No.

Final Report

The Master Plan Study on Pollution Risk Mitigation Program for Sustainable Coal Development in East Kalimantan Province in the Republic of Indonesia

February 2007

Japan International Cooperation Agency
Economic Development Department

ED
JR
07-041

PREFACE

In response to a request from the Government of Republic of Indonesia, the Government of Japan decided to conduct the Master Plan Study on Pollution Risk Mitigation Programme for Sustainable Coal Development in East Kalimantan Province in the Republic of Indonesia, and the Study was implemented by the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr.Hajime Endo of Japan Coal Energy Center(JCOAL), and consist of JCOAL and Nippon Koei Co.,Ltd. to Indonesia between Mar. 2006 and Feb.2005.

The team held discussions with the officials concerned of the Government of Indonesia and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to further sustainable coal development with environment-friendly manner and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Indonesia for their close cooperation extended to the study.

February 2007

Tadashi IZAWA
Vice President
Japan International Cooperation Agency

February 2007

Mr. Tadashi IZAWA
Vice President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Izawa,

Letter of Transmittal

We are pleased to submit the Final Report on completion of The Master Plan Study on Pollution Risk Mitigation Program for Sustainable Coal Development in East Kalimantan Province in the Republic of Indonesia. The report consolidates the achievement of collaborative work between related organization in Indonesia and the study team over the past one year.

Indonesia's main products are oil, natural gas, and coal in terms of energy resources. Depletion of these resources owing to an increase in demand and nationalism over resources has begun surfacing. As Indonesia has large reserves of coal and Indonesian coal is lower in environmental impact than that of foreign countries, the country plays a key role in stably supplying coal to Asian coal-consuming countries. A recent rise in energy resource prices has further accelerated an expansion of coal production.

The purpose of this master plan is to carry out environment-friendly, sustainable coal development by determining and analyzing the present condition of environmental pollution in coal preparation plants, which is one of the coal production activities, and by planning environmental pollution mitigation measures. The study team is proud that the team members designed an environmental pollution mitigation measure in line with the current local condition through a frank and candid exchange of opinions with local mining companies, local residents, and the East Kalimantan provincial government.

On the basis of the investigation results, we proposed Indonesia, in this master plan, to construct "Technology transfer center to control environmental pollution caused by coal production activities" and "a power plant" that consumes waste coal high in environmental impact. We believe that the goal will be attained soon now that Indonesian agencies concerned have already started to take action to implement this proposal.

Lastly, we express our heartfelt gratitude to JICA's relevant departments and local office for a kind support and guidance, as well as to the Ministry of Energy and Mineral Resources, the government of East Kalimantan province and organizations concerned including PLN, coal mine companies and Mulawarman Uni. for their cooperation and sincere attitude toward the study. We also offer cordial thanks to Japan Bank for International Cooperation and the Embassy of Japan in Indonesia for their assistance and cooperation lent to us to make this investigation a reality.

Very truly yours,

Hajime ENDO, Team Leader
The Master Plan Study on Pollution Risk Mitigation Program for Sustainable Coal Development in East Kalimantan Province in the Republic of Indonesia.

Contents

Exchange Rate: 1US$=110 Yen
1US$=9,000 Rp
1Rp =0.012222 Yen

Glossary

Abbreviation	English or Indonesian	Japanese
AAS	Atomic absorption spectrometry	原子吸光分析
AD	Air Dry base	気乾ベース
AMDAL	Analisa Mengenai Dampak Lingkungan	環境影響評価
AR	As Received base	到着ベース、石炭の水分を示す場合の状態
Avg.	Average	平均値
BAPEDAL	BADAN PENGENDALIAN DAMPACT LINGKUNGEN	環境影響管理庁（旧） 環境省と統合
BAPEDALDA	BADAN PENGENDALIAN DAMPACT LINGKUNGEN DAERAH	地方環境影響管理局
BBE	Pt Bukit Baiduri Energi	ﾌﾞｷｯﾄﾞ ﾊﾞｲﾄﾞﾘ ｴﾈﾙｷﾞ炭鉱
BCF	Billion Cubic Feet	ガスの量を示す単位
BE	Bucket elevator	バケット エレベーター
BMCR	Boiler Maximum Continuous Rating	ボイラー最大連続運転性能規格
BOD	Biochemical oxygen demand	生物化学的酸素要求量
Caluc.	Calculated value	計算値
CFB	Circulated Fluidized Bed Boiler	循環流動層ボイラー
COD	Chemical oxygen demand	化学的酸素要求量
Conc.	Concentration	濃度
Conc.	Concentration	濃度
CRT	Cathode Ray Tube	ブラウン管
D_{50}	Cut point	分離点、分離比重、分級点
DCS	Distributed Control System	中央制御
DO	Dissolved oxygen	溶存酸素
EIA	Environmental Impact Assessment	環境影響評価
Ep	Ecart probable (Terra index)	テラ指数
ESDM	ENERGI SUMBER DAYA MINERAL	鉱物エネルギー省(インドネシア名)
FBS	Pt Fajar Bumi Sakti	ﾌｧｼﾞｬｰﾙ ﾌﾞﾐ ｻｸﾃｨ 炭鉱
FEGT	Furnace Gas Exit Temperature	燃焼ガスの炉出口温度
FS	Feasibility Study	フィジィビリティスタディ、経済的可能性調査
GCV	Gross Calorific Value	総発熱量（高位発熱量）
GCV	Gross calorific value	総発熱量
HHV	High Heating Value	高位発熱量
I	Imperfection	不完全度
IEE	Initial Environmental Examination	初期環境評価
IM	inhalant Moisture	固有水分
IPP	Independent Power Producer	独立系発電事業者
IRR	Internal Rate of Return	内部収益率
JAXA	Japan Aerospace Exploration Agency	日本宇宙航空開発庁
Jig	Jig separator, one of the coal separating	ジグ、選炭機の一種
KAN	Komite Akreditasi Nasional	国家認証委員会

Abbreviation	English or Indonesian	Japanese
KP	KUASA PERTAMBANGAN	KP
LHV	Low Heating Value	低位発熱量
LNG	Liquid Natural Gas	液化天然ガス
Max.	Maximum	最大値
MEMR	Ministry of Energy and Mineral Resources	鉱物エネルギー省（英語名）
MHU	Pt Multi Harapan Utama	ﾏﾙﾁ ﾊﾗﾊﾟﾝ 炭鉱
Min.	Minimum	最小値
MMBTU	Million British Thermal Unit	熱量単位
MMscfd	Million Standard Cubic Feet per Day	気体輸送量単位（100万立方ﾌｨｰﾄ/日）
MOE	Ministry of Environment	環境省
㎛	Micro Meter, 1㎛=0.000001m=0.001mm	ミクロンメーター、1㎛=0.001mm
NASDA	National Aerospace Development Agency,	日本宇宙航空開発庁
ODA	Official Development Assistance	政府開発援助
PAC	Poli Aluminum Chloride	凝集剤の一種、パック
PKP2B	PERJYANIAN KARYA PERTAMBANGAN BATUBARA	PKP2B（炭鉱分類の一つ）
PLN	PT. Perusahaan Listrik Negara	国営インドネシア電力公社
ppm	parts per million	（単位）100万分の1
PROPER	Program Peringkat Kinerja Perusahaan Pertambangan	鉱物生産企業のランク付け評価プログラム（仮訳）
Pt	PERSEROAN TERBATAS	株式会社（インドネシア名）
PTBA	PT. Tambang Batubara Bukit Asam	国営石炭会社
Reject	One of the product from a coal separating facility	ボタ（選炭機からの産物の一種で、廃棄する産物）
ROM	Run of Mine	原炭
Rp	Rupiah	インドネシアの貨幣単位
SNI	Standar Nasional Indonesia	インドネシア国家規格
Sp.Gr	Specific gravity	比重
SS	Suspended Solid	懸濁物
SS	Suspended solid (Same as TSS)	浮遊固体物質 (TSSに同じ)
TCF	Tririon Cubic Feet	ガスの量を示す単位（埋蔵量）
TDS	Total Dissolved Solid	全溶解固体物質
tekMIRA	R&D Center for Mineral and Coal Technology Department of Energy & Mineral	鉱物エネルギー省鉱物石炭技術研究開発センター
T-N	Total nigrogen	全窒素
TOR	Terms of Reference	調査事項
T-P	Total phosphorus	全リン
TS	Total Sulfur	全硫黄
TS	Total sulfur	全硫黄分
TSS	Total suspended solid	全浮遊固体物質
Wt	Weight	重量
Σ↓	Cumulative value	累計値

List of Tables, Figures and Photos

Reference

East Kalimantan in Figures, 2004.
Estate Crop Service, East Kalimantan Province
Fishery Service Office of East Kalimantan
Livestock Service of East Kalimantan Province
Tourism, Art and Culture Office, East Kalimantan Province
Mining and Human Resource Service of East Kalimantan Province)
Year Book of 2003, East Kalimantan Province
Yearly Book of 2003, East Kalimantan Province
Yearly Book of 2003, East Kalimantan Province
Government Regulation of the Republic of Indonesia,
No. 82 of 2001 regarding Water Quality Management and Water Pollution Control
Law of the Republic of Indonesia No.23, 1997 regarding Environmental Management
TekMIRA
PLN
Ministry of Energy and Mineral Resources 2005
Indonesia Energy Outlook and Statistics 2004
Ministry of Energy and Mineral Resources 2004
US Embassy Indonesia Home page
Indonesia Energy Outlook and Statistics 2003
Petroleum Report Indonesia, 2004 – 2003, Embassy of the United States of America, March 2004
Mineral, Coal and Geothermal Static 2006, by Ministry of Energy and Mineral Resources
Law of the Republic of Indonesia No.23, 1997 regarding Environmental Management
PTBA

The outline of the study

1. Background of the study

The Republic of Indonesia is the world's leading producer of coal and is rapidly increasing production in line with present energy demand. Production in 2005 reached about 150 million tons, an increase of some 1.7 times within the recent five-year period. The majority comes from coal mines in Kalimantan and in particular East Kalimantan, which accounts for more than half the coal production and coal export from Indonesia.

Given this situation, the environmental impacts associated with the rapid increase in activity of coal mines have been a common concern. As many coal mines are located along the Mahakam river in central East Kalimantan, these concerns include the inflow and discharge of non-marketable fine coal from coal washeries to the river leading to detrimental impacts on living conditions and the total reliance of the approximately one million inhabitants in the river basin on this economic activity in recent years.

A pollution risk mitigation program for sustainable coal mine development is therefore required in Indonesia and a program based on environmental pollution control measures is viewed as an immediate priority within the Ministry of Energy and Mineral Resources of the Indonesian Government.

Within this context, a study was initially proposed in 2004 by the Indonesian Government and agreed with Mineral Research & Development of the Ministry of Energy and Mineral Resources. This was followed by a preliminary review in July 2005.

2. Purpose of this study

This study aims to carry out an assessment of effective countermeasures to mitigate environmental impacts associated with coal mine production, especially in view of the importance of coal development and its contribution to the Indonesian economy and its position as a major energy resource. A further aim is to design a master plan based on a pollution risk mitigation program relating to implementation of environmental monitoring and effective utilization of non-marketable fine coal.

The primary factors, which are aimed at contributing to economic development in Indonesia while keeping in mind “Sustainable development” and “Building of a self-sustainable technology transfer”, include:

①Preparing a plan to mitigate pollution risk caused by the coal mining industry.

②Proposing management measures to mitigate against environmental deterioration, focusing on an environmental monitoring plan.

③Preparing a plan of effective utilization of low quality coal such as nonmarketable fine coal.
④Supporting capacity development of those people involved in the study.

The survey content included in the JICA service assignment is as follows:

① Review and collection of existing data and information
② Survey of present status of coal wash process, wastewater treatment and environmental monitoring
③ Survey of non-marketable fine coal utilization technology, non-marketable fine coal-based power generation system and socio-environmental issues
④ Master Plan preparation

3. Area of the Study

The area covered by the field survey extends over a coal producing area in East Kalimantan in Indonesia, and specifically includes Samarinda City and the Central and East Kutai Prefectures. **Figure 1 and Figure 2** show surveyed area..

Figure 1. The Republic of Indonesia and main area of the study

Figure 2. Samarinda City and Mahakam River

4. Scope of the Study

The content of the study, time schedule, and so on was in accordance with the Scope of Work agreed and signed in December 2005.

5. Counterparts of the Study

The chief of the counterparts is nominated as tekMIRA, Mineral and Coal Technology Research Center, the Ministry of Energy and Mineral Resources, assisted by the State Government of East Kalimantan. In order to carry out the study in an efficient manner, it was proposed that a Steering Committee and Advisory Board be organized as part of the support to be provided by the Indonesian Government.

(1) Steering Committee

Base	Jakarta
Chair	Head of ARDEMR
Committee Member	Directorate General Mineral Coal & Geothermal Directorate Electricity & Energy Utility Head of Mineral and Coal Technology Research Center (tekMIRA)
Meeting Date	1st Meeting: Time of Inception Report Presentation and Discussion 2nd Meeting: Time of 1st workshop in Samarinda 3rd Meeting: Time of 2nd Workshop in Jakarta
Purpose and Duty	Periodic progress reporting and discussion Provision of feedback to the Central Government for policy-making, coal development and environmental protection plan

(2) Advisory Board

Base	Samarinda
Chair	Head of Dinas Pertambangan, East Kalimantan State
Committee Member	BAPEDALDA, East Kalimantan State Bureau of Construction, etc. of East Kalimantan State Mulawarman University Coal Mine companies around Mahakam River PLN in East Kalimantan State Representatives from industries Representative of NGOs
Meeting Date	1st Meeting: Time of the Inception Report Presentation and Discussion 2nd Meeting and after: Meetings arranged on as required basis. One such occasion is the time of 1st workshop in Samarinda
Purpose and Duty	Periodic progress reporting and discussion Hearing and understanding of local voices on local situation, direction, problems, and capabilities

6. Team Members and Task Assignments

Six professionals are nominated for the Study. The names of the personnel and relevant task assignments are shown below.

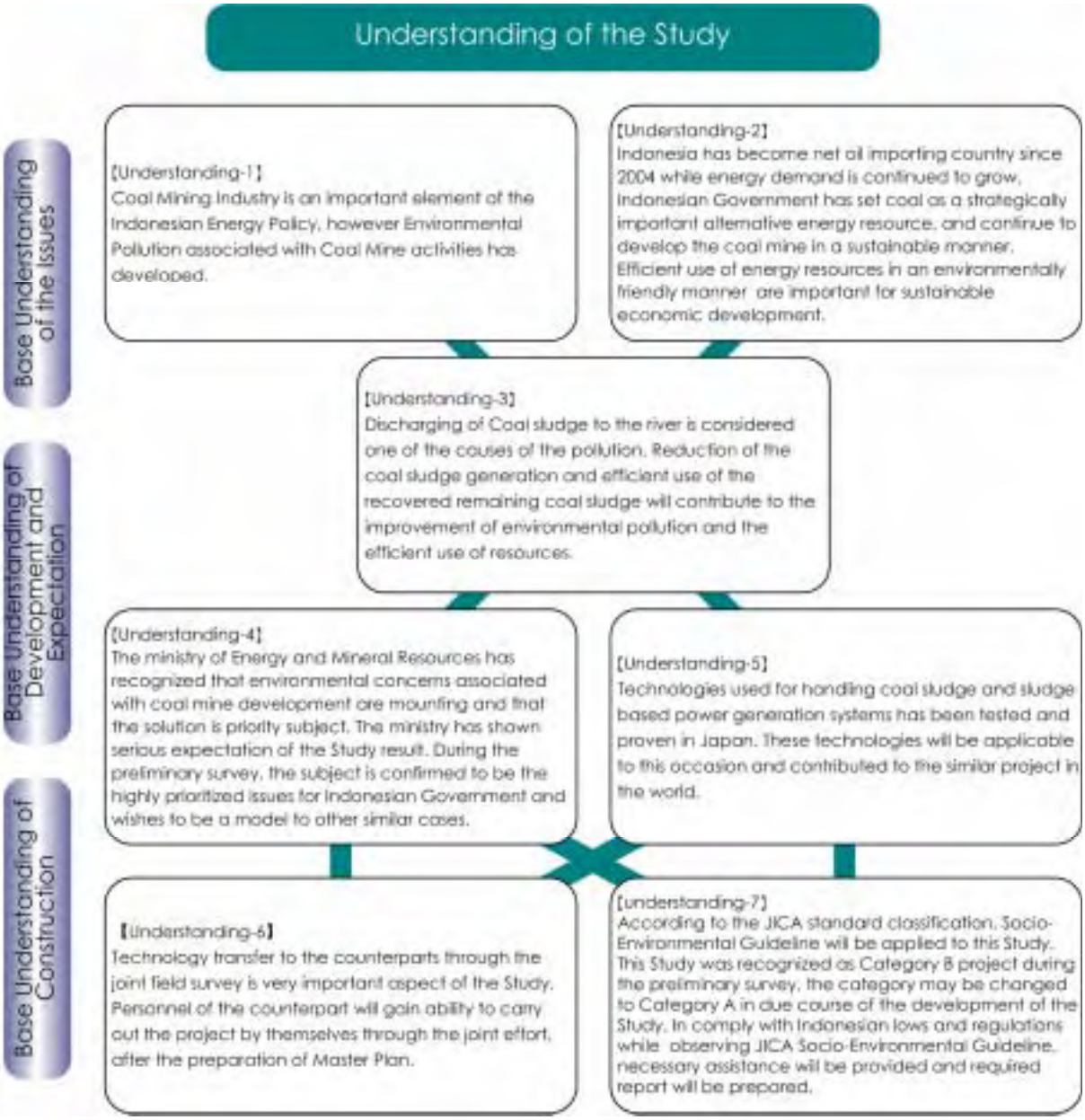
No.	Name	Role in Charge
1	Hajime ENDO	Team Leader, Coal Policy, Waste Water Treatment
2	Nobuhiro KOYANAGI	Coal Washing Process
3	Ryozo OHNO	Environmental Monitoring/Analysis
4	Masaaki EBINA	Effective Utilization of Non-marketable fine coal and Power Generating by Non-marketable fine coal
5	Eiichiro MAKINO	Energy Policy/Organization/Economics
6	Satoru KUSHIDA	Socio-Environmental Concern

7. Study Principle and Direction

Non-marketable fine coal is considered to be one of the major pollutants and contributing to industrial waste in the area. The Study will investigate the situation of non-marketable fine coal generation and review of sludge discharge to the environment at the coal washing plants in 5 coal mine companies. These will include PT Tanito Harum, PT Kitadin, PT Fajar Bumi Sakti, PT Multi Harapan and PT Bukit Baiduri, located along the Mahakam River in East Kalimantan State.

The investigation, to be undertaken in conjunction with the assigned counterparts, covers the review of the coal washing process, waste water treatment system and monitoring of the environment. The Master Plan for establishment of an effective and efficient monitoring system and application of utilization technology will be prepared in the Study.

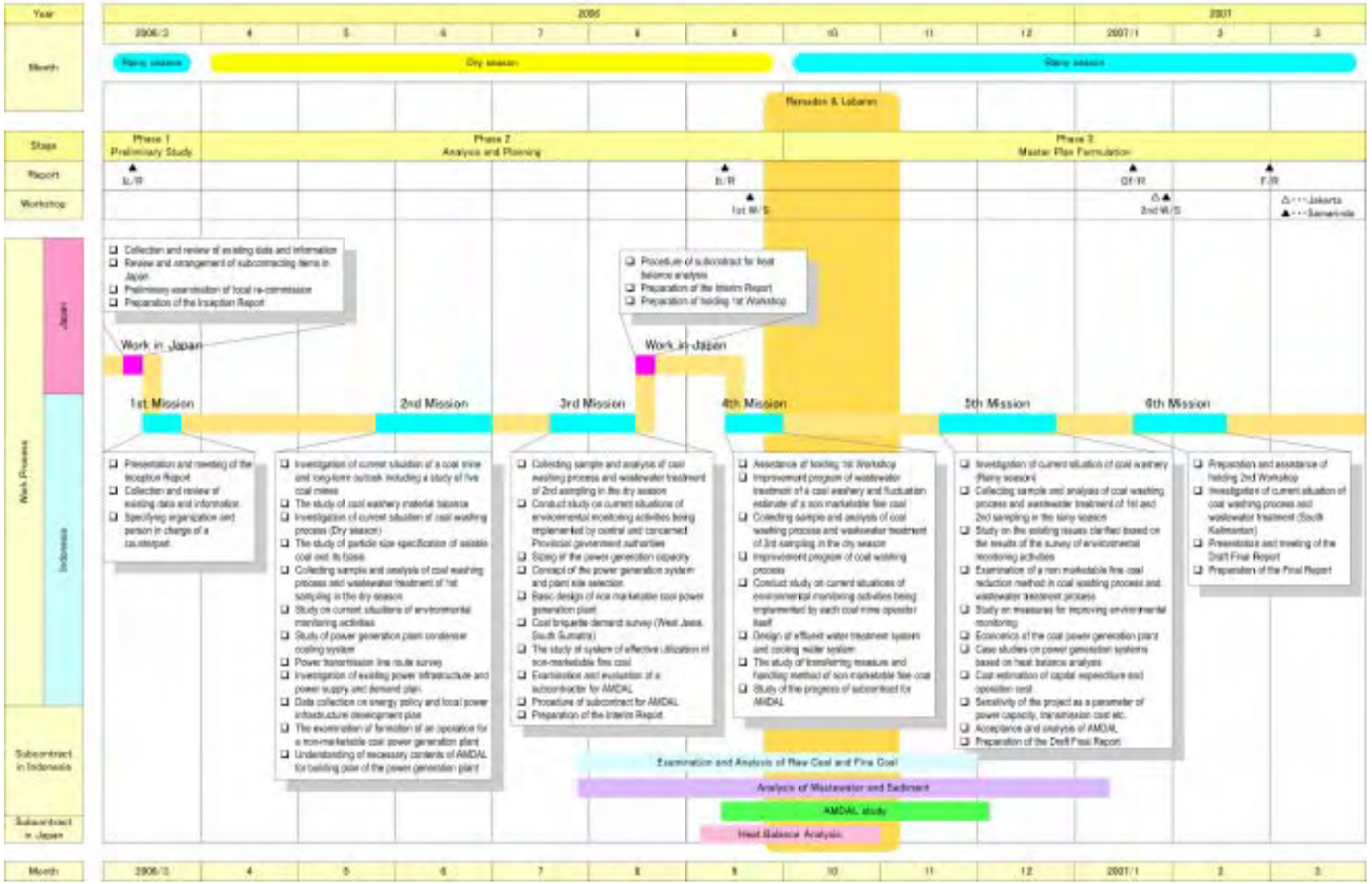
Understanding and direction of the Study for the joint Japanese and Indonesian team is as follows:



8. Study Commencement

The Study is commencing in March 2006 and will be completed in February 2007, a total period of 13 months. The work flow of the study is shown next illustration.

Work Flow of the JICA Study



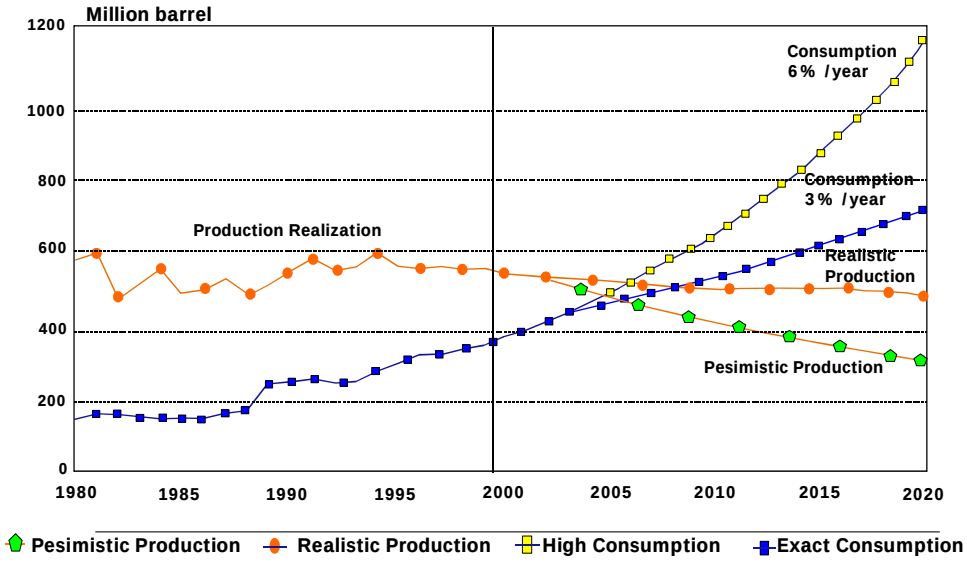
Chapter 1 Energy Supply and Demand Situation in Indonesia

1.1. General

Indonesian oil output peaked in 1996 and produced 1,380,000 BPD. Since 1997, oil production has continued to decline. With a rapid increase in the domestic petroleum product consumption, Indonesia has become a net oil importer since 2004. Indonesian economy relies on oil and gas exports which accounts for 21% in total in 2002. Indonesian crude oil is known as low sulfur. Market price of Indonesian crude oil is set higher than the standard Middle East crude oil. Indonesia has exported its own crude oil to overseas, and imports crude oils from Middle East same time to refine and supply to their own domestic market. To meet the increasing domestic demand, an import of oil products has been increased.

In 1990's, Japan imported 50-70% of Indonesian crude oils, but this has dropped to nearly 30% as the share of China and other Asian countries has increased to over 50%. The changing energy balance in Indonesia will impact on the energy balance of other Asian nations, including Japan.

Figure 1-1-1 shows crude oil (including condensate) production and domestic oil consumption in Indonesia. The gap between the oil production and oil consumption will continue to widen as the domestic oil consumption increases.



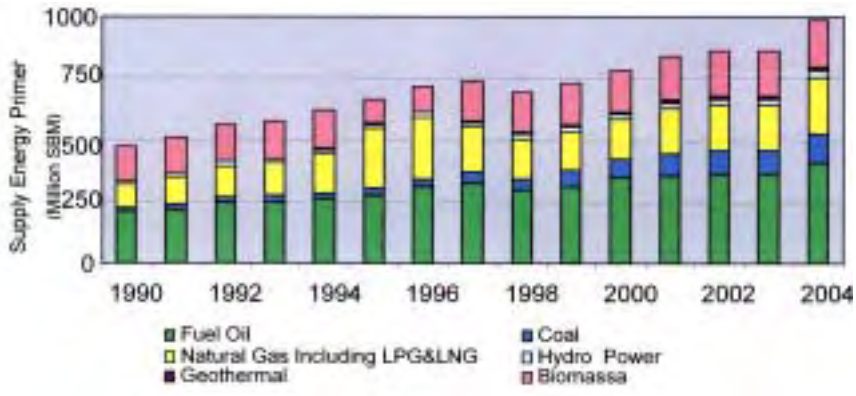
Source: Ministry of Energy and Mineral Resources 2005

Fig. 1-1-1 Indonesian Crude and Oil Condensate Production and Domestic Oil Consumption

An increasing import of Middle East crude oil and petroleum products will worsen the primary balance of the Indonesian national budget. Indonesian government has set a program to enhance the production of domestic crude oil and refined oil products. It is very important for Japan to assist in the development of alternative energies to oil products together with Indonesian

counter parts.

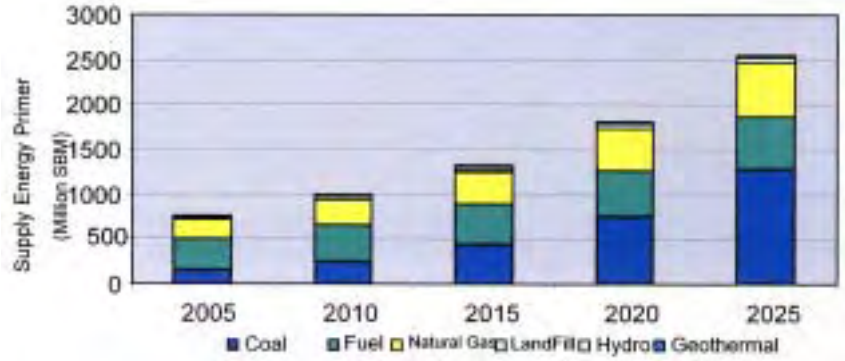
The supply of primary energy in Indonesia grew 5.4% from 1990 to 2004 (**Figure 1-1-2**). Energy consumption in 2004 was 987.9 million BOE, of which 41% come from oil products, 19% is from biomass, and 12% is from coal.



Source: Ministry of Energy and Mineral Resources 2005

Fig. 1-1-2 Indonesia's Primary Energy Supply

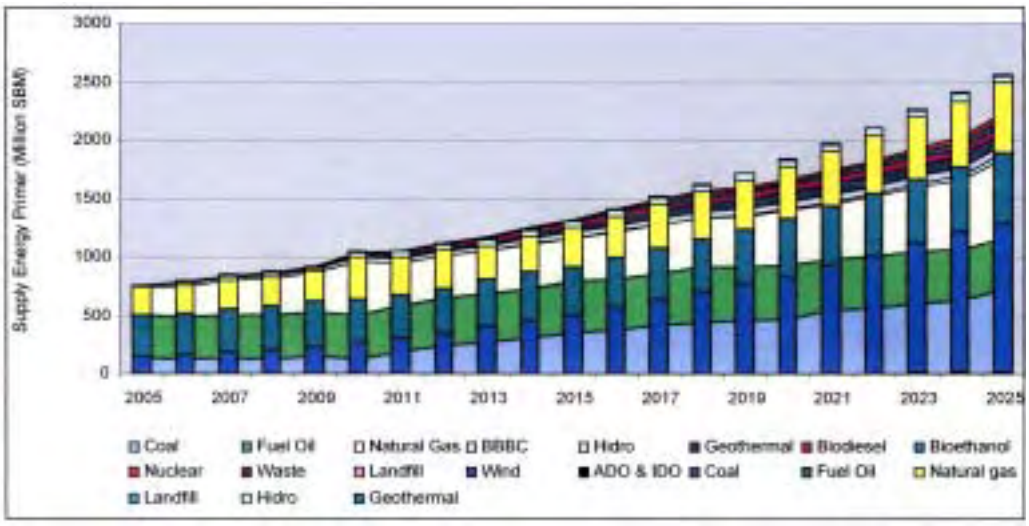
According to the Ministry of Energy and Mineral Resources, the primary energy supply is forecast to grow at 6.2% annum from 2005 to 2025, as shown in **Figure 1-1-3**.



Source: Ministry of Energy and Mineral Resources 2005

Fig. 1-1-3 Primary Energy Supply Forecast

The coal supply is expected to grow at 11% annum. Coal accounts for 12% of primary energy supply in 2004 and will be increased to 50% in 2025. However, Presidential Order in 2005 advised that more alternative energy should be introduced in lieu of coal and oil to mitigate the environmental impact. Numerical target for the introduction of alternative energies is indicated in the plan and the energy consumption growth from 2004 to 2025 is 5.5% per year in the plan. Coal and oil consumption is lowered while the use of Bio-diesel, Ethanol, Nuclear Energy, Geothermal, and Solar power generation are encouraged. **Figure 1-1-4** is a primary energy supply forecast reflecting the introduction of these alternatives energies.



Source: Ministry of Energy and Mineral Resources 2005

Fig. 1-1-4 Primary Energy Supply after Introduction of Alternative Energy

Secondary energy demand forecast is shown in **Figure 1-1-5**. The supply of Bio-Diesel and Ethanol as substitutes for gasoline and diesel is expected to be introduced in 2010. Annual growth of these alternative fuel is expected to be 20%.

1.2. Coal

1.2.1. Coal Policy

According to the Indonesian national coal policy announced by the Minister of Energy and Mineral Resources in January 29, 2004, Importance of coal development for Indonesia was emphasized and infrastructure construction for the development of coals, including road, railway, river transportation, and coal terminal was highlighted. Environmental impact associated with the development of coal mine and transportation is also addressed and preparation of the sustainable coal development program is highly awaited. Coal is not just for export, but utilized as a resource for high efficiency power generation and coal liquefaction to produce oil alternatives.

1.2.2. Coal Resources

According to the 2004 Statistics issued by the Ministry of Energy and Mineral Resources, ultimate coal reserves are 60.5 billion tons, of which 10.7 billion tons is measured, 12.2 billion tons is Indicated, and 33.8 billion tons is inferred. In addition, 3.7 billion tons is hypothetic reserves. In view of coal quality, 16% is bituminous, 84% is classified as a low rank coal inclusive of lignite and sub-bituminous coals as shown in the **Table 1-2-2**.

A general characteristic of Indonesian low-rank coal is known as low ash and low sulfur contents, and considered environmentally friendly in the combustion. Indonesian coals exported to India and US have been used as mixing ingredients to reduce the level of SOx emission.

Table 1-2-1 Coal Reserve by Location

Location	Resources (MM tons)					%	Prvd.Reserves (MM tons)	%
	Hypothetic	Inferred	Indicate	Measured	total			
Sumatra	1,862	12,931	11,675	928	27,396	45	2,744	39
Jawa	0	14	0	0	14	0	0	0
Kalimantan	1,818	20,706	563	9,820	32,907	54	4,262	61
Slawesi	0	112	1	21	134	0	0	0
Papua	0	62	0	0	62	0	-	
Total	3,680	33,825	12,239	10,769	60,513	100	7,006	100

Source : Indonesian Coal Book 2006/2007

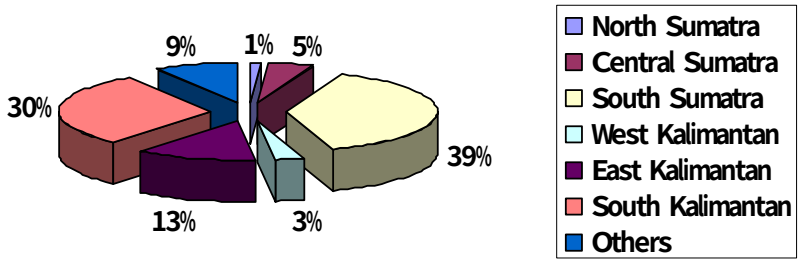
Table 1-2-2 Coal Reserve by Quality

Quality	Heating Value (kcal/Kg)	Resources (MM tons)					%	Prvd.Reserves (MM tons)	%
		Hypothetic	Inferred	Indicate	Measured	total			
Low	<5,100	1,685	8,711	2,382	2,317	15,095	25	3,452	49
Middle	5,100-6,100	1,924	19,653	9,176	4,939	35,692	59	1,828	26
High	6,100-7,100	71	4,998	670	3,326	9,065	15	1,668	24
Vwry High	>7,100	0	464	11	187	662	1	59	1
	Total	3,680	33,826	12,239	10,769	60,514	100	7,007	100

Source : Indonesian Coal Book 2006/2007

Most of coal reserve lies in Kalimantan and Sumatra as shown in **Figure 1-2-1**. Coal reserves in Kalimantan accounts for 46% of the total reserves. Coal quality range in the area is classified as Middle to High. 96% of coals are exported from Kalimantan.

South Sumatra alone account for 39% of total coal reserves. However, 98% of the coal reserve in the area is classified as low-rank coal, namely, lignite. Micro-pores of lignite contain much water and heating value is lower than ordinal coal. Due to a spontaneous ignition characteristic, lignite is not suitable for long distance transportation and long time open air storage. Because of these characteristics, they are left unexploited until recently.



Source: Ministry of Energy and Mineral Resources 2005

Fig. 1-2-1 Indonesia's Coal Reserves by Region

1.2.3. Coal Production Forecast

Coal production in 1995 was 42 Million tons. The production has increased to 152 Million tons in 2005 and Indonesia has become the world's 9th largest coal producing county and the second largest coal producing county in the Asia-Pacific rim, after Australia. Coal exports in 2005 were 110 Million tons, mostly for the use of thermal power generation. 80% of the export coal is classified as sub-bituminous, characterized by low ash, low sulfur and low nitrogen contents. Domestic coal consumption was 41 Million tons, mostly for power generation.

Table 1-2-3 Coal Supply and Demand Forecast for 2005-2025

(1000 ton)

	Actual			Forecast							
	2003	2004	2005	2006	2007	2008	2009	2010	2015	2020	2025
Export	85,680	93,759	110,790	126,516	131,629	136,670	136,178	141,000	141,000	105,000	105,000
Domestic	30,657	36,081	41,351	42,899	43,844	44,916	44,896	75,000	106,000	150,000	195,000
Total	116,337	129,840	152,141	169,415	175,473	181,586	181,074	216,000	247,000	255,000	300,000

Note

1. Actual till 2005 is from mineral and Coal Statistics by the Ministry of Energy and Mineral Resources
2. 2006-2009 Forecast is based on Production Plan (RKAB PKP2B 2005)
3. Forecast for 2010, 2015, and 2020 is based on KBN2004-2020
4. Forecast for 2025 is based on the assumption by BPEN (Blue Print)

Source: Indonesian Coal Book 2006/2007

Coal production by location is shown in the following **Table 1-2-4**. Coal export from Kalimantan accounts for 96 % of total coal export from Indonesia.

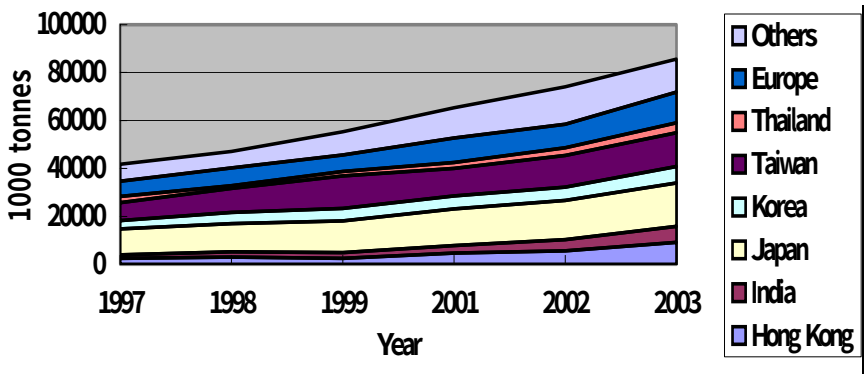
Table 1-2-4 Coal Production by Location

Location	Production		Sales			
			Domestic		Export	
	2004	2005	2004	2005	2004	2005
E.,Kalimantan	71,770	86,964	14,050	17,325	55,663	67,639
S.Kalimantan	47,868	54,009	11,410	15,488	34,458	35,491
C.Kalimantan	458	824	0	0	191	788
S.Sumatra	8,707	8,607	7,210	7,193	2,712	2,492
W.sumatra	185	34	195	56	0	0
Riau	94	555	18	219	76	241
Bengkulu	429	218	1	101	410	243
Total	129,511	151,211	32,884	40,382	93,510	106,894

Source : Correction of Indonesian Coal Book 2006/2007

Due to an environmentally friendly nature of the Indonesian coal, it has been exported to various countries, including America, Europe and Asia.

Indonesian coal is exported to more than 35 countries. In the last few years, annual growth of export is 15% in average, and the growth will continue. Export in 2005 exceeded 100 million tons. The largest importer of coal from Indonesia is Japan, accounts for 21% of total coal exports, followed by Taiwan at 17% and India at 8%.



Source: Indonesia Energy Outlook and Statistics 2004

Fig. 1-2-2 Coal Exports by Importing Country

1.2.4. Domestic Consumption

Domestic demand in 2004 was 36 million tons, increasing to 41 million tons in 2005, and will be 46 million tons in 2006. Major coal consumers by sector are Electric Power, Cement, and Other General Industries including Pulp and Metallurgy. Electric power sector accounts for 70% of domestic coal consumption and will be increased due to an increasing number of coal power plant construction plants scheduled in future. Tanjung Jati B (1,320 MW) is expected to be commissioned in 2006 and many other coal-fired power plant projects including Paiton Expasion and Cirachap are scheduled in near future.

In 2006, Government of Indonesia announced “Crash Program” to accelerate the construction of coal power plant to supply 10,000 MW of power to Java-Bali and other local systems by 2009/10. Required coal consumption to support this program will be 40 Million tons per year. Present coal consumption will be doubled in the next few years. Further power requirement of 8,000 MW is forecast by 2020 and additional 32 Million tons of coal will be required. Coal is the most secured resources and cost competitive among other competing fuels. Coal fired power plant is a practical choice for power generation.

In 2003, 75% of the total coal production was exported as shown in **Figure 1-2-3**. In 2010, the ratio is forecast to fall to 55% if Crash Program is implemented as scheduled as shown in **Figure 1-2-4**. The ratio will be down further by 2020.

Coal export is a very important industry for Indonesia. The utilization of non marketable low rank coals for domestic use is very important for Indonesian nation. Utilization of non marketable coals will contribute to the saving of natural resources. These coals will not be affected by the international market price. This also contributes to the economically stable power plant operation, and allows maximizing the export of coal at an international market price.

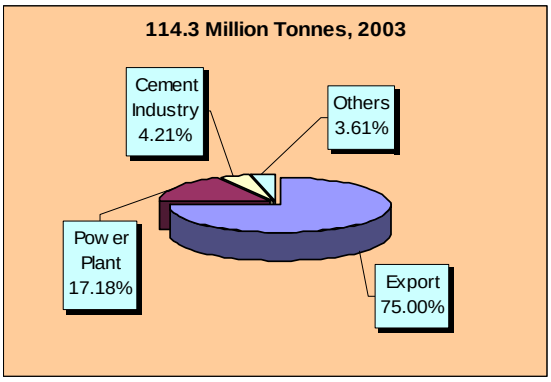


Fig. 1-2-3 Indonesia's Coal Use (2003)

Source: Ministry of Energy and Mineral Resources 2004

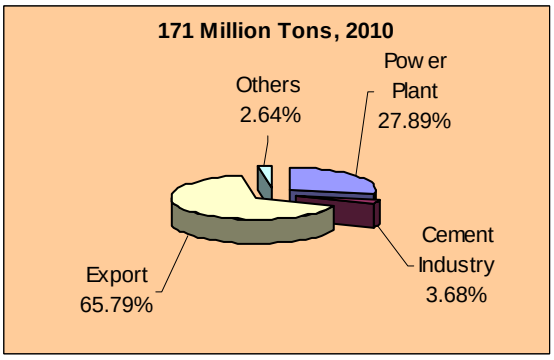


Fig. 1-2-4 Coal Utilization Indonesia (2010)

1.3. Oil Supply and Demand

Indonesian crude oil production peaked in 1996 and produced 1,380,000 BPD. This production has started to decline. Domestic oil product consumption has increased significantly since 1990's and exceeded over the production in 2004. This is the moment of Indonesia to become a net oil importer.

Indonesian crude oil has characteristics of low sulphur content. In view of SOx Emission, international sulfur specification in the petroleum product has become tightened due to an environmental concern of the people. Advantage of the use of Indonesian crude oil is that oil refinery does not require rigorous desulphurization unit in the refinery to manufacture oil product including gasoline, diesel, kerosene, and fuel oils. Installation of desulphurization facility is expensive, however, these investment cost can be minimized if Indonesian low sulfur crude oil is used.

Indonesian crude oil has been priced at about $2/Barrel higher than standard Middle East crude oil because of the above advantage.

Major crude oil fields in Indonesia are Minas and Duri. These oil field concessions are owned by Caltex Pacific Indonesia, subsidiary of a U.S. Oil Company. Minas is the largest oil field located near Pekanbaru, Riau, Sumatra. The oil field was formed in the sandstone developed in the Central Sumatra Basin during the Tertiary Miocene period. Depth to the reservoir is in the range of 600-800 m. Recoverable oil is estimated at about 7.2 billion barrels, and 4.3 billion have already been produced. The crude oil has 18 % of paraffin/wax components with a pour point of 32°C. The specific gravity is 34.4 degrees API, and sulphur content is 0.09%. Because of the low sulphur content, it is used as a fuel for steam power plant in Japan, where it is injected to the boiler directly. Production peak was in 1974. Production rate was 420,000 barrels per day at the peak time and it has declined to 100,000 barrels per day at present.

Duri oil field is located near Minas field. Depth of the reservoir is rather shallow and 70-200 m deep from the ground. Recoverable oil is 2 billion barrels, and current production rate is

200,000 barrels per day. Duri crude oil is naphthenic and forms naphtenic acid in the process of refining. This causes corrosion in the part of process unit and special design is required for these facilities. Specific gravity is 20.3 degrees API, sulphur content is 0.19%, wax content is 14% and pour point is 15.9°C.

According to the Petroleum Report by the American Embassy in Indonesia, Indonesia's crude oil production continues to decline, and production rate in 2002 was 1,251,400 BPD, including condensate. Of this, Caltex Pacific Indonesia Accounts for 46%, CNOOC, Chinese National Oil Company, account for 9% and has taken second place.

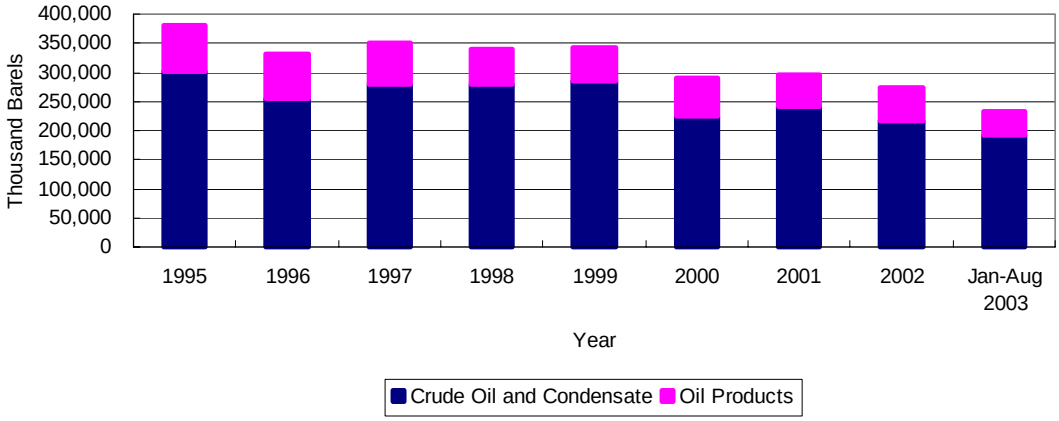
Table 1-3-1 Crude Oil Production (by Company)

(Unit: 1000 BPD)

Company	2000	2001	2002
Caltex	705.9	643.3	577.5
CNOOC/YPFMax	126.6	125.7	115
ConocoPhilips*	87.9	78.1	64.5
TotalFinaElf	85.5	90.0	80.0
Exspan	67.2	82.5	85.5
BP	62.6	50.8	46.5
Unocal	59.4	59.3	56.2
Vico	48.4	40.8	36.2
Pertamina	46.3	43.6	40.0
Petrochina	37.6	45.8	42.4
ExxonMobil**	28.2	13.4	25.3
PT Bumi Siak***	-	-	13.9
Kondur Petrol	14.9	13.8	11.1
Talisman	14.6	13.8	12.7
Others	29.0	43.2	44.6
TOTAL	1414.1	1344.1	1251.4
- Crude	1271.8	1212.2	1119
- Condensate	142.3	131.9	132.4

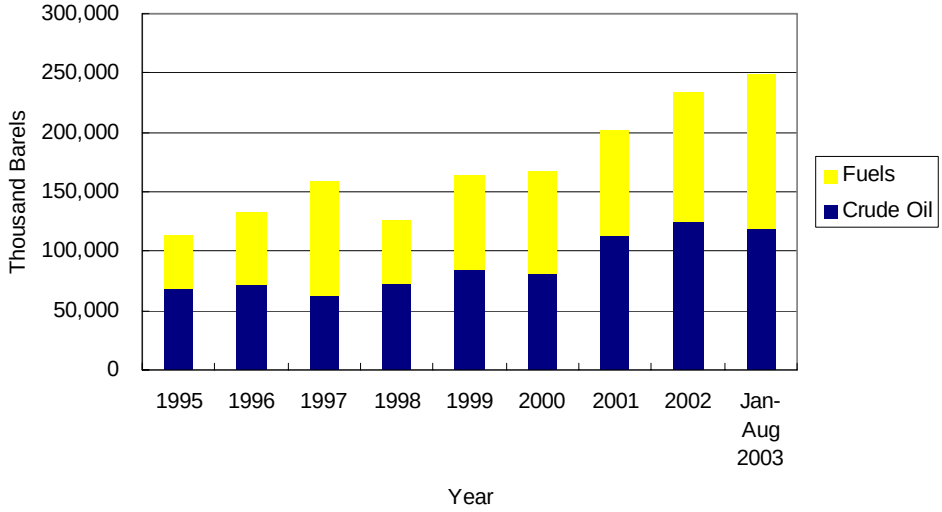
Source: US Embassy Indonesia Home page

Indonesian government has exported Indonesian domestic crude oil to overseas at a higher price than average Middle East crude oils, on the other hand, imported Middle East crude oil for domestic supply. Indonesian crude oil contains less gasoline fraction than average Middle East crude oils, however, lower sulfur contents has made up for the disadvantage of gasoline fraction. Due to a limitation on the capacity of domestic refining facilities, petroleum products are also imported to fill in the supply demand gap. **Figure 1-3-1** shows export of crude oil and product oil, while **Figure 1-3-2** shows the import of crude oils and product oils.



Source: Indonesia Energy Outlook and Statistics 2004

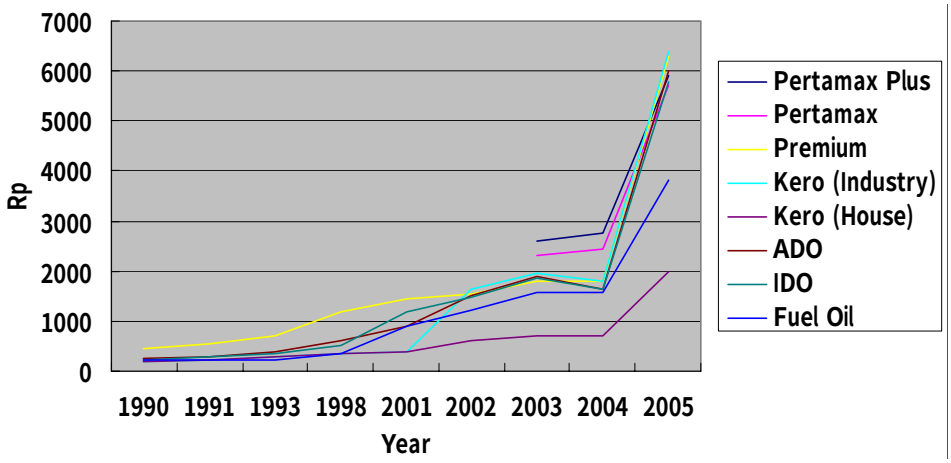
Fig. 1-3-1 Crude Oil and Petroleum Product Export



Source: Indonesia Energy Outlook and Statistics 2004

Fig. 1-3-2 Crude Oil and Petroleum Products Import

Indonesian petroleum products had been supported by generous subsidies from the government, to the point that in the summer of 2005 the amount of these subsidies grew to over 25% of the annual government budget. Crude oil price rose significantly and price of import products oils has also risen. Subsidies for the oil product has inflated significantly and exceeded the limits of the national budget. In October 2005 the government announced a lift of subsides, resulting in the hike of fuel prices in Indonesia. **Figure 1-3-3** shows fuel prices from 1990-2005.



Source: Pertamina Home Page, Indonesia Energy Outlook 2004

Fig. 1-3-3 Increase in the Price of Petroleum Products

The price of petroleum fuel for power generation has also risen significantly. Indonesian state-owned electricity company (PLN), however, cannot transfer the fuel cost to the customers and suffered from rapidly inflated accumulation of huge losses. PLN will need to pass the fuel cost through to the customers and also to switch fuel from oil to coal or gas to improve financial situation. It is necessary to achieve appropriate energy mix in view of energy security and optimize power cost structure, while minimizing the environmental impacts.

1.4. Gas Demand and Supply

Indonesia has abundant natural gas resources, with probable reserves of 182 Tcf. **Figure 1-4-1** shows the natural gas field and infrastructure. Main gas fields include Natuna Gas Fields, Arun in North Sumatra, Bontang in East Kalimantan, and Tangghu, Irian Jaya, while small to medium-sized fields are located in Central to South Sumatra, and the East and West Java Sea. Amongst these, development of Tangguh, Irian Jaya and Masela, East Natuna, are new and promising gas fields expected to complement the depleting existing Arun gas field.

Arun Gas Field will be depleting and production will be down to 200 MMscfd in 2010, 10% of its peak production. These unavoidable situations will impact on the supply of LNG to Japan.

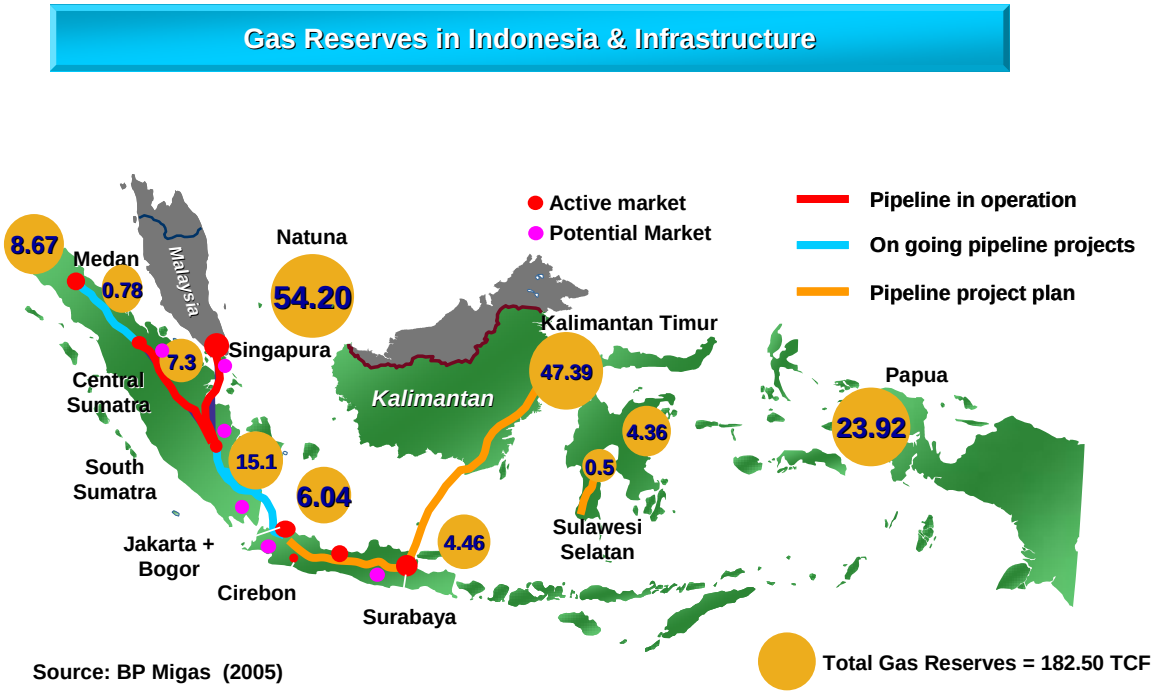
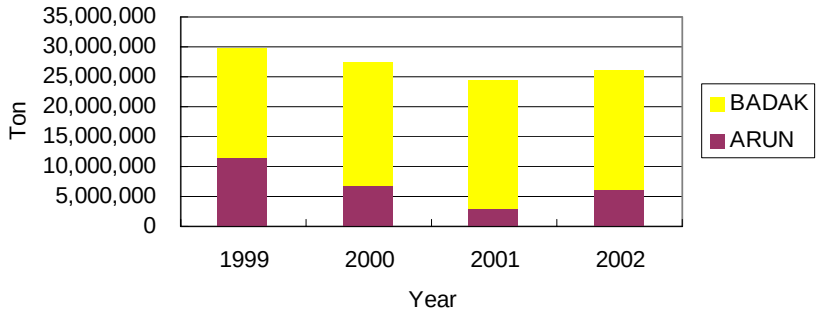


Fig. 1-4-1 Indonesia's Natural Gas Fields and Pipeline Infrastructure

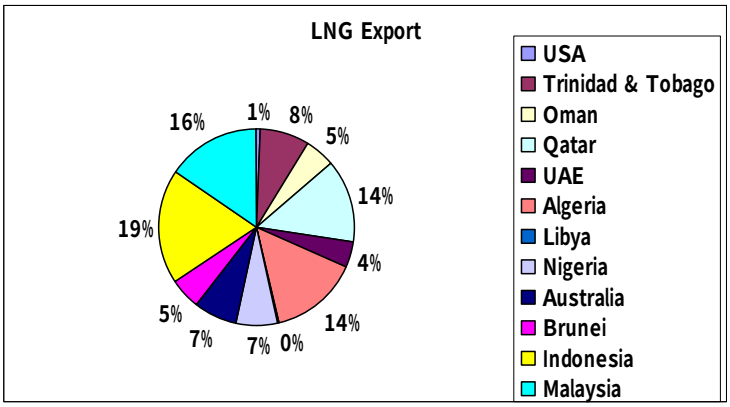
Arun gas field in North Sumatra and Bontang gas field in East Kalimantan are the largest gas field under production. Gas production from these two fields makes up 60% of Indonesia's total export, in a form of LNG. **Figure 1-4-2** shows LNG production in Indonesia.



Source: Indonesia Energy Outlook and Statistics 2003

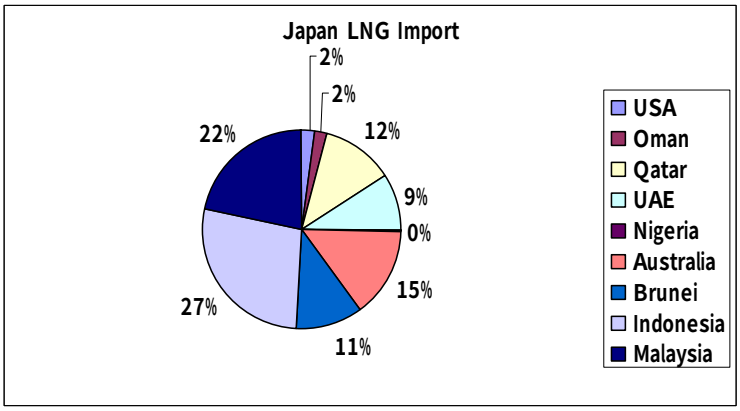
Fig. 1-4-2 LNG Production

According to BP statistics, Indonesia's LNG production in 2004 was 24,500,000 tons, accounts for 19% of the world total export and the largest LNG exporting country in the world. Malaysia follows and accounts for 16%. Indonesia exports 15,000,000 tons of LNG to Japan, which account for 27% of Japan's total import.



Source: BP Statistics 2004

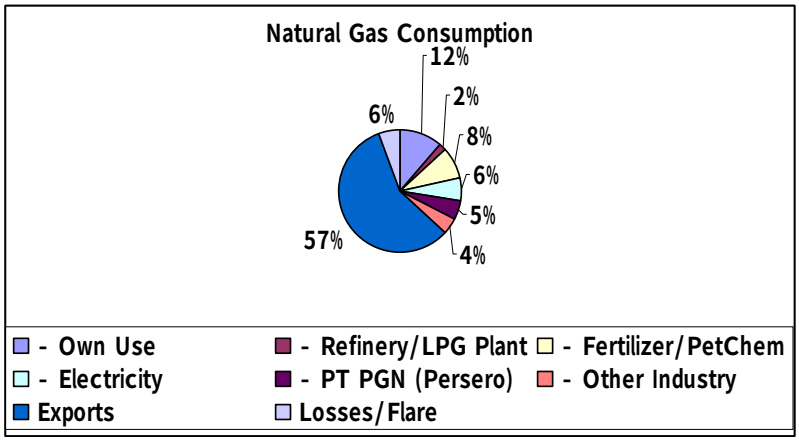
Fig. 1-4-3 World LNG Export Volume



Source: BP Statistics 2004

Fig. 1-4-4 Japanese LNG Import

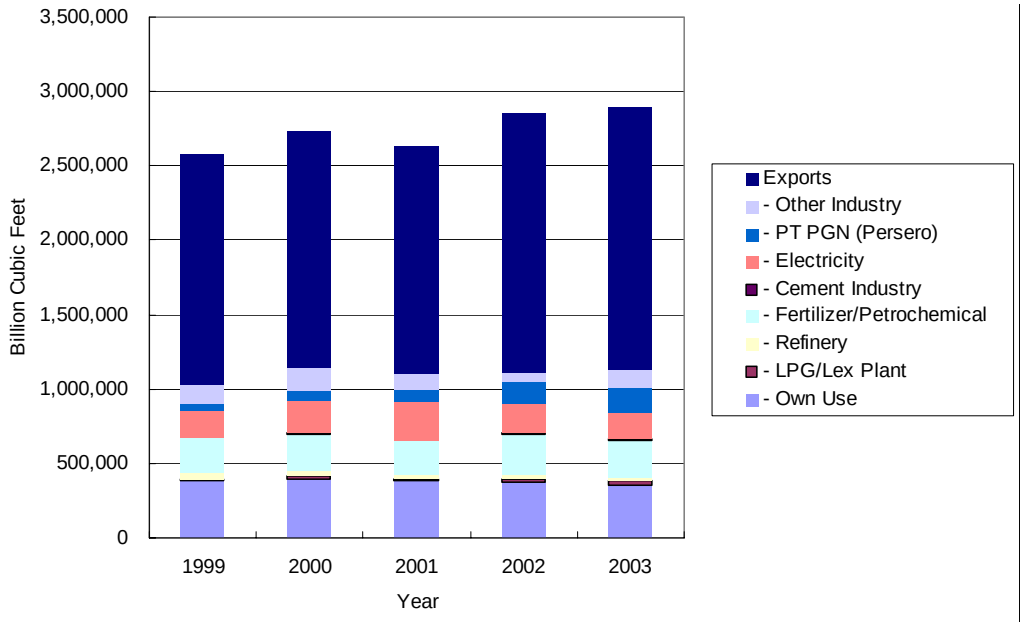
Gas production in 2003 was 3,073,482 Billion Cubic Feet. Of which, 6% was consumed by the system or flaring, and 12% used for LNG manufacturing and natural gas field operations. Urea industry and Electricity Company are the largest users, and account for 8% and 6% respectively. Other industrial users are steel making company using DRI process and methanol production companies. Natural gas for export account for 57% of total production, mostly in a form of LNG and some exported via pipeline to Singapore. City Gas user does not exist.



Source: Indonesia Energy Outlook and Statistics 2003

Fig. 1-4-5 Natural Gas Consumption (2003)

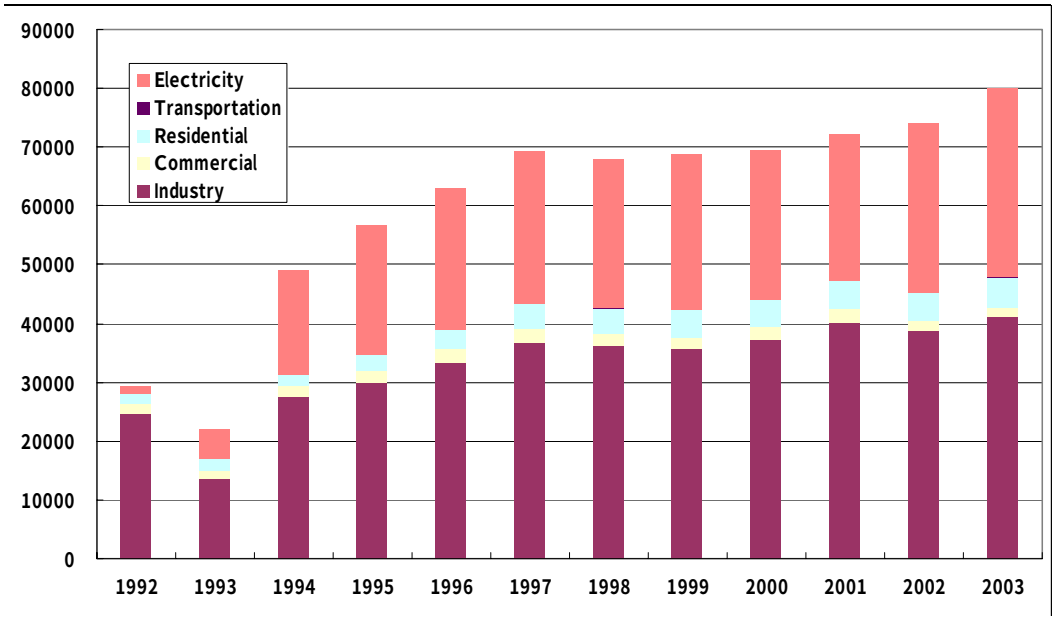
Figure 1-4-6 shows natural gas consumption excluding system loss and flaring. Utilization of natural gas is limited to the fertilizer manufacturing and the electrical power companies, and it has not become a choice of other general industrial users due to an insufficient pipeline infrastructure.



Source: Indonesia Energy Outlook and Statistics 2005

Fig. 1-4-6 Production and Utilization of Natural Gas (1999-2003)

Natural gas demand by industrial users will continue to increase in the future, provided that pipeline infrastructure is constructed. Because of a lack of pipeline, potential gas demand has not been fully developed and remains rooms for further development. **Figure 1-4-7** shows gas consumption by Users.



Source: Indonesia Energy Outlook and Statistics 2003

Fig. 1-4-7 Gas Consumption by Users (1992-2003)

The domestic natural gas price is regulated by the Indonesian Government. **Table 1-4-1** shows a list of gas prices for each industry. Natural gas is supplied directly to industrial consumers by pipeline at a fixed price. Gas price for industrial feedstock is even lower than fuel use and designed to be competitive in the international market. Considering the energy price level of the current international market, the present gas price is considered very competitive.

Table 1-4-1 Natural Gas Supply Price

(US$/MMBTU)

	Gas Price
FUEL	
1.Fertilizer Plant	1.00-2.00
2.Steel Industry	2.00
3.Electricity	2.45-3.00
4.Cement Industry	2.70-3.00
5.Paper Industry	1.30
6.Refinery	1.49
7.Plywood	0.97
8.City Gas	0.27-0.45
FEEDSTOCK	
1.Fertilizer Plant	1.00-2.00
2.Steel Industry	0.65
3.Methanol Plant	1.42-2.00
Source: Petroleum Report Indonesia, 2002-2003, Embassy of the United States of America, March 2004	

Actual gas supply to industry has become tighter due to a limitation on the gas production. Supply of gas to fertilizer plant has been reduced and supply price to industries has risen significantly, for the last few years. Gas price in the future will be linked with a crude oil price.

1.5. Hydropower, Geothermal, and Others

Indonesia is rich in renewable energies, including hydropower, micro hydro, geothermal, biomass, solar, and wind power as shown in **Table 1-5-1**. Hydropower and geothermal power are the most widely developed in Indonesia, with generating capacities of 4,200 MW and 807 MW respectively as of 2005. Such resources can economically compete with conventional hydrocarbon energies. These can generate reliable electric power.

However, biomass, micro hydro, solar heat and wind power do not necessarily offer competitiveness and reliable supply. Because of low "energy density" and instability of supply under the current technological level, introduction of these renewable energies in general will not be economically and practically feasible, unless some mechanism is in place to incorporate such energy in the existing energy system.

To reduce the carbon dioxide emission, continued effort to introduce renewable energies should be exercised. In practice unstable energies should be used together with hydrocarbons as a supplementary energy resources.

Table 1-5-1 Renewable Energy Potential

Renewable Energy

Energy Type	Unit	Potential	Existing Capacity	Energy Utilization
Hydro	MW	75670	4200	5.55%
Geothermal	MW	27000	807	2.99%
Micro Hydro	MW	500	84	16.80%
Biomass	MW	49810	445	0.89%
Sola	MW	1203000000	8	0.00%
Wind	MW	9287	0.6	0.01%

Source: Indonesia Energy Outlook and Statistics 2003

1.6. Electric Power Situation

From 1990 to 1997, annual growth of power demand in Indonesia exceeded 10% in average. This slowed down to 1% in 1997 due to the economic recession followed by the Asian Currency Crisis.

Since 2000 the power demand growth has returned to 7%, and is forecast to continue at this level in the future.

Most of Indonesian provinces have suffered from shortage of power. In order to enhance power plant construction, Government of Indonesia has issued Presidential Order No. 71 in 2006 on 5th July 2006. This presidential order is called "Crash Program" and advising the construction of 10,000 MW coal fired power plants in total by 2009/10 in all over the Indonesia. Indicated Coal quality used for this plant is 4300 Kcal/kg. 50 Million tons of coal will be required to support the program.

35 locations are announced so far. On 10th July 2006, Indonesian government has announced 10 construction sites in Java-Bali System and started the process of international tender, as listed in

the **Table 1-6-1**. Other 25 construction sites were announced on 18th December 2006, as shown in the **Table 1-6-2**.

In order to implement the program, coal transportation system should be arranged and access to the power transmission should be secured.

Table 1-6-1 Crash Program Java-Bali System

No	Location	Train	Capacity (MW)	Location
1	Banten No.1	1	600 - 700	Sularaya
2	Banten No.2	2	300 - 400	Labuhan
3	Banten No.3	3	300 - 400	Tangeran
4	West Java No.1	3	300 - 400	Indoramayu
5	West Java No.2	3	300 - 400	Purabuhanratu
6	Central Java No.1	2	300 - 400	Lunbang
7	Central Java No.2	1	600 - 700	Tanjung Jati
8	East Java No.1	2	300 - 400	Patitan
9	East Java No.2	1	600 - 700	Paiton
10	East Java No.3	2	300 - 400	Tuban

Source: PLN

Table 1-6-2 Crash Program Other Area

No	Location	Train	Capacity (MW)
1	Ache No.1	2	100 - 150
2	North Sumatra No.2	2	200
3	West Sumatra	2	100 - 150
4	Banka/Biliton No.3	2	25
5	Banka/Biliton No.4	2	15
6	Liau No.1	2	10
7	Liau No.2	2	7
8	Liau Island	2	7
9	Lampung	2	100 - 150
10	West Kalimantan No.1	2	50
11	West Kalimantan No.2	2	25
12	South Kalimantan	2	65
13	Central Kalimantan No.1	2	60
14	North Surawesi No.2	2	25
15	Golontaro	2	25
16	South Surawesi	2	50
17	Central Surawesi	2	10
18	West Nusatengara No.1	2	10
19	West Nusatengara No.2	2	25
20	East Nusatengara No.1	2	7
21	Eest Nusatengara No.2	2	15
22	Maruku	2	15
23	Morth Maruku	2	7
24	Papua No.1	2	7
25	Papua No.2	2	10

Source: PLN

According to PLN East Kalimantan, Construction sites for these power plants in Kalimantan have been decided. 2x 60 MW is scheduled in Plankeraya, Central Kalimantan, 2 x 60 MW is scheduled in Ponkeanap, West Kalimantan, and 2 x 25 M in Sinkawan, West Kalimantan. 2x 65 MW is planned in Asam Asam, South Kalimantan. Equipment Procurement has started in Ponkeanap. Most of them will be financed by loans extended from China.

Chapter 2 General Outline of the Province of East Kalimantan

1. General

The province of East Kalimantan facing the Makassar Strait has a surface area of 200,000km2, a size roughly equal to Japan's main island Honshu. Historically it was an important material supply center as evidenced by the existence of the Kutai Kingdom. East Kalimantan has a sham population. Ethnically it is divided between Malays who live along the east coast and Dayaks who live in the central interior parts. The 18th century was marked by the settlement of the Bugi people from Surawesi Island on the opposite cost in East Kalimantan. East Kalimantan is a peaceful province and has a good law and order record and no racial or ethnic conflict.

At present, East Kalimantan produces timber, coal, LNG, and petroleum resources. The province accounts for approximately a fourth of Indonesia's resource exports including products sent to Japan and thus plays an important role in the national economy. The rate of population increase was 1.68% in 2004. From the interior parts, a large number of Dayaks have moved to areas along the coastline in the quest for employment and have settled there. The extensive transmigration that has also taken place from Java and Surawesi has led to significant population increase over the last 10 years on a scale such that the transmigrant population is in the process of exceeding the native Dayaks and Malays. East Kalimantan's capital is Samarinda, a materials freight town for mainly timber situated at the mouth of the Mahakam River. The largest city, however, is Balikpapan, which has developed as a base of the development of East Kalimantan's natural resources, petroleum and gas. At present, petroleum and gas production is shifting to the sea bed of the Mahakam river mouth. During the Second World War, Japan rapidly occupied the city in a desperate quest for oil. In the counteroffensive of the Allied Powers, the Allied Forces launched, in June 1945, a naval attack on Balikpapan on account of its having been a petroleum stronghold. After the war, there was a concentration camp for the Japanese prisoners of war at Loa Duri, and even today, large numbers of Japanese come to visit Lao Duri to pay their last respects to the war dead.

Statistically, the province of East Kalimantan is a case of extremes. On the one hand, it is Indonesia's largest province and on the other it has the smallest population. It also is the healthiest part of Indonesia as a whole. With a land surface area of 210 thousand square kilometers, it is roughly double the size of Java and its population is only less than 3 million. Per capita income in the region is more than double the national average. Most of the income is generated by mineral mining and resource extraction, with petroleum, natural gas and lumbering playing the most important roles.

2. Geography and Climate

2.1 Geography

East Kalimantan Province is the biggest province of Indonesia and has total area of 245,237.80 km2 or one and a half times bigger than Java and Madura Island. East Kalimantan Province consists of 13 administration regions, which are 9 kabupatens, 4 cities, 109 Kecamatan, as well as 1,299 villages. East Kalimantan Province is located between 113°44' and 119°00' East Longitude and between 4°24' North and 2°25' South Latitude. In the previous decade the province was famous as a wood storehouse. It has 7 big rivers that flow through almost all of the kabupaten and cities. The Mahakam River is one of the longest rivers. It is one of the gateways to Eastern Indonesia development. East Kalimantan Province is located at the eastern end of Kalimantan and borders with Malaysia. The borders of the province are as follows:

・North side borders with Malaysia
・East side borders with the Sea of Sulawesi and the Strait of Makassar
・South side borders with South Kalimantan Province
・West side borders with West Kalimantan and Central Kalimantan Provinces, and Malaysia.

(Source: East Kalimantan in Figures, 2004.)

2.2 Climate

There are two seasons in East Kalimantan, the dry season (May to October) and the wet or rainy season (November to April). Since this province is located in the equatorial zone the climate in East Kalimantan Province is influenced by both the West monsoon (November-April) and East monsoon (May-October).

East Kalimantan has a hot climate. In 2004 its temperature was from 17.90°C (based upon Long Baswan Meteorological Station, September) to 35.40°C (at Tanjung Selor Metereological Station, May). The minimum average air temperature of 18.83°C happened in Long Bawan and the maximum average temperature was 34.69°C, which happened in Tanjung Selor (Source: East Kalimantan in Figures 2004.)

The maximum average rainfall of East Kalimantan in 2004 was 267.32 mm at Balikpapan Meteorological Station, while the minimum average of rainfall was 122.59 mm at Long Bawan Meteorological Station. **Figure 2-2-1** shows the rainfall at Samarinda Meteorological Station from 1996 to 2005.

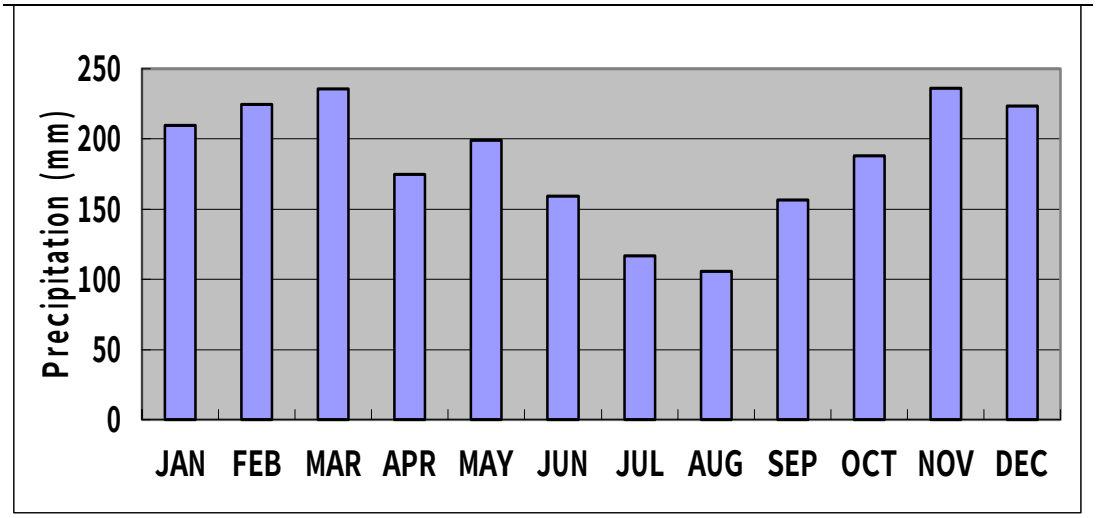


Figure 2-2-1 Rain fall at Samarinda Meteorological Station from 1996 to 2005.

(Source: East Kalimantan in Figures 2004.)

3. Government Administration

East Kalimantan Province consists of 13 administration regions, which are made up of nine kabupatens, four cities, 109 Kecamatan, as well as 1,347 villages.

The thirteen Administration Regions are as follows:

Table 2-3-1 Regional Government (City and Prefecture) in East Kalimantan Province (As of August 2006)

Administration Area	Capital
Samarinda City（Capital of Province）	
Balikpapan City	
Tarakan City	
Bontang City	
Kutai Kartanegara Prefecture	Tenggarong
Kutai Barat Prefecture	Sendawar
Kutai Timur Prefecture	Sangata
Berau Prefecture	Tanjung Redeb
Bulungan Prefecture	Tanjung Seloras
Malinau Prefecture	Malinau
Nunukan Prefecture	Nunukan
Pasir Prefecture	Tanah Grogot
Penajam Paser Utara Prefecture	Penajam

Figure 2-3-1 Administration regions in East Kaimantan

(Source: East Kalimantan in Figures, 2004.)

Table 2-3-2 Government in East Kalimantan Province (As of August 2006)

Governor
Vice Governor
Secretariat
Assistant Charge of Protocol
Assistant Charge of Economy
Assistant Charge of Administration

Table 2-3-3 Bureau in East Kalimantan Province (As of August 2006)

Indonesian	English
Biro Pemerintahan	Bureau of Government
Biro Hukum	Bureau of Law
Biro Humas	Bureau of Civil Law
Biro Penyusunan Program	Bureau of Program Arrangement
Biro Ekonomi	Bureau of Economy
Biro Sosial &Pemberdayaan Perempuan	Bureau of Social & Status of Women
Biro Keuangan	Bureau of Finance
Biro Umum&Perlengkapan	Bureau of Facility
Biro Organisasi	Bureau of Organization

Table 2-3-4 Provincial Departments in East Kalimantan Province (As of August 2006)

Indonesian	English
Dinas Pendapatan Daerah	Department of Regional Revenue
Dinas Pendidikan	Department of Education
Dinas Pariwisata	Department of Tourism
Dinas Perhubungan	Department of Transportation
Dinas Pekerjaan umum dan kimpraswil	Department of Admministration, Infrastructure and Residence
Dinas Pertambangan&Energi	Department of Energy and Manning
Dinas Perindustrian, Perindustrian & Koperasi	Department of Industry and Cooperation
Dinas Perkebunan	Department of Agriculture
Dinas Tenaga Kerja & Transmigrasi	Department of Labor and Transmigration
Dinas Pertanian Tanaman Pangan	Department of Fisheries & Marine
Dinas Perikanan & Kelautan	Department of Social
Dinas Sosial	Department of Public Health
Dinas Kesehatan	Department of Animal Husbandry
Dinas Peternakan	Department of Forestry
Dinas Kehutanan	

Table 2-3-5 Provincial Agencies in East Kalimantan Province (As of August 2006)

Indonesian	English
Badan Pengawas Propinsi	Agency for Autonomy
Badan arsip daerah	Agency for Archives
Badan Penelitian & Pengembangan Daerah	Agency for Research and Development
Badan Pemberdayaan Masyarakat	Agency for Welfare
Badan Kepegawaian Daerah	Agency for Public Service
Badan Perencanaan Pembangunan Daerah	Agency for Regional Development Planning
Badan Kesatuan Bangsa Perlindungan Masyarakat	Agency for National Prestige and Residents Protection
Badan Pengendalian Dampak Lingkungan Daerah	Agency for Environmental Impact Control
Badan Pendidikan dan Latihan	Agency for Education and Training
Badan Perpustakaan	Agency for Library
Badan Promosi dan Investasi Daerah	Agency for Regional Investment Promotion
Rumasakit Balikpapan	Balikpapan General Hospital
Rumasakit Samarinda	Samarinda General Hospital
Rumasakit Tarakan	Tarakan General Hospital
Sekretaris DPRD Prop.Kaltim	Secuetariat Provincial Assembly

Table 2-3-6 Provincial Public Company in East Kalimantan Province

(As of August 2006)

Indonesian	English
Bank Pembangunan Daerah	Region Development Bank
Perusahaan Daerah Pertambangan (Bara Kaltim Sejahtera)	Manning Regional Public Company
Perusahaan Daerah Perkebunan	Plantation Regional Public Company
Perusahaan Daerah Kehutanan	Forestry Regional Public Company
Perusahaan Daerah Jasa dan Perdagagan (Melati Bhakti Satya)	Service and Commerce Regional Public Company
Perusahaan Daerah Kelistrikan	Electricity Regional Public Company

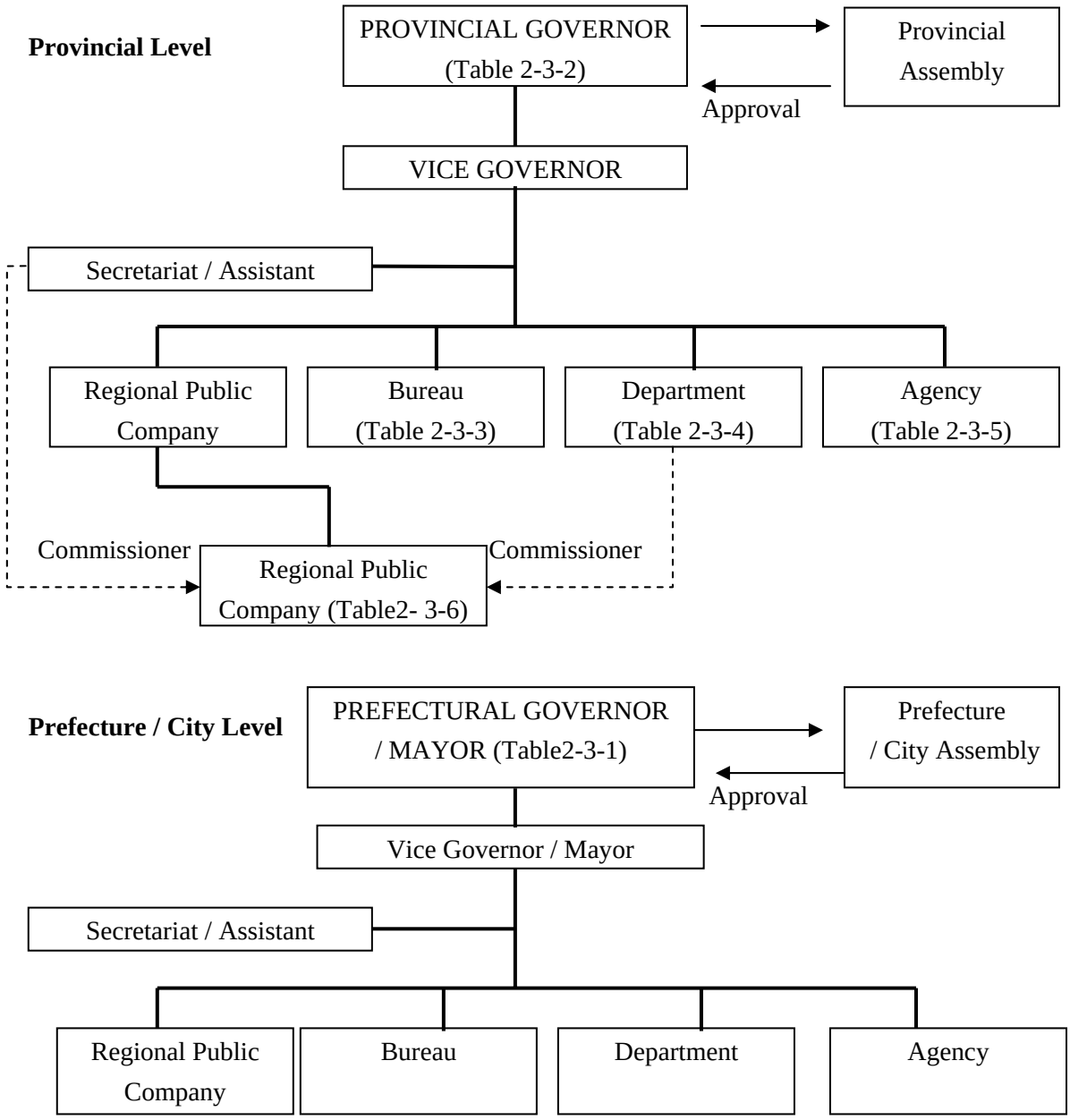


Figure 2-3-2 Organization Chart of East Kalimantan Government

4. Economy

4.1 Condition of Economy

In the year of 2004, total gross domestic product (GDP) in East Kalimantan was Rp. 91.08 trillion for the oil and gas industry and non-oil and gas industries totaled Rp. 39.14 trillion. The economic growth rate was 1.79% for oil and gas and 6.98% for non-oil and gas. **Figure 2-4-1** shows the Growth Rate of Gross Domestic Regional Product 2001-2004.

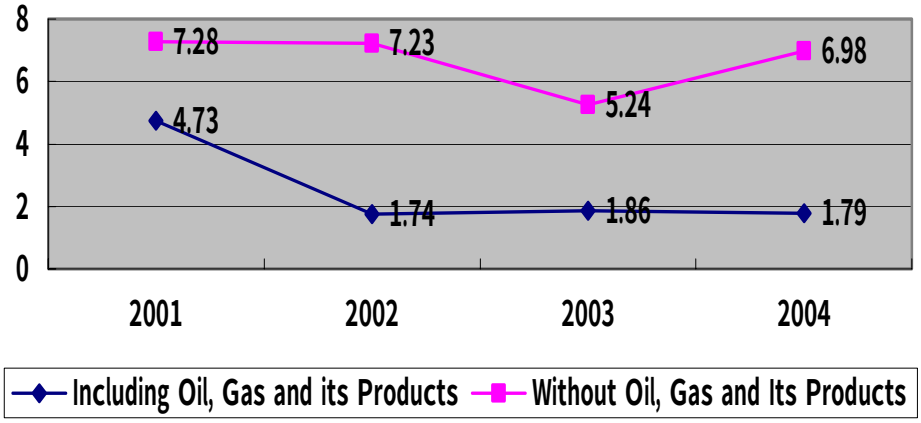


Figure 2-4-1 Growth Rate of Gross Domestic Regional Product 2001-2004

(Source: East Kalimantan in Figures, 2004.)

Some economic sectors in East Kalimantan experienced better growth rates than the year before and some sectors experienced contraction. The sectors with higher economic growth rates were electricity, gas and water, which increased from 1.31% in the previous year to 10.09%. The construction sector also experienced a significant increase from 3.98% to 6.78%. Meanwhile, manufacturing industries experienced a negative growth rate of 0.66% and 0.20% in 2003 and 2004, respectively.

Economic sectors that have important roles in gross domestic regional products in addition to oil and gas were mining (38.89% of GDRP), manufacturing industry (37.53%), agriculture (6.41%) as well as trade, hotels and restaurants (6.16%). Refer to **Figure 2-4-2**Percentage Distribution of Gross Domestic Regional Product at Current Price (Including Oil, Gas)

As for gross domestic regional products to non-oil and gas dominated by mining sector (26.11%), agriculture (16.09%), trade, hotels and restaurants (15.46%), manufacturing industry (14.73%) as well as transportation and communication (9.14%).

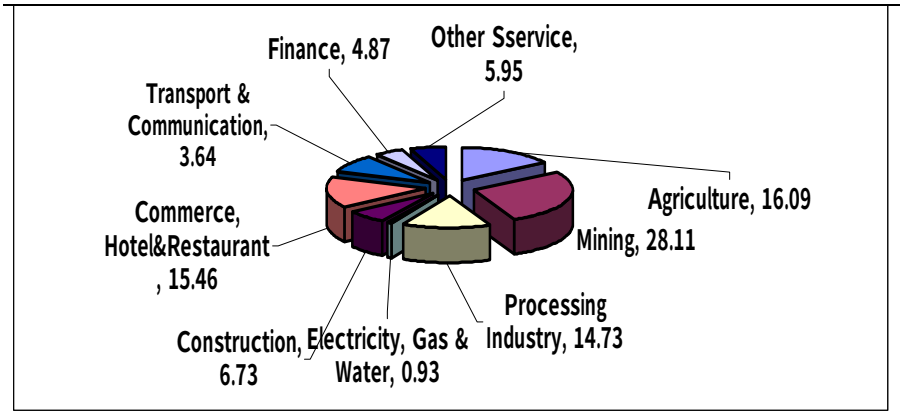


Figure 2-4-2 Percentage Distribution of Gross Domestic Regional Product at Current Price

(Source: East Kalimantan in Figures, 2004.)

4.1.1 Average Salary

The growth of per capita income in East Kalimantan in 2004 was 21.42% for employees in the oil and gas industry, and minus 0.08% for non-oil and gas. Net per capita income in the oil and gas industry increased from Rp. 33,991,833 in 2003 to Rp. 41,272,021 in 2004. Per capita income in the non-oil and gas industries decreased from Rp. 28,531,591 in 2003 to Rp. 28,508,658 in 2004. In the year of 2003, the total manpower in East Kalimantan was 1,077,379 persons and Gross Domestic Regional Product was Rp. 98.43 trillion so average productivity of a single worker was around Rp. 81.54 million per annum. The highest productivity per worker was in mining at Rp. 563.56 million and industry Rp.308.70 million per annum, respectively. While in the agricultural sector, which absorbs 31.78% of total manpower, average productivity was only Rp. 17.02 million per annum, which, notably, is much lower than the average per capita income per annum of East Kalimantan's workers.

4.1.2 Inflation Rate

In 2003 the rate of inflation in East Kalimantan was 7.04%, which was higher than the national rate of inflation of 5.06%. However, from the value side, the rate of inflation in 2003 was lower than the previous year, which was around 10.78%. The high rate of inflation was caused by the high inflation rate in education, recreation and sports of 16.59%, followed by processed food, drink, cigarette and tobacco (10.11%), housing (9.82%), clothing (6.21%), health (4.64%) and food stuffs (3.90%). Transportation and communication had the lowest rate of inflation (1.27%).

4.1.3 Exports and Imports

The amount of exports has been more than four times of the amount of imports since 1999 in East Kalimantan. The amount of oil and natural gas exported has increased. The local government economy is invigorated by these products. On the other hand, the value of wood products exported has been decreasing for several years.

Table 2-4-2 The amount of export 1999～2004 （US1,000＄）

Item	1999	2000	2001	2002	2003	2004
Total	5,337,380	8,513,332	8,861,352	7,747,498	9,029,138	10,913,690
Oil Gas	3,585,778	6,749,157	6,943,322	5,959,075	7,017,807	8,547,723
Non Oil Gas	1,751,602	1,764,175	1,918,030	1,788,423	2,011,331	2,365,967

(Source: East Kalimantan in Figures, 2004.)

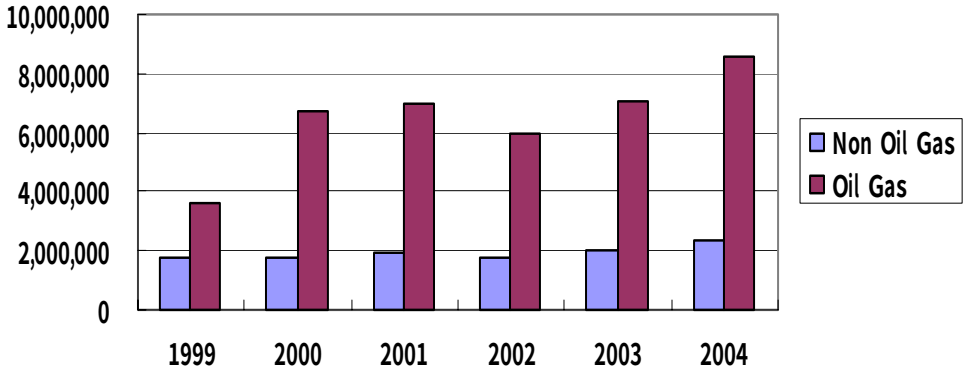


Figure 2-4-3 Amount of Export 1999～2004

(Source: East Kalimantan in Figures, 2004.)

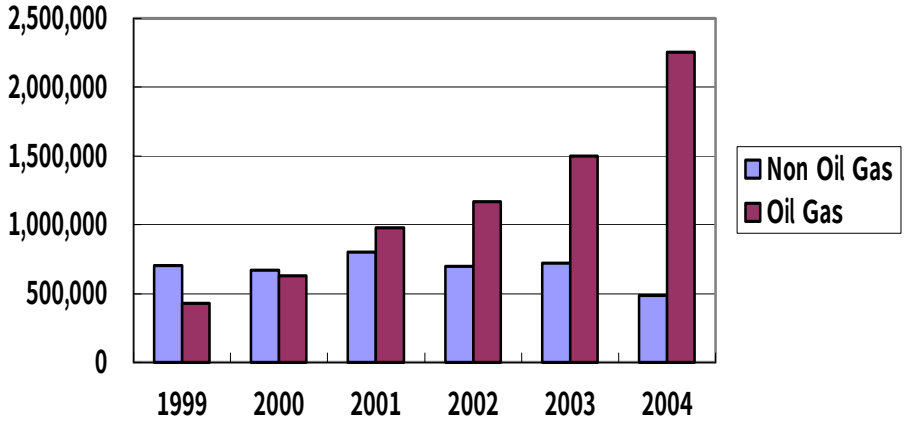


Figure 2-4-4 Amount of Import 1999～2004

(Source: East Kalimantan in Figures, 2004.)

4.1.4 Investment

Investment in East Kalimantan in 2003 reached Rp. 75.57 trillion including government's investment (Rp. 12.60 trillion) especially from the regional budget of Kabupaten/city (Rp. 8.68 trillion) and Province (Rp. 2.76 trillion) as well as National Budget (through State Electricity Enterprise/PLN) (Rp. 1.16 trillion). The private sector's investment through both foreign and domestic investment reached Rp. 2.88 trillion and Rp.29.49 trillion, respectively. The GDRP value of East Kalimantan in 2003 with oil and gas based at current market price reached Rp. 98.4 trillion and Rp. 42.3 trillion without oil and gas. Until 2003 the GDRP of East Kalimantan used for export and import activities reached 96.43% and 32.81%, respectively. Besides, the GDRP of East Kalimantan used for household consumption of 17.62% comprising of food and non-food consumption by 11.18% and 6.44%, respectively, as well as fixed capital formation of 16.21%, while government expenditure was only 1.85%, non-profit private sector of 0.29% and change of stock value 0.41%. The formation of domestic fixed capital experienced the fastest growth compared to other users which reached 8.90%, followed by non-profit institutions of 6.24%, import 6.91%, government expenditure of 5.48%, and change of stock value of 2.89%.

4.2 Financial Institutions (Banks, Non-bank and Insurance)

There are four government owned banks, 13 national private bank enterprises, one region-owned bank company, two Syariah (Islamic) banks, five people's credit banks (Bank Perkreditan Rakyat) and one foreign bank (ABN-Amro Bank.) There are 232 bank offices comprised of 74 units in Balikpapan, 68 units in Samarinda, 23 units in Bontang, 17 units in Tarakan and others spread out through all kabupaten and cities. Currently there are insurance companies in all the cities and kabupaten in the province, consisting of:

Government owned insurance companies such as

- Indonesia Health Insurance (Asuransi Kesehatan Indonesia),
- PT Persero Jiwasraya
- PT Persero Asuransi
- PT Persero Jamsosek.

Private insurance companies:

- PT Asuransi Central Asia Raya
- PT Asuransi Jiwa BumiPutera 1912
- AsuransiJiwa Bersama
- Abda Asuransi
- AIA Indonesia
- PT AIG Lippo Life
- PT Asuransi Allianz Life Indonesia
- PT Asuransi Allianz Utama Indonesia
- PT Asuransi Asih Great Eastern

・PT Asuransi Jiwa Askrindo
・PT Astra Buana
・PT Asuransi Asra Buana
・PT Asuransi Axa Life

The existing money changers are in Balikpapan, Samarinda, Tarakan, and Kabupaten Nunukan. Financing institutions consist of non-bank institution or financing institutions such as Kaltim Sarana Ventura and others managed by government and the private sectors.

4.3 Business and Trade Facilities

4.3.1 Business Facilities

Industrial zones ready to invite investors are as follows;

①Kaltim Industrial Estate (KIE) in Bontang

The KIE was established in 1990 on 64 hectares of Tanjung Harapan area and another 65 hectares at Paku Aji Timur in Bontang city. The industrial zone above aims for natural gas based industries. For supporting the manufacturing establishment, several supporting facilities were needed as follows: two units of concrete ready mix processing available with capacity of 100 cubic meters per hour; heavy equipment to support the operation of manufacturing: electric power house with capacity of 190,080 Kwh per annum or around 34 MW per hour, and 804,000 tons per annum steam production or around 100 tons per hour. Other supporting facilities are offices, banking, post office, telecommunications office, and a three-star hotel. To guarantee the smoothness of cargo and passenger flows within the area, there is an airport that can handle Dash Seven and Cassa aircraft and a sea harbor with a ship capacity of –up to 40,000 tons as well as a concrete-based highway. Several companies already operating here are those producing Ammonia and Urea fertilizers, Melamine, Hexamine, Ammonium Bicarbonate, MDF Resin & Resin, Plywood, plastic bags, electricity, Methanol, Soda Ash & Sodium Bicarbonate, Ammonium Nitrate, LPG & Condensate and multiple fertilizers.

②Kariangu Industrial Zone (KIK)

The KIK is one of the facilities especially established to support industrial activities in Balikpapan. It is located at the sandy beach of Balikpapan city. The total KIK area is 1,989,539 hectares with an effective area of 1,232.36 hectares to be developed to compete as one of the facilities to develop the industrial sector as the main basis of economic activities in Balikpapan. KIK is being managed by PT Kawasan Industri Kariangau, a regional government company of Balikpapan city, complete with infrastructure and facilities such as an industrial area, storage house, harbor and other general facilities including supporting facilities such as electric power plant and water reservoir complete with distribution network. Several companies already operating here among others are those dealing with maintenance for oil and gas equipment, the timber industry, ship yard, refrigerated warehouses and heavy equipment maintenance shops.

③Pegingin Industrial Zone (KIP)

The cooler industrial zone (KIP) is aimed to be the center of industrial activities of Kabupaten Kutai Kertanegara with total land area of 300 hectare.

④Nunukan Bonded Industrial Zone (KBN)

The Nunukan Bonded Industrial Zone (KBN), which is located in Kabupaten Nunukan with a total lad area of 1,000 hectares aims to be the center of the bonded industrial trade zone including the border crossing trade with Nunukan.

⑤Maloy Agropolitan Zone

The Maloy Agropolitan Zone is an agro-business area located in Sangata in Kabupaten Kutai Timur.

⑥Integrated Economic Development Zone (IEDZ)

Business development in IEDZ has been conceptually constructed to push regional economic growth by creating a conducive climate for development of agricultural commodity businesses. East Kalimantan Province has been specified an integrated economic zone covering Sanga-Sanga - Samboja - Balikpapan and is known as the Sasamba IEDZ. The development of agricultural commodity businesses in the form of investment, trade and services, is aimed to catalyze inter action among agricultural institutions (including government agencies, communities and businesses) in Sanga-Sanga, Samboja and Balikpapan.

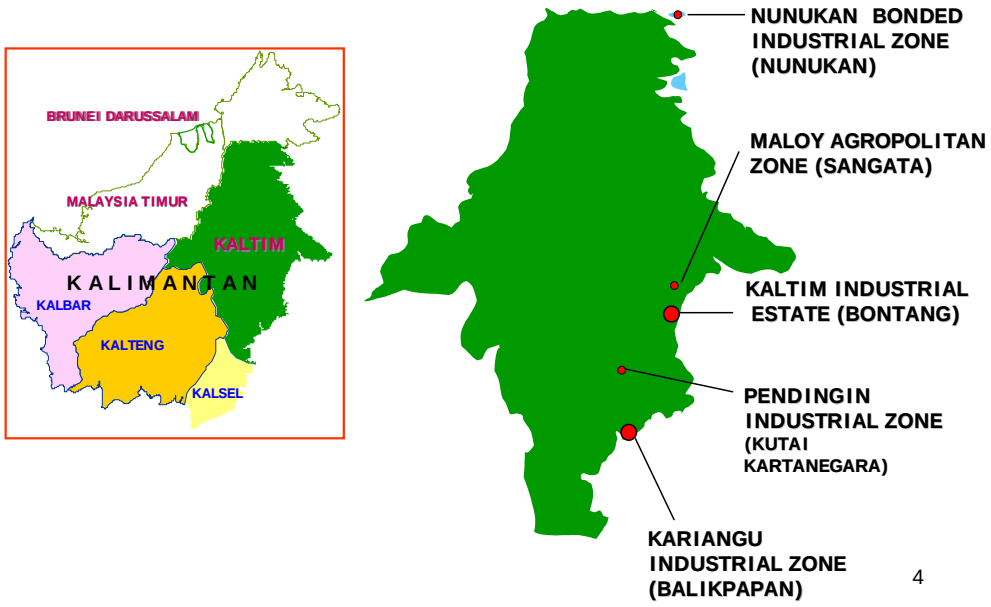


Figure 2-4-5 Industry Area in East Kalimantan

(Source: East Kalimantan in Figures, 2004.)

4.3.2 Trade facilities

Currently, the facilities managed by the private sector and still under development stage are the Islamic Center and Samarinda Business Center, Balikpapan Convention Center, Balikpapan Dome, Tarakan Marketing Point and Pasar Baru Square of Balikpapan. Additionally, there are Trade Centers already existing in the form of 68 Malls and Supermarkets that have operated in 13 kabupaten and cities, among them, the following are quite representative:

①Samarinda

Lembuswana Mall, Mesra Indah Mall, Samarinda Central Plaza, Citra Niaga, Juanda Plaza, and 99 Supermarket.

②Balikpapan

Balikpapan Centre, Balikpapan Permai, Bandar Balikpapan, Fantasi Mall, and Muara Rapak Plaza

③Tarakan

THM Plaza and Gusher Shopping Center.

④Bontang

Bontang Plaza

5. Industry

5.1 Crops

Production of various estate crop commodities in East Kalimantan increased at an annual rate of up to 25.11% from 514,697.5 tons in 2000 to 902,423.5 tons in 2003. In general, productivity of estate crops in East Kalimantan is still low, especially for smallholdings, compared with the average production rate. However, the estate crops sub-sector gives quite significant contribution to the regional economy of East Kalimantan even in comparison with the foreign exchange of non-oil/gas earned by this province. Details of estate crop production development during 2000 to 2003 shown

Table 2-5-1 Total area of estates crops of East Kalimantan Province

Type of Crop	2000 (Ha)	2001 (Ha)	2002 (Ha)	2003 (Ha)	Average Growth/ year
1. Rubber	63,162.00	54,493.00	60,706.50	60,477.50	-1.42
2. Coconut	51,584.50	53,564.50	53,588.50	49,466.00	-1.37
3. Oil Palm	116,887.50	117,055.00	132,173.50	159,079.00	12.03
4. Coffee	16,022.00	16,158.00	16,907.00	16,512.00	1.02
5. Cocoa	29,367.00	33,830.50	31,697.50	32,927.50	4.04
6. Pepper	10,547.50	10,788.50	13,829.00	13,662.00	9.84
7. Clove	354.50	328.50	341.50	291.00	-5.97
8. Others	5,229.50	5,911.00	6,558.50	6,631.50	8.94
Total	293,155.00	292,129.00	315,802.00	339,046.50	522
Total of Estates Companies	189,182	188,622	225,602	226,954	9.98

(Source : Estate Crop Service, East Kalimantan Province)

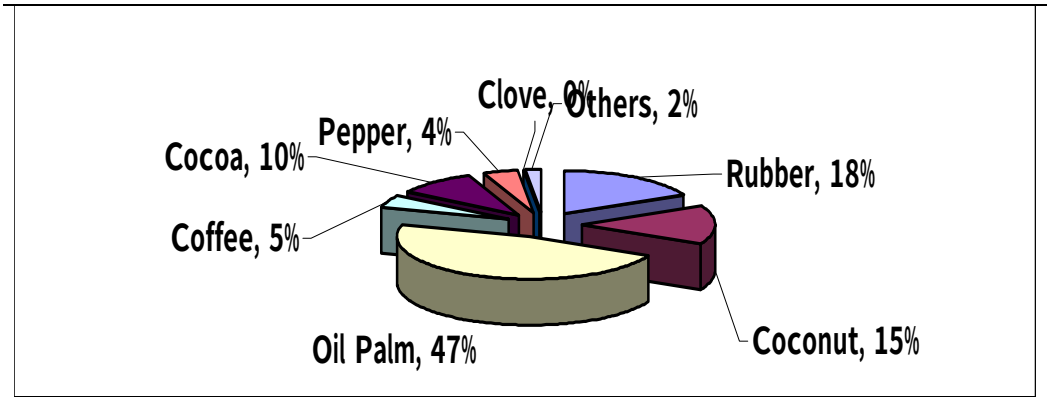


Figure 2-5-1 Distribution Rate of Planted Area of Estates (2003)

(Source : Estate Crop Service, East Kalimantan Province)

Table 2-5-2 Total Production of Estate Crops Private Large-Scale Estates Company in East Kalimantan (tons)

Crops	2000	2001	2002	2003	2004
1. Rubber	21,560.00	26,391.00	25,430.00	29,629.00	12.48
2. Coconut	31,332.00	41,883.50	40,649.00	40,830.50	10.11
3. Oil Palm	433,645.00	466,729.00	760,293.00	791,064.00	27.47
4. Coffee	4,939.50	5,912.50	6,150.50	6,112.00	7.91
5. Cocoa	15,334.00	18,772.50	27,362.00	22,013.00	14.52
6. Pepper	5,707.50	5,837.50	7,059.50	7,066.50	7.94
7. Clove	14.00	19.50	19.00	17.50	8.33
8. Others	165.50	10,716.50	4,118.50	5.691.50	54.27
Total	514,697.50	576,298.00	871,081.50	902.423.50	25.11

(Source : Estate Crop Service, East Kalimantan Province)

Oil palm has experienced a high growth rate (27.47%). As shown by the production Figures in the above Table, the commodity value of state crops was Rp, 625 billion in 2001, later increased to Rp.1,219,851,960,930 in 2003. The estate crop commodities in East Kalimantan are as follows:

① Oil palm

Oil palm may be the most promising commodity for investment due to the announcement by Provincial Government of East Kalimantan for developing one million hectares of oil palm plantation by 2013. The planted area of oil palm in East Kalimantan increased by 26,905.5 hectares from 132,173.5 hectare in 2002 to 159,079 hectares in 2003, while its production rose by 30,771 tons from 760,293 tons to 791,064 tons during the same period. Meanwhile, there were 49 oil palm business companies spread over eight kabupatens in East Kalimantan with a planted area of 1,259,149.1 hectares.

② Rubber

The planted area of rubber in East Kalimantan decreased by 229 hectares from 60,706.5 hectares in 2002 to 60,477.5 hectares in 2003, while its production rose by 4,199 tons from 25,430 tons to 29,629 tons during the same period. The decrease was caused by old rubber trees as well as the white fungi that attacked the roots of rubber trees. On the other hand, construction of office buildings and housing areas using rubber plantations in Kabupaten Kutai Barat also decreased the total planted areas.

③ Coconut

The planted area of coconut in East Kalimantan decreased by 4,122.5 hectares from 53,588 hectares in 2002 to 49,466 hectares in 2003, while its production rose by 181.5 tons from 40,649 tons to 40,830.5 tons during the same period.
The decreased planted area was caused by the imbalance between replanting and unproductive old coconut trees.

④ Coffee

The planted area of coffee in East Kalimantan decreased by 395 hectares from 16,907 hectares in 2002 to 16,512 hectares in 2003, and its production decreased by 38.5 tons from 6,150.5 tons to 6,112 tons during the same period.

⑤ Pepper

The planted area of pepper in East Kalimantan decreased by 167 hectares from 13,829 hectares in 2002 to 13,662 hectares in 2003, while its production rose by 7.0 tons from 7,059.5 tons to 7,066.5 tons during the same period.

⑥ Clove

The planted area of clove in East Kalimantan decreased by 50.5 hectares from 341.5 hectares in 2002 to 291 hectares in 2003, while its production decreased by 1.5 tons from 19 tons to 17.5 tons during the same period.

⑦ Cocoa

The planted area of cocoa in East Kalimantan increased by 1,230 hectares from 391,697.5 hectares in 2002 to 32,927.5 hectares in 2003, while its production rose by 5,349 tons from 27,362 tons to 22,013 tons during the same period.

⑧ Others

The total planted area of other estate crops, namely candlenut, aren (special type of palm sugar), nutmeg, kapok, cinnamon, vanilla, ginger, sugarcane, tobacco and castor increased by 73 hectares from 6,558.5 hectares in 2002 to 6,631.5 hectares in 2003, while its production rose by 1,572.5 tons from 4,118.5 tons to 5,691 tons during the same period.

5.2 Agriculture

The total land area of East Kalimantan is 24,523,780 hectares, and it comprises around 225,451 hectares wetland (rice fields) and 22,635,069 hectares non wetland. Among the 225,451 hectares with potential for rice fields only 34,076 hectares are cultivated twice a year and 46,873 hectares are once a year. The remaining 23,232 hectares was temporarily fallow land, which means only around 46% of the available area has been cultivated, and the rest of 121,270 hectares (54%) are not utilized. The portion of the 22,635,069 hectares of non wetland area that consists of potential land for food crops and horticulture is 1,777,300 hectares with dry land of 937,716 hectare (57%) and temporary fallow land of 839,584 hectares. The rest of the land areas such as swamps, dykes, and fresh water ponds total 1,040,082 hectares. Based upon the land area by utilization for rice fields and non-rice fields, we can see that there is still an opportunity to cultivate food crops (paddy, secondary crops, and horticulture) in East Kalimantan.

Table 2-5-3 Harvested Area and Production of Paddy (2000～2004)

Year	Harvested Area (Ha)	Production (ton)
2000	138,348	401,955
2001	125,463	366,708
2002	153,214	442,634
2003	135,809	430,285
2004	141,348	486,166

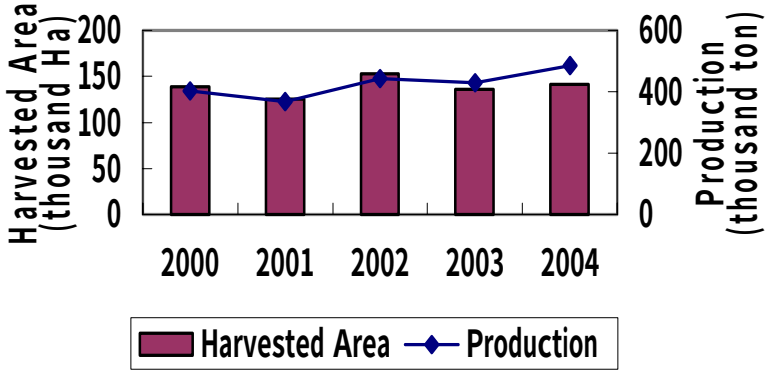


Figure 2-5-2 Harvested Area and Production of Paddy (Wetland and Dryland) 2000-2004 (Source: East Kalimantan in Figures, 2004.)

5.3 Fisheries

The fisheries in East Kalimantan are spread out in all 13 kabupatens and nine of which are located in coastal areas, which are Kabupaten Bulungan, Tarakan City, Kabupaten Berau, Kabupaten Kutai Timur, Kabupaten Kutai Kartanegara, Bontang and Balikpapan Cities,

Kabupaten Penajam Paser Utara and Kabupaten Paser. The situation of the marine industry and fisheries resources as of 2003 is presented in **Table 2-5-4**

Table. 2-5-4 Marine and Fishery Resources

No.	Resources	Total
1.	Coastal Lines	1,185 Km
2.	Sea Area	98,000,000 Km2
3.	Mangrove area	225,000 ha
4.	Public waters area (rivers, lakes, swamps)	2,773,937 ha
5.	Brackish water culture land	225,000 ha
6.	Fresh water culture land	6,000 ha
7.	Brackish water culture land	112,450 ha
8.	Pond area	260.8 ha
9.	Cage area	511 ha
10.	Dyke area	
	- Cultured dyke area	20,000-50,000 fish/ha
	- Dyke RTP	7,412 RTP
	- Intensive dyke	5%
	- Traditional dyke	54%
11.	Hatchery	
	- Tarakan	11 hatchery (farms)
	- Balikpapan	2 hatchery (farms)
	- Kutai Kartanegara	1 hatchery (farms)
	- Pasir	1 hatchery (farms)
12.	Shrimp's fingerlings	
	- come from local catchments	9 billion (15%)
	- come from outside	
	(Java and Lampung)	85%
13.	Potential to be exploited	35%
14.	Potential un-exploited	65%
15.	Marine culture developed (float net, catch net for groupers)	1,087 unit
	- Demand for Groupers fingerlings	1,087,000 fish/year
	- Local catchments (from around East Kalimantan, and the rests are from Java and Lampung	

（Source: Fishery Service Office of East Kalimantan）

Number of fishing boats in East Kalimantan is 10,741 motor boats comprising of 4,850 outboard motor boats and 2,846 non-powered boats.

Total number of capture fisheries production in 2002 was Rp. 110,917.7 tons with value of Rp. 781,502,306,000. Based upon business types, marine fisheries production was 84,088.7 tons with its value of Rp. 699,383,316 as well as public watgers is 6,829 tons with its value of Rp. 82,118,990.

Catching instruments of East Kalimantan in 2002 were 34,542 consist of various types, both active and stationary. According to types used by fishermen of this province, most of them are

using gill nets (45.01 %), lift nets (14.50 %), bamboo traps (16.20 %), coral trawls (9.98 %), pole and line (8.67 %), shell collectors (2.35 %), muroami (0.16 %) and others (3.10%).
Fish export to several destination countries such as United States, Hong Kong, Japan, Singapore, Taiwan and some European Union member countries since 1999 - 2003 experienced a significant increase. Among those exported were frozen and fresh shrimp, frozen and fresh fish, live fish, lobster, labi-labi and sea worm. Fish export activities are carried out through transitory ports like Tanjung Perak in Surabaya and Tanjung Priok in Jakarta. This is due to unavailable direct transportation from East Kalimantan to destination countries.

Table. 2-5-5 List of Fish Export Volume from East Kalimantan 1999-2003

No.	Year	Volume (kg)	Growth (%)	Value (US$)	Growth (%)
1.	1999	10,799,163.00	-	70,811,593.00	-
2.	2000	9,979,607.00	-7.5	83,263,200.30	17.8
3.	2001	12,908,621.08	129.0	109,228,303.00	13.2
4.	2002	11,556,049.00	31.0	91,883,070.00	-15.9
5.	2003	13,429,007.67	31.5	109,145,305.81	160.5

(Source: Fishery Service Office of East Kalimantan)

5.4 Animal Husbandry

Livestock population in the year 2004 in East Kalimantan comprised cows 60,884 head, buffalo 14,463 head, goats and sheep 72,808 head, chicken (native chicken, layers and broilers) 25.99 million head, ducks 284,400 head, pigs and horses 137 head. Livestock culture is generally carried out as small-scale business enterprises in which the maintenance system has never been intensive.

The main product of livestock culture is meat from all livestock types. But meat is still imported from other regions, especially cows and goats.

Table 2-5-6 Production meat, egg and milk of East Kalimantan (tons)

Type of Livestock	2003	2004
A. Meat	29,490.7	29,570.5
B. Egg	8,292.9	8,985.9
C. Milk	0.0	0.0

(Source: Livestock Service of East Kalimantan Province)

The meat and eggs consumed comes from the local area and also slaughtered livestock come from outside the area. All milk consumed in the form of powdered milk and canned sugared-milk comes from outside the area. Prospective development of livestock in East Kalimantan is quite promising with an available area of 550,000 hectares to meet the self-sufficiency for meat in 2010 in which 68,000 head of young beef cattle are needed and also 8,000 tons per annum each of layer eggs, native chicken eggs and duck eggs.

5.5 Forestry

Based upon the Decree of the Minister of Forestry No.79/KPTS-1I/2001, the total forest area in East Kalimantan around of 18,000,000hectares consists of national park forest of 1,823,650 hectares, protected forest of 2,533,016 hectares, limited production forest of 4,532,256 hectares, conversion forest of 64,922,207 hectares, production forest of 4,708,312 hectares as well as education forest (no data).

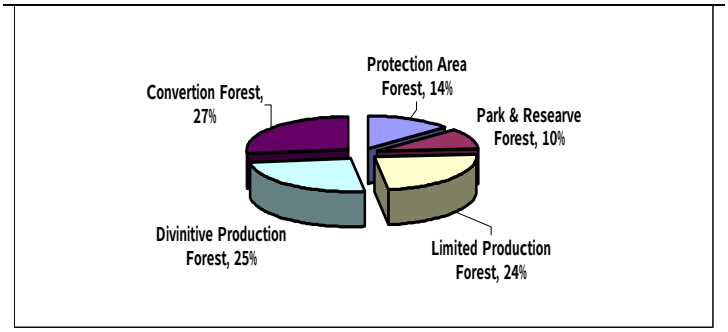


Figure 2-5-3 Percentage of Forest Area in East Kalimantan Province By Forest Land Use Consensus 2004 (Source: East Kalimantan in Figures, 2004.)

Forest management is carried out through forest management rights (HPH) and business permits to utilize wood (IUPHHK). Up to present, there are 71 licensed companies with total forest area of 8.58 million hectares that spread across 10 kabupatens and cities.

During the last several years the wood production of East Kalimantan and total logged area in 2004 was 2.677 million cubic meters from total of 72,490.21hectares forest area. The biggest production were plywood (1.45 million cubic meters), and other processed wood products such as sawn wood, block board, veneer, MDF, chip wood etc.

5.6 Tourism

Attractive and various types of tourist objects in East Kalimantan including things for nature and unique ethnic tourists are spread out in 13 Kabupaten and cities.

Table 2-5-6 Types of tourist objects in East Kalimantan

Type of object		Total
1.	Nature	182
2.	Culture	30
3.	Man-made	15
4.	Historical and Pre-historical relics	43
5.	Museum	2
6.	Art Gallery	N.A
7.	Cultural Park	6
8.	Performing Art	N.A
9.	Traditional Handicraft Village	30
10.	Tourist Natural Park	10

(Source: Tourism, Art and Culture Office, East Kalimantan Province)

6. Infrastructure

6.1 Transportation

(1) Land

Generally, public land transportation has been connected from the capital city of East Kalimantan, Samarinda to all capital cities of kabupatens/municipalities within the province, except Tarakan and Nunukan, and even with South Kalimantan with buses, Taxis and rental cars.

The length of inland road in 2003 was:

A total of 1,226.21 km of State road consisted of:

Asphalted	194.35 km
Macadam	157.44 km
Dirt road	56.54 km
Others	44.50 km

A total of 1,762.07 km of Provincial roads consisted of:

Asphalted	766.90 km
Macadam	662.84 km
Dirt road	332.33 km
Others	- km

A total of 5,472.15 km of Kabupaten/City roads consisted of:

Asphalted	1,935.87 km
Macadam	1,634.17 km
Dirt road	1,833.38 km
Others	68.63 km

There are 409 bridges with total the length of 12,761.90 meters comprising:

State bridges	239
Total length	6,862.40 m

Provincial bridges	171
Total length	5,898.10 m

(2) Airport

Currently, the province is served by air transportation that has an important role in supporting oil drilling, coal mining and others that need high inter-region mobility within the province, especially to Jakarta. Sepinggan international airport in Balikpapan has 2,500 meters of runway with 45 meters of width and can handle Boeing767, Air Bus and DC9 aircraft. Additionally, Juata airport in Tarakan has 1,850 meters of runway that handles B-737 aircraft.

The Juata airport serves local flights, national (domestic) flights, and international flights to Malaysia and Brunei Darussalam.

Table 2-6-1.Air Transportation by Airport of East Kalimantan, 2004

Airport	Flight		Passenger		Cargo (kg)		Baggage (kg)	
	Departure	Arrival	Departure	Arrival	Departure	Arrival	Departure	Arrival
1.Sepinggan, Balikpapan	19,935	20,212	1,125,868	1,043,478	5,028,234	5,052,204	7,572,664	7,527,033
2.Temindung, Samarinda	3,360	3,376	44,184	49,841	390,802	301,575	351,086	332,760
3.Juata, Tarakan	3,419	3,426	153,013	147,147	1,113,072	1,157,073	1,462,260	1,355,489
4.Kalimarau Berau	2,707	2,773	47,051	42,435	101,815	231,097	301,840	311,755
5.Nunukan	380	380	5,022	4,142	39,910	25,121	28,492	19,989
6.Tanjung Harapan Bulungan	1,029	1,029	10,491	9,433	58,195	92,195	120,817	82,962

(Source: East Kalimantan in Figures, 2004.)

(3) Sea harbor

Inter-island shipping traffic in 2004 was through 15 existing harbors in East Kalimantan in which the greatest traffic is through Samarinda harbor and the largest total number of passengers is through Balikpapan harbor, comprising of:

Arrivals: 49,730 ships and 1.2 millions passengers

Departures: 49,730 ships and 1.4 passengers

The main existing sea/river harbors in East Kalimantan to support export, trade and passenger transportation are located in Samarinda, Balikpapan and Tarakan cities. Additionally, there are harbors which have special uses, Bontang harbor (LNG and fertilizer), Bunyu harbor (methanol), Lawe-Lawe harbor and Teluk Lombok harbor (petroleum), Teluk Adang (palm oil/CPO), Sangata (coal) and several other inter-island harbors such as Nunukan, Tanjung Redeb, Tanjung Selor, Tanah Grogot and Sangkulirang.

6.2 Electricity

Electricity availability is currently dominated by the State Electricity Company (PLN), which in 2004 had total installed capacity of 412.32 MW, produced electricity of 296.37 MW with a peak burden of 266.37 MW.

Electric Power Plants consist of:

1. Diesel fueled Power Plants with installed capacity of 325.1 MW
2. Steam fueled Power Plants with installed capacity of 7.0 MW
3. Gas and Steam fueled Power Plants with installed capacity of 80.0 MW
4. Micro-Hydro Electric Power Plants with installed capacity of 0.2 MW

6.3 Telecommunications

Communication means available in East Kalimantan have as many as 238,170 access portals spread out in 13 kabupaten/cities consisting of:

1. Telecommunications: 197,573 units
2. Data communication (Circuit/CCT): 30,453 units
3. Radio Wireless access (SST): 10,144 connection units

In 2003 PT Telkom Persero launched its newly developed mobile telephone network with a Telepon Flexi product, in only two regions, Samarinda and Balikpapan, however, today almost all kabupaen and cities of the province have telecommunication networks. Additionally, cellular telephone has been also developed and managed by the private sector, Telkomsel, Satelindo and Indosat among others.

6.4 Potable Water

The requirements for potable water in all the Kabupaten/cities of East Kalimantn are managed by the PDAM (Regional Potable Water Company) of each Kabupaten/city, with a total potential capacity of 4,124 liter/second and effective installed capacity of 3,088 liter/second, and with a production of 44,888 liter/second.

The raw water to fulfill the needs for potable water production is sourced from:

Rivers	:	2
Water springs	:	2
Dams	:	2
Artesian wells	:	3
Others	:	2

Additionally, some potable water is supplied by private companies, including PT Bangun Tirtama Sarana Mulya, which serve industry needs in Bontang Industrial Zone.

7. Social Environment

7.1 Population and Manpower

The total population of East Kalimantan in 2004 was 2.75 million for a population density of 13.18 persons per square kilometer and a population growth rate of 1.68 %. Distribution of population is concentrated in Samarinda, Balikpapan, Tarakan and Bontang with 1,190,290 persons or 46.52% living in these areas totaling 1,707.8 km2 which is 0.85% of the total area of East Kalimantan. Population density in these areas was 696.97 persons per square kilometer. The remaining 53.48% or 1,368,282 persons occupied eight kabupaten with 198,678 km2 which

is 99.15% of the total area of East Kalimantan, giving a population density of 6.87 persons per square kilometer.

The areas which are recommended by the East Kalimantan Government as transmigration locations are as follows;

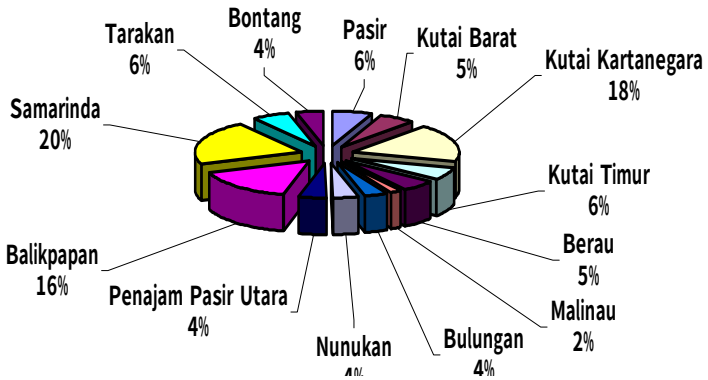


Figure 2-7-1 Distribution Population by Regency / Municipality (2004)

(Source : East Kalimantan in Figures, 2004.)

Job opportunities exist in the fields of aquiculture, trade, hotels, restaurants, and service. Percentage of population aged 15 and over by activity is shown in **Figure 2-7-2**.

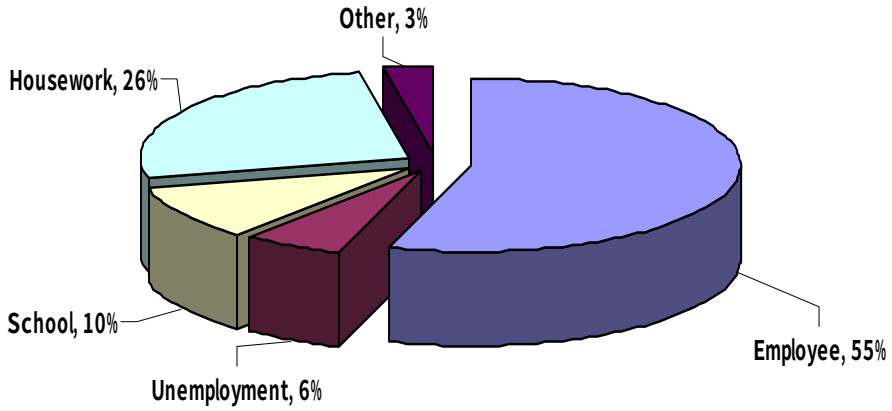


Figure 2-7-2 Percentage of Population Aged 15 Years and Over by Activity

(Source: East Kalimantan in Figures, 2004.)

7.2 Religion

Most of the population of East Kalimantan (87.49%) are Moslem, 10.94% Christian Protestant, 5.7% Catholic, 0.88% are Buddhist, 0.48% are Hindu and 0.75% others .

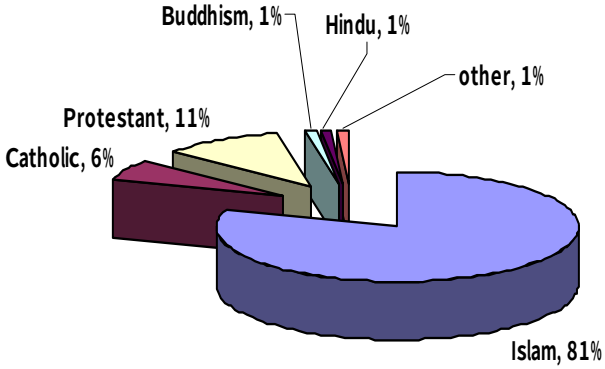


Figure 2-7-3 Percentage of Population by Religion 2004

(Source: East Kalimantan in Figures, 2004.)

7.3 Education

The number of primary schools up to high school (managed by both the government and the private sector) are as follows: 2,155 primary schools, 525 junior high schools, 289 senior high schools, 104 vocational schools, and 48 s university/diploma schools.

Through education, the government tries to produce and increase the quality of human resources to compete in economic activities and job opportunities. The total number of population that finished school indicates the quality of human resources in that area. Up to 2003, the total number of population that finished primary school and over has tended to increase.

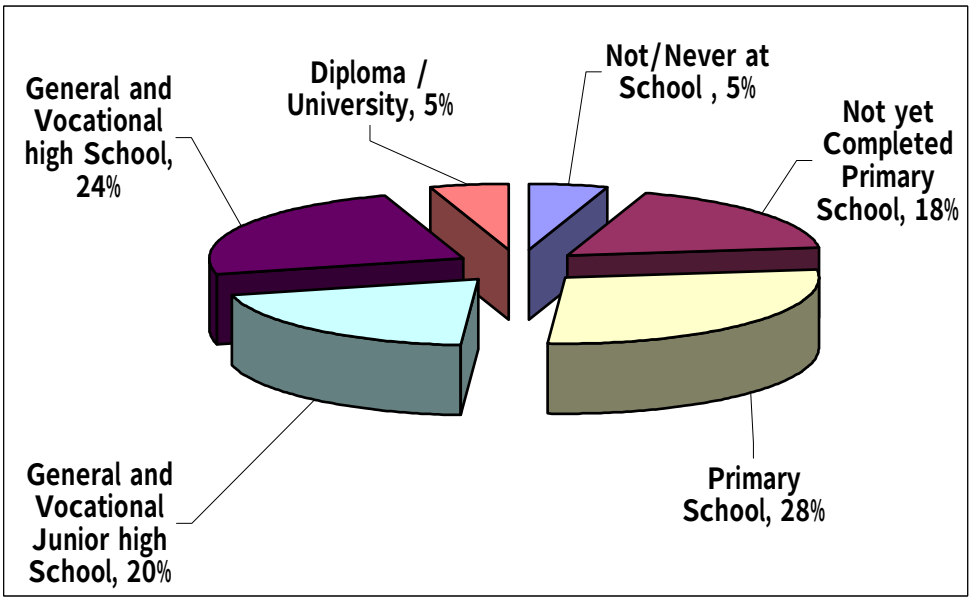


Figure 2-7-4 Percentage of educated level in East Kalimantan

(Source: East Kalimantan in Figures, 2004.)

7.4 Health

The provincial government has extended efforts so that curative, rehabilitative, promotional, and preventive medical service maximally involve the role of the people. In general, community health development in East Kalimantan has had a good tendency, as shown through health indicators such as the infant mortality rate (IMR). Additionally, infant life expectancy has increased.

7.5 Sport and Recreation Facilities

Currently sport facilities are being extended and increased to support East Kalimantan to host of the XVII National Sport Week 2008. The facilities that have been constructed are integrated sport venues with international standards, namely Stadion Maya Puslatda in Sempaja, Samarinda. Meanwhile, the facilities being developed are a main sport stadium to an international level in Palaran, then Oar Sport Stadium is located close to Benanga Dam and other sport stadiums in kabupaten and cities of Samarinda, Balikpapan, Bontang and Kabupaten Kutai Kartanegara, the later to be used as sport venues for various sport events.

8. Energy

The mining sector, including oil and gas, and non-oil/gas is the most promising sector to East Kalimantan's economy. In 2004, East Kalimantan gained foreign currency income from mining export amounting to US$ 8,547,723,000 which significantly contributed to the national revenue.

The mining sector of the province still has great potential to be further developed in areas besides oil and gas. The province is also endowed with coal, peat, nickel, gold, silver, antimony, iron and tin as well as other mining materials. This sector in general is not optimally exploited yet. For this purpose, it should be continually developed taking care of its environmental impacts.

Business opportunities to exploit the mining sector exist in almost all the kabupaten and cities of the province which in 2004 involved 25,277 of Indonesia’s workers and 133 expatriates in total.

The Mining and Mineral Resources Service of East Kalimantan estimated that still there are deposits in the form of petroleum of 920 billion barrels (MMSTB) and natural gas of 47.37 trillion SCF. Several areas are currently being worked by some companies using both domestic and foreign capital, that produce petroleum in this province, based upon production sharing contracts and technical contracts. These include PERTAMINA DOH Kalimantan, Total Final Elf, UNOCAL, VICO, Infex, Exspan Nusantara, Perkasa Els and Senco.

Product results of natural gas collected from various fields are accommodated at the Badak Central facilities in VICO Indonesia - Muara Badak area, then are transferred to PT Badak NGD & Co Bontang, and processed in Train Badak as a liquefied natural gas.

8.1 Production

General mining commodities produced in East Kalimantan are coal and gold, and mining products of Category C carried out by the Mining Companies in Kabupaten/City level.

There are 19 coal and gold mining companies in East Kalimantan with CCOW permits, as well as KP permits and working contract permits. Total KP exploited area is 167,369 hectares, while total newly opened exploitation areas in 2004 were 13,010.66 hectares, and there were 12,581.64 hectares of reclaimed mining areas.

Generally the mining activities are carried out through open pit mining. Additionally, two mining companies use underground mining and opene mining. There are also village cooperative units (KUD) with mining exploitation authority permits.

Coal production of East Kalimantan from year to year continually increases as shown through Table 6 in which average growth is 15 % per annum. In 2003, coal production of East Kalimantan reached over 45 million tons or more than half of the total coal production of the country.

PT Kaltim Prima Coal is the company that has the highest production volume of 25 million tons per annum, which makes the company the biggest coal producer in Indonesia.
More than 90% of coal production in East Kalimantan is exported overseas to Japan, Korea, the Philippines, Thailand, Malaysia, India, Europe and the United States. The remaining 10% was for domestic consumption such as cement factories in Java and Sulawesi, as well as paper factories, nickel smelting and steam powered electricity plants (PLTU) in Suralaya and Paiton.

Table 2-8-1 Coal Production of East Kalimantan Province

No.	Name of Company	2001	2002	2003	2004
1.	PT. Kaltim Prima Coal	15.572.809	17.671.759	16.271.678	19.694.354
2.	PT. Multi Harapan Utama	1.262.119	861.929	1.574.456	1.552.772
3.	PT. Tatino Harum	1.500.000	1.807.478	1 .456.634	1.242.789
4.	PT. Bukit Baiduri Enterprise	1.357.667	2.106.435	2.320.287	1.141.909
5.	PT. Fajar Bumi Sakti	121.881	100.523	70.390	100.792
6.	PI. Kitadin	901.504	1.837.486	1 .577 .796	1.627.363
7.	PI. Berau Coal	6.750.359	7.240.549	14.055.940	16.133.374
8.	PT. Kideco Jaya Agung	9.403.424	11.489.545	14.055.940	16.926.726
9.	PT. BHP Kendilo Coallnd	794.941			
10.	PT. Indomico Mandiri	4.604.071	5.182.250	5.843.446	7.867.053
11.	PT. Baradinamika MS	319.319	455.198	305.666	450.000
12.	PT. Gunung Bayan PC	2.068.427	2.713.498	3.256.442	3.088.109
13.	PT. Kitadin Tandung Mayang	0	518.229	248.152	0
14.	PI. Lanna Harita Indonesia	0	945.426	1.186.854	1.638.797
15.	PI. Kartika Selabumi Mining	0	1 .600.000	2.098.485	2.000.000
16.	PT. Kartika Selabumi Mining	0	*	253.312	667.472
17.	PT. Mandiri Inti Perkasa	0	*	*	188.161
18.	PT. Garda Tujuh Buana	0	*	*	*
19.	CV. Mutiara Hitam	0	*	*	*
	TOTAL	42,618,559	55,114,569	59,070,521	66,017,780

(Source: Mining and Human Resource Service of East Kalimantan Province)

8.2 Coal Deposits

At the end of 2004 there were several mining companies that had finished their exploration stage and feasibility studies and were then ready to begin the construction stage and later to production stage.

Related to the activities mentioned above, coal mining companies have contributed to national income through 'dead rents' for Agreements on Coal Mining Exploitation Cooperation in the amount of US$ 353,974.77 and Rp. 2,997,800, additionally, earnings from the mining authority is US$ 5,363.60 and Rp. 210,012,261.60. The money value originating from coal sales were US$ 27,121,382.38 and Rp. 923,796,067.

Total coal deposits in the location of the operating companies generally are still in significant volume, besides there are several companies with expired permits (mine closures) such as PT BHP Kendilo Coal Mining in Kabupaten Pasir with estimated coal deposit balances as shown in **Table 2-8-2.**

Table 2-8-2 Estimated Coal Deposit in East Kalimantan

No.	Name of Company	Deposit			
		2001	2002	2003	2004
1	PT. Kaltim Prima Coal	2,013,977,268	1,996,305,509	1,980,053,831	1,960,339,477
2	PT. Multi Harapan Utama	7,882,488	47,520,559	45,946,103	44,939,331
3	PT. Tatino Harum	20,377,924	18,877,924	17,070,446	15,613,812
4	PT. Bukit Baiduri Enterprise	87,280	85,173,573	82,853,286	81,711,377
5	PT. Fajar Bumi Sakti	96,270,955	96,170,432	96,100,042	95,999,250
6	PI. Kitadin	49,572,370	47,734,884	46,157,008	44,529,725
7	PI. Berau Coal	23,931,190	216,690,641	208,605,123	202,471,749
8	PT. Kideco Jaya Agung	1,080,733,217	1,069,243,672	105,518,732	1,038,261,006
9	PT. BHP Kendilo Coallnd	60,268,319			
10	PT. Indomico Mandiri	680,495,220	675,312,970	669,469,529	661,602,471
11	PT. Baradinamika MS	220,974,506	220,519,308	220,213,624	219,763,642
12	PT. Gunung Bayan PC	14,615,443	11,901,945	8,645,503	5,557,934
13	PT. Kitadin Tandung Mayang	12,000,000	11,481,771	11,233,619	11,233,619
14	PI. Lanna Harita Indonesia	25,000,000	24,054,574	22,868,422	21,229,625
15	PI. Kartika Selabumi Mining	12,000,000	10,400,000	8,301,515	6,662,718
16	PT. Kartika Selabumi Mining	8,700,000	*	8,446,688	7,779,216
17	PT. Mandiri Inti Perkasa	6,000,000	*	*	5,811,839
18	PT. Garda Tujuh Buana	400,000,000		*	*
19	CV. Mutiara Hitam	*	*	*	*

(Source: Mining and Human Resource Service of East Kalimantan Province)

8.3 Gold and Silver

The only company dealing with gold mining and granted with working contract specially which successfully developing its activities up to production process is PT Kelian Equatorial Mining in Kabupaten Kutai Barat. The company mines prime gold ore and the processing is carried out through 'cyanidization' procedure to produce 'buillon' in accordance to the current regulation, later to be purified in gold purification factory of Precious Metal Unit of PT Aneka Tambang in Jakarta. Beside gold, silver also produced

Production of gold and silver since 2001 until 2004 that produced by PT Kelian Equatorial Mining shown in Table 11 below. The highest volume reached in 1998 was 14.9 tons of gold and 13,604 tons of silver.

PT Kelian Equatorial Mining did not carry out the mining activities in 2004, and only processing the low grade stuffs, since there is no more existing deposit or no new deposit found and mining closure will be done.

The rest of ore deposit of gold and silver by this year amounts to 10 million tons and average quality of gold of 1.6 gram/tons and silver of 0.67 gram/tons.
Till now in preparing of all everything related to the mine closure, especially on employees, environmental problems and anticipation of other impacts as the consequence of mine closure.

Table 2-8-3 Gold and Silver Production of East Kalimantan Province

PT. Kelian Equatorial Mining	2001	2002	2003	2004
Gold	19,959	16,779	14,403	10,019
Silver	12,764	10,839	10,660	9,032

(Source: Mining and Human Resources Service of East Kalimantan Province)

Chapter 3 Present Situation of the Environment of the of Mahakam River Basin

This chapter provides a summary of the results obtained through the survey of water quality at BAPEDALDA in East Kalimantan and through the study of the contents of the "Flooding and Navigation Safety Management Project for Mahakam River (tentative translation)" published in 2002 by the "Mahakam River Master Plan Committee (tentative translation) and other environmentally related surveys and review.

1. Mahakam River basin

Figure 3-1-1 shows the extent of the Mahakam River basin.

1.1 Hydrology and geography

Table 3-1-1 shows the hydrology and geography of Mahakam River basin.

Table 3-1-1 Hydrology and geography of Mahakam River basin

Total length		960 km
Total catchments area		77,095 k㎡
Three large lakes located along the River		Jempang / Melintang / Semayang
Precipitation	Upstream area	2400-3000 mm
	Middle reach area	2000-2400 mm
	Downstream area	1800-2000 mm
Forest coverage area	1962	57,466 k㎡ (86% of total catchments area)
	2001	40,761 k㎡ (61% of total catchments area)
	Depletion rate	-428 k㎡/year

Source: Year Book of 2003, East Kalimantan Province

Figure 3-1-2 shows monthly rainfall for 2005 in Samarinda located in the downstream region of the Mahakam River. The rainfall for 2005was about 2500 mm.

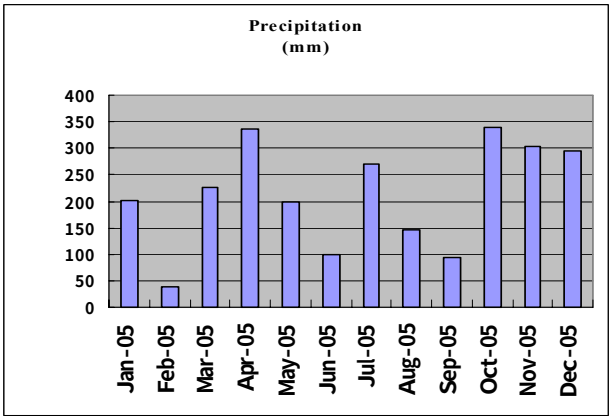


Figure 3-1-2 Monthly rainfall for 2005 in Samarinda

Source: Yearly Book of 2003, East Kalimantan Province

A bullet (●) in the figure denotes a principal local city.

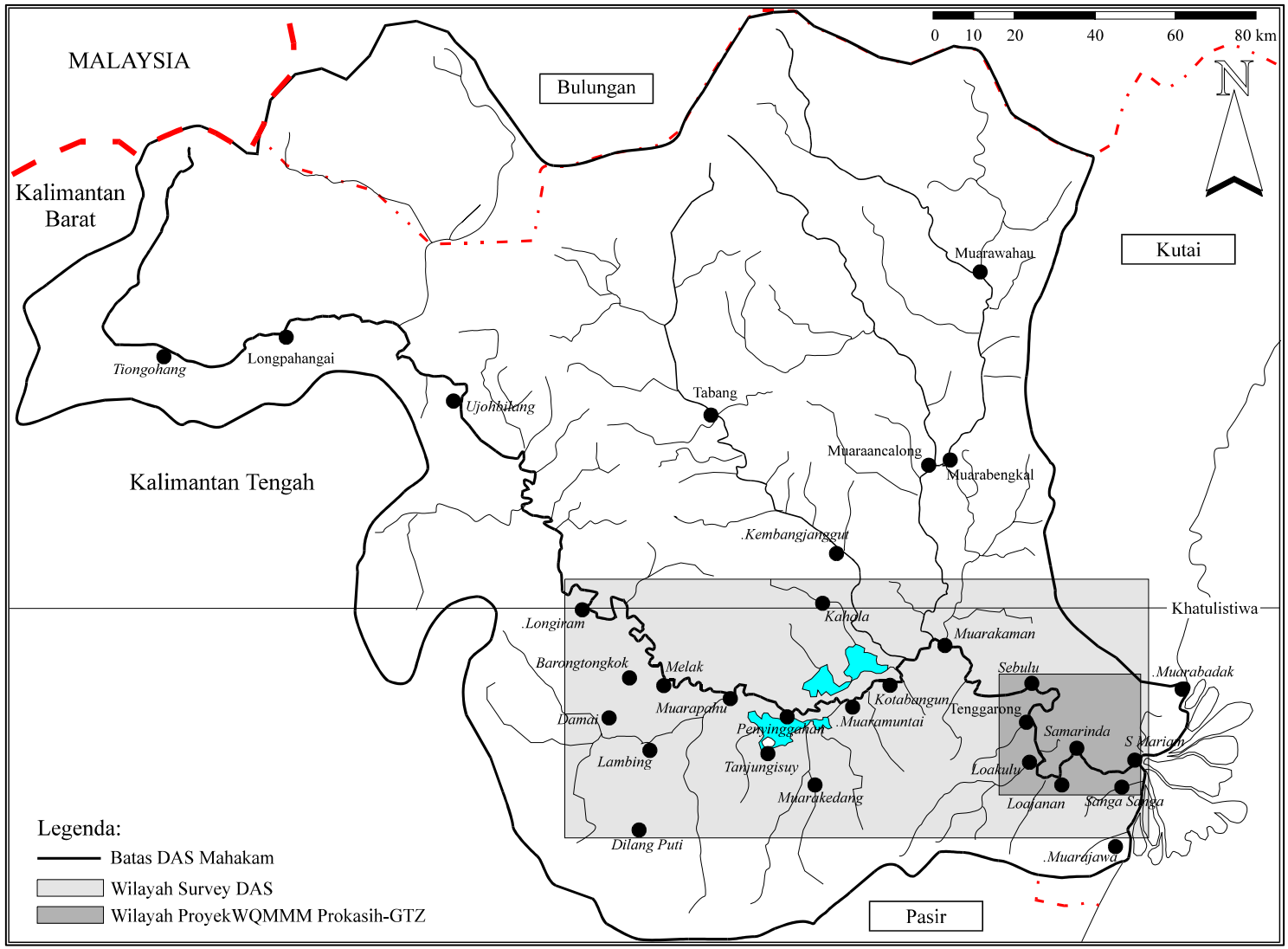


Figure 3-1-1 Area Map of Mahakam River Basin

1.2 Social environment

(1) City and province

The following city and four provinces are located in the Mahakam River basin (**Table 3-1-2**).

Table 3-1-2 City and provinces of Mahakam River basin

City	Samarinda			
Province	Malinau	Kutai Barat	Kutai Kartangan	Kutai Timur

Source: Yearly Book of 2003, East Kalimantan Province

(2) Population (as of the year 2000)

The Mahakam River basin had a population of 1.08 million people in 2000, which accounted for 44.2% of the entire population of East Kalimantan. **Table 3-1-3** shows the population density. The table indicates that the downstream region has the majority of the population.

Table 3-1-3 Population density of the basin (in 2000)

Downstream area	138 person/k㎡
Middle reach area	8 person/k㎡
Upstream area	5 person/k㎡

Source: Yearly Book of 2003, East Kalimantan Province

(3) Economic activities

Table 3-1-4 shows the percentage of the GDP of Indonesia that the Mahakam River basin accounted for in 2003. The table indicates that the proportion of oil and gas is conspicuous.

Table 3-1-4 Percentage of the GDP in 2003

Industry	Percentage
Oil and gas production	58 %
Mining and quarrying	9 %
Trading and services	9 %
Manufacturing	8 %
Agriculture, livestock breeding, fishery and forestry	7 %
Transportation and construction	6 %
Others	3 %

Source: Yearly Book of 2003, East Kalimantan Province

2. Water quality of the Mahakam River basin

2.1 Environmental quality standards

Environmental quality standards for the water quality of Indonesian rivers including Mahakam River have been established. The standards, which are classified into four categories from Class I to IV, depending on how the water is used, are shown in **Table 3-2-1**. The definition of these classes is as shown below.

- Class I : Standard water and potable water
- Class II : Recreation-related water
- Class III : Water used for fish farming, agriculture, and stock raising
- Class IV : Water for gardening

Mahakam River belongs to Class I in view of its importance and contribution to society.

Table 3-2-1 River water quality standards (1/2)

Classification	PH	TSS (mg/l)	Fe (mg/l)	Mn (mg/l)
Class I	6 – 9	50	0.3	0.1
Class II	6 – 9	50	-	-
Class III	6 – 9	50	-	-
Class IV	5 – 9	400	-	-

Table 3-2-1 River water quality standards (2/2)

Classification	DO (mg/l)	BOD (mg/l)	COD (mg/l)	Total coliform (MPN/100ml)
Class I	≧6	≦2	≦10	≦1,000
Class II	≧4	≦3	≦25	≦5,000
Class III	≧3	≦6	≦50	≦10,000
Class IV	≧0	≦12	≦100	≦10,000

Source: Government Regulation of the Republic of Indonesia,
No. 82 of 2001 regarding Water Quality Management and Water Pollution Control

It should be noted that an environmental quality standard, which is a numerical representation of how a river should be, differs from an effluent standard in which the water quality of effluent from business establishments is defined.

2.2 Sampling points

Water quality tests of Mahakam River have been conducted at BAPEDALDA in East Kalimantan for many years. **Figure 3-2-1** shows the sampling points. Water is sampled at six points from upstream MA1413 to downstream MA0357 as shown in the figure.

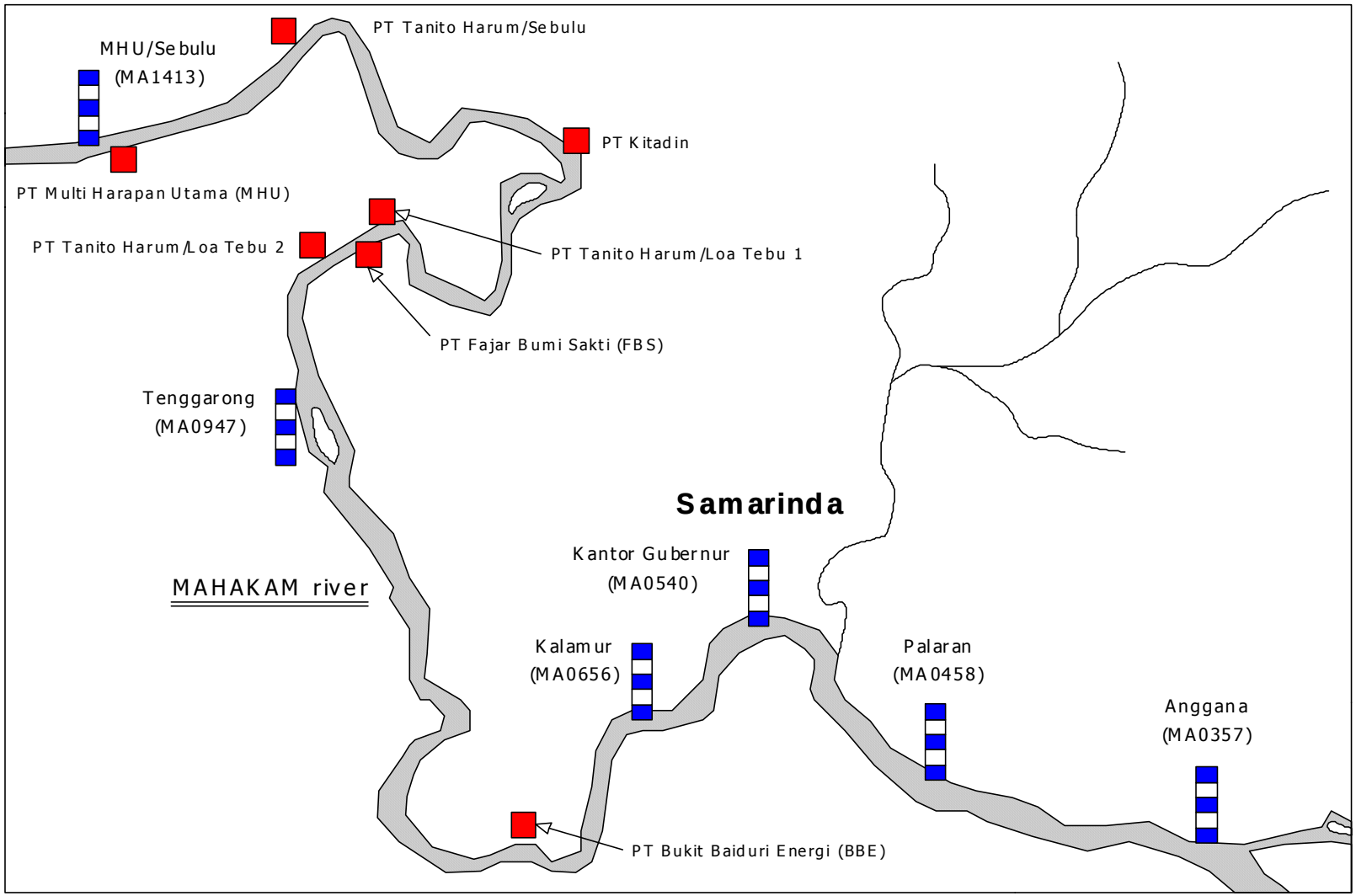


Figure 3-2-1 Sampling points along Mahakam River (BAPEDALDA)

2.3 Results of water quality analysis

Table 3-2-2 shows the comprehensive water quality analysis at the above referenced six sampling points from June 1989 through January 2006. Only water quality items in which coal mining may be involved were selected.

Table 3-2-2 Comprehensive water quality analyses

	TSS (mg/l)				pH			
	Max	Min	Avg	Std	**Max**	Min	Avg	Std
MA1413	532	3	73	70	7.8	5.1	6.5	0.5
MA0947	254	13	70	49	7.8	5.4	6.6	0.5
MA0656	153	20	63	37	7.8	5.5	6.5	0.4
MA0540	306	8	69	50	7.7	5.1	6.5	0.5
MA0458	192	3	53	47	7.8	4.1	6.4	0.7
MA0357	302	4	69	53	7.9	5.1	6.5	0.5
	Fe (mg/l)				Mn (mg/l)			
	Max	Min	Avg	Std	**Max**	Min	Avg	Std
MA1413	5.74	0.05	1.45	1.14	3.60	0.00	0.31	0.77
MA0947	4.82	0.07	1.45	0.92	3.00	0.00	0.27	0.64
MA0656	3.40	0.40	1.74	0.76	3.00	0.00	0.39	0.82
MA0540	4.39	0.04	1.53	0.89	3.60	0.00	0.24	0.64
MA0458	3.92	0.02	1.56	0.92	3.60	0.00	0.45	0.87
MA0357	3.91	0.09	1.52	0.79	2.20	0.00	0.25	0.50

For TSS, Fe and Mn the maximum value (Max) and average value (Avg) exceeded the established environmental quality standards. For pH, the minimum value (Min) also exceeded those standards.

(1) Local change

A mean value ± 1σ was calculated for each analysis item in order to examine whether there was a local change from MA1413 (the most upstream point) to MA0357 (the most downstream point). This is shown in **Table 3-2-3**.

Table 3-2-3 Mean value ± 1σ

	TSS (mg/l)			pH			Fe (mg/l)			Mn (mg/l)		
	+1σ	Avg	**-1σ**	**+1σ**	Avg	**-1σ**	**+1σ**	Avg	**-1σ**	**+1σ**	Avg	**-1σ**
MA1413	143	73	3	7.0	6.5	5.9	2.60	1.45	0.31	1.08	0.31	0.00
MA0947	119	70	20	7.0	6.6	6.1	2.37	1.45	0.53	0.91	0.27	0.00
MA0656	100	63	25	6.9	6.5	6.0	2.50	1.74	0.98	1.21	0.39	0.00
MA0540	119	69	19	7.0	6.5	5.9	2.42	1.53	0.64	0.89	0.24	0.00
MA0458	100	53	6	7.1	6.4	5.7	2.48	1.56	0.64	1.32	0.45	0.00
MA0357	122	69	16	7.0	6.5	5.9	2.31	1.52	0.73	0.75	0.25	0.00

The TSS tends to be slightly high at upstream points, but this tendency is not so conspicuous. For substances other than the TSS, no local change is in evidence.

(2) Secular change

1) TSS

Figure 3-2-2 through **Figure 3-2-7** show the secular change of the TSS at each sampling point from upstream to the downstream.

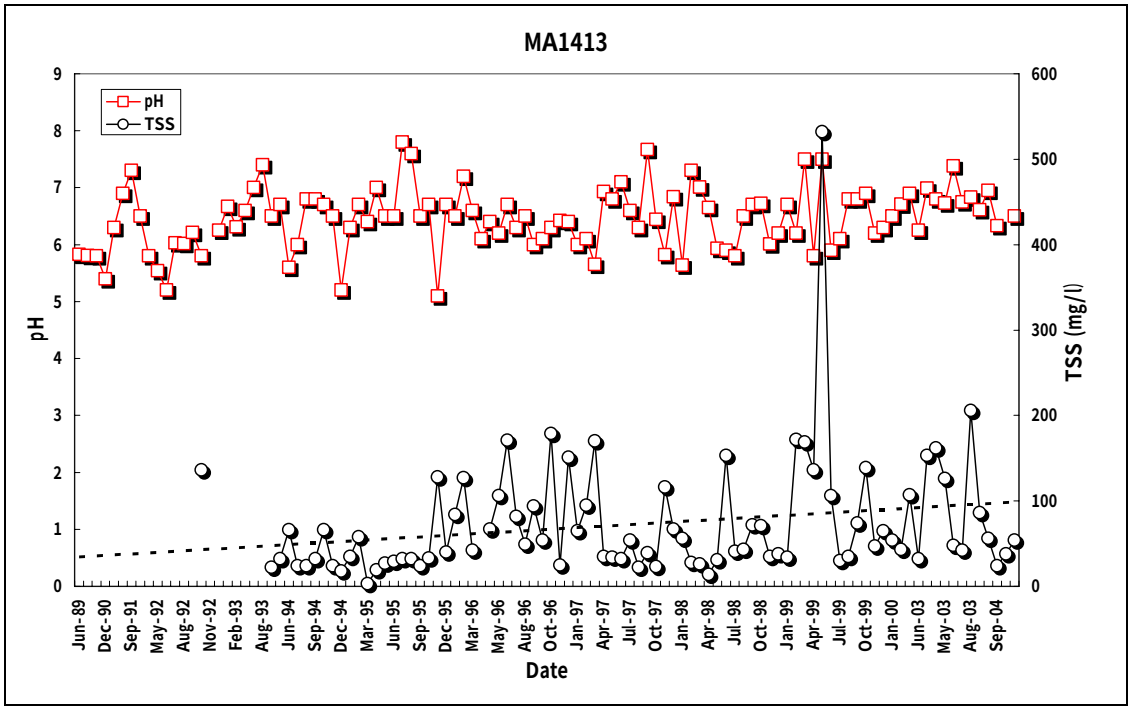


Figure 3-2-2 Secular change of TSS (MA1413)

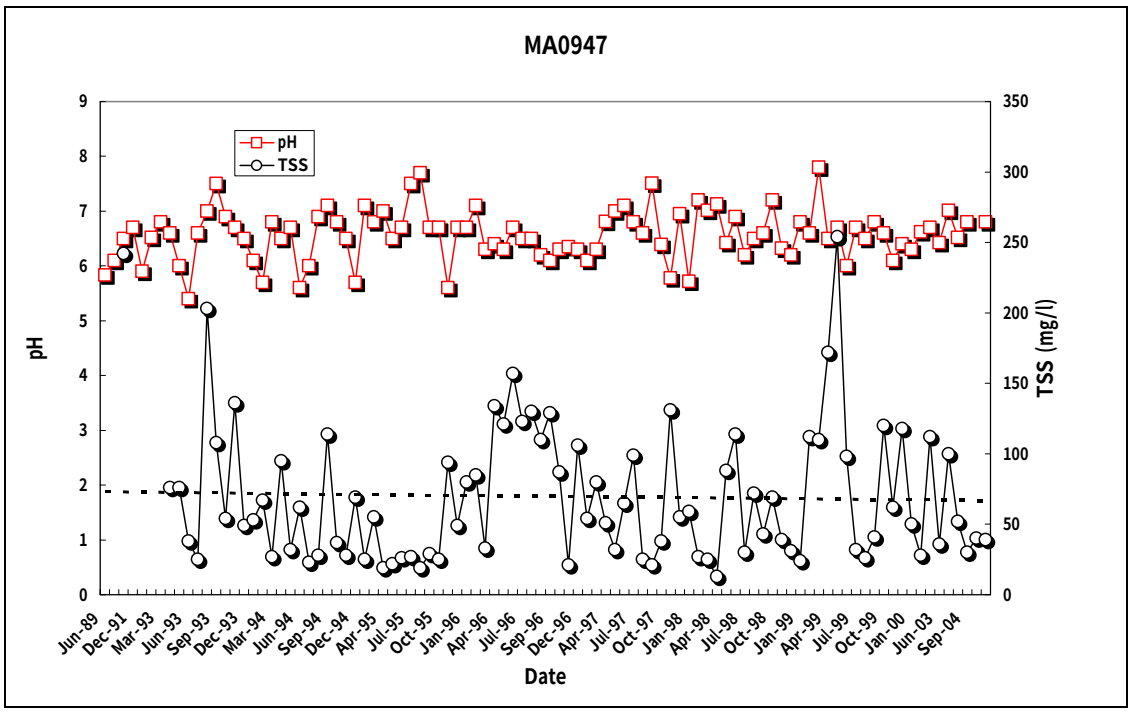


Figure 3-2-3 Secular change of TSS (MA0947)

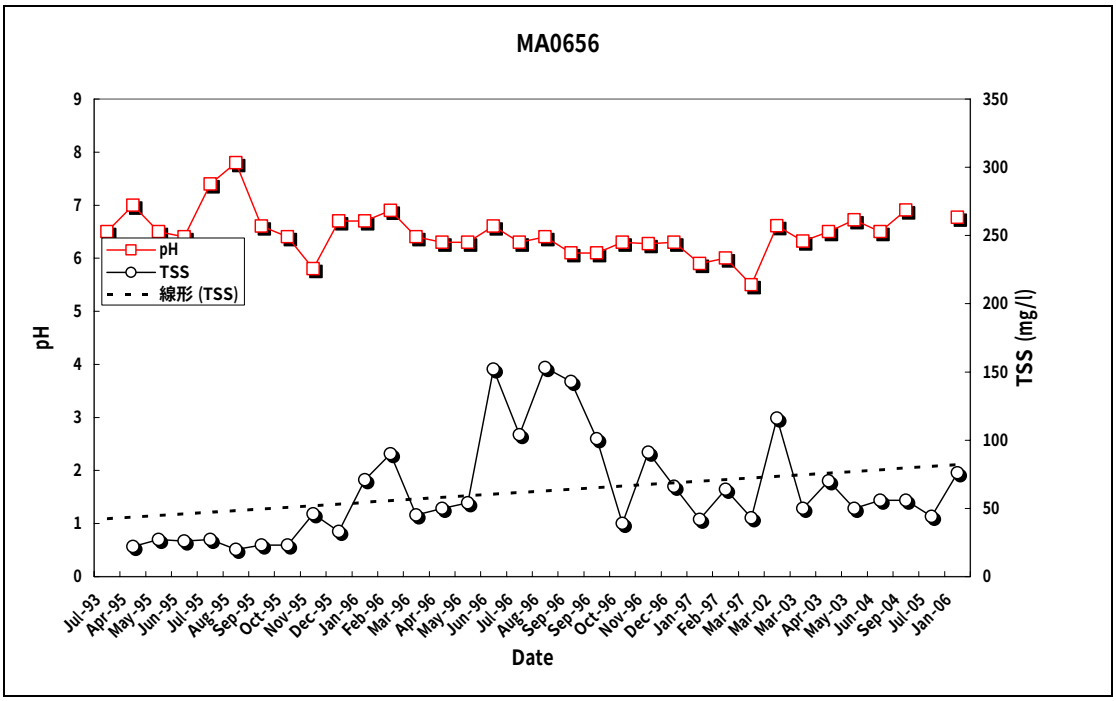


Figure 3-2-4 Secular change of TSS (MA0656)

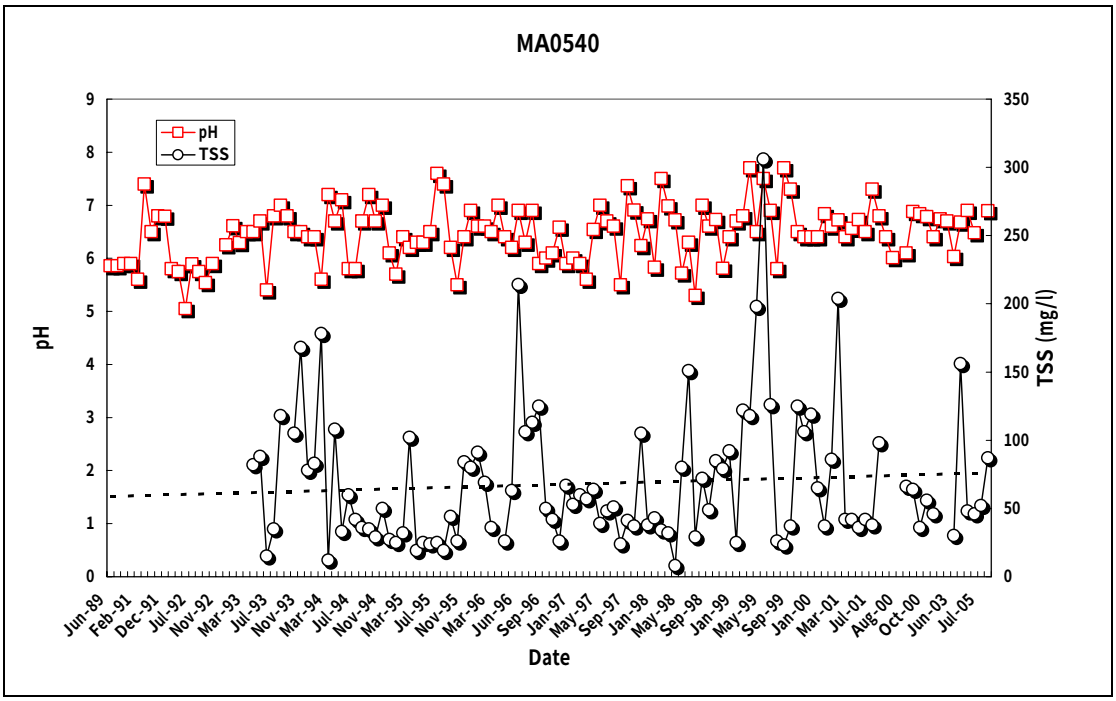


Figure 3-2-5 Secular change of TSS (MA0540)

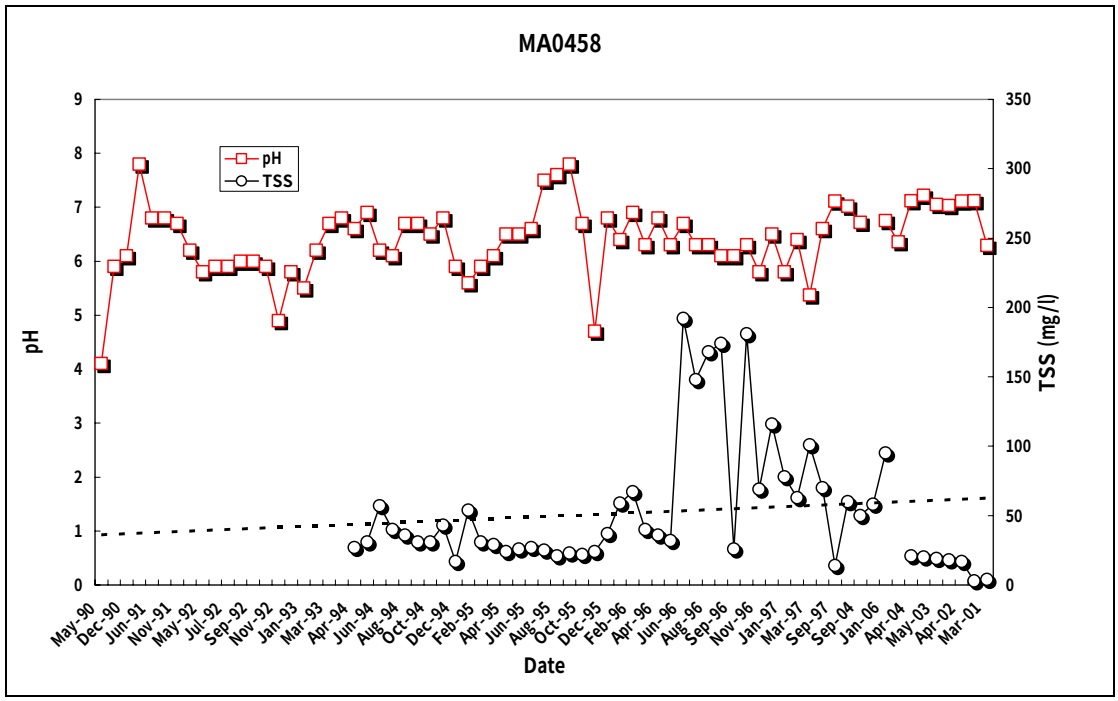


Figure 3-2-6 Secular change of TSS (MA0458)

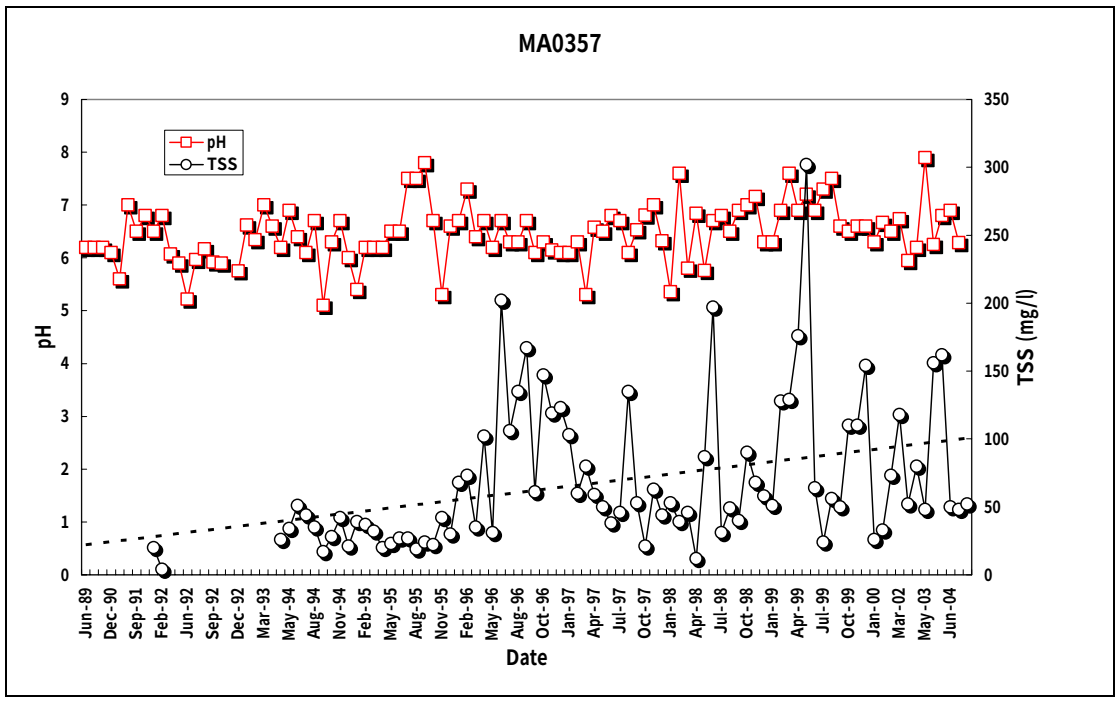


Figure 3-2-7 Secular change of TSS (MA0357)

The broken line in the figures shows the secular change of the TSS values in linear form. Only at MA0947 do the TSS values tend to slightly decrease, they are on the increase at all other points. This proves that the contamination of Mahakam River is steadily aggravated. The pH values show no noticeable secular change.

2) Fe, Mn

Figure 3-2-8 through **Figure 3-2-13** show the secular change of Fe and Mn at each sampling point from the upstream to the downstream.

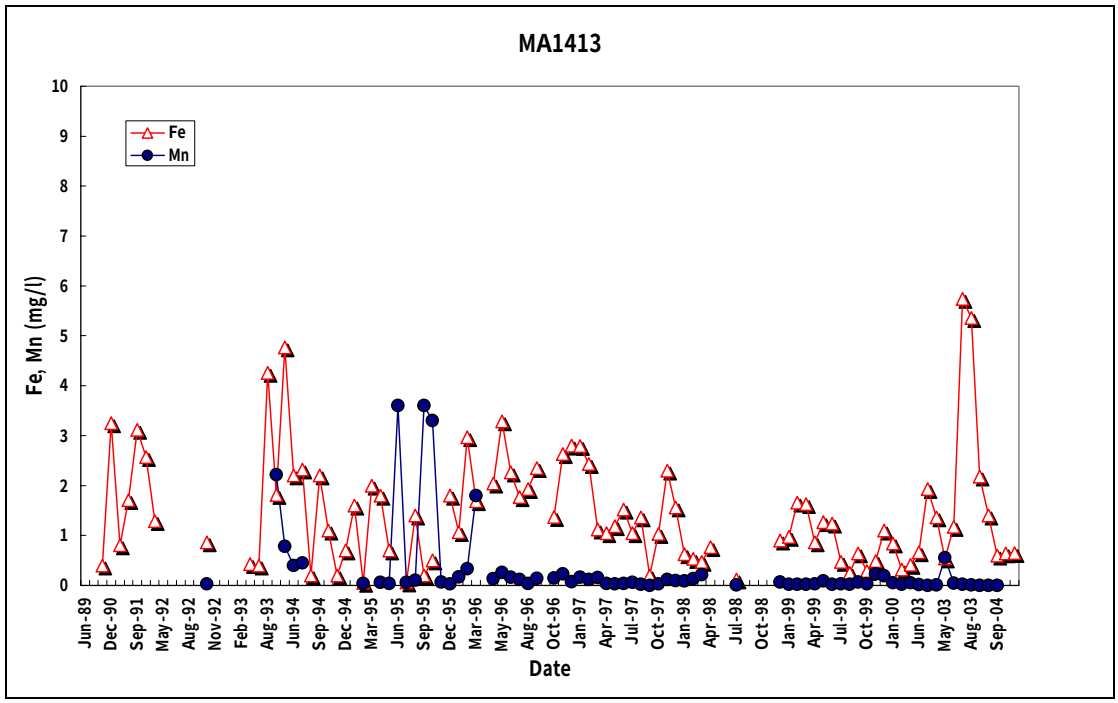


Figure 3-2-8 Secular change of Fe and Mn (MA1413)

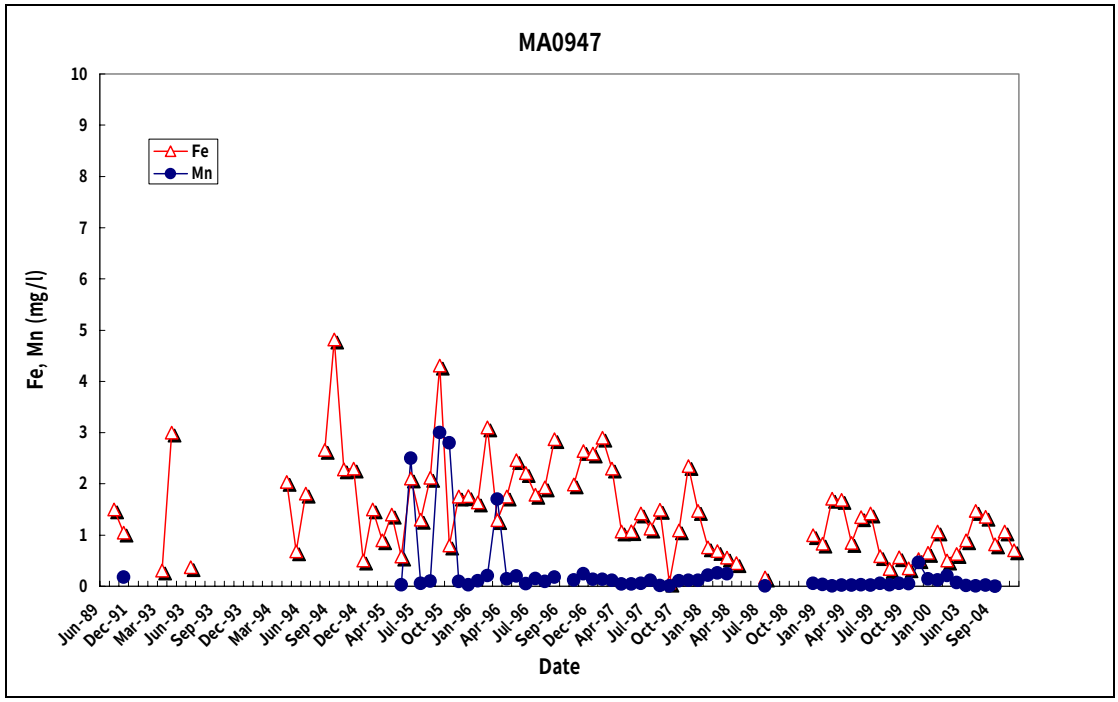


Figure 3-2-9 Secular change of Fe and Mn (MA0947)

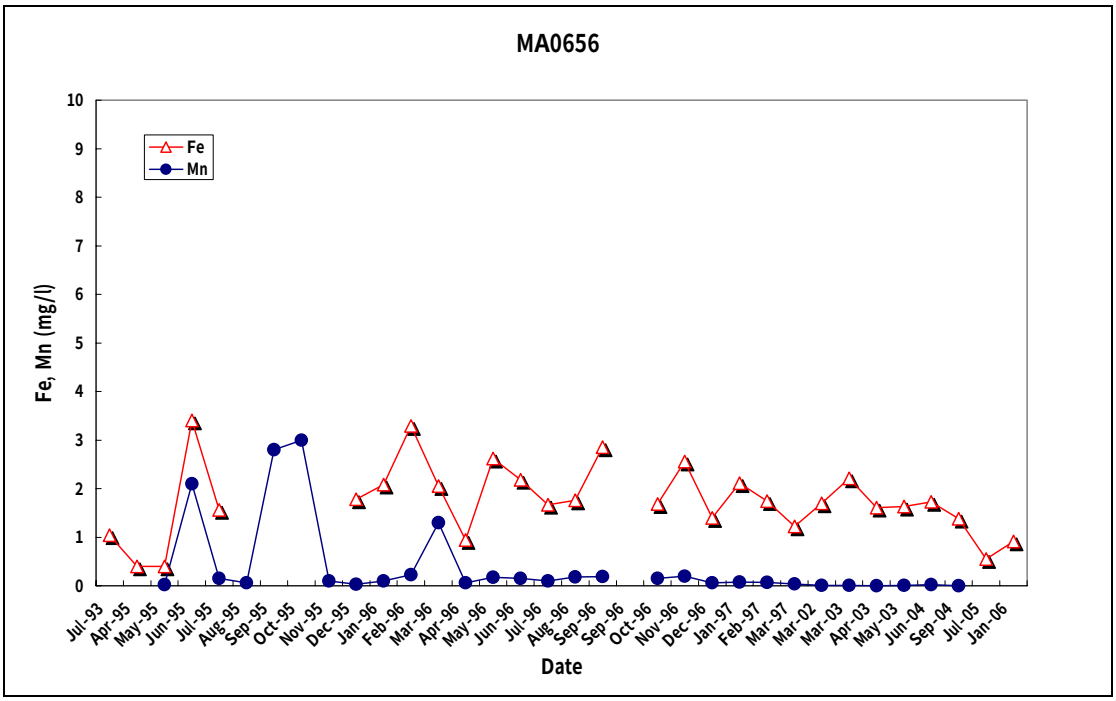


Figure 3-2-10 Secular change of Fe and Mn (MA0656)

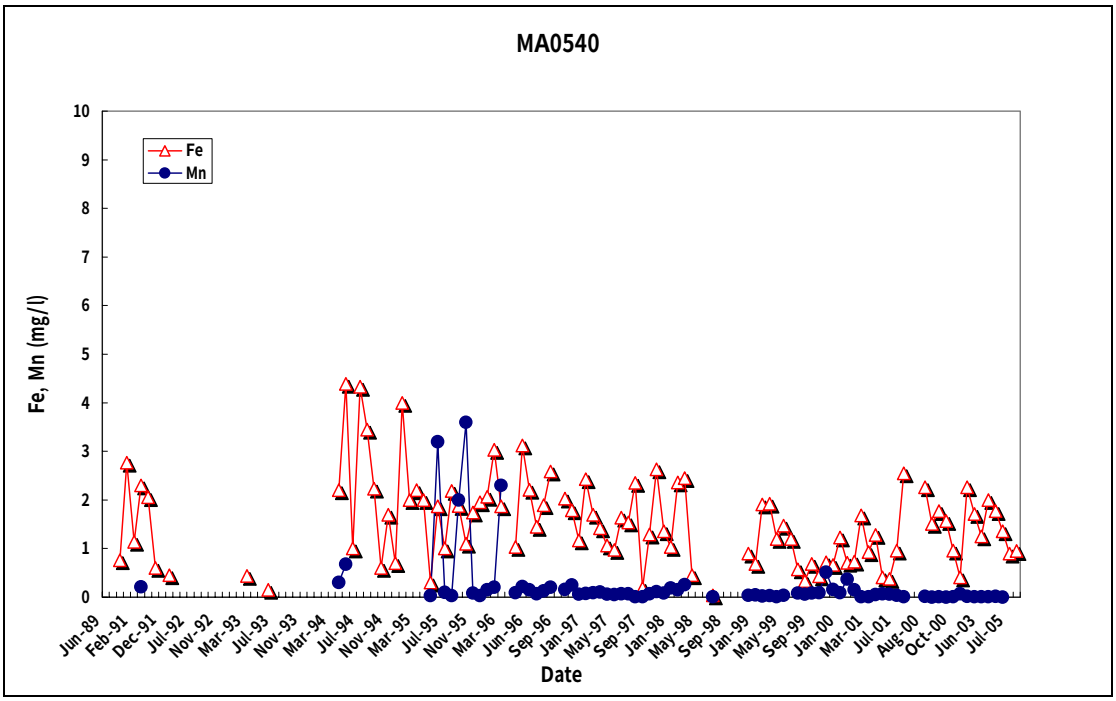


Figure 3-2-11 Secular change of Fe and Mn (MA0540)

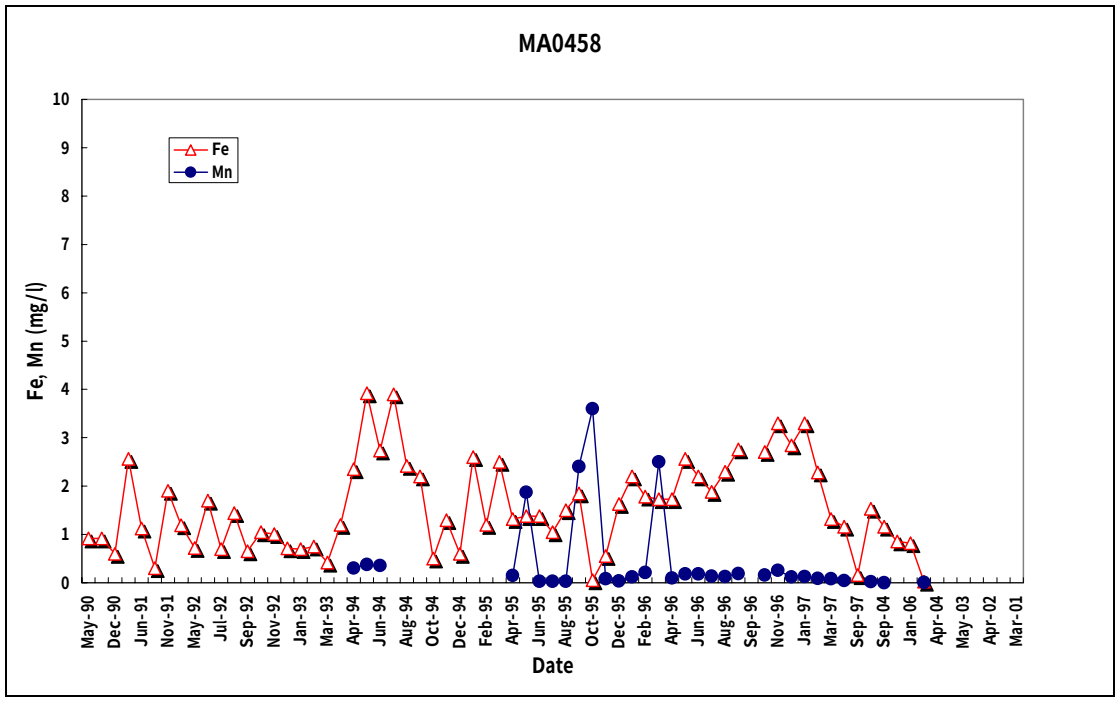


Figure 3-2-12 Secular change of Fe and Mn (MA0458)

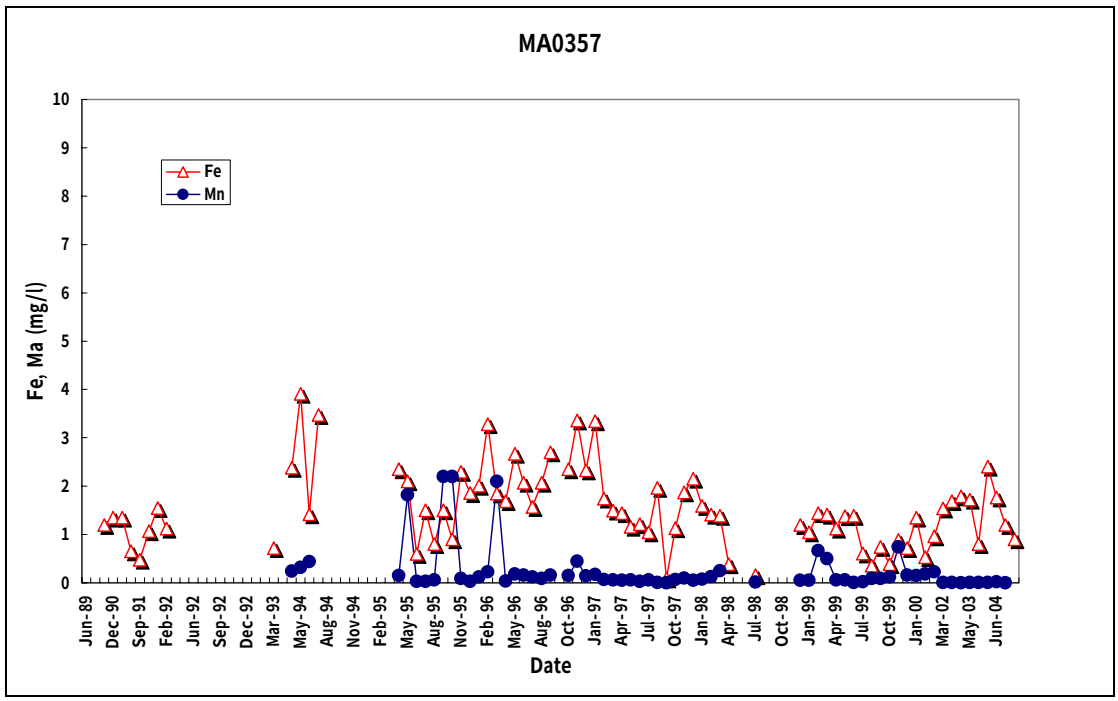


Figure 3-2-13 Secular change of Fe and Mn (MA0357)

There is no moment-to-moment change of Fe or Mn at any point.

(3) Relationship between items

Figure 3-2-14 and **Figure 3-2-15** show the relationship between pH and TSS and between pH and Fe/Mn, respectively. They are plots of all the data obtained. There is no relationship between these items.

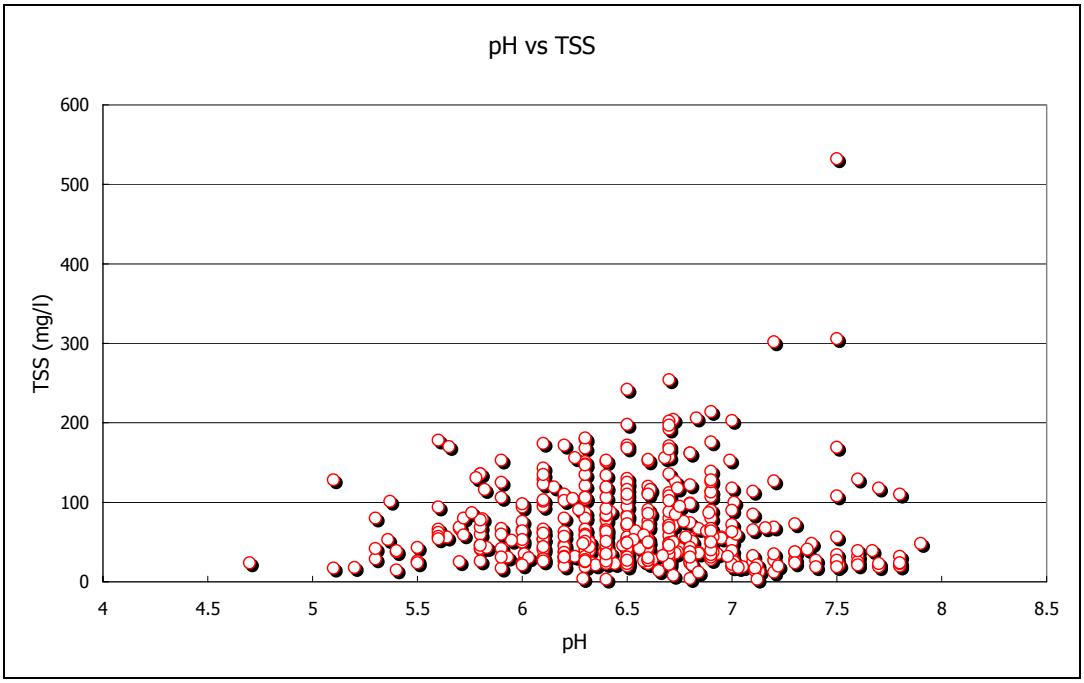


Figure 3-2-14 pH versus TSS

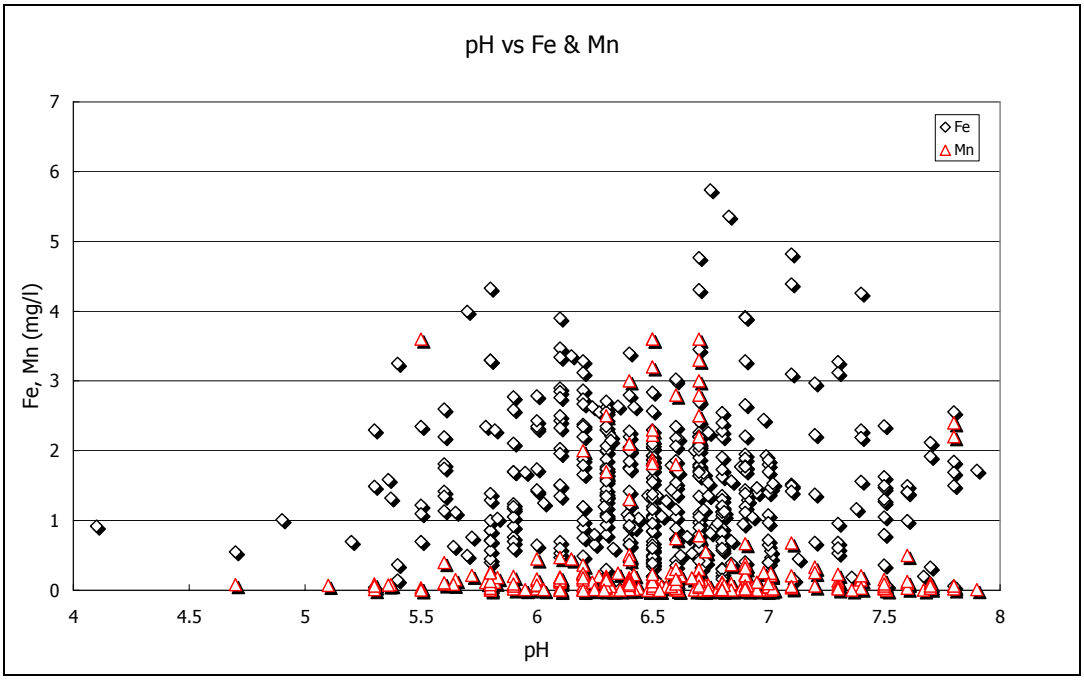


Figure 3-2-15 pH versus Fe & Mn

3. Factors behind aggravated water quality of Mahakam River

3.1 Various factors

The following factors may be involved in the aggravation of the water quality of Mahakam River.

1) Activities for producing coal: Drainage into the river and topsoil erosion
2) Activities for producing other mineral resources: Drainage into the river and topsoil erosion
3) Deforestation and activities for producing timber: Topsoil erosion, disappearance of forests, and flooding
4) Agricultural and stock breeding activities: Disappearance of forests, flooding, and generation of solid and liquid wastes
5) Urban development: Generation of solid and liquid wastes

Figure3-3-1 presents the mutual relation among these factors and the impact on the environment.

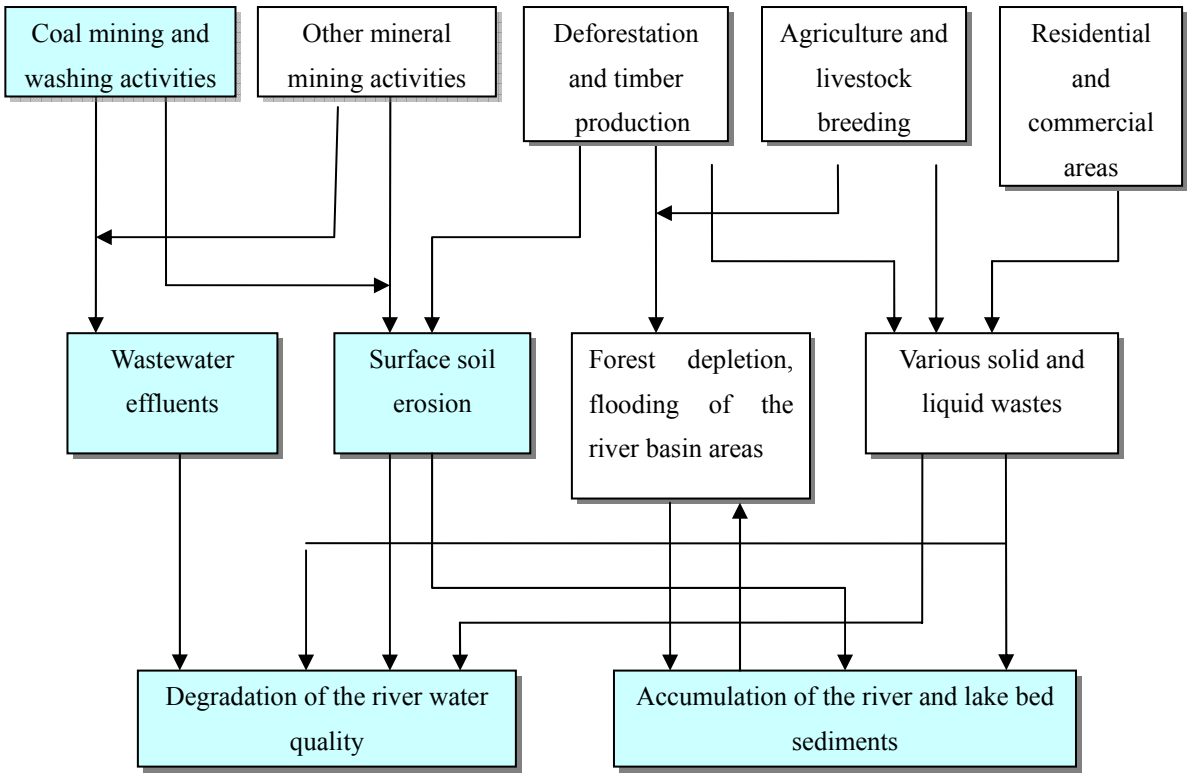


Figure 3-3-1 Factors affecting water quality, mutual, relationship and impact

3.2 Effect of coal mines

(1) TSS

Figure 3-3-2 shows a change in TSS by place. This is a graphic plot of **Table 3-2-3** above. Although it is not clear what percentage the effect of coal mining activities accounts for, apparently coal mining activities contribute to an increase of TSS in view of the small population living at the two upstream points (MA1413 & MA0947) and the great number of coal mines. The increase of TSS at MA0540 may be attributable to the daily life of the citizens of Samarinda.

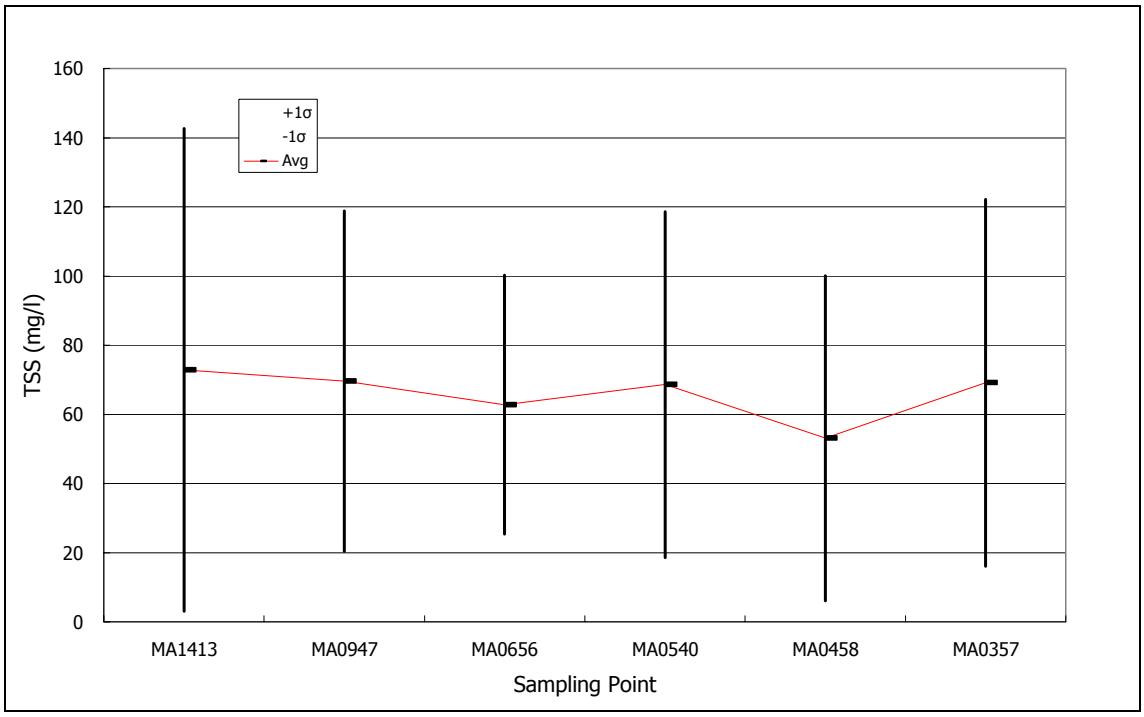


Figure 3-2-2 Local change of TSS

(2) pH, Fe and Mn

Pyrite (FeS_2) sulfur is typical inorganic sulfur in a coal seam. This sulfur is decomposed into H^+, Fe^{2+}, and SO_4^{2-} by water and air. As a result, it generates low-pH, high-iron-content water. Therefore, if the water of Mahakam River is affected by coal mining activities, then there must be some change in the pH or Fe content of the river water.

4. Problems of the Mahakam River basin and suggestions

4.1 Environmental problems

The following is a summary of the environmental problems in the Mahakam River basin.

(1) Problems of the water quality of the river

- Deterioration in the water quality due to wastewater from mining sites including coal mines, factories and other industrial facilities, and farms.
- Deterioration in the water quality due to household effluent from residential areas in cities, towns, and villages

(2) Topsoil erosion

- Topsoil erosion caused by precipitation on bare land where trees were logged, the open-pit coal mining was conducted, and other minerals were once extracted.
- Topsoil erosion caused by heavy rain in the upper reaches of the river
- Exposure of topsoil caused by land development

(3) Sedimentation of soil in the river and lake bottoms

- Sedimentation of the above-mentioned eroded topsoil in the river and lake bottoms
- Adverse effect of a rise of the river bottom upon river transport

(4) Deforestation

4.2 Suggestions on how to reduce environmental risks

1) Tightened environmental management and monitoring in mining of coal and other minerals.
2) Prepare and redevelop bare land where open-pit coal mining was once conducted or other minerals were mined.
3) Establish environmental management and monitoring systems in a wide area along Mahakam River.
4) Manage and dispose of solid and liquid waste from farmlands.
5) Prevent illegal logging and land development.
6) Treat and dispose of solid and liquid waste from residential areas.
7) Tighten environmental regulations.

A summary of various problems and risk-reducing measures is shown in **Table 3-4-1**.

Table 3-4-1 Various problems and risk-reducing measures

Industrial and other activities along the river	Various wastes produced and other issues	Potential impacts to the river basin environment	Impact mitigation measures and remarks
Open pit coal mining and coal washing plants	- Soil erosion and muddy wastewater effluent - Non-marketable fine coal and high TSS wastewater effluent	- Negative impacts to the river water quality - TSS of the river water will become high	- Reclamation and afforestation for abandoned open pit mines - Monitor the wastewater effluents and evaluate the monitored data - Improve wastewater treatment facilities as needed - Use of remote sensing technology to identify locations of abandoned open mine areas where reclamation was not conducted.
Other mining activities	- Soil erosion and muddy wastewater effluent - Wastewater which may contain heavy metals and other toxic waste	- Negative impacts to the river water quality - May pollute the river water with heavy metals and toxic substances	- Reclamation and afforestation - Use of remote sensing technology as above - Impose penalties on the persons or organizations that violate the related land use and other laws.
Deforestation, timber production	- Soil erosion and muddy wastewater effluent	- Negative impacts to the river water quality - TSS of the river water will become high - Forest depletion	- Evaluate the monitored data and determine the area of forest depletion - Afforestation - Impose penalties on the persons or organizations that violate the related land use and other laws
Agriculture and livestock breeding	- Illegal forest logging	- Forest depletion	- Afforestation - Impose penalties on the persons or organizations that violate the related land use and other laws
Residential areas	- Illegal forest logging - Solid and liquid domestic wastes	- Forest depletion - Negative impacts to the river water quality - Soil pollution by illegal waste disposal	- Prepare appropriate domestic waste disposal sites Construct sewage treatment facilities - Impose penalties on the persons or organizations that violate the related land use and other laws