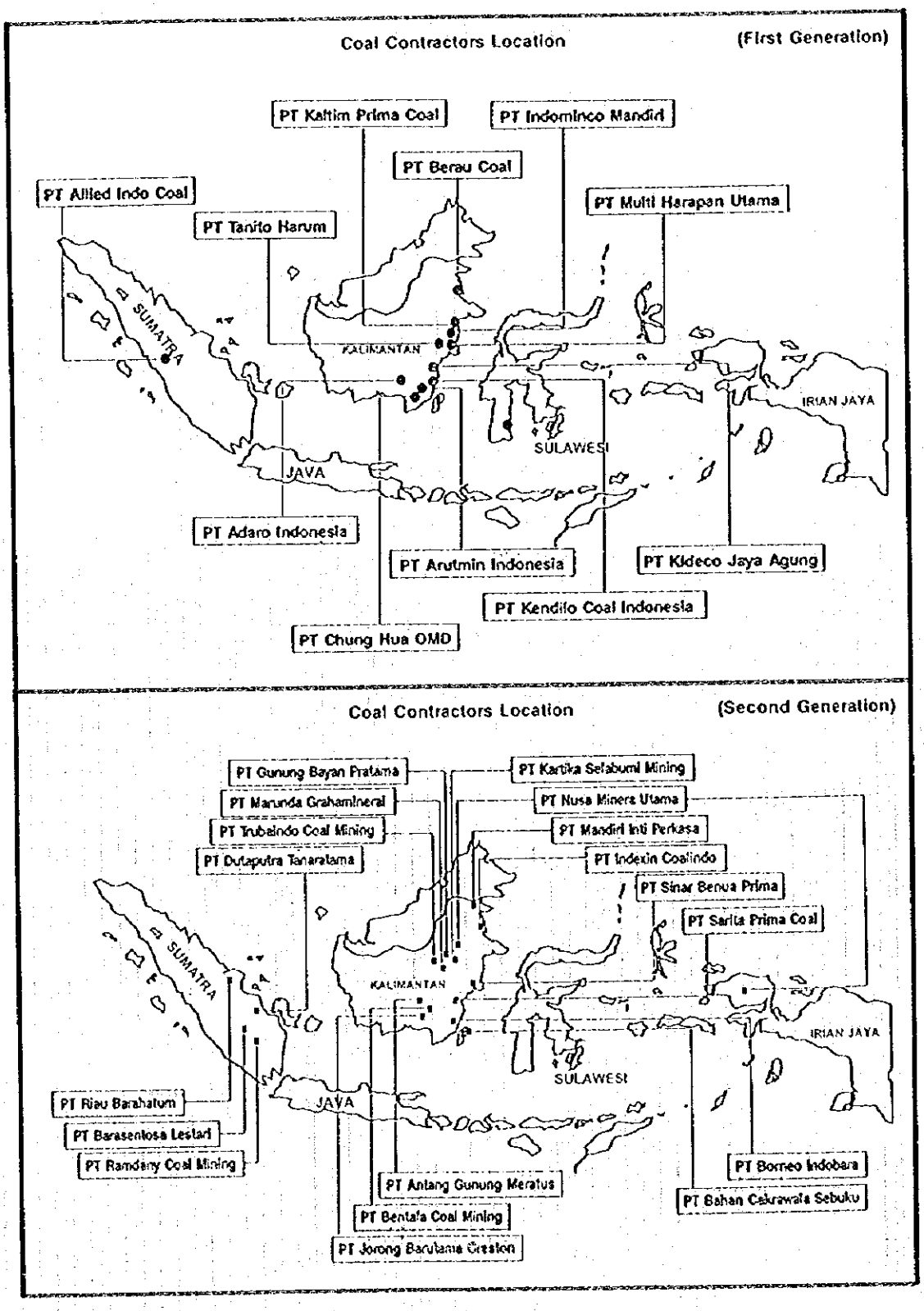


Figure 2-1 Coal Contractors Locations (First, Second Generation)

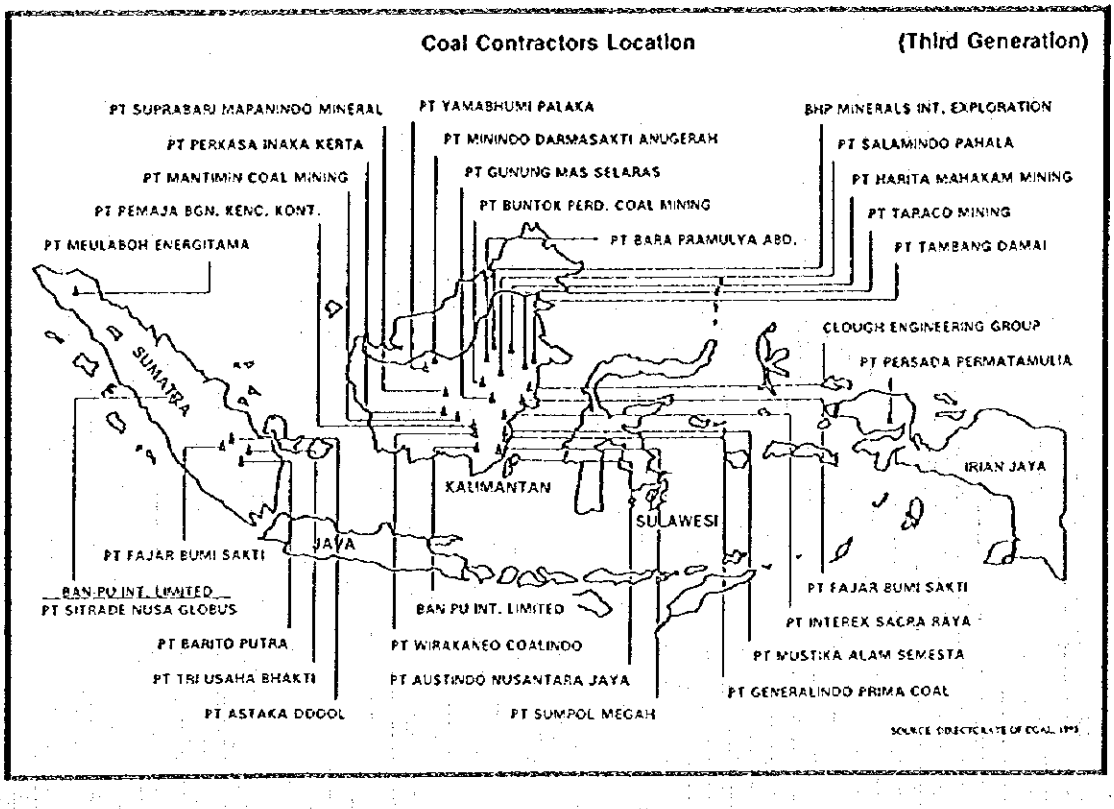


Figure 2-2 Coal Contractors Locations (Third Generation)

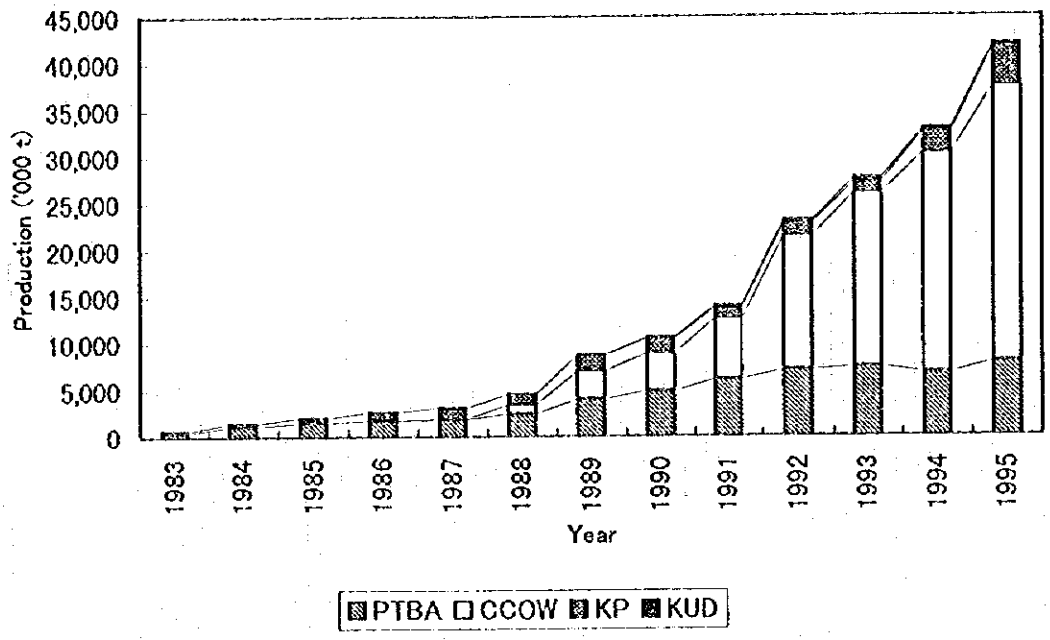


Figure 2-3 Production Records of Indonesia

2-2 Coal Geology and Reserves

Table 2-1 Coal Reserves in Indonesia

(Million tons)

Regions	Mesured	Indicated	Inferred	Hypothetic	Total	%
Sumatra	2, 888	11, 166	2, 280	8, 343	24, 677	68
North	-	1, 272	2	433	1, 707	5
Central	718	2, 371	58	1, 019	4, 166	11
South	2, 143	7, 506	2, 204	6, 891	18, 744	52
Bengkulu	27	17	16	-	60	0
Kalimantan	1, 986	1, 494	3, 789	4, 231	11, 500	32
West	2	69	211	1, 838	2, 120	6
South	1, 113	668	1, 848	-	3, 629	10
East	871	757	1, 730	1, 957	5, 315	15
Central	-	-	-	436	436	1
Java	12	29	-	20	61	0
Sulawesi	5	12	7	-	24	-
Irian Jaya	-	79	4	-	83	0
Sub-Total	4, 891	12, 780	6, 080	12, 594	36, 345	100
Total Production(1965-1993)	75	-	-	-	75	
Total	4, 816	12, 780	6, 080	12, 594	36, 270	

Source : DOC 1993

Table 2-2 Coal Reserves by Rank

Regions	Anthracite	Bituminous	Sub-Bituminous	Lignite	Total
Sumatra	132	651	2,585	21,309	24,677
North			1,707		1,707
Central	4	473	380	3,309	4,165
South	128	178	438	18,000	18,744
Bengkulu			60		60
Kalimantan		4,560	6,940		11,500
West		1,976	144		2,120
South		1,323	2,306		3,629
East		825	4,490		5,315
Central		436			436
Java		15	46		61
Sulawesi			24		24
Irian Jaya			83		83
Total	132 (0.4%)	5,226 (14.4%)	9,678 (26.6%)	21,309 (58.6%)	36,345

The geological age of Indonesian coal dates back to the Palaeogene to Pliocene. Wide and thick coal reserves are found in the basins of the Middle and Late Miocene to Pliocene. As shown in Table 2-1, total coal reserves are 36 billion tons. 70% of them are located in Sumatra and 30% are located in Kalimantan. Only around 1% of the reserves are located in other regions, such as Sulawesi or Irian Jaya. It is estimated that the estimated reserves will increase after further exploration work to be conducted in other regions, i.e. Irian Jaya, etc. Measured reserves are estimated at 4.8 billion tons, consisting of sub-bituminous and lignite (85%) and bituminous coal (15%) suitable for export as shown in Table 2-2.

2-3 Production Method

There are four groups of coal producers in Indonesia i.e., PTBA, CCOW, KP and KUD. The production records of the companies are shown in Figure 2-3, of which the PTBA and CCOW contractors are major producers.

There are three underground coal producers in Indonesia i.e., the Ombilin mine of PTBA, and two coal mines in Mahakam area, East Kalimantan. A total of 115 concessions has been registered as KP mines in the country, of which 10 mines are operating. The mines, except for 3 underground coal mines, are producing coal by open cut mining method.

2-3-1 Open Cut Mining

Only Air Laya pit of PTBA's Tanjung Enim mine is producing coal with the Bucket Wheel Excavator mining system. The other open cut mines of PTBA, CCOW and KP are using a Truck and Shovel method.
At present, around 70% of the coal is produced by CCOW contractors.

2-3-2 Underground Mining

Currently only three coal mines are producing coal from underground operation. These are the Ombilin mine (Sawahluhung pit) of PTBA, Embalut mine of PT.KITADIN and Kutai mine (Loa Ulung pit) of PT.Fajar Bumi Sakti (PT.FBS). Total production is around 0.7 million tons per year.

3. Estimation of Coal Demand & Supply

3-1 Trend of Energy

Indonesia has rich energy resources such as crude oil, natural gas and coal. The amounts of these reserves are 48.4 billion barrels (crude oil), 216.8 trillion ft ^{3} (natural gas) and 36.0 billion tons (coal) according to an official report.
The amount of energy supply was 495 million BOE in 1994 and 340 million BOE was consumed. If the amounts of supplied energy are classified, seeing that Indonesia is also one of oil producing countries, it can be seen that crude oil occupies 60% followed by natural gas at 24% and coal at 10%. In Indonesia, the consumption ratio for coal is currently low although the amount of its coal reserves occupy more than 60% of all fossil resources in Indonesia.

With Indonesia's rapid economic growth at more than 6%, the demand for natural resources is estimated to be 504 million BOE in 1998, if calculated on an oil basis.

Table 3-1 Primary Energy Supply and Consumption

(Million BOE)

	1994		1998	
Oil	296	(60%)	360	(52%)
Coal	49	(10%)	120	(17%)
Natural Gas	117	(24%)	163	(24%)
Hydro	29	(6%)	3	(5%)
Geothermal	4	(1%)	12	(2%)
Total	495		689	
Industry	146	(43%)	245	(48%)
Transportation	115	(34%)	160	(32%)
Household	79	(23%)	90	(20%)
Total	340		504	

Source : Repelita 6

Oil which occupies 2/3 the primary energy of Indonesia has reserves of 10.7 billion barrels (proven + inferred). If current production of 0.5 billion barrels is maintained in the future, its reserves will be consumed in 20 and several years' time. Thus, the basic policy of the energy sector of Indonesia's Repelita 6 (1994/95 - 1998/99) states that Indonesia will make efforts to export as much oil as possible to gain foreign currency while increasing its consumption ratio for non-oil energies whose reserves are relatively large, such as natural gas and coal .

Table 3-2 Fossil Energy Reserves

	unit	proven	inferred	hypothetical	Total
Oil	Bill bbl(Gtce)	5.30(1.03)	5.43 (1.06)	37.67 (7.34)	48.40 (9.43)
Natural Gas	TSCF(Gtce)	63.6(2.11)	38.2 (1.26)	115.0 (3.81)	216.80(7.18)
Coal	Bill.t (Gtce)	4.82(4.10)	18.85 (16.04)	12.59(10.71)	36.26(30.85)
Total	(Gtce)	7.24	18.36	21.86	47.46

Source : IEA Coal Research, 1994

3-2 Estimation of Coal Demand

In 1994, production of coal was 32 million tons and domestic consumption was 8 million tons, equivalent to about 25%. It is estimated that in the future, coal demand will increase significantly by 18% annually on average to 27 million tons in 1998/99, 55 million tons in 2003/04 and 97 million tons in 2008/09. After this the rate of growth will remain at 5% until 2020/21, when coal consumption is estimated to reach roughly 176 million tons, a level about 21 times that of 1993/94.

The electricity sector as the biggest consumer of coal will show a positive commitment to the construction of new coal-fired power plants and to the expansion of existing ones in a general effort to diversify its energy sources in the future and to change over from petroleum to alternative energies. As a result, coal consumption by the power sector is estimated to grow at an annual rate of 12% to reach 127.1 million tons in 2020/21. This is an overwhelming share of 72% of total coal consumption.

The cement industry as the second biggest user of coal after electricity will reach a coal consumption level of 18 million tons in 2020/21 and rising in parallel with the country economic growth and with the expansion of the nation's social infrastructure. At that time (2020/21), per capita cement consumption will reach 500 kg/year.

Table 3-3 Forecast of Coal Demand in Indonesia

(Million tons)

	1993/94	1998/99	2003/01	2008/09	2013/14	2018/19	2020/21
Consumption	8.4	27.3	55.3	96.5	119.2	156.4	175.8
-Electricity	5.4(63%)	16.6	38.6	71.3	84.2	113.0	127.1(72%)
-Cement	2.6 (31%)	5.4	5.7	7.7	11.6	15.5	17.8(10%)
-Other Industry	0.5 (6%)	4.3	6.5	8.5	10.8	12.6	14.6(9%)
-Household	-	1.0	4.5	9.0	12.6	15.3	16.3(9%)

The small-scale manufacturing sector, is seen as likely to go over to coal instead of using petroleum as its energy source. The paper and pulp industry, in particular, is expected to change over to coal in order to save boiler fuel. The civilian consumer sector, however, is estimated to have a coal demand equal to that of the cement industry and the small-scale manufacturing sector, assuming that there will be a smooth transition to the general use of briquettes as the household fuel.

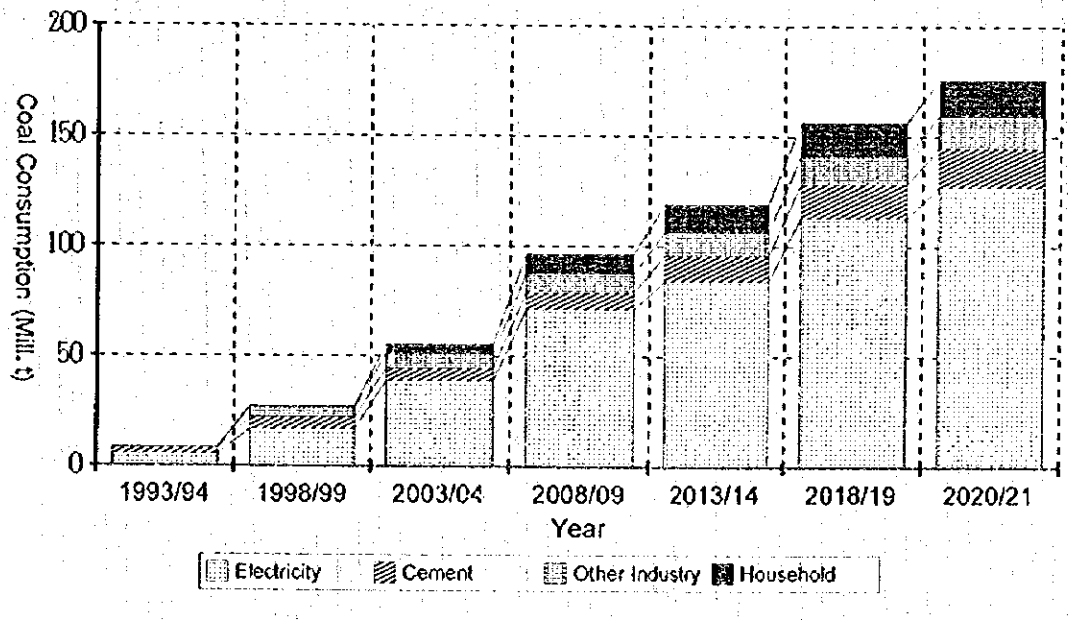


Figure 3-1 Estimation of Coal Demand

To ensure coal supply as scheduled to cope with the future rapid increase in the demand, the following four items should be properly considered and appropriate countermeasures taken.

* Economic and effective production of low quality coal
* Creation of infrastructure
* Compliance with statutory emission levels for SOx and NOx in coal-fired power plants
* Development of economic production methods for coal briquettes, establishment of combustion technology and its penetration

3-3 Coal Production Planning

3-3-1 Existing Coal Mines

Present coal mines in operation are 2 coal mines of PTBA, 9 contractors of CCOW, 10 companies of KP and 6 companies of KUD, respectively. The total coal production in 1995 was about 4.2 million tons, of which 70% are produced from the mines of the CCOW.

The annual coal production projections of the existing coal mines are made based on the results of the Questionnaires dispatched to the coal companies and the Hearing at the visit of main coal companies.
The results are summarized in Figure 3-2.

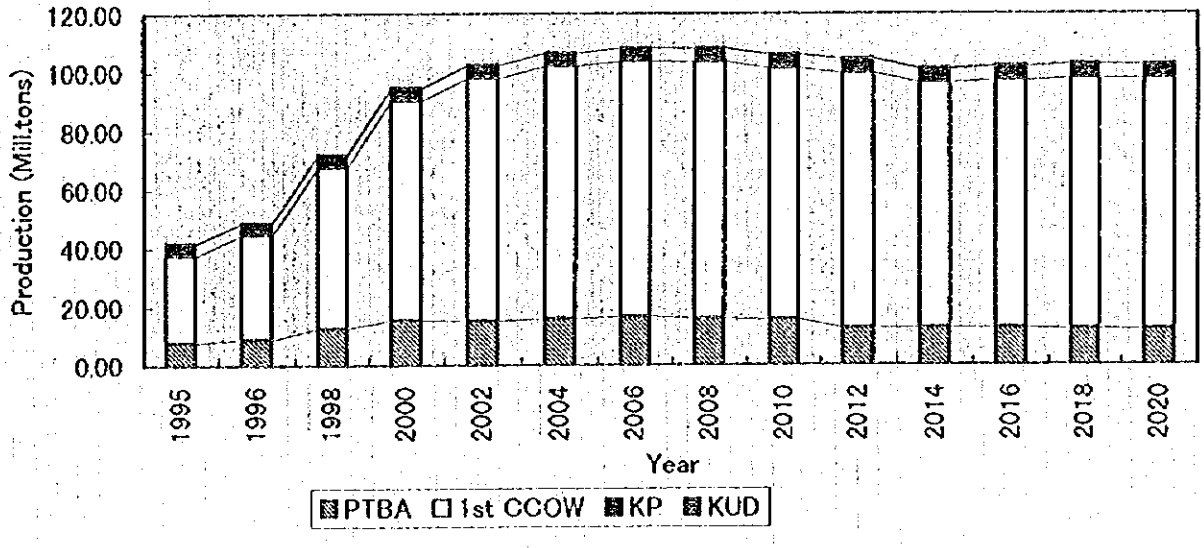


Figure 3-2 Coal Production Projections of the Existing Coal Mines

As a result, approximately 100 million tons of coal production, which are 2.4 times of the present production, are projected in 2020. Especially the CCOW mines are expecting to establish their production expansion into 3 times of the present level in order to respond rapid expansions of the coal export and the long-term contract with new domestic coal-fired thermal power plants to be constructed in near future. Major changes of mining method with the existing coal mines would not be

happened at present. As underground coal mines, 2 new mines, consisting of one from the CCOW contractors and another from the KP mines, will be developed in addition to the existing 3 underground coal mines.

3-3-2 New Coal Mines

New coal mines to be developed are consisting of CCOW contractors of 2nd and 3rd generation, KP mines and KUD mines. As an additional production projection, those of the 2nd and 3rd generation CCOW contractors are considered in the report because the information of KP and KUD coal mines is very few and the total production of them is very minor against the whole country's coal production.

The coal companies of the 2nd generation CCOW, which are under exploration, are 18 in number while those of 3rd generation CCOW, which are under the stage of contract negotiation or application, are counted into 91.
Therefore, the annual production projections of these new CCOW contractors are made as shown below under the following assumptions:

1) The total coal production of CCOW 2nd generation contractors in 2020 is computed under the following formula:

18 Companies x 50%(Success ratio) x 2 Mill.tons/company = 18 Mill.tons

2) The total coal production of CCOW 3rd generation contractors in 2020 is calculated under the following formula:

91 Companies x 50%(Success ratio) x 1.5 Mill.tons/company = 68.25 Mill.tons

3) The proportion between the open pit mines and the underground mines of the 2nd and 3rd CCOW contractors is assumed into 80:20.

4) The success ratio and the annual production of the 2nd and 3rd generation contractors are decided after the mutual discussion between the DOC and the JICA mission.

Also the saleable amount of each coal product in the coal market has to be reviewed in the future because the new contractors are under the exploration stage and the exact quality of each coal product is not available in the study period.

The transition of coal production projections from the new CCOW coal contractors by the year 2020 is shown in Figure 3-3.

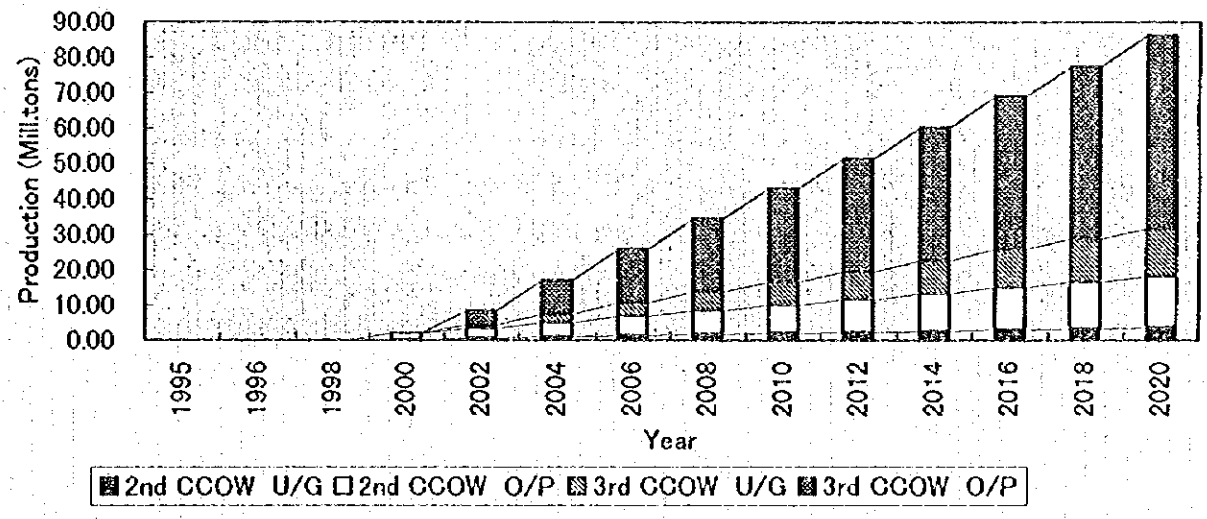


Figure 3-3 Coal Production Projections of The New Coal Mines

The coal production of new CCOW mines is estimated to start from the year 2000 and will reach to approximately 90 million tons in 2020.
The development of underground coal mines which need more costs for operation will be concentrated in the Kalimantan island where the higher quality coals are abundant.

3-3-3 Analysis and Evaluation of Coal Production Projections

The annual coal production projections for existing and new coal mines are summarized in Table 3-4, and the total coal production is estimated to approximately 190 million tons per annum in 2020.

Table 3-4 Coal Production Forecast (1995-2020)

Company	Mines (Mining Method)	Coal Quality			Annual Coal Production Forecast (Mill. tons)														Remarks
		H.V.	Ash	T.S.	1995	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	2020	
PT Bukit Asam	Ombilin (U)	6,880	7.43	<1.00	0.06	0.05	0.05	-	-	0.11	0.60	1.00	1.40	1.50	1.50	1.50	1.20	1.00	
	Sigalut (U)	6,880	7.40	<1.00	-	-	-	0.07	0.06	0.05	0.05	0.20	0.53	0.54	0.56	0.57	0.50	0.50	
	Ombilin (O)	6,940	7.13	0.60	1.11	0.90	0.60	0.40	0.40	0.40	-	-	-	-	-	-	-	-	
	Ombilin Total				1.17	0.95	0.65	0.47	0.46	0.56	0.65	1.30	1.93	2.04	2.06	2.07	1.70	1.50	
	Air Laya (O)	5,240	7.80	0.40	4.46	3.00	3.00	5.00	5.30	5.70	6.00	4.50	3.00	-	-	-	-	-	
	N. Muara Tiga B. (O)	4,850	6.50	<1.00	2.30	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	
	W. Banko (O)	4,840	6.85	0.50	-	-	3.90	4.50	4.70	4.90	5.10	5.30	5.60	5.60	5.60	5.60	5.60	5.60	
	Bukit Kendi (O)	6,760	<4.00	<0.05	-	0.30	0.60	1.00	-	-	-	-	-	-	-	-	-	-	
	S. Muara Tiga B. (O)	5,220	5.00	<0.92	-	0.60	0.50	0.40	0.60	0.80	0.80	0.80	1.00	1.00	1.00	1.00	1.00	1.00	
	Tanjung Enim Total				6.78	7.90	12.00	14.90	14.60	15.40	15.90	14.60	13.60	10.60	10.60	10.60	10.60	10.60	
	U/G Sub-total				0.06	0.05	0.05	0.07	0.06	0.16	0.65	1.30	1.93	2.04	2.06	2.07	1.70	1.50	U
	O/P Sub-total				7.89	8.80	12.60	15.30	15.00	15.80	15.90	14.60	13.60	10.60	10.60	10.60	10.60	10.60	
	Total				7.95	8.85	12.65	15.37	15.06	15.96	16.55	15.90	15.53	12.64	12.66	12.67	12.30	12.10	
PT Arutmin Indonesia	Senakin	6,900	9.00	0.80	) 5.36	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	-	-	-	-	
	Satui	6,800	8.00	0.80		2.00	2.00	2.00	2.20	2.20	2.20	2.20	-	-	-	-	-	-	
	Mulia	-	-	-	-	-	0.60	1.50	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	
	Asam Asam	4,680	3.30	0.19	-	-	-	0.39	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
	Batulicin	-	-	-	-	-	0.50	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	
	Total (O/P)				5.36	6.00	7.10	8.89	13.40	13.40	13.40	13.40	11.20	11.20	7.20	7.20	7.20	7.20	
PT Kendilo Coal	Petnegie	6,700	12.00	0.6~1.4	1.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	Bindu	6,090	17.90	2.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total (O/P)				1.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
PT Berau Coal	Lati	5,110	4.00	0.70	0.67	1.10	2.00	4.50	5.00	5.70	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	
	Binungan	6,200	3.50	0.80	-	0.50	1.70	3.20	3.60	3.80	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	
	Total (O/P)				0.67	1.60	3.70	7.70	8.60	9.50	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	
PT Multi Harapan Utama	Busang	6,400	4.00	<1.00	1.40	1.40	1.40	1.00	0.80	0.80	-	-	-	-	-	-	-	-	
	Jonggon				0.57	0.70	1.00	1.00	1.00	1.00	1.00	0.50	-	-	-	-	-	-	
	Citan	6,000	4.00	0.40	-	-	-	-	-	-	-	-	0.50	0.80	0.80	0.80	0.80	0.80	
	Loakula				-	-	-	0.80	1.00	1.00	1.00	1.30	1.30	1.20	1.00	1.00	1.00	1.00	
	Le Hau	7,100	2.00	0.70	-	-	-	-	-	-	1.00	1.20	1.20	1.20	1.20	1.20	1.20	0.70	
	Putak				-	-	-	-	-	-	-	-	-	-	-	-	-	0.50	
	Total (O/P)				1.97	2.10	2.40	2.80	2.80	2.80	3.00	3.00	3.00	3.20	3.00	3.00	3.00	3.00	
PT Kideco Jaya Agung	Roto I	5,830	1.20	0.10	-	2.00	2.20	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	
	Roto II				-	0.80	1.80	2.50	2.80	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
	Samu				-	-	0.50	1.00	1.30	1.50	1.50	1.50	1.50	1.80	2.00	2.40	2.70	3.00	
	Sasubang				-	-	-	0.50	0.80	1.00	1.20	1.40	1.50	1.80	2.00	2.20	2.50	2.50	
	Semerangau	4,910	2.10	0.10	-	-	-	0.20	0.60	1.00	1.20	1.50	1.50	2.00	2.50	2.70	3.00	3.00	
	Pinang				-	-	-	0.30	0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	Total (O/P)				2.50	2.80	4.50	7.00	8.70	10.00	10.40	10.90	11.00	12.10	13.00	13.80	14.70	15.00	
PT Kaltim Prima Coal	Pinang	7100(L)	4.00	0.50	10.21														
		6,300	7.00	0.40															
	Bintang																		
	Bengalon	6,000																	
	Seperi-Sentan																		
	Total (O/P)				10.21	11.50	16.00	20.00	21.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	
PT Allied Indo Coal	Parambahan	(7,800	0.80	0.60		1.20	1.20	1.00											
		7,000	8.00	1.20															
	Total (O/P)				1.20	1.20	1.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
PT Tanito Harum	Mine I and II (O/P)	6,400	5.00	0.80		1.30	1.40	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	
	Pondok/Lobu (U/G)	6,400	5.00	0.80		-	0.30	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
	Total				1.10	1.30	1.70	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	
PT Adaro Indonesia	Paringin	5,900	1.00	0.10		7.20	7.00	6.00	2.00	-	-	-	-	-	-	-	-	-	
	Tutupan	5,600	1.50	0.10		-	7.00	8.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	
	Wara	4,680	2.50	0.18		-	2.00	6.00	8.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	
	Total (O/P)				5.55	7.20	16.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	
PT Chung Hua Overseas	Coal Belt III, IV & V (O/P)	7,120	0.90	0.60	-	0.20	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
PT Indominco Mandiri	Western Block	6,400	5.50	<0.80															
	Eastern Block	6,250	3.00	<1.90															
	Total (O/P)				-	0.86	1.00	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	
CCOW	U/G				-	-	0.30	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	U
	O/P				29.58	35.76	54.80	74.39	82.50	85.70	86.80	87.30	85.20	86.50	83.20	84.00	84.90	85.20	
	Total				29.58	35.76	55.10	74.89	83.00	86.20	87.30	87.80	85.70	87.00	83.70	84.50	85.40	85.70	
PTBA+CCOW	U/G				0.06	0.05	0.35	0.57	0.56	0.66	1.15	1.80	2.43	2.54	2.56	2.57	2.20	2.00	U
	O/P				37.47	44.56	67.40	89.69	97.50	101.50	102.70	101.90	98.80	97.10	93.80	94.60	95.50	95.80	
	Total				37.53	44.61	67.75	90.26	98.06	102.16	103.85	103.70	101.23	99.64	96.36	97.17	97.70	97.80	
PT Bukit Baiduri	Merenda	6,900	9.00	<1.00	-	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	By 2000
	Galaxy				-	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.70	0.70	0.70	0.70	0.70	0.70	
	N. Teluk Dalam	6,000	2.50	0.60	-	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	-	-	-	-	-	
	Total (O/P)				0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.70	
PT Fajar Bumi Sakti	Mine I (U/G)	6,700	4.00	0.40	0.53	0.60	0.10	-	-	-	-	-	-	-	-	-	-	-	
	Loa Ulung (U/G)				-	0.05	0.55	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	
	Total				U 0.58	0.65	0.65	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	
PT Kitadin	Mine I, II, III (U/G)	6,500	7.00	<0.80	U 0.42	0.40	0.40	0.50	0.50	0.50	0.50	0.50	0.60	0.60	0.60	0.60	0.70	0.70	
	#19 (O/P)	5,700			O 0.30	0.10	0.10	-	-	-	-	-	-	-	-	-	-	-	
	Total				0.72	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.60	0.60	0.60	0.60	0.70	0.70	
PT Bukit Sunur	Arantigas (O/P)	6,300	7.00	<0.80		0.60	0.70	-	-	-	-	-	-	-	-	-	-	-	
	Lubuk Bungin (U/G)	6,800	12.00	<0.80			-	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	
	Suluang Barat (U/G)	6,800	12.00	<0.80			-	U 0.10	0.30	0.30	0.30	0.30	0.50	0.50	0.50	0.50	0.50	0.50	
	Total				0.80	0.80	0.80	1.00	1.00	1.00	1.00	1.00	1.20	1.20	1.20	1.20	1.20	1.20	
PT Danau Mas Hitam	Danau M. Hitam	6,300	<12.00	<1.00	0.67	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.30	-	-	-	-	
	Other areas				-	-	-	-	-	-	-	-	-	0.20	0.50	0.50	0.60	0.60	
	Total (O/P)				0.67	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.60	0.60	
PT Bukit Bara Utama	No Information				0.08	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
PT Karbindo Abesyapradhi	No information				0.36	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
Other Mines					0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	
KP Mines	U/G				1.00	1.05	1.05	1.30	1.30	1.30	1.30	1.30	1.40	1.40	1.40	1.40	1.50	1.50	
	O/P				3.22	2.90	2.90	3.00	3.00	3.00	3.00	3.00	3.20	3.20	3.20	3.20	3.20	3.00	
	Total				4.22	3.95	3.95	4.30	4.30	4.30	4.30	4.30	4.60	4.60	4.60	4.60	4.70	4.50	
KUD Usaha Karya Cempaka	O/P	6,700	0.86	0.56	0.04	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
KUD Bersama	O/P				0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	
KUD Maduratna	O/P (70%)	6,700	?	<1.00	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	
KUD Bina Bersama	U/G?				0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
KUD Makmur	O/P?				0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
KUD Karya Mumi	O/P?				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
U/G					0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	U
O/P					0.19	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
Total					0.23	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	
Current Oper.U/G					1.10	1.15	1.45	1.92	1.91	2.01	2.50	3.15	3.88	3.99	4.01	4.02	3.75	3.55	
" O/P					40.88	47.71	70.55	92.94	100.75	104.75	105.95	105.15	102.25	100.55	97.25	98.25	98.95	99.05	
" Total					41.98	48.86	72.00	94.86	102.66	106.76	108.45	108.30	106.13	104.54	101.26	102.27	102.70	102.60	
CCOW 2-Gen.U/G					-	-	-	0.20	0.70	1.00	1.40	1.70	2.00	2.30	2.60	3.00	3.30	3.60	
" O/P					-	-	-	1.80	2.80	4.00	5.40	6.80	8.00	9.20	10.60	12.00	13.20	14.40	
" Total					-	-	-	2.00	3.50	5.00	6.80	8.50	10.00	11.50	13.20	15.00	16.50	18.00	
CCOW 3-Gen U/G					-	-	-	-	1.00	2.40	3.80	5.20	6.60	8.00	9.40	10.80	12.20	13.65	
" O/P					-	-	-	-	4.00	9.60	15.20	20.80	26.40	32.00	37.60	43.20	48.80	54.60	
" Total					-	-	-	-	5.00	12.00	19.00	26.00	33.00	40.00	47.00	54.00	61.00	68.25	
Grand Total U/G					1.10	1.15	1.45	2.12	3.61	5.41	7.70	10.05	12.48	14.29	16.01	17.82	19.25	20.80	
Grand Total O/P					40.88	47.71	70.55	94.74	107.55	118.35	126.55	132.75	136.65	141.75	145.45	153.45	160.95	168.05	
Grand Total Total					41.98	48.86	72.00	96.86	111.16	123.76	134.25	142.80	149.13	156.04	161.46	171.27	180.20	188.85	

1) Analysis of Coal Production Projections by Contract System

The annual coal production projections by contract system are shown in Figure 3-4. In the figure, the coal production of the 1st generation CCOW coal mines will reach to nearly its peak in 2000, and those of the 2nd and 3rd generation CCOW coal mines will start to increase after the year 2000. Therefore, the securing of future coal production is practically depending on the result of coal mine development by 2nd and 3rd generation CCOW contractors.

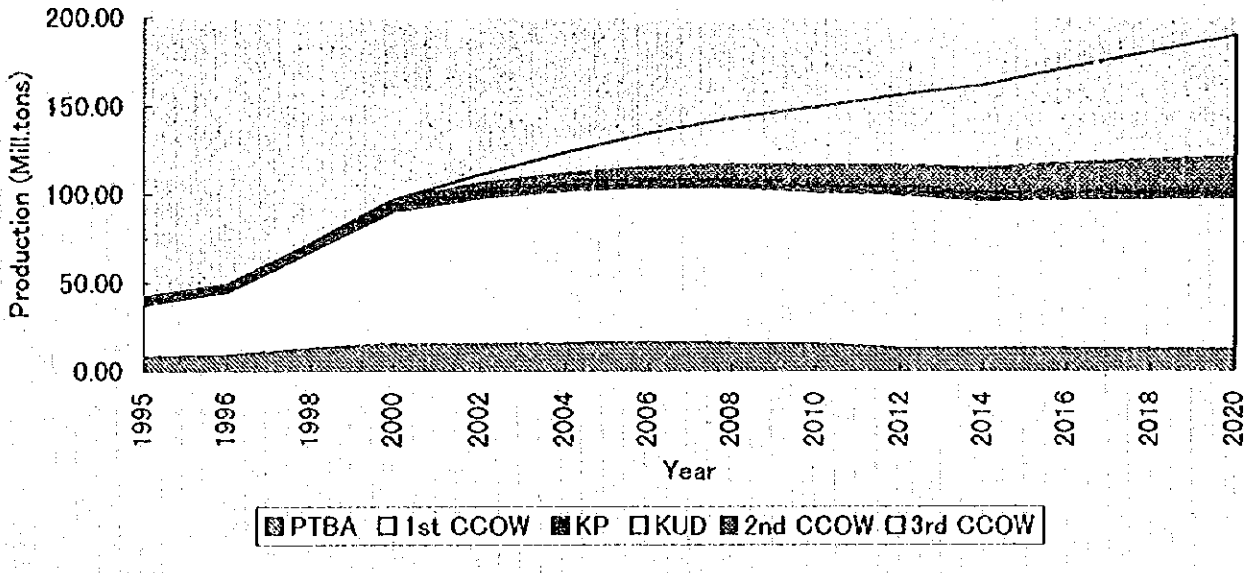


Figure 3-4 Coal Production Projections by Contract System

2) Analysis of Coal Production Projections by Region

The main active coalfields in the country are distributing in Sumatra and Kalimantan islands. Further, the Kalimantan island is classified into East Kalimantan, South Kalimantan and the others. In 1995, the coal production from Sumatra (mainly from 2 mines of PTBA), South Kalimantan (mainly from PT Adaro Indonesia and PT Arutmin Indonesia) and East Kalimantan (mainly from PT Kaltim Prima Coal) was reached to 11 million tons, 11 million tons and 20 million tons, respectively.

The progress of coal production projections by region is shown in Figure 3-5, in which a marked increase in coal production from the Kalimantan island is recognized, and the production from the Kalimantan island is estimated to 70% of the whole domestic production.

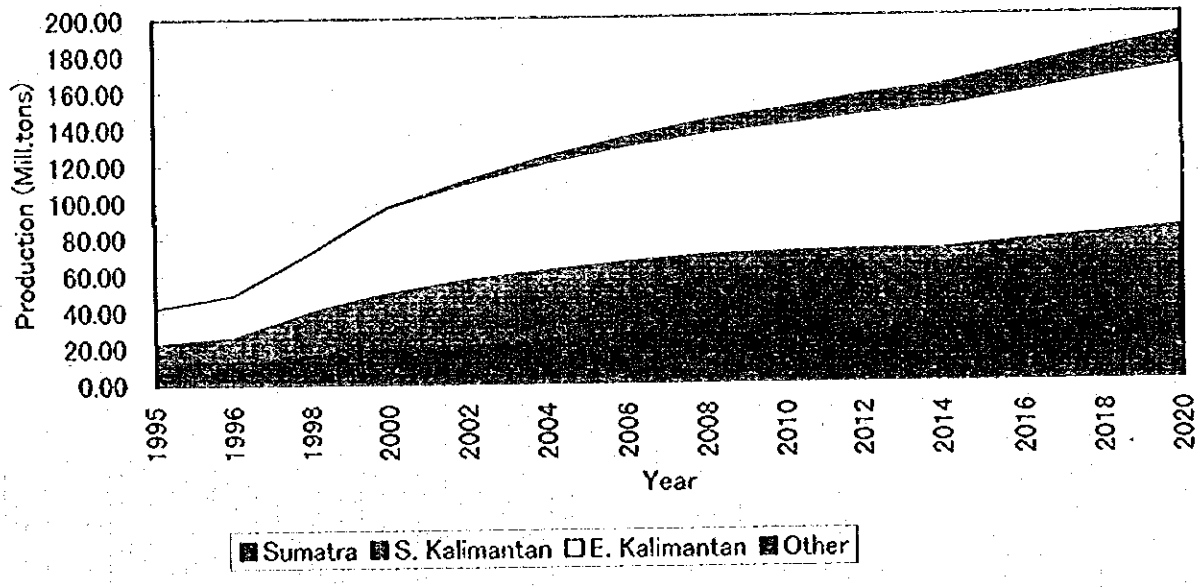


Figure 3-5 Coal Production Projections by Region

3) Analysis of Coal Production Projection by Mining Method

At present, 97% of the total coal production are coming from the open pit coal mines, and this trend may continue to 2020 without any marked changes. And the various reasons, such as

a) increment in strip ratio of the present open pit mines
b) stop of strip mining due to run out of minable coal reserves in the contract area
c) strict control of surface reclamation after open pit mining, etc.,

will allow to increase the proportion of underground coal production from about 3% at present to about 11% by 2020 gradually.

The coal production projections by mining method until 2020 are shown in Figure 3-6.

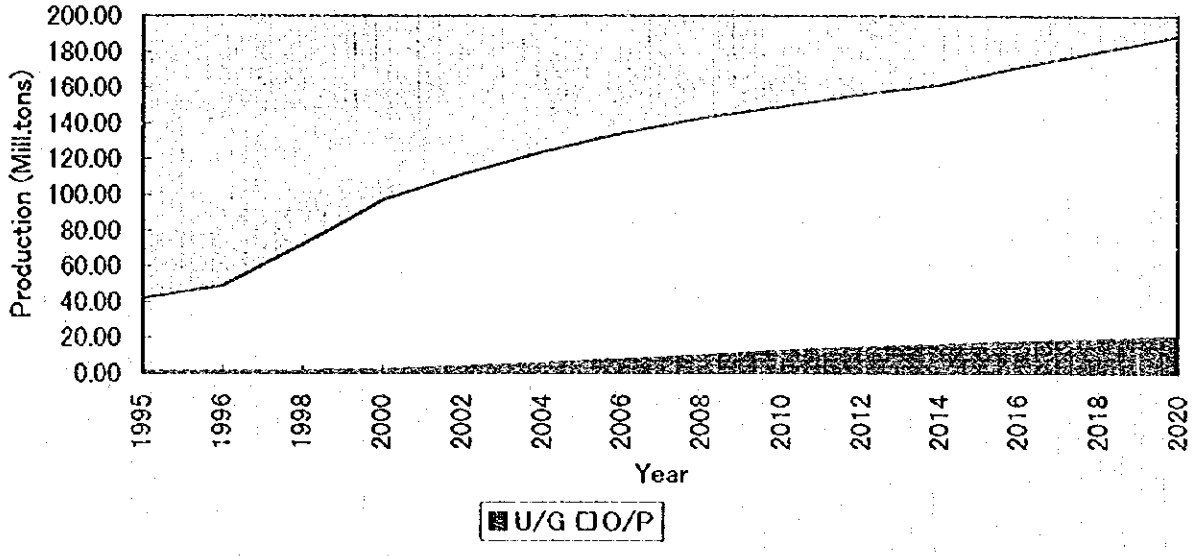


Figure 3-6 Coal Production Projections by Mining Method

4) Three Scenarios

In order to minimize the risks on long term coal production projections by 2020, the three scenarios, such as the High Scenario, the Base Scenario and the Low Scenario, are considered based on the Base Scenario which is made from the data in Table 3-4. The High Scenario is set at 20% up of the Base Scenario, and the Low Scenario is set at 10% down of the Base Scenario.

Also The annual coal production projections of 3 scenarios in every 2 year by 2020 are shown in Table 3-5.

Table 3-5 Coal Production Projections for 3 Scenarios in every 2 Year by 2020

(百万トン)

		PTBA			CCOW (1st Geneneration)			KP & KUD Mines			CCOW (2nd Generation)			CCOW (After 3rd Generation)			Grand Total		
Year	Scen.	U/G	O/P	Total	U/G	O/P	Total	U/G	O/P	Total	U/G	O/P	Total	U/G	O/P	Total	U/G	O/P	Total
1996	High	0.06	10.56	10.62	-	42.91	42.91	1.32	3.78	5.10	-	-	-	-	-	-	1.38	57.25	58.62
	Base	0.05	8.80	8.85	-	35.76	35.76	1.10	3.15	4.25	-	-	-	-	-	-	1.15	47.71	48.86
	Low	0.05	7.92	7.97	-	32.18	32.18	0.99	2.84	3.83	-	-	-	-	-	-	1.02	42.94	43.97
1998	High	0.06	15.12	15.18	0.36	65.76	66.12	1.32	3.78	5.10	-	-	-	-	-	-	1.74	84.66	86.40
	Base	0.05	12.60	12.65	0.30	54.80	55.10	1.10	3.15	4.25	-	-	-	-	-	-	1.45	70.55	72.00
	Low	0.05	11.34	11.39	0.27	49.32	49.59	0.99	2.84	3.83	-	-	-	-	-	-	1.31	63.50	64.80
2000	High	0.08	18.36	18.44	0.60	89.27	89.87	1.62	2.90	5.52	0.24	2.16	2.40	-	-	-	2.54	113.69	116.23
	Base	0.07	15.30	15.37	0.50	74.39	74.89	1.35	3.25	4.60	0.20	1.80	2.00	-	-	-	2.12	94.74	96.86
	Low	0.06	13.77	13.83	0.45	66.95	67.40	1.22	2.92	4.14	0.18	1.62	1.80	-	-	-	1.91	85.27	87.17
2002	High	0.07	16.20	16.27	0.60	99.00	99.60	1.62	2.90	5.52	0.84	3.36	4.20	1.20	4.80	6.00	4.33	129.06	133.39
	Base	0.06	15.00	15.06	0.50	82.50	83.00	1.35	3.25	4.60	0.70	2.80	3.50	1.00	4.00	5.00	3.61	107.55	111.16
	Low	0.05	13.50	14.36	0.45	74.25	74.70	1.22	2.92	4.14	0.63	2.52	3.15	0.90	3.60	4.50	3.25	96.79	100.04
2004	High	0.19	18.96	19.15	0.60	102.84	103.44	1.62	2.90	5.52	1.20	4.80	6.00	2.88	11.52	14.40	6.49	142.02	148.51
	Base	0.16	15.80	15.96	0.50	85.70	86.20	1.35	3.25	4.60	1.00	4.00	5.00	2.40	9.60	12.00	5.41	118.35	123.76
	Low	0.14	14.22	14.36	0.45	77.13	77.58	1.22	2.92	4.14	0.90	3.60	4.50	2.16	8.64	10.80	4.87	106.52	111.38
2006	High	0.78	19.08	19.86	0.60	104.16	104.76	1.62	2.90	5.52	1.68	6.48	8.16	4.56	18.24	22.80	9.24	151.86	161.10
	Base	0.65	15.90	16.55	0.50	86.80	87.30	1.35	3.25	4.60	1.40	5.40	6.80	3.80	15.20	19.00	7.70	126.55	134.25
	Low	0.59	14.31	14.90	0.45	78.12	78.57	1.22	2.92	4.14	1.26	4.86	6.12	3.42	13.68	17.10	6.93	113.89	120.82
2008	High	1.56	17.50	19.10	0.60	104.76	105.36	1.62	2.90	5.52	2.04	8.16	10.20	6.24	24.96	31.20	12.06	159.18	171.36
	Base	1.30	14.60	15.90	0.50	87.30	87.80	1.35	3.25	4.60	1.70	6.80	8.50	5.20	20.80	26.00	10.05	132.65	142.80
	Low	1.17	13.14	14.31	0.45	78.57	79.02	1.22	2.92	4.14	1.53	6.12	7.65	4.68	18.72	23.40	9.05	119.38	128.52
2010	High	2.32	16.32	18.64	0.60	102.24	102.84	1.74	4.14	5.88	2.40	9.60	12.00	7.92	31.68	39.60	14.98	163.98	178.96
	Base	1.93	13.60	15.53	0.50	85.20	85.70	1.45	3.45	4.90	2.00	8.00	10.00	6.60	26.40	33.00	12.48	136.65	149.13
	Low	1.74	12.24	12.98	0.45	76.68	77.13	1.31	3.10	4.41	1.80	7.20	9.00	5.94	23.76	29.70	11.23	122.98	134.22
2012	High	2.45	12.72	15.17	0.60	103.80	104.40	1.74	4.14	5.88	2.76	11.04	13.80	9.60	38.40	48.00	17.15	170.10	187.25
	Base	2.04	10.60	12.64	0.50	86.50	87.00	1.45	3.45	4.90	2.30	9.20	11.50	8.00	32.00	40.00	14.29	141.75	156.04
	Low	1.84	9.54	11.38	0.45	77.85	78.30	1.31	3.10	4.41	2.07	8.28	10.35	7.20	28.80	36.00	12.86	127.57	140.44
2014	High	2.47	12.72	15.19	0.60	99.84	100.44	1.74	4.14	5.88	3.12	12.72	15.84	11.28	45.12	56.40	19.21	174.54	193.75
	Base	2.06	10.60	12.66	0.50	83.20	83.70	1.45	3.45	4.90	2.60	10.60	13.20	9.40	37.60	47.00	16.01	145.45	161.46
	LOw	1.85	9.54	11.29	0.45	74.88	75.33	1.31	3.10	4.41	2.34	9.54	11.88	8.46	33.84	42.30	14.41	130.91	145.31
2016	High	2.48	12.72	15.20	0.60	100.80	101.40	1.74	4.14	5.88	3.60	14.40	18.00	12.96	51.84	64.80	21.38	184.14	205.52
	Base	2.07	10.60	12.67	0.50	84.00	84.50	1.45	3.45	4.90	3.00	12.00	15.00	10.80	43.20	54.00	17.82	153.45	171.27
	LOw	1.86	9.54	11.40	0.45	75.60	76.05	1.30	3.11	4.41	2.70	10.80	13.50	9.72	38.88	48.60	16.04	138.10	154.14
2018	High	2.04	12.72	14.76	0.60	101.88	102.48	1.86	4.14	6.00	3.96	15.84	19.80	14.64	58.56	73.20	23.10	193.14	216.24
	Base	1.70	10.60	12.30	0.50	84.90	85.40	1.55	3.45	5.00	3.30	13.20	16.50	12.20	48.80	61.00	19.25	160.95	180.20
	Low	1.53	9.54	11.07	0.45	76.41	76.86	1.39	3.11	4.50	2.97	11.88	14.85	10.98	43.92	54.90	17.33	144.85	162.18
2020	High	1.80	12.72	14.52	0.60	102.24	102.84	1.86	3.90	5.76	4.32	17.28	21.60	16.38	65.52	81.90	24.96	201.66	226.62
	Base	1.50	10.60	12.10	0.50	85.20	85.70	1.55	3.25	4.80	3.60	14.40	18.00	13.65	54.60	68.25	20.80	168.05	188.85
	Low	1.35	9.54	10.88	0.45	76.68	77.13	1.39	2.93	4.32	3.24	12.96	16.20	12.29	49.14	61.43	18.72	151.25	169.97

Remarks: High & Low scenarios are 20% up and 10% down of Base scenario

4. Study on Human Resources Development

4-1 Present Education and Training of Manpower for Coal Industry

The education and training of knowledge and technology on coal mining and its related operations in Indonesia have been conducted in various schools, government organizations and coal mines. As an educational facilities, 15 schools, consisting of one technical college and 14 universities, and one government owned technical school, LPPT, have courses related to the coal mining and its related technology.

As a training center, the Manpower Development Center for Mines (MDCM) in Bandung belonging to the DGM and the KPC's Human Resources Development Centre locating in the mine site, north of Sangatta Baru town, are known.

4-1-1 Education on Coal Mining and its Related Technology in the School

A total of fifteen schools is teaching technology on coal mining, geology and other courses related to coal. Among the total graduates of 4,605, those from mining, geology and the other courses are counted at 2,036, 1,869 and 700, respectively.

1) Institute of Technology Bandung

Among these universities, the most famous and authorized university is the "Institute of Technology Bandung" (ITB). In the ITB, the Department of Mining Engineering is established in the Faculty of Mineral Technology since 1950 and has three major options, such as Mining Exploration, Mining Engineering and Metallurgy consisting of Metallurgical Engineering and Extractive Metallurgy.

A total of 36 top teaching members is taking care of 380 students in total. Every year about 60 students enter the Department. In addition to these, there are 115 students in Master courses (S2) and 5 students in Doctor courses (S3) at present.

Table 4-1 Schools Conducting Coal Mining and its Related Courses

Name	Grade	Courses	Location	Students
STM	College	Geology	Jogyakarta	150
"		Mining	"	150
ITB	University	"	Bandung	382
"		Geology	"	301(4)
UGM	University	"	Jogyakarta	401(4)
UNSRI	"	Mining	Palembang	280(1)
UNHAS	"	Geology	Ujung Pandang	185
UPN	"	"	Jogyakarta	200(12)
"		Mining	"	200
UI	"	Metallurgical	Jakarta	200
ITS	"	Industry	Surabaya	250
USAKTI	"	Geology	Jakarta	200
"		Mining	"	100
UNPAD	"	Geology	Bandung	232(4)
STTB	"	Mining	Ombilin	40
ITM	"	Geology	Medan	200
"	"	Mining	"	300
UNISBA	"	"	Bandung	584
UNJANI	"	Metallurgical	Bandung	100(2)
UNPAS	"	Industry	"	150
Total				4,605(30)

Remarks: a) Abbreviation of Schools

- STM - Sekolah Teknik Menengah
- ITB - Institut Teknologi Bandung
- UGM - Universitas Gajah Mada
- UNSRI - Universitas Sriwidjaja
- UNHAS - Universitas Hasannudin
- UPN - Universitas Pembangunan National
- UI - Universitas Indonesia
- ITS - Inst. Technologi Sepuluh Nopember Sulabaya
- USAKTI - Universitas Trisakti
- UNPAD - Universitas Pajajaran
- STTB - Sekolah Tinggi Teknologi Batubara
- UNISBA - Universitas Islam Bandung
- UNJANI - Universitas Jenderal Achmad Yani
- UNPAS - Universitas Pasundan

b) Constitution of graduates: Mining - 2,036; Geology - 1,869; Metallurgical - 300; Industry - 400

c) Numbers in parenthesis beside number of students are those of attendants to the "Training on Coal Exploration and Mining Development" held at MDCM in Bandung in 1995.

2) Lembaga Pendidkan Dan Pelatihan Tambang (LPPT)

This mining school was established in 1916 with the exclusive use of the Ombilin mine which was opened in 1919 by the Dutch government. The purpose of the school was to supplement the shortage of Dutch supervisors caused by the World War I.

In 1992, the name of the school was changed into "Lembaga Pendidikan dan Pelatihan Tambang" (LPPT) and the total programs were shortened to two years without changing the contents of the training. The school was operated by PTBA belonging to the Ministry of Mines and Energy.

Training programs are divided into three subjects, such as a) Mining, b) Mining mechanical and c) Mining electrical. A total of four semesters has to be cleared within two years. The training consists 30% of theoretical and 70% of practical studies. Field practice is usually carried out from Monday through Thursday every week.

3) Ombilin Mines Training College

In June, 1996, the DGM is under negotiation to enter into an agreement with Australian "John Batman Institute of TAFE" in order to establish a national mines training center.

4-1-2 Training on Coal Mining and its Related Technologies

As a government training center for mining and its related technology development, the Manpower Development Centre for Mines (MDCM) was established on December 31, 1992 under the Decree of the Minister of Mines and Energy No. 1748 based on the Presidential Decree No. 67 issued on December 21, 1992. The center was branched from the Mineral Technology Development Centre (MTDC) which was established on November 11, 1976 by the Official Decree of the Minister of Mines and Energy No. 548, and training manpower for all mining industry. The Mineral Technology Research and Department Centre (MTRDC), which was also branched from the MTDC at the same time with the MDCM and

operating as a research center of the government. Both centers located side by side in Bandung city and are functioning for both manpower and technology development in mining and its related industries by utilizing facilities and exchanging experts with each other.

As a training center of the private sector, the training center of the PT Kaltim Prima Coal is a facility to be noted. The other mines are conducting training in different ways with or without their own special training facilities.

1) Manpower Development Centre for Mines (MDCM)

The MDCM is only one government's training center for all mining and its related industries.

The center consists of three divisions, such as geological engineering, mining engineering, and administration and management divisions.
The main duties are to conduct manpower development of the above three fields and to provide accreditation and certification for the trainees. The mission is to promote human resources research and development, and also to execute human resources training and education in order to secure qualified manpower.

2) Mineral Technology Research and Development Centre (MTRDC)

The MTRDC was branched from the MTDC on November 31, 1992, the same as the MDCM. The MTRDC locates beside the MDCM in Bandung city, and is an executive unit of the DGM in the field of research and development of mining technology, mineral processing, coal utilization, mining engineering and design, techno-economics of mineral and mineral information and providing guidance on mining technology and coal utilization.

The center consists of five major divisions and an administration division. Among them, the core of the center is the Second Division, i.e. Research and Development of Mineral Processing Technology Division.

The division handling coal is the Research and Development of Coal Utilization

Technology Division and consists of four sections, such as a) Physical and Chemical Test of Coal Section, b) Coal Processing Technology Test Section, c) Coal Conversion Technology Test Section, and d) Coal Combustion Technology Test Section. Actual works carrying out in divisions are mainly regarding coal utilization purposes, such as coal quality analyses, chemical analyses of ash, coal briquetting, coal water mix, coal oil mix, coal gasification, and coal liquefaction, etc.

3) Training of PT Kaltim Prima Coal

The development of training programs was introduced in 1991 to train operators and young engineers of senior high school graduates for development of their skills in trucking, monitoring and recording systems, etc.

At first, a general training is conducted in the pit for two months. Next, the training for maintenance of machinery and equipment is carried out for three months.

4) Training of KP Mines

a) PT Kitadin Corporation

The training of the new employees consists of a) one day for entrance formalities and physical examination, b) 3 days for lecture, and 3 months on-the-job training. A promotion training from the worker to the staff is carried out time to time. As a training for safety, the re-training of new employees is conducted with analyses of injuries and ventilation, etc. including morning instructions every day. A total of seven times per month inspection for underground operation and one time for 3 months inspection for surface operation is conducted routinely.

At the visit to the mine site, a management training of 60 hours, consisting of 40 hours in management and 20 hours in correspondence/dealing for problems, was in progress with department heads and division chiefs. The company has a program to carry out training for a total of 300 hours in the year. At first, about 100 of staff from underground works, in which 25% are engineers from university

graduates and 75% are experienced staff from senior high school graduates, are scheduled to receive training. In addition, about 150 surface staff from the open pit mine, preparation plant and loading facilities, mechanical/electrical works, personnel division and others, etc. are waiting the training.

b) PT Fajar Bumi Sakti

The company has its own small-scale training center in the mine site, and provides training to every new employee before giving a new job. The training starts with an introduction to the safety (SOP) and proceeds to the standard operation procedure (FEJOB).

After one year, a refresh training course including that of regulation is carried out for 5 days (From 7 to 17 hours) with 50 trainees. For staff training, the training held by the government like MDCM is utilized usually. At present, the upgrade of skills with foremen of 14 and assistant foremen of 17 in underground, is desired together with that of surface electrical manpower, consisting of one superintendent, one supervisor and three foremen.

c) PT Bukit Sunur

As the operation is limited to the open pit mining, the training of new employees is carried out by way of on-the-job training. Operations and maintenance of machinery and equipment for mining are conducted by the suppliers at present. However, if the underground mining of the Suluang Barat area is actually required, urgent training of underground workers will be required. At present, recruitment of about 70 Chinese for training of about 200 new employees from the domestic source is programmed. In addition to that, it is desired to send about 20 trainees to the LPPT every year to receive the training of supervisory level.

4-2 Analysis of Manpower Requirement

4-2-1 Existing Coal Mines

Manpower of the existing coal mines is about 29,000 in total consisting of 23,000 from the open pit mines (80%) and 6,000 from the underground mines (20%).

Regarding the manpower forecast of the existing mines by 2020, the measures being adopted are

a) to collect information on manpower from each company through the Questionnaire and Hearing as much as possible, and

b) to compensate the lacking data in a most appropriate way after referring and analyzing existing data and in considering future projections.

The results obtained through these ways are summarized in Figure 4-1.

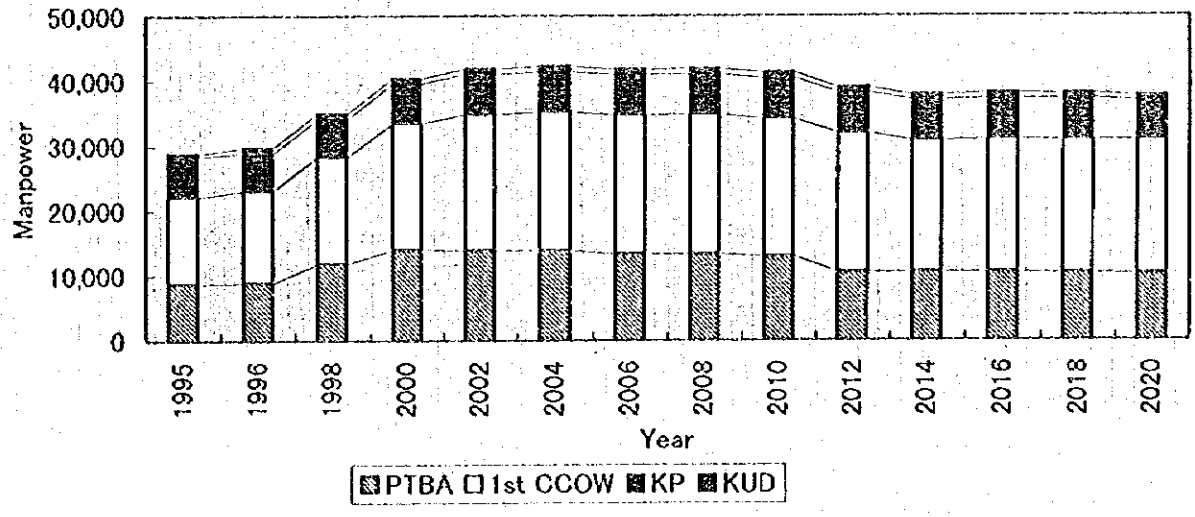


Figure 4-1 Manpower Forecasts of the Existing Coal Mines by 2020

As the result, the required manpower of the existing mines in 2020 is forecasted at about 38,000 which are 1.3 times of the present one while the production is estimated at 2.4 times of the present one. Therefore, the productivity will become about 2 times of the present's.

4-2-2 New Coal Mines

Forecasts of the manpower for new coal mines are made under the following measures:

a) Grouping of the existing coal mines by production scale and mining method,
b) Calculation of average productivity for each group at present and in 2020 referring the data of the existing coal mines,
c) Estimation of productivity for coal mines of 2nd and 3rd generation CCOW, and
d) Calculation of manpower by production and productivity under the following formula:

* Manpower (day) = Production (t/y) ÷ Productivity (t/man·day)
÷ Working days (day)

Required manpower of the new coal mines in 2020 is estimated at 75,000 in total as shown in Figure 4-2, of which those of the 2nd and 3rd generation CCOW are assumed at 16,000 and 59,000, respectively.

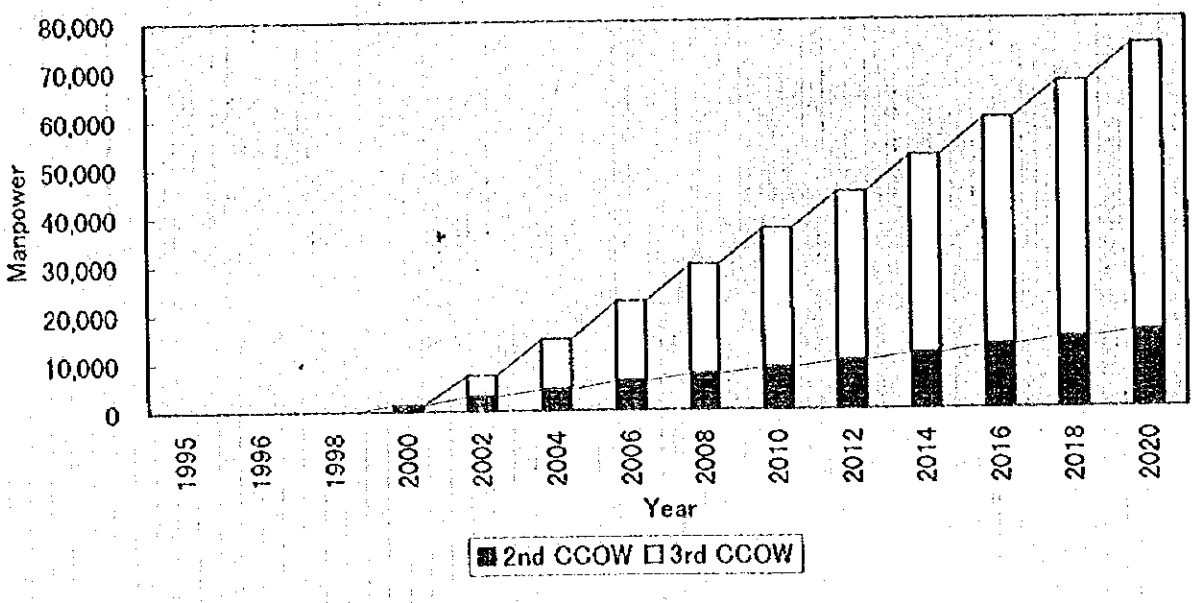


Figure 4-2 Required Manpower Projection of 2nd & 3rd Generation CCOW

4-2-3 Analysis and Evaluation on Necessary Manpower Projections

1) Analysis of Manpower Projection by Contract Type

According to the manpower projections by contract type, those of the existing coal mines belonging to PTBA, 1st generation CCOW and KP mines have completed their increment by 2000 and maintain stable after 2000. After 2000, the necessary manpower of the coal mines belonging to the 2nd and 3rd generation CCOW contractors starts to increase quite rapidly.

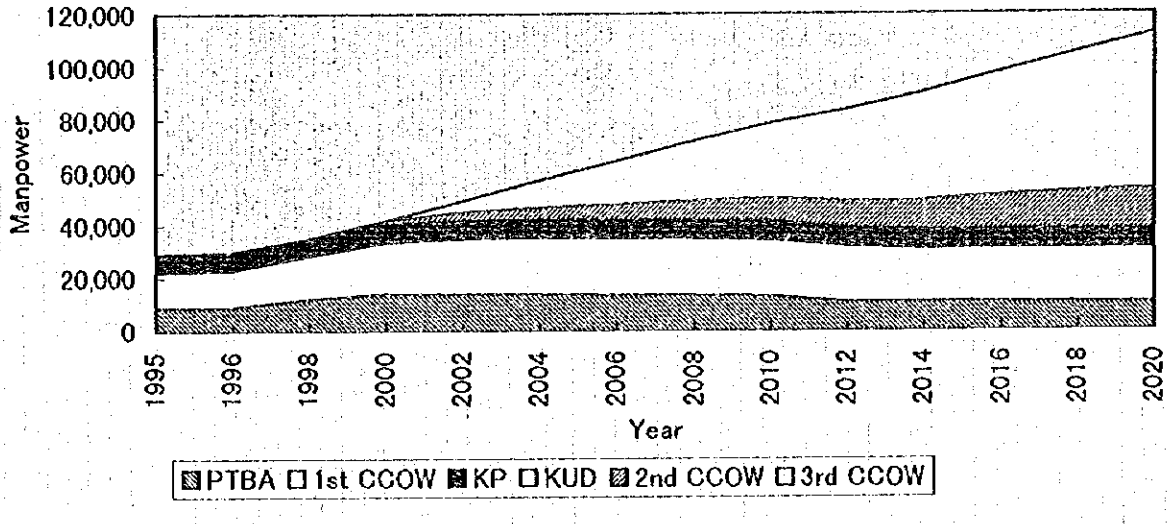


Figure 4-3 Manpower Projections by Contract Type

2) Analysis of Manpower Projection by Mining Method

The present manpower of underground coal mines is about 6,000 which is about 20% of the total manpower. It might be increased into about 50,000, 8 times of the present one and 45% of the total, by 2020.

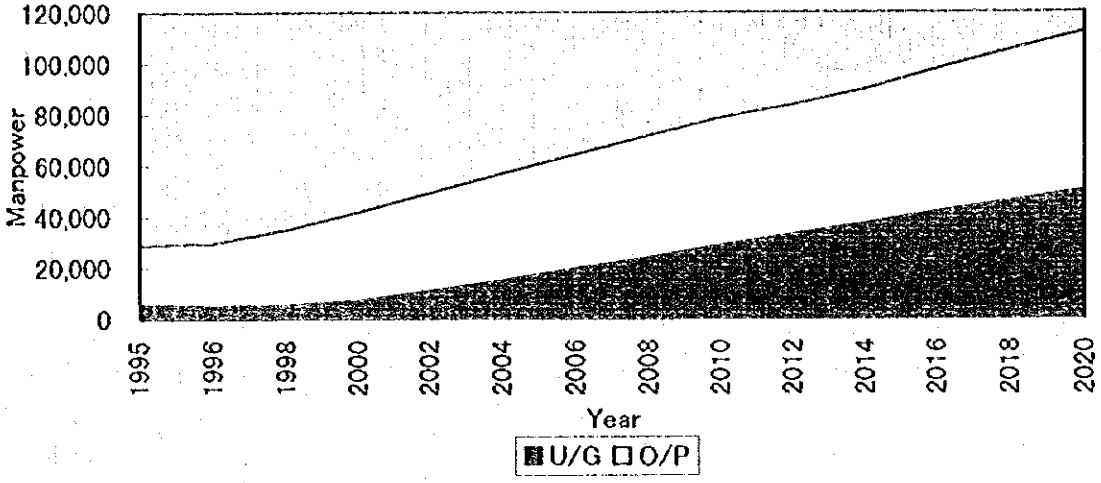


Figure 4-4 Manpower Projections by Mining Method

3) Three Scenarios on Manpower Projection

As same as the case of the coal production projection, three scenarios, i.e. High, Base and Low scenario, are made and shown in Table 4-2. Manpower of the High and Low scenarios in 2020 are estimated at about 130,000 and 100,000, respectively.

Table 4-2 Manpower Projection for Three Scenarios of Every 2 Years Interval by 2020/21

		PTBA			CCOW(1st Generation)			KP & KUD Mines			CCOW(2nd Generation			CCOW(After 3rd Generation)			Grand Total		
Year	Scenario	U/G	O/P	Total	U/G	O/P	Total	U/G	O/P	Total	U/G	O/P	Total	U/G	O/P	Total	U/G	O/P	Total
1996	High	2,040	8,640	10,680	-	16,999	16,999	3,984	3,976	7,960	-	-	-	-	-	-	6,024	29,615	35,639
	Base	1,700	7,200	8,900	-	14,166	14,166	3,320	3,313	6,633	-	-	-	-	-	-	5,020	24,679	29,699
	Low	1,530	6,480	8,010	-	12,749	12,749	2,988	2,988	5,970	-	-	-	-	-	-	4,518	22,211	26,729
1998	High	1,920	12,360	14,280	360	19,334	19,694	4,025	3,975	8,000	-	-	-	-	-	-	6,545	35,389	41,934
	Base	1,600	10,300	11,900	300	16,412	16,712	3,354	3,313	6,667	-	-	-	-	-	-	5,454	29,491	34,945
	Low	1,440	9,270	10,710	270	14,771	15,041	3,018	2,982	6,000	-	-	-	-	-	-	4,909	26,542	31,451
2000	High	1,860	15,000	16,860	996	22,279	23,275	5,027	3,341	8,368	604	979	1,583	-	-	-	8,669	41,417	50,086
	Base	1,550	12,500	14,050	830	18,566	19,396	4,189	2,784	6,973	503	816	1,319	-	-	-	7,224	34,514	41,738
	Low	1,395	11,250	12,645	747	16,709	17,456	3,770	2,506	6,276	453	734	1,187	-	-	-	6,502	6,502	13,003
2002	High	1,740	15,000	16,740	996	24,142	25,138	5,027	3,341	8,368	2,114	1,522	3,636	3,019	2,174	5,194	13,078	45,996	59,074
	Base	1,450	12,500	13,950	830	20,118	20,948	4,189	2,784	6,973	1,762	1,268	3,030	2,516	1,812	4,328	10,898	38,330	49,228
	Low	1,305	11,250	12,555	747	18,106	18,853	3,770	2,506	6,276	1,586	1,141	2,727	2,264	1,631	3,895	9,808	34,497	44,305
2004	High	1,680	15,000	16,680	996	24,646	25,642	5,027	3,341	8,368	3,019	2,174	5,194	7,247	5,218	12,464	18,151	50,196	68,347
	Base	1,400	12,500	13,900	830	20,538	21,368	4,189	2,784	6,973	2,516	1,812	4,328	6,039	4,348	10,387	15,126	41,830	56,956
	Low	1,260	11,250	12,510	747	18,484	19,231	3,770	2,506	6,276	2,264	1,631	3,895	5,435	3,913	9,348	13,613	37,647	51,260
2006	High	1,680	14,340	16,020	996	24,754	25,750	5,030	3,341	8,371	4,226	2,935	7,162	11,473	8,262	19,735	23,588	53,449	77,038
	Base	1,400	11,950	13,350	830	20,628	21,458	4,192	2,784	6,976	3,522	2,446	5,968	9,561	6,885	16,446	19,657	44,541	64,198
	Low	1,260	10,755	12,015	747	18,565	19,312	3,773	2,506	6,279	3,170	2,201	5,371	8,605	6,197	14,801	17,691	40,087	57,778
2008	High	1,680	14,328	16,008	996	24,868	25,864	5,030	3,341	8,371	5,132	3,696	8,828	15,701	11,305	27,006	28,722	57,355	86,077
	Base	1,400	11,940	13,340	830	20,723	21,553	4,192	2,784	6,976	4,277	3,080	7,357	13,084	9,421	22,505	23,935	47,796	71,731
	Low	1,260	10,746	12,006	747	18,651	19,398	3,773	2,506	6,279	3,849	2,772	6,621	11,776	8,479	20,255	21,542	43,016	64,558
2010	High	2,220	13,356	15,576	996	24,520	25,516	5,103	3,377	8,480	6,038	4,349	10,387	19,927	14,350	34,277	34,505	59,731	94,236
	Base	1,850	11,130	12,980	830	20,433	21,263	4,253	2,814	7,067	5,032	3,624	8,656	16,606	11,958	28,564	28,754	49,776	78,530
	Low	1,665	10,017	11,682	747	18,390	19,137	3,828	2,532	6,260	4,529	3,262	7,790	14,945	10,762	25,708	25,879	44,798	70,677
2012	High	2,220	10,404	12,624	996	22,480	23,476	5,103	3,377	8,480	6,944	5,000	11,945	24,155	17,393	41,548	39,637	60,655	100,292
	Base	1,850	8,670	10,520	830	18,733	19,563	4,253	2,814	7,067	5,787	4,167	9,954	20,129	14,494	34,623	33,031	50,546	83,577
	Low	1,665	7,803	9,468	747	16,860	17,607	3,828	2,532	6,260	5,208	3,750	8,959	18,116	13,045	31,161	29,728	45,491	75,219
2014	High	2,220	10,440	12,660	996	23,548	24,304	5,103	3,377	8,480	7,850	5,761	13,612	28,381	20,437	48,818	44,770	63,104	107,874
	Base	1,850	8,700	10,550	830	19,423	20,253	4,253	2,814	7,067	6,542	4,801	11,343	23,651	17,031	40,682	37,308	52,587	89,895
	Low	1,665	7,800	9,495	747	17,661	18,228	3,828	2,532	6,260	5,888	4,321	10,209	21,286	15,328	36,614	33,577	47,328	80,906
2016	High	2,220	10,500	12,720	996	23,548	24,544	5,103	3,377	8,480	9,058	6,523	15,581	32,609	23,480	56,089	50,204	67,210	117,414
	Base	1,850	8,750	10,600	830	19,623	20,453	4,253	2,814	7,067	7,548	5,436	12,984	27,174	19,567	46,741	41,837	56,008	97,845
	Low	1,665	7,875	9,540	747	17,661	18,408	3,828	2,532	6,260	6,793	4,892	11,686	24,457	17,610	42,067	37,653	50,407	88,061
2018	High	1,848	10,560	12,408	996	23,668	24,634	5,181	3,419	8,600	9,964	7,175	17,138	36,835	26,525	63,360	55,080	71,090	126,170
	Base	1,540	8,800	10,340	830	19,723	20,553	4,318	2,849	7,167	8,303	5,979	14,282	30,696	22,104	52,800	45,900	59,242	105,142
	Low	1,386	7,920	9,306	747	17,751	18,498	3,886	2,564	6,450	7,473	5,381	12,854	27,626	19,894	47,520	41,310	53,318	94,628
2020	High	1,680	10,620	12,300	996	23,848	24,844	5,181	2,903	8,084	10,870	7,826	18,696	41,214	29,677	70,891	60,196	74,620	134,815
	Base	1,400	8,850	10,250	830	19,873	20,703	4,318	2,419	6,737	9,058	6,522	15,580	34,345	24,731	59,076	50,163	62,183	112,346
	Low	1,260	7,965	9,225	747	17,886	18,633	3,886	2,177	6,063	8,152	5,870	14,022	30,911	22,258	53,168	45,147	55,965	101,111

Remarks: High and Low Scenarios are set at 20% up and 10% down of the Base Scenario

4-3 Manpower Projections by Kind of Occupation

The kinds of occupation are classified into 6 technical and one administration based on the classification by the DOC. The manpower distribution by kind of occupation is summarized in Table 4-3 according the information collected through the Questionnaire.

Table 4-3 Proportion Constitution of Manpower by Kind of Occupation

(%)

Kind of Occupation	DOC	Questionnaire	
	1995/96	Average (1995)	Average (2020)
Management	6.04	0.68	0.72
Professional	6.54	4.10	4.34
Technician/Supervisor	16.42	4.25	4.53
Operator Skilled	31.77	9.16	10.24
Operator Middle Skilled	11.84	8.31	8.88
Operator Unskilled	0.83	14.00	16.62
Administration	26.56	4.70	4.97
Sub-total	100.00	45.20	50.28
Sub-contractor	0.00	54.80	49.72
Total	100.00	100.00	100.00

The proportion of each kind is quite different between that of the DOC and each average obtained from the Questionnaire. So average of the figures in the Table 4-3 is used in the report.

The manpower constituents and its annual increment by work with 3 scenarios in every 2 years during 1996 and 2020 are shown in Table 4-4.

The coal production in 2020 is estimated at about 4.5 times of the present one. The manpower in 2020 is, however, projected about 4 times, 112,346, of the present on a Base case, and the numbers above the supervisor are estimated at 10,803 (Supervisor: 5,106), which are about 3.4 times of the present numbers.

Table 4-4 Manpower Constituents and Its Increment (1996 - 2020)

		1996		1998		2000		2002		2004		2006		2008		2010		2012		2014		2016		2018		2020
PTBA	Direct	5,536		7,254		8,490		8,410		8,370		7,971		7,885		7,335		5,869		5,836		5,795		5,744		5,693
	Sub-Con.	3,364		4,646		5,560		5,540		5,530		5,379		5,455		5,645		4,651		4,714		4,805		4,596		4,557
	Sub-Total	8,900		11,900		14,050		13,950		13,900		13,350		13,340		12,980		10,520		10,550		10,600		10,340		10,250
CCOW	Direct	8,037		7,293		8,912		10,142		10,267		10,287		10,307		10,036		10,071		9,937		9,067		9,092		9,117
1st	Sub-Con.	8,129		9,119		10,484		10,806		11,101		11,171		11,246		11,227		11,342		11,316		11,386		11,461		11,586
	Sub-Total	14,166		16,412		19,396		20,948		21,368		21,458		21,553		21,263		21,413		20,253		20,453		20,553		20,703
KP	Direct	3,219		3,219		3,382		3,382		3,382		3,382		3,382		3,412		3,412		3,412		3,412		3,442		3,342
	Sub-Con.	2,614		2,614		2,791		2,791		2,791		2,794		2,794		2,855		2,855		2,855		2,855		2,925		2,595
	Sub-Total	5,833		5,833		6,173		6,173		6,173		6,176		6,176		6,267		6,267		6,267		6,267		6,367		5,937
KUD	Direct	800		800		800		800		800		800		800		800		800		800		800		800		800
	Sub-Con.																									
	Sub-Total																									
CCOW	Direct	0		0		704		1,645		2,338		3,205		3,932		4,522		5,143		5,687		6,497		7,159		7,834
2nd	Sub-Con.	0		0		615		1,385		1,990		2,763		3,426		4,133		4,811		5,657		6,487		7,123		7,746
	Sub-Total	0		0		1,319		3,030		4,328		5,968		7,357		8,656		9,954		11,343		12,984		14,282		15,580
CCOW	Direct	0		0		0		2,350		5,611		8,832		12,026		14,924		17,890		20,395		23,388		26,467		29,706
3rd	Sub-Con.	0		0		0		1,978		4,776		7,614		10,479		13,640		16,733		20,287		23,353		26,334		29,370
	Sub-Total	0		0		0		4,328		10,387		16,446		22,505		28,564		34,623		40,682		46,741		52,800		59,076
Total	Direct	15592		18566		22,288		26,729		30,768		34,477		38,332		41,029		43,186		45,066		48,959		52,703		56,492
	Sub-Con.	14107		16379		19,450		22,500		26,188		29,721		33,400		37,501		40,391		44,829		48,887		52,439		55,854
	Sub-Total	29699		34945		41,738		49,229		56,956		64,198		71,731		78,530		83,577		89,895		97,845		105,142		112,346
	High	293		350		419		498		567		626		687		726		758		785		848		911		973
Manager	Base	244	24	291	29	349	33	415	29	472	25	522	25	573	16	605	13	632	11	654	26	707	26	759	26	811
	Low	220		262		314		373		425		470		516		544		568		589		636		683		729
	High	1,751		2,097		2,514		2,984		3,399		3,759		4,127		4,359		4,553		4,715		5,097		5,471		5,845
Professional	Base	1,459	144	1,748	173	2,095	196	2,487	173	2,832	150	3,133	153	3,439	97	3,633	81	3,794	68	3,929	159	4,247	156	4,559	156	4,871
	Low	1,313		1,573		1,885		2,208		2,549		2,819		3,095		3,270		3,414		3,536		3,823		4,103		4,384
	High	1,801		2,155		2,584		3,074		3,508		3,889		4,280		4,533		4,742		4,918		5,322		5,716		6,110
Supervisor	Base	1,501	147	1,796	179	2,153	204	2,561	181	2,923	159	3,241	163	3,567	105	3,778	87	3,951	74	4,098	168	4,435	164	4,763	164	5,092
	Low	1,251		1,616		1,938		2,305		2,631		2,917		3,210		3,400		3,556		3,689		3,991		4,287		4,583
	High	3,771		4,487		5,387		6,469		7,456		8,369		9,319		9,991		10,526		10,994		11,950		12,869		13,799
Skilled	Base	3,142	298	3,739	375	4,490	451	5,391	411	6,214	380	6,974	396	7,766	260	8,325	223	8,771	195	9,162	399	9,959	383	10,724	388	11,499
Operator	Low	2,828		3,365		4,041		4,852		5,592		6,277		6,989		7,493		7,894		8,245		8,963		9,651		10,349
	High	3,521		4,211		5,049		6,007		6,858		7,606		8,373		8,871		9,281		9,628		10,420		11,192		11,966
Middle Skilled	Base	2,934	288	3,509	349	4,207	399	5,006	354	5,715	312	6,338	320	6,978	208	7,393	171	7,734	145	8,023	330	8,683	322	9,327	322	9,972
Operator	Low	2,640		3,158		3,786		4,506		5,143		5,704		6,280		6,654		6,961		7,221		7,815		8,394		8,974
	High	5,572		6,582		7,920		9,030		11,247		12,823		14,490		15,764		16,752		17,641		19,277		20,829		22,404
Unskilled	Base	4,643	421	5,485	557	6,600	713	8,025	674	9,373	657	10,686	695	12,075	531	13,137	412	13,960	370	14,701	681	16,064	643	17,350	660	18,670
Operator	Low	4,179		4,937		5,940		7,223		8,435		9,617		10,667		11,823		12,564		13,231		14,458		15,615		16,803
	High	2,002		2,398		2,874		3,413		3,887		4,300		4,722		4,990		5,212		5,398		5,836		6,265		6,694
Administration	Base	1,669	165	1,998	198	2,395	225	2,844	198	3,240	172	3,584	178	3,935	112	4,158	92	4,340	78	4,499	182	4,864	179	5,221	178	5,578
	Low	1,502		1,798		2,155		2,560		2,916		3,225		3,542		3,742		3,909		4,049		4,377		4,699		5,020
	High	16,929		19,655		22,940		27,000		31,425		35,665		40,079		45,001		48,470		53,795		58,664		62,926		67,025
Subcontractor	Base	14,108	1,136	16,379	1,535	19,450	1,525	22,500	1,844	26,188	1,766	29,721	1,839	33,400	2,051	37,501	1,445	40,391	2,219	44,829	2,029	48,887	1,778	52,439	1,708	55,854
	Low	12,697		14,741		17,505		20,250		23,569		26,748		30,060		33,751		36,352		40,346		43,998		47,194		50,269
	High	35,639		41,934		50,086		59,075		68,347		77,037		86,078		94,236		100,293		107,874		117,415		126,170		134,815
Grand-Total	Base	29,699	2,623	34,945	3,397	41,738	3,745	49,229	3,863	56,956	3,621	64,198	3,767	71,731	3,399	78,530	2,524	83,577	3,159	89,895	3,975	97,845	3,648	105,142	3,602	112,346
	Low	26,729		31,451		37,564		44,306		51,260		57,778		64,558		70,877		75,220		80,906		88,061		94,627		101,111

5. Proposed Conceptual Action Plan

5-1 Long-term Production Plan and Manpower Plan

According to the long-term production plan in Indonesia, the coal production that was 40 million tons in 1996 reaches 190 million tons in 2020, which accounts for 6 million tons increase on average every year. However, to achieve the goal, it is indispensable both to improve the mining technology and increase productivity so that the forthcoming change for the worse, increase in stripping ratio for the open pit mining and increase in the number of underground mines, should first be coped with.

As regards the increase in the underground mines, the percentage of production that was only 2.5% in 1995 as compared to the open pit mining is expected to reach as much as 11% in 2020 as shown in Table 5-1.

The number of manpower that was 30,000 in 1995 reaches 110, 000 in 2020, of which underground manpower accounts for 50,000 and open pit mining for 60,000.

Table 5-1 Base Scenario Production up to 2020

	1996	2000	2005	2010	2015	2020
Production (Million.tons)						
U/G	1	2	7	12	17	21
O/P	48	95	122	137	149	168
Total	49	97	129	149	166	189
Manpower (1,000)						
U/G	5	7	18	29	40	50
O/P	25	35	43	50	54	62
Total	30	42	61	79	94	112
U/G Production Rate (%)	2. 4	2. 2	5. 4	8. 4	10. 2	11. 0

5-2 Necessity of Manpower Development

In indonesia, the productivity in the coal industry is rather low as compared with other foreign countries and moreover as to the technical level, it is low as a whole except at some open pit mines. In addition, there is plenty of room for improvement in basic skills as well as in practical skills. To raise the technical level, it is necessary to develop relevant manpower soon.

As regards the manpower development, it is also necessary to provide training and education courses (inside and outside the enterprises) as shown in Figure 5-1 in order to develop and enhance employees' capability to carrying out the works. And as the capability is increased, incentive treatment such as promotion, pay increase, higher position, etc. should be given to them.

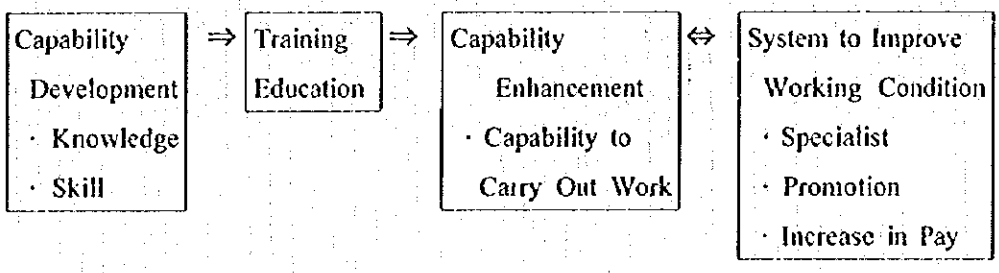


Figure 5-1 Outcome of Manpower Development

5-3 Establishment of Hierarchical Classification in Manpower Development

The hierarchical enterprise organization in coal industry can be divided into six classes from manager to unskilled operator. In this report, however, the hierarchy is roughly divided into the following three classes taking into account the current duties taken in the enterprises and in consideration of the hierarchical manpower development method.

Table 5-2 Hierarchical Classification in Manpower Development

Organization Hierarchy	Manpower Development Hierarchy
Manager, Professional	Manager Class
Supervisor, Skilled operator	Supervisor Class
Middle skilled / Unskilled operator	Operator Class

5-3-1 Hierarchical Manpower Development to be Achieved

Taking into account the following factors,the number of manpower to be developed form now on in manager class, supervisor class and operator class is calculated as follows.

-Annual increase
-Age-limit retiring and turnover rate
-Refresher training is included or not

1) Manager class

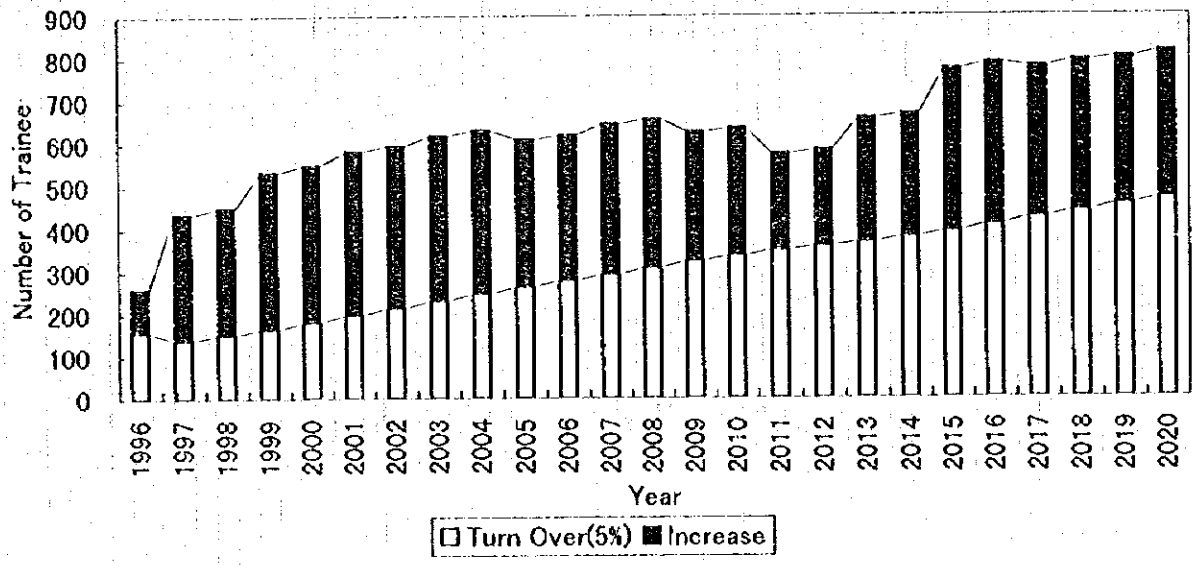


Figure 5-2 Number of Manager Class Manpower to be Developed

Figure 5-2 shows the number of manager class manpower to be developed by 2020, which is calculated taking into account the annual increase and age-limit retiring and turnover rate (5%).

It is known from the Figure 5-2 that in 2020, approx. 800 manager class manpower should be trained.

2) Supervisor class

To calculate the number of supervisor class manpower to be developed by 2020, the periodic refresher training that is necessary for this class once every five years is taken into account in addition to the annual increase and age-limit retiring and turnover rate (10%).

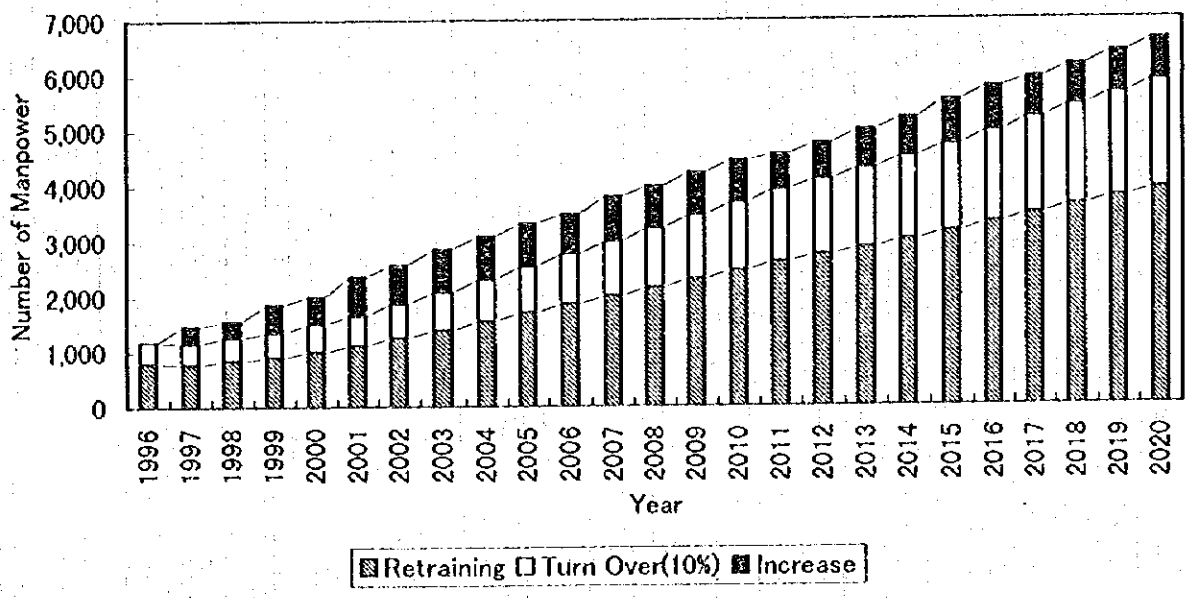


Figure 5-3 Number of Supervisor Class Manpower to be Developed

It is known from the Figure 5-3 that the number of supervisor class manpower to be trained gradually increases from 1,000 in 1996 to 6,600 in 2020.

3) Operator class

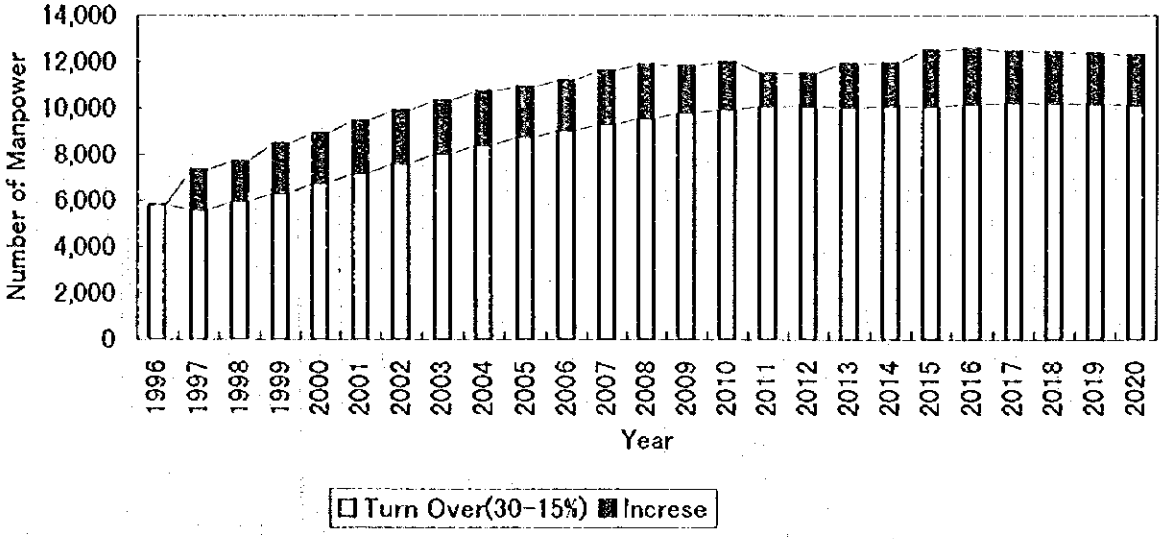


Figure 5-4 Number of Operator Class Manpower to be Developed

The number of operator class manpower to be developed by 2020 is calculated taking into account the annual increase and age-limit retiring and turnover rate (30% to 15%). The age-limit retiring and turnover rate that is as high as 30% at present is set to 15% in 2020 in consideration of the expected improvement in working environment and increase in health and welfare facilities in future.

It is known from the Figure 5-4 that the number of operator class manpower to be trained is on the increases up to 2008 but after that remains stable and is kept in the narrow range of around 12,000 or so as the age-limit retiring and turnover rate decreases.

5-3-2 Manpower Development Organization and Hierarchical Manpower Development

There are three manpower development organizations, namely, school, training center and in-company training. Table 5-3 shows the advantageous points of these organizations respectively. And ploblems involved in manpower development organizations and action plan to be taken is shown in Table 5-4.

Table 5-3 Features of Present Manpower Development Method

	School Education	Training Center	In-Company Training
Purpose	To supply prospective manager class manpower to enterprise	Enhancement of production & safety technology	Development of capability to perform duties
Method of Training	Lecture & instruction in know-how take a leading part	Hierarchical & occupational training - Training on skill - Instruction in know-how	On-the-job training & group safety instruction - Skill training takes a lead part
Prospective trainee	Supervisor class or over 1,150 graduates/year	Supervisor class or over LPPT 50 graduates/year MDCM 1,500 graduates/year	Operator & new employee
Instructor	Full-time instructor Academic career & knowledge level is high. With less actual experience.	Full-time instructor Expertise level is high. With moderate actual experience.	Part-time instructor Knowledge level is generally low. With rich actual experience
Advantages	- Acquisition of basic knowledge up to high-grade expertise	- Acquisition of expertise & job-site know-how - To deepen mutual understanding by exchanging information with other coal mines.	- Acquisition of skill to carry out work in line with job site - On-the-job training - Inexpensive training cost
Dis-advantages	- Difficult to acquire job-site know-how - School fee is expensive - Hardly available except in Java	- Capacity is insufficient - Training cost is expensive - Trainees have to quit performing their duties	- Mostly dependent upon instructor's capability - Often causing waste of time unless carried out systematically

Table 5-4 Problems Involved in Manpower Development Organizations & Action to be Taken

	Problems	Action to be Taken
School Education	- Instructor training	- Disposition of expert instructors specialized in underground mining, instruction by domestic & overseas instructors
	- Execution of joint research	- Selection of research subject
Training Center	- Manpower development capacity : 800+7000 in 2020	- Capacity increase : 2000 x 2
	- Method of manpower : Practical training	- Coal mines to accept trainees
	- Underground technology : Shortage of instructors	- Technology transfer by expert instructors, improvement of curriculum
In-company training	- Inadequate training sections in enterprises	- Increase & Improve training sections
	- Shortage of instructors	- Train instructors at training center
	- Imperfect curriculum	- Rearrange & complete

6. Proposed Action Plan

This execution plan shows how to develop the manpower required to achieve the increased production in future based on the results of survey of the natural conditions, technical level, market, etc. in Indonesian coal industry.

Concerning the hierarchical manpower development method, it is the most important thing to use the following procedure in such a manner as shown in Figure 6-1.

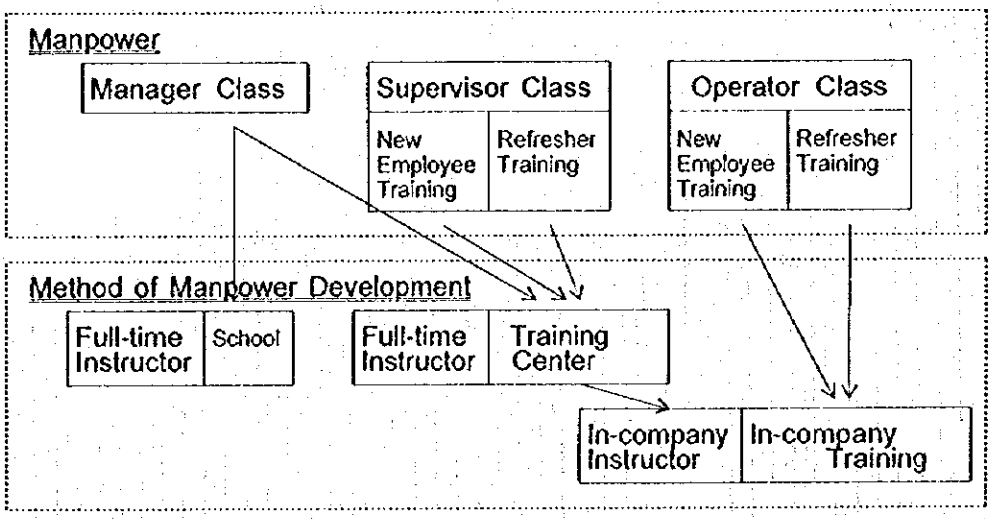


Figure 6-1 Method of Hierarchical Manpower Development

1) Training of manager class manpower should be undertaken by expert instructors in schools (university and college) or professional skill training organizations (MDCM).

2) Training of newly-employed supervisor class manpower and refresher training should be undertaken by expert instructors in professional skill training organizations (LPPT or other training centers) together with the practical training to be given at relevant coal mines.

3) Training of operator class manpower should be undertaken in each enterprise by supervisor class instructors who completed the training course in professional skill training organizations mentioned in 2) above with the job-site practical training taking a leading part of the curriculum.

6-1 School Education (university and college)

6-1-1 Instructor Training

It is necessary to train underground mining engineers. In this regard, such instructors who have relevant knowledge should first be trained at universities and colleges. To achieve the goal, the following method should be adopted.

1) Invite the expatriate instructors specialized in the underground mining technology from Australia, America, Japan, etc.

2) Invite capable personnel who possess skills and experience in the underground mining from the coal enterprises and coal-related organizations to give a lecture at universities and colleges.

3) The Institute of Technology Bandung takes a leading part in training the instructors of other universities.

4) Make full use of study-abroad system such as an exchange professor or the like so that the training is undertaken at overseas universities.

To implement the above plans, it is necessary that the Ministry of Energy and Mines requests the Ministry of Education and Culture to recognize the importance of training the instructors to undertake the training at coal-related universities and that both Ministries should jointly draw up an instructor training program and review it in detail.

It is also necessary that the Department of General Affairs of Mines or other competent organizations should ask for cooperation prior to inviting capable personnel to give a lecture at universities.

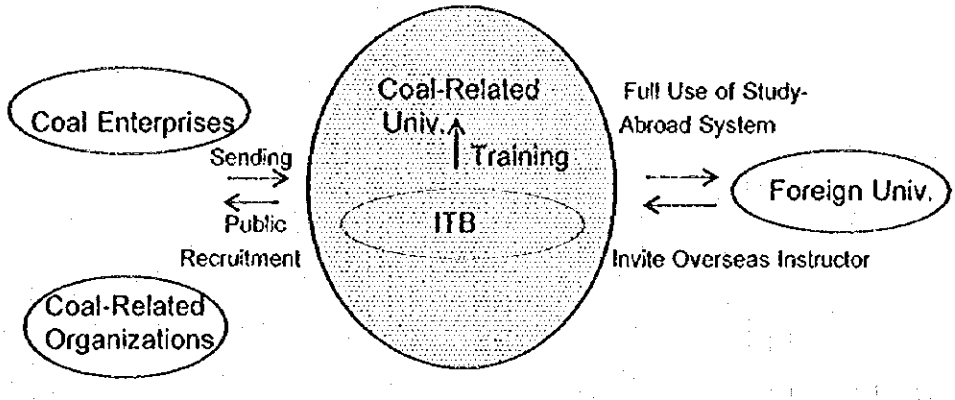


Figure 6-2 Instructor Training at Coal-Related Universities

6-1-2 Execution of Joint Research

Technique which will be needed at present and in future and technical challenges to be solved are as shown below.

-High-speed driving
-Soft soil zone driving
-Thick layer mining system
-Quality and selection and management of mining areas.
-Central monitor system
-Underground gas vent and utilization of gas
-Rock pressure control in deep underground mining
-Investigation of property of mine waste water and measures to be taken

In future, the above matters should be tackled by universities in terms of a graduation thesis or joint research with coal mines so that the problems presently involved in operation of the coal mines may be solved or at least improved thereby increasing the productivity and safety.

Execution of the joint research should be done as shown in Figure 6-3 as well as in the flow as shown below:

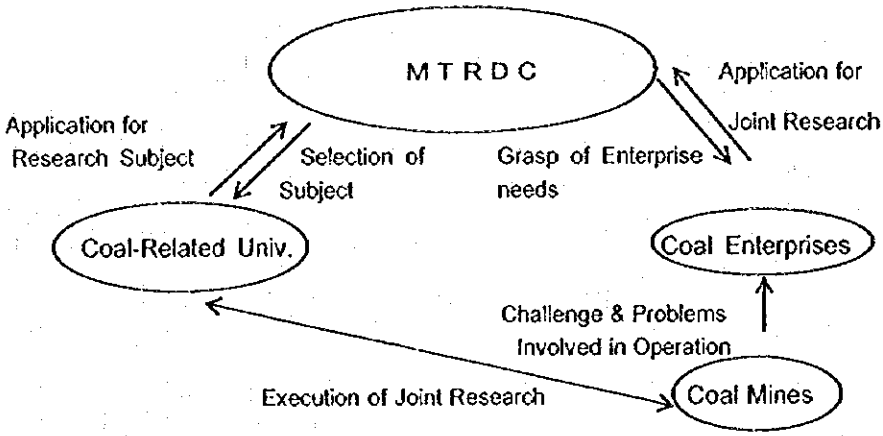


Figure 6-3 Execution Chart of Joint Research

1) Coal mines inform coal enterprises of the present problems and technical challenges to be solved.

2) MTRDC grasps the needs of coal enterprises.

3) Coal enterprises make a request to MTRDC for a joint research and MTRDC is furnished with research subjects from universities.

4) Selection of proper research subjects by MTRDC.

5) Execution of joint research

To implement the above plans, it is again necessary that the Ministry of Energy and Mines requests the Ministry of Education and Culture to plan out the joint research system and that the Department of General Affairs of Mines should secure funds to cater for the coal-related joint research expenses.

6-2 Training Center

6-2-1 Reinforcement of Existing Training Center

1) LPPT

Presently, LPPT is proceeding with the joint operation plan with JBT Co. Although the details are not clear yet, outline of the LPPT that is presumed from the present state of the LPPT is as follows.

Table 6-1 Action Plan at LPPT

	Present States	Future
Capacity	50 (actual result in 1995)	Approx. 1,000 Capacity increases by changing training period
Curriculum	-Mining -Mine mechanical -Mine electrical (50 graduates/year) Two years course	-Mine mechanical -Mine electrical -Mine geology -Heavy equipment maintenance -Transportation & communications Long-term course : for about 3 months Short-term course : for about 3 weeks
Facilities & Equipment	Sufficient	Large-size training equipment are not necessarily required.
Technical Capability of Instructors	Adequate	Training of instructors and trainees by Australian

2) MDCM

Table 6-2 Action Plan at MDCM

	Present States	Future
Capacity	1,500 (actual results in 1995)	Present capacity is enough
Curriculum	Top, middle and lower management courses (180/term/year)	Increase top, middle and lower management courses (800/four terms/year) -Trainee : manager class Newly establish an underground accident prevention course (150/two terms/year) -Trainee : professionals specialized in safety in particular
Facilities & Equipment	Sufficient	Gas & coal dust explosion simulation facilities, and its related teaching materials
Technical Capability of Instructors	Adequate	Participation in seminar or the like at universities

6-2-2 Establishment of A New Training Center

1) Purpose

The purpose of establishing the new training center is to increase the productivity and safety of the underground mining thereby striving hard to achieve the goal of the coal production program of Indonesia.

-Improve productivity by raising the level of underground mining technique
-Reduce accident frequency rate by raising the level of safety technique
-Increase estimated coal reserves by raising the level of exploration technique
-Enlarge marketplace by raising the level of coal preparation technique
-Reduce mine pollution and improve working environment into a complete one by raising the level of environment conservation technique

2) Selection of location

To decide the location of the new training center, the following factors are taken into consideration.

-Number of coal mines and underground coal mines
-Coal production

The location of the new training center should be determined in the Kalimantan regions and most preferably in the East Kalimantan region.

3) Trainees

Trainees should be mainly composed of underground mining supervisors. However, open pit mining supervisors should also be included as necessary. This is because the safety of open pit mining and surface restoration to the original state are expected to become an important technical challenge to be solved from now on.

-Underground mining supervisors
-Underground mining skilled operators
-Open pit mining supervisors

The number of manpower to be trained should be 1,000 in total per year and the aggregated terms 72 weeks per year with all the trainees becoming a boarder. Table 6-3 shows training courses, term, annual frequency and max. capacity per class.

4) Procurement of trainees

As regards the procurement of the trainees, there seems to be no cause for anxiety. This is because the curricula are properly adjusted in such a way that the number of trainees to be sent from each coal mine is limited to that which never impedes the daily operation of them but on the contrary may satisfy the needs of respective coal mines. Nonetheless, the following action should further be taken so as to more facilitate dispatch of trainees from each mine.

a) Prior to establishing the training center, the DGM (Department of General Affairs of Mines) or DOC (Department of Coal) should take a leading part in discussions with each private coal mine and make a request to them for cooperation and moreover to understand that the training center is essentially very effective and in a sense indispensable to each coal mine.

b) Prepare an introductory brochure for the training center after having due discussions with relevant organizations.

c) Establish Operation Management Committee (to be mentioned later) in order to plan out the annual manpower development program including the number of trainees to be sent, curricula, etc.

d) Mine-related staff and operators should be bound to take a state examination for the underground and surface technician's license or obtain such licenses as are compulsory for the coal mine operators. And then relevant training courses should be held at the training center in preparation for the qualifying examinations for those licenses, and a certificate of completion should be given to the graduates of the course.

5) Curriculum

The curriculum should be prepared mainly aiming at the training and education of supervisors and skilled operators and putting emphasis on the training on the technique that are most suitably applied to the underground mines of this region.

It is necessary, however, to modify the curricula from time to time as necessary so as to meet the actual situation of that time. This is because the mining method is expected to be changed from the semi-mechanized to full-mechanized from now on as the advanced technology is introduced and labor cost rises.

Table 6-3 Training Program

Class	Course	Term	Annual Frequency	Max.Capa
Super-visor	Geology & drilling exploration	3 weeks	2 terms/year	40
	Coal mining & driving	5	2	50
	Mine mechanical & electrical	4	2	40
	Coal quality control	3	2	40
	Safety, rescue & first-aid	4	2	50
	Sub-total	38		440
Skilled Operator	Mining	3weeks	2 terms/year	50
	Driving	4	2	50
	U/G equipment maintenance	3	2	50
	Surface 〃	2	2	50
	Safety, rescue & first-aid	2	4	40
	Sub-total	34		560
	Total	72		1,000

6) Procurement of instructors

Procurement of the instructors is a very important thing among others and is one of the two key factors in the operation of the training center. The other key factor is the procurement of the working funds. In this regard, the Department of General Affairs of Mines should basically be responsible for procuring such instructors from the coal industry, official world and academic circles.

However, since the level of the underground mining technique is still low in Indonesia now, the training center should proceed with the instruction of the Expatriate-Indonesian combined instructors for the first five years. And, during this five-year period, the necessary technology should fully be transferred from the Expatriate specialists to the Indonesian instructors.

Expatriate experts :		Indonesia instructors :	
* Geology sector	1	* Geology sector	1
* Mining sector	1	* Mining sector	2
* Safety sector	1	* Safety sector	2
* Mechanical & electrical sector	1	* Mechanical sector	1
		* Electrical sector	1
* Coal preparation & environment sector	1	* Coal preparation & environment sector	1
	5		8

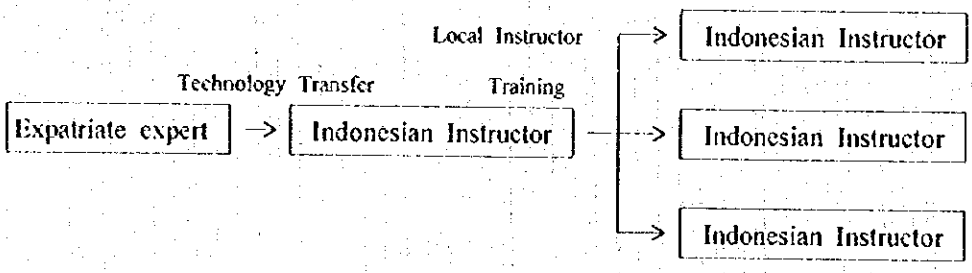
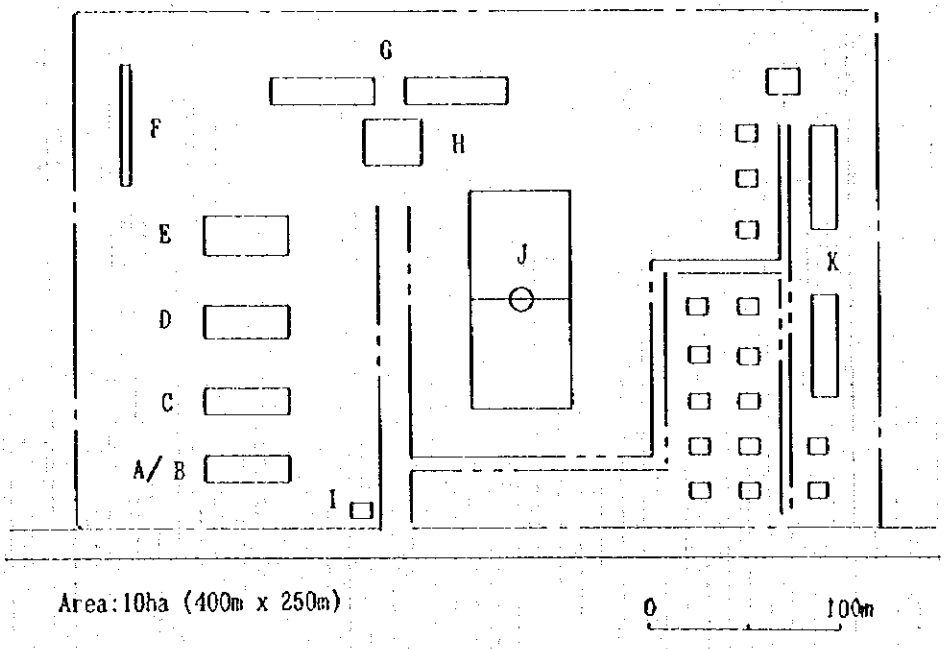


Figure 6-4 Instructor Training

7) Training facilities and investment

Figure 6-5 and 6-6 shows the layout of the training center. The center should be provided with an office, training room (50+50), drawing room, workshop, multi-purpose hall, computer room, laboratory and library, dormitory (100), waiting room for instructors, dining hall, recreation room, training gallery, play ground, etc.

Table 6-4 shows the estimated required investment in the coal mining training center which is 12.145 billion Rp in total, of which the building construction cost amounts to 6.06 billion Rp and the facility and equipment procurement costs 6.085 billion Rp.



A:Office
B:Drawing room/Computer room
C:Training rooms (2 floors)
D:Laboratories
E:Workshop
F:Training Gallery
G:Domitories (2 floors)
H:Multi purpose Hall
I:Security
J:Play ground
K:Residence for Staff and Expatriate

Figure 6-5 Training Center Layout

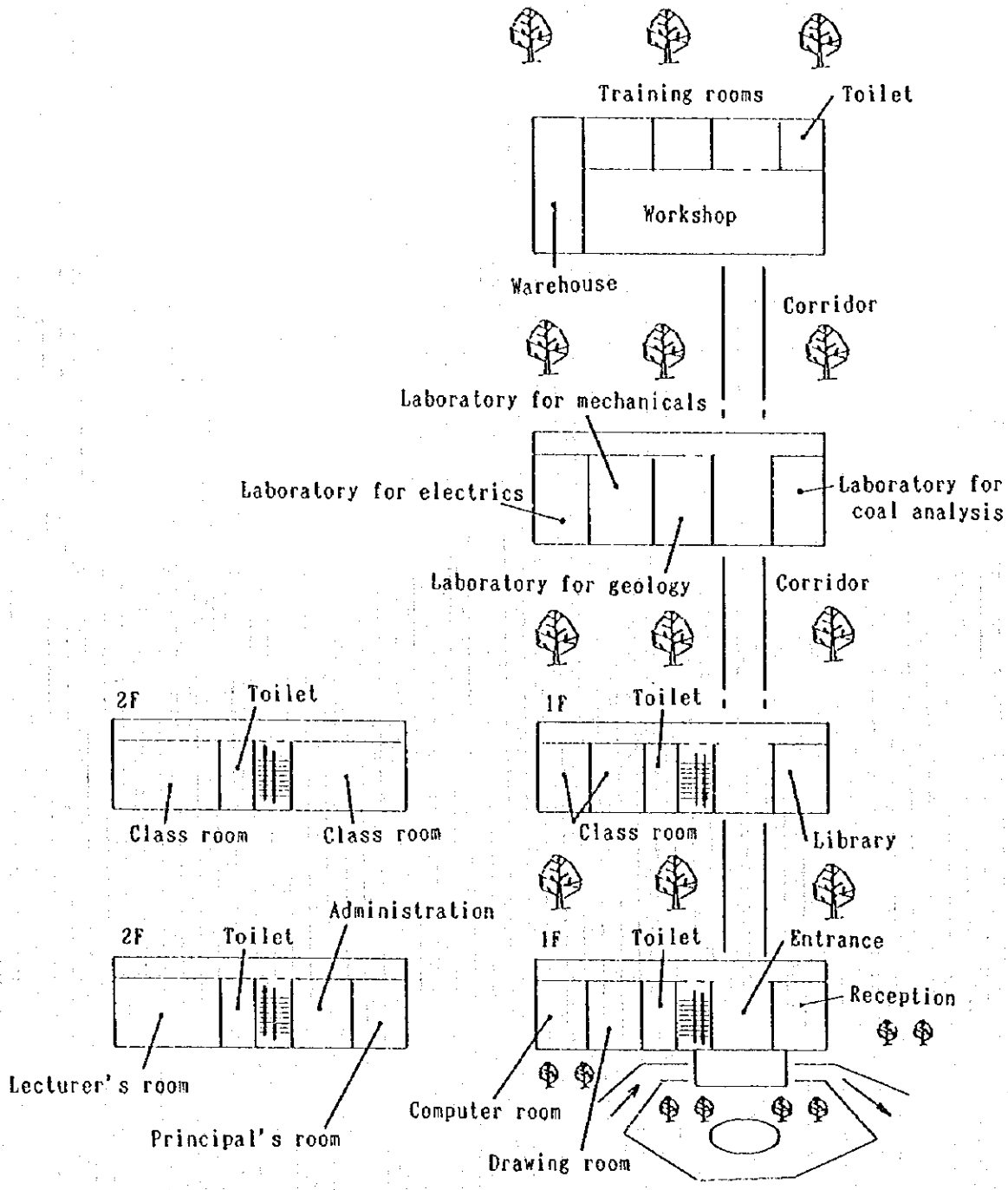


Figure 6-6 Conceptual Layout of Training Facilities

Table 6-4 Estimated Investment in Coal Mining Training Center

(Million Rp)

Item	Quantity	Unit Price	Total
Land & Building			
Land	10 ha	200	2,000
Office	400 m^2	0.5	200
Training Room	720 m^2	0.5	360
Drawing Room	200 m^2	0.5	100
Computer Room	200 m^2	0.5	100
Workshop	800 m^2	0.5	400
Laboratory	600 m^2	0.5	300
Dormitory	2,000 m^2	0.5	1,000
Multi-purpose Hall	600 m^2	0.5	300
Staff Residence	1,500 m^2	0.6	900
Play Ground	1	200	200
Training Gallery	1	200	200
Sub-total			6,060
Facilities & Others			
Mining Technology	1	659	659
Ventilation & Safety	1	566	566
Geological Technology	1	729	729
Mechanical Technology	1	690	690
Electrical Technology	1	515	515
Repair Shop	1	1,840	1,840
Preparation	1	506	506
General	1	580	580
Sub-total			6,085
Total Investment			12,145

8) Administration and operation

At present, any officially established competent scheme relevant to the coal-related manpower development is not available in Indonesia. Under the situation, it is probable that the coal mining training center may have to grope its way, in connection with the establishment, toward how to raise funds, operate and manage the center. In the light of it, the government should have to take a leading part for

some time after the commencement of the center in operation and management and after the center has fully been set on its way, it is recommendable that the center should be put under the private management of such organizations as the Coal Association or the like.

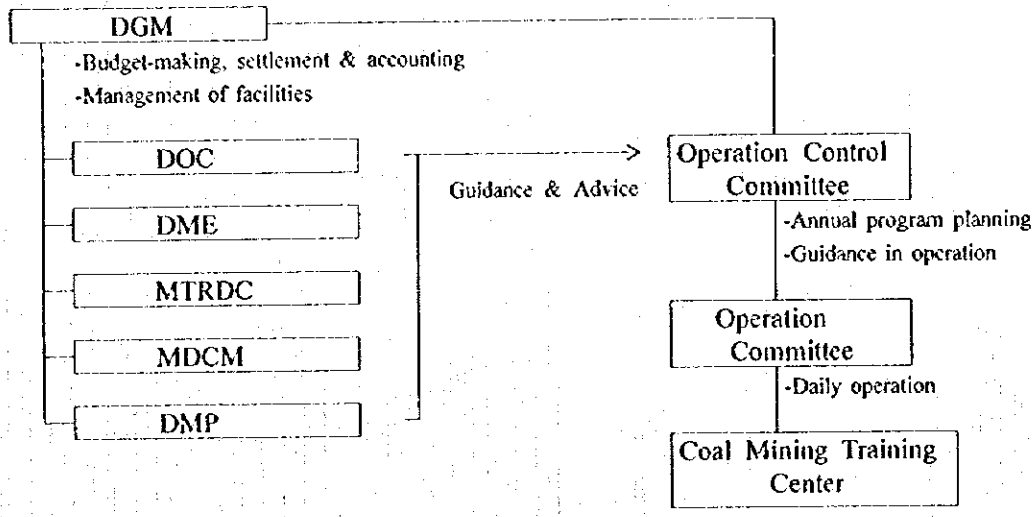
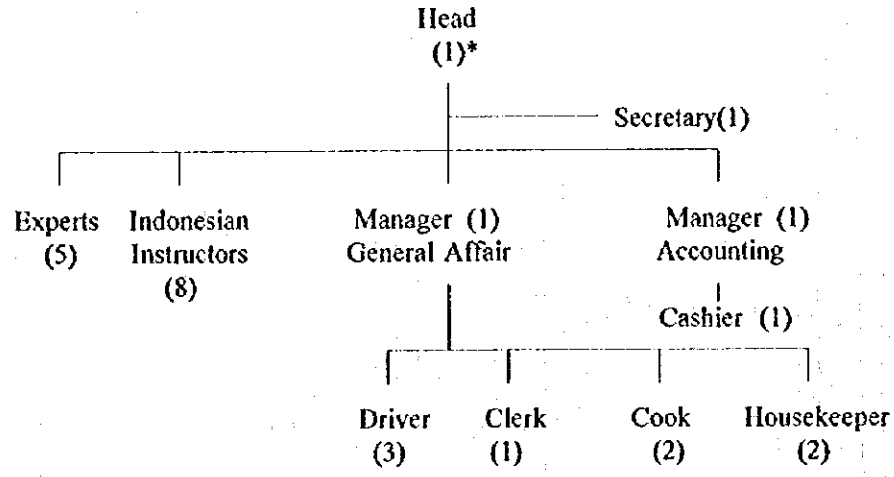


Figure 6-7 Center Operation-Related Organization (Original)

As regards the operation and management of the training center just after the commencement, the Operation and Administration Committee should be set up in the Department of General Affairs of Mines (DGM) with the director of DGM appointed to the chairman of the committee. The Committee should be responsible for planning out the trainee procurement program and giving direction to the center as to its operation.

In addition to the above, Operation Subcommittee should also be set up with the head of the center appointed to the chairman of the subcommittee. The subcommittee should be responsible for the daily operation of the center.

Figure 6-8 shows the organization of the coal mining training center, which is comprised of twenty six full-time staff including the head of the center, plus fifteen part-time personnel as necessary.



Remark : Members marked with * shows Class A and others Class B. In addition to the above member, 15 part-timers are needed.

Figure 6-8 Organization of Training Center

Table 6-5 Presumed Operating Cost of Coal Mining Training Center

(Million Rp)

Item	Quantity	Unit Price	Total
Monthly Salaries			2,330
	(Expatriate) : 5	450	2,250
	(Staff)		80
	Class A 11	5	55
	Class B 10	2.5	25
Maintenance			243
Consumables & materials			200
Others			50
Depreciation			912
	(Land& building)		303
	(Facilities)		609
Overhead			148
Contingency			148
Total			4,031

9) Fund raising and cash flow

Since the LPPT is a government-owned training facility, it is a matter of course that the government takes a leading part in the operation. However, in the case of a training center which deals with the trainees from the private coal mines, it is necessary to consult with the coal enterprises in advance on dispatch of trainees to the center and method of raising funds.

The funds needed for the center are divided into the construction costs (initial investment) for procuring the land, buildings, facilities, etc. and working funds of the center.

The construction costs amount to as much as 0.6 billion Japanese yen in total. It may therefore be difficult for the private enterprises to furnish all of such funds alone. However, since the cost needed for procuring the land and buildings and the cost for facilities, equipment and materials are almost equal with each other, it is desirable that the government provides the government-owned land and buildings. As for the facilities, equipment and materials, however, it may be possible to purchase by using the private funds.

The working funds can be catered for by school fee or otherwise by a subsidy which is inclusive of the amount equivalent to the school fee thereby exempting the trainees from paying the school fee and which should be collected from the coal enterprises. In this case, however, it is necessary to raise private funds anyway in such a style as a subsidy per production ton.

In addition to the above, such cases where overseas assistance is given in a form of investment for facilities and expatriate services are taken into account and then the cash flow of these six cases in total is fully examined with the NPV coefficient set to 15%.

Table 6-6 Training Center Fund-Raising Plan

Case	Overseas Technical Assistance			School Fee	Subsidy/ Production ton
	Land & Building	Facilities & Equipment	Operating Cost (Experts)		
1	×	×	×	○	×
2	×	×	×	×	Rp 48
3	×	×	×	○	Rp 39
4	×	○	○	×	Rp 31
5	×	○	○	○	Rp 21
6	×	○	○	×	Rp 19

Case 1 : All the expenses will be paid by school fee without overseas assistance. This plan can hardly be implemented because of the school fee which amounts to as much as 1.79 million Rp per person for two week course.

Case 2 : All the expenses will be paid by funds collected from the private enterprises in a form of a subsidy per production ton, which comes to 48 Rp, without overseas assistance and with the trainees entirely exempted from the school fee.

Case 3 : All the expenses will be paid both by funds in a form of a subsidy and school fee (0.5 million Rp per person for two week course) without overseas assistance. In this case, it is necessary to collect a subsidy of 39 Rp per production ton from the private enterprises.

Case 4 : All the expenses will be paid by funds in a form of a subsidy per production ton with overseas assistance given in a form of investment for facilities and expatriate services and with the trainees entirely exempted from the school fee. In this case, it is necessary to collect a subsidy of 31 Rp per production ton from the private enterprises.

Case 5 : All the expenses will be paid both by funds in a form of a subsidy and school fee (same as mentioned above) with overseas assistance given in a form of investment for facilities and expatriate services. In this case, it is necessary to collect a subsidy of 21 Rp per production ton from the private enterprises.

Case 6 : All the expenses will be paid by funds in a form of a subsidy per production ton with overseas assistance given in a form of investment for facilities and expatriate services and with the land and buildings furnished by the Indonesian government for the center. In this case, it is necessary to collect a subsidy of 19 Rp per production ton from the private enterprises.

In view of the purpose of establishing the training center and smooth operation of it from now on, it is safe to say that Case 6, where a subsidy of 19 Rp per production ton is collected from the private enterprises, is the most suitable plan.

It is further recommended, however, that the subsidy per production ton should be addressed in two stages as shown below.

(1) For some time after the commencement of the center
Indonesian government should pay the amount equivalent to the subsidy out of the royalty amount of 13.5% collected based on the P/S contract.

(2) When the center has fully been set on its way
Subsidy per production ton should be collected from the private enterprises.

10) Effects of training center

The direct and indirect effects of the coal mining training center are as shown below:

a) Rise in the level of the production technique improves by itself the productivity of each coal mine thereby increasing the production.

b) Rise in the level of the safety, rescue and first-aid technique reduces by itself the frequency rate of large accidents that may lead to suspension of the production.

c) Rise in the level of the exploration technique increases the minable coal reserves thereby enlarging the minable areas and extending the mine service life.

d) Rise in the level of the coal preparation and quality control technique may contribute to development of the export coal market and moreover to increase in the foreign-currency holdings and to economical and environment-friendly utilization of the coal in the domestic industries.

e) Stable operation of coal mines may contribute to hiring more workers by the government.

6-2-3 Ranking of Coal Mining Training Center and LPPT

The coal mining training center and the LPPT are ranked as shown below.

-As mentioned previously, in consideration of the geographical features, the LPPT may have the Sumatra region in its charge for the training and the new training center the Kalimantan region under its charge.

-However, the special curricula to be adopted by these two training centers should be different with each other. This is because these regions differ at present in the method of mining used at the relevant mines where the practical training is available : one is the full-mechanized and the other semi-mechanized.

-Nonetheless, the basic curriculum should be unified and standardized in the light of the future introduction of the qualifying examination and qualification systems.

6-2-4 Establishment of Training Center and Points to Be Noticed from Now On

1) Training center establishment plan

It is estimated that the number of supervisor and skilled operator class manpower to be developed at the training center amounts to 6,600 in 2020. To cope with the situation, it is necessary to gradually increase the number of training centers and reinforce the manpower development capacity as shown in Figure 11-10.

a) Sumatra

The present manpower development capacity of the LPPT should be increased to 1,000/year, then 1,500/year in 2007 and 2,000/year from 2015 onward.

b) Kalimantan

A new training center with the manpower development capacity of 1,000/year should be established in Samalinda, East Kalimantan, and then 2,000/year in 2005, and in 2018, its capacity should be increased to 3,000/year.
In addition, another new training center should be established in Banjarmasin, South Kalimantan in 2001, and then in 2012, its capacity should be increased to 2,000/year.

2) Fund raising and cash flow

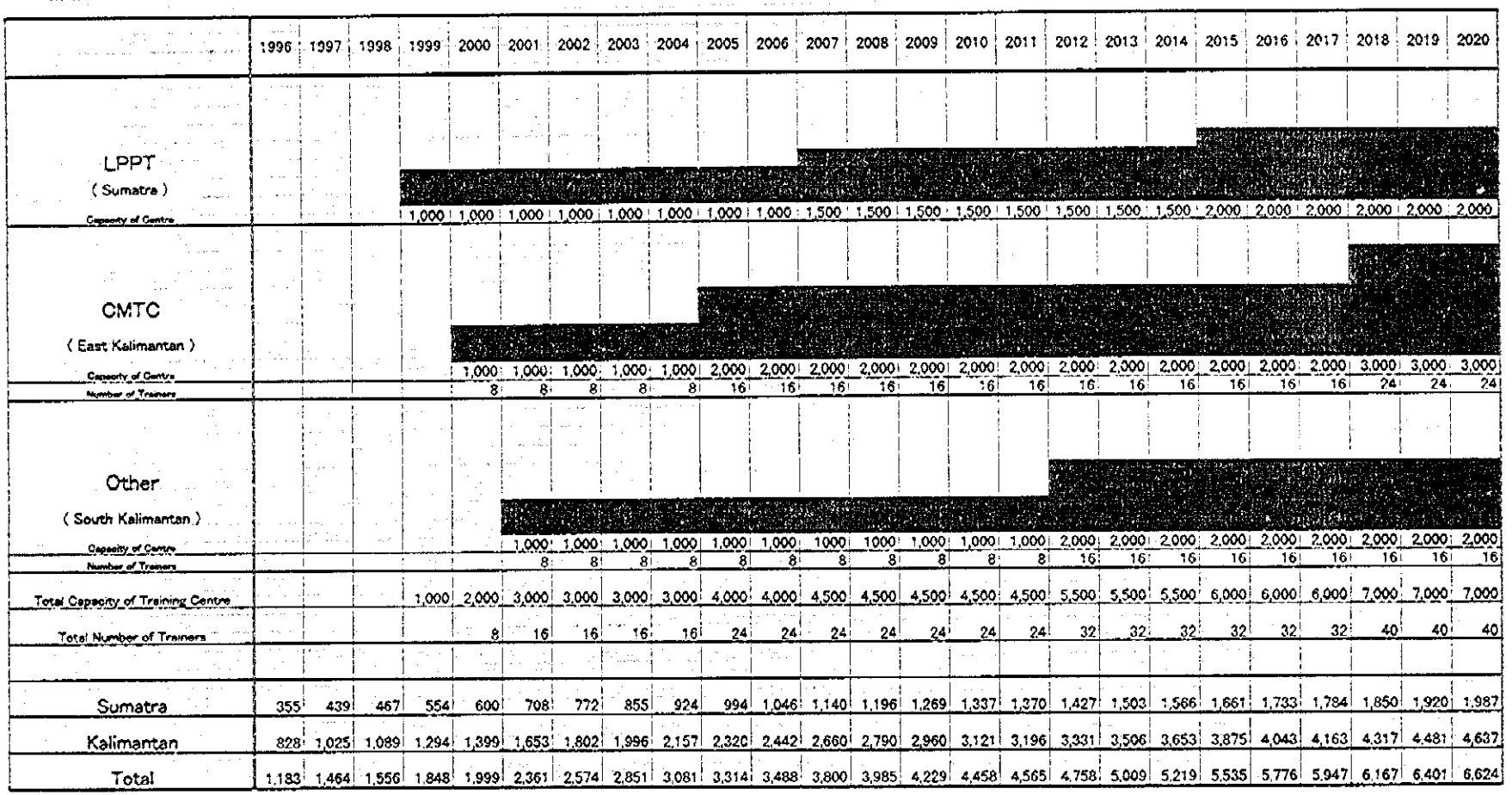
As a result of study of fund raising method and cash flow, it is known that the Case 6, in which the land and buildings are furnished from the Indonesian government, a subsidy of 29 Rp per production ton is collected from the enterprises and the trainees are fully exempted from paying the school fee, is the most suitable case.

3) Points to be noticed from now on

a) Training system should always be such that as the technology advances, the curricula are reviewed from time to time as necessary and the training facilities are improved in such a way that the executed practical training fully satisfies the actual job-site requirements.

b) Effects of the method of training should always be followed up and checked by conducting questionnaire surveys of the activities of the training center graduates in each enterprise or holding interviews with them on job-sites.

c) Opportunities to present the good business results should be given to the training center graduates by holding seminars from time to time or otherwise by issuing periodical publications, thereby giving them an incentive to fully perform their duties on the job-sites.



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
LPPT (Sumatra) Capacity of Centre				1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	2,000	2,000	2,000	2,000	2,000	2,000
CMTC (East Kalimantan) Capacity of Centre					1,000	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	3,000	3,000	3,000
Number of Trainers					8	8	8	8	8	16	16	16	16	16	16	16	16	16	16	16	16	16	24	24	24
Other (South Kalimantan) Capacity of Centre						1,000	1,000	1,000	1,000	1,000	1,000	1000	1000	1,000	1,000	1,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Number of Trainers						8	8	8	8	8	8	8	8	8	8	8	16	16	16	16	16	16	16	16	16
Total Capacity of Training Centre				1,000	2,000	3,000	3,000	3,000	3,000	4,000	4,000	4,500	4,500	4,500	4,500	4,500	5,500	5,500	5,500	6,000	6,000	6,000	7,000	7,000	7,000
Total Number of Trainers					8	16	16	16	16	24	24	24	24	24	24	24	32	32	32	32	32	32	40	40	40
Sumatra	355	439	467	554	600	708	772	855	924	994	1,046	1,140	1,196	1,269	1,337	1,370	1,427	1,503	1,566	1,661	1,733	1,784	1,850	1,920	1,987
Kalimantan	828	1,025	1,089	1,294	1,399	1,653	1,802	1,996	2,157	2,320	2,442	2,660	2,790	2,960	3,121	3,196	3,331	3,506	3,653	3,875	4,043	4,163	4,317	4,481	4,637
Total	1,183	1,464	1,556	1,848	1,999	2,361	2,574	2,851	3,081	3,314	3,488	3,800	3,985	4,229	4,458	4,565	4,758	5,009	5,219	5,535	5,776	5,947	6,167	6,401	6,624

Figure 6-9 Manpower Development Capacity & Training Center Establishment Plan

6-3 In-company Training

6-3-1 Increase and Improvement in Training Sections

1) Establishment, increase and improvement in training sections

To smoothly carry out the manpower development, it is necessary to establish a dedicated manpower development section, or increase or improve the existing manpower development sections into the dedicated ones so that they are able to execute the following tasks.

-Establish in-house manpower development system
-Make the responsibility of the management clear for development of subordinate manpower.
-Set up a training promotion section.
-Set forth relevant in-house rules.
-Make and allocate budget.
-Draw out long-term manpower development plan
-Review and follow up respective training plans submitted from each department.

2) Reinforcement of on-the-job training

To improve the effects of on-the-job training presently under way in each enterprise, it is important to follow up halfway the progress made until then in the actual operation. In this event, however, it is necessary to check the scheduled progress in the manpower development and actual progress for any difference. And if any, it is also necessary to try to find the cause of it and moreover consider proper measures in all its aspects.

Upon completing on-the-job training, effects of the training should be evaluated and inadequate results, if any, should be put in order and reviewed so that they are reflected in setting up the next manpower development goal thereby raising the level of on-the-job training and enhancing the reliability.

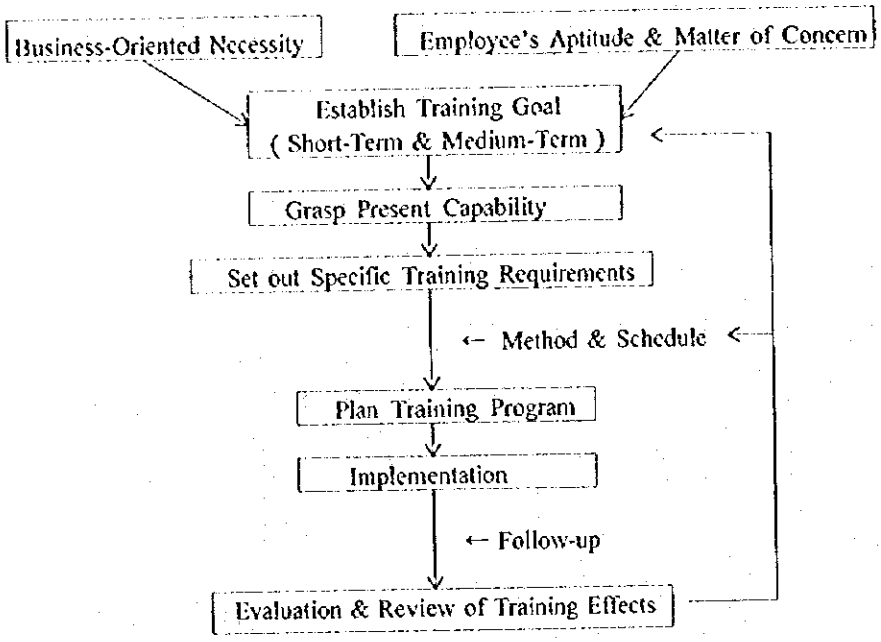


Figure 6-10 Steps in On-the-job Training

In addition, the following tasks should also be performed together with the above-mentioned tasks.

(1) Make the management and superintendents recognize the importance of the in-company training.

(2) Execute the in-company training systematically.

(3) Make company-wide propaganda for the importance of the in-company training.

(4) Create an enlightening work environment.

6-3-2 Training of Full-time Instructors

To smoothly carry out the training of operators who account for more than half the total employees, it is indispensable to increase not only the number of the

instructors but also their capability.

And, in the event of the actual training, it is surely necessary for the instructors to train the operators in such a manner that their production and safety technique that are directly in connection with the job-site works are much advanced. In this regard, the supervisors and skilled operators, who are the superintendents in respect of these operators and in charge of such sectors as mining, driving, mechanical, electrical and coal preparation, should first be sent to the outside training centers to undergo the instructor training courses so that after returning to the enterprises, they are able to undertake the training of the operators belonging to various occupational categories.

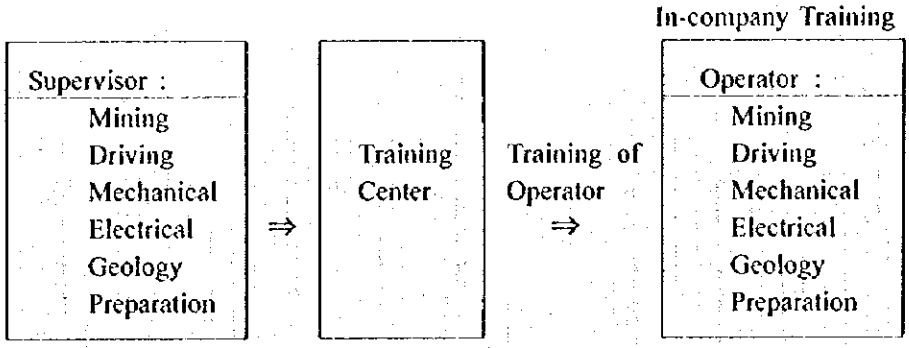


Figure 6-11 Training of In-company Training Instructor

6-3-3 Improvement in Curriculum

To train the operators and newly-hired employees, it is necessary to prepare such curricula as are in compliance with those shown in Table 6-7 and 6-8.

In this event, however, since it is very important in particular to instruct the new employees in the basic knowledge of coal mines and safety, it is desirable that the Department of General Affairs of Mines plays a central role and gives a guidance in preparing the standard curriculum to be commonly used among the coal mining enterprises.

1) New employees

Table 6-7 Newly-Hired Employee Training Curriculum (Example)

Item	Subject	Term
Orientation	- Outline of company - Manners to be observed in communal life - General knowledge to be commonly possessed to lead a business life in company - Hierarchical livelihood protection treatment	Several days
Basic knowledge Instruction	- Disease caused by dust & health care - Prevention of dust from scattering - Ventilation, cleaning, etc. of job-site - Relevant laws & regulations	Several days
Safety Instruction	- Nature of U/G accidents and preventive measure - Prevention of gas & coal dust explosion - Prevention of accident caused by water outburst - Other knowledge necessary to perform works	Several days
Assigned Job Training	- Flow of works in assigned job - Method of inspection & operation of equipment - Extraction of dangerous elements in works - Works auxiliary to assigned job - Shelter in an emergency	5 to 6 months

2) Operators

Table 6-8 Operator Training Curriculum (Example)

Item	Subject	Term
Safety Instruction	- Case study of extraction and analysis of dangerous elements in works - Discussion of causes and measures to be taken in respect of typical accidents - Execution of training on taking shelter - Other knowledge necessary to perform works	Several hours / term
Basic knowledge Instruction	- Work improvement plan submission in term of role playing	Several hours / term
Daily Training	- Direction of work & safety given when superiors make the rounds of job-sites	All the time
Assigned job Training	- Raise the level of skills and discard the habit and custom	As necessary

3) Standard work procedure

Table 6-9 Standard Works (Example)

Sector	Standard Work Item
Mining	Inspection before starting work on mining job-site, inspection of machinery & safety equipment, blasting work, support work, inspection & operation of transportation machinery, support standard
Driving	Inspection before starting work on driving job-site, inspection of machinery & safety equipment, blasting work, support work, inspection & operation of transportation machinery, loading work, support standard
Transport-ation	Inclined shaft winding machine, inspection & operation of storage battery type locomotive, inspection & operation hoist, track, B.C
Blasting	Transportation, control & handling of powder, measures against static electricity, loading & ignition, treatment after blasting, measures to be taken against abnormality

Works to be carried out at coal mines have been conducted manually to the most part and moreover even such mine works that were mechanized still call for manual operation to certain extent. As such, automation or automated control of the works has been seldom applied to the coal mine works.

It is well known that the human doings are under control of such factors as physical strength, capacity for locomotion, motor nerve, etc. In addition, "habit-bound" or "convention-bound" behaviors likewise have an influence on the them as well. Accordingly, only a small change in human doings such as using erroneous operation procedures or taking different posture may probably cause serious accidents quite a few times.

In view of it, it is definitely necessary to establish the standard work procedures so that the works are standardized and simplified as much as possible and the differences among individuals are eliminated thereby increasing safety as well as efficiency of the respective works.

6-4 Qualification

6-4-1 Qualification System

To cope with the increased coal production in future and anticipated forthcoming change for the worse in mining conditions, it is now certain that each enterprise proceeds with mechanization of the mining method and introduction of large-size heavy equipment. In this regard, it is necessary to secure supervisors and operators who possess a certain level of technique so that the safety is maintained as it is now.

To achieve this goal, it is indispensable that in addition to the existing state examination for the safety superintendent's license and blaster's license, such examinations and qualifications as shown in Table 6-10, which are applicable to respective occupational categories, should be introduced. In this event, however, the required qualifications to perform respective duties should clearly be written in the Coal Mine Safety Regulations so that the unqualified personnel are prevented from being on such duties.

Table 6-10 Type of Qualifications

Category	Current Qualifications	Required Qualifications
Safety Superintendent	Safety Superintendent	○ Safety Superintendent
U/G Sv. Surface Sv. Mechanical Sv. Electrical Sv.	Blasting Blasting	○ U/G technician, Blasting ○ Surface technician, Blasting ○ Mechanical technician ○ Electrical technician
Mining Op. Driving Op. Transportation Op. Mechanical Op. Electrical Op.		△ Mining machinery (operation) △ Driving machinery (operation) ○ Large-size winding (operation) △ Mine vehicle (repairs) ○ Electric equipment & appliances (installation & repairs)

Note) Qualifications & qualifying examinations marked with ○ are compulsory and with △ are recommended.
Sv. : Supervisor, Op : Operator

However, it may probably be difficult to materialize the above-mentioned examination and qualification systems at once. Accordingly, phased execution as shown below would be recommendable.

(1) First stage (for the present)

To materialize the examination and qualification systems for technicians.

(2) Second stage (in the future)

To materialize the examination and qualification systems for operators.

As regards the examinations and qualifications for the license to operate mining and driving machinery and vehicle-categorized mine machinery, they should be materialized after due consideration given to the availability of those machinery at each coal mine.

Furthermore, the qualification of candidacy for the above examinations should be set out as shown in Table 6-11 taking into account the School Education Act as well as years of experience in business practice.

Table 6-11 Qualified Examinees for Examination

Qualifications	Years of Experience in Business Practice		
	University & College	High School Graduates	Secondary Graduates
Safety Superintendent	3 years or over	5 years or over	7 years or over
Supervisor	1 year or over	2 years or over	3 years or over
Operator	Nil	Nil	Nil

In addition to the above, it is recommended that the preferential treatment should be given to the qualified personnel in each enterprise in such a way as increase in pay and rise in rank thereby uplifting their sense of responsibility for the work and

giving an incentive to perform the duty thus vitalizing the operation of the coal mines.

It is further recommended that together with the execution of the above examination and qualification systems, standardized lecture and training curricula should be drawn out and commonly adopted among this newly established training center, LPPT, and MDCM where the courses in safety and blasting are already under way in preparation for the qualifying examination for the safety superintendent and blaster, and moreover a certificate of completion should be given to the graduates.

6-4-2 Establishment of Coal-related Organizations

To vitalize the coal industry and encourage the development of it, it is necessary to refurbish, rearrange and complete the various statistical materials in addition to conducting surveys of domestic and overseas coal mine situation and advanced overseas technology and technique for the prospective introduction into Indonesia. To this effect, (Foundation) Coal Association of Indonesia should be established newly thereby completing the supporting system for the sound development of the coal industry.

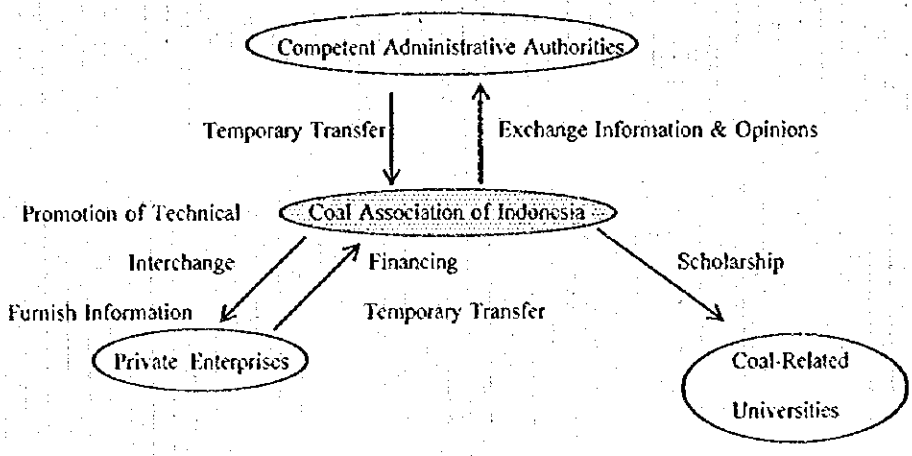


Figure 6-12 Role of Coal Association of Indonesia

Coal Association should undertake the roles mainly as shown below.

-Promote exchange of knowledge among enterprises (meeting for technical interchange and study tour of other coal mines)
-Award an honor to superior mines.
-Survey and study tour of overseas coal mines.
-Provide the industry with all the necessary production, safety, consumption, sales and labor statistical materials.
-Exchange information and opinions with competent administrative authorities.
-Secure capable personnel for the industry.

To materialize the above roles, coal enterprises should make an investment as a member in establishment of the Coal Association as a foundation for themselves.

6-4-3 Scholarship System

It is certain that the first prerequisite for the continuous development of the coal industry from now on is largely dependent on whether the capable manpower can be secured or not. However, this is very difficult because of the following reasons.

-Coal mines, the production job-sites, are located in Kalimantan and Sumatra.
-Eleven universities out of fourteen coal-related universities are located in Java.
-Accident frequency rate is higher than other industries.

Action to be taken to cope with the above situations should be:

-to establish a scholarship system in the school education.

In this event, the Coal Association of Indonesia should take a leading part in encouraging the university graduates to find a job in the coal industry by making good use of funds furnished from the enterprises in the scholarship system.

MASTER PLAN STUDY

FOR COAL MINING IN THE REPUBLIC OF INDONESIA

SUMMARY REPORT

MARCH 1981

JICA