7. Estimation of Coal Demand

7-1 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 7-1 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 7-2 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

7-2 Electric Power

In Indonesia, most of the primary energy is consumed in the form of electric power, the following four supply styles are presented now.

* State enterprise for electricity (PLN)
* Local unit cooperative association (KUD) and electrification cooperative association (KLP)
* Self power generation
* Independent private producer (IPP)

PLN is the only national corporation of Indonesia under the control of the Directorate General of Electric Power and New Energy, Ministry of Mines and Energy (MME) to perform all electric operations from power source development to power distribution. Indonesia faces difficulties in the power supply to local regions because of its geographical features as Indonesia is an archipelago comprising more than 13,000 islands and has a very uneven population distribution, concentrating on Java. Currently, because no submarine cable for power has been laid, individual power sources must be installed on each island. Thus, the KUD and KLP are supporting PLN's electrical operation by medium and small scale diesel power and gas turbine power generation. Because the capacity of power supplied to industry is insufficient, in-house power generation by companies using diesel generator accounts for most of their power consumption. Although electric power produced by in-house generation cannot be sold to ordinary consumers, it can be sold to PLN.

In addition to these organizations, new power supply organization have emerged, namely IPP. The presidential order of 1992 established the principle of deregulation by allowing private enterprises to enter the electric power industry. Indonesia now has a rapid increase in electric power demand and has begun to utilize the power of private companies to counter the government's and PLN's financial difficulties. The IPP has its own power generation capacity and sells generated power to PLN.

Total power generation in 1993/94 was 13,559MW breaking down by power sources: oil produced 54%, hydro power 18%, coal 16%, natural gas 10% and geothermal 2%.

Although at the beginning of the first 5-year Development Plan (1969), Indonesia's power generation depended upon oil (66%) and hydro power (34%), the development and the utilization of non-oil energy have been accelerated since the beginning of 1980, so that coal, natural gas and geothermal energies have been largely introduced in practice.
Total power generation of 49.2TWh by fuel type, breaks down : oil occupies 46%, coal 24% and natural gas 14%. 80% of total power in Indonesia is generated on Java with its high share of the population and Industry. Because of the power distribution system which links Java to Bali and Madura, however, it is not possible to supply power to other regions. As the power distribution lines, except, for the Java-Bali trunk line power transmission system (500KV), has not yet been properly completed, the local electrification rate is still low at only 30%.

Figure 7-1 shows the electric power supply regions, which are divided to eleven regions, including Aceh, North Sumatra, West Sumatra·Riau, South Sumatra·Jambi·Lampung·Bengkulu, West Kalimantan, South·Central·East Kalimantan, North·Central Sulawesi, South·Southeast Sulawesi, Maluku, Irian Jaya, Bali·East & West Nusa Tenggara, and Java.

Electric power consumption increased from 13TWh in 1981/82 to 53TWh in 1992/93 by 13.6% annually. In the same period, PLN's power generation increased from 8TWh to 35TWh while non-PLN generation increased from 5TWh to 18TWh. By consumption, industry has a 68% share, households a 22% and commerce a 10% share of consumption.

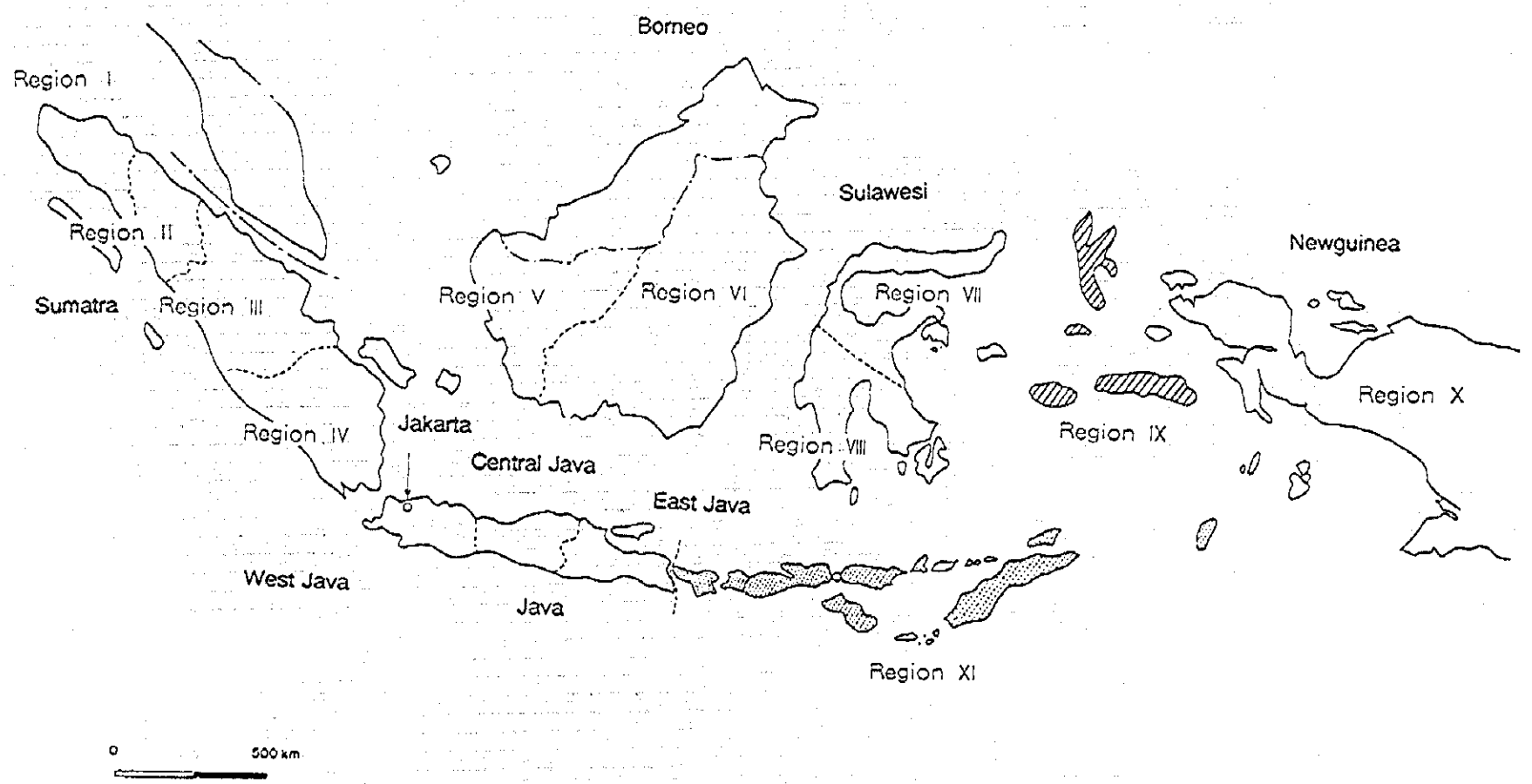


Figure 7-1 Distribution of Electric Power Supply by PLN

Table 7-3 Electric Power Consumption Breakdown

(GWh)

	1981/82	1989/90	1990/91	1992/93	%
PLN	7,886	23,439	27,741	34,963	65
Industry	2,469	11,418	11,166	17,754	33
Commerce	1,951	4,070	4,572	5,542	10
Household	3,425	7,947	9,004	11,677	22
Non-PLN	5,115	19,313	19,728	18,423	35
Sub-Industry	7,584	30,731	33,893	36,177	68
Total	13,001	42,752	47,469	53,386	100

Source : PLN

7-2-1 Current Coal-fired Power Plants

Currently operated coal-fired power plants are the Suralaya power plant (400MW x 4 units) in West Java, Paiton power plant (400MW x 2 units) in East Java and Bukit Asam power plant (65MW x 2 units) in South Sumatra. Their total power generation is 2,530MW, about of 20% total power generation of Indonesia as a whole.

The Suralaya power plant is scheduled to build 3 units (x 600MW) in the period from 1997 to 1998. The Paiton and Bukit Asam power plant is also scheduled to build 3,230MW new capacity by 2008/09 and 65MW x 2 units by 1995/96 respectively.

7-2-2 Perspective of Electric Power Industry

The second long-term 25-year plan (1994 - 2019) includes

* Diversification of energy sources and reduction of dependence on oil
* Promotion of development of electric sources as the basis for the activation of the various industries for national development and acceleration of economic growth to improve economic and social standards
* Acceleration of construction of power generation facilities to promote local electrification and utilization of new energies such as solar power, wind power and biomass, etc.

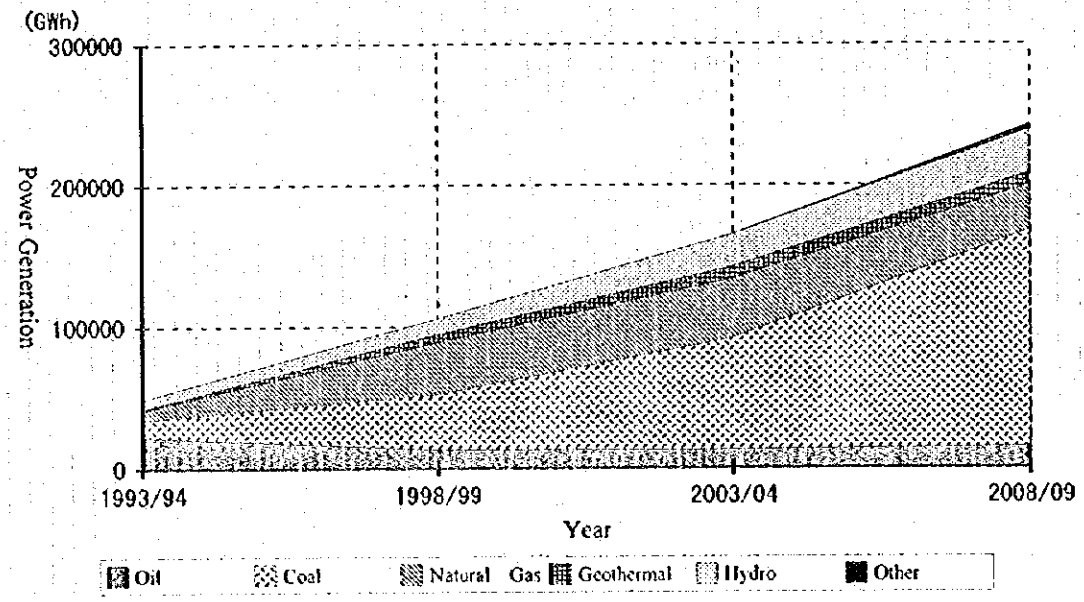
Table 7-4 Power Generation Depending on Fuel Type

(GWh)

	1993/94	%	1998/99	2003/04	2008/09	%
Java-Bali System:						
Oil	15,705	40	4,664	4,152	4,550	3
Coal	11,003	28	30,400	71,900	116,500	70
Natural Gas	6,017	15	31,956	37,444	25,401	15
Geothermal	1,199	3	5,031	5,418	5,418	3
Hydro	5,500	14	6,818	10,588	11,385	7
Other	-		-	-	4,003	2
	39,424		78,869	129,502	167,257	100
Outside Java System:						
Oil	7,066	72	8,909	9,179	10,723	13
Coal	678	7	5,400	11,500	41,800	52
Natural Gas	821	8	4,613	4,374	6,434	8
Geothermal	7	0	971	3,421	3,421	4
Hydro	1,230	13	3,997	11,801	18,813	23
Other	-		-	-	-	
	9,802		23,890	40,275	81,191	100
Indonesia						
Oil	22,771	46	13,573	13,331	15,273	6
Coal	11,681	24	35,800	83,400	158,300	63
Natural Gas	6,838	14	36,569	41,818	31,835	13
Geothermal	1,206	2	6,002	8,839	8,839	4
Hydro	6,730	14	10,815	22,839	30,198	12
Other	-		-	-	4,003	2
Total	49,225		102,759	169,227	248,448	100

Source : IEA Coal Research 1994, PLN

Figure 7-2 Power Generation on Fuel Type



1) Coal-fired Power

Future economic growth is expected to average 6.2% annually. It is estimated that electric power demand will increase by 15% annually. While the world is changing to oil-substituting energy today, natural gas and coal will play a major role in power generation in the medium and long term to enable Indonesia to meet her future demand for electric power. Table 7-5 shows estimated power generation in from 1993 to 2008.

According to a recent estimation by PLN, the amount of power generation is increasing by 11% annually and will increase about five-fold from 49TWh in 1993/94 to 248 TWh in 2008/09. In the same period, the power generation breakdown by fuel type will change significantly. Coal-fired power generation, now accounting for 24%, will occupy a 64% share in 15 years' time while power generation will increase 13-fold. On the other hand, oil thermal power generation will rapidly decrease from 46% to 6%. This tendency is noticeable particularly on Java where more than 70% will be from on coal thermal power generation. In regions other than Java, however, the proportion of oil thermal power generation will decrease, so that the energy used instead will transfer to coal, hydro power, oil and others.

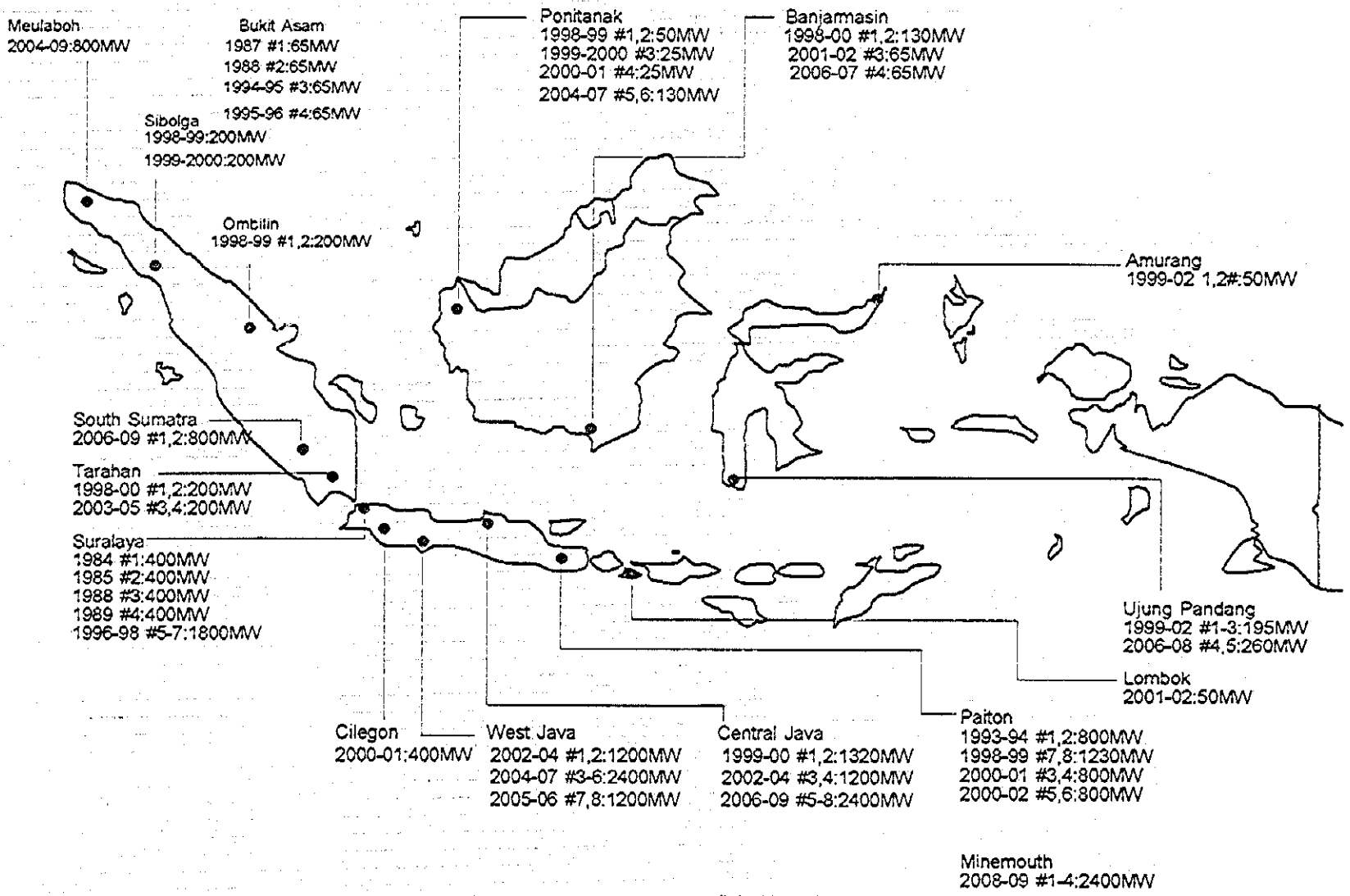


Figure 7-3 Distribution of Planed Coal-fired Generating Capacity

Table 7-5 Development Program for Coal-fired Power Plants

(MW)

	Unit	1994/95	1998/99	2003/04	2008/09
Java-Bali System:					
Suralaya #1-4	400	1,600	1,600	1,600	1,600
Suralaya #5-7	600	-	1,800	1,800	1,800
Paiton #1,2	400	800	800	800	800
Paiton #3,4	400	-	-	800	800
Paiton #5,6	600	-	-	1,200	1,200
Paiton #7,8	615	-	1,230	1,230	1,230
Central Java #1,2	660	-	-	1,320	1,320
Central Java #3,4	600	-	-	1,200	1,200
Central Java #5-8	600	-	-	-	2,400
West Java #1,2	600	-	-	1,200	1,200
West Java #3-6	600	-	-	-	2,400
West Java #7,8	600	-	-	-	1,200
Cilegon	400	-	-	400	400
Java #1,2	600	-	-	-	1,200
Sub total		2,400	5,430	11,550	18,750
Outside Java System:					
Bukit Asam #1,2	65	130	130	130	130
Bukit Asam #3,4	65	-	130	130	130
Ombilin #1,2	100	-	200	200	200
Sibolga #1,2	200	-	200	400	400
Meulaboh	400	-	-	-	800
Tarahan #1,2	100	-	100	200	200
Tarahan #3,4	100	-	-	100	200
South Sumatra	400	-	-	-	800
Banjarmasin #1,2	65	-	65	130	130
Banjarmasin #3,4	65	-	-	65	130
Pontianak #1-4	25	-	50	100	100
Pontianak #5,6	65	-	-	-	130
Ujung Pandang #1-3	65	-	65	195	195
Ujung Pandang #4,5	130	-	-	-	260
Amurang #1,2	25	-	50	50	50
Tonasa #1,2	25	-	50	50	50
Lombok	50	-	-	-	50
Minemouth #1-4	600	-	-	-	2,400
Sub total		130	1,040	1,750	6,355
Total		2,530	6,470	13,300	25,105

Source : PLN

Forecasts for coal-fired thermal power source development up to the year 2020 have been made on the basis of a "JICA Study of the Overall Energy Development Programs in the Indonesian National Power Sector" covering the period from and after 2008/09. On an estimation of Indonesia's future coal production output, however, it is clear that the consumption of coal for power generation is extremely high in the above plans. It is therefore conceivable that this might curtail the scope for coal exports and upset the market balance. For this reason, we have assumed that the level of development target attainment will be 60% from 2008/09 and made the following hypotheses. For the remaining 40% level of non-attainment, it will therefore be necessary to promote the development of other power sources such as combined cycle systems.

Table 7-6 Coal-fired Power Plants Plan by Region until 2020

(MW)

	1993/94	1998/99	2003/04	2008/09	2013/14	2018/19	2020/21
Java-Bali	2,400	5,430	11,550	18,750	20,712	26,952	29,941
Sumatra	130	760	1,160	5,260	6,498	9,078	10,374
Kalimantan		115	295	490	1,602	2,502	2,989
Others		165	295	605	1,608	2,268	2,601
Total	2,530	6,470	13,300	25,105	30,420	40,800	45,906

Source : PLN (1993/94 - 2008/09), JICA Study of the Overall Energy Development Programs in the Indonesian National Power Sector Report March,1996 (2009/10 - 2018/19)

Table 7-7 Power Generation and Coal Consumption

	1993/94	1998/99	2003/04	2008/09	2013/14	2018/19	2020/21
Java-Bali System:							
Power Generation(TWh)	11.0	30.4	71.9	116.5	130.6	170.0	188.8
Coal Consumption(Mt)	5.1	14.1	33.3	52.5	57.3	74.7	82.9
Outside Java System:							
Power Generation(TWh)	0.7	5.4	11.5	41.8	61.2	87.31	100.7
Coal Consumption(Mt)	0.3	2.5	5.3	18.8	26.9	38.3	44.2
Indonesia:							
Power Generation(TWh)	11.7	35.8	83.4	158.3	191.8	257.3	289.5
Coal Consumption(Mt)	5.4	16.6	38.6	71.3	84.2	113.0	127.1

Power generation has been calculated on the assumption of a 72% utilization factor. Coal consumption has been calculated on the basis that the coal has a calorific value of 5,400kcal/kg and that the thermal efficiency can be raised to 37% by 1998/99, to 38% by 2008/09 and to 39% thereafter.

As can be seen from Table 7-6, power source development will still be actively pursued even after 2008 and in connection with this there will be a sharp increase in the consumption of coal, as can be seen from Table 7-7.

Yet, there is a problem in tallying to estimated coal consumption levels shown in Table 7-7, that is, the amount of reserves of high quality coal such as bituminous coal, responsible for most of the current production in Indonesia, is limited. Additionally, it is estimated that a rapid increase of production cannot be expected to meet future domestic demand. On the other hand, Indonesia's high quality coal has sufficient international competitiveness in the export market due to its low ash content and low sulfur content. This can therefore be a major source for gaining foreign currency in the future. Thus, sub-bituminous coal occurred in sufficient reverses in East and South Kalimantan and lignite produced in Sumatra although not suitable for export as a fuel for coal thermal power generation. These will therefore be used for domestic power generation.

For these low quality coals to be used for domestic demand, the following conditions are necessary;

* Design of power plants in which low quality coal can be used
* Establishment of effective, low cost transportation systems from mines in Kalimantan to power plants on Java
* Development of mine mouth power generation in Sumatra and connection of power transmission line between the Sumatra and Java-Bali system.

Because lignite has a small heat value per unit weight, it cannot achieve cost balance in long distance transportation. As lignite is susceptible to spontaneous combustion due to the evaporation of its moisture content, it is not suitable for long distance transportation and long term storage. For the utilization of lignite, it is thus most effective to install power plants near the mine (In this case, it is necessary to consider the high construction costs for power transmission lines from the power plant to Java and power loss on transmission).

Kalimantan has reserves of 70% sub-bituminous coal. As sub-bituminous coal is less prone to spontaneous combustion than lignite, it has fewer problems in transportation and storage. Although the production amount of sub-bituminous coal is small in Kalimantan, it can be an important supply source for power plants in the eastern regions of Java in the future.

2) Power Transmission and Distribution Lines

For Indonesia with its large national territory, power transmission, distribution and supply losses are an important problem. The internal loss rate is 4.3%, the power transmission loss factor is 2.9% and the power distribution loss factor is 9.8%, totaling 17%. The reasons for this high power distribution loss factor are:

* Poorly arranged power distribution system
* Aging of power distribution system
* Household use consists mostly of low voltage consumers
* Electricity meters are tampered with an lawfully
* Frequent Power Stealing

Although station power loss cannot be reduced from a technological viewpoint, transmission loss is scheduled to be curtailed to 12.5% by more efficient utilization of existing power transmission lines as well as the utilization and extension of high-voltage power transmission and distribution lines.

Currently, 500KV high-voltage power transmission lines exist only in the Java-Bali system connecting Java, Bali and Madura. In addition, there are independent power systems of less than 150KV in Sumatra, Kalimantan, and Sulawesi. Figure 7-4, 7-5 and 7-6 show power systems except in Sulawesi island.

Indonesia's electrification rate is 44% on Java, 30% in regions other than Java, with an average electrification rate of 39%. However, according to the second 25-year long-term plan, construction of local power plants and expansion of power transmission lines are scheduled and futher development of recoverable non - commercial energies (solar power, wind, biomass, etc.) will play an important role in the regions, with the schedule being to raise electrification to 100% in the final year of this period.

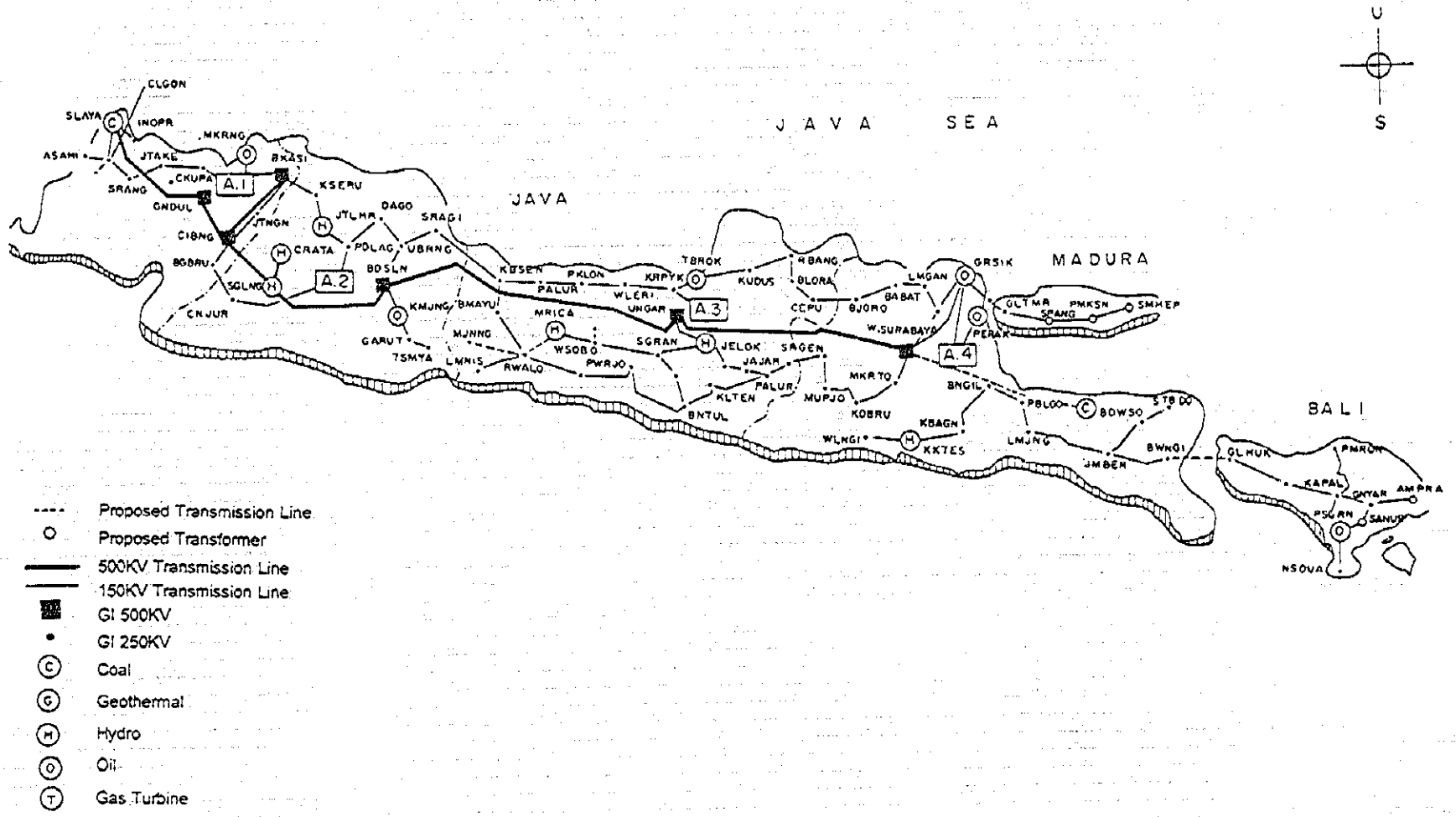


Figure 7-4 Java-Bali-Madura Power Transmission in System

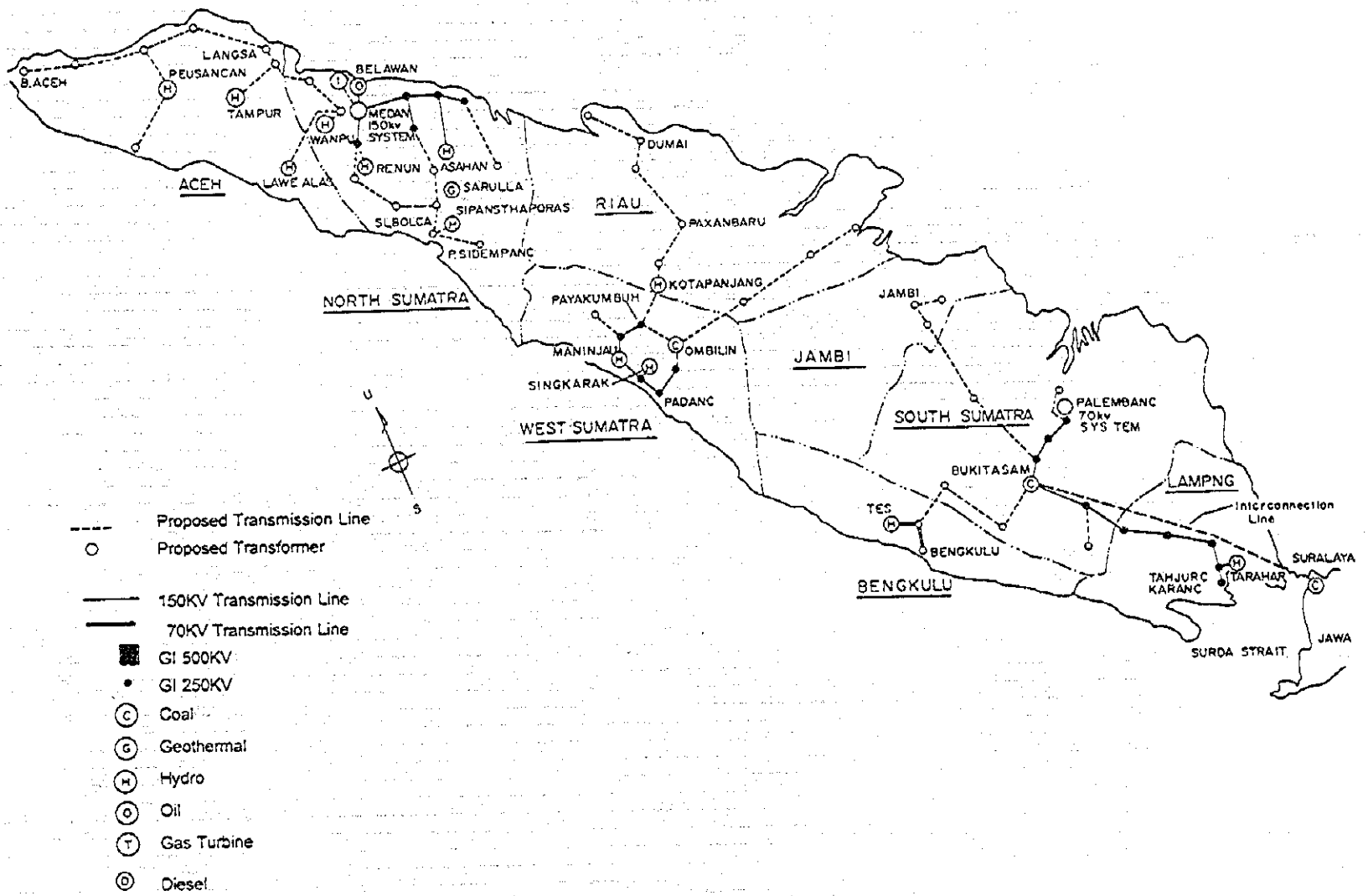


Figure 7-5 Power Transmission Line System in Sumatra

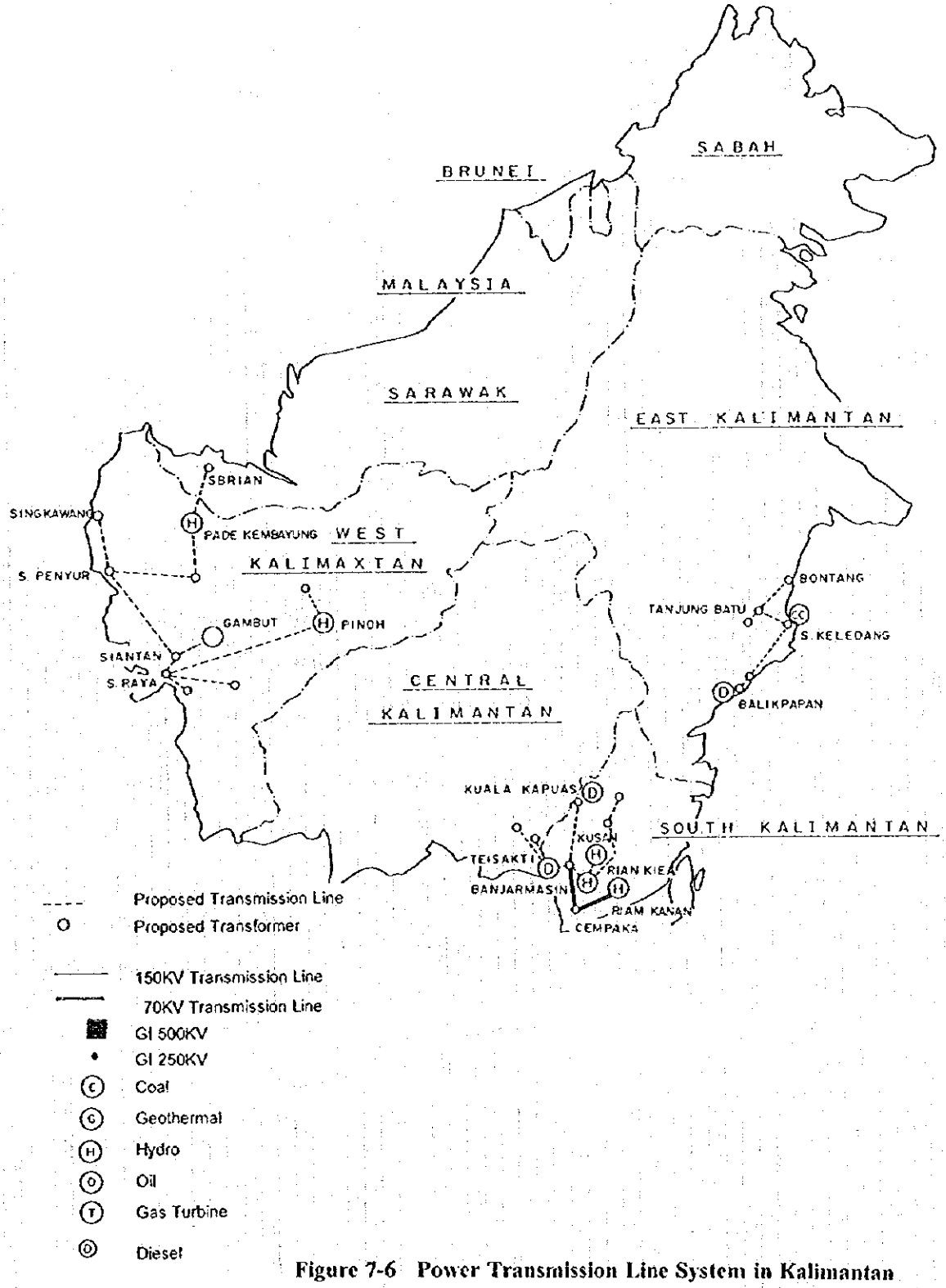


Figure 7-6 Power Transmission Line System in Kalimantan

Table 7-8 Construction Targets of Transmission Line and Transformers

		1994/95	1998/99	2003/04
Distribution				
-Low	(kms.)	162,442	196,741	215,290
-Medium	(kms.)	118,315	133,317	144,295
-High	(kms.)	19,896	10,548	15,390
Transformers				
-Major Station	(MVA)	23,936	30,406	26,080
-Sub Station	(MVA)	17,899	21,824	23,386
Electrification (%)		39	60	74
Java		44	71	87
Outside Java		30	43	55

Source : Coal Report '3149

3) Environmental Restriction on Coal-fired Power Plant

With the progress in economic growth and industrialization, environmental pollution of air and water has become a serious problem in large cities such as Jakarta and Surabaya on Java. Although electrostatic precipitator are installed in coal-fired power plants, no fuel gas desulphurization and denitrification equipment to remove SOx and NOx is provided. Nonetheless, conventional regulation values have been cleared because the sulfur content of the input coal is low.

As the burden on the environment is estimated to increase as a result of the rapid increase in coal demand and the installation of new coal-fired power plants in the future, the conventional regulation values were revised in March, 1995 as shown in Table 7-9. Yet expensive equipment is necessary for achieving low SOx and NOx emission levels. It will therefore be necessary to implement both short- and medium-term measures and long-term measures in order not to hamper economic growth in Indonesia.

* Short-term and medium-term measures:

a. Selection of excellent quality coal grades in the interest of environmental protection

b. Improvement of coal quality by coal blending

* Long-term measures:

a. Suppression of emission by introduction of fuel gas desulphurization and denitrification plants and improvement in their performance

b. Lowering of NOx emissions by improved combustion

c. Reduction in emission levels through improvement in heat efficiency

Because of the existing inadequacies in governmental organization, the shortage of engineers in the civil service will be a serious problem in the actual operation of these facilities. It will therefore be necessary to take suitable countermeasures, both organizational and technological.

Table 7-9 Standard of Emission to Air in Coal-fired Power Plants (1995/3)

Parameter	1995-2000 (mg/m^3)	2000- (mg/m^3)
SPM*	300	150
SO_2	1,500	750
NO_2	1,700	850
Opacity	40%	20%

Source : KEI

SPM* : Suspended Particlate Matter

a) Application of Clean Coal Technology

- Fluid bed combustion technology

Because fluid bed combustion allows the effective combustion even of low quality coal and desulphurization in the furnace, no fuel gas desulphurization plant is needed and the combustion temperature is low at 800-900 ℃ so that NOx generation is very low. Further, pressurized fluidized bed combustion leads to a heat efficiency of 42-43% by the combined cycle. It is thus, necessary to consider the introduction of these technologies in the future.

- Installation of fuel gas desulphurization apparatuses

Although the wet lime gypsum method generally used in Japan ensures a fuel gas

desulphurization rate of more than 95%, equipment and running costs are both high. Thus, the semi dry type simple desulphurization method may be more suitable for Indonesia although its desulphurization rate is low at 80%.

4) Energy Saving Measures

Energy saving measures are implemented in all sectors consuming energy such as electric power sector, manufacturing sector and transportation sector, etc. For the final year of Repelita 6, a 15% reduction with respect to the actual result of 1993 has been set as the energy saving objective. As energy saving measures in the electric power sector, modification of equipment, improvement of equipment and improvement of operation field, for example, relating to maintenance can be considered. Because the developing countries often continue long-time operation without maintenance, sufficient equipment performance cannot be achieved. Thus, improvement in operating efficiency should be achieved by expanding maintenance in the future.

Table 7-10 Energy Saving Objective Values

(%)

	1994/95	1995/96	1996/97	1997/98	1998/99
Industry	1.25	2.50	4.00	11.75	17.00
Transportation	0.75	1.75	4.25	9.25	14.00
Household/Commercial	0.25	0.75	2.00	7.50	12.50

Source : Repelita 6
Reduction rate with energy effectiveness in 1993 as 100

When new power plants are planned, heat efficiency, environmental protection and investment costs should be given full consideration.

Although distribution and transmission power losses can be eliminated with high voltage transmission, this problem should be fully considered in conjunction with economic factors because of the large equipment investments that are needed. Because there is no sufficient data on power stealing, is one of the causes of power loss, details are not clear. In the future, it will be necessary to perfect the administrative and data monitoring procedures.

Table 7-11 Power Generation Efficiency of Coal-fired Power Equipment

	Current Efficiency	Future Efficiency
Coal	Supercritical Coal-fired 39%	Ultra Supercritical Pressure 42 ~ 44% Pressurized Fluid Bed 42 ~ 44% Coal Gasification Combined Cycle 46 ~ 48% Solid Oxide Fuel Cell more than 50%

Source : NEDO Report 1993

7-3 Cement Industry

The next most important large-scale user of coal after the power sector is the cement industry. Its coal consumption in 1994 stood at 3.5 million tons to produce 21.9 million tons of cement. Cement output exceeded the national demand for coal until 1994. Since 1994, however, cement had to be imported to meet the rising demand for the basic infrastructure construction projects such as power plants, roads, and ports, associated with the country's economic growth.

Table 7-12 Cement Factory Production Capacity

(Million tons)

	1989	1990	1991	1992	1993	1994
Cement Production	14.1	15.8	16.2	17.3	18.9	21.9
Domestic Cement Demand	11.4	13.8	15.5	15.8	17.8	21.5

Source : DOC

Currently, there are 10 cement factories in Indonesia, five of which are national organizations and two are partly backed by national capital. Table 7-13 shows cement production capacity in 1995, total is 23 million tons. It is estimated that existing facilities will be extended in the future.

Table 7-13 New Cement Factory Construction and Expansion Projects

(Thousand tons)

Name of Company	Location	Production Capacity	1995	1996	1997	1998
Expansion Project :						
1 PT Semen Padang	W.Sumatra	3,270	-	-	-	2,300
2 PT Semen Gresik	E.Java	4,100	-	-	2,300	-
					(-500)	
3 PT Semen Tonasa	S.Sulawesi	1,200	-	2,300	-	-
4 PT Semen Baturaja	S.Sumatra	500	-	-	-	600
5 PT Semen Kupang	NTT	120	-	-	-	-
6 PT Semen Cibinong	W.Java	3,000	-	-	-	-
7 PT Indocement	W.Java	9,200	600	600	1,800	-
8 PT Semen Andalas	Ache	1,000	-	-	-	-
9 PT Semen Nusantara	C.Java	1,000	550	-	2,600	-
Sub-Total		23,390	1,150	2,900	6,200	5,200
New Plants :						
1 PT Indo Kodeco	S.Kalimantan		-	-	2,400	-
2 PT Semen Bosowa	S.Sulawesi		-	-	-	1,500
3 PT Semen Gombong	C.Java		-	-	-	1,500
4 PT Bintang Semen			-	-	-	600
5 PT Semen Dwima	E.Java		-	-	-	1,500
小 計			0	0	2,400	5,100
合 計		23,390	1,150	2,900	8,600	10,300

Note: PT Semen Gresik will expand 2,300,000 tons and stop wet process kiln (500,000) in 1997.

Although oil was used as a fuel for cement production before 1970, the transition from oil to coal has been implemented since the Oil Crisis so that all the cement factories are using coal now.

The forecasts for cement production until 1998 based on Table 7-13 assume that plant availability will normally be 90%, seeing that the cement plants were run at 94% of their capacity in 1994. The estimates for plants that have been extended or newly built are based on the assumption that they are operated at 60% of capacity for the first year, at 80% in the second year, and at 90% in the third year and thereafter. The scale of production is bound to increase as demand will inevitably rise with the development of the country's infrastructure and in parallel with the rate of economic growth. Consequently, cement production is estimated to maintain an average growth rate of 16% a year from 1994 through 1998, rising from 22 million tons to 38 million tons.

Table 7-14 Cement Output Forecast until 1998

(Thousand tons)

Year	Existing Production	Expansion & New Plants	Total
1994	0.94 x 23,390		21,900
1995	21,900	690	22,590
1996	21,900	2,660	24,560
1997	21,900	8,515	30,415
1998	21,900	16,705	38,605

The cement output forecasts for the period after 1998 have been calculated on the basis of the relationship that exists between the gross national per capita product and the cement consumption in the main Asian countries given in Figure 7-7 (Korea, Thailand, Indonesia, Philippines, and Malaysia). The forecasts have been made on the hypothesis that the entire national cement output will be consumed nationally and that there will no cement exports or imports.

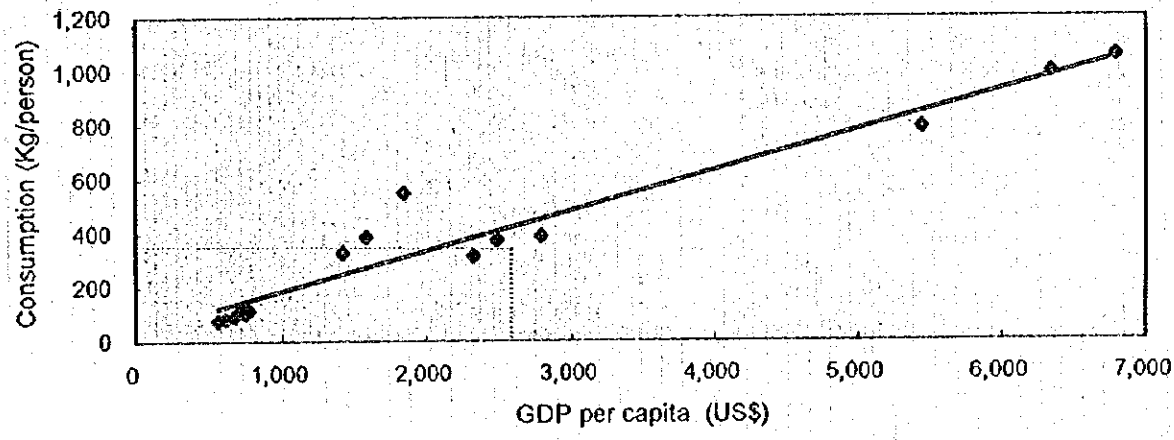


Figure 7-7 GDP per Capita and Cement Consumption

Table 7-15 Forecast Per Capital Cement Consumption

	1993	1998/99	2003/04	2008/09	2013/14	2018/19	2020/21
Population(Million)	189.1	204.4	219.4	233.6	246.5	258.1	262.6
Per capital GNP (US $)	676	775	995	1,317	1,816	2,631	3,000
Cement consumption (kg/person)	100	185	186	234	308	429	484

As a result, an average annual growth rate of 6.0% will be maintained from 1998 through to 2020 and cement output can be estimated to reach 38.6 million tons in 1998, 40.9 million tons in 2003, 54.7 million tons in 2008, and 127.1 million tons in the year 2020.

Table 7-16 Cement Output Forecast until 2020

(Million tons)

	Cement Output	Coal Consumption
1995	22.6	3.2
1996	24.6	3.4
1997	30.4	4.3
1998	38.6	5.4
2003	40.9	5.7
2008	54.7	7.7
2013	76.0	11.6
2018	110.8	15.5
2020	127.1	17.8

Note: Coal consumption is based on the assumption that 0.14 tons of coal are required to produce 1 ton of cement.

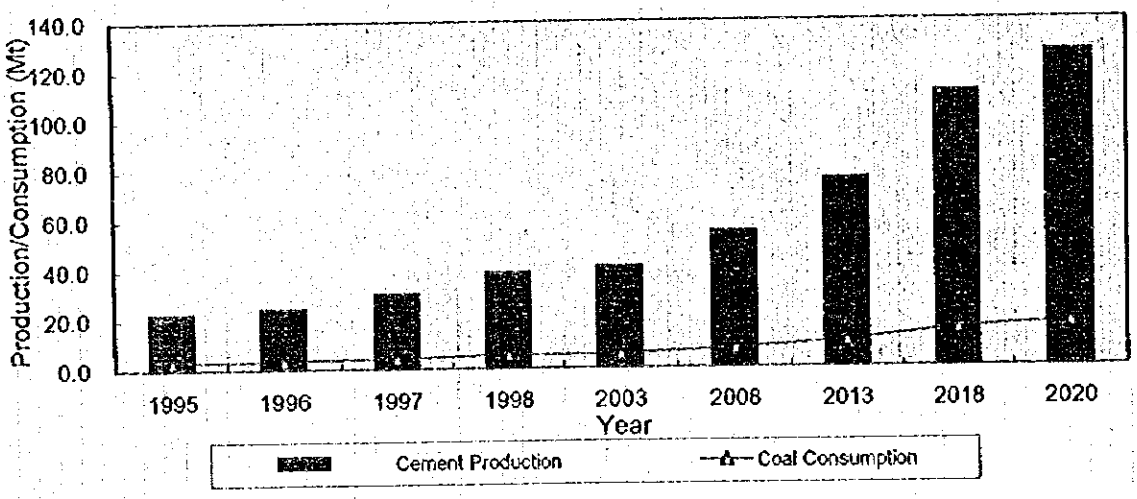


Figure 7-8 Projected Cement Production

Coal consumption has been estimated on the basis that the heat value of clinker in dry kilns is 900kcal/kg of clinker and that the heat value of the coal used is 6,300 kcal/kg, with the level of coal consumption being 140 kg per ton of cement. On this basis, it is estimated that coal consumption will reach 17.8 million tons for the production of the 127.1 million tons of cement estimated as the cement output for the year 2020.

7-4 Other Industries

Other industries prominent in Indonesia include paper and pulp, steel, food, brick, tile, and ceramic. These industries consume 450,000 tons of coal annually.

As the paper and pulp industry consumes a large amount of electric power, coal has been prevalent as the fuel for self-generation boilers. In this case, wood scrap, bark, sludge, etc., produced as waste materials, are mixed with coal and burned in stoker boilers. To improve energy efficiency, fluidized bed boilers are also considered.

Steel making industry, mainly PCI is also introducing coal.

The brick, tile and ceramic industries are small in their factory scale, with wood blocks and oil used as fuel. However, they are positioned as consumers of briquettes.

7-5 Household Use

Household use is divided into lighting and heating. For lighting, electric power, lamp and other oils (palm oil, coconut oil, candles) are used as fuel and for heating, kerosene, LPG, wood, and other commercial energies are consumed. 75% of the energy consumed as heating fuel, particularly in local regions, is wood leading to the rapid destruction of the tropical forests due to reckless deforestation. To cope with this serious problem, the Presidential Order of 1993 called for the use of coal briquettes. This measure has the following four objectives. Currently, research on and the introduction of, briquettes are in progress.

* Use of wood blocks and kerosene as substitute energy (to prevent deforestation and reduce imports of oil due to reduction of use amount of kerosene)
* Effective use of low quality coal
* Creation of employment opportunities
* Reduction of subsidy relating to kerosene

In Indonesia, in particular, low quality coal not suitable for export accounts for 85% of coal reserves, it is of great interest to monitor the introduction of briquettes.

In 1993, briquettes were supplied to a village in Central Java without charge for a market research study. As a result, the amount of kerosene and wood used decreased and at the same time, fuel costs per family also decreased. 50% families continued to use briquettes after this research. As a result, the Directorate of Coal, Ministry of Mines and Energy constructed a briquette production plant capable of producing 3,000 tons of briquette annually in Tanjung Enim, PTBA in 1993 as a promotion measure.

Table 7-17 Construction Plan and Production Capacity for Briquette

Region	Number
Java	28
West Java	18
Central Java	2
East Java	8
Sumatra	5
Kalimantan	8
Sulawesi	6
Total	47

Capacity(Thou.tons)	Number of Company
1 - 10	21
10 - 100	14
100 - 1,000	6
Total	41

Source : DOC

Furthermore, the 10,000 ton capacity NEDO plant has started demonstration operation in 1996 and after this Gresik in East Java is planning to build a 120,000 ton/year capacity plant. In addition, there are plans for the construction of briquette factories in 47 other locations, with the Directorate General of Mines having received applications for registration from a total of 41 companies.

The Directorate of Coal, Ministry of Mines and Energy has made its forecast for future briquette output. As shown in Table 7-18, it is estimated that briquette output will reach 0.5 million tons in 1988/99, 1.0 million tons in 2000, and 5.0 million tons in 2008/09.

Table 7-18 Forecast of Briquette Production by DOC

(Million tons)

	1998/99	2003/04	2008/09
Briquette Production	0.5	2.5	5.0
Coal Consumption	1.0	4.5	9.0

Source : DOC

Production from and after 2008/09 has been estimated from the forecast production growth rate of Figure 7-9. On the hypothesis that this growth rate will be 7% in the period 2008/09 - 2013/14, 4% from 2013/14 - 2018/19, and 3% from 2018/19 - 2020/21, it can be estimated that briquette output will reach 7.0 million tons in 2013/14, 8.5 million tons in 2018/19 and 9.0 million tons in 2020/21.

Coal consumption is estimated to reach 12.6 million tons , 15.3 million tons , and 16.2 million tons, respectively, for the above fiscal years.

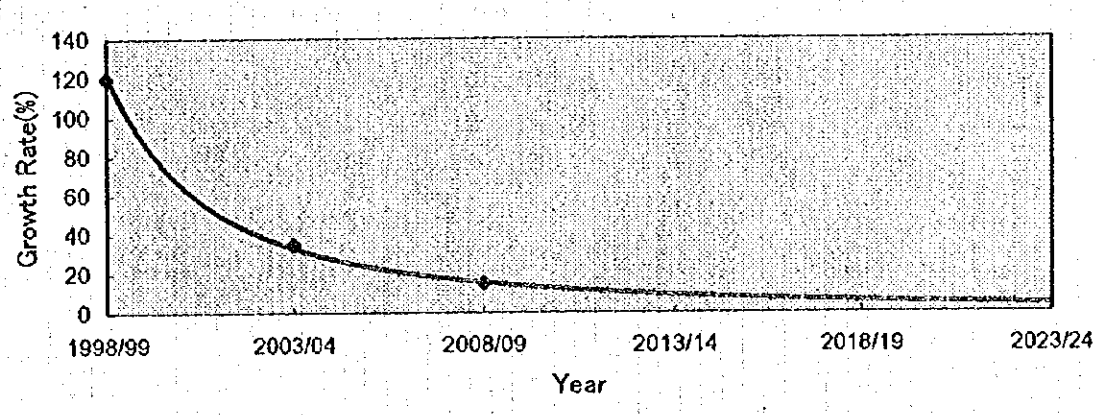


Figure 7-9 Growth Rate of Briquette Production

Table 7-19 Forecast of Briquette Production until 2020

(Million tons)

	1998/99	2003/04	2008/09	2013/14	2018/19	2020/21
Briquette Production	0.5	2.5	5.0	7.0	8.5	9.0
Coal Consumption	1.0	4.5	9.0	12.6	15.3	16.2

To assure the future full-scale use of briquettes, some economic problems remain, so that steady promotion activities as well as improvements in quality and reduction in costs are necessary to foster the transition from kerosene and wood to briquettes.

7-6 Coal Transportation

Coal production in Indonesia is limited practically exclusively to the islands of Kalimantan and Sumatra. The distributive flow of coal is mainly directed at the domestic users on Java and toward exports. At present, the coal loading ports have a total handling capacity of 44.6 million tons/year. Sumatra accounts for a share of 9 million tons (20%) and Kalimantan for 35.6 million tons (80%).

Coal from Sumatra, mainly the coal from Tanjung Enim, South Sumatra, is shipped for power generation to Suralaya Power Station in West Java. In connection with the future expansion of this power station, it is scheduled that the coal-handling port will also be expanded.

Kalimantan produces a high-quality coal that is internationally competitive, so that this coal will mainly be exported. For this reason, a large terminal is under construction to permit large vessels to enter the port. The result will be a major expansion in Kalimantan's maritime shipping capability.

The system in which coal is transported from the coal mine to the coal loading port differs substantially between Sumatra and Kalimantan. Whereas Sumatra relies primarily on truck and railway transportation, Kalimantan uses barges and trucks for its coal transport. At PT. Kaltim Prima Coal, coal is transported directly from the mine site to the coal-loading port by belt conveyor.

Table 7-20 Coal Loading Ports and Capacity

Port and Region	Operator	Start	Max. Vessel Size (DWT)	Throughput Capacity (Mt/y)	Stock Pile (Mt)	Loading Capacity (t/hr)
1 Tarahan S.Sumatra	PTBA	1988	Handy 40,000	5.5 (12.0)	0.12	4,500
2 Teluk Bayur W.Sumatra	PTBA	1991	Handy 35,000	2.5	0.09	1,000
3 Tanjung Bara E.Kalimantan	Kaltim Prima	1991	Cape 180,000	10.0 (12.0)	0.50	4,700
4 Tanah Merah E.Kalimantan	Kideco Jaya	1992	Panamax 60,000	2.6	0.26	1,500
5 N Pulau Laut S.Kalimantan	Arutmin	1994	Cape 150,000	10.0	0.50	4,000
6 Balikpapan E.Kalimantan	DPP [1]	1994	Panamax 65,000	3.0 (5.0)	0.52	2,800
7 Pulau Laut	IBT [2]					
	Phase 1	(1997)	Panamax 60,000	(10.0)	(0.75)	(4,000)
	Phase 2	(1999)	Cape 200,000	(20.0)	(1.50)	
8 Pulau Baai Bengkulu	General Port	1985	Handy 35,000	1.0	0.40	500
Sub-total				34.6 (65.1)		
Self loading/crane E.S Kalimantan				10.0 (15.0)		
Total				44.6 (80.1)		

Source : DOC

Note : ( ) expansion program

[1] DPP : Dermaga Perkasa Pratama

[2] IBT : Indonesia Bulk Terminal

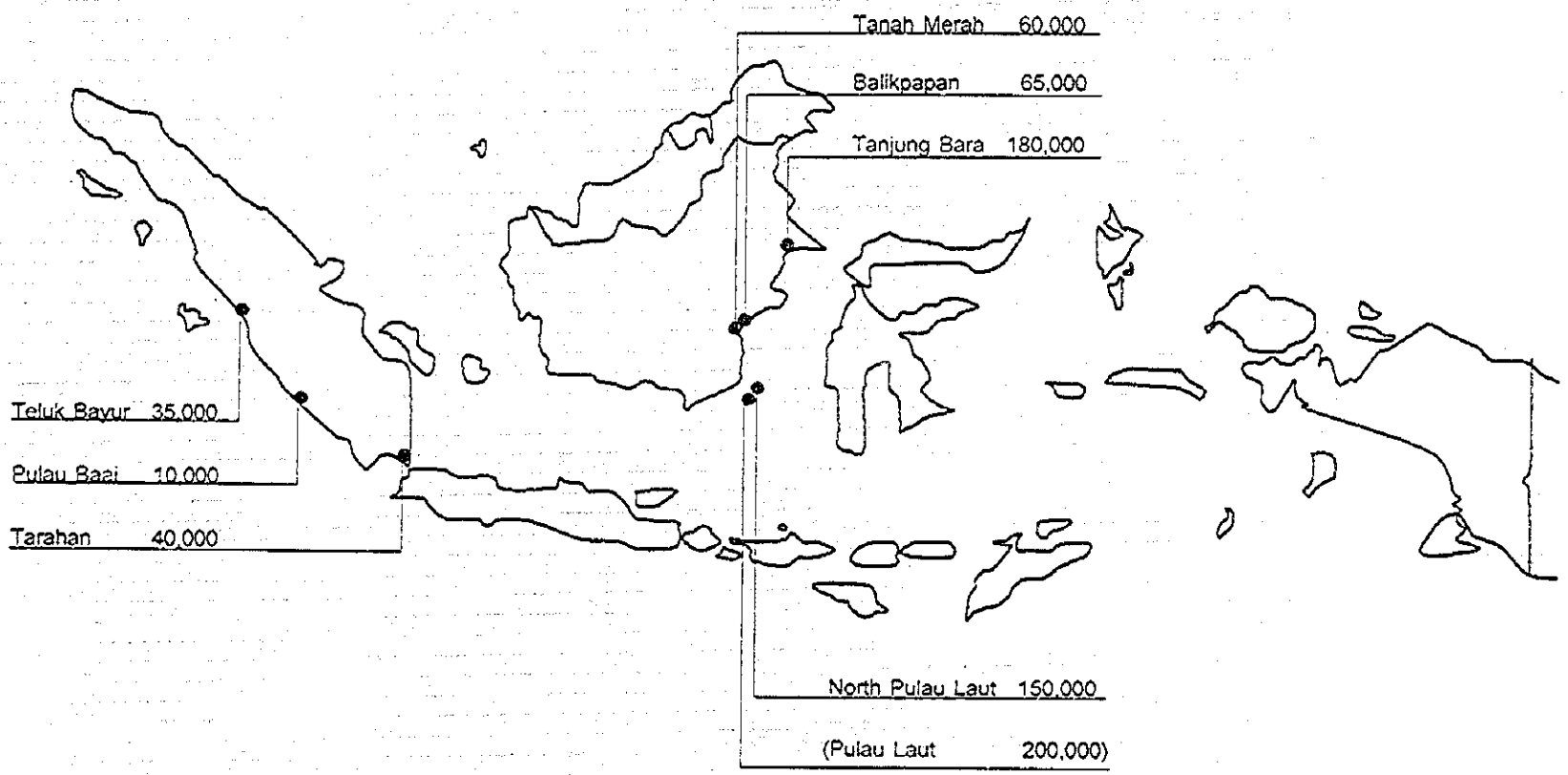


Figure 7-10 Coal Export Terminal

To meet the forecast increase in coal demand mainly for the country's coal-fired power stations it will be necessary to reinforce the inland barge fleet for coal transportation and use large barges as well as reinforce the land haulage capacity, expand the existing terminals and build large-scale shipping ports. It will also be necessary to provide unloading facilities capable of accepting large vessels at power stations.

At present, the expansion projects that are being planned are estimated to have a capacity of 80.1 million tons/year. It will be necessary to strengthen this transport capability still further to allow for the domestic demand forecast for the year 2020.

7-7 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 7-21 Forecast of Coal Demand in Indonesia

(Million tons)

	1993/94	1998/99	2003/04	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.

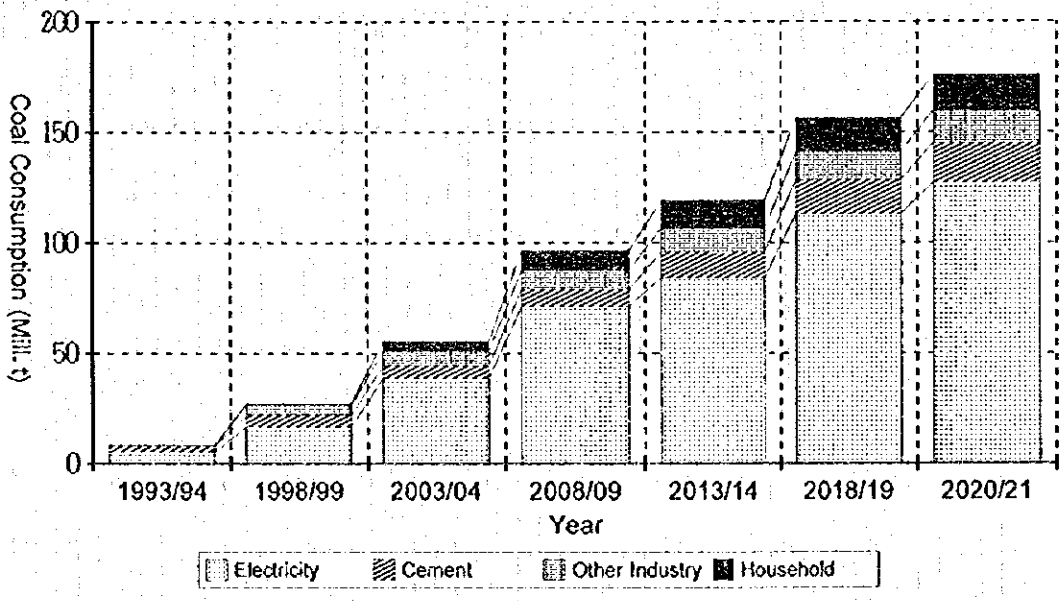


Figure 7-11 Estimation of Coal Demand

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

8. Study on Human Resources Development

The coal production in Indonesia has been made through the four different coal contract systems, such as State Owned Coal Mine Company (PTBA), Production Sharing Coal Contractors (CCOW), National Private Companies (KP) and Cooperatives (KUD). At present, coal mines conducting underground mining are the Ombilin mine of PTBA and 2 KP mines, i.e. PT Kitadin Corp. and PT Fajar Bumi Sakti.

The organization of coal mines changes depending on not only contract systems but also mining methods, such as open pit and underground mining, etc. In general, there is a tendency that the proportion of direct employees is bigger in underground coal mines and smaller in the open pit coal mines. Also the proportion of direct employees is rather higher with the historically old coal mines, such as PTBA and KP mines. While, in the CCOW mines which are carrying out the open pit mining, the proportion of sub-contractor is higher (57%).

The Ombilin mine of PTBA has been operating a own mining school and training high school graduates into supervisors. While, the PTBA's Tanjung Enim mine is conducting training by foreign experts from the sub-contractors or makers.
The coal mines of CCOW contractors, which are mostly consisting of the foreign coal companies with international level technology, are conducting technology transfer to the indigenous employees mainly on an own in-house training basis.
To the contrary, the national private companies are carrying out the technology transfer through the Taiwanese or Japanese experts.
Most of Cooperatives are scarcely carrying out training and operation by outside engineers or sub-contractors.

The production, manpower, and productivity of each coal company by contract type are summarized in Table 8-1.

Table 8-1 Present Manpower Constitution of Coal Mines in Indonesia

Kind of Contract	Name of Coal Mine	Production in 1995	Mining Method	Manpower Constituents Direct	Contract	Total	Productivity T/Man・Day(Shift)	Remarks
PTBA	Ombilin	1,175,002	U/G & O/P	1,442	366	1,808	2.17	300 Work'-D/Y
	Tanjung Enim	6,777,297	O/P	3,970	2,941	6,911	2.93	335 "
	Sub-total	7,952,299		5,412	3,307	8,719	2.76(0.80)	(330 Work'-D/Y)
CCOW	PT Allied Indo Coal	1,189,850	O/P	225	589	814	4.06(1.51)	360 Work'-D/Y
	PT Arutmin Indonesia	5,355,252	O/P	1,170	1,067	2,237	6.65(2.07)	360 "
	PT Kaltim Prima Coal	10,208,219	O/P	2,211	2,717	4,928	5.75(2.37)	360 "
	PT Multi Harapan Utama	1,974,210	O/P	212	754	966	6.70(1.98)	305 "
	PT Tanito Harum	1,107,474	O/P	406	472	878	3.94(1.45)	320 "
	PT Adaro Indonesia	5,553,146	O/P	370	828	1,198	12.88(4.82)	360 "
	PT Kideco Jaya Agung	2,500,425	O/P	850	594	1,444	4.81(2.17)	360 "
	PT Berau Coal	665,889	O/P	223	275	498	3.71(0.99)	360 "
	PT Kindilo Coal	1,021,850	O/P	75	178	253	11.22(3.27)	360 "
	PT Indominco	-		60	189	249		
	Sub-total	29,576,315		5,802	7,663	13,465	6.30(2.29)	(355 Work'-D/Y)
KP Mines	PT Bukit Baiduri Ent.	749,813	O/P	415	399	814	3.07(0.67)	300 Work'-D/Y
	PT Fajar Bumi Sakti	585,447	U/G	760	798	1,558	1.25(0.68)	300 Work'-D/Y;96/2
	PT Kitadin Corporation	718,238	U/G & O/P	2,391	270	2,661	0.98(0.20)	275 Work'-D/Y;96/2
	PT Bukit Sunur	796,060	O/P	159	337	496	5.35(0.97)	275 Work'-D/Y;96/2
	PT Danau Mas Hitam	670,006	O/P	115	125	240	9.30	300
	PT Bukit Bara Utama	76,866		68	69	137	1.95	300 Work'-D/Y
	PT Karbindo Abesyapradhi	365,600		165	172	337	3.56	300 "
	Others	260,242						
	Sub-total	4,222,272		4,073+	2,170+	6,243+	1.90(0.63)	(288 Work'-D/Y)
KUD Mines	Usaha Karya Cempaka	42,836	O/P	180	0	180	1.94(0.38)	275 Work'-D/Y
	Bersama	58,271	O/P?	39	0	39	4.98(1.95)	300 Work'-D/Y
	Maduratna	51,871	O/P&U/G	68	0	68	4.01(0.70)	300 Work'-D/Y
	Bina Bersama	19,462	U/G?	30	0	30	2.36(0.19)	275 Work'-D/Y
	Makmur	21,297		?	?	?	-	No report
	Karya Murni &others	5,263		?	?	?	-	"
	Sub-total	229,091		317+	0	317+	2.18(0.81)	(292 Work'-D/Y)
	Total	41,979,977		15,604+	13,140+	28,744+		

Remarks: 1) Coal production: From Coal Production Table in 1995 by DOC; 2) Productivity in parenthesis on a t/man・shift basis was taken fromProductivity of Indonesian Coal Mines (1993-1994); 3) Manpower was taken from Historical Manpower in Coal Mining Indonesia (1985-1995).

8-1 Present Situation of Manpower and Organization of Coal Mines

8-1-1 Government Own Coal Company (PTBA)

The PTBA is a subsidiary of the government and owns two major coal mines, i.e. the Ombilin mine in the central west Sumatra and the Tanjung Enim mine in the central south Sumatra. The main office of PTBA is in Tanjung Enim where the Air Laya open pit and its satellite mines have produced about 6.8 million tons of sub-bituminous coal with an average heating value of 5,300 Kcal/kg in 1995 to supply fuel coal for PLN's Suralaya coal-fired thermal power plant through the Tarahan coal terminal. Another mine is in Sawahlunto city, and in 1995, it has produced about 1.2 million tons of bituminous coal with high heating value ranging from 6,500 to 7,500 Kcal/kg. The organization of the company is shown in Figure 8-1.

According to the study conducted in 1991 by JATEC, a total of 1,876 manpower, consisting of 366 staff and 1,510 workers, was recognized in the Ombilin mine for its annual production of about 0.65 million tons in 1990. The manpower was increased to 2,375 in 1993. The organization chart of the Ombilin mine is shown in Figure 8-2.

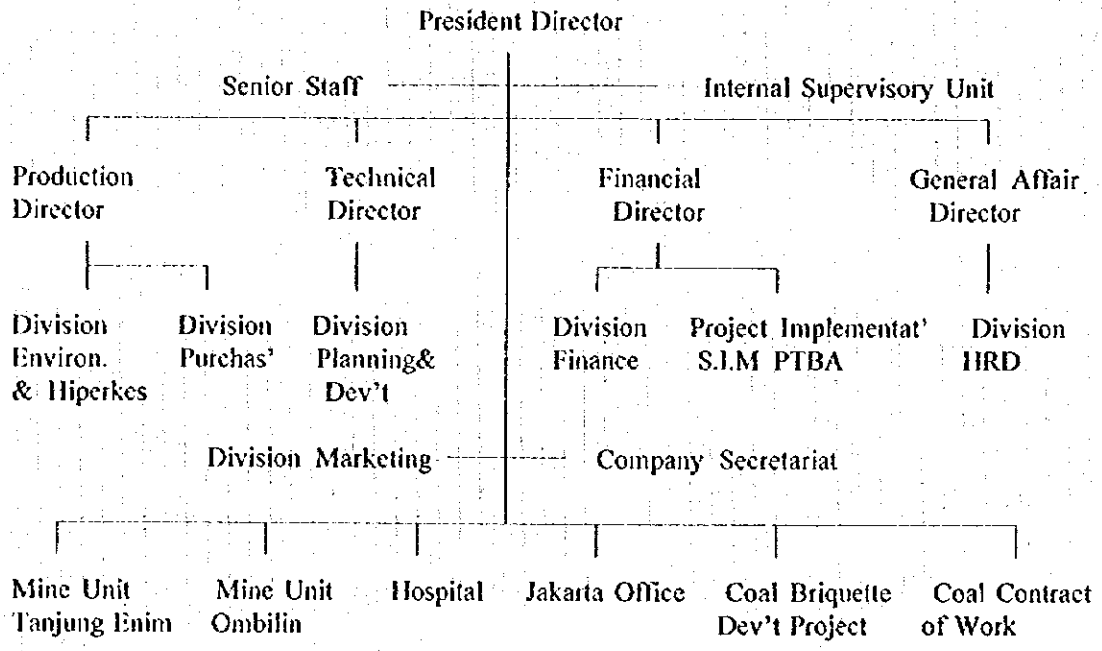


Figure 8-1 Organization Chart of the PT Bukit Asam (Main Office)

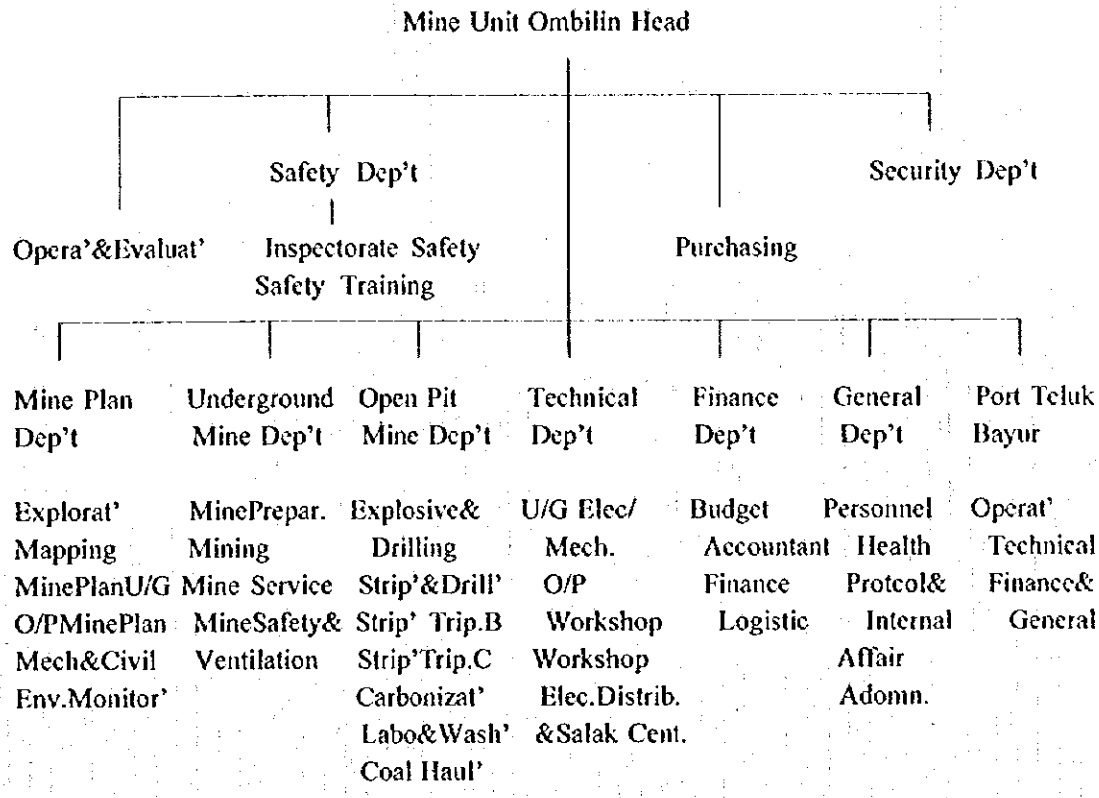


Figure 8-2 Organization Chart of the PTBA Ombilin Mine

The manpower of the Tanjung Enim mine is recorded as 3,753 in 1993 and has reached to 8,719 including 2,941 of sub-contractor's in 1995 according to the statistic data by Directorate of Mining and Engineering. A detail break down of manpower in PTBA is shown in Table 8-1. Organization chart of the Tanjung Enim mine is shown in Figure 8-3.

The ratio of direct manpower to the total manpower is 68% with the PTBA, 80% with the Ombilin mine and 57% with the Tanjung Enim mine, respectively.

In the Ombilin mine, there is an own mining school, the Lembaga Pendidikan Dan Pelatihan Tambang (LPPT), locating between the office and the mine site. The details of the school will be described in the following chapter. Actually this school was restored in 1992 by changing the name from Sekolah Teknik Tambang Menengah (STTM) to LPPT and the total courses from 4 years to 2 years without changing the total curricula. The main purpose of this school is to supply supervisor class manpower to the mine. Therefore, the students from high school,

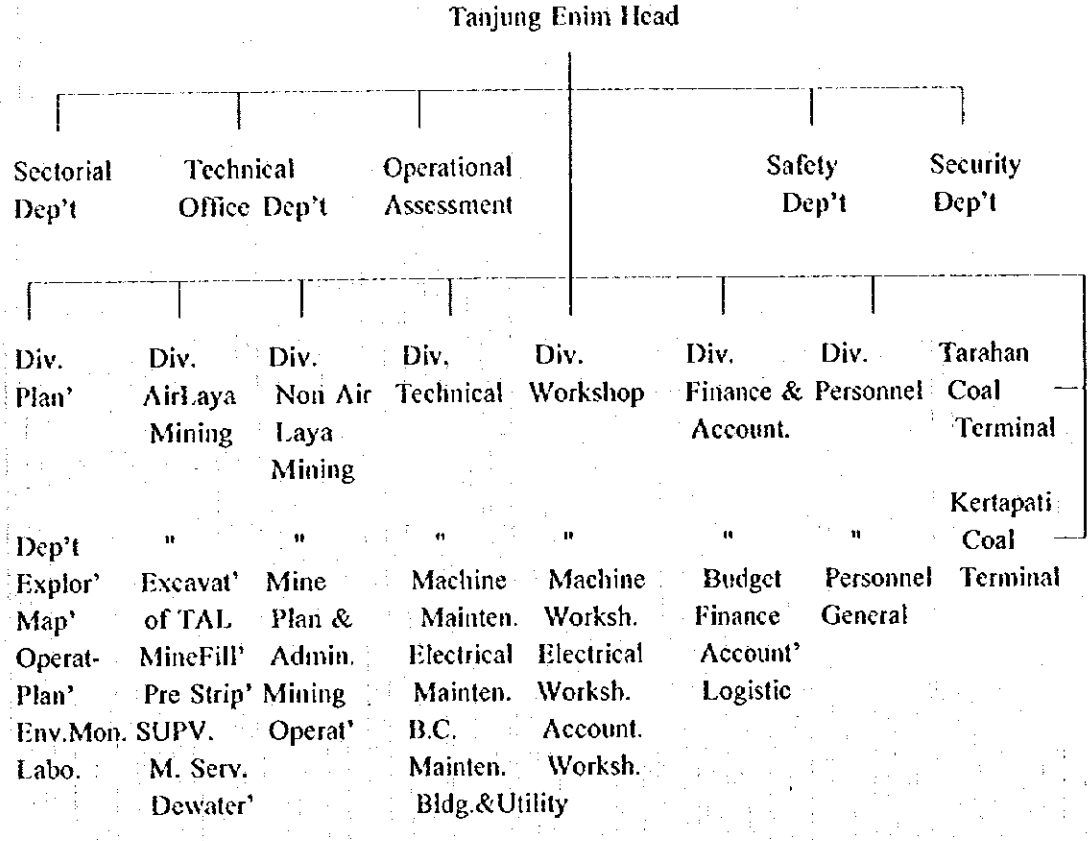


Figure 8-3 Organization Chart of the PTBA Tanjung Enim Mine

technical school and selected company employees are given free tuition, food and accommodation but in return they have a duty to work in the mine for at least 5 years.

This school is to change ownership from PTBA to DGM in 1995 because the Ombilin mine has to make its restructuring in order to respond to the government's policy on privatization and also has enough manpower for its operation. Since the decision by the DGM, the school stopped recruiting so that it has only one class remaining at present. During a 2 year moratorium, the government has to decide its course of action whether it should belong to the Manpower Development Center for Mines (MDCM), which is a training center for manpower development in mining industry and belonging to the DGM directly, or not.

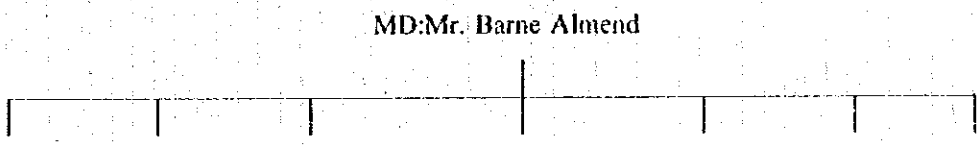
8-1-2 Production Sharing Companies (CCOW Coal Mines)

Almost all companies belonging to the first generation are operating under the open pit mining system except the PT Tanito Harum, in which the Sukadadi mine is producing coal from underground in negligibly minor amount and the company is expecting to develop new underground coal mines in future..

A total of 13,465 manpower is recorded by DOC in June, 1995, in which 5,802 (43%) are direct employees and 7,663 (57%) are indirect employees. The high percentage for indirect employees is caused by open pit mining system.

As mentioned above, the training of manpower in open pit mines is usually conducted by makers or contractors. The PT Kaltim Prima Coal (KPC) has, however, its own training facility in the mine site for training the staff and the other workers by its own systematic training system. A brief organization chart of the KPC obtained at the visit is shown in Figure 8-4.

As shown in Table 8-1, the manpower of the KPC consists of about 2,200 direct employees and about 2,700 indirect employees from the 45 contractors. The details of direct employees are composed of 1 general manager, 7 managers, 38 superintendents, 200+ supervisors and about 2,130 workers.



GM: New Mine Dev't	GM: Mining Div.	GM: Process' Div. Port/Coal Chain/ Power St./Ship Load'	GM: Human Resources Div.	GM: Commercial Section	GM: Market' Div.	GM: General affairs (Jakarta)
Mr. Ray Dchwschel	Mr.Peter Marshall	Mr.Irawan Poerwd	Mr.Howard Russell	Mr.Kinil Mitchel	Mr.Ross Tromans	Mr.BP Hadi

Remarks: MD - 1; GM - 7; MGR - 24; SUPI - 38; SUPV - 200+; WH - 2,130; Total Direct -2,200+; Indirect - 2,700/ 45 Contractors; Manpower Grand Total - 4,900+

Figure 8-4 Organization Chart of the PT Kaltim Prima Coal

8-1-3 National Coal Companies (KP Mines)

A total of approximately 4.2 million tons of coal was produced by the KP mines in 1995 (Table 8-1). A total of 6,243 manpower is recorded for 4 companies, namely PT Bukit Baiduri Ent., PT Fajar Bumi Sakti, PT Kitadin Corporation, PT Bukit Sunur, PT Danau Mas Hitam, PT Bukit Bara Utama and PT Karbindo Abesyapradhi, in which 4,073 employees are direct and 2,170 are indirect.

The ratio of direct employees to the total of the present major operating companies is about 65% in average. The ratio of the direct employees of the underground mines ranges from 49% of PT Fajar Bumi Sakti to 90% of PT Kitadin Corporation, and that of the open pit mines ranges from 51% of PT Bukit Baiduri Enterprise and 32% of PT Bukit Sunur.

As an example of the underground mine, the organization chart of PT Fajar Bumi Sakti in 1995 is shown in Figures 8-5a, 8-5b and 8-5c.

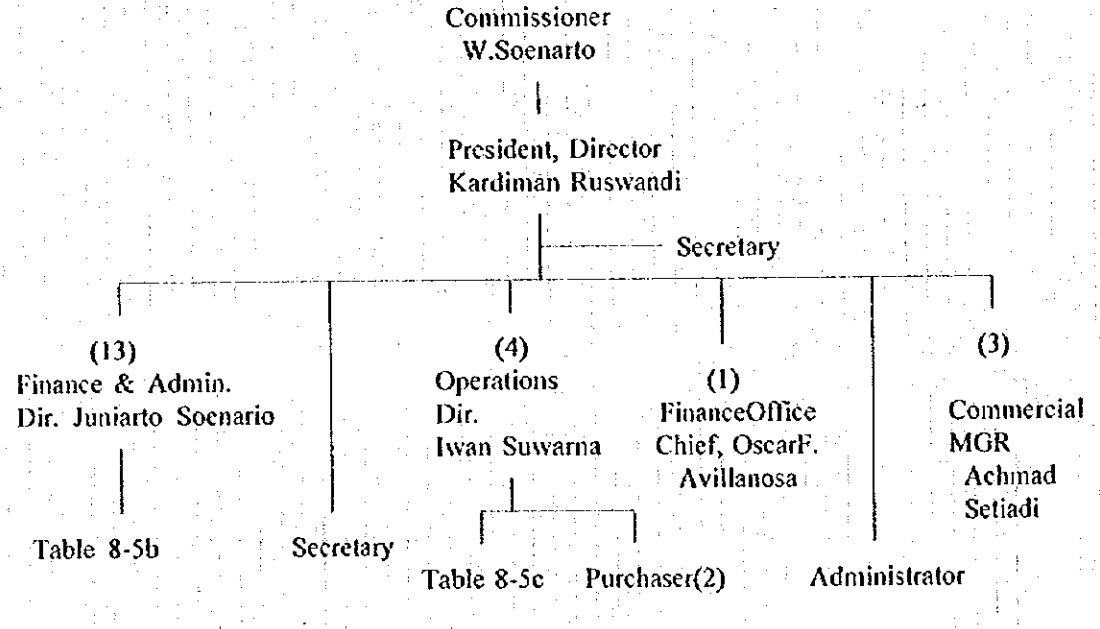


Figure 8-5a Organization Chart of the PT Fajar Bumi Sakti (Main Office)

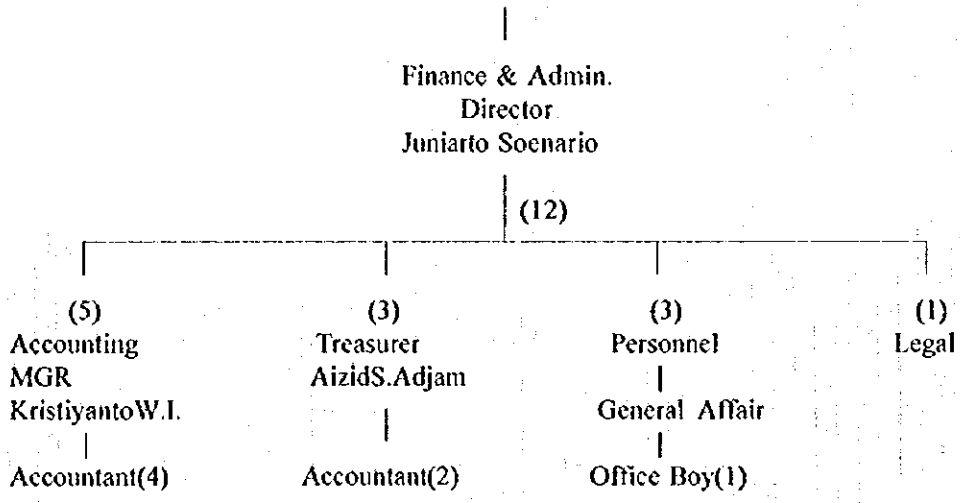


Figure 8-5b Organization Chart of the PT Fajar Bumi Sakti (Finance & Admin.)

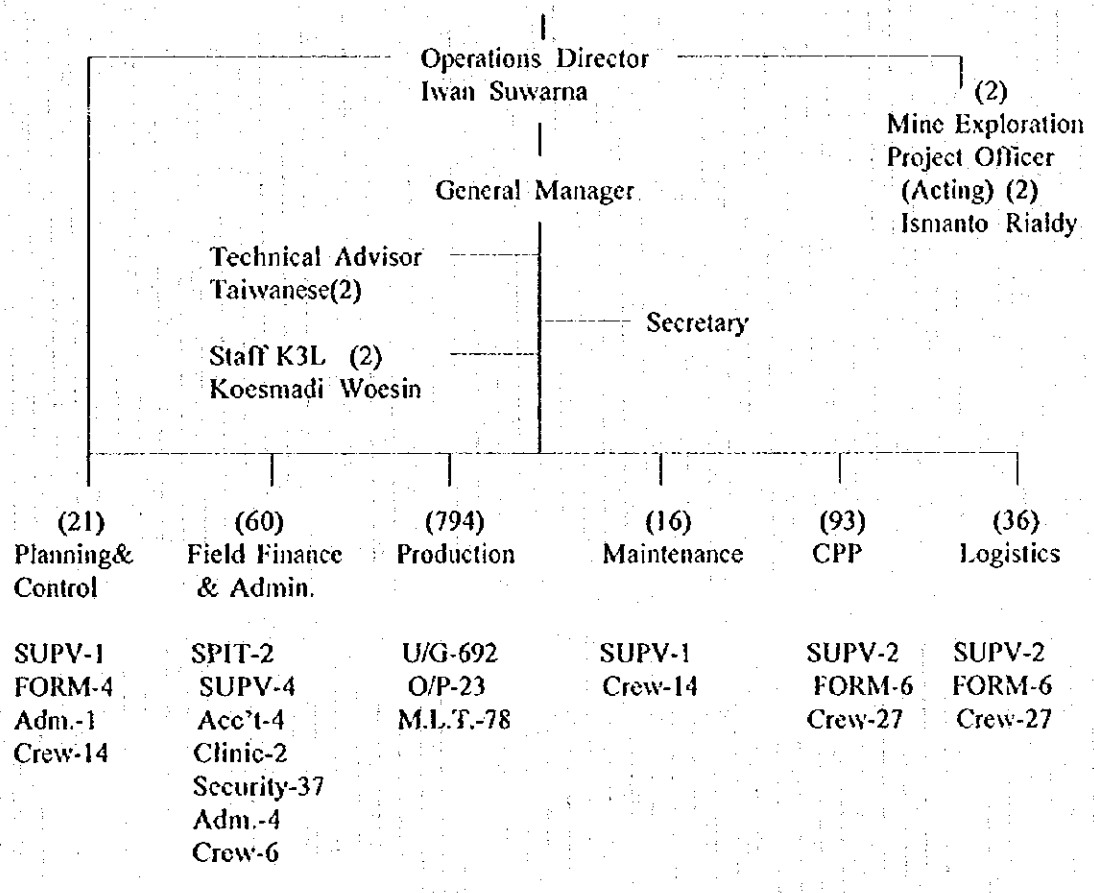


Figure 8-5c Organization Chart of the PT Fajar Bumi Sakti (Mine Site)

8-1-4 Cooperatives (KUD Mines)

The total production from 7 KUD mines was 229,091 tons in 1995 as shown in Table 8-1. The total manpower of four mines reported to the DOC was 317. The share in production and manpower of the KUD mines to those of whole mines is only about 1%.

According to the hearing from two KUD mines, i.e. Maduratna and Usaha Karya mines, each cooperative has about 1,300 of manpower for whole business, such as mini market, rice mill, fertilizer preparation and coal mining, etc. Among them, about 250 persons including 70 direct employees are working for coal mining.

8-2 Current Technical Level of Each Coal Producers

Generally speaking, Indonesian peoples are optimistic. Especially the worker level like easy going ways.

Management class staffs are well educated including overseas experience. However experience in the operation site is limited. So many companies employ expatriate staffs for the mine management. Most of the feasibility studies are prepared by foreign consultants. This mean that the training will be required not only for technology but also management.

Followings are the quality of the manpower by each coal related organizations.

1) Government

Education level of the government staffs are high enough. Many staffs have a experience of overseas training. Inspectors of Jakarta office have a knowledge and experience of underground mine, however inspectors of regional office don't have enough knowledge and experience. In order to control the increasing coal production, training for the government people will be required as well.

2) PTBA

Tanjung Enim mine is utilizing the Bucket Wheel Excavator for open cut mining. Quality of the staffs are adequate. It is desired for staffs to improve the planning skill and management skill.

3) CCOW

Most of the open cut mines are planned and developed with the assistance of expatriate. These technologies are under the process of transition to local engineers. It is estimated that many coal mines to be developed will use the expatriate assistance.

Regarding the underground technology, quality of the engineers are unknown condition. CCOW will take the major portion of the underground production, and expatriate will transfer their technology to local engineers. However it is not sure that the background of their technology is suitable for Indonesian condition or not. Quality of local staffs is also unknown condition, but it is clear that the training program will be required for increasing manpower.

4) KP

Regarding the open cut mining, it is estimated that smaller equipment will be replaced with more bigger equipment. The training from equipment supplier will be important. It is necessary to study the environment protection technology and quality control technology.

The technical level of underground mines located near Mahakam river have been improving through the technical assistance of Taiwanese and Japanese engineers. However quality of the technical level must be improved. For example, it is necessary to train about the survey technology, maintenance and operation technology of the equipment, operation control technology, safety management technology, ventilation technology, electric technology, quality control technology and cost management skill.

5) KUD

Surveying technology and mine planning skills are not good enough and these are the reason of uncontrolled mining. Technology for the quality control is also not good enough at this moment.

Regarding the underground technology, they don't have enough experience so far. Quality of underground skill of the staffs are unknown. Compared with other coal production groups, financial background is not so strong enough to employ expatriate. It is difficult to apply the underground technology without proper training.

Technical level of each coal producers are summarized in Table 8-2.

Figure 8-2 Level of Skill (PTBA,CCOW,KP,KUD)

Item	PTBA			CCOW	KP Mines			KUD Mines		Total		
No of Mines	U/G	O/P	Total	O/P	U/G	O/P	Total	U/G ~ O/P	Total	U/G	O/P	Total
	1	1	2	9/11	2	5+	7+		6+	3	14+	25+
Production Scale (Mill. t)	1.17	6.78	7.95	0.7 ~ 10.2 (Tot.29.58)	0.6 ~ 0.7	0.1 ~ 0.7	4.22	0.01 ~ 0.06	0.23	1.10	40.88	41.98
Productivity (t/man · day)	2.17	2.93	(2.76)	3.71 ~ 12.88 (6.30)	1~ 1.25	2~ 5.4	(1.90)	1.9 ~ 4.98	(2.18)	1.0 ~ 2.17	2.0 ~ 12.88	1.0 ~ 12.88
Manpower:Direct	1,442	3,970	5,412	5,802	3,151	922	4,073	50+ 312+	362+	4,643	11,066	15,709
Sub-Cont.	366	2,941	3,307	7,663	798	1,372	2,170	- -	-	1,164	11,916	23,080
Total	1,808	6,911	8,719	13,465	3,949	2,294	6,243	50+ 312+	362+	5,807	22,982	28,789
Mining method	U/G	O/P			U/G	O/P		U/G	O/P			
Mining Equipment	SAS+DC (advanced)	BWE+BC (advanced)		Tr&Sh (advanced ~ conventional)	SM (conventional)	Tr&Sh (advanced ~ conventional)		Manual (adit mining)	Tr&Sh(poor planning)			
Level of Skill	need to improve	need to improve		need to improve for small mine	high turnover for skilled worker	need to improve		poor planning	poor pit operation			
In-company training	LPPT	Training system		Training system	mainly for unskilled worker			not available				
Type of occupation needed training	Survey, Cutting, op /maint. of Transportation system. Mining op. Safety, Vent. cont.& maint. of Electrical equipment.			Technical transfer by foreign experts	Training by manufacturer for Heavy Equipment. QC, Environmental Protection, Survey, maint. & op., Safety, vent. Electrical equipment.			Exploration, Pit design, QC				
Counter measures	Enforcement for LPPT and Training Exim Training System			Small mine supervisor ·training at training centre ·trainer for In-company training	supervisor ·training at training centre ·trainer for In-company training			supervisor ·training at training center ·trainer for In-company training				

Remark: O/P : Open Pit Mining
U/G : Underground Mining
Tr : Truck
Sh : Shovel
DC : Drum Shearer
BWE : Bucket Wheel Excavator
SM : Semi-mechanized
SAS : Self Advanced Support
op. : operation
maint. : maintenance
cont. : control
QC : Quality Control

8-3 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.

8-3-1 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.

The curriculum is composed of 8 semesters and some other special semesters.

Table 8-3 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.

New students take a common course, i.e. Curricula of the Department of Mining Engineering, consisting of Semester I of 18 credits and Semester II of 19 credits, in the first year and shift to the option courses from the second year. In the third year, a field study course of 2 weeks is included. At the end of the third year, students have to do a practical work for 5 weeks in the industry. In the fourth year, students have to carry out practical work for 3 months in the industry in addition to writing their Graduation Paper.

A total of 6 hours work per week, consisting of 2 hours lecture per week, 2 hours exercise per week and 2 hours preparation per week, is carried out for 2 credits. So one lecture is conducted 2 times per week.

Minimum of 144 credits have to be cleared for graduation (Maximum is 166). The graduate of the Department is awarded the S1 Degree (Degree for university graduates) but their jobs after graduate are unknown. The graduates not always aim to enter the mining company but also proceed to equipment sales or staff position in banks and conglomerates, etc.

The organization of the Faculty of Mineral Technology is shown in Figure 8-6.

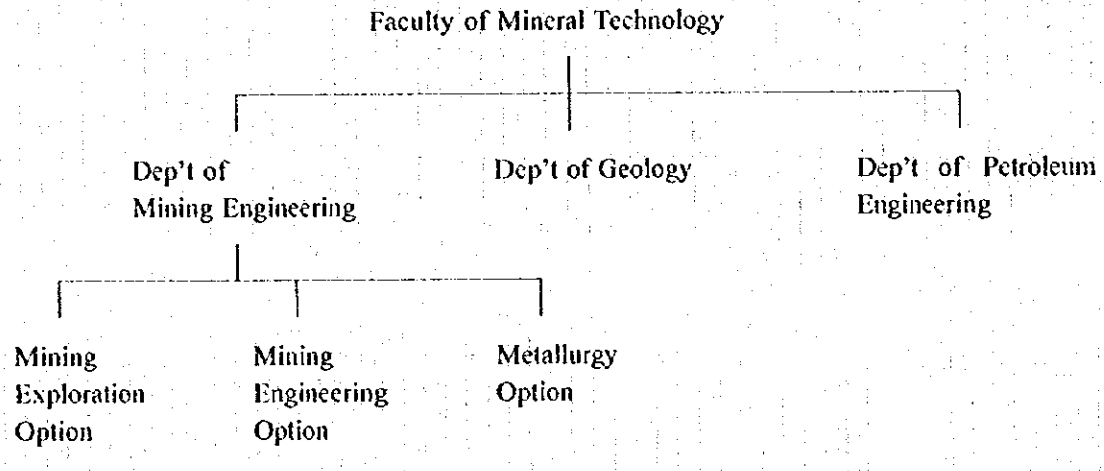


Figure 8-6 Organization Chart of the Faculty of Mineral Technology in the ITB

Also the relation between options and groups in the Department of Mining Engineering is shown in Figure 8-7. In the table, the main groups in each option and the name of teaching staff are listed.

Exploration Technology Group
Chairman : Ir. Munawar Siradj

Laboratory of Exploration Engineering
Head : Ir. Munawar Siradj

MINING ENGINEERING OPTION

Chairman : Dr.Ir. Made Astawa Rai

Mining Technology Group
Chairman : Ir. Soebedo Joesnadi

Laboratory of Mine Environment
Head : Prof.Dr.Ir. Ambyo Mangunwidjaja

Laboratory of Mine Surveying
Head : Ir. Soebedo Joesnadi

Studio of Mine Design and Experimental Mine
Head : Prof.Ir. Partanto Prodjosumarto

Coal Technology Group
Chairman : Prof.Dr.Ir. Ambyo Mangunwidjaja

Laboratory of Coal
Head : Dr.Ir. Rudy Sayoga Gautama

Geomechanics Group
Chairman : Ir. Moelhim Kartodharmo

Laboratory of Blasting Techniques
Head : Ir. Moelhim Kartodharmo

Laboratory of Rock Mechanics
Head : Dr.Ir. Made Astawa Rai

Laboratory of Mine Modelling
Head : Dr.Ir. Irwandy Arif, M.Sc.

Under Water Mining Group
Chairman : Prof.Ir. Partanto Prodjosumarto

Laboratory of Mining System
Head : Prof.Ir. Partanto Prodjosumarto

METALLURGY ENGINEERING OPTION

Chairman : Dr.Ir. Rizal Astrawinata

Mineral Processing Group
Chairman : Ir. Alwi Ibrahim

Laboratory of Mineral Processing
Head : Ir. Alwi Ibrahim

Chemical and Extractive Metallurgy Group
Chairman : Dr.Ir. Rizal Astrawinata

Laboratory of Pyrometallurgy
Head : Dr.Ir. Rizal Astrawinata

Laboratory of Hydrometallurgy
Head : Prof.Dr.Ir. Faraz Umar

Laboratory of Electrometallurgy and Corrosion
Head : Dr.Ir. Sunara Purwadaria

Physical Metallurgy Group
Chairman : Ir. Waspodo Martojo

Laboratory of Foundry Engineering
Head : Ir. Waspodo Martojo

Laboratory of Physical Metallurgy and Ceramics
Head : Dr. Ir. Syoni Soepriyanto

SERVICE LABORATORY AND STUDIO COMPUTATION

Laboratory of Ore, Mineral and Metal Analysis

Head : Dr.Ir. Sunara Purwadaria

Studio Computation

Head : Dr.Ir. Gatot Hari Priowirjanto
Dr.Ir. Rudy Sayoga Gautama
Dr.Ir. Arief Sudarsono

Figure 8-7 Relation between Options and Groups in the Department of Mining Engineering

The Department is giving advices to the other Universities, such as UPN "Veteran" in Yogyakarta (Sending teachers from the ITB), State University Sriwidjaja in Palembang (Supervising since 20 years ago to Mining Engineering Department) and new University Trisakti in Jakarta (Supervising Engineering Department since last year), etc.

As a reference of post-graduates from the university, the numbers of geologists, who are working for coal mines or enterprises related to coal and who have attended the "Training on Coal Exploration and Mining Development" held at MDCM in Bandung during Nov. 27 to Dec. 8, 1995, are noted in Table 8-2. Among 30 attendants, one was a graduate from the Australian University. A marked event is that there are 12 graduates from the "Veteran University" in Yogyakarta. Possibly this may be due to its special treatment of students. For example, the school gives a certain qualification for those finishing a three years special course. So the students could have a temporary absence from the school once and finish the credits for graduation after coming back to the school later. This system was, however, changed recently.

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. The training program for two years consists of two courses, i.e. a) Mining and b) Mining mechanical and electrical. The school was once closed in 1943.

After the end of World War II, the Dutch supervisors did not return to the Ombilin mine. So the lack of supervisors in the mine induced the resumption of the school by the Indonesian government as "Sekolah Teknik Tambang Menengah (STTM) in 1953. The programs and period of the study were as same as those of the previous school. This school was closed again in 1968 after fulfilling its initial purpose.

The increase in coal production in the 1980's led to the re-opening of the STTM again in 1988 after increasing its total training programs to three courses, such as a)

Mining, b) Mining mechanical and c) Mining electrical, for a total four year course. The school was included into the Ministry of Mines and Energy.

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.

As mentioned in the previous chapter, the school was transferred to the DGM from the PTBA last year with a two years' moratorium. So one class only remains now because no entrant was accepted last year.

The objective of the training in LPPT is to provide trainees with the knowledge and practical skills required for mining and engineering supervisors in the coal mining industry.

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.

The training entrants are a) high school graduates who mastered in physics, or b) technical high school graduates who mastered in mining, mechanical, electrical and civil engineering, or c) company employees below 30 who have been working for five years and are high school leavers, and d) Indonesian residents from all provinces.

At present, the total tuition for one trainee, which is computed at approximately Rp 6 million per year, is free and accommodation and food are also free. In addition PTBA gives a certain allowance to the students.

A total of 220 students has graduated among the 233 entrants by 1995 since 1991. At present one class of 40 students remain at the school.

Graduates are able to enter not only to PTBA but also the other coal contractors although the graduates have to work for more than five years in the company they joined. The entrants and graduates by 1995 are shown in APPENDIX VIII-II, Entrants and Graduates of LPPT, and the 220 graduates break down with 124 at the PTBA Tanjung Enim, 86 at PTBA Ombilin, 7 at Kideco Jaya Agung and 3 at PT Baradinamika, respectively.

The curricula employed at LPPT are shown in APPENDIX VIII-III by semester. The credits obtained for each semester are from 20 to 24. A total of 17 full time instructors, consisting of 2 mining, 6 mechanical, 4 electrical and 5 assistant, is nominated formally. In addition to the formal instructors, 2 part time instructors from the Ombilin mine are assigned.

The facilities are composed of a) two dormitory buildings with 56 rooms for 124 trainees, b) laboratories for mining science, mechanical, electrical and computer, c) meeting /audio visual rooms, d) underground training galleries in Ombilin mine, e) 4 class rooms and 1 drawing room, f) 5 office rooms, g) a library, and h) a workshop for mining, mechanical and electrical sections, etc. as shown in Appendix VIII- IV. The plan of the LPPT is shown in Figure 8-8.

Since the stop on the recruiting of new entrants in 1995, the facilities are also utilized for the training of the company's own employees from the open pit mine in order to provide skills for underground operations. As PTBA has no need for its own mining school, the DGM is looking for operators from outside, according to the privatization policy. At the moment, the MDCM is in charge of the management of LPPT during the moratorium.

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. The briefing of the training center project is as follows:

* The existing LPPT facilities including dormitory buildings will be used.
* The task of the center is to achieve national consistency in mines training of all employees including new comers to bring quality certification by raising their

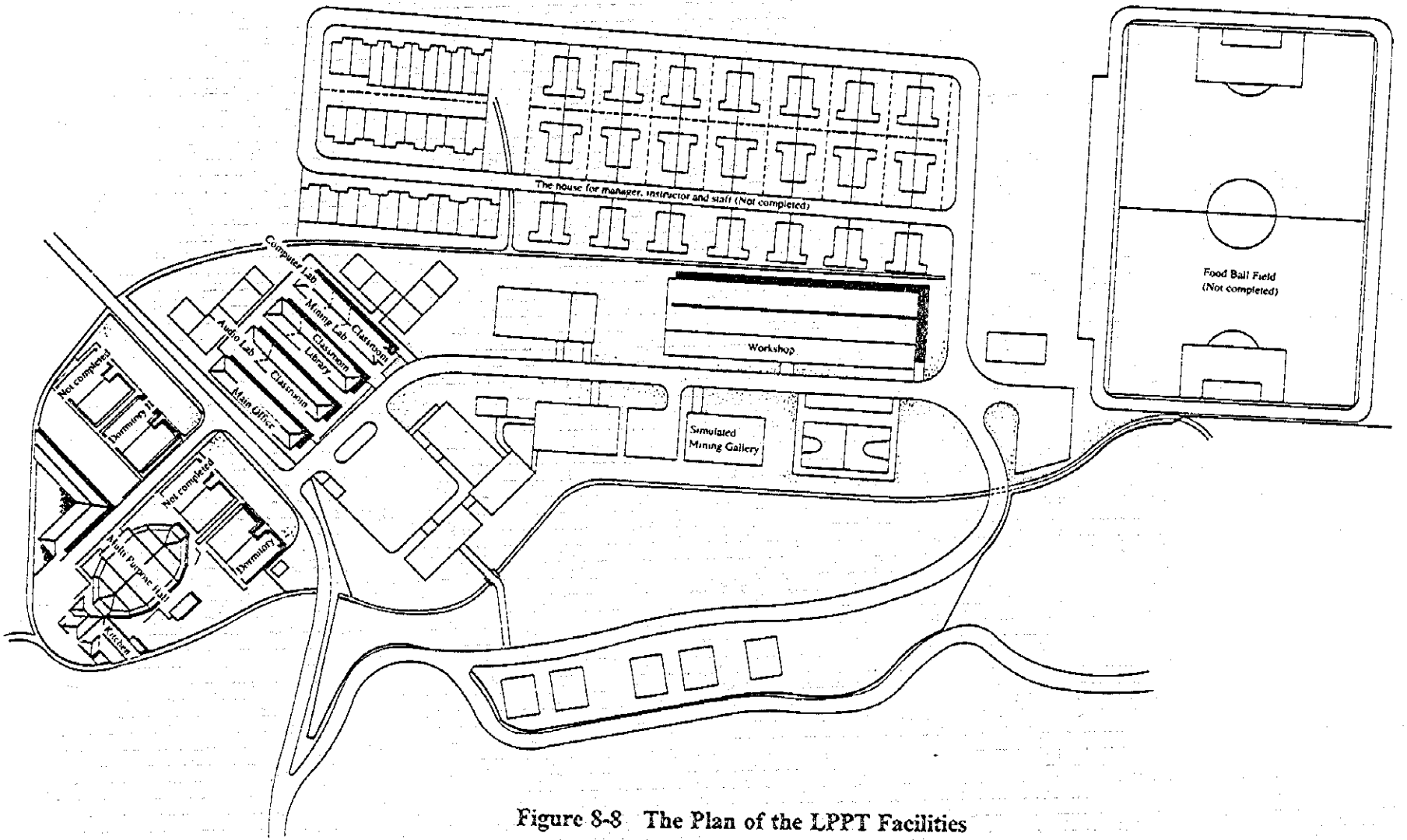


Figure 8-8 The Plan of the LPPT Facilities

skills into world standards.

* Existing LPPT programs will be reviewed and modified as to their stability and outcomes related to the mining industry needs and developing national standards. Additional programs will be developed to meet industry requirements for basic and advanced skills, while specific programs will be developed for the scheme which allows certification of personnel in specialist skilled occupations as required on mine sites.
* New programs, such as short term course of one to two weeks and long term course of longer than three months, will be implemented as demand requires, and the level of course will vary from basic (entry to specific skills of national mines standard) up to Diploma courses linked to universities in Australia.
* The foundation will fully fund the Mines Training College at Ombilin for the first year of operation or until stage 3 "development" is implemented and operative. Full implementation of the development stage will have the college operating on a user pays basis. After costs have been deducted the surplus will be divided equally between the Directorate of Mining and John Batman Institute of TAFE.
* The organization is as follows:
  - Principal (Expatriate Position), Accountant (Indonesian Position), Secretary (Indonesian Position)
  - Senior Executive (Indonesian Position; Administration), Senior Executive (Expatriate Position),
  - Assets Supervisor (Indonesian Position; Maintenance of facilities & staff, Student amenities facilities, Cleaning/Catering)
  - Office & Administration Supervisor (Indonesian Position; Administration, Student enrolment & records, Program production equipment & staff)
  - Senior Teacher (Indonesian Position; Time tabling, Teacher duties, Programing of teaching aids, Scheduling of classes, etc.)
  - Senior Teacher 1 (Indonesian Position; Workshop development, Assist Indonesian staff, Implementation of programs)
  - Senior Teacher 2 (Expatriate Position; Review of existing programs, Development of new programs, Training of trainer)
  - Consultant (Expatriate Position)
  - Trainers (Indonesian Position; 11 Trainers)
* The center will open about June 1997 (Start preparation in September, 1996)

8-3-2 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.

As shown in Figure 8-9, 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.

The network between the MDCM and institutions under the Department of Mines and Energy, local governments, mining enterprises, related institutions, and

ORGANIZATION STRUCTURE OF
MANPOWER DEVELOPMENT CENTRE FOR MINES

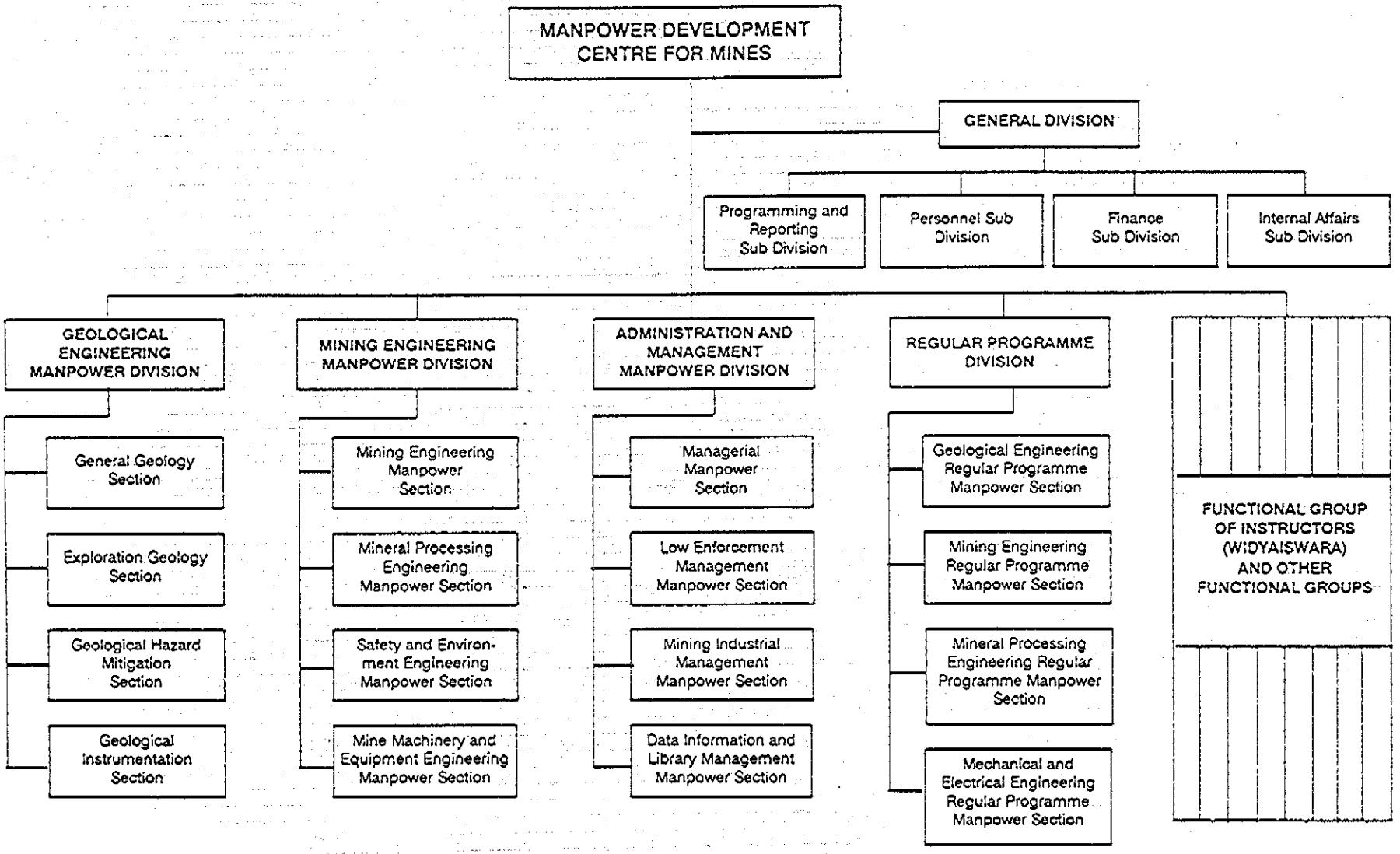


Figure 8-9 Organization Structure of Manpower Development Centre for Mines

universities/institutions is illustrated in Figure 8-10. The MDCM is receiving trainees and education participants or exchanging facilities and instructor assistance from/to the above organizations/institutions and enterprises. Also the center is giving consultancy assistance to the organizations and enterprises except university.

The Center plays a role as mediator or in problem solving on human resources problems within the mining sub-sector against institution/organization/companies in relation with a) need and availability of manpower, b) training needs, c) qualification / accreditation / certification, d) program information and training and education implementation, and e) information on manpower development policy, through the utilization of information and data center in the MDCM.

The primary training programs of the MDCM are as follows:

1. Ground water drilling technique course
2. Environmental geology for land use planning course
3. Volcanological investigation course
4. Exploration drilling technique course
5. Mining inspector course
6. Regional mine inspector course
7. Second class blasting course
8. First class blasting course
9. Mine reclamation and environmental course
10. Lower management course
11. Middle management course
12. Management of training (MOT)
13. Training of trainers (TOT)
14. Training officers course
15. Qualification improvement program for regional mining official in geology and mining level C1, C2, C, B, AB, and A.

The course programs on manpower development for mines are summarized in Appendix VIII-V. Also the curricula conducted in the fiscal year 1995/1996 are shown in Appendix VIII-VI.

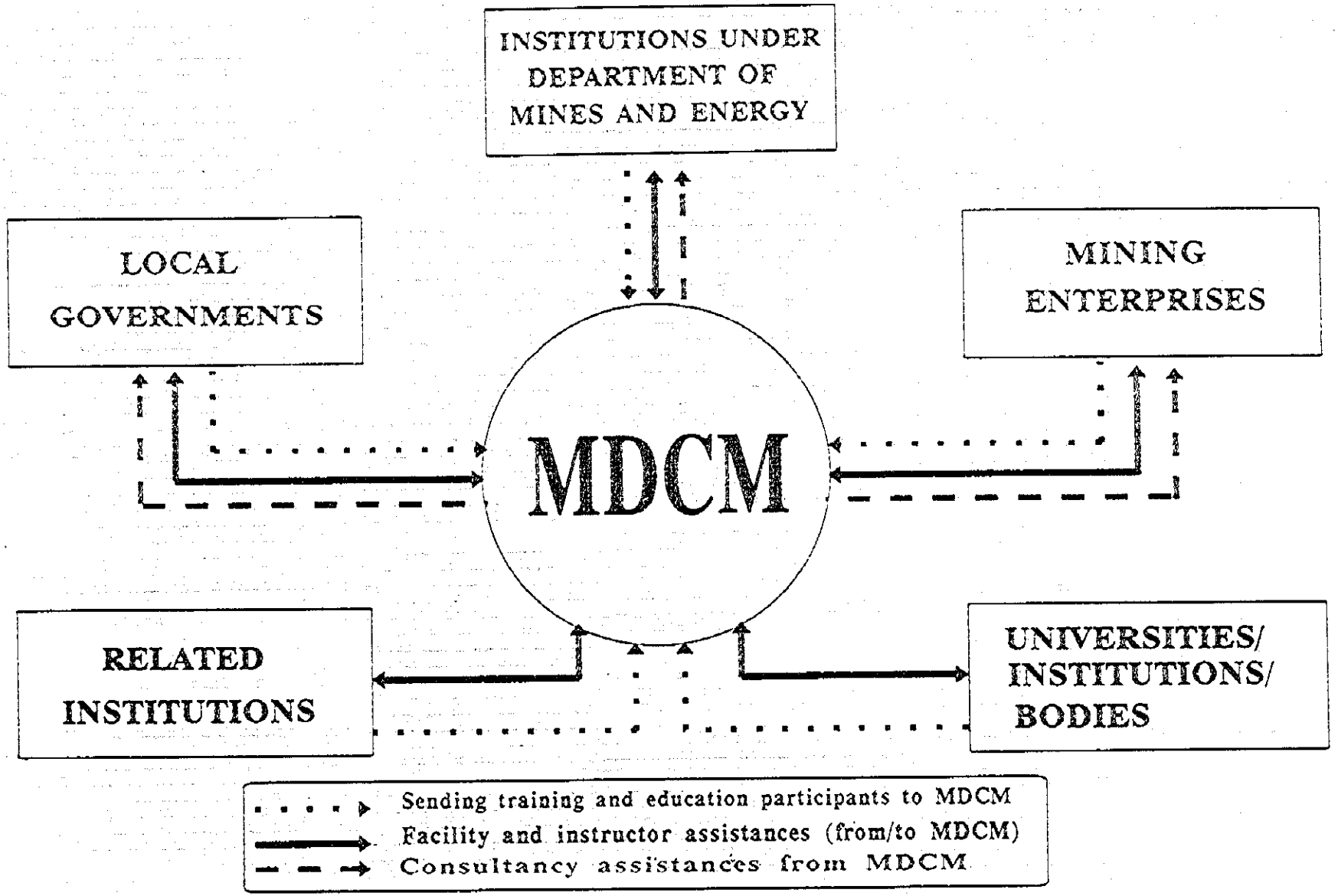


Figure 8-10 Network of MDCM as Training and Education Executive Unit

Usually training is carried out in the following manner:

45 minutes/course x 10 course hours/day x 5 days/week + field visits.

The MDCM does not have rescue course due to lack of apparatuses but has a common safety course. The blasting programs are carried out for 2 classes, i.e. the second class blasting which gives a certificate for person who makes actual blasting in the field, and the first class blasting which is needed for superintendent who does not conduct actual blasting. The MDCM issues certificates and the DGM gives licence, which is required even for expatriates to conduct blasting.
The operating expenses are mainly supplied from the government's budget, but special courses are sometimes sponsored by private companies. A total of about 1,500 trainees, consisting of roughly 60 times programs by 30 trainees in average, are trained every year. In the fiscal year 1995/96, at least 55 programs have been conducted.

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 organization of the MTRDC is shown in Figure 8-11.

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.

A total of 465 manpower, consisting of 67 in the First Division, 90 in the Second Division, 42 in the Third Division, 52 in the Fourth Division, 110 in the Fifth Data and Information, and 100 in the Administration Division, is working in the center. Human resources development has been made three years ago but not yet reach to

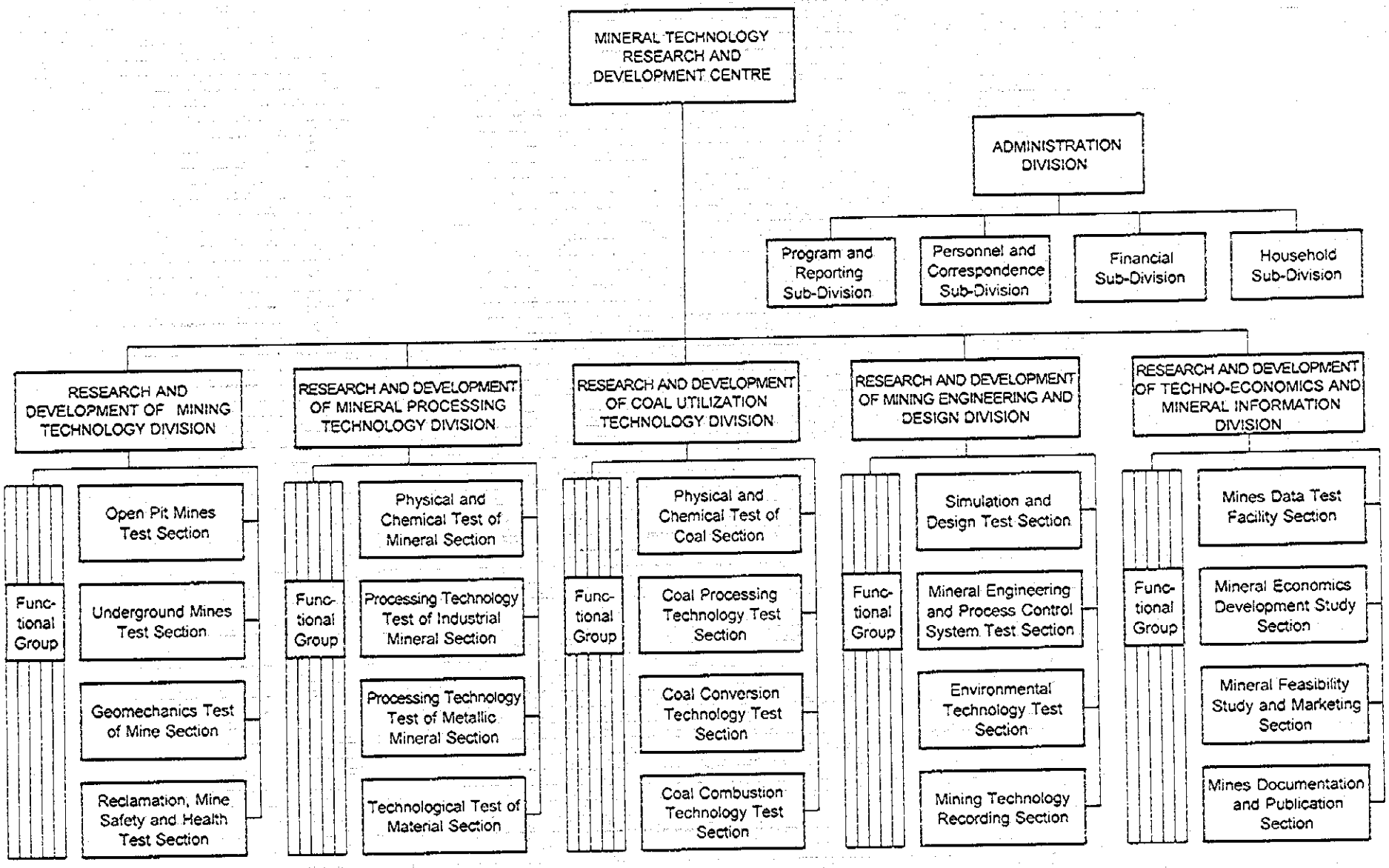


Figure 8-11 Organization Structure of MTRDC

the required level. So a dispatch of JICA experts is requested to make a short training. The operating cost is about Rp. 9 billion per annum.

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.

The mission of the center is focussed on small to medium scale industries because foreign investors are taking care of large scale industries.

The main functions of the MTRDC are shown in the following:

a) Research and development of technology on open pit and underground mines, mining geomechanics, mining reclamation and safety works, and providing guidance on mining technology;

b) Physical tests and chemical analyses of various samples of minerals, research and development of industrial and metallic minerals processing, raw materials, and giving guidance and services on mineral extraction/processing technology;

c) Physical tests and chemical analyses of coal and peat including research and development of processing technology of coal and peat burning and conversion;

d) Research and development of simulation and design of process control and mineral engineering, environmental technology and mining technology recording;

e) Carrying out collection and processing of mineralization/mining data, research and development of mineral economics, feasibility study and mineral marketing, documentation and dissemination of mining/mineral information;

f) Preparation of work programs and plans, managing personnel and financial administration, conducting filing and correspondence, managing facilities and internal services of MTRDC.

The investigation of the safety equipment is conducted in the Underground Mines Test Section of the First Division. Manpower training itself is carried out in the MDCM. Some of training of the MDCM are conducted in the MTRDC using necessary facilities in the center.

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. Details of the KPC training system will be explained in the following Chapter.

The training starts with the reading and writing of Indonesian language. Appropriate text books are imported and translated into Indonesian language except special technical terms in English.

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. Then, the actual training on particular vehicles is commenced in the following order:

a) Light vehicle driving,
b) Large trucks of 6 tons class,
c) Field trucks of 10 tons class,
d) Dump trucks, like DJB D350,
e) 777 Cap trucks of 77 tons, and
f) Huge trucks of 130 to 160 tons.

Since 1995, skills in one or two different vehicles have been mastered for more than 200 new operators through the above training system. While training them, an instructor is accompanied with the trainee for at least 5 weeks, and the test is

carried out after 4 weeks training. The first priority in training is on safety in operation. According to the training calender in 1996, a total of 9 courses is programmed as shown below:

* Staff Development on 17 curricula of 200 hours in total and Computer on 11 curricula of 170 hours in total excluding on the job coaching,
* Mine Training on 18 curricula in all pits or particular pit through the year,
* Coal Processing & Surface Training Section on 17 curricula of more than 135 hours for safety, on 3 curricula of more than 3 hours for operator and on a curriculum of more than 4 hours for contractor,
* Maintenance Training for mechanics (6 groups of 10 per year 1996) 31 curricula from 113 to 1,344 hours,
* Maintenance Training for 27 auto-electrician on 13 courses from 61 to 282 hours, for 16 welder on 12 curricula from 53 to 400 hours, and for three nominations of supply contractors,
* General Training of Language, English and Indonesian, for 18 curricula of 840 hours in total and Induction on 2 curricula of 24 hours in total,
* General Training for Trainer Training on 15 curricula of 82 hours in total, and
* Commercial Training for secretarial/office administration on 6 curricula of 330 hours in total, for accounting on 5 curricula of 165 hours in total, for supply on 5 curricula of 136 hours in total, for warehousing on 4 curricula of 80 hours in total, and for other nominated electives on 1 curriculum of 30 hours.

In addition to the above company's training, the contractors have their own training system.

The company is giving extraordinary benefits to the employees. For example, workers are able to purchase their own houses at an extraordinary cheap price, eg. approximately Rp. 8,000/house, under the terms, i.e. interest free and pay back in 10 years, etc. Even the supervisor class is able to buy a house at a price of approximately Rp. 55,000. At present, the company is constructing 400 houses in Sangatta town and even the employees of the contractor could buy these houses. So no body wants to leave the company. Thus the separation rate is very low in the mine.

4) Training of KP Mines

Present situation of the training in the KP mines is studied with PT Kitadin Corporation (PT Kitadin), PT Fajar Bumi Sakti (PT FBS) and PT Bukit Sunur.

a) PT Kitadin Corporation

The mine is operating mainly under the semi-mechanized underground mining system in a labor intensive manner. The manpower constituents of the mine in 1995 are shown in Table 8-4. According to the table, about 68% of the total manpower, 2,756, are unskilled.

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).

Table 8-4 Manpower Constituents of the PT Kitadin Corporation in 1995

	Mining	Geology	Chemical (Processing)	Mechanical	Electrical	Administration Accounting, etc.	Sub-contractor	Total
1. Management								
- Expatriate								
- University						4		4
- High School								
Total						4		4
2. Professional								
- Expatriate	2	1						3
- University	5				3	7		15
- High School						3		3
- Secondary School								
Total	7	1			3	10		21
3. Technical / Supervisor								
- Expatriate								
- University	28	3		2	4	8		45
- High School	5	1		6		7		19
- Secondary School	3			1		1		5
Total	36	4		9	4	16		69
4. Operator / Skilled								
- High School	410					10		420
- Secondary School	195					5		200
Total	605					15		620
5. Administration								
- University						9		9
- High School					3	15		18
- Secondary School						3		3
Total						27		30
6. Middle Skilled								
- High School	25			20	10	64		119
- Secondary School	24				3			27
- Primary School								
Total	49			20	13	64		146
7. Unskilled								
- Secondary School	1.506							1.506
- Primary School	360							360
Total	1.866							1.866
Total: Expatriate								3
Total: University								73
Total: High School								2756 579
Total: Secondary School								1741
Total: Primary School								360

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.

In connection with the shifting to underground mines, the transition from the old to the new may take about 10 years. At least 200 underground workers might be required for the new mines in addition to the present manpower.

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.