

INDONESIAN COAL UTILIZATION AND ITS ENVIRONMENTAL ISSUES *)

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I. INTRODUCTION

The prospect of coal industries for the next decade is promising, since the demand is increasing together with the industrial development due to the growth of the manufacturing industries. It is the most widely used as energy source in electricity generation. It is shown that world coal consumption is predicted increasing by 2.2 billion tons from 5.3 billion tons in 2001 to 7.5 billion tons in 2025.

As already known, Indonesia possesses coal in relatively abundance. Indonesia's coal resources are estimated about 50.6 billion tons. Recently, Indonesian coal plays an important role, both as domestic energy resource and as source of foreign exchange revenue to sustain economic development (Attachment 1). However, some efforts are still required to maximize the benefits from the exploitation of those coal resources in order to get optimal result for the national benefits.

In the past, the general energy policy specified that Indonesia possessed plenty of energy resources. Therefore, three main policies have been stressed in developing those resources namely intensification, diversification and conservation. Diversification was achieved through the allocation policy to encourage the role of gas and coal as primary energy beside oil. However, it was recognized that energy resources, especially fossil energy, is relatively limited. For example, Indonesian coal reserves is only around 4.7 billions tons (about 0.4% of the world's reserves). Therefore, new perception of energy conservation is directed not only to conserve the energy use but also to conserve the limited available energy resources.

In term of environmental issues, Indonesia should also consequently pay attention to the environment aspects in applying coal as energy source. One of the attempted steps that have been conducted is to promote Clean Coal Technology (CCT) to respond environment problems and to increase efficiency. Some efforts have been carried out through some programs of technology transfer from developed countries such as Japan, Australia, United State of America and some of European countries.

*) **Presented at the "APEC/EGCLPE Clean Fossil Energy Technical and Policy Seminar", Seoul, South Korea, 9-12 December 2003**

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II. STRATEGY OF INDONESIAN COAL UTILIZATION

Indonesian coal industry has grown rapidly in a short period of time. Indonesian coal production reached 103.4 Mt in 2002. It is almost ten times from 1990 and estimated 171 Mt in 2010 (Attachment 2). 30% of total production consumed by domestic market, more than 70% of it consumed by power plant. It has been projected that coal will become the main alternative energy for domestic use in the next decade (Attachment 3). The main driven factors behind the rapid development of Indonesian coal production are:

- relatively large coal deposits, suitable for open-pit mining (low to moderate stripping ratios)
- low-sulphur steaming coal for which there is increasing demand in Asia
- relatively favourable investment climate for large-scale mining companies
- geographic proximity to Asian markets.

Historically, Indonesian mining industry made significant contribution to Indonesia's national economy but rarely considered sustainable development opportunities. The government has come to realize that mine development and ultimate closure present a complex mixture of environmental, social, economic and development issues which need to be addressed. Future mining projects have the potential to become important part of sustainable development if local government, members of affected communities and other stakeholders are involved in planning process. They also have to operate and be closed according to the above planning in an environmentally and socially acceptable manner. This kind of development has enormous potential to help local communities reduce poverty.

The new paradigm of reformation leads to a situation, which change aspirations and requirements of the local government. The most important issue is total coal mining management under autonomy. In this situation, therefore, new national coal policy has to stress and cover the important role of coal where the benefits of coal development are belonging to all Indonesian people and as mechanism to accomplish their better live. However, the global issues such as environment considerations should also be seriously taken into account in coal development program.

The new condition creates a situation requiring careful review of existing national and local guidance. It is also needed to determine whether they are compatible with the changed aspirations of the Indonesian people. The new national coal policy must recognize that the Indonesian people have the right to the many benefits of coal development. It is also has to consider the increasing income and employment as a result of coal development.

The conflicting impact of the autonomy implementation in coal sector might be anticipated by considering some crucial factors, namely promoting applied technologies and economic concern based on strengthening community development and local people welfare, developing general policy including regulation, guidelines, standard, norm, procedure, and criteria for coal industry and improving human resources quality. It is believed that this concern might lead to the proper coal development management to satisfy local community as well as to accomplish the globalisation issues.

Environmental issues also become one of the policy mentioned in General Energy Policy (Kebijaksanaan Umum Bidang Energy/KUBE). Indonesia has to reduce negative impact and increase positive impact of energy utilization to the environment.

One important thing regarding environmental aspects in mining is Environmental Impact Analysis (AMDAL). AMDAL is a study of large and significant impacts of a planned business and/or activity that is needed in the decision-making process regarding business and/or activity implementation. It tries to describe the potential impacts of development that might emerge from its activities and what should be done to develop the positive impact and prevent or mitigate the negative impact of the development, as mentioned in KUBE. The AMDAL study should cover not only the physical, biological, chemical and geological impacts but also the socio-economic impact of the development.

In KUBE, for coal utilization development policy it is mentioned that:

- Coal is allocated as export commodity. The good coal quality is for export and others for domestic use.
- Besides economic aspects, environmental aspects should also be considered in development of mining industries and coal utilization industries.
- In understanding know-how about CCT, R&D and improvement of human resources quality have been done.
- Technology level, type of coal, and type of product will determine the CCT technology we choose.
- Coal utilization has to have positive impact to regional development.

III. ENVIRONMENTAL ISSUES

International convention has important role in Indonesia's regulation. It is one of the sources for regulation in Indonesia.

During Rio Summit Conference of 1992 or United Nations Conference on Environment and Development (UNCED), Indonesia became a part of Framework Climate Change Convention (FCCC). Furthermore, Indonesia has its ratification that is Law No. 6 of 1994. Commitment to FCCC is a strong basic law for Indonesia. The main objective of FCCC is to stabilize concentration of green house gases (GHG) to the safe level.

In general, the coal industry performance against sustained issues has improved significantly in many areas. Presently many challenges to coal industry regarding the Rio Summit still exist. For example the development of higher combustion efficiency technologies to reduce emissions, health, safety and environmental management practices, more complete integration of environmental considerations and improving transparency and company accountability as well. In view of environmental aspect, introducing and promoting cleaner coal technologies have also been seriously considered. Indonesian government assistance for R&D into the development of CCT was already given since many years ago to fulfill the global environment obligation.

3.1. Promoting Technology

Except for electricity (Attachment 4) and as direct fuel for small-scale industries (lime burning, blacksmith, tile and brick burning, drying process and household industries), some coal processing technologies have also been particularly considered to be applied in the future in order to produce various better coal products.

For example, recently technology of coal briquette has already been adopted to substitute the role of oil and firewood in the household and industry sector. In cooperation with NEDO, Indonesian government through the Ministry of Energy and Mineral Resources has developed two types of briquette in Tanjung Enim and Palimanan Cirebon. Bio-coal briquette produced in Palimanan Cirebon (consist of \pm 80% coal and 20% sugar cane waste) performs better compared with pure coal briquette, especially in resulting less smoke and odor. Besides, aim of the program is also to conduct environmental protection against de-forestry. Moreover, this program might also lead to bring more value added of Indonesian coal, especially for low rank coal.

In addition to that, some other coal processing technologies have also intensively been considered. Research and development processing of carbonized briquette, coal liquefaction, coal gasification, coal for cokes as well as upgrading brown coal currently has been carrying out as well. This program is actually related to the effort of diversification of energy for

domestic use based on environmental needs. In case of the development of Indonesian brown coal, Indonesian government has strongly recommended to develop integrated mine mouth coal industries by applying appropriate technologies to yield some of low cost and environmental friendly coal products. In the future, more attention would be paid to apply such technologies to become a commercial feasibility operation.

3.2. Challenges

Normally, large gap between the poor coal mining and utilisation practices prevalent in many developing countries, and the best practice standards of health, safety and environmental performance in developed countries. The operation of illegal small-scale mines and the burning of coal in unventilated home fires have serious health and environmental impacts in a number of developing countries like Indonesia. Therefore, certain programs to resolve illegal mines and suitable applied coal technology to poor rural households are required.

Environmental problems created by coal mining are usually coming from activities such as land clearing, overburden stripping (or blasting), and extraction and processing of coal.

Most of Indonesian coal mines are open pit mining. This method characterized by removing of overburden and coal deposit in the huge amount. Actual impacts from this activity are huge and open excavation that can eventually be formed into lake. Possible impacts included sedimentation, soil erosion, river and lake deposition, ground water contamination, air pollution, and aesthetics/landscape problems.

In the coal mining area or coal washing plant, one of most problems related to the environment issues is how to handle the produced fine coal. Although fine coal is actually fuel, but to some extent it is categorised as a waste. Appropriate technology to handle this fine coal is necessary.

Other important technology needed is how to handle coal ash properly. Some methods to investigate coal ash are also required, since Indonesian coal ash unfortunately is categorised as harmful waste. Some technologies to handle coal ash, such as technology for hardened substances and technology for utilization of molten coal ash, are also very important for Indonesian coal development.

As energy source, coal can be used directly or through conversion process. Direct usage as fuel can have negative impact to environment, especially to the air quality. Steps should be taken to reduce the impact to air quality i.e. pre-combustion, ongoing combustion, and post combustion.

1. PRE-COMBUSTION

- Aims : • to improve coal quality
• to increase transportation efficiency
- Technology : • Advanced Coal Preparation
• Conversion (Carbonization, Liquefaction, Gasification)
• Coal Water Fuel, Coal Oil Fuel, Liquid From Coal
• Substitution and Blending

2. ONGOING-COMBUSTION

- Aims : • to increase combustion efficiency
• to reduce pollution gas emission
- Technology : • Fluidized Bed Combustion (FBC), Integrated Gasification Combined Cycle (IGCC), Lime Direct Injection

3. POST-COMBUSTION

- Aims : • to reduce pollution gas emission and ash
- Technology : • Electrostatic Precipitator, Flue Gas Desulfurization, Ammonia-Selective Catalytic Reduction System, Electron Beam-SO_x and NO_x Removal

Various efforts in using the above technology have been done in laboratory scale. Several of them have been improved into pilot scale and also applied commercially.

Promoting CCT, including CO₂ disposal, is important to reduce emissions and use coal efficiently and economically in view of global environmental problems such as global warming. In Indonesia, efforts to reduce CO₂, SO_x, NO_x and dust from combustion process have also been promoted. However, to certain extent, higher cost is still as a consideration to fully apply those of environment protection equipment.

Moreover, there are several reasons to justify for not using fully CCT in Indonesia:

- Indonesian coal is clean enough, especially because its ash, sulphur, and nitrogen content are very low.
- Indonesia has tropical forest that can absorb polluter.
- Coal usage in Indonesia relatively small compared to other countries such as China, Japan, Australia, USA, and others.

In national scope, Indonesia has to apply CCT in pre-combustion and ongoing-combustion level. Technology used in ongoing-combustion level such as FBC and IGCC have high efficiency and can be used for low rank coal. Increasing 5% efficiency in a power plant can decrease CO₂ emission up to 10%. In post-combustion level, Electrostatic Precipitator need to be considered because several mines have coal with ash content more than 5%.

Finally, maintaining and increasing international co-operation in the framework of coal mining development, technology transfer, and human resources development should also be seriously considered by Government and by coal companies as well.

IV. CLOSING REMARKS

- ◆ Coal industries in Indonesia are still focussed on primary raw materials trading. It should be considered that coal processing should be applied in order to produce better coal products in term of economical and environment aspects.
- ◆ Several aspects such as management of coal mining activities efficiency and productivity, conservation and inventory of the resources should be taken into account to develop Indonesian coal. Besides, application of appropriate technologies, building up-and-down stream linkages, improving human resource skill as well as concerning social and environmental aspects should also be considered.
- ◆ Applying of processing technologies should be considered to produce better and cleaner coal products. For that reason, R&D processing of briquette, liquefaction, gasification and upgrading brown coal has been conducting. It is recommended to develop integrated mine mouth coal industries to yield some of low cost coal products.
- ◆ There are several reasons for not using fully CCT in Indonesia: Indonesian coal is relatively clean, Indonesia has tropical forest, and the coal usage in Indonesia relatively small compared to other countries.

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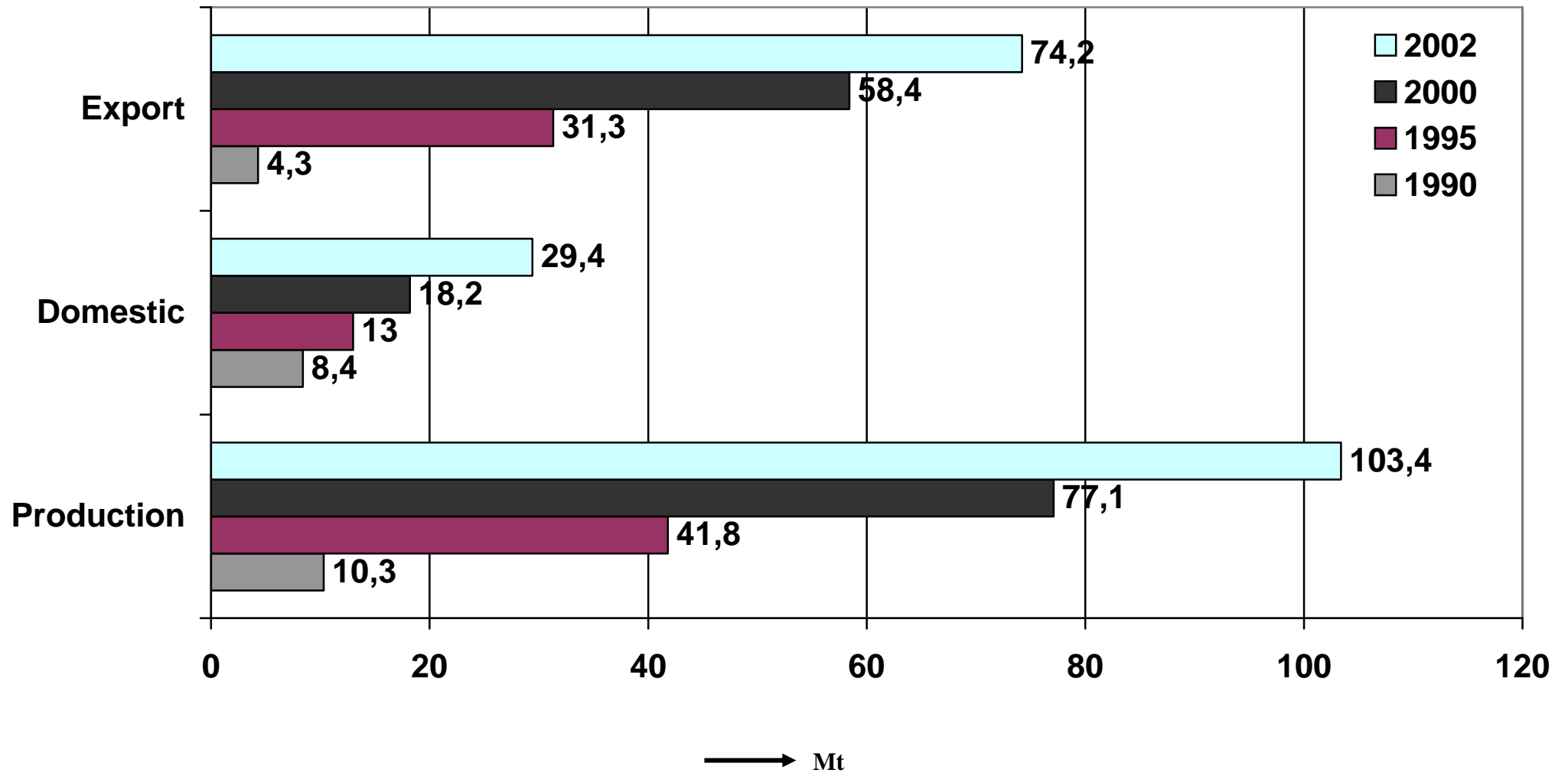
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**ATTACHMENT 1
LOCATION OF INDONESIAN COAL**

Reserve (%)	Location/Province	Resource (%)
0.0	Central Kalimantan	44.8
50.1	East Kalimantan	9.9
23.5	South Kalimantan	11.9
23.2	South Sumatra	25.1
3.2	Others	9.3
100.0	Indonesia	100.0

Source: Directorate of Mineral Inventory, 2003

ATTACHMENT 2
ACTUAL OF COAL PRODUCTION, DOMESTIC AND EXPORT



ATTACHMENT 2-A
INDONESIAN COAL PRODUCTION (1990 – 2002)

COAL PLAYERS	1990	1995	2000	2002	GROWTH RATE, Mt/Yr (2002/1990)
1. PT BA/STATE-OWNEDCOMPANY	4.8	8.0	10.7	9.5	0.39
2. PKP2B/CCoW	3.8	29.6	61.7	87.1	6.94
3. KP/KUD/MA+COOPERATIVE UNIT	2.0	4.2	4.7	6.8	0.40
TOTAL	10.6	41.8	77.1	103.4	7.73

ATTACHMENT 2-B
DOMESTIC USE OF COAL (1993 – 2001)

Mt

USE	1993	1995	2000	2001	GROWTH RATE, Mt/Yr (2002/1993)
- Electricity	5.4	9.8	13.72	19.52	1.77
- Cement	2.6	2.7	3.64 *)	4.40	0.23
- Other industries (metallurgy, textile, pulp/paper)	0.5	0.5	0.81	1.04	0.07
- Small Industry (briquette)	0.008	0.015	0.02	0.02	0.002
Total	8.4	13.0	18.19	24.98	2.07

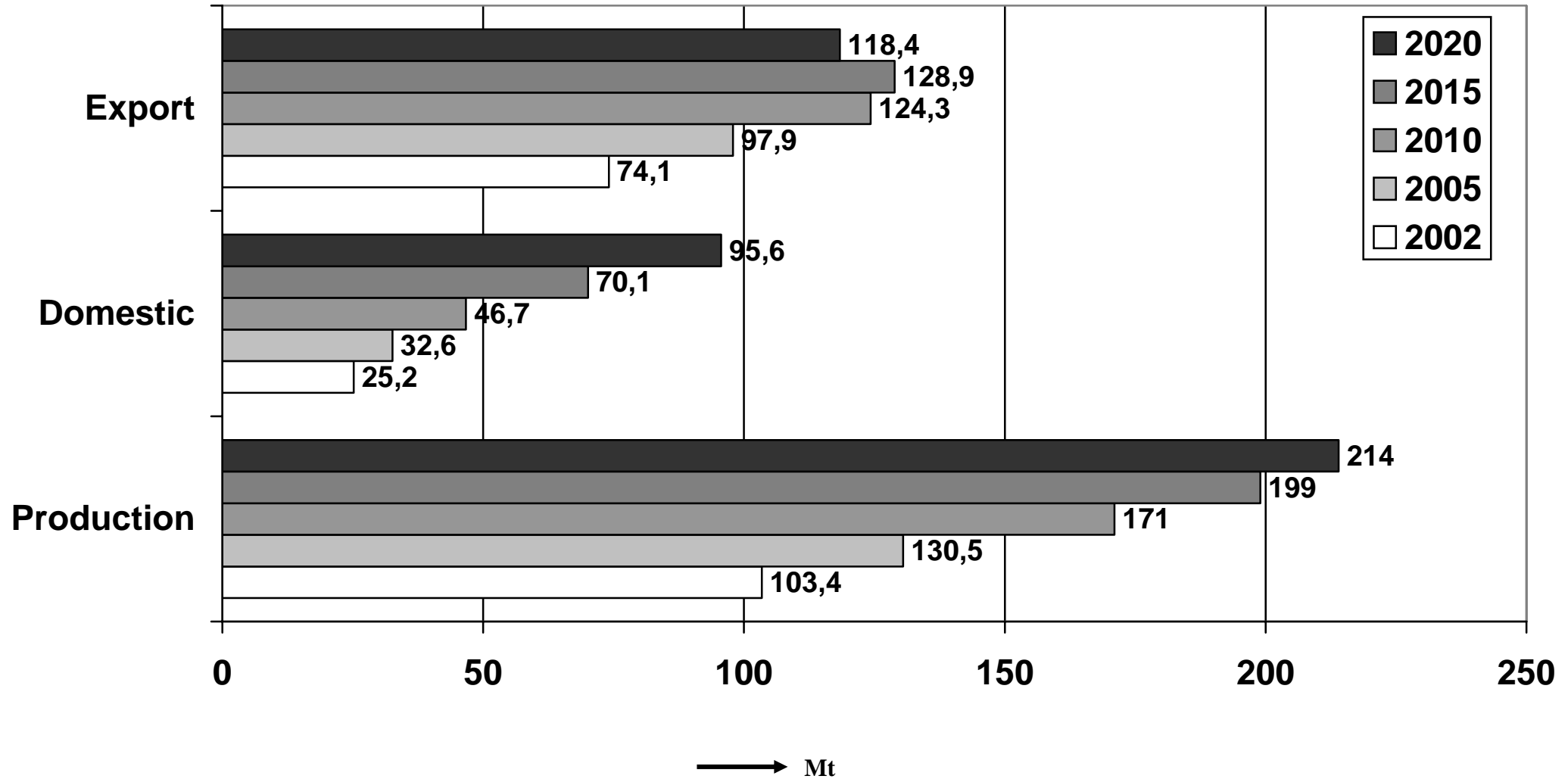
*) extrapolation

ATTACHMENT 2-C
INDONESIAN COAL EXPORT (1990 – 2002)

Mt

COAL PLAYERS	1990	1995	2000	2002	GROWTH RATE, Mt/Yr (2002/1990)
1. PT BA/STATE OWNED COMPANY	1.50	2.16	2.14	1.85	0.04
2. PKP2B/CCoW	2.30	25.90	52.17	66.50	5.19
3. KP/KUD/MA-COOPERATIVE UNIT	0.50	3.26	4.10	5.82	0.34
TOTAL	4.30	31.32	58.41	74.17	5.82

**ATTACHMENT 3
PROJECTION OF COAL PRODUCTION, DOMESTIC AND EXPORT IN INDONESIA**



ATTACHMENT 4
LIST OF COAL FIRE POWER PLANT
(EXISTING)

NO.	NAME	LOCATION	CAPACITY (MW)	OP. TIME	COAL (t/yr)	COAL TYPE	LOCATION/ PROVINCE
I.	PLN						
1	PLTU Ombilin	Sawalunto – Sumbar	200	1996	630,720	Sub Bituminous	Sumbar
2	PLTU Bukit Asam	Tanjung Enim – Sumsel	260	1987	1,002,144	Sub Bituminous	Sumsel
3	PLTU Suralaya	Merak – Banten	3400	1984	11,913,600	Sub Bituminous	Sumsel, Kalsel
4	PLTU Paiton	Probolinggo – Jatim	800	1994	2,803,200	Sub Bituminous	Kalsel, Kaltim
5	PLTU Asam-asam #1&2	Banjarmasin – Kalsel	130	2000	592,176	Lignite	Kalsel
II	IPP						
1	PLTU Paiton I (PEC)	Probolinggo - Jatim	1230	2000	3,878,928	Sub Bituminous	Kalsel
2	PLTU Paiton II (Jawa Power)	Probolinggo - Jatim	1220	2000	3,847,392	Sub Bituminous	Kalsel

ATTACHMENT 4-A
LIST OF COAL FIRE POWER PLANT
(ON GOING)

NO.	NAME	LOCATION	CAPACITY (MW)	OP. TIME	COAL (t/yr)	COAL TYPE	LOCATION PROVINCE
1.	PLTU Tanjung Jati B	Jepara – Kateng	1320	2005	4,162,752	Sub Bituminous	Kalsel, Kaltim
2.	PLTU Cilacap	Cilacap – Jateng	450	2006	1,419,120	Sub Bituminous	Kalsel, Sumsel
3.	PLTU Tarahan # 1 & 2	Tarahan - Lampung	200	2007	770,880	Sub Bituminous	Sumsel, Kalsel, Bengkulu
4.	PLTU Tarahan # 3 & 4	Tarahan - Lampung	200	2006	770,880	Sub Bituminous	Sumsel
5.	PLTU Labuan Angin	Sibolga – Sumut	230	2007	1,047,696	Lignite	Bengkulu, Sumsel, Riau
6.	PLTU Amurang	Manado – Sulut	110	2006	346,896	Sub Bituminous	Kaltim, Kalsel
7.	PLTU Sibolga	Sibolga – Sumut	200	2006	630,720	Sub Bituminous	Bengkulu, Sumsel, Riau
8.	PLTU Cilegon	Cilegon – Banten	450	2008	1,419,120	Sub Bituminous	Sumsel, Kalsel, Bengkulu
9.	PLTU MT PeranaP	Riau	500	2007	2,277,600	Lignite	Riau
10.	PLTU Banjarsari	Sumatera Selatan	200	2007	911,040	Sub Bituminous	Sumsel
11.	PLTU Lubung Linggau	Sumatera Selatan	130	2007	592,176	Sub Bituminous	Sumsel
12.	PLTU Sarolangon	Jambi	14	2005	63,773	Sub Bituminous	Jambi
13.	PLTU Bangka	Bangka	30	2006	136,656	Sub Bituminous	Riau
14.	PLTU MT Lati	Kaltim	14	2003	68,678	Reject Coal	Kaltim
15.	PLTU MT Sangatta	Kaltim	14	2004	68,678	Reject Coal	Kaltim
16.	PLTU Sintang	Kalbar	14	2005	68,678	Reject Coal	Kalsel
17.	PLTU Kupang	NTT	30	2005	136,656	Sub Bituminous	Kalsel
18.	PLTU Palu	Sulteng	30	2005	136,656	Sub Bituminous	Kaltim, Kalsel