Chapter 5 Proposed Environmental Pollution Control Measures

1. Environmental monitoring

To determine the actual degree of environmental pollution in the Mahakam River is the first step to restore and preserve the environment of the river. Thus, the contents of effluent discharged from coal mines must be monitored and identified first of all.

1.1. Monitoring standards

1.1.1 Wastewater standards

Success or failure in monitoring is determined by referring to wastewater standards. The following two regulations concerning wastewater standards are applied to the mining industry subject to inspection under this project.

1) MOE Minister's Law No.113, 2002
2) Provincial Governor's Law, SK Gub. No. 26 tahun 2002

Table 5-1-1 lists the standards of the ordinance and order. Although there are some differences between the two regulations, Governor's Order 2) is enforced on wastewater standard values of coal mines in East Kalimantan Province. However, the standard value actually being applied at present is the old standard value (TSS: 400mg/l) introduced prior to the issuance of Governor's Order in 2002.

Table 5-1-1 Wastewater standards for coal preparation plant

Monitoring parameter	Maximum allowable value		Sampling frequency	Analysis method recommended by the Province
	MOE	East Kalimantan Province		
pH	6.0 to 9.0	6.0 to 9.0	Once per month	Electrode meter
TSS	200	300	Once per month	Weight measurement
Fe	7	10	Once per month	AAS
Mn	4	5	Once per month	AAS
Maximum wastewater discharge	2 m^3 per ton of coal product	2 m^3 per ton of coal product	Once per month	

The "Law of the Republic of Indonesia No.23, 1997 regarding Environmental Management",

Chapter IX, Articles 41, 42, 43, 44, 45 and 46 establishes the penalties against intentional and accidental violations of environmental pollution control regulations, ordinances and orders. Penalties include imprisonment and fines.

1.1.2 Institutional monitoring system

Figure 5I-1-1 illustrates the institutional monitoring system for coal mine.

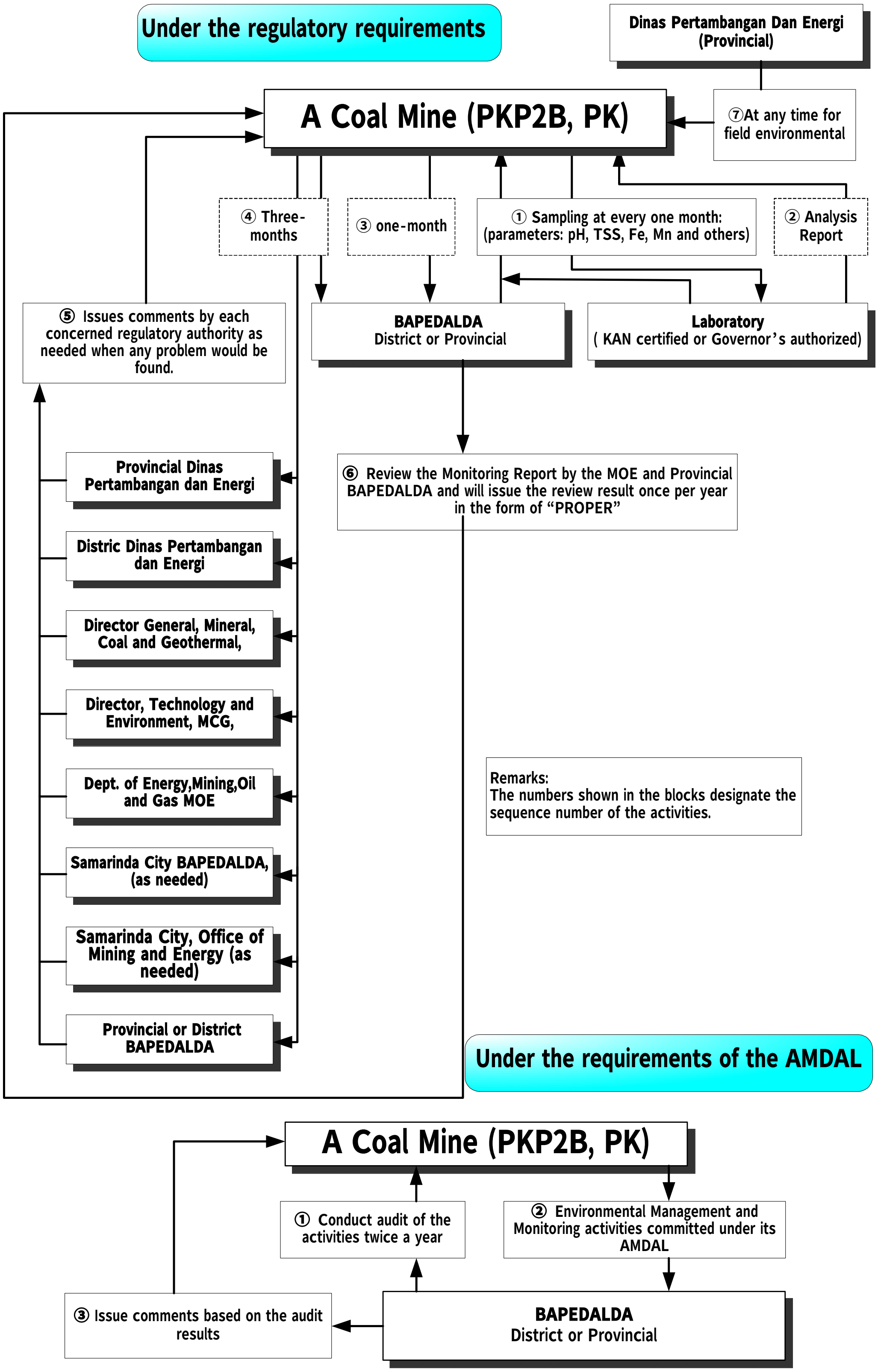


Figure 5-1-1 Environmental Monitoring Activity Flow for Coal Mines

(1) Competent authorities

1) Ministry of Environment (MOE)

Under the Environmental Management Law (No.23, 1977), MOE enacts regulations concerning the environment, including the following water and air quality control measures, and leads the environmental administration.

- Decree No.113, 2003 regarding Wastewater Standard for Coal Mining Activity
- Decree No.82, 2001 regarding Water Quality Management and Water Pollution Control
- Decree No.41, 1999 regarding Air Pollution Control
- Decree No.129, 2003 regarding Emission Standards for Businesses and/or Activities concerning Natural Gas and Oil

Since 2005, MOE has divided the country into five regions and established the regional MOE branch office under direct control in each of the regions. **Table 5-1-2** lists the regional branch offices.

Table 5-1-2 Five Regional MOE Branch Offices

Region	Base	Duty Area
Region 1	Pekanbaru	All Sumatra
Region 2	Denpasar	Bali, West Nusa Tenggara and East Nusa Tenggara
Region 3	Makassar	Sulawesi, Maluku and Irian Jaya
Region 4	Yogyakarta	All Java Island
Region 5	Balikpapan	All Kalimantan

Remarks : The above information was obtained on July 21, 2006 from the meeting discussion carried out in the MOE Headquarters.

2) Local Environmental Impact Control Bureau (BAPEDALDA)

BAPEDALDA, a unit of the provincial government, inspects the water quality of coal mines in accordance with MOE's Ministerial Ordinance No.113, 2002 and the Provincial Governor's Order SK Gub. No. 26, 2002. The main inspections include the followings,

- Witnessing monthly collections of wastewater samples
- Specifying wastewater sample collection points
- Assessing wastewater quality analysis results
- Studying and assessing water quality monitoring result reports submitted by coal mines every three months
- Preparing a table of assessment result ranks every year
- Transmitting water quality monitoring results through the telecom system to the Environmental Control Center located in suburbs of Jakarta. However, the telecom system is not normally in operation because the system has failed and has not maintained its satellite license royalties.
- Recommending improvement measures for wastewater quality of coal mines when necessary

3) East Kalimantan Province Mineral Resource and Energy Bureau

- Control and inspection of forestation and reclamation of sites after development ends

(2) Sampling

All the environmental monitoring points in the wastewater treatment process of individual coal preparation plant are designated by BAPEDALDA. Sampling is conducted once a month in the presence of a BAPEDALDA inspector. Although the presence is not regular, an MOE inspector and/or provincial or county officials of the mineral resource and energy bureau witness the collection of samples.

(3) Analysis

Analysis of water quality items is entrusted to analysis institutes accredited by the National Accreditation Committee (Komite Akreditasi Nasional, KAN) or to analysis institutes approved by provincial governors. Certification of public analysis is made in accordance with the Indonesian National Standard (SNI: Standar Nasional Indonesia) based on ISO. Certification is valid for four years. KAN inspects certifications once or twice a year. KAN determines inspection frequencies for analysis institutes after taking their content and reliability into account. Analysis institutes need substantial budgets for the maintenance of analytical instruments and for personnel staffing. In addition, analysis institutes are required to bear expenses for KAN inspectors, including their trip expenses, when conducting certification. Even after obtaining certification, mining companies seem to have many kinds of burdens to maintain the status. Meanwhile, there are other analysis institutes, approved by provincial governors other than KAN, which are authorized to conduct public analysis of water quality. Public analysis institutes in East Kalimantan Province are as follows:

1) Analysis institute accredited by KAN

- Baristand Indag Samarinda (DEPARTEMEN PERINDUSTRRIAN RI, BADAN PENELITIAN DAN PENGEMBANGAN INDUSTRI, BALAI RISET DAN STANDARDISASI INDUSTRI DAN PERDAGANGAN, SAMARINDA)
- Provincial laboratory “UPTD BALAI LABORATORIUM KESEHATAN SAMARINDA”
- Pubuk Kaltim Tbk
- VICO
- Pertamina
- Kaltim Prima Coal (KPC)
- P.T. Badak NGL

2) Analysis institutes approved by provincial governors

- Pusat Penelitian Lingkungan Hidup, Lembaga Penelitian Universiti MULAWARMAN
- PT. SUCOFINDO
- Indoassey

SUCOFINDO carries out industrial analysis and water quality analysis, whereas KAN certifies industrial analysis only. CCI, which is specialized in industrial analysis, has not obtaied accreditaton from KAN.

(4) Reporting results

Monthly monitoring results must be submitted to BAPEDALDA. In additon, “Quaterly Reports on Environmental Monitoring” must be submitted to the following governmental agencies for inspection.

1) Provincial and District Dinas Pertambangan dan Energi
2) Provincial or District BAPEDALDA as the case needed
3) Samarinda City BAPEDALDA, as needed
4) Samarinda City, Office of Mining and Energy, when needed
5) Director General, Mineral, Coal and Geothermal, MEMR
6) Director, Technology and Environment, MCG, MEMR
7) Department of Energy, Mining, Oil and Gas, MOE

Each of the coal mines is required to submit a written document after receiving a comment from any of the above-mentioned governmental agencies.

(5) Assessment

MOE and BAPEDALDA rate coal mines once a year using five grades (black, red, blue, green, and gold) based on the results of analysis wastewater discharged from their coal preparation plants in accordance with PROPER (Program Peringkat Kinerja Perusahaan Pertambangan, a program for assessing and rating mining companies). Black refers to a grade in which wastewater exceeds the reference value considerably; red refers to a grade in which wastewater exceeds the reference value slightly and requires improving; blue refers to a grade in which wastewater satisfies the reference value; green refers to a grade in which wastewater is lower than the reference value; and gold refers to a grade in which wastewater is considerably lower than the reference value indicating excellent quality of wastewater. When a mining corporation is rated as “black” two consecutive times, MOE is supposed to bring the case before the court. No mining corporations have been rated as “gold” so far.

This five-grade assessment rating covers not only wastewater quality treatment, but also, for example, whether AMDAL renewal (once in five years), and environmental management and monitoring programs defined by AMDAL are executed. **Table 5-1-3** lists a method for assessing wastewater quality. Like the method for assessing water quality, MOE and BAPEDALDA mark other items and collect all the scores before rating mining companies.

Table 5-1-3 Method for assessing wastewater quality

Red	Refers to a grade that satisfies 50% of the reference values of all the defined parameters: 50 points
Black	Refers to a grade that satisfies 50% or higher up to 100% of the reference values of all the defined parameters: 50 to 100 points
Blue	Refers to a grade that satisfies just the reference values of all the defined parameters: 100 points
Green	Refers to a grade that satisfies 150% of the reference values of all the defined parameters: 150 points
Gold	Refers to a grade that satisfies 200% of the reference values of all the defined parameters: 200 points

Table 5-1-4 lists assessment results for the two years from 2004 to 2005. The table is called the "Status of PROPER (Audit of Environmental Management 2006)." Of the five coal mines inspected this time, two coal mines were rated as "black" and one coal mine was rated as "red."

No.	Name of Company	Mine Activity		Place of Company		Grade/Color 2004-2005
				Major City	Province	
1	PT. Bukit Sunur	Coal	Mining	North Bengkulu	Bengkulu	Black
2	PT. Bukit Bara Utama	Coal	Mining	Seluma	Bengkulu	Black
3	PT. Coal Mining Bukit Asam	Coal	Mining	Muara Enim	South Sumatra	Blue
4	PT. Adaro Indonesia	Coal	Mining	Tabalong & Balangan	South Kalimantan	Red
5	PT. Arutmin - Senakir	Coal	Mining	Kotabaru	South Kalimantan	Blue
6	PT. Arutmin - Satui	Coal	Mining	Tanah Bumbu	South Kalimantan	Red
7	PT. Jorong Barutama Greston	Coal	Mining	Tanah Laut	South Kalimantan	Red
8	PT. Trubaindo Coal Mining	Coal	Mining	Kutai Barat	South Kalimantan	
9	PT. Gunung Bayan Pratama	Coal	Mining	Kutai Barat	South Kalimantan	
10	PT. Indominco Mandiı	Coal	Mining	Kutai East	East Kalimantan	Blue
11	PT. Kaltim Prima Coa	Coal	Mining	Kutai East	East Kalimantan	Blue
12	PT. Berau Coal - Binungan	Coal	Mining	Berau	East Kalimantan	Blue
13	PT. Berau Coal - Lati	Coal	Mining	Berau	East Kalimantan	Blue
14	PT. Berau Coal - Sambarata	Coal	Mining	Berau	East Kalimantan	Blue
15	PT. Muti Harapan Utama	Coal	Mining	Kutai Kartanegara	East Kalimantan	Black
16	PT. Kideco Jaya Agung	Coal	Mining	Pasir	East Kalimantan	
17	PT. Bukit Baiduri Energi	Coal	Mining	Kutai Kartanegara	East Kalimantan	Red
18	PT. Fajar Bumi Sakti	Coal	Mining	Kutai Kartanegara	East Kalimantan	Red
19	PT. Kitadin	Coal	Mining	Kutai Kartanegara	East Kalimantan	Red
20	PT. Tanito Harum	Coal	Mining	Kutai Kartanegara	East Kalimantan	Red

Remarks: This table is prepared Based on the original table with same title of "STATUS OF PROPER"、which was provided by the MOE.

Table 5-1-4 STATUS OF PROPER (AUDIT OF ENVIRONMENTAL MANAGEMENT 2006)

1.2. Present situation of monitoring at coal mines

No proper names are used in this document because some of the coal mines discharge wastewater that exceeds the reference value. Instead, letters A to F are used to describe coal mines.

1.2.1 Coal mine A

(1) Environment related organizations

Figure 5-1-2 illustrates environment related organizations. Coal mine A has the "Environment Department," under which the "environmental monitoring and data control section," the "environmental recovery section," and the "miscellaneous section" are established.

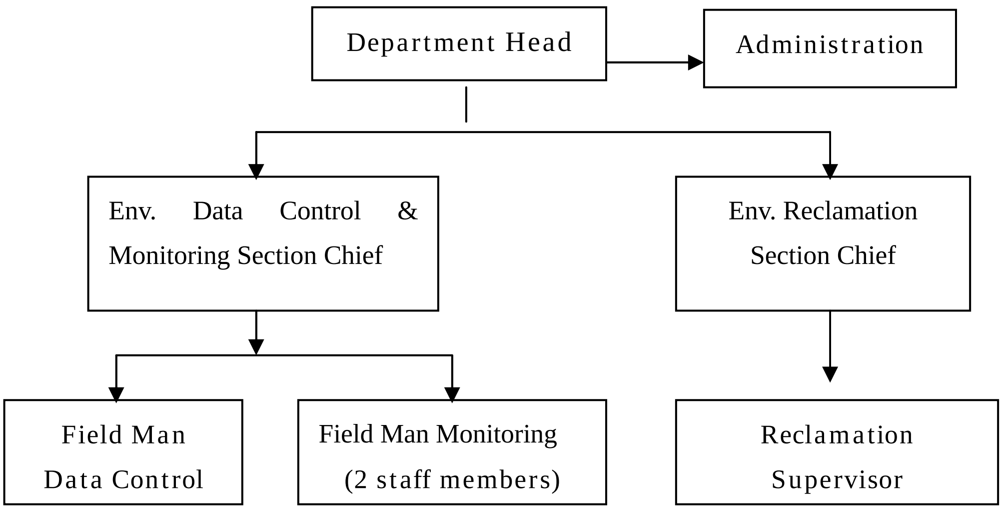


Figure 5-1-2 Environment related organizations/coal mine A

(2) Present monitoring situation

Once-a-month motoring is conducted to check pH, TSS, Fe, Mn, and maximum discharge volumes. Samples are collected at points specified by BAPEDALDA in the presence of BAPEDALDA officials. Though their presence is not regular, inspectors of MOE and the provincial mineral resource and energy bureau may witness the collection when necessary.

(3) Wastewater analysis results

Table 5-1-5 lists analytical results for the period of January through April 2006. Analysis was entrusted to KAN-accredited Baristand Indag Sarimanda. In connection with athe nalysis, bold-faced figures indicate those exceeding the reference value. **Table 5-1-6** lists volumes of coal dressing water used from October to December 2005.

(4) Data of recent quarterly reports on environmental monitoring

Figure 5-1-3 and **Figure 5-1-4** illustrate wastewater quality data for the 13 months to April 2006 (data on October through December 2005 are unavailable). In connection with this, Mn is not presented in the graph because it was indicated to have been less than 0.1mg/l. TSS values for January to September 2005 exceed the reference value by far. However, pH, Fe, and Mn values for other than May 2005 are within the acceptable range of the reference values.

Table 5-1-5 Wastewater Quality Analysis Results（Coal mine A）

Sampling location	Parameter	Unit	Quality standard	Year of 2006				
				Jan	Feb	Mar		Apr
Outlet from WP	pH	-	6 - 9	7.46	7.59	7.17	7.9	7.12
	TSS	mg/l	400	110	398	***2510***	***1950***	***8020***
	Fe	mg/l	7	<0.02	***9.37***	4.17	***11.7***	3.34
	Mn	mg/l	4	0.007	<0.006	0.038	0.024	0.056
Runoff south pit	pH	-	6 - 9	6.71	7.32	7.85	7.69	6.98
	TSS	mg/l	400	246	270	440	1266	2360
	Fe	mg/l	7	<0.02	14.7	1.05	8.21	1.70
	Mn	mg/l	4	0.003	0.016	0.022	0.034	0.072
Runoff discharge to Mahakam Rive	pH	-	6 - 9	7.82	7.48	8.32	9.17	7.90
	TSS	mg/l	400	412	210	248	56	720
	Fe	mg/l	7	<0.02	<0.02	0.61	0.24	0.79
	Mn	mg/l	4	0.015	0.016	0.014	<0.001	0.01

Table 5-1-6 Water Volume being Used for coal Washing (Coal mine A)

Standard of water volume used (limit value)	The year 2005		
	Oct	Nov	Dec
2 m^3 /ton coal production	1.61	1.65	2.2

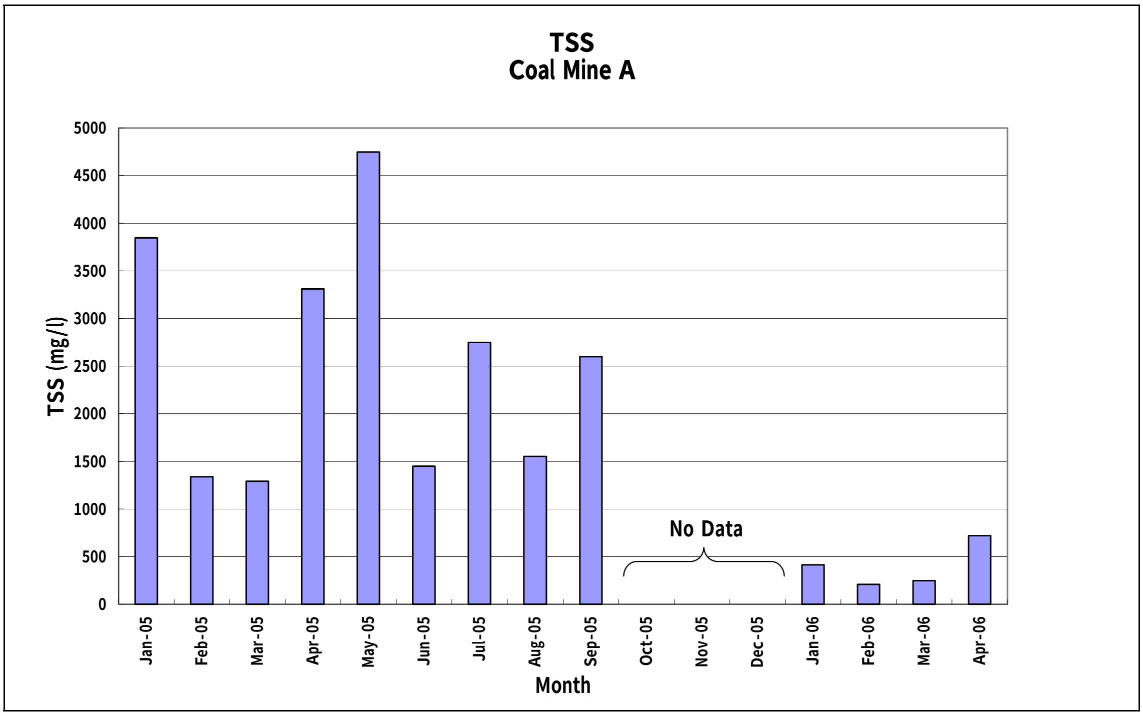


Figure 5-1-3 TSS of wastewater for coal mine A

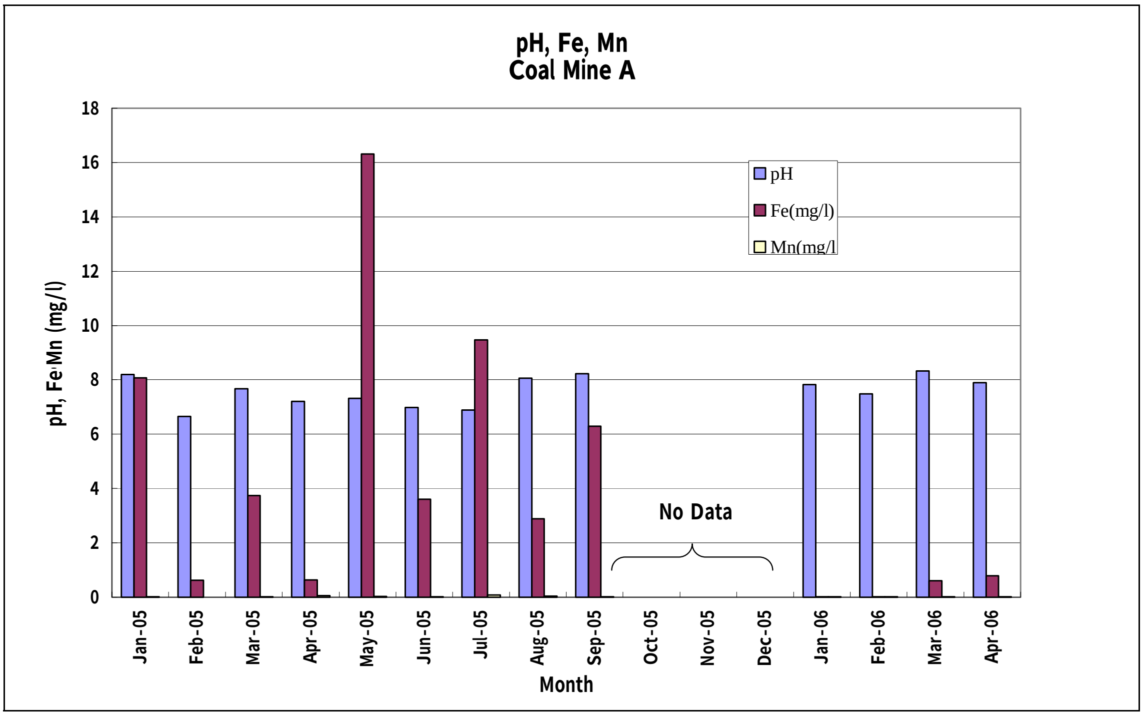


Figure 5-1-4 pH and other qualities of wastewater for coal mine A

1.2.2 Coal mine B

(1) Environment related organizations

No information on the environment related organizations of coal mine B is available.

(2) Present monitoring situation

Same as coal mine A.

(3) Wastewater analysis results

Table 5-1-7 lists the results of the wastewater analyzed. **Table 5-1-8** lists volumes of coal preparation water used.

(4) Data on recent quarterly reports on environmental monitoring

Figure 5-1-5 and **Figure 5-1-6** illustrate data on wastewater qualities for January through March 2005. No Mn was detected. All inspection items are within the range of the acceptable reference values. Quarterly reports show no records on wastewater analysis since April 2005. However, the coal preparation plant of coal mine B has achieved the complete recycling of service water. No wastewater was discharged from coal mine B during the inspection.

Table 5-1-7 Wastewater Quality Analysis Results（Coal Mine B）

Sampling location	Parameter	Unit	Quality standard	2005		2006
				Jan	Feb	May
P1	pH	-	6 - 9	7.9	8.3	7.6
	TSS	mg/l	400	54	42	118
	Fe	mg/l	7	0.02	1.05	0.02
	Mn	mg/l	4	0.005	0.006	0.006
P2	pH	-	6 - 9	7.7	8.08	7.63
	TSS	mg/l	400	44	60	108
	Fe	mg/l	7	0.02	3.86	0.09
	Mn	mg/l	4	0.004	0.006	0.006
P3	pH	-	6 - 9	7.5	-	7.5
	TSS	mg/l	400	88	-	142
	Fe	mg/l	7	0.37	-	0.02
	Mn	mg/l	4	0.011	-	0.006
P4	pH	-	6 - 9	8.4	6.68	8.39
	TSS	mg/l	400	110	148	304
	Fe	mg/l	7	1.64	1.25	0.44
	Mn	mg/l	4	0.002	0.006	0.006

Note: Sampling point (P1) is in the drain to the river.

Table 5-1-8 Water Volume being Used for Coal Washing (Coal Mine B)

Standard of water volume used (limit value)	2005		2006
	Jan	Feb	May
2 m^3/ton coal production	1.86	1.85	1.86

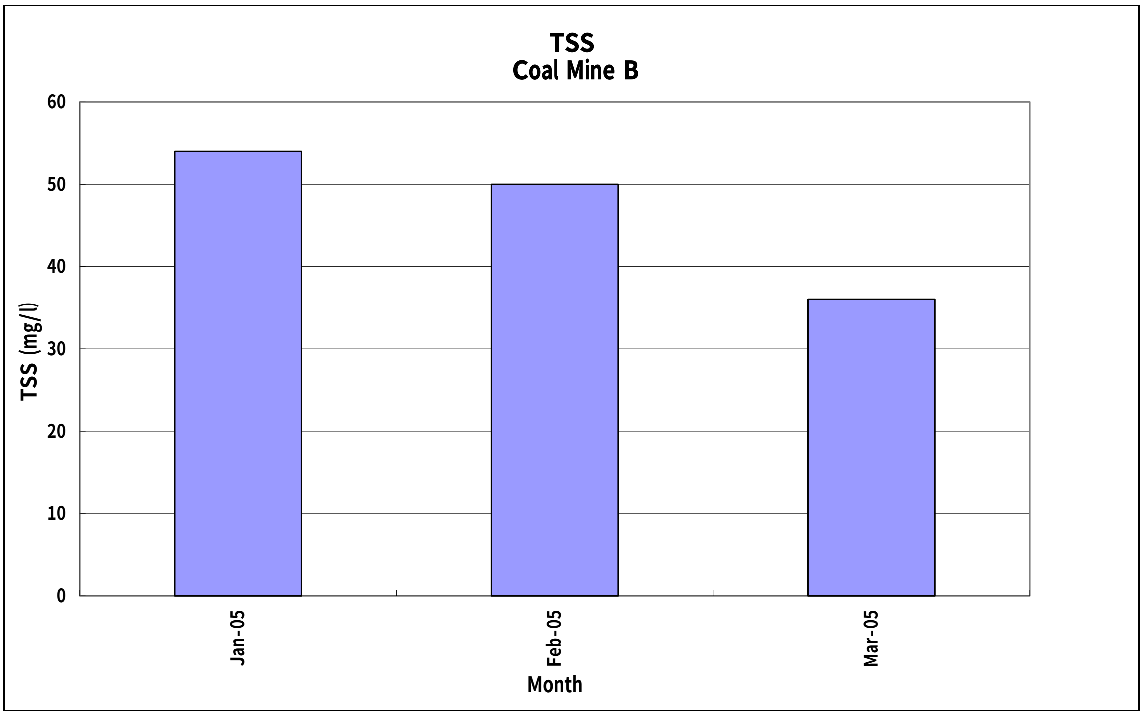


Figure 5-1-5 TSS quality of wastewater for coal mine B

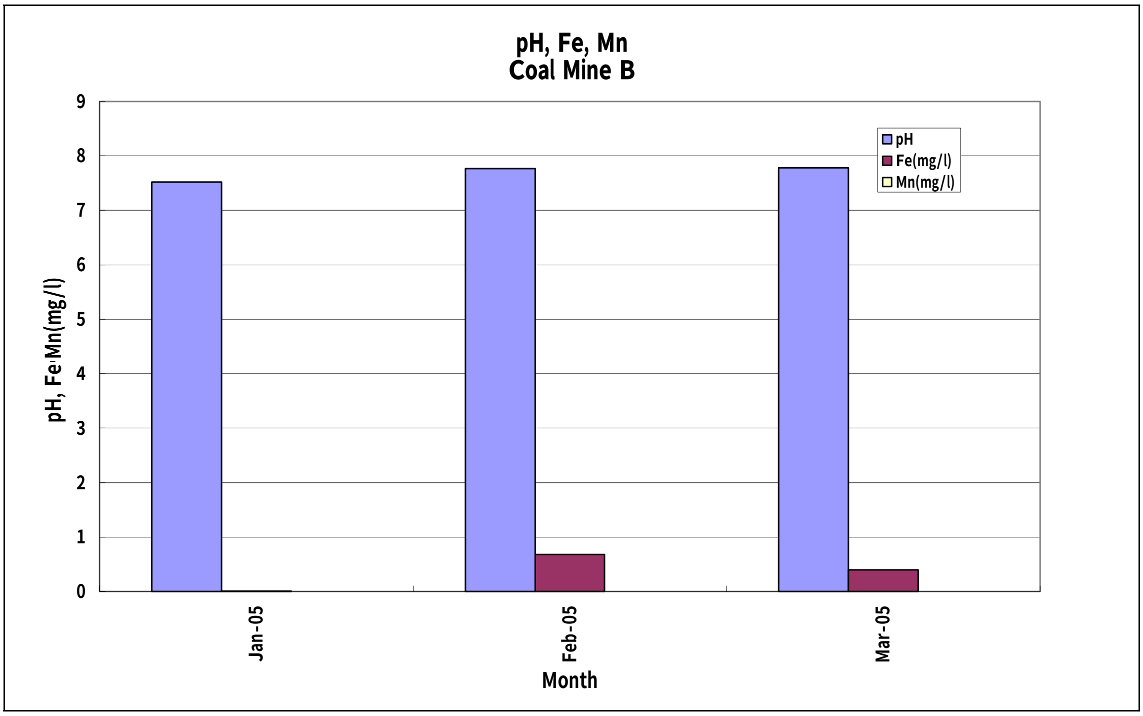


Figure 5-1-6 pH and other qualities of wastewater for coal mine B

1.2.3 Coal mine C

(1) Environment related organizations

No information on environment related organizations of coal mine C is available.

(2) Present monitoring situations

Same as coal mine A.

(3) Wastewater analysis results

Table 5-1-9 lists results of analysis obtained for January 2006.

Table 5-1-9 Wastewater analysis results/coal mine C

Parameter	Unit	Quality standard	Sampling Points			
			(1)	(2)	(3)	(4)
pH	-	6 - 9	-	7.36	6.91	7.92
TSS	mg/l	400	-	230	56	90
Fe	mg/l	7	-	2.63	3.72	1.18
Mn	mg/l	4	-	0.0003	0.0042	0.016

Note: Sampling point (4) is in the drain to the river.

(4) Data on recent quarterly reports on environmental monitoring

Figure 5-1-7 and **Figure 5-1-8** illustrate data on wastewater qualities for the period from April 2005 through January 2006 (Data for June through September 2005 are unavailable). Mn concentration was less than 0.1mg/l. All the inspection items were within the range of the acceptable reference values.

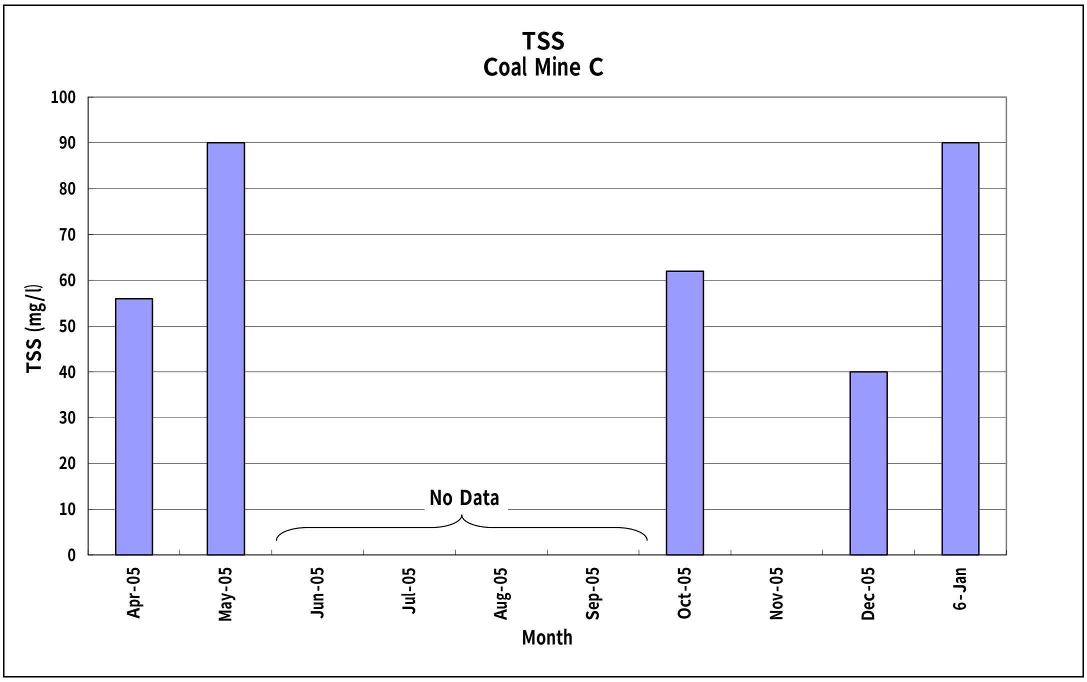


Figure 5-1-7 TSS quality of wastewater for coal mine C

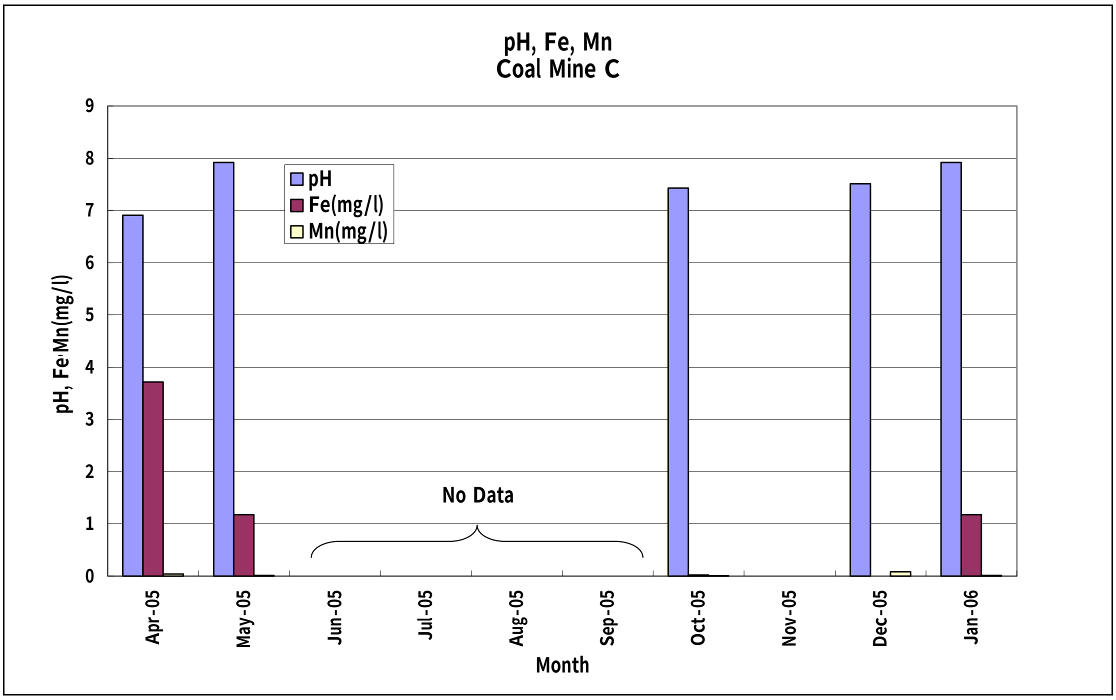


Figure 5-1-8 pH and other qualities of wastewater/coal mine C

1.2.4 Coal mine D

(1) Environment related organizations

No information on environment related organizations of coal mine D is available.

(2) Present monitoring situations

Same as coal mine A.

(3) Wastewater analysis results

Table 5-1-10 lists analysis results obtained for the period of January 2006.

Table 5-1-10 Wastewater analysis results/coal mine D

Parameter	Unit	Quality standard	Sampling points		
				(2)	(3)
pH	-	6 - 9		6.89	7.21
TSS	mg/l	400		168	138
Fe	mg/l	7		0.31	1.66
Mn	mg/l	4		0	0.024

Note: Sampling point (3) is in the drain to the river.

(4) Data on recent quarterly reports on environmental monitoring

Figures 5-1-9 and **5-1-10** illustrate data on wastewater qualities for the period of April 2005 through January 2006. (Data for July to September 2005 are unavailable.) Mn concentration was less than 0.1mg/l. All the inspection items are within the acceptable range of the reference values.

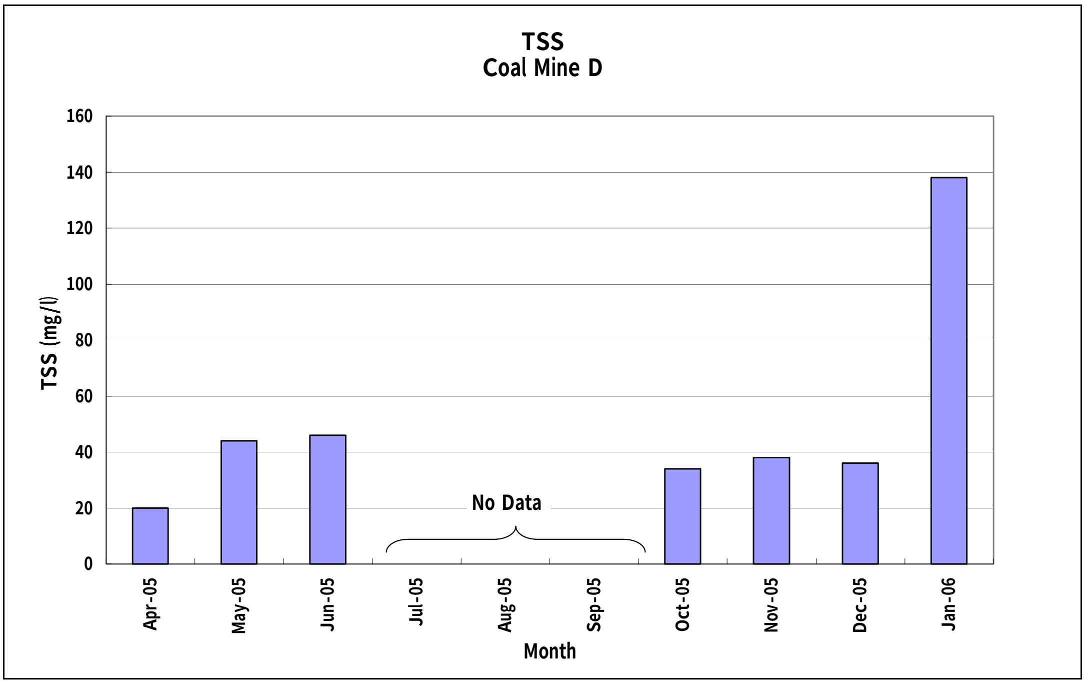


Figure 5-1-9 TSS quality of wastewater for coal mine D

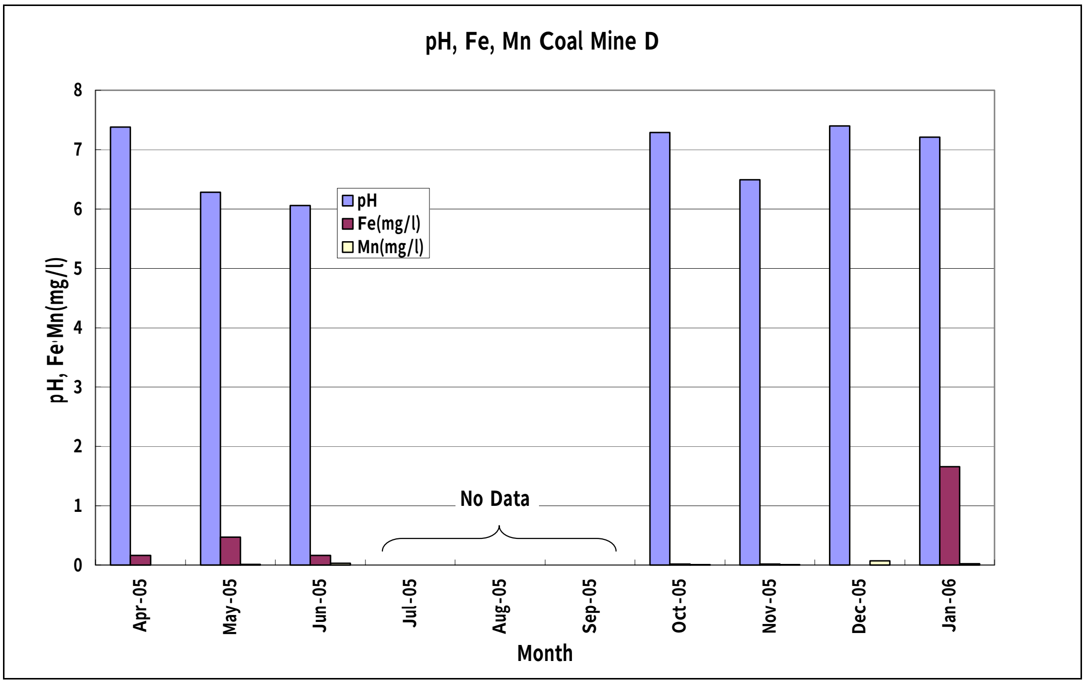


Figure 5-1-10 pH and other qualities of wastewater for coal mine D

1.2.5 Coal mine E

(1) Environment related organizations

The environment related organizations of coal mine E are administered by the operation control manager and coal mine manager, under whom the person in charge of environmental control, the environmental recovery supervisor, and on-site environmental recovery staff are assigned. **Figure 5-1-11** illustrates the organization chart.

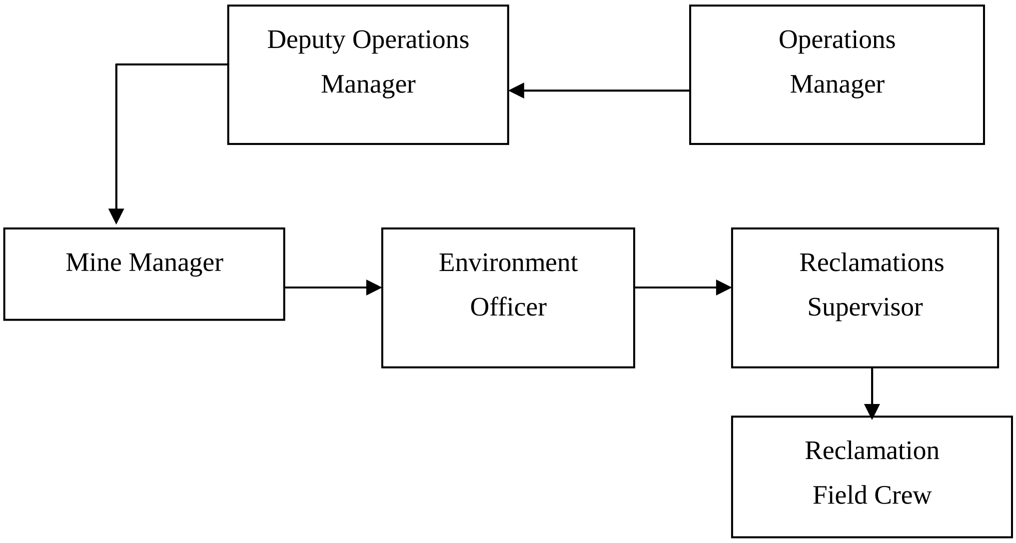


Figure 5-1-11 Environment related organizations/coal mine E

(2) Present monitoring situations

Same as coal mine A.

(3) Wastewater analysis results

Table I-1-11 lists analysis results obtained for the period of the most recent several months. Analysis was entrusted to KAN-accredited Baristand Indag Sarimanda. Coal mine E conducts BOD and COD analyses, in addition to analysis of the water quality parameters stated below. Although the standards for wastewater qualities for coal preparation plants have no criteria for allowable levels of BOD or COD, East Kalimantan Governor's Order sets those values for wastewater discharged from wood yards. They are 100mg/l (BOD) and 125mg/l (COD). At coal mine E, BOD and COD analysis highest values were 15 and 319 respectively, in March 2006. The COD value exceeded the control value by far.

The volume of water used for coal preparation was, on average, 0.33 m^3/ton of coal production, which is below the control values.

Table 5-1-11 Wastewater analysis results for coal mine E

Sampling location	Parameter	Unit	Quality standard	2006		
				Jan	Feb	Mar
A	pH	-	6 - 9	6.44	7.09	6.79
	TSS	mg/l	400	56	72	4080
	Fe	mg/l	7	<0.02	<0.02	2.31
	Mn	mg/l	4	0.053	0.009	0.008
B	pH	-	6 - 9	6.58	6.92	6.36
	TSS	mg/l	400	64	84	120
	Fe	mg/l	7	<0.02	<0.02	0.18
	Mn	mg/l	4	0.03	0.018	0.007
C	pH	-	6 - 9	6.36	6.83	6.69
	TSS	mg/l	400	64	108	104
	Fe	mg/l	7	<0.02	0.49	0.32
	Mn	mg/l	4	0.012	<0.006	0.011
D	pH	-	6 - 9	6.63	7.14	7.32
	TSS	mg/l	400	38	48	116
	Fe	mg/l	7	<0.02	<0.02	0.13
	Mn	mg/l	4	0.007	<0.006	0.006

Note: Sampling point (B) is in the drain to the river

(4) Data on recent quarterly reports on environmental monitoring

Figure 5-1-12 and **5-1-13** illustrate data on wastewater qualities for the period from December 2004 to March 2006. (Data are unavailable for April through June and September and December 2005.) All the inspection items are within the range of the reference values.

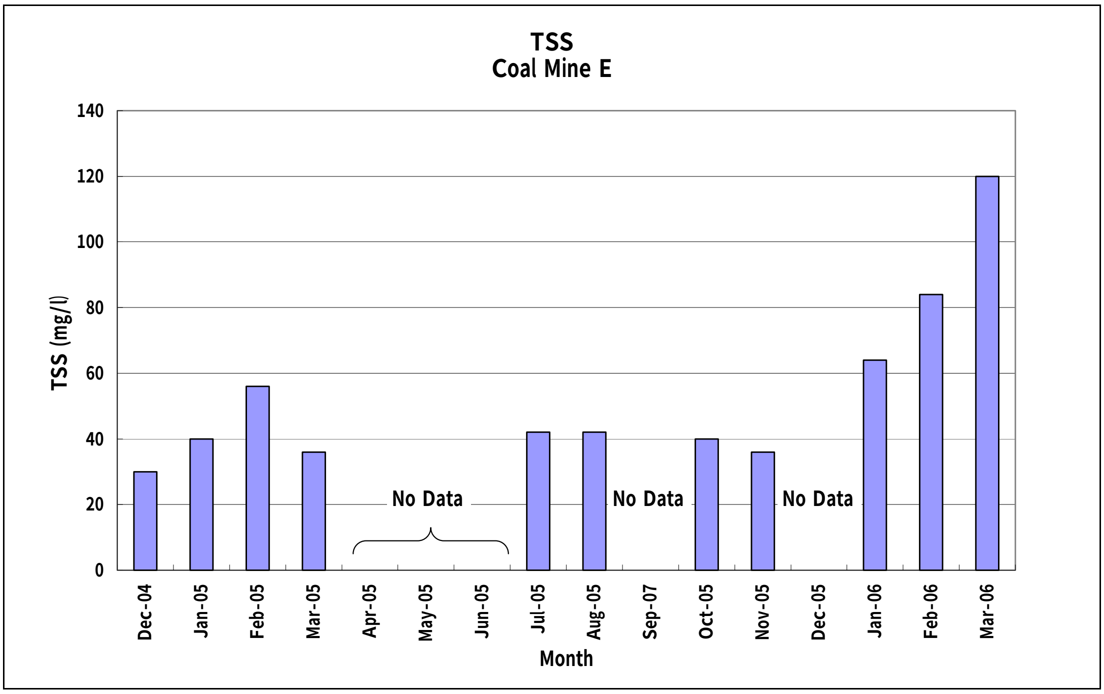


Figure 5-1-12 TSS quality of wastewater for coal mine E

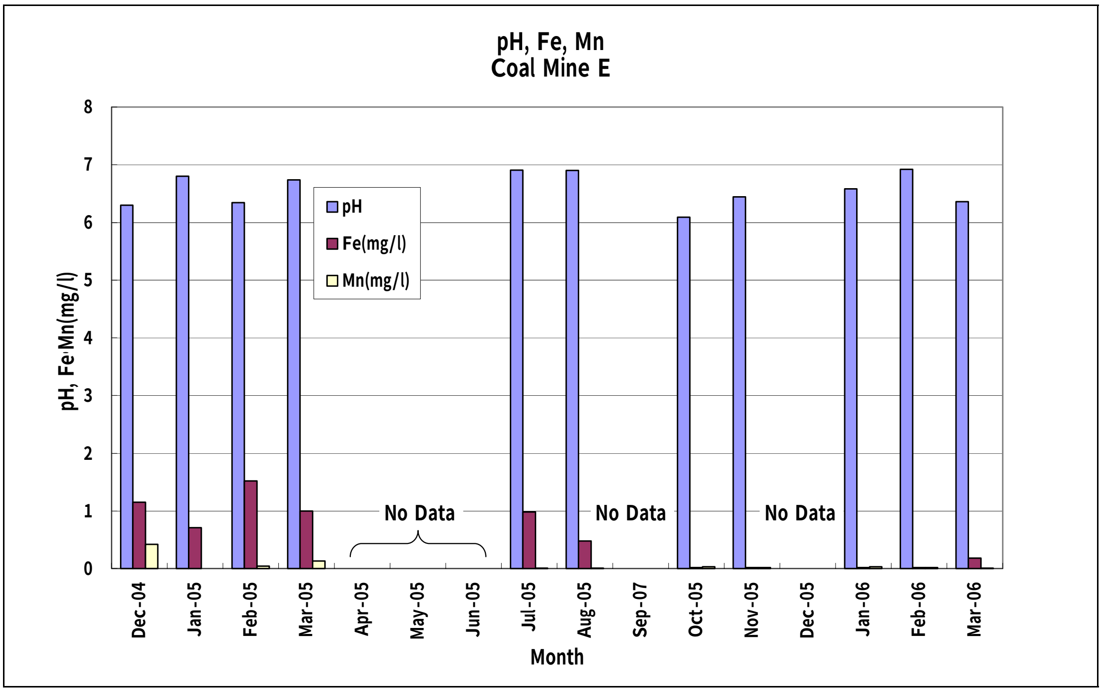


Figure 5-1-13 pH and other qualities of wastewater/ for oal mine E

1.2.6 Coal Mine F

(1) Environment related organization

Coal mine F has an Environmental Department. The "Safety and Environmental Manager" and the "Deputy Manager" oversees the "Environmental Supervisor" who leads eight staff members and the "Safety Supervisor" who leads four staff members. **Figure 5-1-14** illustrates the organizational chart.

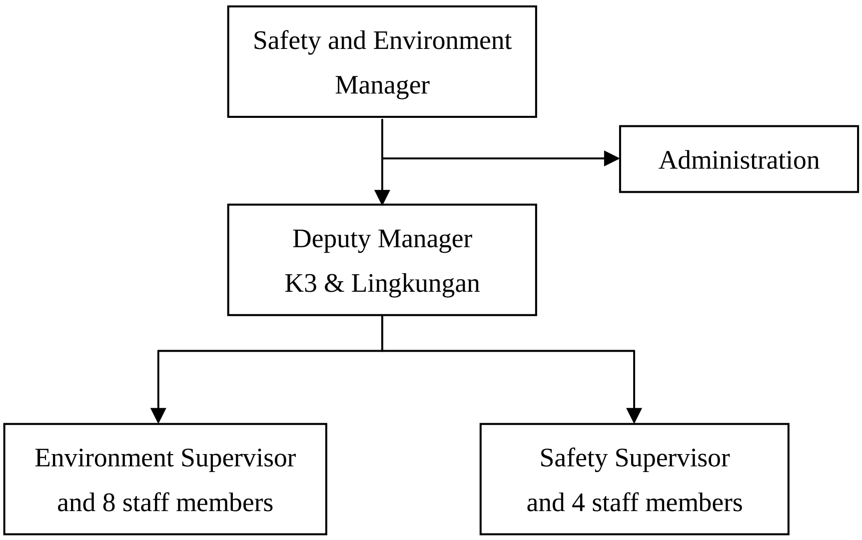


Figure 5-1-14 Environment related organizations for coal mine F

(2) Present monitoring situations

Same as coal mine A.

(3) Wastewater analysis results

Table 5-1-12 lists analytical results for the period from November 2005 through March 2006. Analysis was entrusted to KAN-accredited Baristand Indag Sarimanda. However, the table has no information on the drain to the river. The volume of water used for coal preparation is, on average, 1.074 m^3/ton of coal production, which is lower than the control value.

Table 5-1-12 Wastewater analysis results for coal mine F

Sampling location	Para meter	Unit	Quality standard	2005		2006		
				Nov	Dec	Jan	Feb	Mar
Settling Pond for Preparation and WP (P1)	pH	-	6 - 9	6.52	6.69	6.83	6.51	5.89
	TSS	mg/l	400	36	152	590	38	36
	Fe	mg/l	7	5.24	<0.002	<0.02	0.46	<0.02
	Mn	mg/l	4	0.005	0.091	0.007	<0.006	0.001
Settling Pond No.2 (P2)	pH	-	6 - 9	4.14	5.39	6.70	5.82	3.46
	TSS	mg/l	400	114	46	2840	118	32
	Fe	mg/l	7	5.25	<0.002	22.0	1.96	1.09
	Mn	mg/l	4	0.084	0.250	0.175	0.076	0.692

Note: No information on drain to the river.

(4) Data on recent quarterly reports on environmental monitoring

Figure 5-1-15 and **Figure 5-1-16** show data on wastewater quality for the period from February 2005 to March 2006. TSS values exceeded the reference value for the periods of February to March 2005, December 2005, and January 2006. pH values were out of the reference values in April and June 2005, and March 2006. Other inspection items are within the range of the reference values.

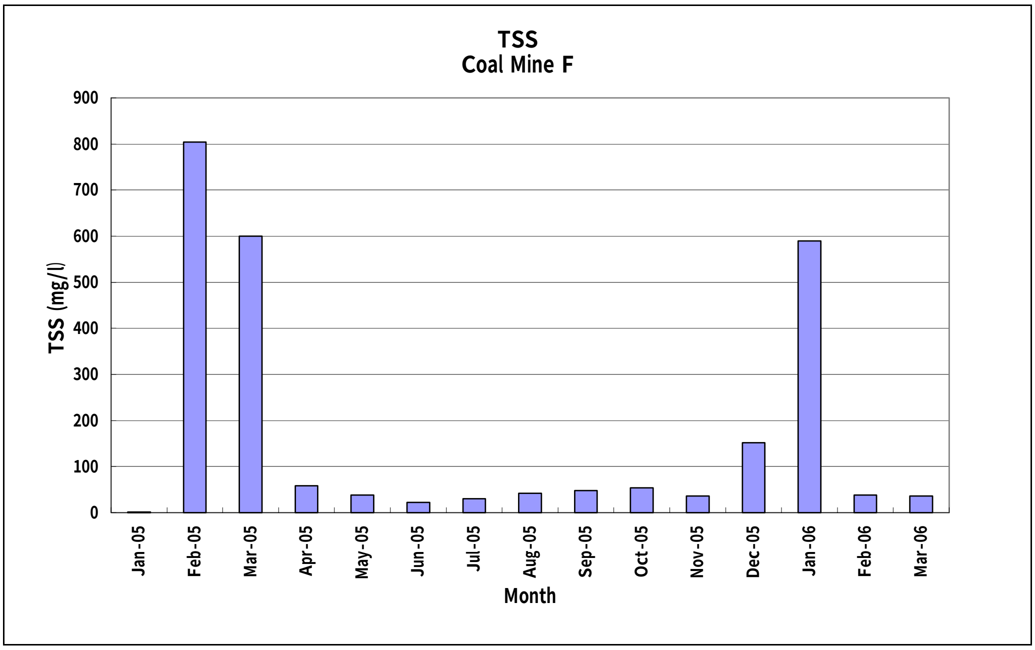


Figure 5-1-15 TSS quality of wastewater for coal mine F

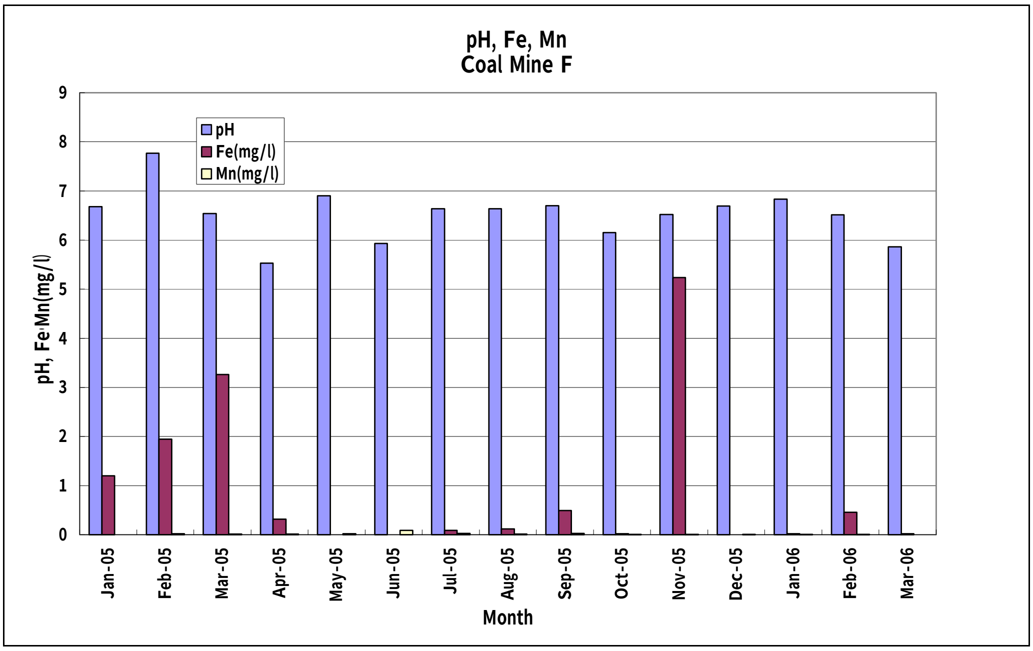


Figure 5-1-16 pH and other qualities of wastewater for coal mine F

1.3 Issues of environmental monitoring

1.3.1 Administrative issues

(1) Unification of control standards

It has not been clearly specified yet which of the two control standards should be applied, the control standard stipulated in the laws and regulations of the Department of Environment or the control standard stipulated in the Provincial Governor's Order. In addition, old control standards are still being accepted. The control standards need to be unified first of all.

(2) Standardization of forms and their conversion into electronic files

The wastewater quality analysis report forms to be submitted by mining companies have not been standardized. In order to make databases of wastewater quality analysis results, the standardization of the analysis report forms is imperative. In addition, guidance should be provided to the mining companies so that they always attach a report signed by an analytical organization authorized by KAN to the report they submit. Furthermore, those reports should be converted into electronic files in order to share the data with concerned organizations.

(3) Information disclosure

It is desired that various information concerning environmental monitoring be disclosed to the local residents.

(4) Enhancement of leadership

The effect of guidance on the improvement of the quality of wastewater discharged from coal mines has not been sufficiently determined. The enforcement of penalties is insufficient.

(5) Effective operation of the Environmental Control Center

The "Environmental Control Center," which is under the direct control of MOE, is in a situation that makes it difficult to operate sustainably at present. In particular, the telecom system which uses the host computer of the center is also in a situation that makes it difficult to operate. The reason is reportedly because neither the budget nor the personnel required for the operation and maintenance can be secured.

1.3.2 Coal mine issues

(1) Improvement of environment related organizations

Because environment related organizations have only been established in two coal mines, the organizational scheme remains unclear. Environment related organizations need to be established at all mines immediately.

(2) Establishment of analysis laboratories

Because there are no coal mine specific water quality analysis laboratories in existence, the data required for the improvement of the process cannot be easily obtained. It is desired that the necessary analysis laboratories are established immediately.

1.4. Proposal for the improvement of environmental monitoring

1.4.1 Construction of an environmental monitoring system

In order to improve the quality of wastewater that is discharged from various industrial facilities, including coal mines, and consequently to conserve the water quality of the Mahakam River, the efforts of various industrial facilities and administrative supervisory authorities are indispensable. However, those efforts by themselves will be insufficient to conserve the local environment. It is desired to construct a regionally appropriate environmental monitoring system in light of the previous experiences. To that end, what is most necessary is the participation of regional residents in the environmental monitoring. The participation of regional residents is expected to serve to implement an environmental monitoring system more appropriate for the actual condition of the region. It can be said that what is important is environmental monitoring through the cooperation of all the parties concerned including the regional residents.

Our proposal for the construction of the regionally appropriate environmental monitoring system through the participation of the regional residents in the environmental monitoring is as presented below:

1) Establish a "Committee of Environmental Management" (hereinafter abbreviated as CEMM) with representatives of the regional residents around the coal mines, representatives of coal mining companies, representatives of local governments such as the provincial government, and representatives of environmental administration authorities included as members and ensure effective operation of the committee.

2) The major roles of the relevant committee (CEMM) are as follows:
   - Formulating regulations and so on required for the operation of CEMM, and manage and supervise their implementation and observance.
   - Determine a method for sharing the cost required for the operation of the entire CEMM.
   - Coordination among the parties concerned comprising CEMM
   - Holding periodic meetings to discuss various related matters and plan solutions
   - Others

3) Establish the following groups under CEMM.
   - Secretariat:
     Performs the general duties required for the management and operation of CEMM and supports various activities of the committee.
   - Technical Advisory Group:
     Provides technical advice for the activities of the group.

- Auditor Group:
  Implements environmental monitoring and witnessing at coal preparation plants and so on, and provides the results to the Environmental Data Evaluation and Management group and the Documentation and Document Control Group in document form.
- Environmental Data Evaluation and Management group:
  Analyzes, assesses, and manages various information and data reported by the Auditor Group.
- Documentation and Document Control Group:
  Puts various papers and data submitted from the above groups into document form, and archives and controls the prepared documents.

Figure 5-1-17 shows the composition and the framework (proposed) of the committee. The expenditure required for the operation of the committee needs to be budgeted in accordance with a new order by the provincial governor.

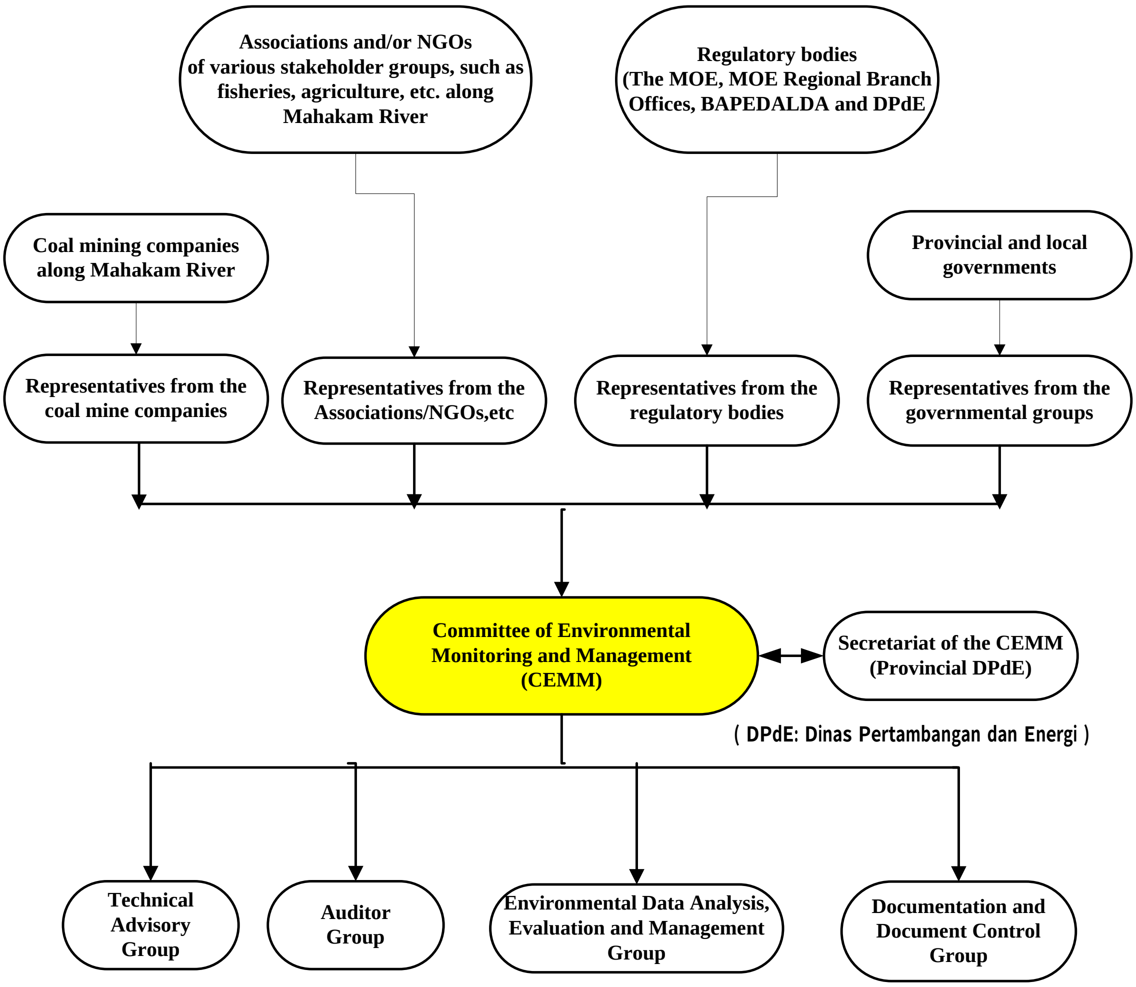


Figure 5-1-17 Framework (proposed) of the committee

1.4.2 Reconstruction of the telecommunication system

(1) Present situation of the telecom system

In 2004, MOE constructed the telecommunication system for the environmental monitoring database with the aid of the Canadian government and started the operation of the system. The system, however, has been kept out of service after having been operated for only one year. The major reason reportedly lies in the nonpayment of the satellite usage fee to be born by BAPEDALDAs of the individual provinces and the shortfall in personnel staff operating the system.

This system connects the MOE Headquarters, five branch offices under the direct control of MOE, and BAPEDALDAs in individual provinces via satellite with the host computer of the Environmental Control Center located in a suburb of Jakarta as a hub to enable sharing and management of information and various environment related data. The MOE Headquarters administer the systems as a whole. Once the coal mines compile the environmental monitoring databases and convert them into electronic files, the databases can be linked to this system. **Figure 5-1-18** shows a diagram of the telecommunication system that the study team developed based on the information of the MOE Headquarters.

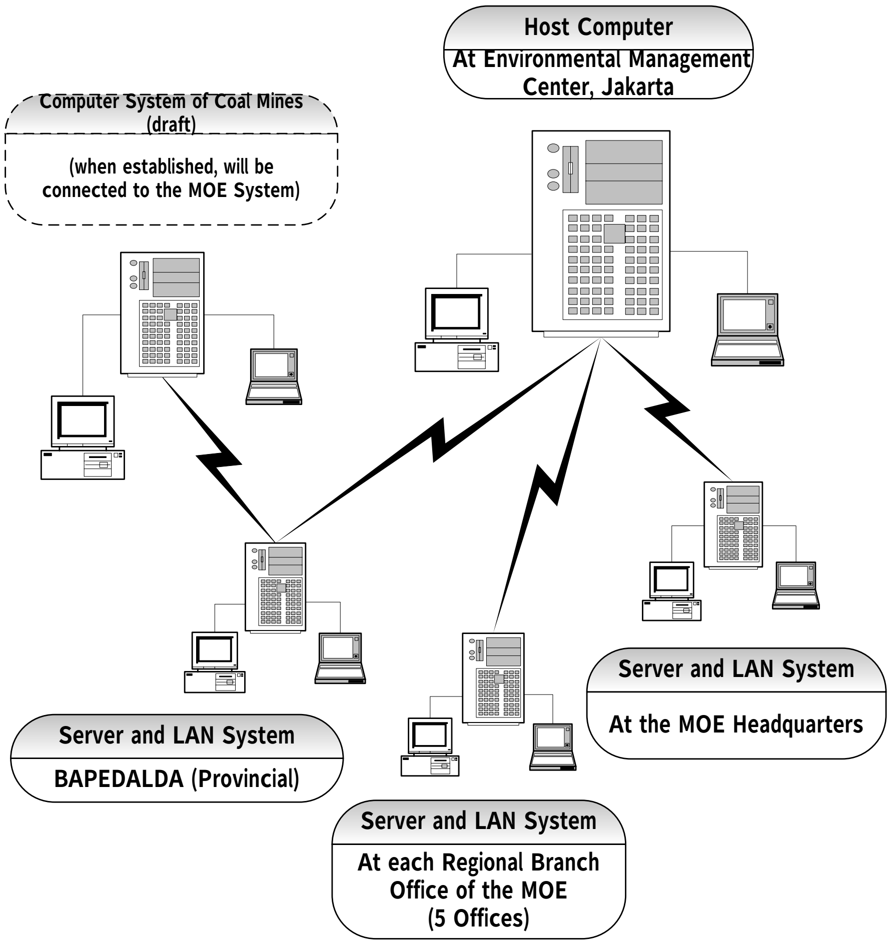


Figure 5-1-18 Conceptual diagram of the telecommunication system

(2) Reconstruction of the telecom system

Such a precious telecommunication system should be reconstructed immediately. There two things that should be kept in mind in reconstructing the system:

1) Secure the budget and develop personnel staffing; and
2) Link the database of coal mining companies, which has been converted to electronic files, to the telecommunication system.

1.4.3 Establishment of the Provincial Environmental Control Center

A province-specific "Environmental Control Center" should be established. This center should be managed and operated by the provincial government organization. In the center, the water quality monitoring and comprehensive telecom surveillance system will be installed to link it to the telecom systems of the coal mines. The water quality monitoring and comprehensive telecom surveillance system of the center will be also linked to the MOE's telecom system as needed.

1.4.4 Compilation of databases of environmental monitoring results obtained at coal mines

(1) Compilation of databases

A standardized form will be adopted for the wastewater quality analysis report. It is desired to adopt the report form of an analytical organization authorized by KAN. Various data input in accordance the form will be accumulated to construct databases.

(2) Linkage to the telecom system

The databases of the mining companies, which have been converted into electronic files, will be linked to the telecommunication system to use for transfer, recording, and management of wastewater quality data and reports among all the coal mines and administrative organizations.

1.4.5 Enhancement of environmental monitoring techniques in coal mines

(1) Enhancement of the organization in charge of environmental considerations

In order to enable all the environmental management activities including environmental monitoring, the organizations in charge of environmental considerations in coal mines need to be enhanced and personnel staffing secured. **Figure 5-1-19** shows a proposed buildup measure for an organization in charge of environmental considerations for coal mine F.

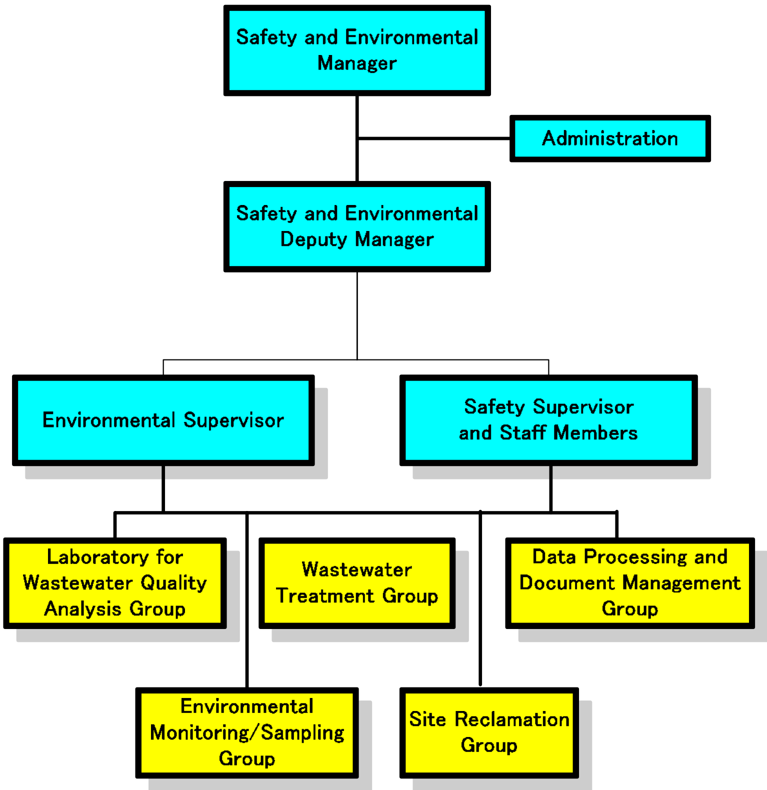


Figure 5-1-19 Proposed buildup measure for an organization

(2) Human resources development

The capabilities of the personnel in charge of environmental considerations need to be improved through education and practical training.

(3) Preparation of the "Environmental Management and Monitoring Manual"

It is desired to incorporate the following items into the manual:

1) General information

- Glossary of terms
- Regulations and standards for wastewater
- Personnel involved in environmental management and monitoring and their responsibilities
- Outline of coal preparation plant facilities, flow diagram, and drainage paths
- Expense budget

2) Wastewater monitoring program

- Sampling points, parameters, and frequency
- Analytical methods and analytical instruments for samples
- Maintenance of analytical instruments

3) Compilation of database and reports, and document control

- Guidelines on data processing and database compilation
- Data transfer system

4) Guidelines on the use of monitoring results and database

5) Personnel education and training program

6) Guidelines on outsourcing including analysis work

(4) Establishment of water quality analysis laboratories

Coal mine specific water quality analysis laboratories should be established. Devices such as an electronic balance and a dryer have to be gradually provided. No full-time analysis personnel need to be stationed in the laboratory but arrangements made so that the analysis may be performed when needed. In addition, a tool kit is commercially available that can measure Fe and Mn in about a minute similar to litmus paper. Introduction of such device will result in simplification of materials to be purchased and allow more frequent measurements.

1.4.6 Introduction of continuous analyzers

Introduction of continuous analyzers for water quality such as pH and TSS and a data transfer system is desired. **Figure 5-1-20** shows an example of a continuous water quality sensor. **Table 5-1-13** shows parameters measurable by the continuous sensor.

Multi-parameter water quality sensor

Water quality sensor and telemeter

Figure 5-1-20 Auto-sensing and telemeter system

Table 5-1-13 Measurable parameters

Parameters to be monitored & others	DS5X	DS5	MS5	Quanta
Sensor washer	○	△	△	
Water temperature	○	○	○	○
Electric conductivity	○	○	○	○
Salinity	○	○	○	○
Water depth, level	○	○	○	○
Dissolved Oxygen (DO)	○	○	○	
DO (by membrane covered type)	○	○	○	○
pH	○	○	○	○
Chlorophyll a	○	○	○	
Turbidity (0-100 NTU)		○		○
Turbidity (0-3000 NTU)	○	○	○	
Degree of transparency	○	○		
Total dissolved gases	○	○	○	
Ion sensing	○	○	○	

1.4.7 Reinforcement of the wide-area environmental monitoring for the Mahakam River basin

(1) Introduction of a continuous water quality monitoring system

A continuous water quality monitoring system will be introduced to reinforce the existing water quality monitoring implemented by the Provincial BAPEDALDA that covers the wider area of the downstream region of the Mahakam River. The monitoring points will be determined after performing a preliminary study. **Figure 5-1-21** shows a conceptual diagram of the continuous river water quality monitoring system.

(2) Application of remote sensing technologies

Environmental monitoring technologies applying remote sensing technologies have been already adopted in various countries including Indonesia. In 2000, the Mulawarman University started a study to develop a method to predict forest fires all over the East Kalimantan Province using remote sensing satellite images and studied the method to identify the places with high probability to catch fire under contract to the Ministry of Forests of Indonesia. The study was completed in 2002 after further investigating its relativity with the Indonesian climatic data. The Department of Forests of the Mulawarman University and the Research Institute of the Living Environment are in the process of studying the method to apply various remote sensing images obtained from satellites to environmental monitoring all over the province.

The Yokohama Environmental Science Research Institute controls the water quality of Tokyo Bay by using remote sensing images obtained from NASDA of Japan. This system detects changes in the water quality by monitoring chlorophyll-a concentration, water temperature, TSS, and transparency of the sea water of Tokyo Bay. The institute also performs follow-up surveys of the ground surface as needed.

It is desired that a wide-area environmental monitoring system using remote sensing technologies be constructed and operated for the Mahakam River basin as well. The fields of application include the following:

1) Surveillance of land rehabilitation of abandoned open pit sites or other abandoned mineral stopes;
2) Surveillance of wastewater discharged from various industrial facilities, farmlands, stock farms, and others;
3) Surveillance of changes in land use; and
4) Environmental monitoring of the Mahakam River Delta and the coastal waters.

Although the practical use of those environmental monitoring methods entails technological development, once put into practical use, the methods will become a powerful tool for environmental auditing. **Figure 5-1-22** shows a conceptual drawing of the Mahakam River wide-area environmental monitoring proposal.

Photo 5-1-1 is a remote sensing image shot in the downstream region of the Mahakam River recently (2006). **Photo 5-1-2** was developed by use of remote sensing satellite images in a collaborative project by the Yokohama Environmental Science Research Institute and the National Space Development Agency of Japan (September 1999 to March 2001). The photo captures a scene of stream of mud flowing into Tokyo Bay from rivers after downpour.

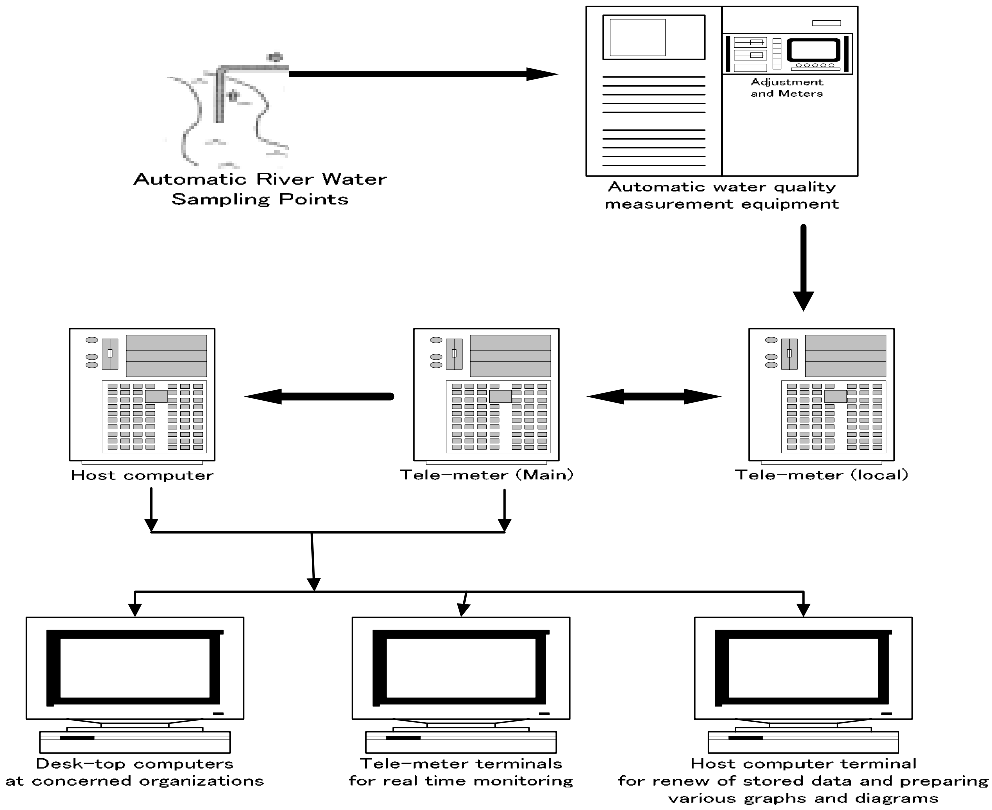


Figure 5-1-21 Conceptual diagram of the continuous monitoring system

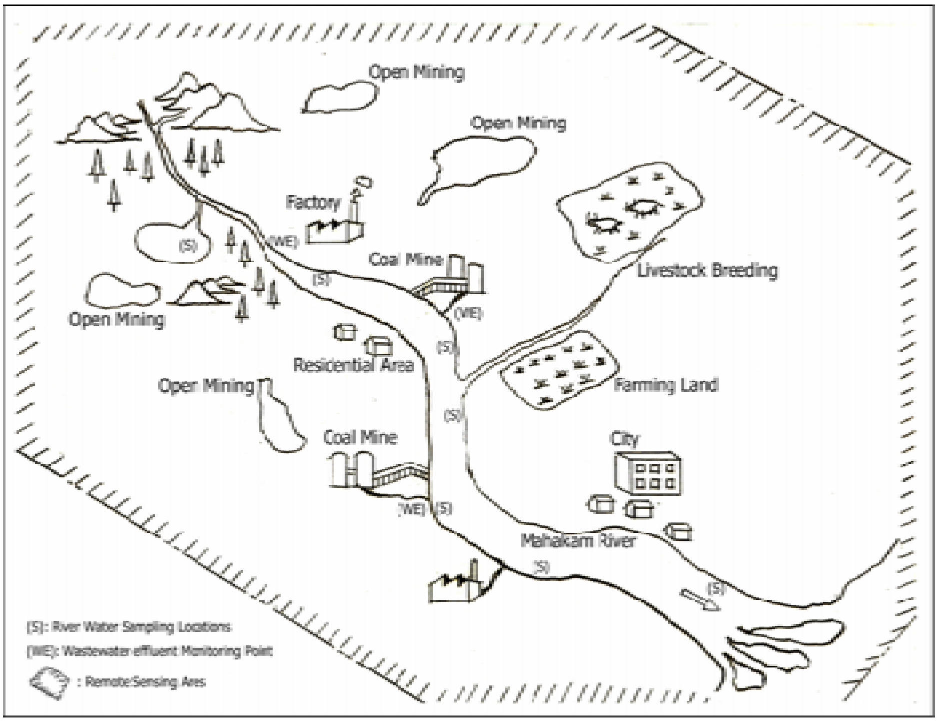


Figure 5-1-22 Conceptual drawing of the Mahakam River Monitoring

Photo 5-1-1 Remote sensing image shot of the Mahakam River (2006)

Source：Web site of Japan Aerospace Exploration Agency (JAXA)

Photo 5-1-2 Remote sensing satellite images of Tokyo Bay

2. Reduction Technologies at Source

Reduction technologies include improvements on the coal washing process and the establishment of the wastewater treatment procedures. Based on the sampling data obtained at the studied coal washing plants, a model case was developed and a proposal for improvements at the coal washing plants was prepared.

2.1. Improvements of the Coal washing Process

2.1.1 Jig Separating System

A prerequisite for lowering cut point size of "the coal washing process/wastewater treatment process " and mixing finer particles with salable coal products is the stability of the grade of coarse products that provide the basis for the mixed coal. Jigs capable of controlling grade are currently installed at only two washeries. Jigs were evaluated and proposals were put forward.

(1) PT. Kitadin

Japanese coal cleaning engineers are providing technical guidance. There was no salable coal misplaced with the rejects and the Jig was properly operated and managed.

(2) PT. Fajar Bumi Sakti (FBS)

The jig was not properly operated. In the first vessel the wave was poorly formed, loosening, tightening and proceeding were not promoted, and coal was simply flowing through both sides of the vessel. In all probability the result would be inadequate layer formation. Just as imagined, large amounts of salable coal were mixed with the rejects which is a product generated in the first vessel. It is necessary to examine the proper amount of coal feed, proper amount of air and proper amount of water required to form a proper wave and thereby improve the performaance of the jig. **Fig. 5-2-1** shows the results of the jig-separation (of +10 mm raw coal).

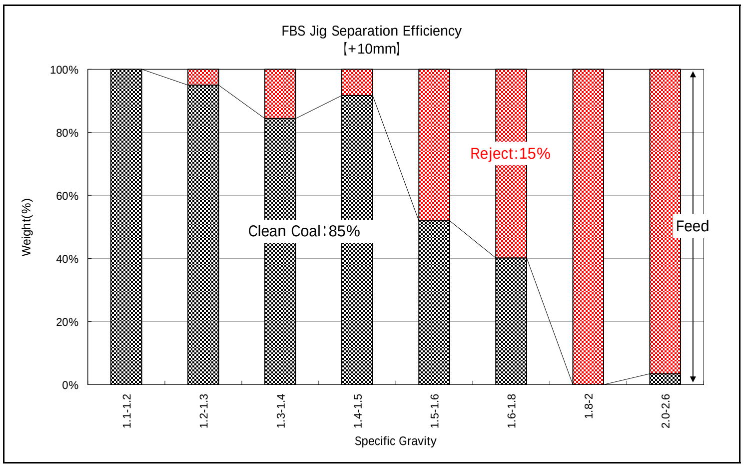


Fig. 5-2-1 Results of jig-separation (of +10 mm raw coal)

Rejects contain large amounts of coal particles, while clean coal contains large amounts of reject particles. **Table 5-2-1** shows the evaluation of the results of jig-separation.

Table 5-2-1 Evaluation of the results of FBS jig-separation

Products	Feed			Clean Coal			Reject		
	Wt %	Ash %	GCV	Wt %	Ash %	GCV	Wt %	Ash %	GCV
	100	9.28	6267	85.34	3.95	6708	14.56	39.24	3793
Performance	D_{50} Separation Density			Ep Ecart Probable			I Imperfection		
	1.59			0.16			0.27		

The Imperfection "I", an indicator of the separation accuracy, was as high as 0.27, pointing to poor separation. As a result, the calorific value of the rejects were as high as 3,793 kcal/kg. Table 5 II -1-2 shows the results of separation that may be achieved when this jig is operated in the condition generally managed in Japan.

Table 5-2-2 results of jig operated in the c0ndition generally managed in Japan.

Products	Feed			Clean Coal			Reject		
	Wt %	Ash %	GCV	Wt %	Ash %	GCV	Wt %	Ash %	GCV
	100	9.28	6267	91.51	3.95	6708	8.49	66.81	1515
Performance	D_{50} Separation Density			Ep Ecart Probable			I Imperfection		
	1.74			0.09			0.13		

Although the clean coal with 6,708 kcal/kg remains the same, the yield of clean coal has increased by 6 percentage points to 91.51%. This is because coal particles which were previously mixed with the rejects were recovered as clean coal. The grade of the rejects decreased significantly to 1,515 kcal/kg as a result.

2.1.2 Coal Washing Process / Wastewater Treatment Process Turning Facilities

The basics of reduction technologies in the coal washing process lie in how many particles can be retained within the coal washing process to prevent them from being transported out into the wastewater treatment process. In other words, facilities designed to separate the coal washing process from the wastewater treatment process are crucial. The turning facilities studied include settling pits, desliming screens and cyclone classifiers. These facilities are described again in **Table 5-2-3.**

Materials to be separated at this cut point include argillaceous minerals that are very fine particles after they have absorbed water and have become muddy and other coal particles. **Fig. 5-2--2 s**hows the relationship between the grain size and ash content of suspended particles sampled at the areas where wastewater is generated. At some plants, the ash content increases sharply with the grain size of around 100μm and it reaches 50% or more at less than 50μm.

This indicates that most of the argillaceous minerals have a grain size of 150μm or less.

Table 5-2-3 Coal Washing / Wastewater Treatment Process Turning Facilities

	Washery	Washing process/Wastewater process turning Point		
1	PT. Kitadin	Settling Pit	+	Bucket Elevator
2	PT. Fajar Bumi Sakti (FBS)	De-slime Screen / 0.5mm		
3	PT. Tanito Harum / Sebulu	Settling Pit	+	Bucket Elevator
4	PT. Tanito Harum / Loa Tebu 1	Cyclone Classifier	+	Screen / 0.5mm
5	PT. Multi Harapan Utama (MHU)	Cyclone Classifier	+	Screen / 0.25mm
6	PT. Bukit Baiduri Energy (BBE)	Cyclone Classifier	+	Screen / 0.5mm

A cyclone classifier is the most suitable sizing machine for the grain size of 150μm and it has already been adopted at three coal washing plants. **Table 5-2-4** shows the performance of the cyclone classifier. In this table, D_{50} represents the grain size of the cut point and Ep denotes the accuracy of sizing. The cyclone classifier at BBE is well managed and is sizing particles with the grain size of 160μm.

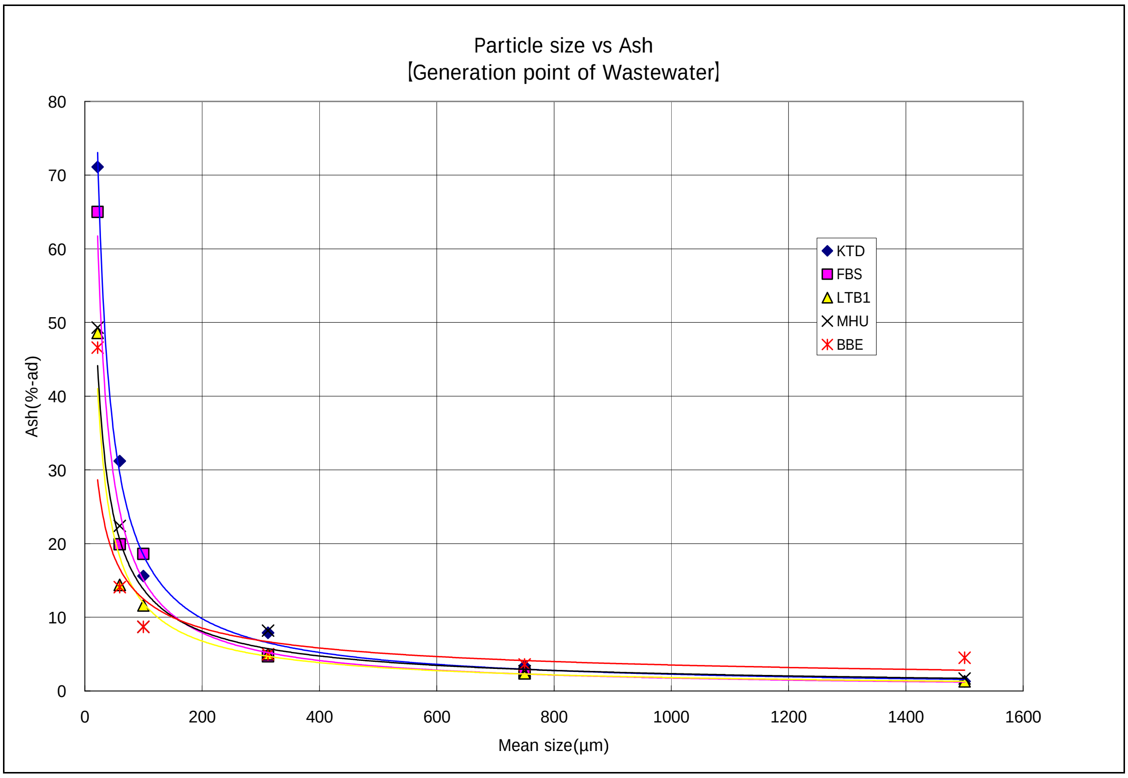


Fig. 5-2-2 Particle size vs Ash content

Table 5-2-4 Performance of Cyclone Classifier

Washery	Performance of Cyclone Classifier		
	D_{50}	Ep	Yield of Under-flow
4 PT. Tanito Harum / Loa Tebu 1	320μm	220μm	59%
5 PT. Multi Harapan Utama (MHU)	840μm	650μm	20%
6 PT. Bukit Baiduri Energy (BBE)	160μm	125μm	79%

How much can wastewater be reduced if cyclone classifiers that deliver the same performance as that at BBE are installed at all the coal washing plants? A list of wastewater reduction effects is shown in **Table 5-2-5** and a table of the calculation of reduction effects is shown in **Table 5-2-6**. As is apparent from these tables, Kitadin and FBS, which have not installed cyclone classifiers, could reduce the amount of wastewater by 77-78% from the current level. Loa Tebu 1, which is operating a cyclone classifier that has performance lower than that of the one installed at BBE, could reduce the amount of wastewater by nearly half to 58% and MHU could reduce the amount of wastewater by 76% from the current level.

Once fine coal has been fed into the wastewater process it cannot be recovered for sale. In addition, dredging, carrying and disposal expenses will be incurred. Sparing effort and neglecting the operational management of the cyclone classifier will result in an irreparable mistake. Installing a new cyclone classifier will cost US$150,000 or so but if the coal price is estimated at US$43/t, then the amount of fine coal will be 3,500 tons, so this investment can be recovered in less than one year. The comments on "the coal separation process / wastewater treatment process" turning facilities at each coal washing plant are indicated below. (Sebulu was excluded because this plant is primarily engaged in dry sizing operations.)

Table 5-2-5 List of Wastewater Reduction Effects with BBE-Cyclone Classifier

		Kitadin			FBS		
		Befire	After	Reduction Rate	Befire	After	Reduction Rate
Wastewater or Feed	Wt %	100.00	100.00		100.00	100.00	
	Ash %	49.23	49.23		43.49	43.49	
	GCV	2960	2960		3442	3442	
Under-Flow ⇒ Product	Wt %		22.61			22.42	
	Ash %		16.38			13.55	
	GCV		5360			5915	
Over-Flow ⇒ Wastewater	Wt %		77.39	77%		77.58	78%
	Ash %		58.82			52.14	
	GCV		2260			2727	
		Loa Tebu 1			**MHU**		
		Befire	After	Reduction Rate	Befire	After	Reduction Rate
Feed	Wt %	100.00	100.00		100.00	100.00	
	Ash %	12.15	12.15		26.80	26.80	
	GCV	5993	5993		4864	4864	
Under-Flow ⇒ Product	Wt %	58.73	75.95		20.24	39.66	
	Ash %	5.93	6.13		16.10	13.40	
	GCV	6392	6376		5752	5975	
Over-Flow ⇒ Wastewater	Wt %	41.27	24.05	58%	79.76	60.34	76%
	Ash %	16.00	22.80		29.80	37.30	
	GCV	5554	4987		4607	3985	

Table 5-2-6 Wastewater Reduction Effects with BBE-Cyclone Classifier

【Kitadin】 (-ad)

	Feed			Under Flow			Over Flow		
	Wt%	Ash%	GCV	Wt%	Ash%	GCV	Wt%	Ash%	GCV
+1000µm	0.18	1.3	6212	0.18	1.3	6212	0.00	1.3	6212
1000 - 500	2.04	3.4	6660	2.04	3.4	6660	0.00	3.4	6660
500 - 125	20.14	7.9	5941	14.98	7.9	5941	5.16	7.9	5941
125 - 75	8.28	15.6	5333	1.84	15.6	5333	6.44	15.6	5333
75 - 44	7.62	31.2	4308	0.95	31.2	4308	6.67	31.2	4308
-44	61.74	71.1	1372	2.62	71.1	1372	59.12	71.1	1372
Total	100.00	49.23	2960	22.61	16.38	5360	77.39	58.82	2260

【FBS】 (-ad)

	Feed			Under Flow			Over Flow		
	Wt%	Ash%	GCV	Wt%	Ash%	GCV	Wt%	Ash%	GCV
+1000µm									
1000 - 500	1.10	2.4	6836	1.10	2.4	6836	0.00	2.4	6836
500 - 125	20.79	4.7	6646	15.46	4.7	6646	5.33	4.7	6646
125 - 75	10.86	18.6	5498	2.41	18.6	5498	8.45	18.6	5498
75 - 44	7.20	19.9	5390	0.90	19.9	5390	6.30	19.9	5390
-44	60.05	65.0	1665	2.55	65.0	1665	57.50	65.0	1665
Total	100.00	43.49	3442	22.42	13.55	5915	77.58	52.14	2727

【Tanito/Loa Tebu 1】 (-ad)

	Feed			Under Flow			Over Flow		
	Wt%	Ash%	GCV	Wt%	Ash%	GCV	Wt%	Ash%	GCV
+1000µm	13.46	2.9	6700	13.46	3.3	6611	0.00	2.6	6669
1000 - 500	31.04	4.0	6612	31.01	4.9	6478	0.03	3.1	6628
500 - 125	39.79	9.9	6177	29.60	6.9	6311	10.19	8.5	6178
125 - 75	4.85	23.8	5035	1.08	25.4	4770	3.78	12.5	5845
75 - 44	4.08	37.4	4007	0.51	43.8	3237	3.57	23.3	4945
-44	6.77	57.6	2546	0.29	52.2	2538	6.48	51.1	2629
Total	100.00	12.15	5993	75.95	6.13	6376	24.05	22.80	4987

【MHU】 (-ad)

	Feed			Under Flow			Over Flow		
	Wt%	Ash%	GCV	Wt%	Ash%	GCV	Wt%	Ash%	GCV
+1000µm	3.65	4.8	6695	3.65	7.3	6486	0.00	2.9	6853
1000 - 500	11.42	6.5	6553	11.41	6.9	6520	0.01	4.9	6686
500 - 125	26.40	9.2	6328	19.64	12.3	6069	6.76	8.2	6411
125 - 75	10.31	15.9	5769	2.29	26.0	4927	8.02	14.3	5902
75 - 44	7.57	20.7	5369	0.94	36.4	4059	6.62	20.2	5410
-44	40.65	49.7	2950	1.73	53.1	2666	38.92	50.0	2925
Total	100.00	26.8	4864	39.66	13.4	5975	60.34	37.3	3985

(1) PT. Kitadin

A cyclone classifier must be installed. This facility can reduce the amount of wastewater by 77% from the current level. The product reclaimed in the wastewater reduction process will be mixed with clean coal as 5,360 kcal/kg coal particles. Because the current wastewater generation rate represents 7.4% of the raw coal, a 1.70% yield increase can be achieved.

(2) PT. Fajar Bumi Sakti (FBS)

A cyclone classifier must be installed. This facility can reduce the amount of wastewater by 78% from the current level. The product reclaimed in the wastewater reduction process will be mixed with clean coal as 5,915 kcal/kg coal particles. Because the current wastewater generation rate represents 3.4% of the raw coal, a 0.75% yield increase can be achieved.

(3) PT. Tanito Harum / Loa Tebu 1

The existing cyclone classifier must be improved in terms of its functions. The cyclone feed pump was being operated in an absorbed-up manner, so its essential sizing function was disturbed. This must be improved in the first place. A solution to the absorbed-up problem is a bypass valve that carries the cyclone's overflow water back into the feed pump (see **Photo 5-2-1**), but this valve was often clogged up. The valve must be remodeled so that it will not clog, or some other measures should be carried out to allow the valve to be easily cleared when it become clog.

Photo 5-2-1 Overflow Bypass Pipe

A cyclone classifier that was as carefully managed as the cyclone at BBE could reduce the amount of wastewater by up to 58% from the current level. The product reclaimed in the wastewater reduction process will be mixed with clean coal as 6,376 kcal/kg coal particles. Because the current wastewater generation rate represents 9.2% of the raw coal, a remarkable 3.86% yield increase can be achieved.

(4) PT. Multi Harapan Utama (MHU)

The cyclone classifier was seemingly well taken care of but the cut point was very large at 840μm. Probably the feed flow rate and pressure into the cyclone classifier might be under the design values. Causes should be investigated and the cyclone must be restored to its normal condition.

In the future, some deliberate measures must be taken, such as: The eight cyclone classifier feed pipes (**Photo 5-2-2**) should be provided with pressure gauges and valves, so that if pressure goes down below the prescribed level, the number of cyclone classifiers can be decreased.

A cyclone classifier that was as carefully managed as the cyclone at BBE could reduce the amount of wastewater by 76% from the current level. The product reclaimed in the wastewater reduction process will be mixed with clean coal as 5,975 kcal/kg coal particles. Because the current wastewater generation rate represents 2.6% of the raw coal, a 0.62% yield increase can be achieved.

Photo 5-2-2 Eight cyclone classifier feed pipes

(5) PT. Bukit Baiduri Energi (BBE)

This cyclone classifier was the best cared for among the plants investigated. In order to maintain this cyclone classifier in good condition, periodic sampling and performance test should be carried out.

2.1.3 Other

A number of washeries can also be encountered here and there that are still in a condition in which any talk about equipment improvement or upgrading of operating conditions seems rather premature. In such washeries, for example, the area around the washing machine is inundated with coal and slurry and there is nowhere to put one's feet. It is all a matter of quality control awareness. At the root of it all is the presence of dredged fine coal piled up all around.

2.2. Establishment of the Wastewater Treatment Procedure

2.2.1 Wastewater Treatment Process

The basics of the wastewater process lie in the use of circulating water and not releasing wastewater outside. The amount of circulating water decreases slowly as it adheres to the surface of products shipped and therefore riverwater is supplied to make up for this decrement. Considering that the quantity of SS in the Mahakam River was measured to be 170 mg/l on July 7, 2005, it is suggested to set the target concentration of circulating water at 200 mg/l or so. The comments on the wastewater process at each coal separation plant follow.

(1) PT. Kitadin

A facility designed to recycle jigging water is installed (**Photo 5-2-3**). The SS concentration of this recycling jigging water exceeds 10,000 mg/l but it is still usable as jigging water (somewhat turbid water could improve the jigging accuracy). However, this jigging water cannot be used to wash products, so washing water is taken from the Mahakam River.

Photo 5-2-3 Facility Designed to Recycle Jigging Water

This recycling jigging water with a SS concentration of more than 10,000 mg/l is mixed with low SS concentration wastewater used in washing and is fed into the wastewater treatment process. The basis of wastewater treatment lies in "not mixing and not diluting." Recycling jigging water that may be high in SS concentration should never be mixed with low SS concentration wastewater used in washing.

Recycling jigging water should be recycled in a closed circuit constructed around the jig. A thickener or a cyclone classifier should be installed and overflow water from this thickener or cyclone classifier should be stored in a circulating water head tank as recycling jigging water. Coarse particles from them should be fed into the clean coal screen or stored in a small settling pond and be dredged.

In the meantime, only low SS concentration wastewater used in washing at the screen should be fed into the present wastewater process settling pond. A coagulant may have to be added but it should not be added at the outlet of the settling pond as it is now but it should be added at the inlet of the settling pond. The load on the wastewater treatment process will be decreased significantly, washing water for screening can be recycled, and a system that does not discharge this water outside can be constructed.

(2) PT. Fajar Bumi Sakti (FBS)

At this plant, a complete recycling system has already been completed (**Photo 5-2-4**). Because fine particles generated in this area are sandy particles and display a better settling quality than those at other plants, the water might have been easily completely recycled. Recycling jigging water and washing water are mixed together but the particles have a good settling quality and so this mixing practice has not imposed a load on the wastewater treatment process.

Photo 5-2-3 Facility Designed to Recycling Water

(3) PT. Tanito Harumu / Sebulu

At this plant, high Fe ion and acidic water are primary concerns. Neutralizing is the only solution to this problem, so that lime milk-based neutralizing facilities are installed. Without rainfall, acidic water would not be generated, but the moment rain comes in contact with high-sulfur coal piled in the storage yard or the dredged fine coal, acidic water will be generated. Rainfall at the site represents the amount of acid waste, so that there is a huge quantity of the acidic water. The only way to solve this problem is to store acidic rain in a balancing reservoir where it is gradually neutralized and is then discharged to the river. The cost of performing this treatment is not negligible.

High Fe ion and acidic rain occur more or less at all coal washing plants where pyrite-containing high-sulfur coal is being handled. A desirable approach is to reduce the number of washing plants handling high-sulfur coal and to put together washing plants fully equipped with neutralizing facilities.

An example of an acidic water neutralizing facility installed in Japan is shown in **Fig. 5-2-3.** This facility is capable of treating wastewater with a pH of 2-3 and a Fe ion content of more than 1,000 ppm at the rate of 20 m^3/min. The facility is totally home-made and fly ash produced by a nearby power plant is used. It entails very low costs of construction and operation.

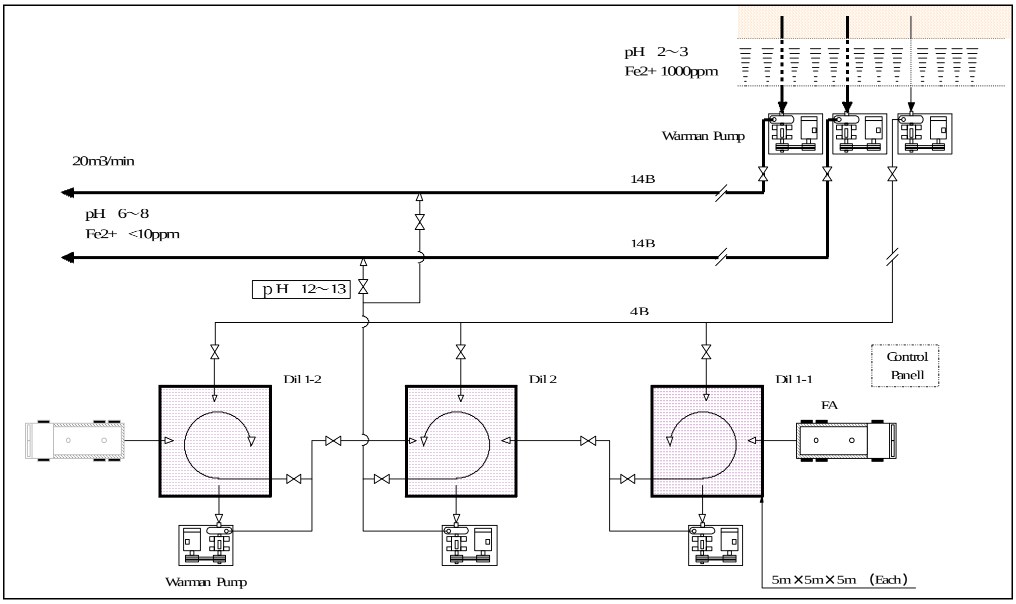


Fig. 5-2-3 Example of Acidic Water Neutralizing Facility in Japan

(4) PT. Tanito Harum / Loa Tebu 1

No recycling water system has been installed. Judging from the quality the water can be adequately recycled but before implementing this practice, a wastewater discharge line must be constructed. Facilities at this plant are installed at the same level as the coal storage yards. The plant is surrounded by coal storage piles and, as a result, is located at a low spot, so that gravity water discharge is difficult and the facilities are operated with their lower parts submerged under muddy water. Before installing a new circulating water intake line, the existing wastewater discharge line must be improved. **Photo 5-2-5** shows the layout of the washing facilities and Photo 5Ⅱ-2-4 shows the condition around the washing facilities.

Photo 5-2-4 Layout of Facilities **Photo 5-2-5 Condition around Facilities**

(5) PT. Multi Harapan Utama (MHU)

No recycling water system has been installed. Currently secondary and tertiary settling ponds are being reduced. To counter this, a plan to construct a new settling pond near the washing plant has been established. The planned settling pond is smaller in area than the current settling ponds, so that installing flocculants adding facilities is essential. The new plan should include the recycling of feed water.

(6) PT. Bukit Baiduri Energi (BBE)

At present, a water channel leading from near the final discharge outlet to the plant is being drilled in order to implement a recycling water system (**Photo 5-2-7**). Settling ponds in this area are very functionally arranged. The grain size of deposits decreases uniformly from the primary settling pond to the secondary and tertiary ponds. Scaffolds for heavy machinery and a truck road have been constructed for dredging purposes. The quaternary settling pond is equipped with two flocculants adding facilities. The complete system is now in place.

Photo 5-2-7 Water Channel for Recycling water

2.2.2 Flocculants

(1) Inorganic Flocculants

Kitadin is using inorganic flocculants, while Loa Tebu 1 and BBE are using organic polymer flocculants. Wastewater in this area contains large amounts of very fine argillaceous minerals, which are all negatively charged and repelling each other and consequently are very hard to settle. Therefore, the use of an inorganic coagulant with a positive electric charge is an appropriate solution to neutralize the negatively charged minerals. If the settling velocity is to be increased, an organic polymer coagulant may be added after an inorganic coagulant is added. The coagulation and flocculating structure is shown in **Fig. 5-2-4**.

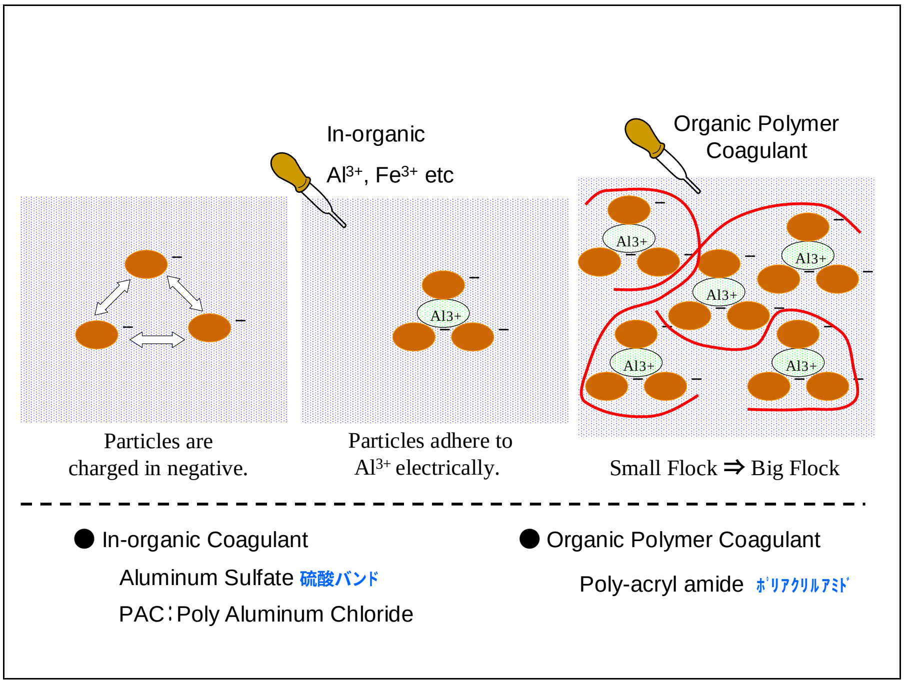
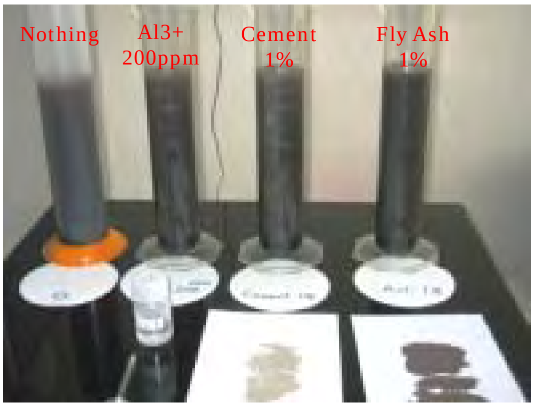


Fig. 5-2-4 Flocculating Structure

(2) Fly Ash

Typical inorganic flocculants include "aluminum sulfate" and "poly aluminum chloride (PAC)". Cement and fly ash are also effective organic flocculants. **Photo 5-2-8** shows settling tests conducted using aluminum sulfates, cement and fly ash. To obtain fly ash, dredged fine particles collected at BBE were incinerated to ashes and were ground in a mill.

The amounts added to 500 cc each of raw water were 200 ppm of aluminum sulfate, 1% of cement, and 1% of fly ash. One hour after the tests were begun, the clear layer of water to which aluminum sulfate were added was cloudy but the clear layer of the water to which cement and fly ash were added remained clear. Two hours later, pH was 7.50 for the raw water, 5.85 for the water to which aluminum sulfate was added, 11.58 for the water to which cement was added, and 7.43 for the water to which fly ash was added. Because the regulatory pH value ranges from 6 to 9, the amounts of sulfur acid bands and cement added must be decreased. While numerous strong alkali fly ashes occur, coal ashes collected in this area are neutral. This fact provides tremendous advantages in that coal ashes can be used as inorganic flocculants and in considering possible effective uses of coal ashes.



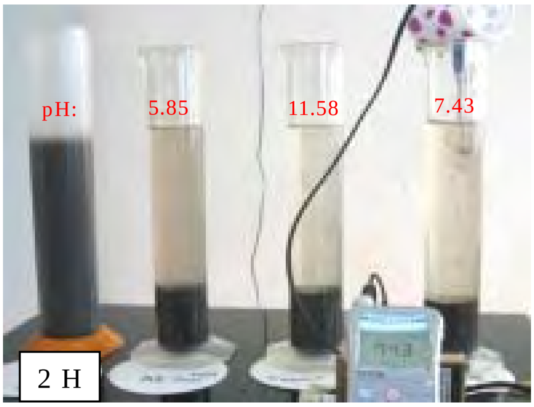


Photo 5-2-8 Settling Tests (1/2)

(3) High Fe ion and Acidic Water

Al^{3+} contained in aluminum sulfate neutralizes the negative charges of clay minerals and coagulates them, while Fe^{2+} and Fe^{3+} contained in high Fe ion and acidic water also have the inorganic coagulation effect as with aluminum sulfate. High Fe ion and acidic water are nothing but bothers, but these may be worth consideration as an inexhaustible supply of flocculants for the hard to settle clay minerals that occur in this area. The sedimentation examination using the high Fe and the acidic water (pH:2.5, Feion:2000 mg/l) extracted by Sebulu is shown in a **Photo 5-2-9.** The rate of addition of high Fe and acidic water is 0.5%. Since pH (5.38) is too low, the amount of addition needs to be decreased.


Photo 5-2-9 Settling Tests (2/2)

2.3. Human Resources Development

The present study has produced various suggestions for improvements, including a drastic proposal for more than 20% reductions in the amount of wastewater. These suggestions for improvements cannot be realized unless a desirable system from the coal washing process to the wastewater process is quantitatively analyzed and a specific solution is developed. Fundamental abilities to do this cannot be cultivated in a short time. Education, training and human resources development on the part of our counterparts are an essential condition for sustainable development for the future. An education and training program, including on-the-job training, for improvements of workers' fundamental abilities concerning coal wastewater treatment must be promoted vigorously.

3. Utilization of non-marketable fine coals

3.1. Briquette Production Plan

3.1.1 The Policy regarding promotion of Coal Briquette Usage

Production of coal briquettes was started in several Provinces in the 1980s and production of coal briquettes was started as a national project in the 1990s when crude oil production came to its peak and was projected to decline. Despite marketing efforts, the coal briquette market was limited, due primarily to the lower prices of other competitive fuels, i.e., kerosene and LPG. In addition, the possible negative health concerns have been pointed out and use of LPG and kerosene was encouraged. After a hike in the price of crude oil, demand for coal briquettes has increased to a certain extent.

According to the Blue Book of The Ministry of Energy and Mineral Resources in 2005, consumption of oil as a primary energy source will be reduced from the level of 54% in 2005 down to 33% by 2025. To support the policy, use of coal is encouraged under the best energy mix policy. So far, no special arrangement for the promotion of the coal briquettes has been provided.

3.1.2 Demand for Coal Briquettes

In connection with the abolition of the subsidy being given to oil products in 2005, demand for coal briquettes has increased to a certain extent. However, about 25% subsidy has still been provided to domestic use of kerosene and LPG, and the coal briquette market is still limited to small and/or middle scale industries. The potential coal briquette market is shown in **Figure 5-3-1**.

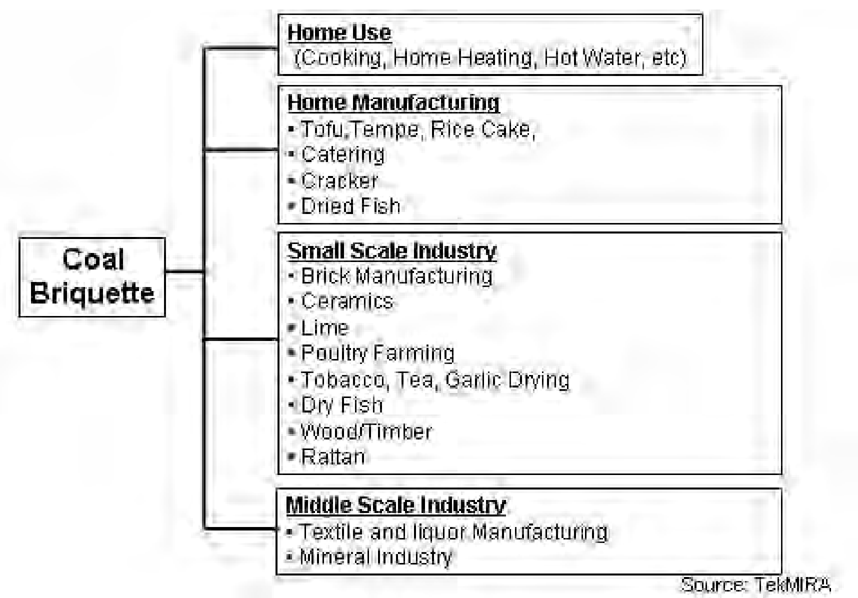
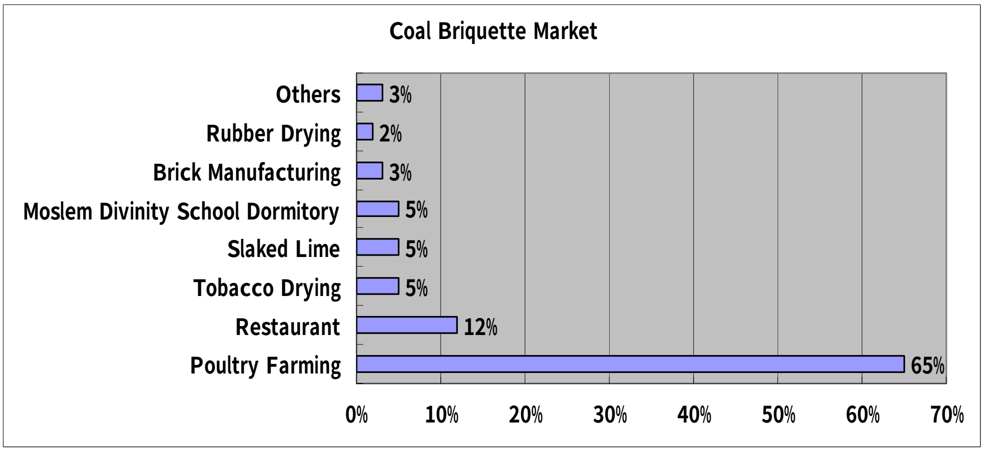


Figure 5-3-1 Potential Coal Briquette Market

Once the coal briquettes are fired and reach stable condition, it will continue to burn for a few hours. It is difficult to turn on and off. On the other hand, LPG and Kerosene are easily turned on and off and are suitable for domestic or home use such as cooking, heating and hot water supply purposes. This is one of the reasons why the coal briquette is not used for home use.
Coal briquettes can be used for small scale food industries such as soy bean curd manufacturing, rice crackers, dry fish, etc. or other small/middle scale industries like poultry farming, pottery and brick manufacturing, drying tobacco and tea leaves, processing wood/timber and rattans.
Middle scale industries like the textile industry use middle scale boilers and this may be a market for coal briquettes. However, the price of briquettes is higher than coal itself and it is considered very difficult to compete as a boiler fuel.

Figure 5-3-2 shows the present coal briquette market.



Source: TekMIRA

Figure 5-3-2 Coal Briquette Market (2005)

A total of 65% of coal briquettes are sold to the poultry farming industry and 12% is for restaurants. Others are for tobacco drying, slaked lime manufacturing, uses for Moslem divinity school dormitories, brick and rubble manufacturing.
There is a regional difference in the market. The largest coal briquette demand is in Java; however demand in Sumatra is very limited due to the availability of alternative and competing energy sources of firewood.

3.1.3 Coal Briquette Price and Competitiveness

There are two types of coal briquettes being sold in the market, a carbonized briquette using carbonized coal powder and a non carbonized briquette using raw coal powder. These powders are molded in the form of briquettes using binding materials. Carbonized briquettes have a higher heating value and no smoke and odor in the combustion. On the other hand, non carbonized briquettes will make smoke when ignited and odor in the combustion.

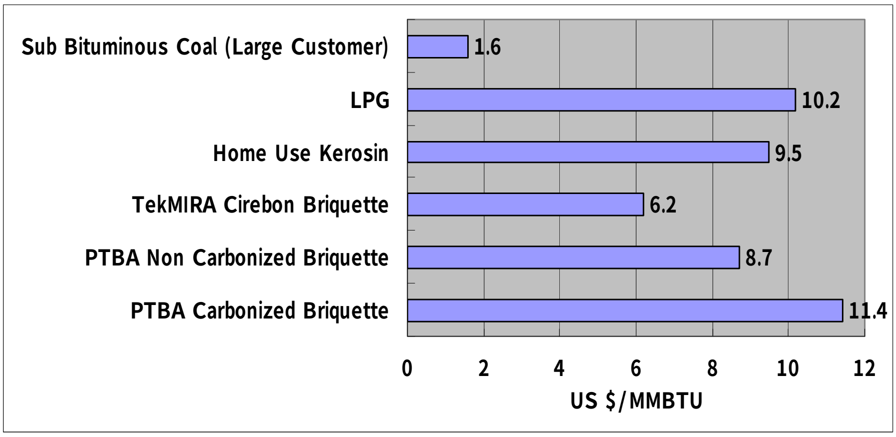
Table 5-3-1 shows the Ex-Work price and market price for carbonized briquettes and non carbonized briquettes.

Table 5-3-1 Coal Briquette Price List

Type	kcal/kg		Rp/kg	$/MMBTU
Carbonized	6000	ExWork Price	1500	7.8
		Market Price	2200	11.4
Non Carbonized	5500	ExWork Price	800	4.2
		Market Price	1200	6.2

Source: PTBA and TekMIRA Cirebon

Under the current energy price system as shown in **Figure 5-3-3**, the price of coal briquettes is not necessarily competitive and advantageous over the other competing energy sources. Carbonized coal briquettes produced by PTBA have no smoke or odor, and longer burning time. This product has its own strong demand, although the price is high. However, non carbonized coal briquettes should have to compete with other fuels, including LPG and kerosene in which 25 % of the sales price is subsidized by the government. The subsidy will be lifted gradually, and the coal briquettes are expected to be competitive over other competing fuels.



TekMIRA Cirebon	kcal/kg	5500	Market	1200 Rp/kg	6.2
Home Use Kerosin	kcal/l	8900	Market	3000 Rp/l	9.5
LPG	kcal/kg	12000	Market	4362 Rp/kg	10.2
Sub Bituminous Coal	kcal/kg	5300	FOB	35 $/ton	1.6
Natural Gas	$/MMBTU		Wholesale		6

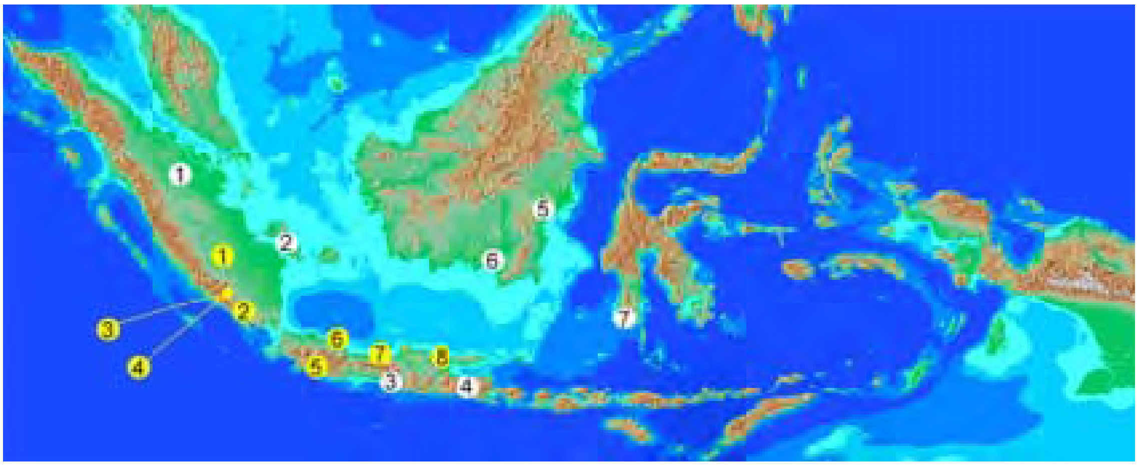
Source: MEMR

Figure 5-3-3 Energy Price Comparison

3.1.4 Coal Briquette Supply

At present, coal briquettes are manufactured at eight locations. PTBA has three manufacturing facilities, one each in Tanjung Enim、Lampung and Gresik. PTBA is the largest briquette manufacturer and supplier in the country. They have a production capacity of 85,000 tons per year, account for 85% of total production capacity in Indonesia. Next largest is TekMIRA Cirebon, with the manufacturing capacity of 10,000 tons per year, account for 10% of total production capacity in Indonesia. There are four other briquette manufacturing facilities, but each of their manufacturing capacity is small.

Figure 5-3-1-4 shows the locations of the coal briquette manufacturing facilities in Indonesia. Existing facilities are marked yellow and the other marked facilities are planned for the future.



? Nama/Lokasi Pabrik	Kap. Produksi	? Nama/Lokasi Pabrik	Ren. Kap. Produksi
Pabrik Briket yang Produksi		**Pabrik Briket belum Produksi**	
1. Hashimoto, Tanjung Enim	10.000 ton/tahun	1. Solok, Sumatera Barat	1.500 ton/tahun
2. PTBA Tarahan Lampung	5,000 ton/tahun	2. Pangkal Pinang, Bangka Belitung	1.500 ton/tahun
3. PD. Bengkulu Mandiri, Bengkulu	1.500 ton/tahun	3. Bantul, Jawa Tengah	1.500 ton/tahun
4. PUSKUDINDO, Bengkulu.	300 ton/tahun	4. Lumajang, Jawa Timur	1.500 ton/tahun
5. Kop. Purna Praja Wibawa Mukti, Garut	1.500 ton/tahun	5. Pasir. Kalimantan Timur	1.500 ton/tahun
6. Bio Coal Tekmira, Cirebon	10.000 ton/tahun	6. Banjarbaru, Kalimantan Selatan	1.500 ton/tahun
7. CV. Sinar Teknik Utama, Tegal	1.500 ton/tahun	7. Takalar, Sulawesi Selatan	1.500 ton/tahun
8. PTBA, Gresik Jatim	70.000 ton/tahun		

Note: **Yellow: Exiting Facilities**
White: Planed Facilities

Figure 5-3-4 Coal Briquette Production Site Map (Source: TekMIRA)

Production capacity for each facility is shown in Figure 5-3-5.

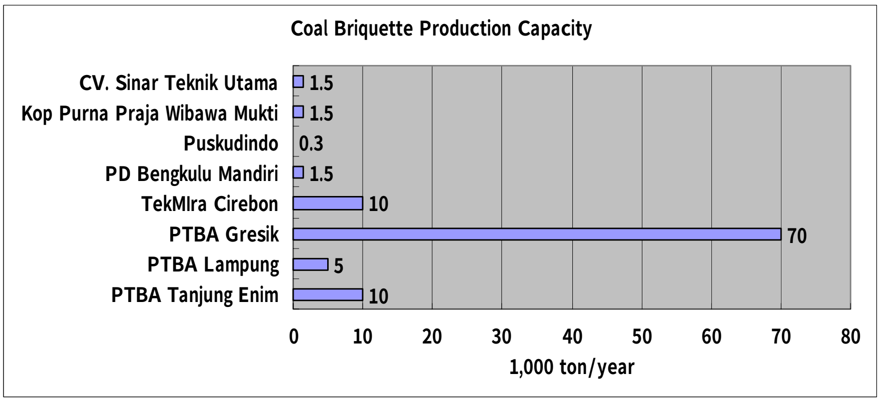


Figure 5-3-5 Coal Briquette Production Capacity by Facility **(Source: TekMIRA)**

There are several types of coal briquettes. They differ in ingredients and manufacturing process as listed below.
Total production capacity is still larger than the demand.

1) Carbonized Briquettes

Carbonized briquettes are manufactured by the use of carbonated coal powder, produced by removing impurities, such as volatile matters and sulfur, which are produced in the process of coal carbonization. The powder is molded in the form of briquettes together with tapioca starch which works as a binding agent. The carbon content is high and quality is stable. It is suitable for long time storage and transportation. No smoke and smell is produced in the combustion and the fire last a long time. This type is manufactured at Tanjung Enim by PTBA.

2) Non Carbonized Coal Briquettes

Non carbonized coal briquettes are manufactured by using a powder of low sulfur coal and solidified by tapioca starch. This generates smoke during ignition. This is produced at Lampung and Gresik of PTBA.

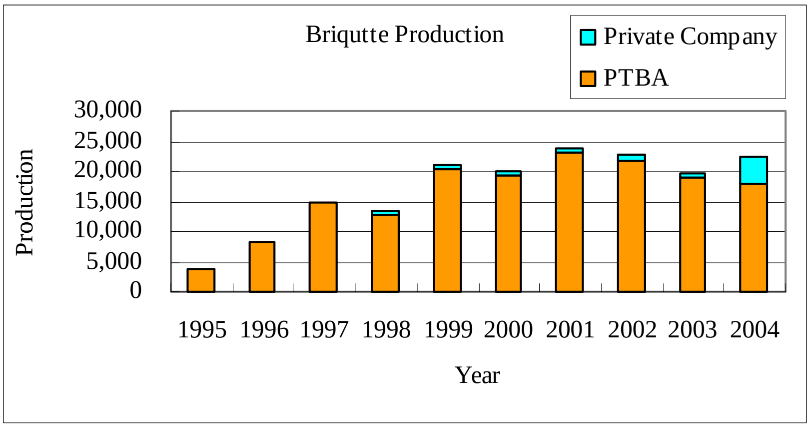
3) Non Carbonized Bio-briquettes, High Caloric Value Type

This is produced by mixing lime stone and bio-mass with high caloric coal and is solidified with molasses. This generates some smoke during ignition. This is produced at TekMIRA Cirebon.

4) Non Carbonized Bio-briquettes, High Caloric Value Type

This is produced by mixing clay and bio-mass with low caloric and low sulfur coal, and is solidified with molasses. This generates some smoke during ignition. This is also produced at TekMIRA Cirebon.

Total Briquette Production in Indonesia is shown in the **Figure 5-3-6**.



Source: MEMR

Figure 5-3-6 Briquette Production in Indonesia

3.1.5 Coal briquette Manufacturing Facilities

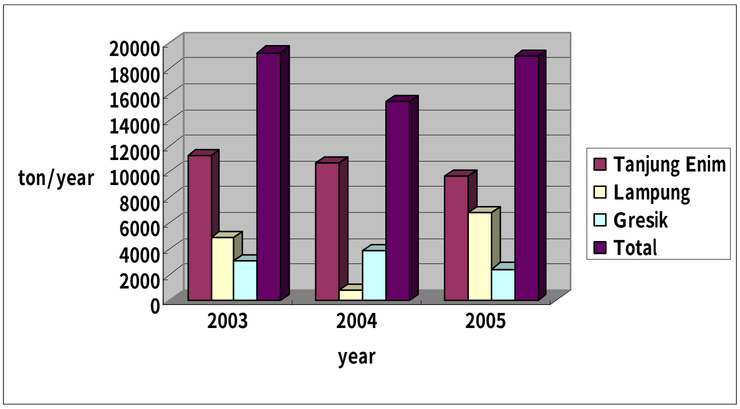
Coal briquette manufacturing facilities can be classified into two types, carbonized briquette production or non carbonized briquette production. But the general manufacturing processes are similar. Production capacity of PTBA accounts for 85 % and that of TekMIRA accounts for 10 %. Demand for PTBA carbonized coal briquettes has increased and become greater than manufacturing capacity, depending on the price level. However the market for non carbonized coal briquettes is limited and supply capacity is much larger than demand. Ex-work price of PTBA carbonized coal briquettes is 1,500 Rp/kg and market price is 2,200Rp/kg inclusive of transportation and handling cost of 700Rp/kg, while the Ex-Work price of non carbonized coal briquettes is 1,000Rp/kg and market price is 1,700Rp/kg, inclusive of transportation and handling cost of 700Rp/kg. Ex-work price of non carbonized bio-briquettes manufactured by TekMIRA is 800Rp/kg and market price for this product is 1,200Rp/kg. If prices of these non carbonized coal briquettes are compared, TekMIRA product is more competitive than the PTBA product.

(1) Production facility of PTBA

<u>**Coal Briquette Production Rate**</u>

PTBA has three coal briquette production facilities, one each at Tanjung Enim、Lampung and Gresik. Carbonized coal briquettes are manufactured at Tanjung Enim and non carbonized coal briquettes are manufactured at the other two facilities. A total of 10,000 tons/year of briquettes are manufactured in Tanjung Enim and 80% of them are shipped to Java. Since the market for non carbonized coal briquettes is limited, PTBA started to plan to expand the carbonized briquette production facility. These carbonized briquettes have a caloric value of 5,500-6,000Kcal/kg with a 5% water content and has been sold under the brand name of “Super” at 1,500Rp/kg ex-works. Non carbonized briquettes have a caloric value of 5,000-5,500Kcal/kg and are sold at 1,000Rp/kg ex-works.

Figure 5-3-7 shows the production status of the PTBA facilities.



Source: PTBA

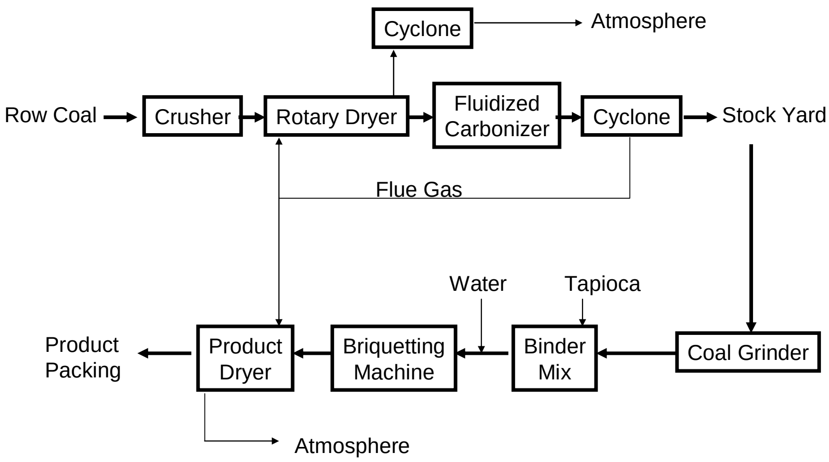
Figure 5-37 Coal Briquette Production by BPBA

Carbonized Briquette Production Facilities

The carbonized briquette manufacturing facility at Tanjung Enim was constructed using NEDO funds, and started operation in 1997. An outline of the facility is shown in **Figure 5-3-8**.

Raw material coals are crushed into a certain size by a Crusher and then sent to a Rotary Dryer. The dried coal powder is then sent to a Fluidized Bed Carbonizer for carbonization. After the carbonization process, the powder is separated from the flue gas in a cyclone and transported to a stock yard. The flammable gas from cyclone is sent back to the rotary dryer through a flue to be burned and the effluent gas is used to dry the incoming coals. The effluent gas from the Rotary Dryer is released to the atmosphere via a Cyclone.

The carbonized coal product is further ground and mixed with 5% of the binder (tapioca). After mixing with water, the mixture is sent to a briquetting machine. The briquettes are then heated and dried before moving to a packing facility to make the final product.



Source: PTBA

Figure 5-3-8 Carbonized Briquette Manufacturing Process

Raw Materials and Product Specifications

Raw materials to manufacture carbonized briquettes are coal and tapioca (starch). **Table 5-3-2** shows the specifications for the raw coal material for carbonized briquette manufacturing. This coal has low sulfur and low ash contents.

Table 5-3-2 Coal Specifications for Carbonized Coal Briquette

Raw Coal Specification				
NO	Parameter	Basis	Unit	Specification
1	Total Moisture	AR	%	20 - 30
2	Inherent Moisture	Adb	%	10 - 20
3	Ash Contents	Adb	%	5 - 10
4	Volatile Matter	Adb	%	35 - 45
5	Fixed Carbon	Adb	%	33 - 45
6	Sulfur	Adb	%	< 0.5
7	Caloric Value	Adb	Kcal/kg	5,000 - 6,000

Source: PTBA

Carbonized coal briquette specifications are shown in **Table 5-3-3** as follows:

Table 5-3-3 Carbonized Coal Briquette Specification

Briket Super Specification				
NO	Parameter	Basis	Unit	Specification
1	Total Moisture	AR	%	< 7.5
2	Ash	AR	%	14 - 18
3	Volatile Matter	AR	%	24 - 27
4	Fixed Carbon	AR	%	55 - 60
5	Caloric Value	AR	Kcal/kg	5,500 - 6,000
6	Total Sulfur	AR	%	< 0.5
7	Ash Fusion Temp.	AR	C	> 1,250
8		AR	Kgf/pc	> 60
9	Size			
	Hight		mm	36 - 40
			mm	54 x 51
10	Weight		gr	49 - 54
11	Composition Analysis	AR		
	Carbon		%	64 - 67
	Hydrogen		%	2.7 - 4.9
	Oxigen		%	11.1 - 13.0
	Nitrogen		%	1.0 - 1.2
12	Ash Composition			
	SiO2		%	56.0 - 62.7
	Al2O3		%	17.9 - 24.3
	Fe2O3		%	6.4 - 9.1
	TiO2		%	0.1 - 1.1
	CaO		%	2.7 - 4.1
	MgO		%	1.1 - 1.9
	Na2O		%	0,4 - 2.3
	K2O		%	0.5 - 0.8
	P2O5		%	0.2 - 0.4
	SO3		%	2.3 - 8.9
	Mn3O4		%	0..07 - 0.08
13	Gas Emission			
	SO2		%	< 5
	Nox		%	< 2
	CO		%	< 1000

Source: PTBA

Production cost

Production cost is broken down into the following cost elements **(Figure 5-3-9):**

Coal: 250 Rp/Kg

Labor Cost: 350 Rp/Kg

Other cost: 900 Rp/Kg

The other cost include tapioca, packing bags, spare parts for the facility, electricity and fuel for transportation machineries, but exclude depreciation cost and interest payments. The facility operation is based on 4 shifts; each shift has 33 personnel, consisting of the following groups:

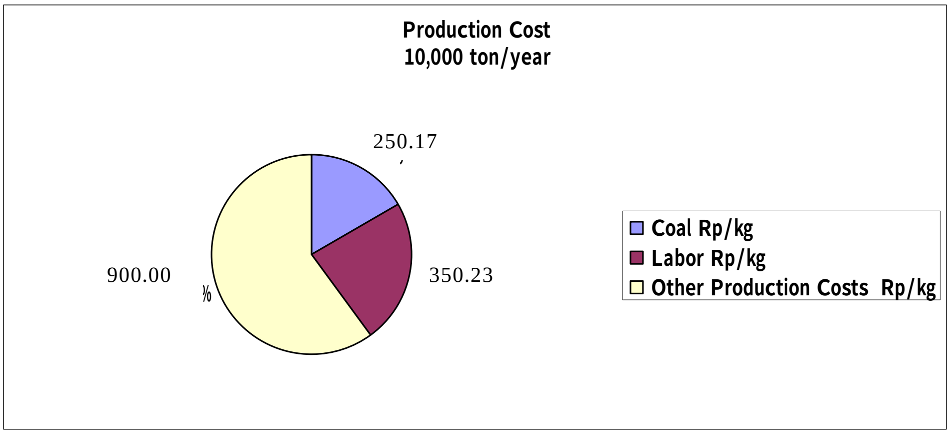
Packing: 11

Maintenance: 4 (2 for machinery, 2 for electricity)

Operators: 7

Others: 11 in total (including driver, laborers, supervisor, etc).

In order to produce one ton of carbonized coal, two tons of coal are required. Production capacity is limited by the capacity of the Carbonizer in the manufacturing process.



Source: PTBA

Figure 5-3-9 Carbonized Coal Briquette Production Cost

PTBA plans to increase the production capacity of carbonized coal briquettes from the current 10,000ton/yr to 30,000ton/yr. Project Schedule is as follows:

2006: Basic Design and Cost Estimate for budget purposes

2007: Construction Commencement

2008: Start Operation

Quotation for the project by a Japanese Manufacturer (Hashimoto Sangyo) is Rp 115 billion. Verification of the proposal and quotation is under way by the Project Team.

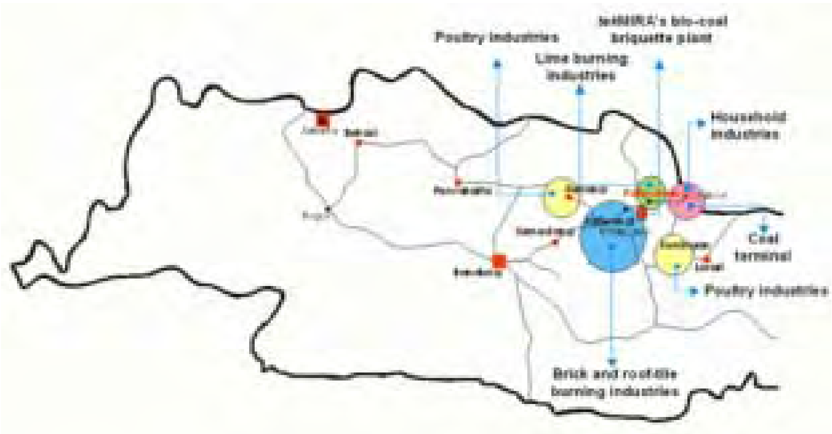
(2) TekMIRA Coal Briquette Production Facility

The TekMIRA coal briquette production facility is located in Cirebon. The facility was constructed under an agreement between the Governments of Japan (NEDO) and the Government of Indonesia (MEMR) and opened in November 2001. The product is non carbonized coal briquettes. Raw coal powder is mixed with lime stone powder, bio-mass or clay, and molasses as a binder. The mixture is molded to form briquettes in a briquette manufacturing machine. The briquettes are dried naturally for two days before being shipped out as a final product. The production facility was designed by Mitsui Mining Corp. and two types of briquettes can be produced from this facility.

TekMIRA is operating the facility jointly with PT. Paragonesiatama and manufacture bio-briquettes under a joint development agreement valid till 2008. TekMIRA and PT. Paragonesiatama have constructed a new production line to manufacture Low Calorie bio-briquettes jointly in the vicinity of the facility.

High calorie briquettes produce no odor during ignition. Low calorie briquettes generate slight smoke during ignition and also odor, and storage time is limited to about 2 months, depending on the storage condition.

Although the facility has a production capacity of 3,000tons per month, present production rate is only 500 to 600 tons per month, still, this is much improved in comparison with the production rate before 2005 when the level of production was as low as only 200 to 300 tons per moth. Demand for briquettes has increased due to a rise in the price of oil. Present market for these briquettes is poultry farming and food processing industry, including soy bean curd and tempe manufacturing, and garlic drying. Overview of the potential market for these briquettes is shown in **Figure 5-3-10**.



Source: TekMIRA

Figure 5-3-10 Potential Bio-Briquette Market Around Cirebon

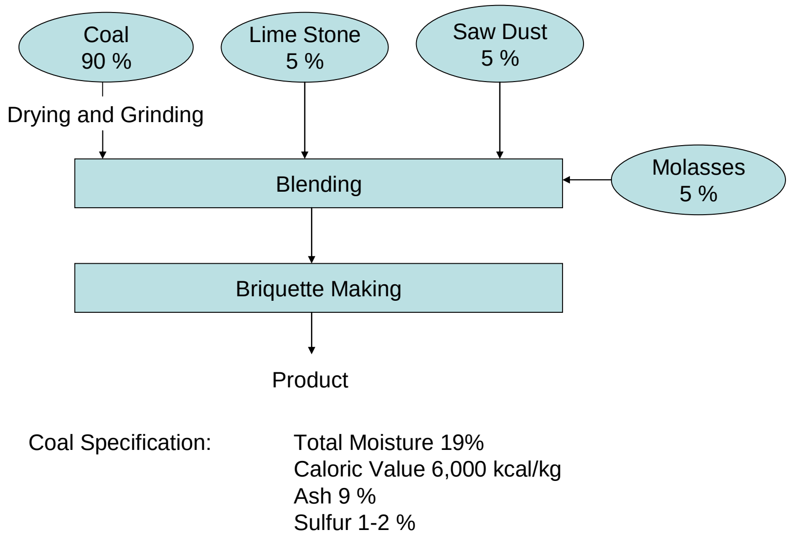
<u>Briquette Specifications</u>

Two types of briquettes are produced, i.e., High Calorie Bio-Briquettes and Low Calorie Bio-Briquettes.

High calorie briquettes (more than 5,500Kcal/kg) are sold at 800 Rp/kg, Ex-Works. The ingredients of these briquettes are as follows:

Bio-mass (saw dust):	5%
Lime stone:	5%
Coal:	90%

In addition, molasses is used as a binder. Raw coal has a caloric value of 6000Kcal/Kg, with 9% ash, 1-2% sulfur, and 19% total moisture. The moisture of the raw coal is reduced down to 10% in the dryer. Coal price was 390,000Rp/ton, as of July 2006. To minimize the generation of SO_2 in the combustion, lime stone powder is also mixed to capture the sulfur to transform it into Gypsum and this is recovered in the form of ash.



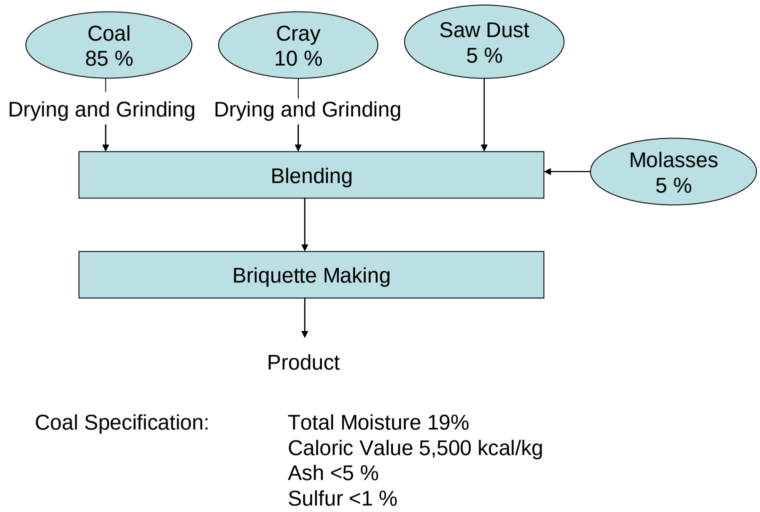
Source: TekMIRA

Figure 5-3-11 High Calorie Briquettes

Low calorie briquettes (5000 Kcal/kg) are sold at 750Rp/kg, Ex-Works. At present, these briquettes are produced on a new separate line using a Chinese briquette machine. Ingredients of these briquettes are as follows:

Clay:	10%
Bio-mass:	5%
Coal:	85%

In addition, 5% molasses is used as a binder. Raw coal has a caloric value of 5500Kcal/kg, 5% ash contents as maximum and less than 1% sulfur contents. Coal price is 260,000Rp/ton. The produced briquettes require 2 days of further natural drying before being sold to market (**Figure 4-3-12)**.

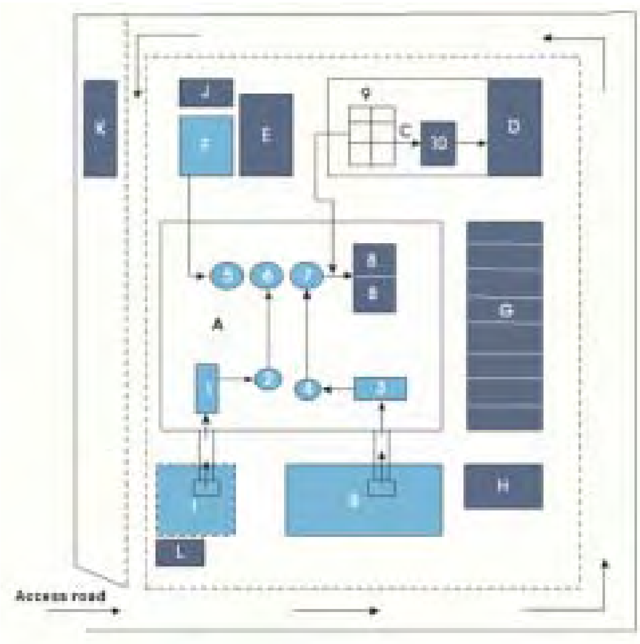


Source: TekMIRA

Figure 5-3-12 Low Calorie Briquettes

Outline of High Caloric Briquette Production Facility

The production processes consists of Coal Drying, Coal Crusher, Mixing and Briquette Forming and the Drying Processes. **Figure 5-3-13** shows the outline of the high caloric briquette production facility.



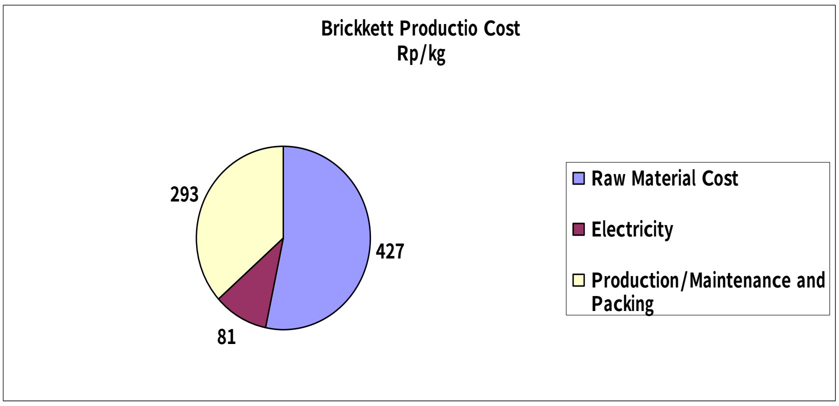
Construction
A. Main building
B. Sugar cane waste strore
C. Packing room
D. Product store
E. Kettle room
F. Lime store
G. Office and laboratories
H. Power house
I. Coal stockpile
J. Recreation room
K.Gasemission laboratory
L. Security house

Devices and Machines
1. Coal dryer
2. Coal crusher
3. Sugar cane waste dryer
4. Sugar cane wastecutter
5. Lime bin
6. Coal bin
7. Sugar cane waste bin
8. Briquetting room
9. Vibration sreen
10. Packing machine room

Source: TekMIRA

Figure 5-3-13 High Caloric Briquette Production Facility

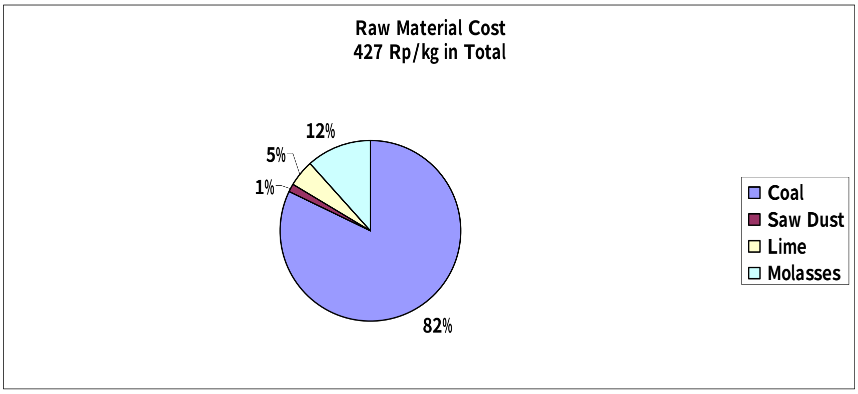
Briquette sale break even line is 400 tons/month. At present, 50 operators and 10 helpers are working in the facility. Among the 50 operators, 15 are mechanics. The facility operates 8 hours per day (one shift). Production cost is shown in **Figure 5-3--14**.



Source: TekMIRA

Figure 5-3-14 High Calorie Briquette Production Cost

Raw material cost is shown in **Figure 5-3-15** as follows:



Source: TekMIRA

Figure 5-3-15 Raw Material Cost

<u>Production Process of Low Caloric Briquettes</u>

Production process of Low Calorie Briquettes is simple. The process is divided into several unit operations:

Coal Preparation (**Photo 5-3-1**)   Clay Drying and Powdering (**Photo 5-3-2**)

Raw Material Mixing (**Photo 5-3-3**)   Molasses mixing process (**Photo 5-3-4**)

Briquette manufacturing (**Photo 5-3-5**) Drying (**Photo 5-3-6**)

Details are as follows:

Photo 5-3-1 Raw Coal Preparation

Photo 5-3-2 Clay Drying and Preparation Process

Photo 5-3-3 Raw Material Mixing

Photo 5-3-4 Molasses Mixing Process

Photo 5-3-5 Briquette Manufacturing

Photo 5-3-6 Drying

3.1.6 Economics of Coal Briquette Manufacturing

PTBA plans to increase production capacity from the current 10,000ton/yr to 30,000ton/yr.

The number of operators is assumed to be the same as the present number working for 10,000 ton/year production. A corporate tax of 30 % is imposed if it is operated on a private enterprise basis. Depreciation is set to be 10 years for this type of facility. Economic Parameters are summarized in the following Table.

Table 5-3-4 Economic Parameters for 30000 ton/year Carbonized Briquette Facility

Production	30,000 ton/year
ExWork Price	1500 Rp/kg
Coal Price	250 Rp/kg
Labor Cost	120 Rp/kg
Other Cost	900 Rp/kg
Depreciation	10 Year
Investment Base Cost	Rp 115,000 MM
Tax	30%

Source: JICA Study Team

Selling price will be 1500Rp/Kg, Ex-Works.

As a result, the Internal Rate of Return (IRR) under the above economic conditions is –5% after 10 years of operation. This project will not be economically viable. A 10 % cost reduction from “Other Cost” will achieve –2%, however, the project is still not feasible. If investment cost can be cut to half by using domestic equipment (Basic Design in Japan and Manufactured in Indonesia), the IRR will be improved to 7%. If coal price is reduced by 20 %, IRR will be improved further to the level of 9% and the project will almost reach a feasible level.

Figure 5-3-22 illustrates the scenario of IRR improvement.

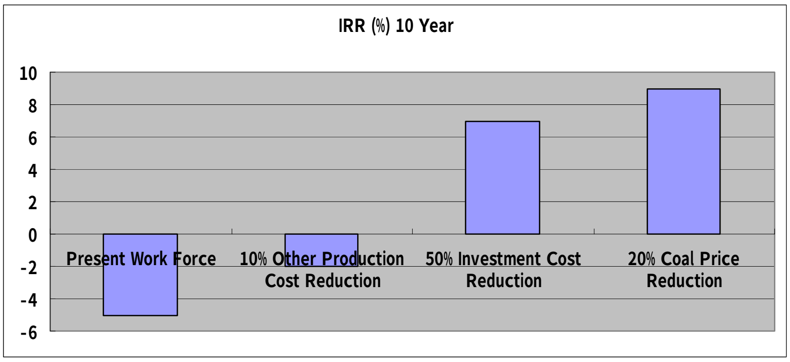


Figure 5-3-16 Economics of Carbonized Coal Briquettes

Source: JICA Study Team

In summary, if the project is implemented on a private enterprise basis, the following efforts will be required:

1) Production of 30,000ton/yr should be achieved by the same number of operators and helpers as that of the existing 10,000ton/yr facility.
2) Cut “Other Cost” portion by 10% through management efforts.
3) Cut the investment by 50% by designing the facility in Japan and manufacturing the equipment in Indonesia.
4) Negotiate with the coal suppliers and cut the coal supply cost by 20%.

If the above cost saving is achieved, the project will be commercially feasible.

3.1.7 Coal Briquette Future Prospects

Hurdles for commercial operation of a carbonized coal briquette manufacturing facility may be high under the current energy pricing system. Further verification will be necessary. Market for non carbonized coal briquettes manufactured by TekMIRA JV in Cirebon may be expanding slowly influenced by other competing energies. However, market size will be limited due to a storage time limitation and inconvenience in the transportation of heavy weight briquettes.

Use of coal with low ash and low sulfur contents with high caloric value will be desirable for

briquette manufacturing; however, this type of coal can be costly in the future.
In conclusion, the market for coal briquettes is small in size and supply and demand is localized due to the nature of the briquettes.

3.2. Outline of Proposed Power Plant

3.2.1 Proposed Power Plant

Details see Attachment 1 "Environmentally Friendly Power Station Utilizing Non-Marketable Coal". Here, only the point is described.

(1) Power supply and demand

Present total power supply capacity is 203MW only and dependable power supply capacity is 180 MW, and just covers present peak load in the system. In general maintenance cost including parts replacement cost for diesel engine generator increases to the aging of the engine. General retirement life time of the engine is 15 years, and it become increasingly difficult to obtain spare parts after 15 years of service time.

87% of diesel engine generators used presently is more than 15 years old already and among these, engines older than 15 years takes up 29%. In addition to the upheaval of diesel oil price, higher maintenance cost has become a heavy burden for PLN in East Kalimantan.

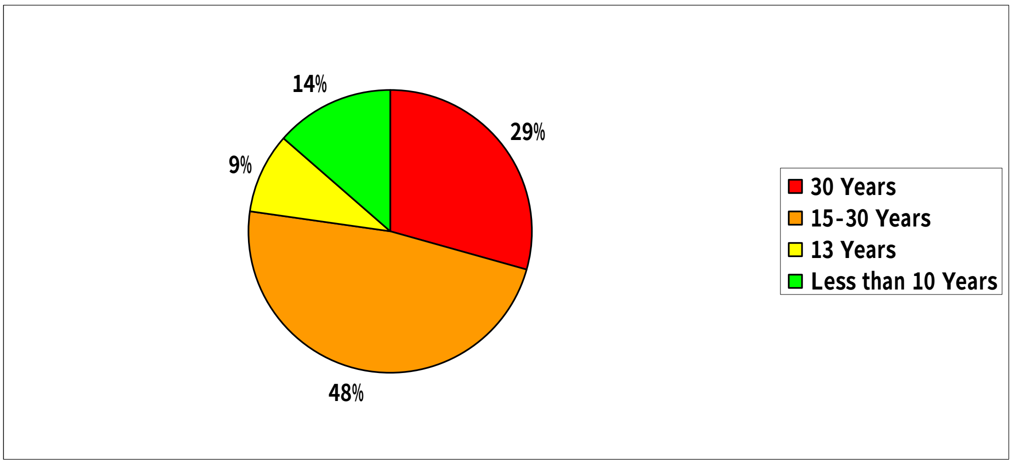


Figure 5-3-17 Aging of Diesel Power Generator Mahakam System

Sourse: PLN

At present, PLN is trying to develop new power plants in a form of IPPs (Independent Power Producers) in order to make up for the phased out diesel capacity and meeting the increasing demand.

In this survey, the above 10-year plan was examined through Load Flow Analysis. Since the majority of new projects are located in north part of the Mahakam System, it may not be feasible to implement the 10-year plan as it was planned. They would necessitate a major expansion of the existing substations and large capacitor to accommodate a voltage reduction in the southern districts around Balikpapan.

In discussion with PLN Balikpapan, the 10-year plan has been reviewed. The PLTU Kaltim 2 x 60MW of TJ Batu will be moved to Penajam and the PLTU Mulut Tambang 2 x 25 of Bukuan to Samboja. This would result in a dramatic improvement on the power balance between the south and north. It would also make it possible to build a 100MW power plant near Samarinda in 2012.

To increase the transmission capacity and also improve the transmission stability, loop configuration is also recommended by installing 47 km transmission line between Bukuan and Senipha.

Table 5-3-5 shows the results of the study conducted jointly with PLN Balikpapan.

Table 5-3- 5 PLN Power Supply Plan (10 Years) Reviewed Dec.2006

Project	Fuel	Location	Capacity (MW)		Year
			Unit	Total	
PLTU TJ Batu	Coal	TJ Batu	2 X 25	50	2007/08
PLTG Menamas	Gas	TJ Batu	1 X 20	20	2008
PLTU Kaltim	Coal	**Penajam**	2 X 60	120	2008/09
PLTU Mulut Tambang	Coal	**Samboja**	2 X 25	50	2008/09
PLTG Balikpapan	Gas	Senipah	2 x 40	80	2009
PLTGU Bontang	Gas	Bontang	2 X 75	150	2009/10
PLTU Biomass	Biomass	Kuaro	2 X 15	30	2010
PLTU Unit 1	**Coal**	**Samarinda**	**50**	**50**	**2012**
PLTU Unit 2	**Coal**	**Samarinda**	**50**	**50**	**2012**
PLTU	Coal			65	2015

Source: PLN

In line with the construction of new power projects, construction of new transmission system should also be implemented.

Acquisition of the land for the construction of transmission lines in East Kalimantan is relatively easy and accomplished at low cost, differ from other part of the countries. **Table 5-3-6** shows the power supply and demand forecast for the Mahakam System, including expansion of the power supply area and new power projects.

Table 5-3-6 Power Supply and Demand Forecast

No.	NAMA	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Demand												
1	Mahakam System 2006	200	203	205	223	249	281	309	340	375	414	456
2	Mahakam System Extention	0	9	24	62	70	104	115	126	139	154	169
3	Total Peak Load Forecast	200	213	229	286	319	385	423	466	514	567	625
4	Requred Capacity (20％Margin)	239	255	274	343	383	462	508	559	616	680	750
Supply												
1	Existing	203	203	203	151	102	76	76	76	76	76	76
2	PLTD Retirement	0	0	-52	-49	-26	0	0	0	0	0	0
3	Existing Total	203	203	151	102	76	76	76	76	76	76	76
4	Scheduled Future Project											
	PLTU TJ Batu		50	50	50	50	50	50	50	50	50	50
	PLTG Menamas			20	20	20	20	20	20	20	20	20
	PLTU Kaltim			60	120	120	120	120	120	120	120	120
	PLTU Mulut Tambang			25	50	50	50	50	50	50	50	50
	PLTG Balikpapan				80	80	80	80	80	80	80	80
	PLTGU Bontang				75	150	150	150	150	150	150	150
	PLTU Biomass					30	30	30	30	30	30	30
	PLTU Samarinda Proposed							100	100	100	100	100
	PLTU										65	65
6	Total Supply Capacity	203	253	306	497	576	576	676	676	676	741	741

Figure 5-3-18 shows the total power supply capacity, peak load and the required capacity.

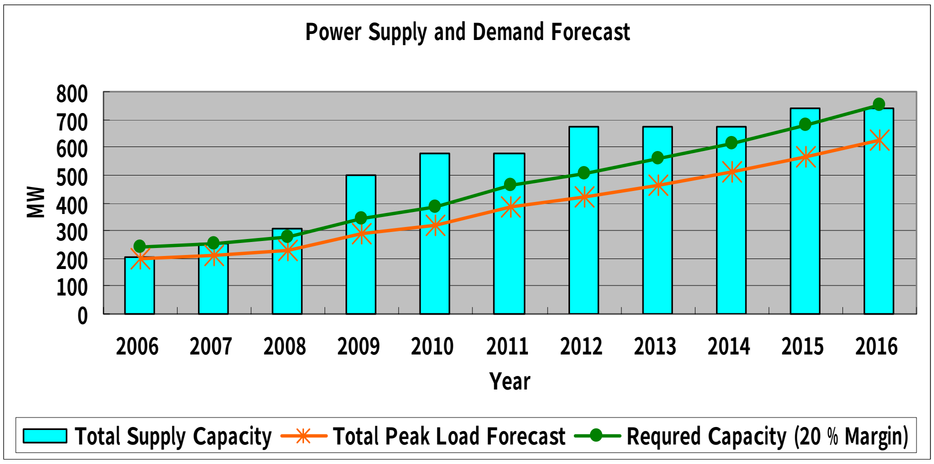


Figure 5-3-18 Power Supply and Demand Forecast

It is clear that the addition of 100-150MW new power capacity will be required in the Mahakam System in 2012 - 2015.

(2) Review of power fuel

Proposed Power Plant should be designed to fully utilize non-marketable fine coals and dirty coals. These coals are known as pollutants of the river environment and need to be eliminated.

Non-marketable fine coal is currently generated on a scale of 400,000 tons. Although the definite quantities have not been confirmed yet because of the closure of coalmines and the opening of new coal mines in the future, it can be forecast that minimum amount at the present is around 100,000 tons. Dirty coal output on the other hand, is estimated to amount to 5 – 10% of coal production and is likely to be produced in large quantities. Since non-marketable fine coal is essentially a serious factor of environmental pollution, the dirty coal usage quantities will be determined on the premise that the entire amount of fine coals are utilized at that time.

On the other hand, the physical properties of the non-marketable coal as a fuel (calorific content, ash content, sulfur content, etc.) vary significantly. While, even for the same non-marketable coal, there are variations according the locations from which the non-marketable coal comes, the ash tends to have a low melting point. In contrast, the ash of dirty coal tends to have a high melting point. One of the most important factors in the design of power plants is the heating value of the coal, and this may vary between 1,500kcal/kg and 6,000kcal/kg. It is therefore necessary to adjust the total heating value using a reference coal with known properties (for supplement combustion adjustment) for stable power generation and incinerating these non marketable coals.

a. Non-marketable fine coal

The results of analysis on non-marketable fine coal have shown that the heating value may vary significantly from 1,500kcal/kg to 4,500kcal/kg. Presuming, however, that the coal has a regular distribution, the average calorific value is 2,920kcal/kg (AR). The average ash content is 24.7% (AR). The type of sulfur is actually divided into combustible sulfur and incombustible sulfur compound. In these calculations, the total sulfur content is used as the basis and the average sulfur content becomes 1% (AR). As ash has a low fusion temperature, caution is required in the operation.

Figure 5-3-19 shows the relationship between the ash content and the heating value (AR) based on non-marketable fine coal samples tests. **Figure 5-3-20** shows the sulfur content of each sample.

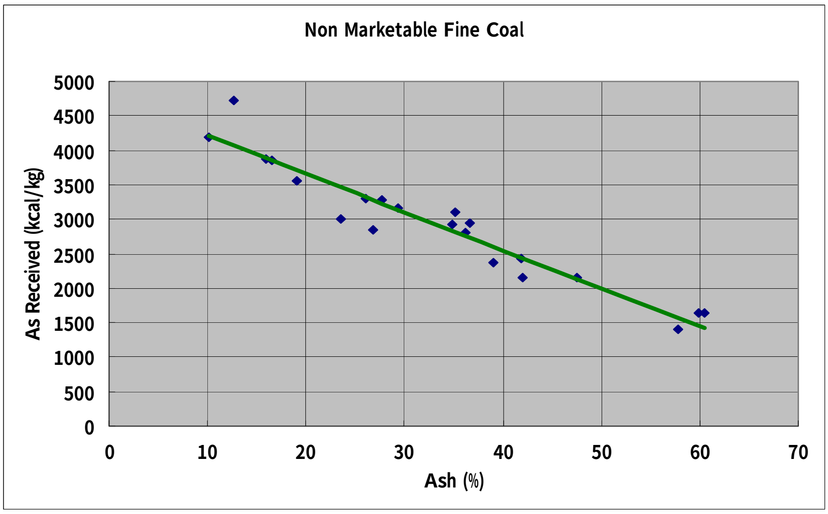


Figure 5-3-19 Non Marketable Fine Coal Ash Contents

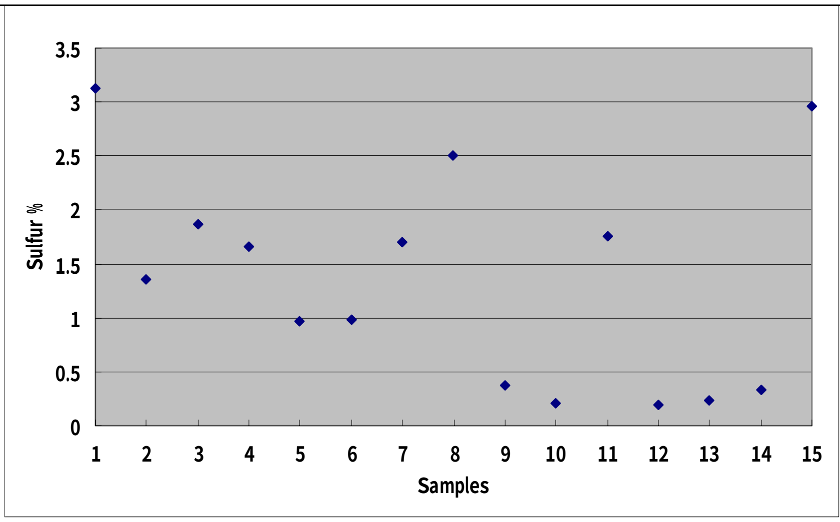


Figure 5-3-20 Non Marketable Fine Coal Sulfur Contents

b. Dirty coal

Result of the analysis on dirty coal samples have shown that the heating value varies significantly from 2,000kcal/kg to 6,000kcal/kg. Presuming, however, that the coal has a regular distribution, the average calorific value is 3,840kcal/kg (AR). The average ash content is 20.7% (AR). As stated in the previous section, total sulfur content is used as the basis and the average sulfur content is 0.67% (AR). In contrast to non-marketable fine coal, non-marketable dirty coal is characterized as higher ash fusion temperature.

Figure 5-3-21 shows the relationship between the ash content and the heating value (AR) based on non-marketable dirty coal samples analysis. **Figure 5-3-22** shows the sulfur content of each sample.

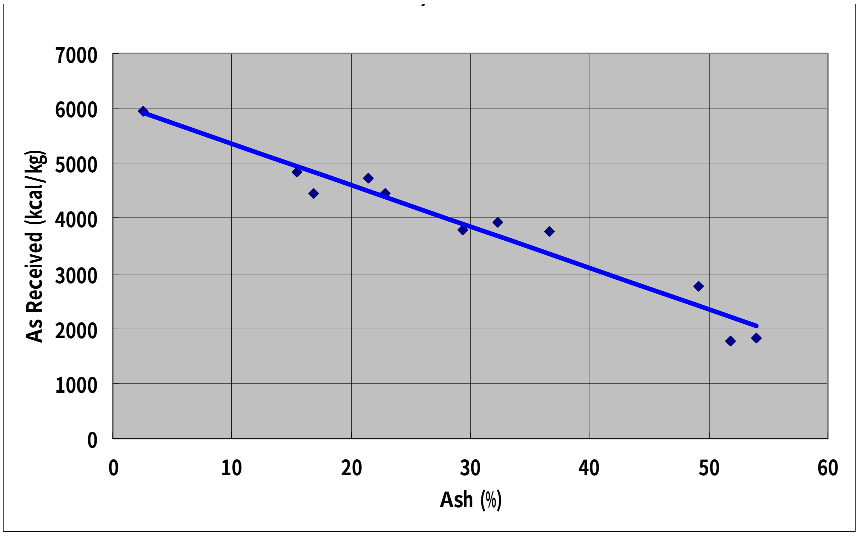


Figure 5-3-21 Non Marketable Dirty Coal Ash Contents

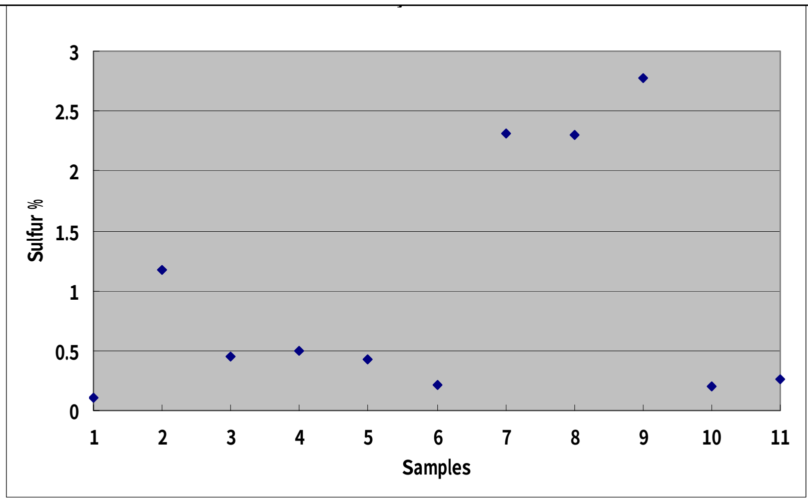


Figure 5-3-22 Non Marketable Dirty Coal Sulfur Contents

c. Supplement Coal

Supplemental Coal with known physical properties should be utilized to achieve steady combustion when using a coal with unstable properties. For the purpose of power generation, about half of the heating output has to be supplied by a supplement coal. In this Project, it is proposed to utilize low rank coals as a supplement coal available abundantly in the project area.

(3) Selection of power plant construction site

A power plant as a part of the energy infrastructure has an operational service life of over 30 years. It is therefore very important to study a range of different factors and aspects when selecting the construction site for a power plant as listed below.

- Fuel transport costs
- Access to plant site including fuel and material delivery
- Access to power transmission systems or substations
- Soil conditions and possibility of water (flood) damage
- Water avail (No possibility of ingress of sea water)
- Proximity to a center of power demand
- Land acquisition
- Ensuring recycling/reuse of coal ash or securing land for ash disposal
- Understanding and cooperation of local people

It is also necessary to resolve the issue of ash handling and disposal from coal-fired power plants. Coal ash is widely used as a material for cement or as an aggregate by construction industry. By cooperating with the cement industry, it will be possible to achieve the Zero-Emission Concept from Coal Power Plant. When it is not possible to enlist the cooperation with the cement industry the only alternative is to acquire landfills for ash disposal as an industrial waste. In this case, a statutory duty for the management and operation of the landfill will persist for 30 years after the power plant has been taken out of operation. At present, BPPT and the Indonesia Cement Association are carrying out a detailed survey on ash utilization. Generally, the ash of Indonesian coal has very low heavy metals content and not reachable. It is believed that it does not become an environmental and health hazard. At present, there is a great demand for coal ash and the project will be able to achieve the Zero Emission goal.

As shown in **Figure 5-3-23** five candidate locations were surveyed under this Study.

(1) Old ferry terminal site (Owned by Samarinda City)
(2) Land owned by Daya Desar Corporation (Samarinda actig as mediator)
(3) Land owned by Kiyani Lestari Corporation (Samarinda actig as mediator)
(4) Land privately owned by Balik Buaya (Samarinda actig as mediator)
(5) Pt Bukit Baiduri Energi (Owned by the Provincial government and leased to Coalmine)

Figure 5-3-23 Power Plant Site Selection

PT. Bukit Baiduri Energi is a coalmine company. The property rights of the land belong to the regional government, and the land is leased to this company. The property will be returned to the local government after termination of the coal mining in the area. The old coal shipping area of this land, now using as a coal storage yard is considered as a candidate site. There are no problems with the land acquisition, water intake, soil condition and ash landfill, and it is considered to satisfy all conditions required for the selection of the site for the power plant. **Figure 5-3-24** is a photo of the Site.

Open Cut Mine for Ash Disposal

Old Coal Export Facilities

Figure 5-3-24 Power Plant Site Selection-PT Bukit Baiduri

Table 5-3-10 shows the results of an overall assessment of the five candidate sites above.

Table 5-3- 10 Power Plant Site Selection

No.	1	2	3	4	5
Name	Old Ferry Terminal	PT. Daya Besar	PT. Kiyani Lesari	Balik Buaya Area	PT. Bukit Baiduri
Land Acquisition	Ok	OK	OK	OK	OK, **Returned to the Local Government**
Water Intake	Ok	OK	OK	No Sea Water Problem	OK
Soil Condition	**Limited Land Space**	**Need to Investigate**	**Need to Investigate**	No	OK
Access by Road/River	OK	OK	No **Limited**	OK	OK
Substation	**Gl. Harapan Baru**	**Bukuan**	**Bukuan**	**Bukuan**	**Cross River, Gl. Harapan Baru**
Ash Land Fill Area	Need to find Outside	Ash Utilized by Tunasa Cement	Need to find Outside	Available at Adjacent Area	OK

The Bukit Baiduri Coalmine is extensive. Candidate land is only a part of the old coal shipping area.

(4) Non-Marketable coal transportation cost

As shown in **Figure 5-3-25,** the barge loading cost for fine non-marketable coal is 3 USD/ton, the barge transportation costs 3 USD/ton and the barge unloading cost 0.7 USD/ton. To ensure commercial sustainability, incentive of 2 USD/ton is assumed. Consequently, the delivery cost of fine non-marketable coal is 8.7 USD/ton.

Transportation of dirty coal starts from the mining site. The cost breakdown is shown below. In the case of dirty coal, the mining costs at the mining site are 0.7USD/ton, transportation to the riverside and handling costs are 4 USD/ton. Barge loading and unloading cost are the same as fine coal. Delivery cost of this dirty coal at the power plant site is 13.4 USD/ton, inclusive of 2.0 USD/ton of incentive.

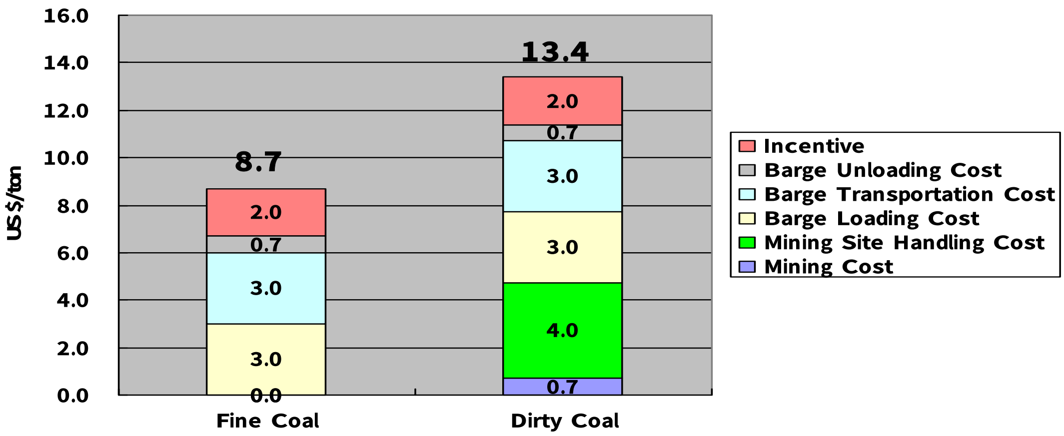


Figure 5-3-25 Non Marketable Coal Gathering Cost

Once these non marketable coals are utilized for power generation, such non-marketable coals will be priced as stated above. In view of the coal purchasers or power plant operators, quality and price of such will be examined. Question of "what they paid for and Who is the guarantor of the quality" should answered In the long run, coal supply terms and conditions should be documented in a form of "Fuel Supply Agreement".

Non-marketable coal is generated by a number of coalmines, and the properties of non-marketable coal from these coalmines differ from each other. Quality control and handling of these coals will be a major burden for the power company.

Consequently, public institutions such as coal trading companies owned by The State Government should preferably intervene and take a role of supplying such non-marketable coal to the power company under a single Fuel Supply Agreement.

A basket specification may be introduced in the fuel supply agreements with the power company; in which the minimum Heating Value is specified.

Figure 5-3-26 shows the proposed fuel supply arrangement.

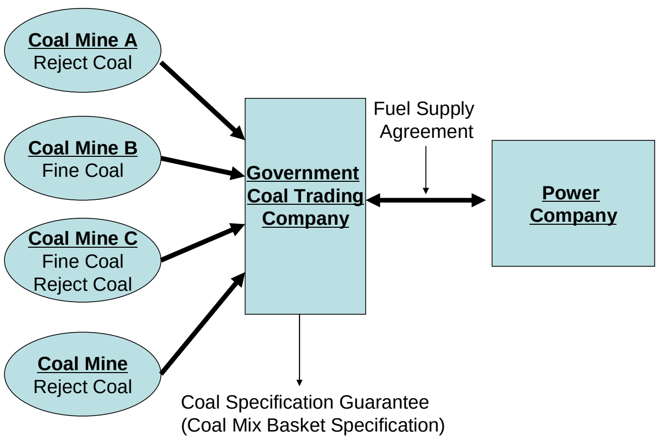


Figure 5-3-26 Proposed Fuel Supply System

3.2.2 Power plant concept

The concepts of the proposed power plant will be as follows.

- Capable of supporting all types of coal fuel, including non-marketable coal.
- Environmentally friendly power generating system
- Supplying the electricity at the lowest cost

Since the properties of non-marketable fine/dirty coals, especially heating values, vary from lot to lot and site to site, combustion performance will not be stable if combusted as it is. In order to stabilize the combustion performance, use of the higher and stable heating value of coal, named supplement coal, will be required. Property of supplement coal can be a low-rank coal, abundantly present in the area. To ensure stable combustion in the furnace, feed rate of each fuel is controlled to meet the boiler performance. Non-marketable coal with a high water and ash content are difficult to burn and therefore require a longer combustion or reaction time.

For environmental aspect, special care must be exercised to protect the riparian environment as the power facilities are built on the river side. Discharge of hot cooling water will impact the ecological system of the river. For this reason, circulating cooling water system will be employed and no hot effluent water will be discharged to the river.

Proposed power plant is equipped with internal desulfurization (de-SOx) systems to minimize the SOx emission level. Limestone powder is injected in the furnace with coals and the sulfur in the coal reacts with the limestone to form gypsum (calcium sulfate) and recovered as part of coal ash. To reduce NOx emission level, a relatively low combustion temperature served to lower the level of NOx generation.

The use of non-marketable fine coal and dirty coal will help reduce the fuel cost, and power generation cost can also be lowered.

CFB (Circulated Fluidized Bed Boiler) is recommended to use. It is suitable to combust low-heating value fuels in an efficient manner for the complete combustion. There are two types of circulated fluidized-bed boiler: the internally circulating type or the externally circulating type. The internally circulating type is in general used for municipal waste incineration, and waste heat can be recovered as an electric power. Scale of the power generation is small. The scale of power generation is a maximum of around 10-30 MW.

Application field of the externally circulating system is wide. Variety of fuels including biomass, lignite, and also industrial waste can be combusted in an efficient manner. In the burning process, unburned carbon is rejected and returned back to the combustion section until to the complete combustion. Only Flue gas with fine fly ash can pass through the cyclone to the boiler section.

The largest CFB application is lignite based power plant with the capacity of 460 MW super critical boiler turbine generators in Europe.

CFB can control the combustion gas temperature. This feature serves to reduce the NOx formation and also avoid reaching ash fusion temperature. If the combustion gas temperature exceeds the ash fusion temperature, these ash will cling to the surface of the tubes and boiler walls, and as a result, maintenance cost will be higher and reliability of the boiler will be lower.

3.2.3 Outline of power plant and investigation on coal mixing

In order to combust three types of fuel with different specifications in a stable manner it is necessary to determine in broad terms their mixing ratio by taking into consideration the particular properties of each type of coal. It is also necessary to take the gathering or delivery costs of these fuels into account.

Table 5-3-11 shows the calculation results for the coal mix proportions for the base case of a 2x50MW power plant. The capacity factor (availability) is assumed to be 75%.

Table 5-3-11 Coal Mixture Study (２×50 MW Unit)

Item	Unit	Main		
Net Power Output	MWe	50		
Aux. Power Ratio	%	10		
Gross Power Output	MWe	55.6		
Turbine Plant Efficiency	%	39		
Boiler Efficiency	%	90		
Power Generation Efficiency	%	35		
Fuel Heat Input	MWth	158.3		
	10^6 kcal/h	136.1		
Item	**Unit**	**Fine Coal**	**Dirty Coal**	**Supplement Coal**
Heat Input per Fuel	%	15	35	50
	10^6 kcal/h	19.9	48.1	68.0
Fuel Heating Value, HHV-AR	kcal/kg	2,920	3,840	5,000
Fuel Heating Value, LHV-AR	kcal/kg	2,615	3,575	4,701
Rated Fuel Feed Rate	t/h	7.61	13.47	14.48
Operation (Capacity) Factor	%	75		
Operating Hours	h/y	8,000		
Average Boiler Load	%	82		
Average Fuel Feed Rate	t/h	6.25	11.06	11.89
Annual Fuel Consumption	t/y	50,000	88,481	95,101
No. of Unit	-	2	2	2
Total Annual Fuel Consumption	t/y	100,000	176,963	190,202

The coal-mix ratio on a weight basis is: 21% non-marketable fine coal, 39% dirty coal, and 41% supplement coal.

The utilization of mix of these non-marketable coals also has economic advantages. The non-marketable fine coal has an average heating value of 2,920kcal/kg. The gathering costs for this coal is 8.7USD/ton, including the gathering incentive. Dirty coal has an average heating value of 3,840kcal/kg and the gathering cost for this coal is 13.4USD/ton. These are mixed with the 5,000kcal/kg heating value low-rank coal. Delivery price of this low rank coal at site is 27USD/ton.

Table 5-3-12 shows the summary of the coal mix. Average heating value of the coal mix is 4,198kcal/kg and the price is 17.4USD/ton.

Table 5-3-12 Comparison of prices of the different fuels per unit power output

Coal Mix	Kcal/kg	$/ton	ton/year	wt %
Non Marketable Fine Coal	2,920	8.7	100,000	21.4
Non Marketable Dirty Coal	3,840	13.4	177,000	37.9
Supplement Low Rank Coal	5,000	27	190,000	40.7
Average	4,198	17.4	-	-

Comparison of the fuel cost per unit power output (kWh) shows that a mixture of non-marketable coal, dirty coal, and supplement coal will be able to offer at 1.15 cent/kWh, the lowest fuel cost. On the other hand, low rank coal with 5000 kcal/kg at 27 $/ton corresponds to 1.41 cent/kWh. This demonstrates that use of a coal mix will be economically advantageous than the use of any other competing fuels.

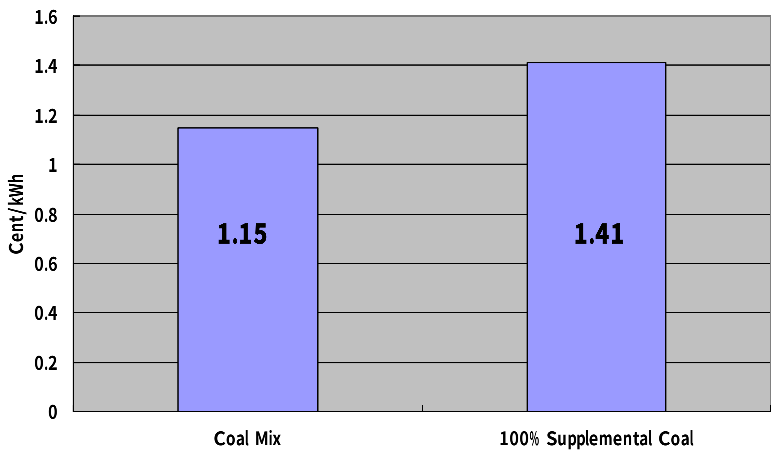


Figure 5-3- 28 Fuel Cost for Power Generation

3.2.4 Economics of Proposed Power Plant

According to PLN plan in 2006, the existing diesel engine driven power generators, mostly owned by PLN, will be gradually taken out of services until 2010. PLN will therefore need to relay on the Independent Power Producers (IPP) for its significant part of power generation. If, however, the system operators do not have a steady supply of power generation facility, there might be a possibility that the operation of the system might suffer from instability.

This study assumes that PLN has responsibility to expand the electrification area and supply stable power to entire area in the east Kalimantan. To fulfill the responsibility, existing power transmission system should be continuously extended and power station should be constructed based on the appropriate power supply plan.

Proposed power plant construction plan therefore includes the transmission infrastructure reinforcement plan and the power plant is designed to operate more than 30 years as a center piece of the electric power infrastructure in the area. PLN is assumed to be an owner of the project and construction budget is assumed to be a soft loan or Official Development Assistance (ODA).

In this section, ODA based power tariff was calculated. To compare with economics of the projects between IPP case and PLN case, IRR for both cases are calculated.

ODA-based feasibility study

The power tariff calculations are based on the following conditions.

·	Gross Power Generation Capacity (MW)	2 x 55.6 MW
·	Net Power Output (MW)	2 x 50 MW
·	Power Generation Efficiency (LVH)	35%
·	Internal Power Consumption	2 x 5.5 MW
·	Capacity Utilization Factor (availability) of power plant	80%
·	Construction Period	3 years
·	Total Operating Costs (% share in CAPEX)	4.0%
·	Grace Period of the Loan Repayment	3 years
·	Loan Length, including Grace Period	40 years
·	Depreciation (straight-line depreciation method)	40 years
·	Average Interest Rate (ODA Sub-lease)	6%
·	Exchange rate (Rp/USD)	9,000
·	Exchange rate (Yen/USD)	110
·	Mixed Coal Price	17.9USD/ton
·	Mixed Coal AR (HHV)	4,198 kcal/kg
·	Mixed Coal AR (LVH)	3,998 kcal/kg

(1) Construction cost

The construction costs includes all power generation equipments including auxiliary facilities, the infrastructure, and the construction costs for the transmission line from the power plant to the neighboring substation, and the costs for the new the transmission line from Bukuan to Senipha (transmission line: 47km) to reinforce the transmission system.

The initial cost estimate shows that the total project cost will be $ 178 million, or 1,600 USD/kW, including 15% of contingency. This estimated cost is considered conservative but considered reasonable as a base to be used for an economics study.

Table 5-3-14 Project Cost (Preliminary Estimation)

Unit: MM $

		Item	Description	Total Cost	$/kW
100	**Coal & Lime Stone System**			**4.5**	**40.5**
	10	Dirty/Supplement Coal Feed System			
	20	Fine Coal Feed System			
	30	Limestone Handling			
200	**Ash Handlin System**			**3**	**27.0**
		Ash Handling System			
300	**Boiler System**			**79**	**710.4**
	10	Boiler System			
	20	Draft Fan Unit			
	30	Flue Gas Duct and Stack			
	40	Electric Precipitator			
	50	Auxiliary System			
400	**Steam Turbine Genersator System**			**42**	**377.7**
	10	Boiler Feed Water System			
	20	Steam Turbine System			
	30	Generator/Main Transformer			
	40	Auxiliary System			
500	**Coolin Water System**			**1.9**	**17.1**
	10	Cooling Tower System			
	20	Cooling Water Pump			
600	**Utility System**			**4**	**36.0**
	10	Air Compressor Station			
	20	Water Intake Pump Station			
	30	Water Clarifier and Storage System			
	40	Deminerizing and Tank System			
	50	Oil Tankage			
	60	Others			
700	**Fire Safty System**			**1**	**9.0**
	10	Fire Pump Station			
	20	Others			
800	**Electric Power Transmission System**			**6.71**	**60.3**
	10	Emergency Generator/Transformer			
	20	Switchyard			
	30	Transmission Line Power Plant to Harapan Baru	10 km		
	40	Transmission Line Bukuan to Senipha	47 km		
900	**DCS and Instrumentation**			**4**	**36.0**
	10	DCS			
	20	Others			
A100	**Temporary Facilities**			**3**	**27.0**
	Freight (Transship from Samarinda to Construction Site)			**1**	**9.0**
		EPC Total		150.11	1349.9
	Management and Engineering			**5**	**45.0**
	Contingency		**15%**	**23**	**209.2**
Total Cost Estimate				**178**	**1604.1**

Project Cost
Preliminary Estimation

Contingency : 15%
Project Cost : $ 178 MM
($ 1600/kW)
All Infrastructure Included
(Bukuan-Senipha Transmission Line)

(2) Interest Rate and Principal Repayment

A soft ODA loan is assumed for the Proposed Power Project for a period of 40 years. Interest rate of the ODA Loan for environmental projects will be 0.75%. The loan will be subleased with 0.5 % of premium charge to government companies. Interest rate of 1.25 % is assumed for this project.

The repayment for the state owned companies is completed over a 37- year period after 3 years of the grace period, i.e., during the construction period. Equal amortization will be used so that the total of principal and interest will remain equal. The calculation results are shown for the case that the project costs are considered as being USD178 million. The annual repayment amount, including the principal and interest, is USD6 million. For the power tariff calculations, this value is used to calculate the Capacity Charge.

Equal Amortization Calculation
(Principal Payment and Interest Payment)

Interest Rate :	6%
Grace Period :	3 years
Total Loan Length :	40 years
Project Cost :	US $ 178 MM
Equal Amortization :	US $ 12 MM/Year

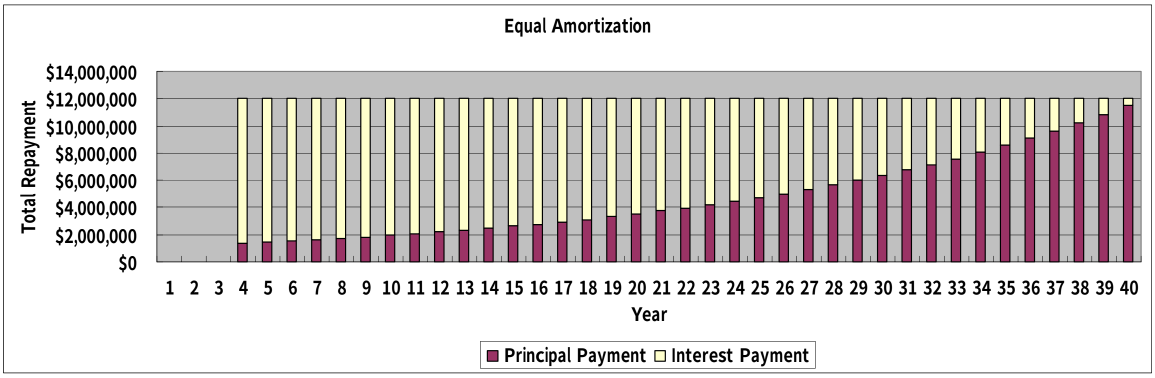


Figure 5-3-29 Equal Amortization Calculation (Principal Payment and Interest Payment)

(3) Fuel Cost

Due to the effective use of non-marketable coal, the proposed fuel has become the lowest cost fuel in the area. Fuel cost is the most important element among the variable costs and that it is influenced by the operating time. The price of the coal mix used in this Project has been calculated as USD17.9 per ton. Since there is no market for coals such as non-marketable coals and low rank lignite, fuel price risk for the economics will be very small.

(4) Operation & Maintenance

The annual operation and maintenance costs for this Project are assumed 4.0% of the total Project Cost. This figure is a little on the high side compared to actual data from other projects in Indonesia. It will be necessary to investigate the operation and maintenance costs at the next stage of the project.

(5) Power Tariff

The calculation results for the power tariff are shown in the **Table 5-3-15**, as follows: The project will be able to supply power at the price of 2.91 US cents/kWh, with the operation factor of 85 % for the next 37 years. Since the fuel cost and availability risk is very small, the power tariff will be very stable.

Table 5-3-15 Power Tariff Calculation

	US¢/kWh
Capacity Charge	0.81
Fuel Charge	1.15
Operation & Maintenance	0.96
Total	2.91

Note

Operation Factor :	85%
Capacity Charge :	Annual Loan Payment
Fuel Charge :	Coal Mix Price @ Plant Site
Operation & Maintenance:	4 % of Project Cost

3.2.5 Schedule

Proposed power plant construction schedule was also investigated. Based on the PLN Ten-Year Plan prepared in 2006, the timing for the startup will be January 2012, based on ODA financial arrangement.

Major milestones in the project execution step are as follows:

(1) PLN Ten Year Plan listed (Reviewed in December 2006)

(2) Preparation stage for construction, including Basic Engineering and confirmation of the Feasibility

FS

AMDAL

Power Purchase Agreement (If Applicable)

Fuel Supply Agreement

Preparation of Various Approval Documents

Procedure of Funding Arrangement Process

Selection of Consultants and/or Contractors

(3) Start of Detailed Design (May 2009)

(4) Construction (June 2009 – December 2011)

(5) Commissioning and Commencement of the Commercial Operation (January 2012 or thereafter)

Further works to complete the Feasibility of the Project is listed as follows:

(1) Local boring survey

(2) Combustion tests using coal samples

(3) Ash Sample Analysis

(4) Prepare Equipment Specification and Detailed Construction Cost Study

(5) Review of the Construction Schedule

3.2.6 Environmental and Social Considerations for the power plant

Please see an “Environmental and Social Consideration on Construction of the Power Plant” of attachment 2 about details.

(1) Objective of the EIA (AMDAL) Study

In JICA development study "The Master Plan Study on Pollution Risk Mitigation Program for Sustainable Coal Mine Development in East Kalimantan Province in the Republic of Indonesia", the IEE when the construction of the coal power plant to use the non-marketable coal effectively was assumed was executed. The implementation of AMDAL is described in the specification of the JICA study. However, AMDAL in the law of Indonesia is EIA. The IEE study was implemented in this study because there is no project owner and this is the Masterplan Study.
The preliminary AMDAL study is called "AMDAL" in this chapter.

(2) AMDAL schedule

Table 5-3-16 AMDAL Schedule

Activities	2006															2007					
	8			9			10			11			12			1			2		
Study of Legislations & Standard Regulations for AMDAL Study																					
Stakeholder Meeting (AUDIENSI)	■																				
Scoping				■																	
AMDAL Study																					
Collection & Analysis of Secondary data					■	■	■	■	■	■	■	■									
Collection & Analysis of Primary data					■	■	■	■	■	■	■	■									
Public Hearing					■	■	■	■	■	■	■	■									
Stakeholder Meeting (Public Consultansi)														■							
Evaluation of Environmental Impacts													■	■							
Draft Final Report																		■			
Workshop (Jakarta & Samarinda)																		■			
Final Report																					■

(3) Scope of AMDAL study

Extensive and significant impacts analysed in this study was identified based upon the results of scoping process discussed in EIA Regulations. Those impacts have been determined as probable impacts of the construction of the power plant and its associated transmission lines that needs careful assessment. They were also predicted to occur during the pre-construction, construction, operation and post-operation stages.

(4) Method of AMDAL study

The planned activity will take place in PT Bukit Baiduri Energy area. The power plant will be constructed in vacant 20-hectares. The collected data are primary and secondary data. They include geophysics-chemical, biological, socio-economic and socio-cultural and public health aspects. Primary data were collected through direct observations, measurements and interviews in the field. While secondary data were gathered via literature studies and by collecting accessible documents from respective institutions or organisations. These secondary data include maps, district's notes and reports, city and regency statistics, and relevant laws and regulations.

(5) Result of EIA

Based on the result of scoping, EIA study was implemented separately by the development stages (the pre-construction, construction, operation and post-operation stages). The evaluation result is shown from Table 5 -2-8 in Table 5 -2-9.

(6) Management guideline

Based on the result of EIA study, it was made the management guideline that mitigate or minimise the negative impacts and increase the positive impacts.

(7) Public consultancy

After AMDAL study had been implemented, stakeholder meetings (Public Consultancy) were executed for the local communities around the planned power plant construction site. The Public Consultancy was executed in two places assumed to be influenced by the power plant construction especially.

This was executed according to "JICA environment and society consideration guideline". Resident, NGO, provincial government, city organization, county organization, the village mayor, the army, the police, and the city council member, etc. participated in this meeting, and an active opinion exchange was done. The remark expected of the power plant construction was abundant though the anxiety to the environmental impact had risen. This is because the electricity shortage and the high unemployment continue chronic.

Photo 5-3-7 Loa Duri Ulu Village

Photo 5-3-8 Sungai Kunjang district

Table 5-3-17 Matrix interaction of extensive and significant impact on preconstruction phase

Activity Phase	Pre-construction					
Environmental Component	*1*	*2*	*3*	*4*	*5*	*6*
1. Climate, Air Quality, and Noisy						
a. Noise and Vibration						□
2. Hydrology						
a. Water Resources						□
b. Water Resources Quality						□
3. Space, Land, and Soil						
a. Land Utility Existing				■		
b. Land Using				□		
c. Land Owner Status			□	■		
e. Landscape				□		
4. Biology						
f. Freshwater Biotic Composition						
g. Nekton						□
5. Social, Economic, and Culture						
a. Demography					□	
b. Sex Ratio					□	
c. Demography Dispersal					□	
d. Manpower					○	
e. Livelihood			□	□	○	
f. Life Style				□		
g. Acceptability				□		
h. Perception			□	■		

Note

1 = General Survey

2 = Activity Planning Socialization

3 = Planning and Mapping

4 = Land Acquisition

5 = Manpower Recruitment

6 = Jetty Construction

= Important Negative

= Unimportant Negative

= Important Positive

= Unimportant Positive

Table 5-3-18 Matrix interaction of extensive and significant impact on construction phase

Activity Phase	Construction											
Environmental Component	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*
1. Climate, Air Quality, and Noisy												
a. Micro Climate				■								
b. Air Quality				■								
c. Noise and Vibration		□	□	■	□	□	□	□	□	□	□	
2. Physiographic and Geology												
a. Erosion				□								
b. Land Stability				□					□			
c. Ground Water							□					
3. Hydrology												
a. Water Resources	□	□	□	■				□				
b. Water Resources Quality	□	□	□	■				□				
c. Sedimentation				□								
d. Sediment Quality				□								
e. Flood Hazard				□								
4. Space, Land, and Soil												
a. Land Using Existing				□								
b. Landscape	■			□								
5. Biology												
a. Secondary Forest Community				■								
b. Bushes Community				■								
c. Man Made Ecosystem				■								
d. Wildlife Home Range				■								
e. Freshwater Biotic Composition		□	□	□								
f. Nekton		□	□	□								
6. Social, Economic, and Culture												
a. Demography	□											□
b. Sex Ratio	□											□
c. Demography Dispersal	□											□
d. Manpower	●											□
e. Livelihood	●											□
f. Traffic Hazard	■		□									
g. Criminality	■											□
h. Live Style	■											□
i. Acceptability	■											
j. Perception									□	□	□	
k. Acculturation	■											
7. Health												
a. Health Infrastructure	■											
b. Sanitation Hazard	■											

Note:

7 = Manpower Mobilization
8 = Loading Unloading
9 = Equipment Mobilization
10 = Land Clearing and Land Preparation
11 = Land Preparation For PLTU
12 = Installation Development
13 = Freshwater Facility Installation
14 = Infrastructure Construction
15 = Tower Construction
16 = Tower Setting
17 = Cable Pulling and Setting
18 = Manpower Release
= Important Negative
= Unimportant Negative
= Important Positive
= Unimportant Positive

Table 5-3-19 Matrix interaction of extensive and significant impact on operational phase

Activity Phase	Operational										Pasca Oprs		
Environmental Component	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*31*
1. Climate, Air Quality, and Noisy													
a. Micro Climate													
b. Air Quality		□	□		■	□	□	□			□		
c. Noise and Vibration				□	□				□				
2. Hydrology													
a. Water Resources	□		□	■	□			□			○		
b. Water Resources Quality	□		□	■	□			□					
d. Sediment Quality			□	□									
3. Space, Land, and Soil													
a. Landscape												●	
4. Biology													
a. Secondary Forest Community					■								
b. Bushes Community					■								
c. Man Made Ecosystem					■								
d. Wildlife Home Range					■								
5. Social, Economic, and Culture													
a. Manpower	●												
b. Livelihood	●												□
c. Perception	■								■				
6. Health													
a. Sanitation Hazard					■				■				

Note

19 = Manpower Recruitment
20 = Coal Delivery
21 = Coal Pilling
22 = Water Intake and Water Outlet
23 = Coal Combustion
24 = Fly-Ash Pilling
25 = Fly-Ash Transportation
26 = Bottom-Ash Pilling
27 = Power Distribution
28 = Power Plant & Transmission Line Maintenance
29 = Equipment and Material Maintenance
30 = Asset Deliverieable
31 = Manpower Release

= Important Negative
= Unimportant Negative
= Important Positive
= Unimportant Positive

Chapter 6 Transfer of Technologies

1. Water Pollution Control Technologies

1.1 Transfer of Environmental Monitoring related Technologies

(1) Eligible Persons

Eligible persons include officials of “Dinas Pertambangan & Energi”, engineers at the studied coal washing plants, and students of Mulawarman University. Mulawarman University is one of the counter parts in this project. A professor at this university recommended a total of six students including two students at the Department of Science and four at the Department of Fisheries Oceanography. It should be noted that 24 hour continuous monitoring operations were performed by the Mulawarman University students.

(2) Details of Technologies for Transfer

Education was provided in the working theory and operating procedures for the following monitoring instruments:

(a) Flow Meter (**Photo 6-1-1**)

This is a supersonic wave flow meter. It puts out flow velocity data at 4-20 mA, which are stored in a data logger. The flow rate is determined by multiplying this flow velocity by the cross section of flowing water.

(b) Water Gauge (**Photo 6-1-2**)

This is a static capacity home-made water gauge. Based on the water level measured by this gauge, the cross section of flowing water is calculated. There is a linear relationship, as shown in **Fig. 6-1-1**, between the water level indicated by the water gauge and the electric current value, which is stored in a data logger. This water gauge is also used to measure precipitation. **Photo 6-1-3** shows how the water gauge is installed.

(c) Suspended Solids Meter (**Photo 6-1-4**)

This is a suspended solids meter using the amount of light transmitted. It can measure up to 3,000 mg/l. It puts out measurement results at 4-20 mA, which are stored in a data logger.

(d) pH Meter (**Photo 6-1-5**)

This is a handy pH meter. The trainees have seen stationary meters but they said that this was the first time that they had seen a portable pH meter.

(e) Simple Fe Ion and Mn Ion Measuring Instrument (**Photo 6-1-6**)

When these ions are measured at an analysis laboratory, the measurements must be carried out after their acidity has been adjusted to pH 1 or so. Accordingly, simple measuring instruments that allow us to make measurements at the site were used this time around. This simple measuring instrument attracted the greatest attention of workers among the instruments carried here. **Photo 6-1-7** shows a scene of making measurements. In addition to Fe and Mn ions, numerous items of measurements were provided, so a list of measurement items was handed over to workers.

(f) Simple BOD Measuring Instrument (**Photo 6-1-8**)

This is a simple measuring instrument designed to measure dissolved oxygen and determine BOD.

(g) Coal Flow Detector (**Photo 6-1-9**)

This is a static capacity home-made touch sensor. This detector detects coal flowing on a belt conveyor and puts out an electric current of 2mA or so. This electric current is stored in a data logger to provide data whereby to identify the status of operations of the coal washing plant.

(h) Electric Motor Operation Detector (**Photo 6-1-10**)

This is a home-made electric motor operation detector using an electromagnetic wave emitted from an electric motor. When an electric motor operates, it puts out an electric current of 2mA or so. This electric current is stored in a data logger to provide data whereby to identify the status of operations of the coal separation plant.

(i) Data Logger (**Photo 6-1-11**)

This is a logger designed to store the electric current value. Recording intervals can be set at two seconds to one hour. If it is set at intervals of one hour, nearly one year's data can be stored. The stored data can be easily loaded into a personal computer.

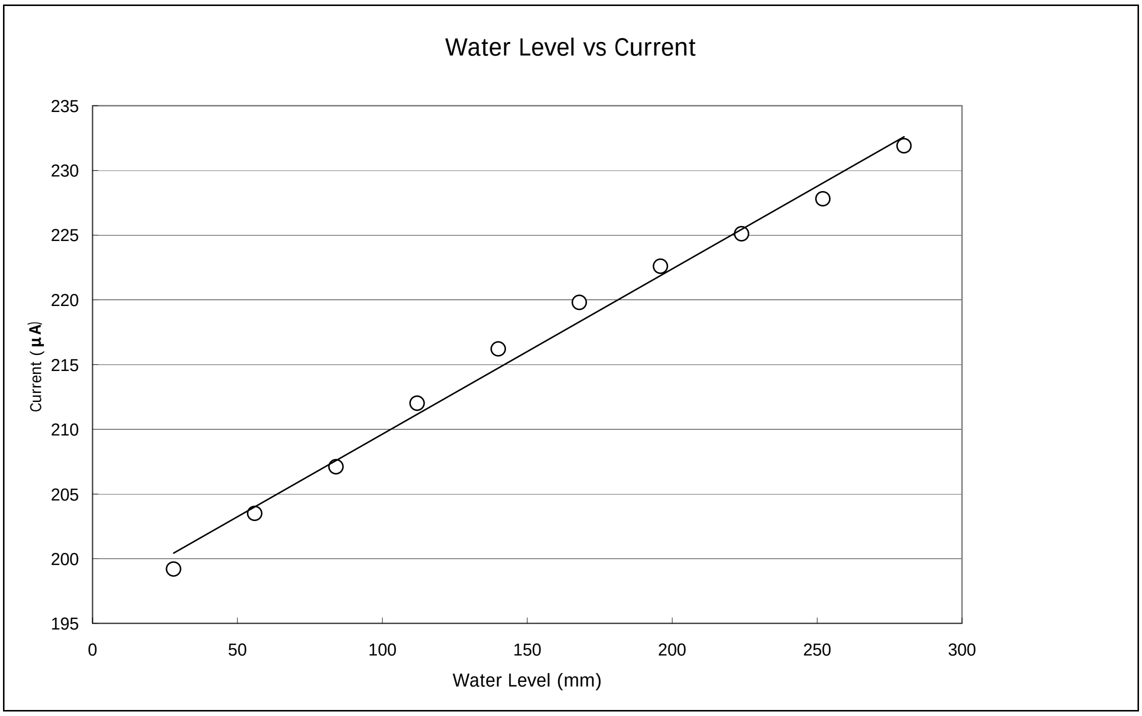


Fig. 6-1-1 Water Level vs electric current

Photo 6-1-1 Flow Meter

Photo 6-1-2 Water Gauge

Photo 6-1-3 Install of Water Gauge

Photo 6-1-4 SS Meter

Photo 6-1-5 pH Meter

Photo 6-1-6 Fe & Mn ion Measuring Instrument

Photo 6-1-7 Scene of Making Measurements of Fe & Mn ion

Photo 6-1-8 BOD Measuring Instrument

Photo 6-1-9 Coal Flow Detector

Photo 6-1-10 Motor Operation Detector

Photo 6-1-11 Data Logger

Photo 6-1-12 shows a scene of 24 hour continuous monitoring.

Photo 6-1-12 Scene of 24 hour continuous monitoring

1.2 An Introduction to Environmental Pollution and Others

(1) Eligible Persons

Officials of "Dinas Pertambangan & Energi".

(2) Details of Technologies for Transfer

The following education courses were held, with textbooks provided. The details of education are consistent with the Japanese Water Pollution Control Law. **Photo 6-2-1** shows a scene at an educational course. Students attending the courses have received the consistent education of this sort for the first time.

(a) An Introduction to Environmental Pollution
(b) Wastewater Treatment Technologies - General

(c) Measuring Technologies
(d) The Pollution Control Manager System
(e) Acidic Wastewater Treatment Technologies


Photo 6-2-1 Scene of Education

1.3 Water Quality Measuring Technologies

(1) Eligible Persons

Officials of “Dinas Pertambangan & Energi”.

(2) Details of Technologies for Transfer

Practical training was provided on how to operate various analytical instruments provided in the present project.

(a) Electronic Balance (**Photo 6-2-2**)

This is an electronic balance capable of weighing up to 4,000 g with accuracy of 0.01 g. It has a built-in calibration weight so that calibration can be readily made with a one-touch operation.

(b) Suspended Solids Measuring Instruments (**Photo 6-2-3**)

This is a home-made vacuum infiltrator designed to measure the quantity of suspended solids. It is equipped with a leaf testing function in order to ensure that the filtration characteristic of mechanical dehydrators, such as belt filters, which may be introduced in the future, can be measured.

Photo 6-2-2 Electronic Balance

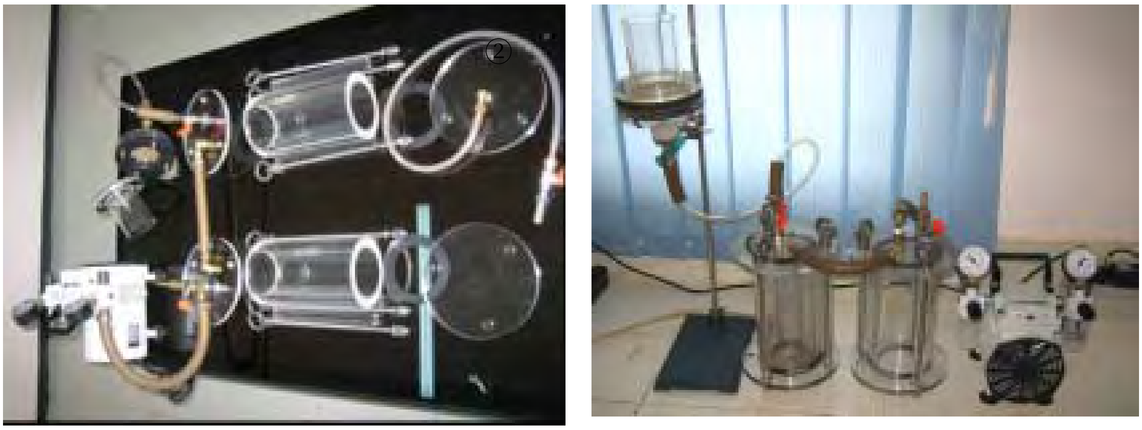


Photo 6-2-3 SS Measuring Instruments

2. Coal Cleaning Technologies

2.1 Assessment of the Performance of Coal Separation Facilities

(1) Eligible Persons

Persons responsible at the studied coal washing plants and persons in charge of the present project.

(2) Details of Technologies for Transfer

At the coal washing plants, questions and answers sessions were held on the coal washing process, the coal washing wastewater turning process, the wastewater treatment process, effluents, and problems and suggestions for improvements noted in this report. Consequently, FBS is due to secure improvement expense and to carry it out instantly. Moreover, MHU considers how to heighten the feed pressure of a cyclone classifier. In order to maintain the cyclone classifier highly efficiently, the cyclone performance showing in **Fig. 6-2-1** was shown, and the point which should be managed was guided.

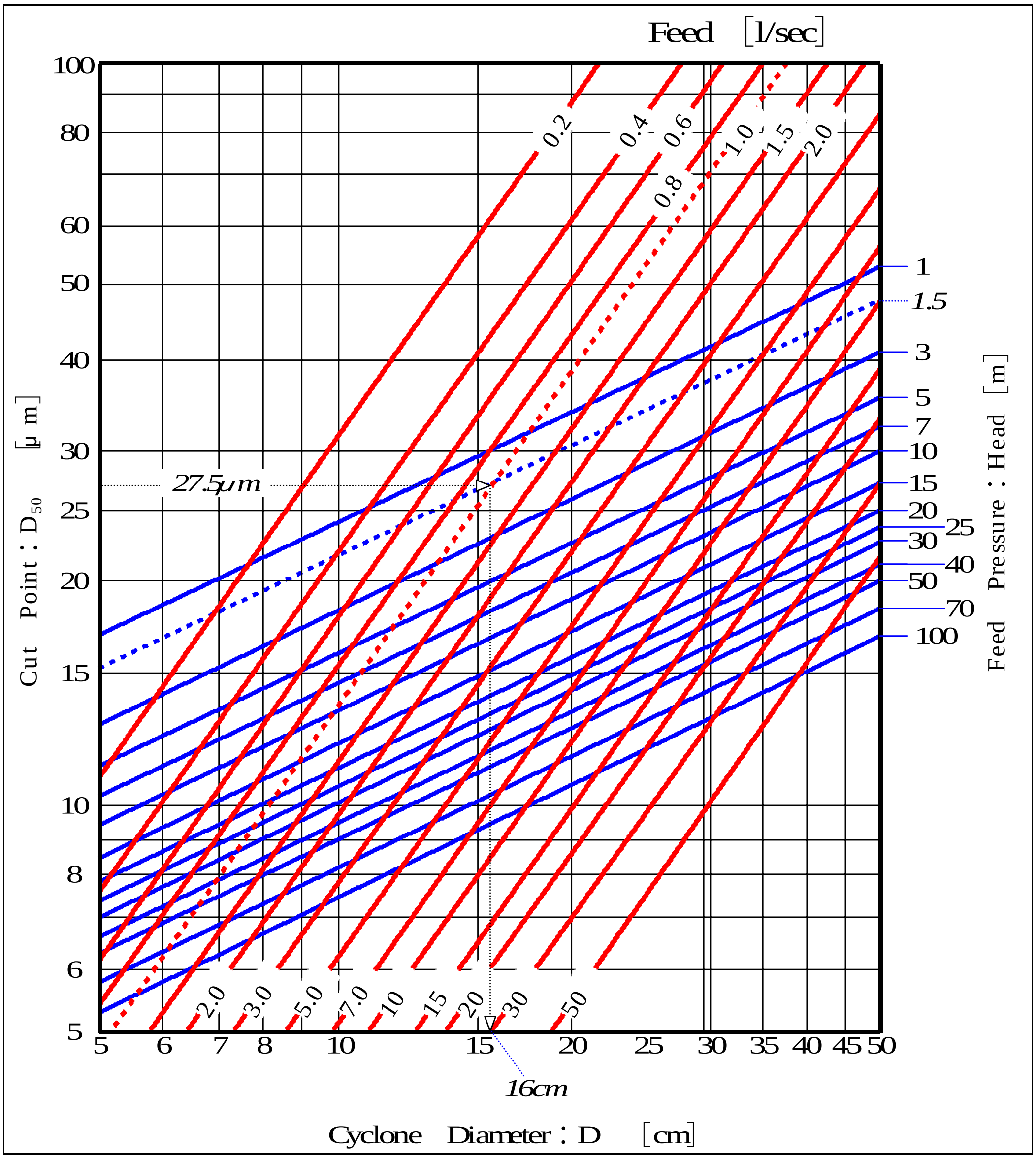


Fig. 6-2-1 cyclone performance

Chapter 7 Conclusions and Recommendations

1. Conclusions

1.1 Affection of environmental contamination to Mahakam River

The environmental limits for some water quality parameters are being exceeded at some coalmines, especially TSS (total suspended solids). However, data measured by BAPEDALDA show that water discharged by coal preparation plants of coal mines located along the Mahakam River does not affect water pollution significantly.

1.2 Environmental pollution sources generated by production activities in the coal mines are as follows:

(a) A potential impact on rivers is that the coal mines are discharging effluent containing TSS in concentrations higher than prescribed standards because the waste water is incompletely treated at the coal preparation plants.

(b) Non-marketable fine coal produced from the waste water treatment is incompletely disposed of and, consequently, is discharged outside the mining area, particularly, in the rainy season.

(c) Sand and gravel generated from open cut mining are discharged to rivers.

(d) High-sulfur content dirty coal dumped in abandoned mine sites is producing acid water, inhibiting the afforestation of abandoned mine sites and lowering the pH value of rivers.

1.3 Counter measures

(a) Establish continuous monitoring systems

(b) Improve the coal washing process and wastewater treatment methods

(c) Enhance environmental management systems

(d) Effectively utilize non-marketable coal

2. Recommendations toward improved measures to be taken in future

2.1 The Urgent (short term) Items to be Implemented

(1) Establish model continuous monitoring systems for pH and TSS of wastewater effluent from a coal washing plant

(2) Reduce the amount of Non-marketable Fine Coal by improving the wastewater treatment process

(3) Increase the wastewater effluent quality by reducing pollutant levels below the appropriate quality criteria by means of improving wastewater treatment process and other measures

(4) Enhance the neutralization treatment process for acid wastewater to be discharged from coal mines

(5) Undertake human resources development, personnel education and training for technology transfer of the above items (1) to (4)

(6) Remove Non-marketable Fine Coal, both current stockpiles and that to be generated in the future, and reduce the amount of Dirty Coal for disposal and thereby materialize the environment friendly reject-fired power plant to reduce environmental risk load

2.2 The Mid-term Items to be Implemented

(7) Disseminate the system of continuous monitoring of environmental pollution sources from coal mining activity to all coal mining areas in Indonesia

(8) Enhance and implement the measures needed for governmental organizations to establish sustainable environmental monitoring systems

(9) Enhance environmental management systems, set effective wastewater effluent criteria, and put in place a strong system for penalties

(10) Develop effective uses of coal ash that will be generated by coal utilization and establish measures to avoid or mitigate the relevant environmental pollution risk

(11) Human resources, personnel education and training for technology transfer of the above items (7) to (10)

3. Recommended Concrete Implementation Plan

In parallel with conducting additional studies of the measures listed in Items 2.1 and 2.2 above and through effective combination of these measures, the following two concrete steps are proposed:

I. Establish a " Technology Transfer Center for Environmental Pollution Control in Coal Production Activity (preliminary title)"

II. Construct a Non-marketable Coal Fired Power Plant

4. Effectiveness of Implementing the Recommended Improvement Measures

I. Establishment of " Technology Transfer Center for Environmental Pollution Control in Coal Production Activity (preliminary title) "

This measure is to transfer technology from Japan to enhance the environmental regulation compliance systems within government organizations and the coal mine industry and to establish sustainable environmental risk mitigation measures through personal training by technology transfer These measures will be effective in the mitigation of environmental risk to be generated by the increase of coal mining activity and coal utilization in Indonesia.

II. Construction of Non-marketable Coal Fired Power Plant

A Coal Fired Power Plant is an environmental measure that effectively utilizes Non-marketable Fine Coal and Dirty Coal for fuel and creates a driver for the positive implementation of wastewater treatment in coal mines. The people of Samarinda City and its surrounding areas will receive stable electric power supply from the coal mining industry, which in turn will improve people's perceptions of the industry in Indonesia.

5. The program schedule

Table 7-1 lists the program schedule and details fro the implementation of recommendations.

Table 7-1 Recommendations toward implementing improved measures to be taken in future

	Contents	Short term (2007-2009)	Medium term (2010-2012)	Long term (20013-2015)
1. " Technology Transfer Center for Environmental Pollution Control in Coal Production Activity (preliminary title)"				
Purpose: Technology transfer				
Coal mine	1) Environmental Monitoring			
	(i) Establishment of a model case of online monitoring system for pH and TSS of wastewater from coal preparation plant	→		
	(ii) Dissemination of the system of online monitoring of environmental pollution sources from coal mining activity to the whole coal mines in Indonesia		→	→
	2) Technology transfer for reduction of the amount of Non-marketable fine coal through improvements of wastewater treatment process (including OJT) (i) General education through class room lectures (ii) OJT at a coal washing plant	→		
	3) Reduce the wastewater effluent quality values down below concerned effluent quality criteria by means of improving wastewater treatment process and others (i) General education through class room lecture (ii) OJT at each coal washing plant	→		
	4) Enhancement of neutralization treatment process for acid wastewater to be discharged (i) General education through class room lectures (ii) OJT at a coal washing plant	→		
	5) Coal washing and quality management (i) General education through class room lectures (ii) OJT at a coal washing plant	→		
	6) Enhancement of environmental management system (i) Enhancement of environmental management technology in a coal mine and technology transfer for enhancement of environmental management organization (ii)Use of unified formats by electronic media for recording monitored data and related documents, of which the formats will be common to all coal mines (iii) Establishment of wastewater quality analysis laboratory in a coal mine with	→	→	
CCT	1) Effective uses of coal ash to be generated by coal utilization and establishment of measures to avoid and mitigate the relevant environmental pollution risk 2) Emission and air quality		→	→
Govern-mental Administ-ration	1) Enhancement and implementation of the measures to be needed for governmental organizations for the purpose of establishing the sustainable environmental monitoring		→	
	2) Enhancement of environmental management system, effective wastewater effluent criteria 3) Establishment of community-based environmental monitoring system for having local 4) Enhancement of environmental monitoring database telecom system 5) Combination with the wide area environmental monitoring of Mahakam River Basin		→	→
2. Construction of "Non-marketable Coal Fired Power Plant"				
Purpose: Removing existing Non-marketable fine coal and those to be generated from now on,				
	(1)Establishment of implementation structure	▬		
	(2)EIA	▬		
	(3) F/S	▬		
	(4)Detailed design	▬	▬	
	(5) Construction		▬	
	(6) Commencement of commercial operation			→

Attachment:	"An Environmentally Sound Dirty Coal-fueled Power Generation Plant"
Attachment:	"Social Environment"
