12-1-2 Setting-up of Environmental Impact Factors

Environmental impact factors in this Project will be exhaust gas, effluent waste water and noise from factory in service, also safety of toxic gas. Correlation between environmental impact factors and environmental component factors are shown in Table 12-1-1.

Table. 12-1-1 The Correlation between Environmental Impact Factors and Environmental Component Factors

Item	Environmental impact factors / Component factors	After operation: Factory production activities
Human health or the living en-viron-ment	Atomosphere Quality	◎
	Offensive Odor	
	Water Quality	◎
	Deposit	
	Soil	
	Land Subsidence	
	Noise	◎
	Vibration	
	Waste Matter	◎
Safety	Carbon Monoxide	◎
	Hydrogen Sulfide	◎
	Methanol	◎

◎ : The environmental impact factors are clearly confirmed.

Blank: No effect on the environment is considered.

12-1-3 Outline of the Project

(1) Planned Location

Location of this project is shown in Fig. 12-1-2.

(2) Outline of the Project

1) Kind of Project and Project Name

Kind of project: Coal gasification and methanol synthesis

Project name: Banko Coal Project

2) Scale of the Project

Total area: 51.5 ha

Planned products capacity (annual): 1.5 million ton/year of methanol

The number of employees to be hired:

Approximately 1000 persons

3) Target Year

Year 2000 for 1st phase production start.

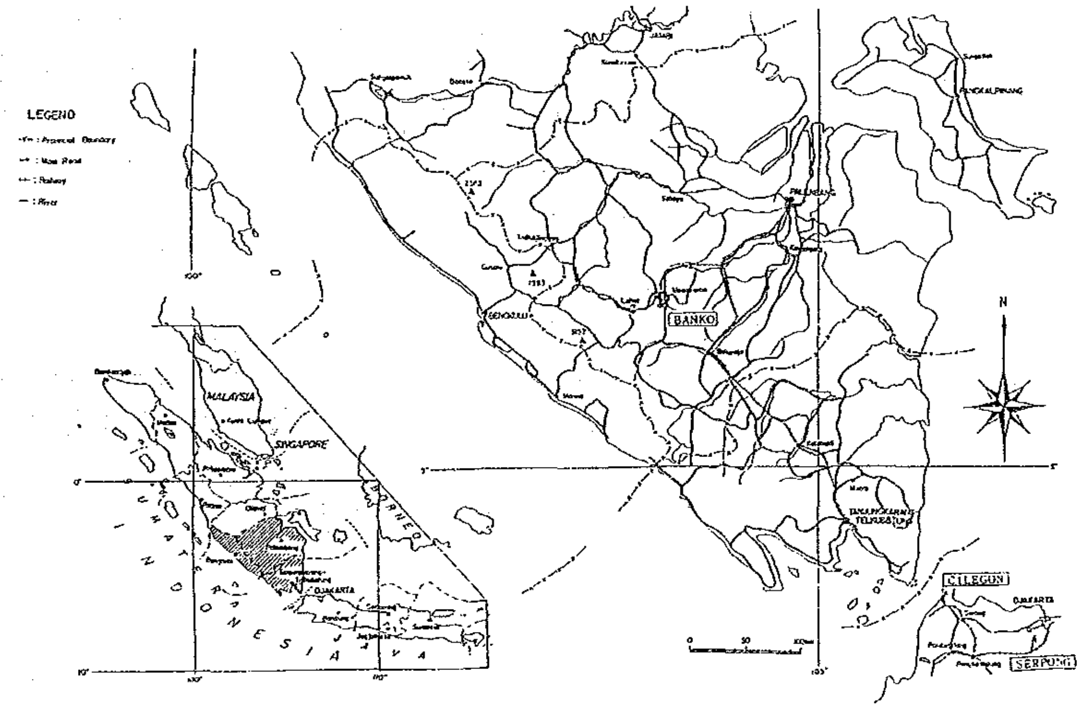


Fig. 12-1-2 Location of Banko

12-2 AIR POLLUTION

12-2-1 Quality of Air

Table 12-2-1 shows the Environmental Quality Standards for air pollution in Japan that is desirable to be attained for maintaining people's health and for preserving a living environment.

Table. 12-2-1 Ambient Air Quality Standards

Substances		
Sulphur dioxide	Carbon monoxide	Nitrogen dioxide
Environmental Conditions		
Daily average of hourly values shall not exceed 0.04 ppm, and hourly value shall not exceed 0.1 ppm.	Daily average of hourly values shall not exceed 10 ppm, and average of hourly values in 8 consecutive hours shall not exceed 20 ppm.	Daily average of hourly values shall be within the range between 0.04 ppm and 0.06 ppm or below.
Measuring Methods		
Conductometric method	Non dispersive infrared analyzer method	Colorimetry employing Saltzmen reagent method

Table 12-2-2 shows range of regulatory standards on boundary line for odor substances.

Table 12-2-2 Range of Regulatory Standards on Boundary Line

Offensive odor substances	Range of standard (ppm)
Ammonia	1 ~5
Methyl mercaptan	0.002~0.01
Hydrogen sulfide	0.02 ~0.2
Methyl sulfide	0.01 ~0.2
Methyl disulfide	0.009~0.1
Trimethylamine	0.005~0.07
Acetaldehyde	0.05 ~0.5
Styrene	0.4 ~2

12-2-2 Short-term Prediction (One Hour Value)

(1) Scope of Prediction

The range covered for calculation of prediction is to be the area within about 5 km radius centering around the planned location.

(2) Prediction Method

1) Effective Stack Height

Effective stack height is calculated by the following formula.

$He = H_o + \triangle H$

H_e : Effective stack height (m)

H_o : Actual stack height (m)

$\triangle H$: Smoke height (m)

The smoke height ($\triangle H$) is calculated using Bosanquet formula in the wind condition, while Briggs formula is used in no-wind condition.

i) Bosanquet formula (in the wind)

$\triangle H = 0.65 \times (\triangle Hm + \triangle Ht)$

$\triangle Hm$: Rising smoke by momentum (m)

$\triangle Ht$: Rising smoke by buoyancy (m) where

To	:	Air temperature on equivalent density of smoke and air (K)
Qv	:	Exhaust intensity on To (Nm^3/s)
Vg	:	Exhaust velocity of smoke (m/s)
u	:	Wind velocity (m/s)
$\triangle T$	:	Exhaust smoke temperature (T) minus To (K)
g	:	9.8 (m/s^2)
d	:	Stack diameter (m)
$d\theta/dz$	:	Gradient of temperature (°C/m)

ii) Briggs formula (no-wind)

$$\triangle H = 1.4 \times Q_H^{0.5} \times (d\theta/dz)^{-3/8}$$

where

Q_H	:	Discharged calory (cal/s)
$d\theta/dz$	:	Gradient of temperature (°C/m)

2) Diffusion Method

For calculation of the short-term prediction (hourly value), the following Plume's formula and no-wind Puff's formula are used.

$$C(R) = \frac{Q}{\pi \cdot \sigma y \cdot \sigma z \cdot u} \exp\left[-\frac{1}{2}\left(\frac{y}{\sigma y}\right)^2\right] \exp\left[-\frac{1}{2}\left(\frac{He}{\sigma z}\right)^2\right] \quad \cdots\cdots\cdots \text{(in the wind)}$$

$$C(R) = \frac{2Q}{(2\pi)^{3/2} \cdot \gamma} \cdot \frac{1}{R^2 + \left(\frac{\alpha}{\gamma}\right)^2 \cdot He^2} \quad \cdots\cdots\cdots \text{(no-wind)}$$

where,

C(R): Concentration on the ground (×10^6 ppm) in the distance of Rm from the smoke source.

Q: Exhaust intensity (Nm^3/s)

σy, σz, α, γ: Diffusion parameter

R: Distance (m) from smoke source to calculation point

y: Distance (m) from the lee axis in the right angles direction of the leeward

u: Wind velocity (m/s)

He: Effective stack height (m)

To obtain hourly value, modification of σy' in diffusion parameter σy in the horizontal direction of Pasquill-Gifford parameter is made as below.

$\sigma y' = \sigma y\ (60/3)^{0.50}$

For diffusion parameter, Pasquill Gifford parameter shown on Fig. 12-2-1 is used in wind condition, and in the no-wind condition; Diffusion parameter shown on the Table 12-2-3 is used.

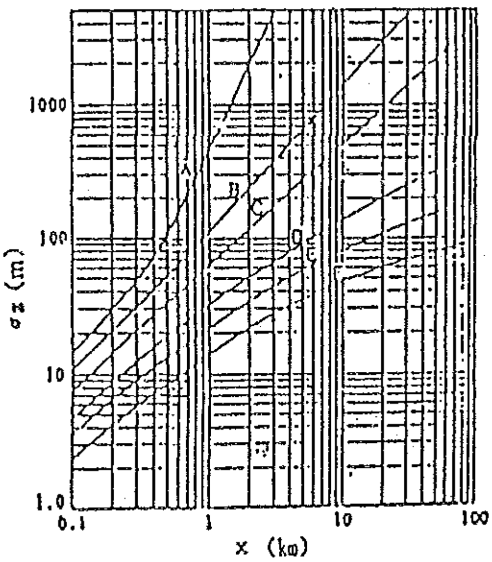


Fig. 12-2-1 Diffusion Parameter (when in the wind)

Table 12-2-3 Diffusion Parameter (no-wind)

Stability	A	B	D	F
α	0.948	0.781	0.470	0.439
γ	1.569	0.474	0.113	0.048

Then, conversion of NO_x into NO_2 is made at the rate of NO_2/NO_x with 0.72.

(3) Meteorological Condition

The meteorological conditions are shown as below on the basis of basic design data,

Wind:

Wind direction: N.W.; 20%

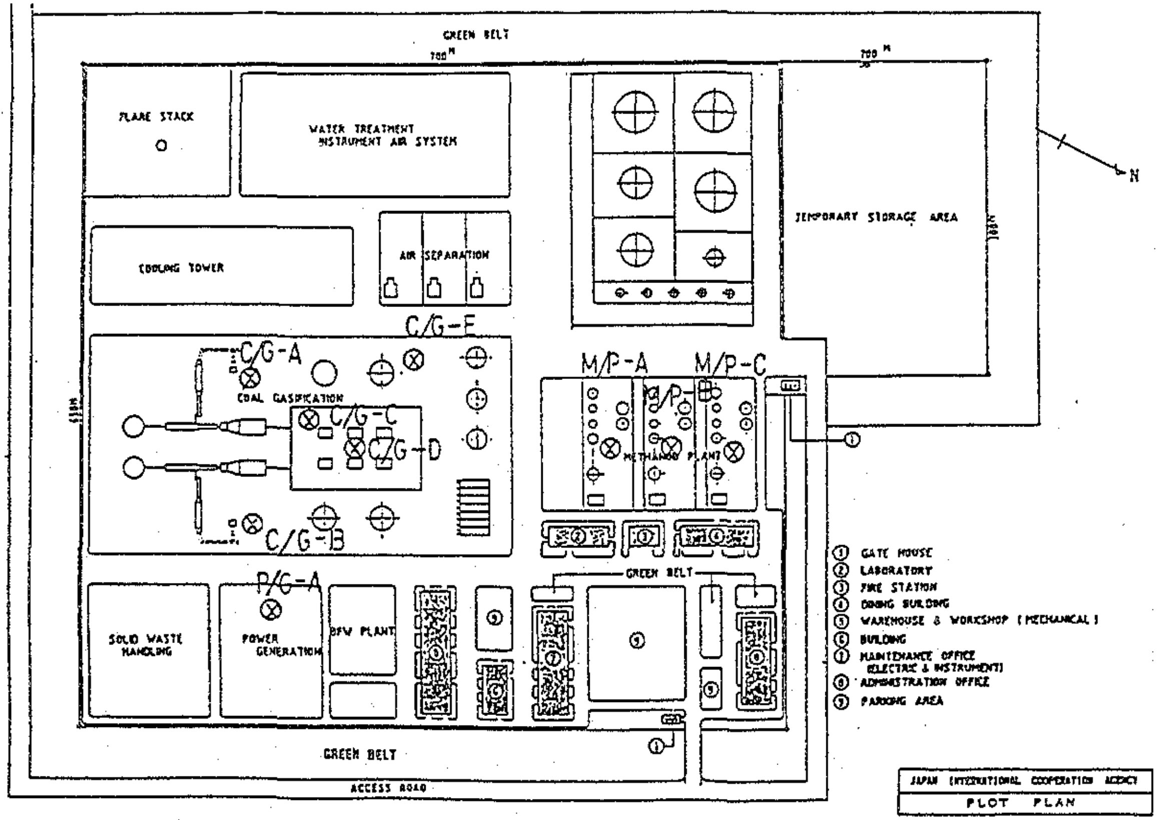
S.E.; 27%

Average wind velocity; 4 m/sec.

Stability for diffusion parameter: D

(4) Smoke Source Condition

Smoke sources are shown in Fig. 12-2-2 on the basis of conceptual design.



Smoke Source Condition

Stack No.	Waste Gas			Total Waste Gas (Nm³/Hr)	Gas Temp (℃)	Stack Dimension	
	SO_x	NO_x	H_2S			Height (m)	Diameter (m)
·Coal Gasification·							
C/G-A	0	7.5	0	125,000	80	25	2
C/G-B	0	7.5	0	125,000	80	25	2
C/G-C	0	45	0	75,000	50	70	1
C/G-D	0	1.5	0	2,500	800	20	0.6
C/G-E	5.2	1	0	8,000	200	70	1.6
·Methanol Plant							
M/P-A	0	0	33.2	56,350	40	60	1.1
M/P-B	0	0	33.2	56,350	40	60	1.1
M/P-C	0	0	33.2	56,350	40	60	1.1
·Power Generation							
P/G-A	105.2	141.6	0	1,180,000	140	30	5.4

Meteorological Condition

1) Ambient Temperature 24.9℃

2) Wind

Wind Derection N.W : 20%
S.E : 27%

Average Wind Velocity 4m/Sec

Fig. 12-2-2 Smoke Source Condition

12-2-3 Result and Evaluation of Short-term Prediction (Hourly Value)

Fig. 12-2-3 - 12-2-11 show the results of short-term prediction (one hour value) on SO_2, NO_2 and H_2S at the time of factory operation. Also, Table 12-2-4 shows the maximum landing concentration. As shown on these figures, the case (3) shows the highest concentration in SO_2; and as to the maximum landing concentration is 0.00245 ppm with SO_2.

The case (1) shows the highest concentration in NO_2 and as to the maximum landing concentration is 0.0176 ppm with NO_2.

Table 12-2-4 Maximum Landing Concentration

Case	Wind Direction	Wind Velocity (m/sec)	Stability for Diffusion Parameter	Maximum Landing Concentration Point (m)	Maximum Landing Concentration (ppm)		
					SO_2	NO_2	H_2S
1	NW	4	D	2200	0.00245	0.0176	0.0448
2	SE	4	D	2200	0.00241	0.0175	0.0448
3	—	0	D	0	0.00322	0.0073	0.016

As shown on the Table 12-2-4 the results of prediction conform to the Environmental Quality Standard for air pollution on the Table 12-2-1.

On the other hand, maximum landing concentration of H_2S (See Table 12-2-4) is 0.0448 ppm. As shown on the Table 12-2-2, the results of prediction on H_2S situates within the range of regulatory standards. So, exhaust stacks for waste gas in Methanol Plant shall be 30 m higher than planned effective stack height at the construction stage.

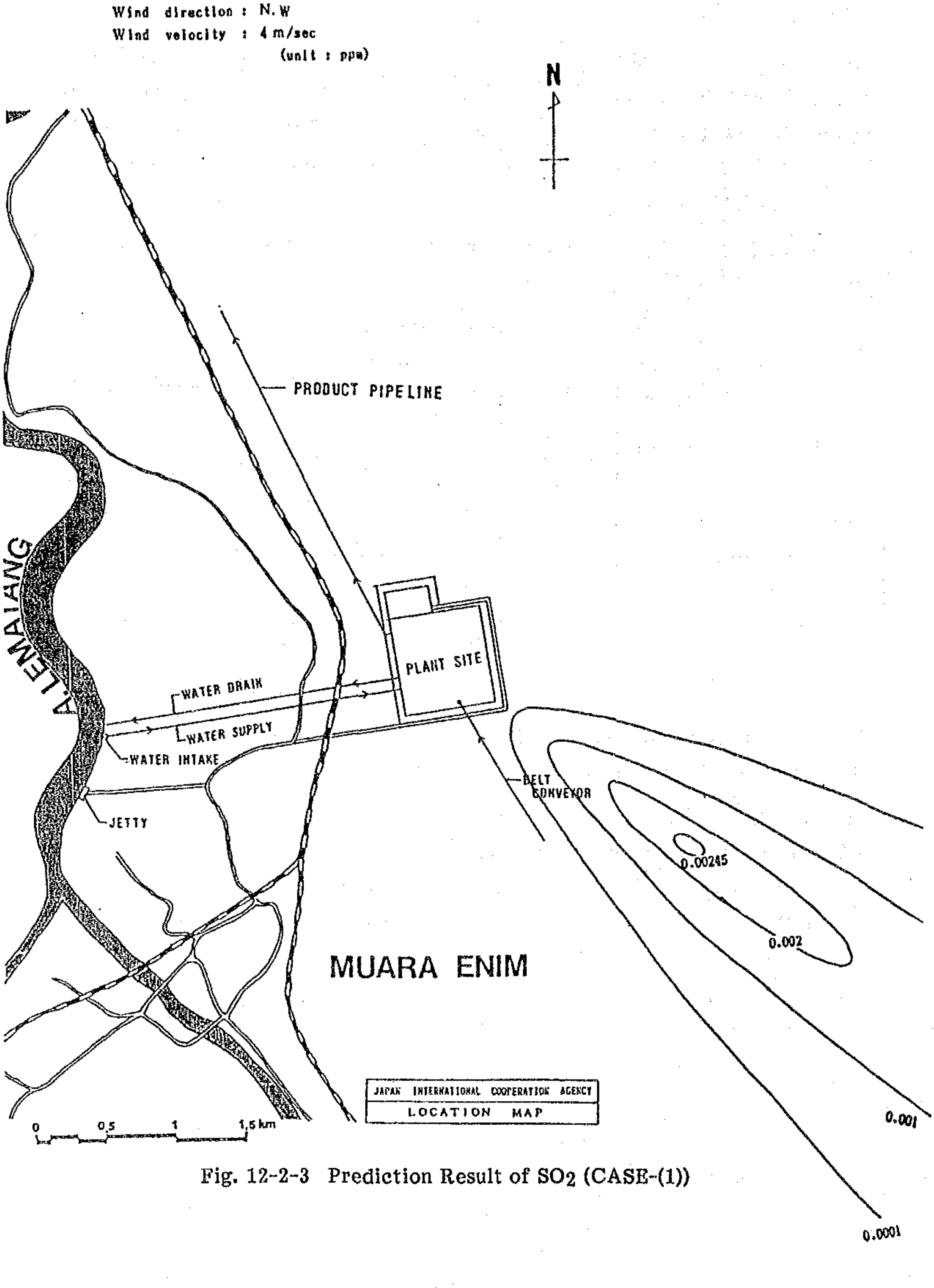


Fig. 12-2-3 Prediction Result of SO_2 (CASE-(1))

Wind direction : S.E.
Wind velocity : 4 m/ sec
(unit : ppm)

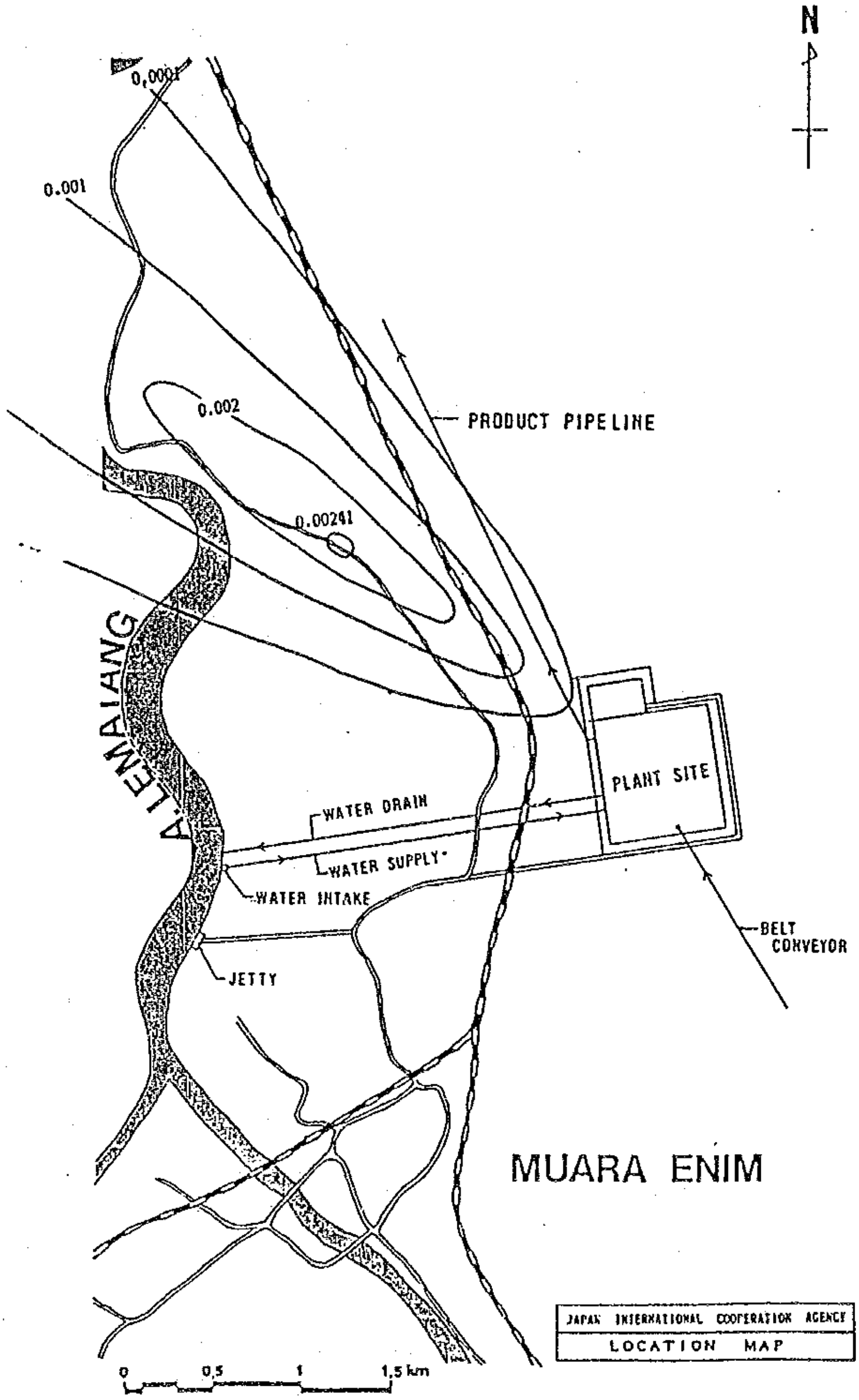


Fig. 12-2-4 Prediction Result of SO_2 (CASE-(2))

Wind direction : ——
Wind velocity : 0 m/ sec
(unit : ppm)

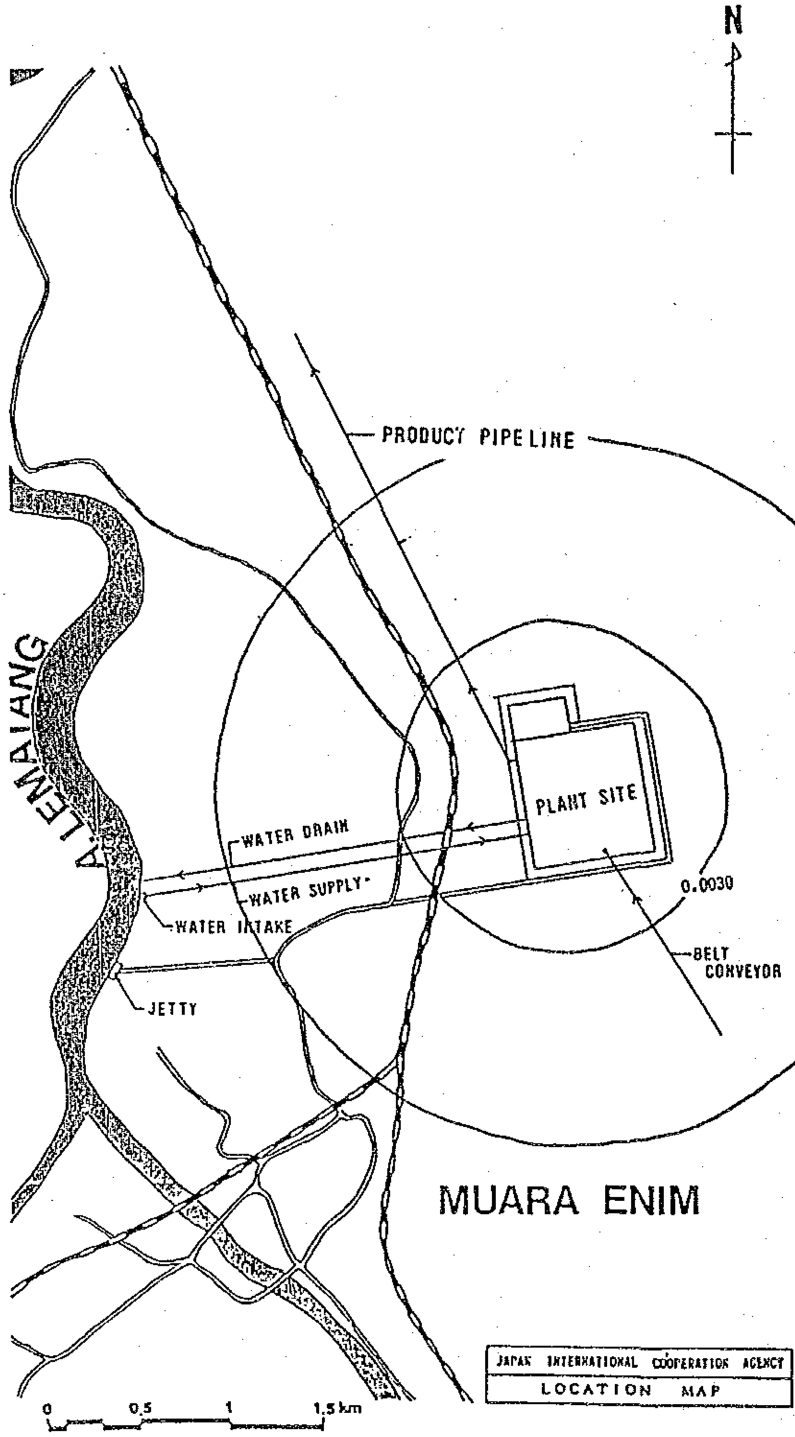


Fig. 12-2-5 Prediction Result of SO_2 (CASE-(3))

Wind direction : N.W
Wind velocity : 4 m/sec
(unit : ppm)

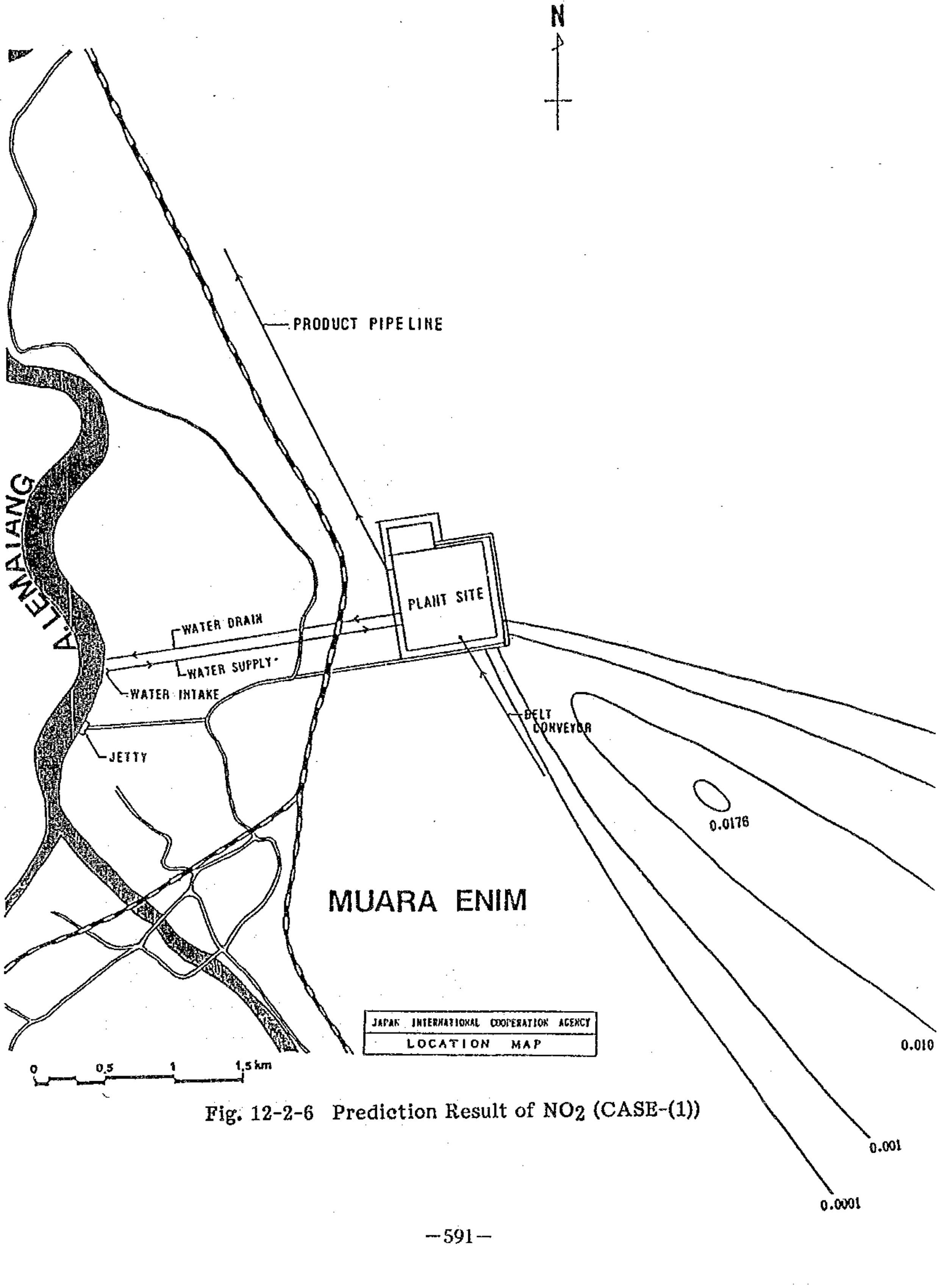


Fig. 12-2-6 Prediction Result of NO_2 (CASE-(1))

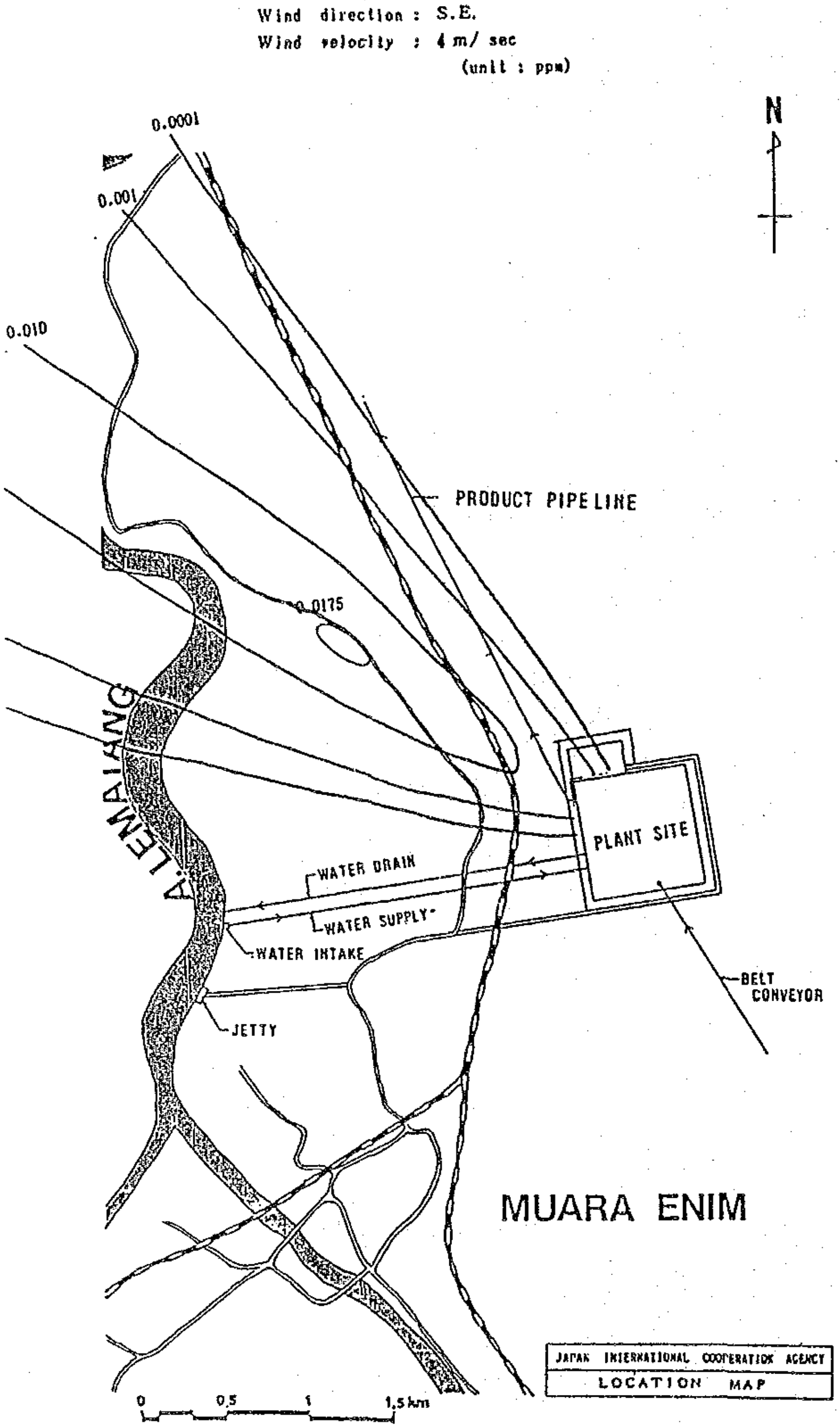


Fig. 12-2-7 Prediction Result of NO_2 (CASE-(2))

Wind direction : —
Wind velocity : 0 m/ sec
(unit : ppm)

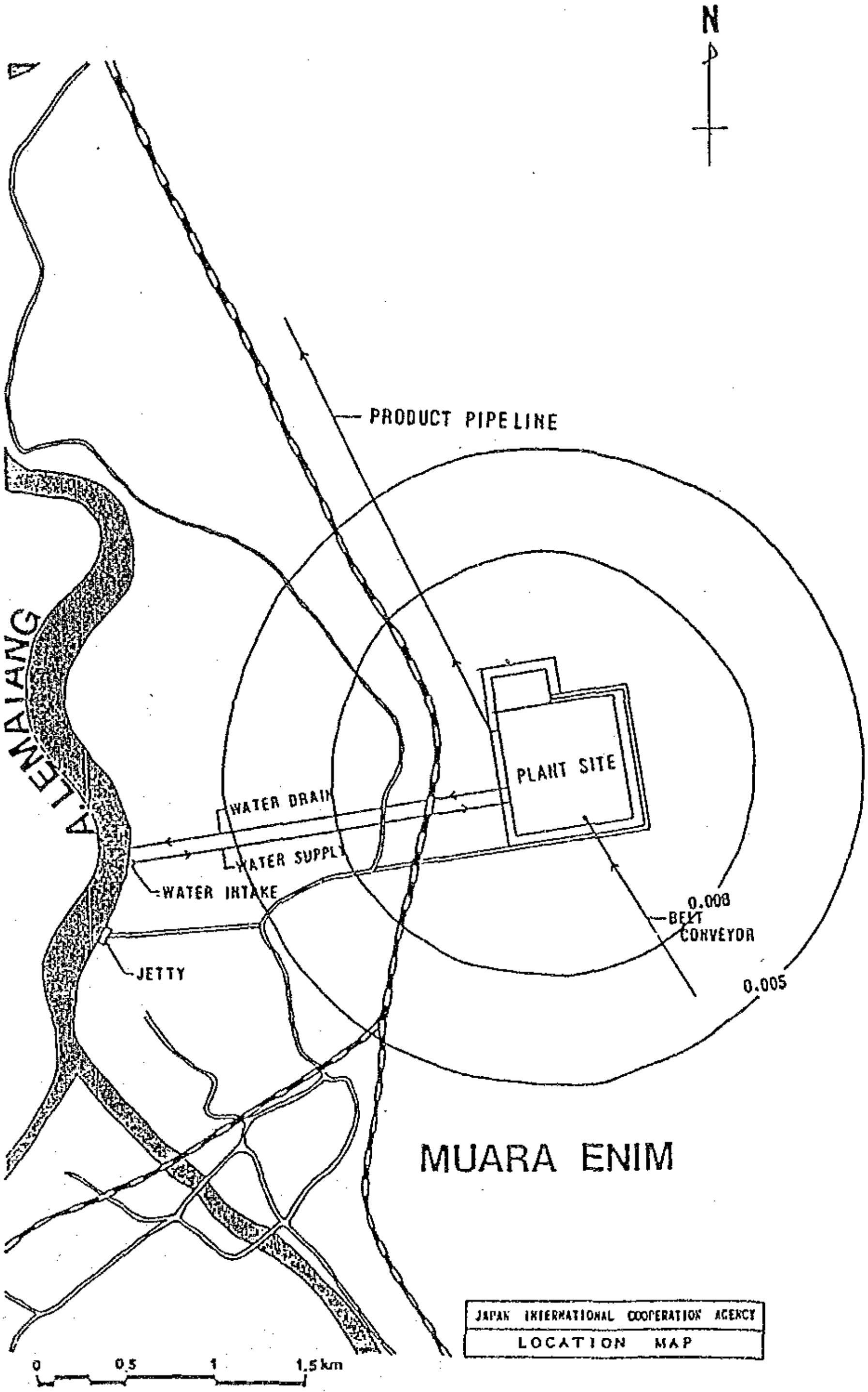


Fig. 12-2-8 Prediction Result of NO_2 (CASE-(3))

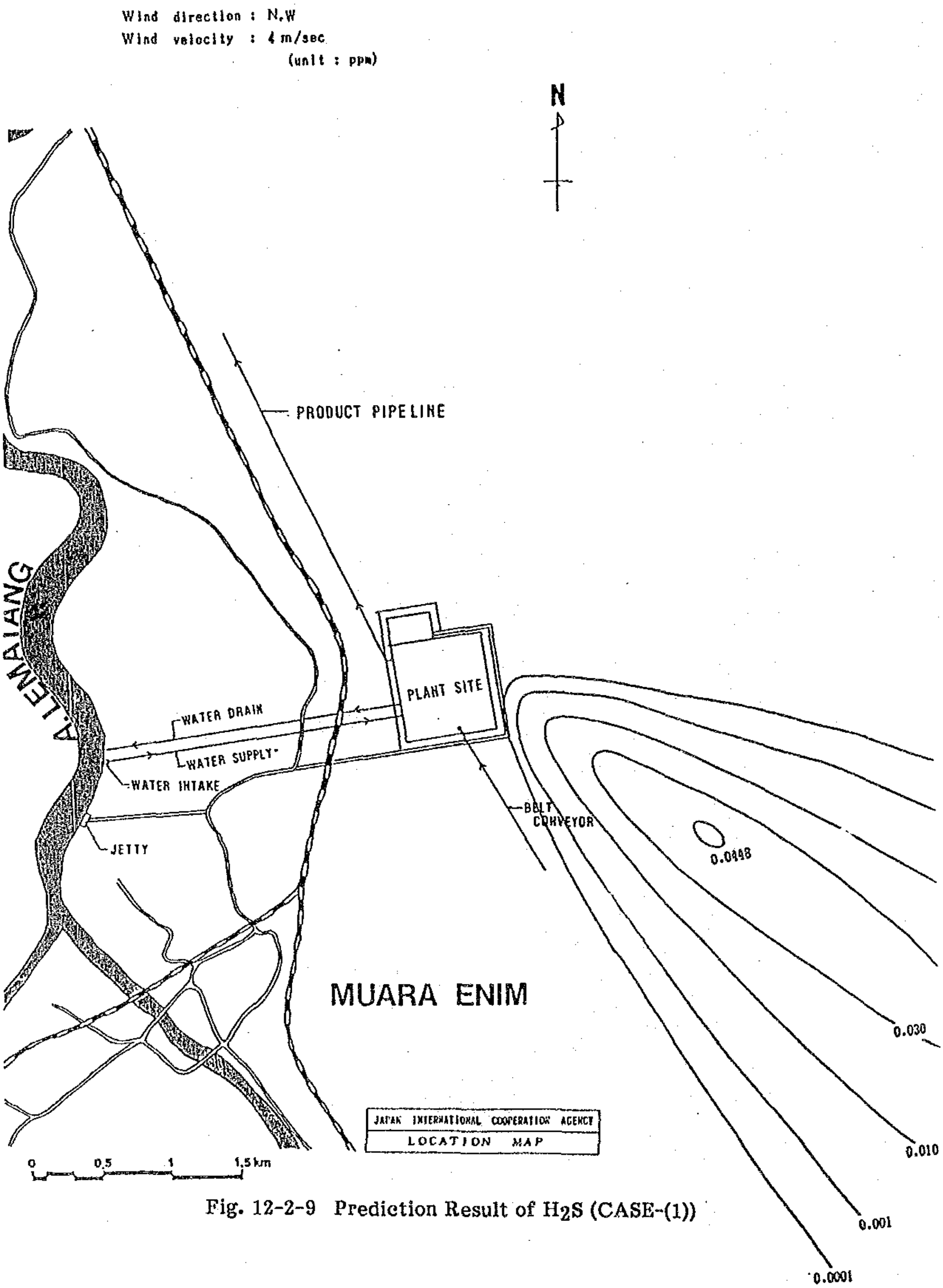


Fig. 12-2-9 Prediction Result of H_2S (CASE-(1))

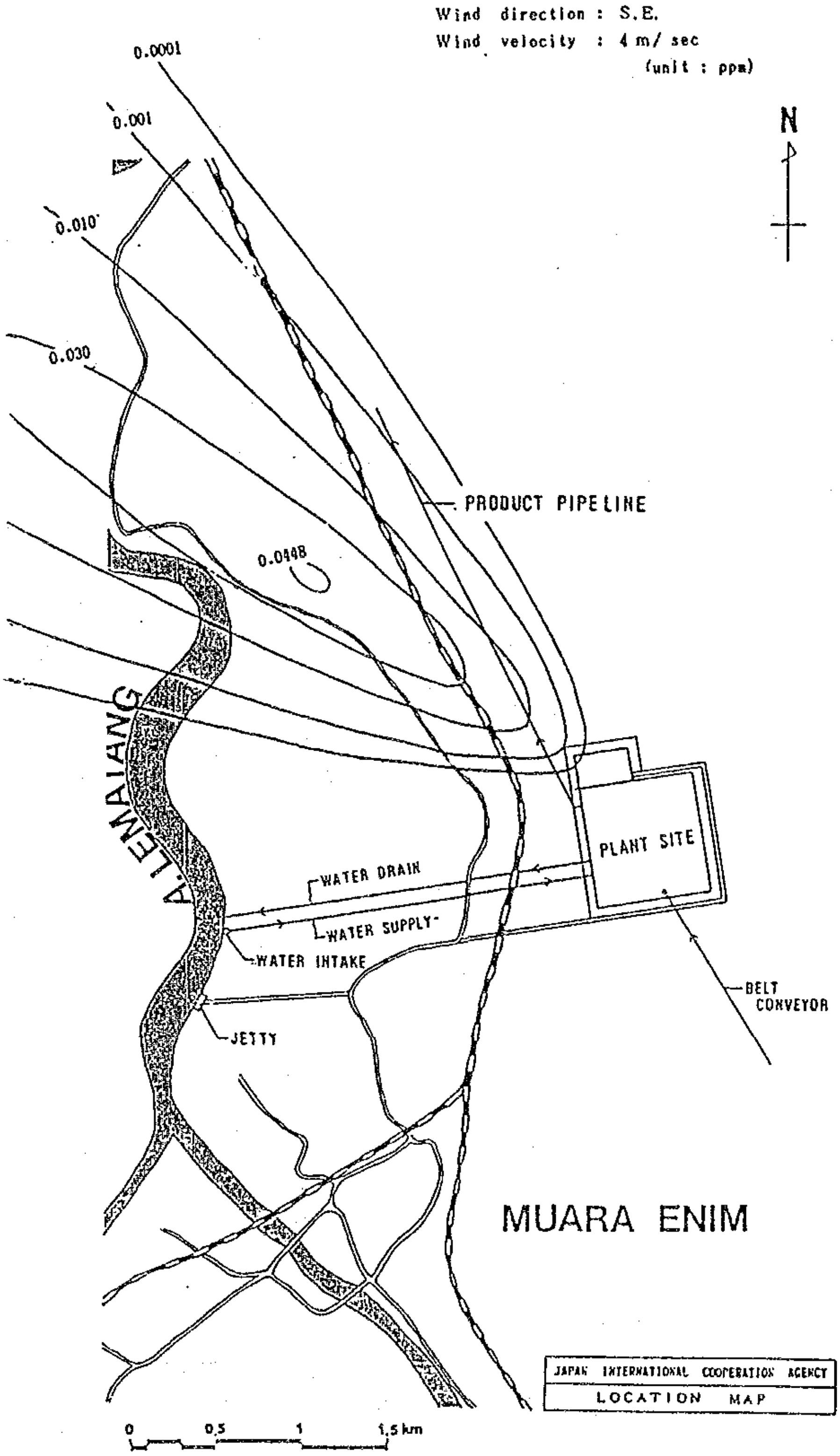


Fig. 12-2-10 Prediction Result of H_2S (CASE-(2))

Wind direction : —
Wind velocity : 0 m/ sec
(unit : ppm)

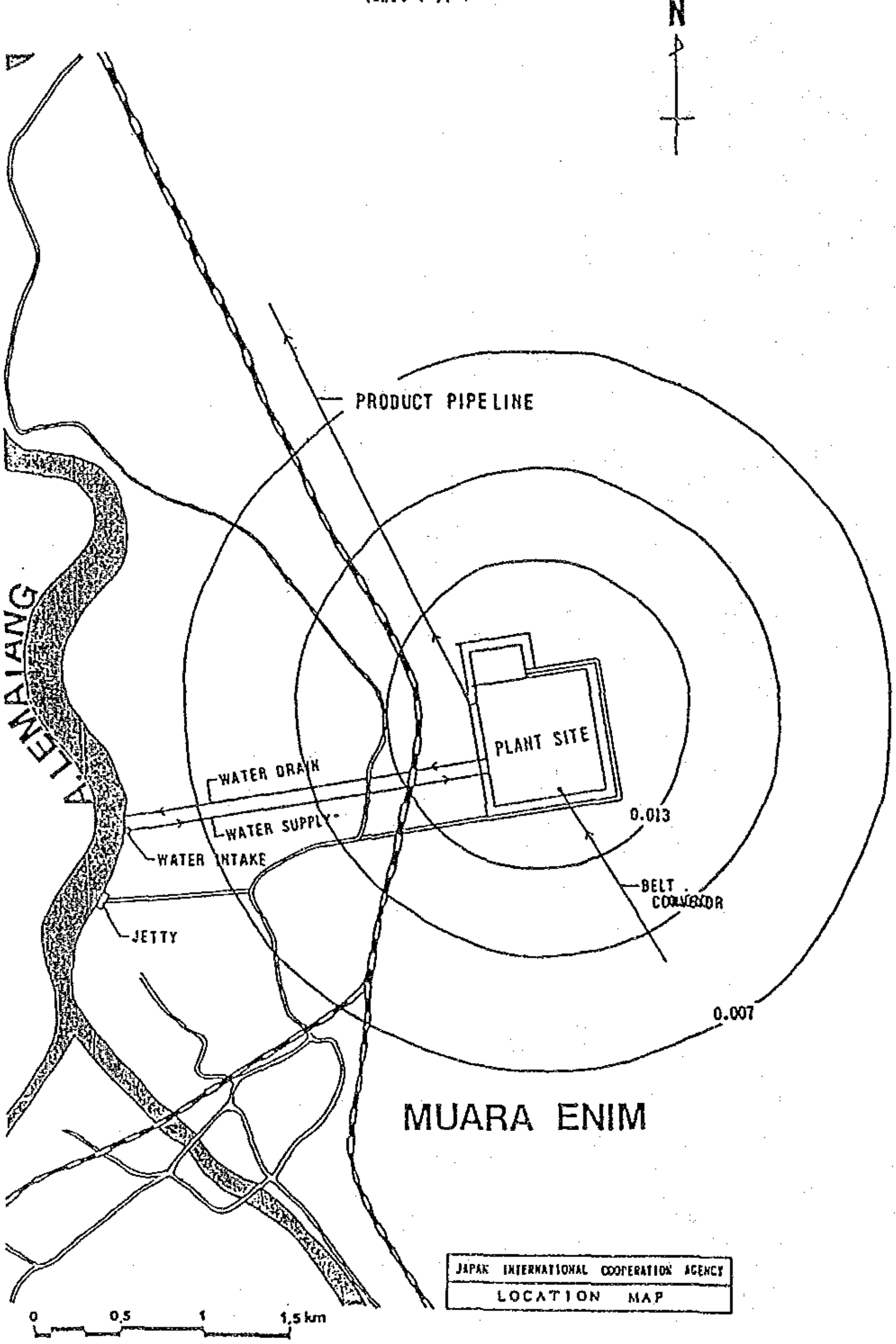


Fig. 12-2-11 Prediction Result of H_2S (CASE-(3))

12-3 WATER POLLUTION

12-3-1 Quality of Water

The Environment Standard for water pollution is provided for protecting human health and for preserving a living environment. Environment Standards for River are classified in category A as shown in Table 12-3-2. Environment Standards for items relating to the living environment such as pH, BOD, etc. are specially provided by the category of the water areas.

Table 12-3-1 Environmental Water Quality Standards relating to Human Health

Item	Standard Value
Cadmium	0.01 mg/liter or less
Cyanide	Not detectable
Organic Phosphorus	Not detectable
Lead	0.1 mg/liter or less
Chromium (Hexavalent)	0.05 mg/liter or less
Arsenic	0.05 mg/liter or less
Total Mercury	0.0005 mg/liter or less
Alkyl Mercury	Not detectable
PCB	Not detectable

Table 12-3-2 Standards relating to Living Environment

Rivers

Category	Item / Purpose of water use	Standard values'				
		pH	Biochemical oxygen demand (BOD)	Suspended solids (SS)	Dissolved oxygen (DO)	Number of coliform groups
AA	Water supply, class 1; conservation of natural environment, and uses listed in A—E	6.5—8.5	1 mg/ℓ or less	25 mg/ℓ or less	7.5 mg/ℓ or more	50 MPN/100mℓ or less
A	Water supply, class 2; fishery, class 1; bathing and uses listed in B—E	6.5—8.5	2 mg/ℓ or less	25 mg/ℓ or less	7.5 mg/ℓ or more	1,000 MPN/100mℓ or less
B	Water supply, class 3; fishery, class 2, and uses listed in C—E	6.5—8.5	3 mg/ℓ or less	25 mg/ℓ or less	5 mg/ℓ or more	5,000 MPN/100mℓ or less
C	Fishery, class 3; industrial water, class 1, and uses listed in D—E	6.5—8.5	5 mg/ℓ or less	50 mg/ℓ or less	5 mg/ℓ or more	—
D	Industrial water, class 2; agricultural water², and uses listed in E	6.0—8.5	8 mg/ℓ or less	100 mg/ℓ or less	2 mg/ℓ or more	—
E	Industrial water, class 3; conservation of environment	6.0—8.5	10 mg/ℓ or less	Floating matter such as garbage should not be observed	2 mg/ℓ or more	—

12-3-2 Prediction and Evaluation of Water Pollution

(1) Content of Prediction

As the industrial waste water generated by the plant operation is planned to be discharged in Lematang river, the survey on the degree of effect has been conducted.

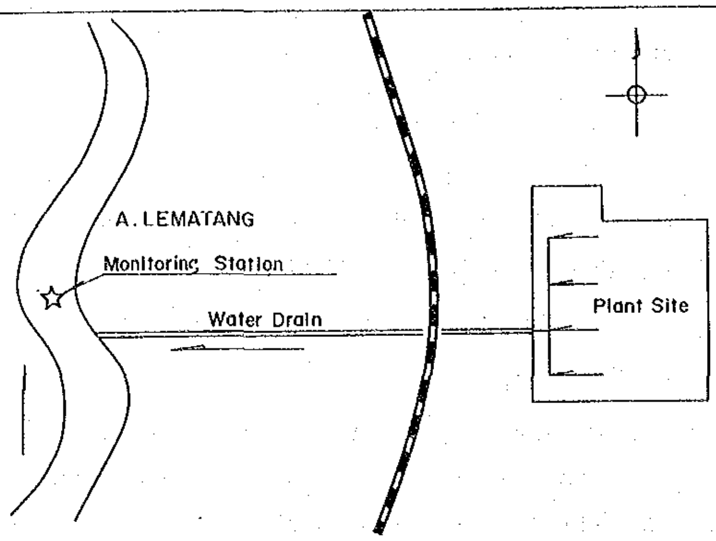
1) Items of Prediction

For discharging route of rain water, and industrial waste water, produced during the plant operation, it is planned as described in the Project Plan that rain water is to be discharged in the rivers while industrial waste water is to be discharged in foul water drain after conducting purification treatment at each plant, then led to flood way and finally discharged in the river. The item for prediction is to be Biochemical Oxigen Demand (BOD) that is the most important index for water pollution in rivers.

2) Monitoring Station and Monitoring Method

Industrial waste water is to be discharged in Lematang river. Monitoring station is the discharged point of river, and for monitoring method, complete mixing method is used.

Fig. 12-3-1 shows rough diagram of monitoring station.



Items		Flow Rate (m^3/Hr)	Quality of Water (mg/ℓ)		
			BOD	SS	N-Hex
River Water		748.8x10^3			
Water Drain	Cooling Water	1.210			
	Waste Water	207	120	200	5

Fig. 12-3-1 Monitoring Station for Water Pollution

(2) Setting-up of Prediction Conditions

1) Effluent Volume

Fig. 12-3-2 shows estimated effluent volume from the plant. On the basis that the plant operation hour is 24 hours continuously, it is made condition that waste water is regularly discharged from treatment facilities.

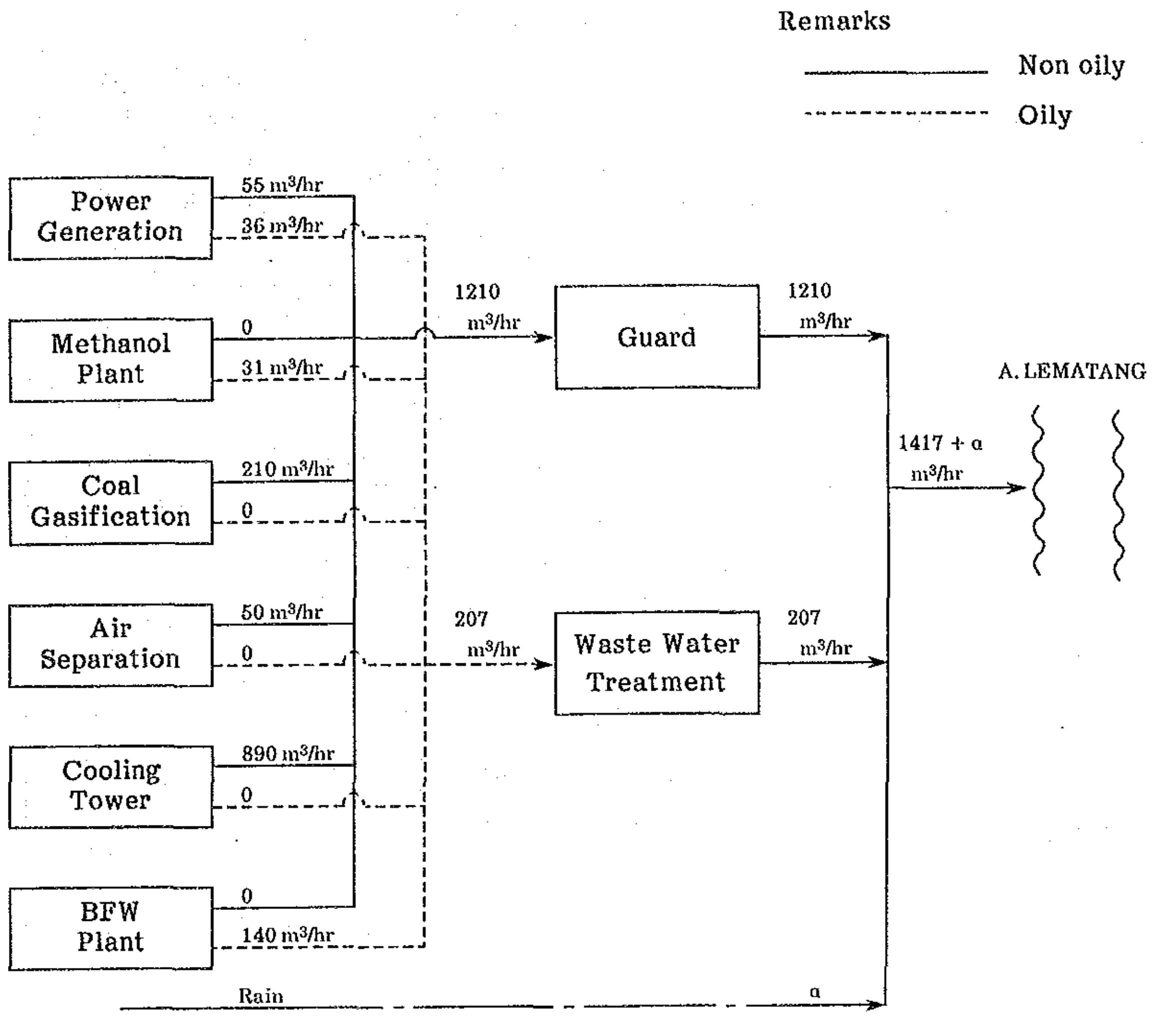


Fig. 12-3-2 Effluent Volume from the Plant

12-3-3 Results of Prediction

As shown on the Table 12-3-3 it is found out that the result of prediction conforms to the Environment Standard (A model).

Table 12-3-3 Results of Prediction

Unit: mg/ℓ

Items		Quality of Water: BOD	SS	N-Hex	Remarks
Water Drain	Cooling Water	—	—	—	( ); kg/h
	Waste Water	120 (24.8)	200 (41.4)	5 (1.0)	
Total		16.3 (24.8)	25.8 (41.4)	0.7 (1.0)	
River Water		α	β	γ	
Results of Prediction on Monitoring Station		α + 0.03	β + 0.05	γ + 0.001	
Environment Standard (A)		2 mg/ℓ or less	25 mg/ℓ or less	—	

12-4 *NOISE*

12-4-1 Standard for Noise

Table 12-4-1 shows the Environment Standard for Noise by the category of area and time, that is desirable to be attained for preserving living environment.

Table 12-4-1 The Environment Standard for Noise by the Category of Area and Time

Area Category	Division of hours			Applicable Areas
	Daytime From 8:00 am To 7:00 pm	Morning and Evening Morning 6:00 am 8:00 am Evening 7:00 pm 10:00 pm	Nighttime From 10:00 pm To 6:00 am of next day	
A	50 dB (A) or less	45 dB (A) or less	40 dB (A) or less	Area used primarily for residential purposes, residential area
B	60 dB (A) or less	55 dB (A) or less	50 dB (A) or less	Area used for commercial and industrial purposes

12-4-2 Prediction and Evaluation of Noise

Survey on the impact to the environment by noise caused by the Plant operation is conducted.

(1) Scope of Prediction

The scope of work for prediction is within 5000 m radius centering the planned location of the Plant. As shown in the Fig. 12-4-2, calculation is made on the basis of 2,500 square mesh (100 m × 100 m).

(2) Prediction Method

Prediction of sound level is made by using the following distance attenuating method (1), and each sound level is determined by the formula (2).

$$Lp = Lw - 20.\log r - 11 + 10.\log Q \quad \cdots\cdots (1)$$

Lp = Sound level (dB (A)) at the monitoring point

Lw = Power level (dB (A))

r = The distance from noise source to monitoring point (m)

Q = Direction factor of noise source (Use Q=2 in half free space)

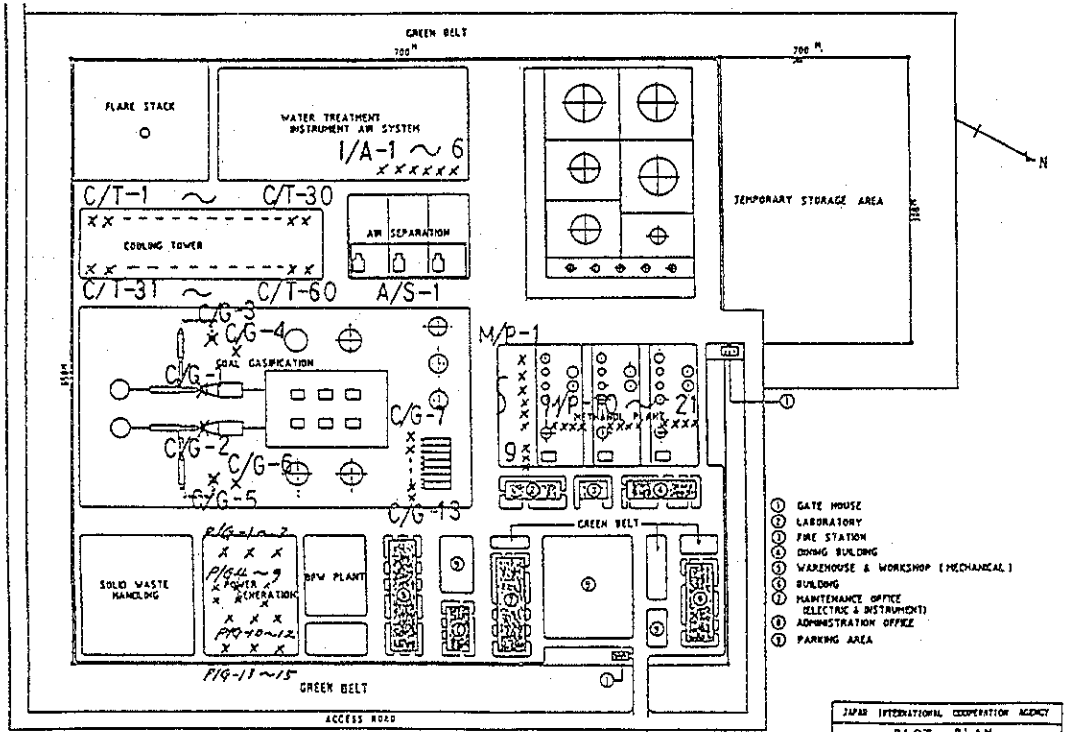
$$L = 10 \cdot \log \left(\sum_{i=1}^{n} 10^{(Lpi/10)} \right) \quad \cdots\cdots (2)$$

Lpi: Sound level according to (i)th noise source (dB (A))

L: Sound level according to total noise sources at the monitoring point (dB (A))

(3) Sound Source Condition

Fig. 12-4-1 shows power level of sound source that is the object of prediction.



Sound Power Level

Item No.	Equipments	Set	Sound Power Level dB (A)
·Instrument Air System			
I/A-1~6	Compressors	6	95
·Cooling Tower			
C/T-1~60	Cooling Fans	60	95
·Air Separation			
A/S-1	Compressor House (125m×25m×9m^H)	1	85
·Coal Gasification			
C/G-1~2	Coal Mills	2	90
C/G-3~13	Fans	11	90
·Methanol Plant			
M/P-1~21		21	104
·Power Generation			
P/G-1~3	Fans	3	90
P/G-4~9	Fans	6	90
P/G-10~12	Boilers	3	85
P/G-13~15	T/C	3	96

Fig. 12-4-1 Sound Source Condition

(4) Result of Survey and Evaluation

Fig. 12-4-2 shows the result of prediction on the sound level according to operation of facilities. The result of noise level prediction around the boundary of the planned plant site is about 70 dB (A) that does not satisfy the object of environmental conservation. (Area Category B)

The plant site should be an exclusive area for industry.

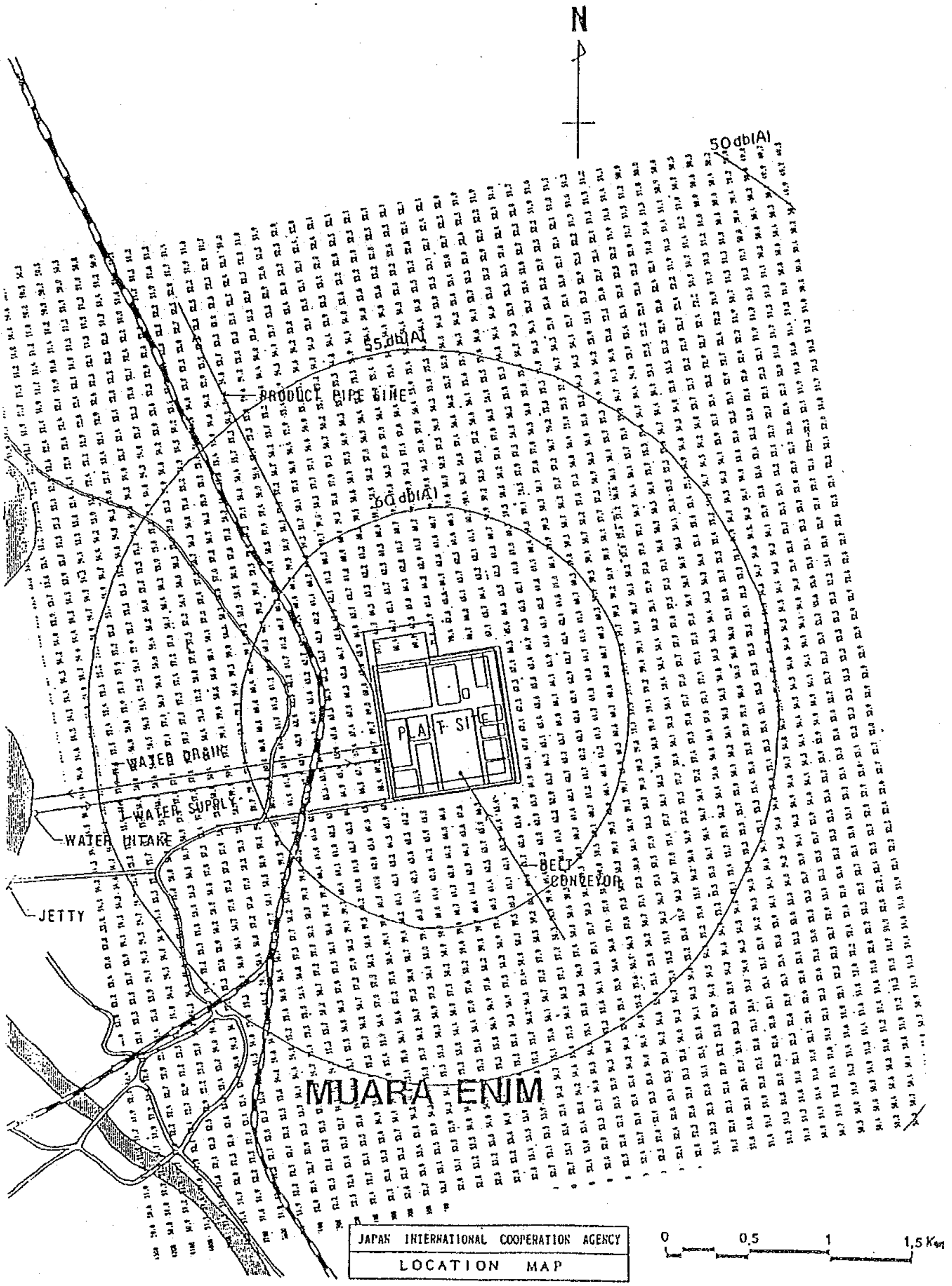


Fig. 12-4-2 Prediction Result for Noise

12-5 OTHERS

12-5-1 Waste Disposal

The slag and dust from operation of facilities shall be filled in the coal mine site and, covered with soil and planted trees.
The slag and dust do not contain any toxic metal, we believe safety for exuded water and for ground water.

12-6 SAFETY ASSESSMENT

12-6-1 Safety Limitation of Toxic Gas

Table 12-6-1 shows the safety limitation of toxic gas, that is surely to be kept for maintaining people's life.

Table 12-6-1 Safety Limitation of Toxic Gas

Unit: Vol ppm

Influence for Life	Carbon Monoxide (CO)	Hydrogen Sulfide (H_2S)
A Instantaneous death	5,000 ~ 10,000	600 ~ 3,000
B Dangerous for life in 0.5 ~ 1.0 hr exposure	2,000 ~ 3,000	500 ~ 700
C Safety for life less than 1 hr exposure	500 ~ 1,000	200 ~ 300
D Safety for life in long hours exposure	500 or less	100 ~ 150
Remark: Stench limitation	——	0.0005

12-6-2 Prediction for Influence of Toxic Gas

(1) Prediction Method

1) Effective Stack Height

Calculation method of effective stack height is the same as the case of the air pollution prediction.

2) Diffusion Method

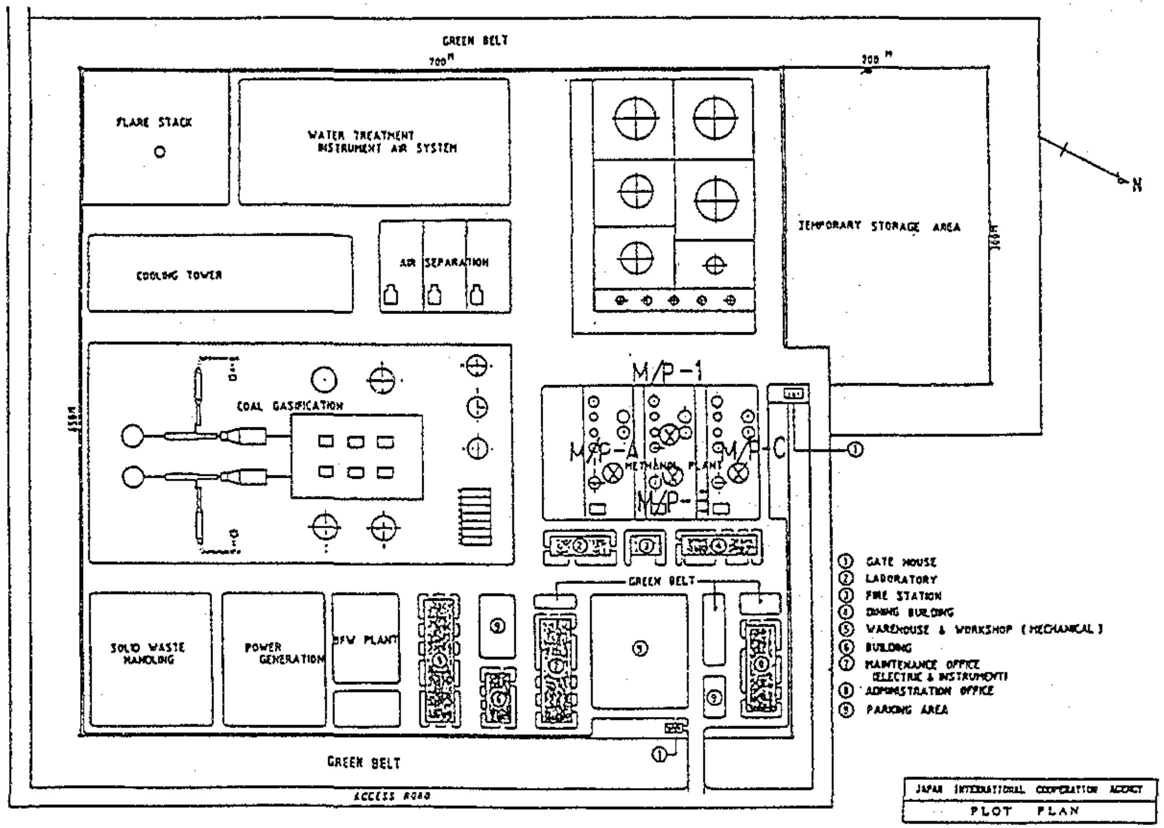
For calculation of the Effluent Standard for toxic gas from the stack, the following formula is used.

$$q = 0.108 \times He^2 \cdot Cm$$

where, q: Exhaust intensity of gas ($N\ m^3/hr$)
He: Effective stack height (m)
Cm: Safety limitation of toxic gas on rank D (ppm)

3) Exhaust Gas Condition

Exhaust sources are shown in Fig. 12-6-1 on the basis of industrial plan.



Exhaust Gas Condition

Exhaust Point	Exhaust Gas			Total (Nm³/Hr)	Effective Stack Height He(m)
	CO	H_2S	Others		
M/P-1	39.750	0	110.250	150.000	40
M/P-A	—	33.2	56327	56.350	81
M/P-B	—	33.2	56327	56.350	81
M/P-C	—	33.2	56327	56.350	81

Fig. 12-6-1 Exhaust Toxic Gas Condition

12-6-3 Prediction and Evaluation of Safety

As shown on the Table 12-6-2 it is found out that the result of prediction conforms to Safety Limitation of Toxic Gas.

Table 12-6-2 Results of Prediction for Safety

	Exhaust Gas Volume (Nm^3/hr)	Permitted Quantity		
		Safety limit (Cm) (ppm)	Effective stack height, He (m)	Gas volume (Nm^3/hr)
CO	39,750	500	40	86,400
H_2S	100	100	81	70,800

12-6-4 Flow-out of Methanol

Flow-out of methanol from facilities should be prevented effectively. Unfortunately, should an accident happen, methanol will be led into an emergency reservoir pond and resolved biologically.

13. ESTIMATION OF CAPITAL INVESTMENT AND OPERATION COST

13-1 Capital Investment

13-1-1 Method for Estimating Capital Investment

Estimation of fixed-capital investment for this Project has been done in two main categories ; on-site facilities and off-site facilities. And these categories are divided into a total of ten components. They include;

On-site facilities

I) Coal gasification plant
II) Methanol plant
III) Air separation plant
IV) Power generation plant
V) Storage facilities
VI) Utility facilities
VII) Common buildings

Off-site facilities

I) Coal transportation facility
II) Product transportation facilities (pipeline from Muara Enim to Palembang, tank yard and berth in Palembang.)
III) Residential facilities

The utility facilities consist of industrial water, cooling water, air compressor, fire fighting, flare stack, BFW, waste water treatment and CO_2 compressor. The common buildings include administration office, dining hall, laboratory, warehouse and maintenance shop. The residential facilities include company's house, mosque, church, school and other miscellaneous facilities.

The estimation are based on the technical data studied in chapter 11 and 12 and obtained from each special constructor who has experience in building similar types of plants. The estimation has been done in a turn key basis in US$ basis in FY'87 value and does not include interest rate during the construction period and escalation.

According to proposed master plan which is studied in section 9-2, the construction is divided into three phases starting operation in 2000. The construction of phase 1 will begin in 1996 and will take 45 months to complete. Phase 2 of this project will start construction in 2000, and start operation in 2003. Phase 3 will start construction in 2002 and start operation in 2005. The construction period of both phase 2 and 3 is estimated at 33 months respectively.

The cost items are as follows which are a typical list of items.

I) Purchased equipment
II) Purchased equipment installation
III) Instrumentation and control
IV) Piping
V) Electrical equipment and materials
VI) Building
VII) Land
Total direct cost

VIII) Engineering and supervision, construction expenses
IX) Equipment transportation
Total Direct and Indirect Cost

The breakdown of each cost items are shown in the followings.

I) *Purchased equipment*

All equipment listed on flow sheets
Spare parts
Surplus equipment and equipment allowance

II) Purchased equipment installation

Installation of all equipment listed on flow sheet
Installation of instrumentation and controls, piping and electrical equipment and materials

Yard improvement
Structural supports, insulation, paint

III) Instrumentation and controls
Instrument, calibration, computer-tie in

IV) Piping
Process piping
Pipe hangers, fittings, valves
Insulation of piping equipment

V) Electrical equipment and materials
Electrical equipment
Electrical materials

VI) Building
Process buildings
Auxiliary buildings
Maintenance shops
Building services
Infrastructure building

VII) Land
On-site
Off-site

VIII) Engineering and supervision
Engineering costs
Engineering supervision and inspection

IX) Equipment transportation

Equipment procured in Indonesia is assumed to be 30% and the remaining 70% of equipment will be imported. Engineering, supervision and construction expenses are estimated at 10% of total direct cost, which is in line with expenditures for similar projects. Know-how fee will be included in purchase equipment. Contingency is not taken into account, because the estimation is done in a turn-key basis.

The land cost of on-site and off-site facilities are calculated based upon the area of each facility. The land ownership status in the planned project area is about 70% by government and 30% by private. The company can use the land under a thirty year's lease with compensation of certain amount of money. The actual compensation cost for all kinds of rights on the land is from 200 to 500RP/m^2. The unit land cost of 200RP/m^2 is used for the on-site facility and coal transportation facility, while 500RP/m^2 for pipeline facility.

The investment schedule for purchased equipment, instrumentation, piping and electrical equipment & materials are assumed to be 30% in 1997, 65% in 1998, 5% in 1999 during the period of phase 1, while 30% in 2000, 65% in 2001, 5% in 2002 during phase 2, and 30% in 2002, 65% in 2003, 5% in 2004 during phase 3.

The investment schedule for equipment transportation is to be in 1998 during the period of phase 1, while in 2001 during phase 2, and in 2003 during phase 3.

Total investment schedule for this project is as follows.

1) Phase 1 1996-1999 (4 years)
   where 12% completion by the end of 1996
   29% completion by the end of 1997
   81% completion by the end of 1998
   100% completion by the end of 1999

2) Phase 2 2000-2002 (3 years)
   where 29% completion by the end of 2000
   78% completion by the end of 2001
   100% completion by the end of 2002

3) Phase 3 2002-2004 (3 years)
   where 29% completion by the end of 2002
   78% completion by the end of 2003
   100% completion by the end of 2004

13-1-2 Capital Investment for On-site Facilities

The capital investment of this Project is shown in Table 13-1-1. The total capital investment for on-site facilities is 735.6 million US$, and this is 80% of total investment for this project. In total, the investment in phase 1 is 339.1 million US$, 222.9 million US$ in phase 2 and 173.6 million US$ in phase 3.

Table 13-1-1 Capital Investment

(Unit : million US$)

(Phase 1)	On-site Facility								Off-site Facility				Miscellaneous Cost	Total
	Gasification	Air Separation	Methanol	Power Plant	Storage	Utility	Common Building	Sub. Total	Coal Transportation	Product Transportation	Residential Facilities	Sub. Total		
Purchased Equipment	87.248	17.104	26.221	15.992	2.101	10.468	1.812	160.946	11.267	2.177	0.555	13.999		174.945
Purchased Equipment Installation	32.658	3.277	16.048	4.187	2.101	2.094	4.785	65.150	1.893	2.010	1.467	5.370		70.520
Instrumentation & Control	1.657	1.820	3.124	1.056	0.000	0.473	3.901	12.031	0.000	0.291	1.196	1.487		13.518
Piping	5.964	0.000	3.171	2.112	0.316	3.757	0.000	15.320	0.000	12.561	0	12.561		27.881
Electrical Equipment & Materials	6.626	0.910	1.278	3.677	0.000	8.429	0.000	20.920	0.000	0.000	0	0.000		20.920
Building	18.932	1.553	0.000	0.000	3.236	10.167	0.000	33.888	0.000	15.558	0	15.558		49.446
Land	0.012	0.000	0.004	0.002	0.007	0.028	0.006	0.059	0.063	0.189	0.004	0.256		0.315
Total Direct Cost	153.097	24.664	49.846	27.026	7.760	35.416	10.504	308.313	13.223	32.786	3.222	49.231	0.000	357.544
Engineering & Supervision	15.310	2.466	4.985	2.703	0.776	3.542	1.050	30.831	1.322	3.279	0.322	4.923	0.000	35.754
Equipment Transportation													27.058	27.058
Total Direct Cost	168.407	27.130	54.831	29.729	8.536	38.958	11.554	339.144	14.545	36.065	3.544	54.154	27.058	420.356

(Phase 2)	On-site Facility								Off-site Facility				Miscellaneous Cost	Total
	Gasification	Air Separation	Methanol	Power Plant	Storage	Utility	Common Building	Sub. Total	Coal Transportation	Product Transportation	Residential Facilities	Sub. Total		
Purchased Equipment	58.330	17.104	26.221	15.992	1.050	4.852	0.000	123.549	0.000	0.601	0	0.601		124.150
Purchased Equipment Installation	10.886	3.277	16.048	4.187	1.050	0.970	0.000	36.418	0.000	0.554	0	0.554		36.972
Instrumentation & Control	0.994	1.820	3.124	1.056	0.000	0.328	0.000	7.322	0.000	0.073	0	0.073		7.395
Piping	3.976	0.000	3.171	2.112	0.158	2.119	0.000	11.536	0.000	0.000	0	0.000		11.536
Electrical Equipment & Materials	4.307	0.910	1.278	3.677	0.000	8.083	0.000	18.255	0.000	0.000	0	0.000		18.255
Building	0.947	1.553	0.000	0.000	1.618	1.396	0.000	5.514	0.000	0.888	0	0.888		6.402
Land	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000		0.000
Total Direct Cost	79.440	24.664	49.842	27.024	3.876	17.748	0.000	202.594	0.000	2.116	0.000	2.116	0.000	204.710
Engineering & Supervision	7.944	2.466	4.984	2.702	0.388	1.775	0.000	20.259	0.000	0.212	0.000	0.212	0.000	20.471
Equipment Transportation													13.575	13.575
Total Direct Cost	87.384	27.130	54.826	29.726	4.264	19.523	0.000	222.853	0.000	2.328	0.000	2.328	13.575	238.756

(Phase 3)	On-site Facility								Off-sites Facility				Miscellaneous Cost	Total
	Gasification	Air Separation	Methanol	Power Plant	Storage	Utility	Common Building	Sub. Total	Coal Transportation	Product Transportation	Residential Facilities	Sub. Total		
Purchased Equipment	28.916	17.104	26.221	15.992	0.000	4.852	0.000	93.085	0.000	0.601	0	0.601		93.686
Purchased Equipment Installation	5.206	3.277	16.048	4.187	0.000	0.970	0.000	29.688	0.000	0.554	0	0.554		30.242
Instrumentation & Control	0.473	1.820	3.124	1.056	0.000	0.328	0.000	6.801	0.000	0.073	0	0.073		6.874
Piping	1.988	0.000	3.171	2.112	0.000	2.119	0.000	9.390	0.000	0.000	0	0.000		9.390
Electrical Equipment & Materials	1.988	0.910	1.278	3.677	0.000	8.083	0.000	15.936	0.000	0.000	0	0.000		15.936
Building	0.000	1.553	0.000	0.000	0.000	1.396	0.000	2.949	0.000	0.888	0	0.888		3.837
Land	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000		0.000
Total Direct Cost	38.571	24.664	49.842	27.024	0.000	17.748	0.000	157.849	0.000	2.116	0.000	2.116	0.000	159.965
Engineering & Supervision	3.857	2.466	4.984	2.702	0.000	1.775	0.000	15.785	0.000	0.212	0.000	0.212	0.000	15.996
Equipment Transportation													9.106	9.106
Total Direct Cost	42.428	27.130	54.826	29.726	0.000	19.523	0.000	173.634	0.000	2.328	0.000	2.328	9.106	185.067

(Total)	On-site Facility								Off-sites Facility				Miscellaneous Cost	Total
	Gasification	Air Separation	Methanol	Power Plant	Storage	Utility	Common Building	Sub. Total	Coal Transportation	Product Transportation	Residential Facilities	Sub. Total		
Purchased Equipment	174.494	51.312	78.663	47.976	3.151	20.172	1.812	377.580	11.267	3.379	0.555	15.201	0.000	392.781
Purchased Equipment Installation	48.750	9.831	48.144	12.561	3.151	4.034	4.785	131.256	1.893	3.118	1.467	6.478	0.000	137.734
Instrumentation & Control	3.124	5.460	9.372	3.168	0.000	1.129	3.901	26.154	0.000	0.437	1.196	1.633	0.000	27.787
Piping	11.928	0.000	9.513	6.336	0.474	7.995	0.000	36.246	0.000	12.561	0.000	12.561	0.000	48.807
Electrical Equipment & Materials	12.921	2.730	3.834	11.031	0.000	24.595	0.000	55.111	0.000	0.000	0.000	0.000	0.000	55.111
Building	19.879	4.659	0.000	0.000	4.854	12.959	0.000	42.351	0.000	17.334	0.000	17.334	0.000	59.685
Land	0.012	0.000	0.004	0.002	0.007	0.028	0.006	0.059	0.063	0.189	0.004	0.256	0.000	0.315
Total Direct Cost	271.108	73.992	149.630	81.074	11.636	70.912	10.504	668.756	13.223	37.018	3.222	53.463	0.000	722.219
Engineering & Supervision	27.111	7.398	14.953	8.107	1.164	7.091	1.050	66.874	1.322	3.702	0.322	5.346	0.000	72.221
Equipment Transportation													49.739	49.739
Total Direct Cost	298.219	81.390	164.483	89.181	12.800	78.003	11.554	735.630	14.545	40.720	3.544	58.809	49.739	844.179

Methanol plant, air separation plant and power generation plant will have the same investment cost for each construction phase, because these three plants will increase the equal capacity for each of the three phases. The common buildings will be completely constructed in the first year of construction period of first phase. The gasification plant will be constructed of three unit in the first phase, then two unit in the second phase and 1 unit in the third phase. For the storage facility, two tanks of methanol will be constructed in the first phase and remaining one tank in the the second phase.

13-1-3 Capital Investment for Off-site Facilities

The off-site facilities include coal transportation facility (belt conveyor), product transportation facilities (pipeline from Muara Enim to Palembang, tank yard and berth in Palembang) and residential facilities. Capital investment for off-site facilities is 58.8 million US$ for all three phases, and this is 7.0% of the total investment for this Project. The construction of coal transportation facilities, pipeline and berth facility are totally done in first phase. Tank yard and storage facilities in Palembang will be constructed of 2 unit in the first phase, then 1 unit in each second and third phase.

13-1-4 Miscellaneous Costs during Construction Period

The miscellaneous costs include equipment transportation cost, working capital, start-up expense, training cost before commissioning the plant and labor cost during construction period.

The equipment transportation cost is estimated to be 49.7 million US$ for all total three phases. The transportation cost in phase 1 is estimated to be 27.1 million US$, while 13.6 million US$ in phase 2 and 9.1 million US$ in phase 3. These differences of cost are caused mainly through the cargo weight by each phases. The cargo weight of each phase is shown as follows.

Phase 1	Phase 2	Phase 3
164,140 F/t	83,580 F/t	52,550 F/t

Among the total equipment transportation costs, the ocean transportation cost to Palembang and inland transportation cost from Palembang to plant-site are as follows.

	Phase 1	Phase 2	Phase 3
Ocean transportation	15.1 million US$	7.9	5.0
Inland transportation	11.9	5.7	4.1

In view of site selection for the on-site facilities, above mentioned transportation cost seems to be reasonable to select Muara Enim at mine mouth.

(1) Working Capital

The working capital is assumed to be two months of the variable costs because storage of major feedstock (coal) is only one week of consumption. Variable cost will be mentioned in Section 13-1-4.

(2) Start-up Expenses

The start-up expenses are assumed to be one month of the variable costs because initial start-up period from coal feed to shipping of fuel methanol is estimated to be less than one month.

(3) Training Cost

Training of employees is assumed to be done both outside and inside Indonesia, the training outside Indonesia is for engineer or foreman classes, and the training period is divided into two cases of six and two months. The six month training is applied to the employees for the plant of which a similar type doesn't exist in Indonesia. For the other remaining plant, the two month training is applied. The number of trainees in six month are 39 people while 58 people in two month. Training inside Indonesia is applied to all persons who are engaged in the plants. The training period is for three months.

Total training cost is estimated at 1.99 million US$, of which 0.9 million US$ for training outside Indonesia and 1.09 million US$ for training inside Indonesia. The operator training will be done in 1999, the previous year of the first phase plant starts operation.

13-1-5 Total Capital Cost and Evaluation

(1) Total Capital Investment

Total capital cost has been estimated at 844 million US$, of which 420 million US$ is for phase 1, 239 million US$ for phase 2 and 185 million US$ for phase 3.

For the purpose of the financial analysis, the estimated capital investment is divided into two main categories; plant and infrastructure. Plant category includes coal transportation facility, coal gasification plant, air separation plant and methanol plant. Infrastructure category consists of power generation plant, storage, utility supply, common buildings, residential facilities and product transportation.

Table 13-1-2 Total Capital Investment

Item	Million US$	(%)
Coal transportation	14.5	(1.7)
Coal gasification	298.2	(35.3)
Air separation	81.4	(9.6)
Methanol	164.5	(19.5)
Power plant	89.2	(10.6)
Tank yard	12.8	(1.5)
Utility	78.0	(9.2)
Common building	11.6	(1.4)
Residential facility	3.5	(0.4)
Product transportation	40.7	(4.8)
Equipment transportation	49.7	(5.9)
Total	844.2	(100)

Table 13-1-3 also shows the detailed capital investment of this Project by categories of plant and infrastructure. The capital investment of plant categories is 595.5 million US$ while 248.7 million US$ in total.

(2) Annual Investment Schedule

Table 13-1-4 shows the annual investment schedule of this Project. The investment is made during the plant construction period from 1996 to 2004 in all three phases.

(3) Evaluation of Estimated Capital Investment

The report of the World Energy Conference published in 1986 shows the investment cost by energy source including the complete new plant, building, engineering and construction costs, know-how, tax and interest during the construction period, and start-up cost are given in Table 13-1-5. This plant capacity is 2000 t/d with commissioning date in 1984. According to this table, total investment cost of lignite based methanol plant which is the same capacity as Banko project, is calculated at around 9 million US$. And specific investment of Banko project is 562.5$/t·y. These calculated costs prove that the estimated figures are justifiable.

Table 13-1-3 Capital Investment of the Project

(Unit : million US$)

(Phase 1)	Plant: Conveyor	Plant: Gasification	Plant: Air Seperation	Plant: Methanol	Plant: Sub Total	Infrastructure: Power Plant	Infrastructure: Tank Yard	Infrastructure: Utility	Infrastructure: Common Building	Infrastructure: Pipeline	Infrastructure: Sub. Total	Total
Purchased Equipment	11.267	87.248	17.104	26.221	141.840	15.992	2.101	10.468	0.000	2.177	30.738	172.578
Purchased Equipment Installation	1.893	32.658	3.277	16.048	53.876	4.187	2.101	2.094	2.367	2.010	12.759	66.635
Instrumentation & Control	0.000	1.657	1.820	3.124	6.601	1.056	0.000	0.473	5.097	0.291	6.917	13.518
Piping	0.000	5.964	0.000	3.171	9.135	2.112	0.316	3.757	0.000	12.561	18.746	27.881
Electrical Equipment & Materials	0.000	6.626	0.910	1.278	8.814	3.677	0.000	8.429	0.000	0.000	12.106	20.920
Building	0.000	18.932	1.553	0.000	20.485	0.000	3.236	10.167	6.252	15.558	35.213	55.698
Land	0.063	0.012	0.000	0.004	0.079	0.002	0.007	0.028	0.010	0.189	0.236	0.315
Total Direct Cost	13.223	153.097	24.664	49.846	240.830	27.026	7.760	35.416	13.726	32.786	116.714	357.544
Engineering & Supervision	1.322	15.310	2.466	4.985	24.083	2.703	0.776	3.542	1.373	3.279	11.671	35.754
Total Direct Cost	14.545	168.407	27.130	54.831	264.913	29.729	8.536	38.958	15.099	36.065	128.385	393.298
Equipment Transportation					20.023						7.035	27.058
Total Investment					284.988						135.367	420.355

(Phase 2)	Plant: Conveyor	Plant: Gasification	Plant: Air Seperation	Plant: Methanol	Plant: Sub Total	Infrastructure: Power Plant	Infrastructure: Tank Yard	Infrastructure: Utility	Infrastructure: Common Building	Infrastructure: Pipeline	Infrastructure: Sub. Total	Total
Purchased Equipment	0.000	58.330	17.104	26.221	101.655	15.992	1.050	4.852	0.000	0.601	22.495	124.150
Purchased Equipment Installation	0.000	10.886	3.277	16.048	30.211	4.187	1.050	0.970	0.000	0.554	6.761	36.972
Instrumentation & Control	0.000	0.994	1.820	3.124	5.938	1.056	0.000	0.328	0.000	0.073	1.457	7.395
Piping	0.000	3.976	0.000	3.171	7.147	2.112	0.158	2.119	0.000	0.000	4.389	11.536
Electrical Equipment & Materials	0.000	4.307	0.910	1.278	6.495	3.677	0.000	8.083	0.000	0.000	11.760	18.255
Building	0.000	0.947	1.553	0.000	2.500	0.000	1.618	1.396	0.000	0.888	3.902	6.402
Land	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Direct Cost	0.000	79.440	24.664	49.842	153.946	27.024	3.876	17.748	0.000	2.116	50.764	204.710
Engineering & Supervision	0.000	7.944	2.466	4.984	15.395	2.702	0.388	1.775	0.000	0.212	5.076	20.471
Total Direct Cost	0.000	87.384	27.130	54.826	169.341	29.726	4.264	19.521	0.000	2.328	55.839	225.179
Equipment Transportation					10.045						3.530	13.575
Total Investment					179.386						59.368	238.754

(Phase 3)	Plant: Conveyor	Plant: Gasification	Plant: Air Seperation	Plant: Methanol	Plant: Sub Total	Infrastructure: Power Plant	Infrastructure: Tank Yard	Infrastructure: Utility	Infrastructure: Common Building	Infrastructure: Pipeline	Infrastructure: Sub. Total	Total
Purchased Equipment	0.000	28.916	17.104	26.221	72.241	15.992	0.000	4.852	0.000	0.601	21.445	93.686
Purchased Equipment Installation	0.000	5.206	3.277	16.048	24.531	4.187	0.000	0.970	0.000	0.554	5.711	30.242
Instrumentation & Control	0.000	0.473	1.820	3.124	5.417	1.056	0.000	0.328	0.000	0.073	1.457	6.874
Piping	0.000	1.988	0.000	3.171	5.159	2.112	0.000	2.119	0.000	0.000	4.231	9.390
Electrical Equipment & Materials	0.000	1.988	0.910	1.278	4.176	3.677	0.000	8.083	0.000	0.000	11.760	15.936
Building	0.000	0.000	1.553	0.000	1.553	0.000	0.000	1.396	0.000	0.888	2.284	3.837
Land	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Direct Cost	0.000	38.571	24.664	49.842	113.077	27.024	0.000	17.748	0.000	2.116	46.888	159.965
Engineering & Supervision	0.000	3.857	2.466	4.984	11.307	2.702	0.000	1.775	0.000	0.212	4.689	15.996
Total Direct Cost	0.000	42.428	27.130	54.826	124.384	29.726	0.000	19.523	0.000	2.328	51.577	175.961
Equipment Transportation					6.738						2.368	9.106
Total Investment					131.124						53.945	185.066

(TOTAL)	Plant: Conveyor	Plant: Gasification	Plant: Air Seperation	Plant: Methanol	Plant: Sub Total	Infrastructure: Power Plant	Infrastructure: Tank Yard	Infrastructure: Utility	Infrastructure: Common Building	Infrastructure: Pipeline	Infrastructure: Sub. Total	Total
Purchased Equipment	11.267	174.494	51.312	78.663	315.736	47.976	3.151	20.172	0.000	3.379	74.678	390.414
Purchased Equipment Installation	1.893	48.750	9.831	48.144	108.618	12.561	3.151	4.034	2.367	3.118	25.231	133.849
Instrumentation & Control	0.000	3.124	5.460	9.372	17.956	3.168	0.000	1.129	5.097	0.437	9.831	27.787
Piping	0.000	11.928	0.000	9.513	21.441	6.336	0.474	7.995	0.000	12.561	27.366	48.807
Electrical Equipment & Materials	0.000	12.921	2.730	3.834	19.485	11.031	0.000	24.595	0.000	0.000	35.626	55.111
Building	0.000	19.879	4.659	0.000	24.538	0.000	4.854	12.959	6.252	17.334	41.399	65.937
Land	0.063	0.012	0.000	0.004	0.079	0.002	0.007	0.028	0.010	0.189	0.236	0.315
Total Direct Cost	13.223	271.107	73.994	149.530	507.854	81.074	11.636	70.911	13.726	37.018	214.365	722.219
Engineering & Supervision	1.322	27.111	7.398	14.953	50.785	8.107	1.164	7.091	1.373	3.702	21.437	72.221
Total Direct Cost	14.545	298.218	81.392	164.483	558.639	89.181	12.800	78.001	15.099	40.720	235.801	794.439
Equipment Transportation					36.806						12.933	49.739
Total Investment					595.498						248.680	844.176

Table 13-1-4 Annual Investment Schedule

[Unit: million US$]

	1996		1997		1998		1999		2000	
	(Plant)	(Infra)	(Plant)	(Infra)	(Plant)	(Infra)	(Plant)	(Infra)	(Plant)	(Infra)
Equipment (Import)	0.000	0.000	34.942	14.386	75.707	31.170	5.824	2.398	25.459	8.421
Equipment (Domestic)	0.000	0.000	14.975	6.166	32.446	13.359	2.496	1.028	10.911	3.609
Transportation (Import)	0.000	0.000	0.000	0.000	11.190	3.931	0.000	0.000	0.000	0.000
Transportation (Domestic)	0.000	0.000	0.000	0.000	8.833	3.104	0.000	0.000	0.000	0.000
Engineering (Import)	16.858	8.170	0.000	0.000	0.000	0.000	0.000	0.000	10.776	3.553
Sub Total (Import)	16.858	8.170	34.942	14.386	86.897	35.101	5.824	2.398	36.236	11.975
Sub Total (Domestic)	0.000	0.000	14.975	6.166	41.279	16.463	2.496	1.028	10.911	3.609
Category C Total	16.858	8.170	49.917	20.552	128.177	51.564	8.320	3.425	47.147	15.584
Building & Instrument	0.000	13.726	0.000	0.000	6.723	34.246	67.638	0.000	0.000	0.000
Land	0.079	0.236	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Engineering (Domestic)	7.225	3.501	0.000	0.000	0.000	0.000	0.000	0.000	4.618	1.523
Category D Total	7.304	17.463	0.000	0.000	6.723	34.246	67.638	0.000	4.618	1.523
Grand Total	24.162	25.633	49.917	20.552	134.900	85.810	75.958	3.425	51.765	17.107

	2001		2002		2003		2004		Total		G. Total
	(Plant)	(Infra)	(Plant)	(Infra)	(Plant)	(Infra)	(Plant)	(Infra)	(Plant)	(Infra)	
Equipment (Import)	55.162	18.246	22.512	9.571	39.582	17.696	3.045	1.361	262.233	103.250	365.483
Equipment (Domestic)	23.641	7.820	9.648	4.102	16.964	7.584	1.305	0.583	112.385	44.250	156.636
Transportation (Import)	5.810	2.042	0.000	0.000	3.733	1.312	0.000	0.000	20.733	7.285	28.018
Transportation (Domestic)	4.235	1.488	0.000	0.000	3.005	1.056	0.000	0.000	16.073	5.648	21.721
Engineering (Import)	0.000	0.000	7.915	3.282	0.000	0.000	0.000	0.000	35.549	15.006	50.555
Sub Total (Import)	60.972	20.288	30.427	12.853	43.315	19.008	3.045	1.361	318.515	125.541	444.056
Sub Total (Domestic)	27.876	9.308	9.648	4.102	19.969	8.640	1.305	0.583	128.458	49.898	178.357
Category C Total	88.848	29.596	40.075	16.955	63.283	27.648	4.350	1.945	446.973	175.439	622.412
Building & Instrument	0.000	0.000	32.711	10.663	0.000	0.000	26.084	7.995	133.156	66.630	199.786
Land	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.079	0.236	0.315
Engineering (Domestic)	0.000	0.000	3.392	1.407	0.000	0.000	0.000	0.000	15.235	6.431	21.666
Category D Total	0.000	0.000	36.103	12.070	0.000	0.000	26.084	7.995	148.470	73.296	221.767
Grand Total	88.848	29.596	76.178	29.025	63.283	27.648	30.434	9.940	595.444	248.736	844.179

Table 13-1-5 Investment Costs for Methanol Plants, Western Europe, Commissioned in 1984; plant capacity 2000 (t/d)

	Natural Gas	Fuel Oil	Hard Coal	Lignite
Total Investment (10^6\$)	120	240	345	365
Specific Investment (\$/t·y)	182	364	520	550

13-2 Operation Cost

13-2-1 Variable Costs

(1) Raw Materials

The unit price of raw materials and raw materials cost at full plant operation on one train are as follows.

	Unit Price		Materials Cost
Coal	14.0	US\$/t	17,326×10^3 \$/y
$CaCO_3$	8.8	US\$/t	310×10^3 \$/y
Scrap	70.0	US\$/t	630×10^3 \$/y

The coal unit price is assumed to be 14.0 US\$/t on the basis of the study on the chapter of coal mining.

(2) Catalysts and Chemicals Costs

The catalyst/chemical cost per one train at full operation is estimated below;

1,360 × 10^3 US\$ per annum.

13-2-2 Fixed Cost

(1) Personnel Cost

The personnel plan of supervisor and operating labor is shown in the Table 13-2-1. The local staff of above manager class (general managers and managers) are to be recruited in 1996. The assistant manager and engineer classes will be hired in 1997. All the staff of 156 persons needed in the first phase plant commissioning are to be hired in 1988. The local staff of this project will be 1992 persons in totally three phases. The 13 expatriate supervisors begin to engage in this project. The number of expatriate supervisors will reach 80 in 1999 and decrease as the project proceeds.

The range of local staff salary is from 2,000 to 14,000 US$ per annum. The average salary of supervisor is 0.1 million US$ per annum. The basic annual salary level of Indonesia for calculating the personnel expenses are shown as follows.

Annual Salary/Wage Levels Assumption

General manager	14,100 US$/y
Manager	4,900
Assistant manager	4,000
Engineer	3,500
Foreman	2,000
Operator	1,400
Supervisor (Expatriate)	100,000

The average salary of supervisor is assumed to be 100,000 US$ per annum. The personnel cost will be studied in Chapter 15.

(2) Depreciation and Amortization, Maintenance, Insurance

These cost items wil be described in Chapter 15 of financial analysis.

Table 13-2-1 The Personnel Plan

	1996									1997									1998								
	Gen	Man	Ass	Eng	Forem	Opera	Sub T	Sup	Total	Gen	Man	Ass	Eng	Forem	Opera	Sub T	Sup	Total	Gen	Man	Ass	Eng	Forem	Opera	Sub T	Sup	Total
Jakarta Office	0	1	0	0	0	0	1	0	1	0	1	1	2	0	0	4	0	4	0	1	1	2	4	2	10	0	10
Palembang Office	0	1	0	0	0	0	1	0	1	0	1	1	2	0	0	4	0	4	0	1	1	2	4	2	10	0	10
Administration	1	6	0	0	0	0	7	0	7	1	6	12	21	0	0	40	0	40	1	6	12	21	30	100	170	0	170
Marketing	1	2	0	0	0	0	3	0	3	1	2	0	4	0	0	7	0	7	1	2	0	4	2	3	12	0	12
Security & Safety	1	3	0	0	0	0	4	0	4	1	3	3	7	0	0	14	0	14	1	3	3	7	10	58	82	0	82
Production Control	1	3	0	0	0	0	4	0	4	1	3	3	7	0	0	14	0	14	1	3	3	7	10	17	41	0	41
Operate (Coal Transportation)	1	1	0	0	0	0	2	0	2	1	1	1	2	0	0	5	0	5	1	1	1	2	8	48	61	0	61
(Gasification)	0	1	0	0	0	0	1	0	1	0	1	2	2	0	0	5	0	5	0	1	2	2	9	69	83	2	85
(Methanol)	0	1	0	0	0	0	1	0	1	0	1	1	4	0	0	6	0	6	0	1	1	4	4	24	34	2	36
(Air Separation)	0	1	0	0	0	0	1	0	1	0	1	1	3	0	0	5	0	5	0	1	1	3	4	16	25	1	26
(Power Genration)	0	1	0	0	0	0	1	0	1	0	1	2	5	0	0	8	0	8	0	1	2	5	8	32	48	2	50
(Common Facilities)	0	1	0	0	0	0	1	0	1	0	1	3	7	0	0	11	0	11	0	1	3	7	12	20	43	3	46
(Sub total)	1	6	0	0	0	0	7	0	7	1	6	10	23	0	0	40	0	40	1	6	10	23	45	209	294	10	304
Maintenance (Mechanical)	1	1	0	0	0	0	2	0	2	1	1	2	8	0	0	12	0	12	1	1	2	8	11	20	43	2	45
(Instrument/Electric)	0	1	0	0	0	0	1	0	1	0	1	2	9	0	0	12	0	12	0	1	2	9	10	14	36	1	37
(Sub Total)	1	2	0	0	0	0	3	0	3	1	2	4	17	0	0	24	0	24	1	2	4	17	21	34	79	3	82
Pipeline & Terminal	1	3	0	0	0	0	4	0	4	1	3	2	3	0	0	9	0	9	1	3	2	3	5	20	34	0	34
Total	7	27	0	0	0	0	34	0	34	7	27	36	86	0	0	156	0	156	7	27	36	86	131	445	732	13	745

	1999									2000									2001								
	Gen	Man	Ass	Eng	Forem	Opera	Sub T	Sup	Total	Gen	Man	Ass	Eng	Forem	Opera	Sub T	Sup	Total	Gen	Man	Ass	Eng	Forem	Opera	Sub T	Sup	Total
Jakarta Office	0	1	1	2	4	2	10	0	10	0	1	1	2	4	2	10	0	10	0	1	1	2	4	2	10	0	10
Palembang Office	0	1	1	2	4	2	10	0	10	0	1	1	2	4	2	10	0	10	0	1	1	2	4	2	10	0	10
Administration	1	6	12	21	30	100	170	0	170	1	6	12	21	30	100	170	0	170	1	6	12	21	30	100	170	0	170
Marketing	1	2	0	4	2	3	12	0	12	1	2	0	4	2	3	12	0	12	1	2	0	4	2	3	12	0	12
Security & Safety	1	3	3	7	10	58	82	0	82	1	3	3	7	10	58	82	0	82	1	3	3	7	10	58	82	0	82
Production Control	1	3	3	7	10	17	41	0	41	1	3	3	7	10	17	41	0	41	1	3	3	7	10	17	41	0	41
Operate (Coal Transportation)	1	1	1	2	8	48	61	4	65	1	1	1	2	8	48	61	4	65	1	1	1	2	8	48	61	0	61
(Gasification)	0	1	2	2	9	69	83	9	92	0	1	2	2	9	69	83	9	92	0	1	2	2	9	69	83	9	92
(Methanol)	0	1	1	4	4	24	34	13	47	0	1	1	4	4	24	34	13	47	0	1	1	4	4	24	34	9	43
(Air Separation)	0	1	1	3	4	16	25	8	33	0	1	1	3	4	16	25	8	33	0	1	1	3	4	16	25	4	29
(Power Genration)	0	1	2	5	8	32	48	13	61	0	1	2	5	8	32	48	13	61	0	1	2	5	8	32	48	9	57
(Common Facilities)	0	1	3	7	12	20	43	12	55	0	1	3	7	12	20	43	12	55	0	1	3	7	12	20	43	4	47
(Sub total)	1	6	10	23	45	209	294	59	353	1	6	10	23	45	209	294	59	353	1	6	10	23	45	209	294	35	329
Maintenance (Mechanical)	1	1	2	8	11	20	43	9	52	1	1	2	8	11	20	43	9	52	1	1	2	8	11	20	43	9	52
(Instrument/Electric)	0	1	2	9	10	14	36	12	48	0	1	2	9	10	14	36	12	48	0	1	2	9	10	14	36	12	48
(Sub Total)	1	2	4	17	21	34	79	21	100	1	2	4	17	21	34	79	21	100	1	2	4	17	21	34	79	21	100
Pipeline & Terminal	1	3	2	3	5	20	34	0	34	1	3	2	3	5	20	34	0	34	1	3	2	3	5	20	34	0	34
Total	7	27	36	86	131	445	732	80	812	7	27	36	86	131	445	732	80	812	7	27	36	86	131	445	732	56	788

	2002									2003									2004								
	Gen	Man	Ass	Eng	Forem	Opera	Sub T	Sup	Total	Gen	Man	Ass	Eng	Forem	Opera	Sub T	Sup	Total	Gen	Man	Ass	Eng	Forem	Opera	Sub T	Sup	Total
Jakarta Office	0	1	1	2	4	2	10	0	10	0	1	1	2	4	2	10	0	10	0	1	1	2	4	2	10	0	10
Palembang Office	0	1	1	2	4	2	10	0	10	0	1	1	2	4	2	10	0	10	0	1	1	2	4	2	10	0	10
Administration	1	6	12	21	30	100	170	0	170	1	6	12	21	30	110	180	0	180	1	6	12	21	30	110	180	0	180
Marketing	1	2	0	4	2	3	12	0	12	1	2	0	4	2	3	12	0	12	1	2	0	4	2	3	12	0	12
Security & Safety	1	3	3	7	10	58	82	0	82	1	3	3	7	10	58	82	0	82	1	3	3	7	10	58	82	0	82
Production Control	1	3	3	7	10	17	41	0	41	1	3	3	7	10	22	46	0	46	1	3	3	7	10	22	46	0	46
Operate (Coal Transportation)	1	1	1	2	8	48	61	0	61	1	1	1	2	8	48	61	0	61	1	1	1	2	8	48	61	0	61
(Gasification)	0	1	2	2	9	69	83	5	88	0	1	3	3	14	98	119	5	124	0	1	3	3	14	98	119	5	124
(Methanol)	0	1	1	4	4	24	34	5	39	0	1	2	4	8	48	63	5	68	0	1	2	4	8	48	63	5	68
(Air Separation)	0	1	1	3	4	16	25	4	29	0	1	1	3	4	20	29	4	33	0	1	1	3	4	20	29	4	33
(Power Genration)	0	1	2	5	8	32	48	5	53	0	1	2	5	16	64	88	5	93	0	1	2	5	16	64	88	5	93
(Common Facilities)	0	1	3	7	12	20	43	4	47	0	1	3	7	12	28	51	4	55	0	1	3	7	12	28	51	4	55
(Sub total)	1	6	10	23	45	209	294	23	317	1	6	12	24	62	306	411	23	434	1	6	12	24	62	306	411	23	434
Maintenance (Mechanical)	1	1	2	8	11	20	43	5	48	1	1	2	8	12	23	47	5	52	1	1	2	8	12	23	47	5	52
(Instrument/Electric)	0	1	2	9	10	14	36	8	44	0	1	2	9	12	18	42	8	50	0	1	2	9	12	18	42	8	50
(Sub Total)	1	2	4	17	21	34	79	13	92	1	2	4	17	24	41	89	13	102	1	2	4	17	24	41	89	13	102
Pipeline & Terminal	1	3	2	3	5	20	34	0	34	1	3	2	3	5	20	34	0	34	1	3	2	3	5	20	34	0	34
Total	7	27	36	86	131	445	732	36	768	7	27	38	87	151	564	874	36	910	7	27	38	87	151	564	874	36	910

	2005									2006								
	Gen	Man	Ass	Eng	Forem	Opera	Sub T	Sup	Total	Gen	Man	Ass	Eng	Forem	Opera	Sub T	Sup	Total
Jakarta Office	0	1	1	2	4	2	10	0	10	0	1	1	2	4	2	10	0	10
Palembang Office	0	1	1	2	4	2	10	0	10	0	1	1	2	4	2	10	0	10
Administration	1	6	12	21	30	120	190	0	190	1	6	12	21	30	120	190	0	190
Marketing	1	2	0	4	2	3	12	0	12	1	2	0	4	2	3	12	0	12
Security & Safety	1	3	3	7	10	58	82	0	82	1	3	3	7	10	58	82	0	82
Production Control	1	3	3	7	10	27	51	0	51	1	3	3	7	10	27	51	0	51
Operate (Coal Transportation)	1	1	1	2	8	48	61	0	61	1	1	1	2	8	48	61	0	61
(Gasification)	0	1	4	4	19	133	161	5	166	0	1	4	4	19	133	161	0	161
(Methanol)	0	1	3	4	12	72	92	5	97	0	1	3	4	12	72	92	0	92
(Air Separation)	0	1	1	3	4	24	33	4	37	0	1	1	3	4	24	33	0	33
(Power Genration)	0	1	2	5	24	96	128	5	133	0	1	2	5	24	96	128	0	128
(Common Facilities)	0	1	3	7	12	28	51	4	55	0	1	3	7	12	28	51	0	51
(Sub total)	1	6	14	25	79	401	526	23	549	1	6	14	25	79	401	526	0	526
Maintenance (Mechanical)	1	1	2	8	13	26	51	5	56	1	1	2	8	13	26	51	0	51
(Instrument/Electric)	0	1	2	9	14	20	46	8	54	0	1	2	9	14	20	46	0	46
(Sub Total)	1	2	4	17	27	46	97	13	110	1	2	4	17	27	46	97	0	97
Pipeline & Terminal	1	3	2	3	5	20	34	0	34	1	3	2	3	5	20	34	0	34
Total	7	27	40	88	171	679	1012	36	1048	7	27	40	88	171	679	1012	0	1012

Gen: General Manager
Man: Manager
Ass: Assistant Manager
Eng: Engineer
Forem: Foreman
Opera: Operator
Sup: Supervisor

14. ENTITY AND FINANCIAL SCHEME

14-1 THE ENTITY'S OPERATIONAL ACTIVITIES

Based on the positive results of financial and economic feasibility studies on the production of fuel methanol from coal, an entity should be founded and take full responsibilities on:

(1) Design and construction of the facilities, including finance

(2) Production of fuel methanol

(3) Distribution of fuel methanol to users at reasonable price

As (1) above takes a time of more than 10 years and requires quite a capital of $844 million excluding (3) above, it is recommended that the entity should be founded at an appropriate time (see the project schedule) with Indonesia's national consensus, taking into consideration of technological and capital transfer from overseas.

14-2 INDONESIA'S NATIONAL CONSENSUS

Fuel methanol is a new product from coal and is regarded as a new alternative to petroleum. As this methanol production and distribution is a very new one in the industry, any governmental ministry or agency has not been authorized to spread the use of fuel methanol in Indonesia. Therefore it is uncertain at present time which governmental ministry or agency in Indonesia is responsible for introduction of fuel methanol. It is proposed that the coordination among governmental ministries and agencies should be made by BAKOREN, which is expected to define each ministry and agency responsibility in the Project, because many projects concerning energy have been implemented on the basis of coordination of BAKOREN in Indonesia. As a supervising agency of pilot test and the overall project, we assume the Ministry of Mine and Energy and the Ministry of Communication shall be appropriate agent which will play an important role.

14-3 CHARTERS OF THE ENTITY

The entity should incorporate the following characteristics into its charters.

(1) Organizational Functions

i) Design and construction of the facilities

ii) Development work of building distribution channels

iii) Procurement of concessionary terms of long term financing especially during the initial constructing and operating period

iv) Implementation of Indonesia's energy policy to promote alternative energies development

(2) Principles of Operation

i) Efficiency

ii) Managerial independence except for accords with Indonesian national energy policy

iii) Financial independence

(3) Type of Entity

The following types of entity should be studied:

i) State enterprise

ii) International joint venture with private sector of oil importing countries

iii) Private enterprise on the basis of BOT (Build, Operate and Transfer)

To choose the best out of the above, it is recommended that international joint venture with majority owned by the Republic of Indonesia should be established.

14-4 FINANCIAL SCHEME

(1) Equity

The proposed entity is suggested to be owned by international joint venture, namely jointly owned by Indonesia's public sector and international private sector with ownership of, for example, 51% and 49% respectively.

(2) Debt

The following assumptions will be set up on the project's financial scheme; the loan of low interest rate of longer repayment period and of limited recourse on the basis of BOT. Then the followings are assumed.

1) Plant

a) 60% of the debt for the use of plant expenditure is from the Export-Import Bank of Japan

b) 40% of the debt for the use of plant expenditure is from Commercial Banks

2) Infrastructure

Debt for the use of infrastructure expenditure is from OECF

For further details such as interest rate, see the following chapter.

15. FINANCIAL ANALYSIS

Financial viability of the Project can be evaluated by profit and loss statement, cash flow analysis together with Financial Internal Rate of Return analysis (hereafter referred to as FIRR).

15-1 ESTABLISHMENT OF PRINCIPAL FACTORS FOR FINANCIAL ANALYSIS

15-1-1 Production Schedule

(1) Annual Production : 1,500,000 t of Methanol

Note: The details of annual production schedule are shown in Table 9-2-4

(2) Plant Construction Period:

1) First Train 1996 - 1999 (4 years)

where 12% completion by the end of 1996
29% completion by the end of 1997
81% completion by the end of 1998
100% completion by the end of 1999

2) Second Train 2000 - 2002 (3 years)

where 29% completion by the end of 2000
81% completion by the end of 2001
100% completion by the end of 2002

3) Third Train 2002 - 2004 (3 years)

where 29% completion by the end of 2002
81% completion by the end of 2003
100% completion by the end of 2004

Note: The details of the plant construction schedule are studied in Table 9-2-4.

(3) Project Life

1) First Train 2000 - 2024 (25 years)

where 70% of full operation in 2000
90% of full operation in 2001
100% of full operation in 2002 and after

2) Second Train 2003 - 2024 (22 years)

where 70% of full operation in 2003
90% of full operation in 2004
100% of full operation in 2005 and after

3) Third Train 2005 - 2024 (20 years)

where 70% of full operation in 2005
90% of full operation in 2006
100% of full operation in 2007 and after

Note: Project life of 25 years as total is assessed taking into account the following;

i) Coal resources are abundant.

ii) Product specification required in the market would not be changed because of its nature of fundamental product among energies.

iii) Mechanical life of facilities is estimated to be longer than 25 years.

(4) Annual Operation Hours: 8000 h/y at full operation

Note: All of the facilities are designed based on 8,000 h/y.

15-1-2 Finance

(1) Debt/Equity Ratio : Debt 75%
Equity 25%

Note: Ratio above is based on past experiences of large scale projects.

(2) Currency : U.S. Dollars

Note: U.S. Dollar is selected, because technical and economic data are available only in U.S. Dollar term.

(3) Debt Repayment Schedule

1) Long Term Debt

i)	Plant	9 year-repayment term with a grace period for each construction period
ii)	Infrastructure	20 year-repayment term with a grace period for 10 years

2) Short Term Debt

Each yearly repayment is due the following year.

(4) Interest:

1) Long Term Interest

i)	60% of Plant	7.5% Japanese Long Term Prime Rate - 0.2% (OECD code of export financing) = 5.5% plus conversion premium to offshore dollar (2%)
ii)	40% of Plant	9.2% Japanese Long Term Prime Rate + 1.5% (country risk and project risk premium) = 7.2% plus conversion premium to offshore dollar (2%)
iii)	Infrastructure	5.0% OECF rate (3.0%) plus conversion premium to offshore dollar (2%)

2) Short Term Interest 13.0%

Fund (8% as of 6 month LIBOR) plus country risk and project risk premium (1.5%) plus conversion premium (3.5%)

Note: 1) LIBOR = London Interbank Offering Rate

2) IDCP (Interest during construction period) is amortized for 10 years.

3) Rates above are indicative as of November, 1988.

15-1-3 Price and Costs

(1) Sales Price of Methanol : US$175/t

Note: Sales price of methanol is assessed on the basis of assumption used in Section 5-5 (market study). The financial and economic feasibilities of the Project would be presented mainly at the sales price of US$175/t.

(2) Capital Investment Costs (Unit: US$1,000) :

1) Fixed Capital Investment

	First Train	Second Train	Third Train
Coal Conveyer	14,545	0	0
Coal Gasification	168,407	87,383	42,428
Air Separation	27,130	27,131	27,131
Gas Treatment/Methanol	54,831	54,826	54,826
Power Generation	29,729	29,726	29,726
Tank Yard	8,536	4,264	0
Utility	38,958	19,521	19,523
Common Facilities	15,099	0	0
Pipeline	36,065	2,328	2,328
Equipment Transportation	27,058	13,575	9,106
Total	420,358	238,754	185,068

Note: The details of fixed capital investment are studied in Chapter 13

2) Working Capital : US$3,371 × 10^3/train

Note: Working capital is assumed to be two months of variable costs, because large amount of raw materials is not required.

3) Start-up Expense : US$1,685 × 10^3/train

Note: Initial start-up operation will need four weeks from the charge of coal till the shipping of the product.
Therefore, variable costs for one month (four weeks) are regarded as start-up expense.

4) Training Cost : US$1,987 × 10^3 for all trains

Note: The details of training cost are discussed in section 13-1.

On the basis of the plant construction period and the capital investment costs mentioned above, the investment schedule for the Project is summarized as follows.

Investment Schedule

(Unit: US$1,000)

First Train

	1996	1997	1998	1999
Fixed Capital	49,795	70,469	220,710	79,383
Working Capital	0	0	0	3,371
Start-up Expense	0	0	0	1,685

Second Train

	2000	2001	2002
Fixed Capital	68,872	118,444	51,441
Working Capital	0	0	3,371
Start-up Expense	0	0	1,685

Third Train

	2002	2003	2004
Fixed Capital	53,762	90,931	40,374
Working Capital	0	0	3,371
Start-up Expense	0	0	1,685

(3) *Annual Expense*

1) Fixed Costs

i) *Depreciation and Amortization*

a) Facilities with a beneficial life exceeding eight years

10% of depreciation rate (declining balance)

b) Buildings and lands

5% of depreciable value (straight-line over 20 years)

Note: Above is based on the Indonesian law.

ii) *Maintenance (incurred from the first year of operation)*

1.5% of capital investment (Unit: US$1,000)

a) First Train 393,300 × 1.5% = 5,899/y

b) Second Train 225,179 × 1.5% = 3,378/y

c) Third Train 175,962 × 1.5% = 2,639/y

Note: Initial spare parts are included in capital investment. Additional costs for spare parts and maintenance fee are assumed to be 1.5% of capital investment.

iii) Insurance (incurred from the first year of operation)

1.0% of capital investment (Unit: US$1,000)

a) First Train 393,300 × 1.0% = 3,933/y

b) Second Train 225,179 × 1.0% = 2,252/y

c) Third Train 175,962 × 1.0% = 1,760/y

Note: Above is based on the international standards of insurance for processing plants.

iv) Personnel Expense

(Unit: US$1,000)

	1996	1997	1998	1999	2000	2001
Expatriate	0	0	1,300	8,000	8,000	5,600
Local	231	676	1,561	1,561	1,561	1,561

	2002	2003	2004	2005	2006	2034
Expatriate	3,600	3,600	3,600	3,600	0	0
Local	1,561	1,779	1,779	1,992	1,992	1,992

Expatriates decrease in number as the Project proceeds.

Note: The details of personnel plan are discussed in Section 13-2.

2) Variable Costs

i) Raw Materials

Coal: US$14.0/t × 154.7 t/h × 8,000 h = US$ 17,326,000

$CaCO_3$: US$8.8/t × 4.4 t/h × 8,000 h = US$ 310,000

Scrap: US$70.0/t × 1.13 t/h × 8,000 h = US$ 633,000

Note: The details are studied in Section 6-4 and 13-2.

ii) Catalysts and Chemicals

US$1,360,000/y/Train (full operation year)

Note: The details are studied in Section 13-2.

iii) Plant Overhead Costs

100% of the personnel expenses of the first operational year

Note: The proposed organization of the Project (see Section 10-3) includes functions as headquarters and branch offices. Therefore plant overhead costs except personnel expense are assumed as above.

iv) Administration Expenses

a) First Construction Year
25% of the personnel expenses of the first operational year

b) Second Construction Year
25% of the personnel expenses of the first operational year

c) Third and Fourth Construction Years
50% of the personnel expenses of the first operational year

Note: Miscellaneous expenses for administration, except personnel expenses, are based on past experiences.

15-2 FINANCIAL ANALYSIS

15-2-1 Financial Internal Rate of Return

The Financial Internal Rate of Return (FIRR) of the Project (Base case assumption: Coal price = $14/ton, Methanol price = $175/ton, Capital expenditure = $844.18 million) is shown on Cash Flow Statement (Table 15-2-1). The FIRR of this Project is 11.90%. The weighted average of financial cost calculated based on the assumptions of Section 15-1 is 10.83% per annum. Therefore the Project is marginally viable.
The Pro Forma profit and loss statement based on the assumption in Section 15-1 is shown in Table 15-2-2. According to the statement, after four continuous deficit years, the Project starts to record profit from the 5th year. The cumulative deficit is eliminated in the 8th year.

15-2-2 Sensitivity Analysis

Coal price, methanol price and capital expenditure are crucial factors for the sensitivity of the project. Cases for sensitivity analysis are shown in Fig. 15-2-1.

Results are summarized in Table 15-2-3. The sensitivities of methanol price, coal price and capital expenditure to FIRR is shown in Fig. 15-2-2. The results show methanol price is the most sensitive to FIRR, capital expenditure has the second and coal price has the third.

Since FIRR of Case 5, 10.03%, is lower than the financial cost, Case 5 assumed by 20% increase of capital expenditure is judged not feasible at all. On the other hand, Case 6, 20% decrease of capital expenditure from Base Case, is attractive with FIRR of 14.34, far higher than financial cost. The decrease of construction cost by 20%, however, is not realistic. Therefore the degree of the decrease would be a key to increase FIRR. Although Case 1 and 4 of which FIRRs are 10.86% and 10.87% respectively, are slightly higher than the financial cost, these cases are not attractive projects for this type of risk taking with research and development components. The remaining cases, Case 2 is the case where the sales price of methanol is increased to $185 and the Case 3 is the case where the coal price is decreased to $10. These are viable for their higher FIRR (12.89% and 12.88% respectively), comparing with the financial cost of 10.834%. However, coal price and methanol price are not factors which can be changed with discretions on the part of the Project sponsor. Therefore, they (Cases 2 and 3) are considered the cases optimistically assumed.

To make judgement as to the Project attractive in terms of FIRR in comparison with the financial cost, the degree how much there would be the change of coal price, methanol price, capital expenditure should be further studied. In addition to this, the change in interest rate, which is very difficult to forecast, would have much effect to this sensitivity analysis for viability. For example, the interest rate would go up by 1% for loans to plant and infrastructure and short term borrowing, weighted average financial cost shall be 11.92%. In this case, Case 1, 4 and 5 shall become unacceptable projects and Cases 2 and 3 as well as Base Case become much more marginally viable.

Table 15-2-1 Cash Flow

(Unit: $1000)
(FIRR: 11.90%)

Year	OP Year	Invest-ment	Profit Before Tax	Depreciation/ Amortization	Interest Paid	Cash Flow	DCF
1996		51,163	(2,803)	0	182	(53,784)	(48,066)
1997		75,216	(3,669)	0	603	(78,282)	(62,521)
1998		233,718	(9,073)	0	1,431	(241,360)	(172,270)
1999		108,587	(17,500)	0	3,159	(122,928)	(78,411)
2000	1	70,834	(52,094)	39,863	30,786	(52,279)	(29,801)
2001	2	125,853	(35,189)	36,993	32,725	(91,324)	(46,524)
2002	3	124,577	(24,306)	34,410	33,213	(81,260)	(36,995)
2003	4	96,568	(17,340)	55,872	46,446	(11,590)	(4,716)
2004	5	55,197	4,314	51,888	42,352	43,357	15,765
2005	6	0	35,856	66,724	45,658	148,238	48,170
2006	7	0	69,044	62,034	34,333	165,411	48,035
2007	8	0	88,432	57,814	25,954	172,200	44,690
2008	9	0	97,022	54,016	21,161	172,199	39,938
2009	10	0	104,163	50,597	17,439	172,199	35,692
2010	11	0	114,450	43,025	14,725	172,199	31,897
2011	12	0	119,995	40,256	11,948	172,199	28,506
2012	13	0	124,640	37,764	9,795	172,199	25,475
2013	14	0	130,799	33,134	8,266	172,199	22,766
2014	15	0	133,846	31,115	7,238	172,199	20,346
2015	16	0	138,050	27,439	6,710	172,199	18,183
2016	17	0	140,212	25,804	6,183	172,199	16,250
2017	18	0	142,211	24,332	5,656	172,199	14,522
2018	19	0	144,062	23,008	5,129	172,199	12,978
2019	20	0	145,782	21,816	4,601	172,199	11,598
2020	21	0	154,050	14,075	4,074	172,199	10,365
2021	22	0	155,543	13,109	3,547	172,199	9,263
2022	23	0	156,939	12,240	3,020	172,199	8,278
2023	24	0	160,724	8,982	2,492	172,199	7,398
2024	25	0	161,956	8,279	1,965	239,325	9,189
Total		941,713	2,360,116	874,589	430,791	2,790,908	(0)

Table 15-2-2 Profit and Loss Statement

(Unit: $1000)

Year	OP Year	Revenue	Variable Cost	Fixed Cost	Interest Paid	Total	Before Tax	Tax	Not Profit	Retained Earning
2000	1	61,250	13,740	68,817	30,786	(52,093)	(52,093)	0	(52,093)	(85,139)
2001	2	78,750	17,666	63,547	32,725	(35,188)	(35,188)	0	(35,188)	(120,327)
2002	3	87500	19,629	58,964	33,213	(24,306)	(24,306)	0	(24,306)	(144,633)
2003	4	148,750	33,369	86,274	46,446	(17,339)	(17,339)	0	(17,339)	(161,972)
2004	5	166,250	37,295	82,290	42,352	4,313	4,313	0	4,313	(157,659)
2005	6	236,250	52,998	101,738	45,658	35,856	35,856	0	35,856	(121,803)
2006	7	253,750	56,924	93,448	34,333	69,045	69,045	0	69,045	(52,758)
2007	8	262,500	58,887	89,228	25,954	88,431	88,431	28,224	60,207	7,449
2008	9	262,500	58,887	85,430	21,161	97,022	97,022	33,958	63,064	70,513
2009	10	262,500	58,887	82,011	17,439	104,163	104,163	36,457	67,706	138,219
2010	11	262,500	58,887	74,439	14,725	114,449	114,449	40,057	74,392	212,611
2011	12	262,500	58,887	71,670	11,948	119,995	119,995	41,998	77,997	290,608
2012	13	262,500	58,887	69,178	9,795	124,640	124,640	43,624	81,016	371,624
2013	14	262,500	58,887	64,548	8,266	130,799	130,799	45,780	85,019	456,643
2014	15	262,500	58,887	62,529	7,238	133,846	133,846	46,846	87,000	543,643
2015	16	262,500	58,887	58,853	6,710	138,050	138,050	48,317	89,733	633,376
2016	17	262,500	58,887	57,218	6,183	140,212	140,212	49,074	91,138	724,514
2017	18	262,500	58,887	55,746	5,656	142,211	142,211	49,774	92,437	816,951
2018	19	262,500	58,887	54,422	5,129	144,062	144,062	50,422	93,640	910,591
2019	20	262,500	58,887	53,230	4,601	145,782	145,782	51,024	94,758	1,005,349
2020	21	262,500	58,887	45,489	4,074	154,050	154,050	53,918	100,132	1,105,481
2021	22	262,500	58,887	44,523	3,547	155,543	155,543	54,440	101,103	1,206,584
2022	23	262,500	58,887	43,654	3,020	156,939	156,939	54,929	102,010	1,308,594
2023	24	262,500	58,887	40,396	2,492	160,725	160,725	56,254	104,471	1,413,065
2024	25	262,500	58,887	39,692	1,965	161,956	161,956	56,684	105,272	1,518,337
Total		5,757,500	1,291,587	1,647,334	425,416	2,393,163	2,393,163	841,780	1,551,383	11,889,861

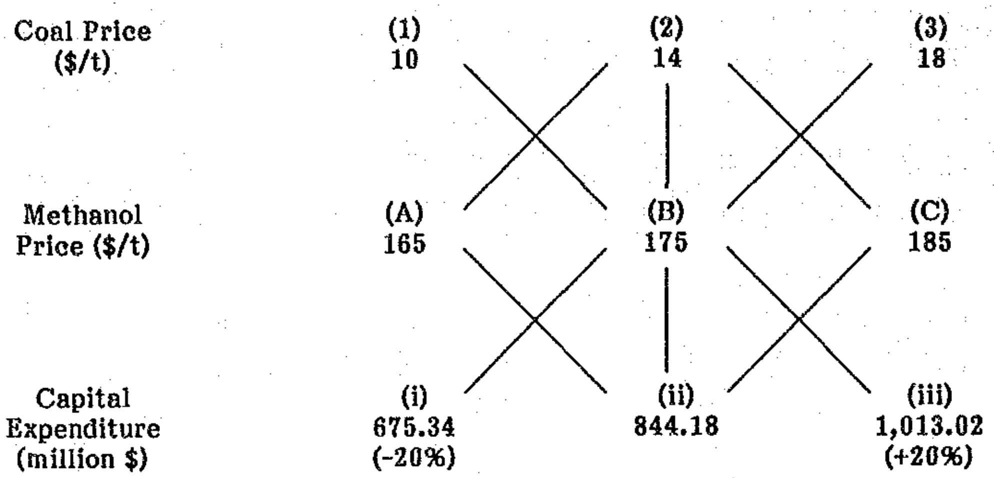
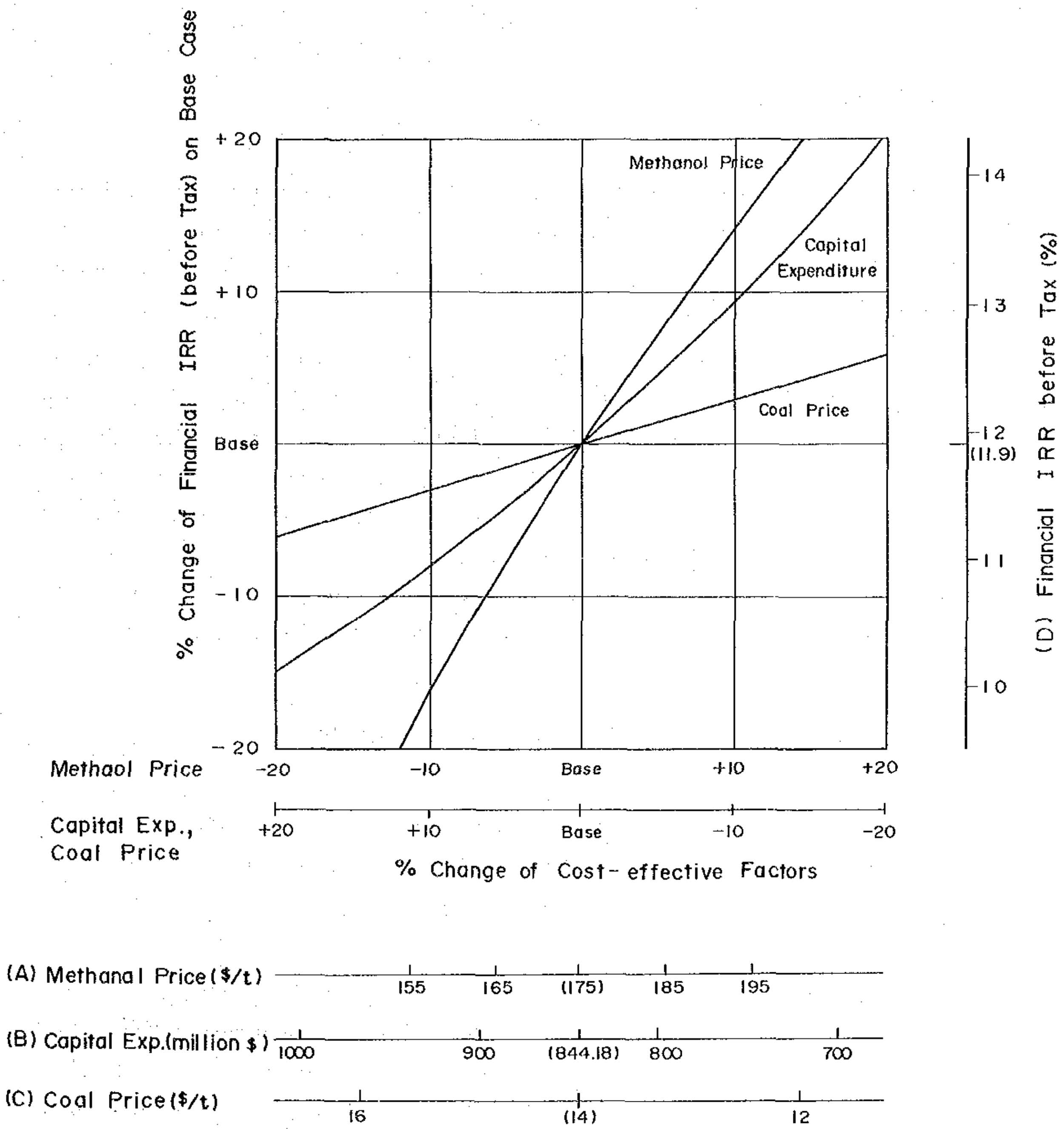


Fig. 15-2-1 Cases for Sensitivity Analysis

Table 15-2-3 Results of Sensitivity Analysis

		FIRR	First year to record profit since the operation	First year to climinate accumulated loss since the operation
Base Case	(2) - (B) - (ii)	11.90	5th	8th
Case 1	(2) - (A) - (ii)	10.86	6th	10th
Case 2	(2) - (C) - (ii)	12.89	5th	7th
Case 3	(1) - (B) - (ii)	12.88	5th	7th
Case 4	(3) - (B) - (ii)	10.87	6th	10th
Case 5	(2) - (B) - (iii)	10.03	6th	11th
Case 6	(2) - (B) - (i)	14.34	4th	7th
Financial Cost		10.83		



Note: (A), (B), (C) and (D) are absolute value of each factor.

Fig. 15-2-2 Financial IRR Sensitivity of Cost-effective Factors

15-3 FINANCIAL VIABILITY OF FUEL METHANOL

15-3-1 Profitability of Fuel Methanol Project

The Project of fuel methanol production (1,500,000 t/y) from Banko coal was evaluated in terms of financial viability and profitability with the resulting showing 11.9% of FIRR before tax in Base Case when the sales price of fuel methanol at Palembang is assumed at 175$/kg.

As a result of financial study, this Project is appraised as viable in case of oil price higher than 30$/bbl, because the methanol price which is linked with the oil price was found to be dominant factor for the profitability of the Project as described in Section 15-2. Fig. 15-3-1 shows the shifts of price of crude oil (FOB, OPEC), methanol and urea (CIF Japan). In case of oil price higher than 30$/bbl, methanol price (CIF Japan) is always higher than 180$/t.
The possibility of the viability for this fuel methanol Project will be emphasized, because the price of non exportable Banko coal is not affected by oil price hike.

15-3-2 Competitiveness of Fuel Methanol against Oil Products

The relative value and competitiveness of fuel methanol for transportation use were roughly estimated in terms of economic aspects compared with commercially used fuel such as gasoline and diesel oil supposing that produced fuel methanol in Banko area is imported to Japan.

By using the fuel efficiency (kcal/km) and the price ($/ℓ) of fuel methanol, gasoline and diesel oil, the fuel costs equivalent to 1 litre of fuel methanol were estimated on the assumption that the imported fuel methanol is delivered through the existing supply system in Japan. The sales price of fuel methanol in Japan was estimated as shown in Table 15-3-1.

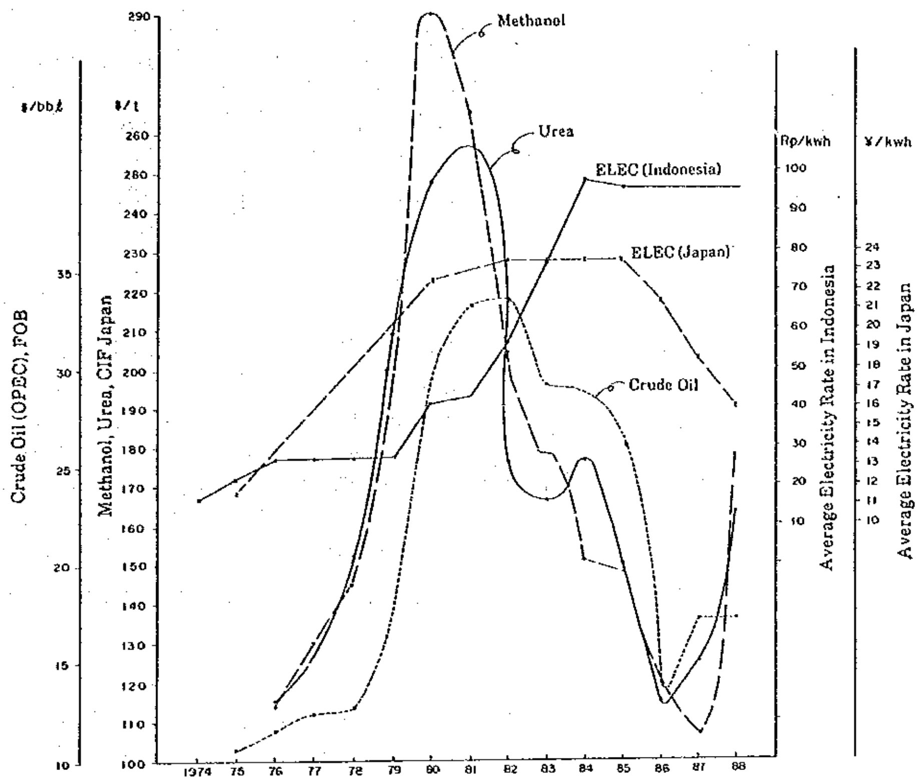


Fig. 15-3-1 Shifts in Price of Crude Oil (FOB OPEC), Methanol and Urea (CIF Japan), and Electricity Rate in Indonesia and Japan

Table 15-3-1 Sales Price of Methanol in Japan

Methanol Price at Palembang	:	0.139 $/ℓ (175 $/t)
Freight (Palembang - Japan)	:	0.008 $/ℓ
Delivery Costs in Japan	:	0.075 $/ℓ
Total (Sales price in Japan)	:	0.222 $/ℓ

Note: Freight and delivery costs are cited from Interim Report, May 1986

The price of oil products were set by retail during last five years as shown in Table 15-3-2.

Table 15-3-2 Sales Price of Oil Products in Japan

Year	Gasoline	Diesel Oil
1983	151.8 ¥/ℓ	108.2 ¥/ℓ
1984	145.7	104.2
1985	140.8	100.3
1986	123.4	84.1
1987	120.7	72.5
Average (incl. Tax)	136.5 ¥/ℓ	93.9 ¥/ℓ
(incl. Tax)	0.683 $/ℓ	0.470 $/ℓ
(before Tax)	0.414 $/ℓ	0.348 $/ℓ

Note: Average exchange rate during last five years is 205 ¥/$.

The results are summerized in Table 15-3-3 and mean that economic viability of fuel methanol as transportation fuel is superior to that of gasoline but inferior to that of diesel oil.

Table 15-3-3 Economic Comparison of Transportation Fuels

	L.H.V kcal/ℓ	Consump-tion Rate (kcal/km)	Retail Price ($/ℓ)	Required Volumetric Ratio (Equiv. to 1 ℓ of Methanol)	Fuel Cost ($/ℓ-methanol equiv.)
Methanol	3,800	253	B. Tax 0.222	1.0	0.222
Gasoline	7,950	335	B. Tax 0.414 (A. Tax 0.683)	0.63[1)]	B. Tax 0.261 A. Tax 0.430)
Diesel Oil	8,650	253	B. Tax 0.348 (A. Tax 0.470)	0.44[2)]	B. Tax 0.153 (A. Tax 0.207)

Note:

1) $$\text{Req. Vol. Ratio} = \frac{\text{Gasoline } (\ell/\text{km})}{\text{Methanol } (\ell/\text{km})} = \frac{335 \text{ (kcal/km)}}{7{,}950 \text{ (kcal/}\ell)} \bigg/ \frac{253 \text{ (kcal/km)}}{3{,}800 \text{ (kcal/}\ell)}$$

$$= 0.63 \; \ell\text{ - gasoline}/\ell\text{ - methanol}$$

2) $$\text{Req. Vol. Ratio} = \frac{\text{Diesel Oil } (\ell/\text{km})}{\text{Methanol } (\ell/\text{km})} = \frac{253 \text{ (kcal/km)}}{8{,}650 \text{ (kcal/}\ell)} \bigg/ \frac{253 \text{ (kcal/km)}}{3{,}800 \text{ (kcal/}\ell)}$$

$$= 0.44 \; \ell\text{ - diesel oil}/\ell\text{ - methanol}$$

In addition to the economic aspects, fuel methanol should be evaluated as clean energy for environmental problems. Environmental pollution caused mainly by exhaused gas emission from automobiles is one of the urban problems especially in Japan where the NOx emission standard (0.06 ppm) has not yet been cleared. Among all transportation fuels, diesel fuel is supposed to be the main source of NOx emission, and in order to establish an effective technology to clear the standard, methanol engine is under development to put it into practice in Japan.

16. ECONOMIC EVALUATION

16-1 ECONOMIC INTERNAL RATE OF RETURN

16-1-1 Methodology and Assumptions

(1) Concept and Methodology

The economic appraisal is undertaken to ascertain the overall impact of the project on a country's economy. In the financial analysis, as seen in the previous chapter, the viewpoint is that of a project sponsor. In the economic analysis it is that of a government decision maker concerned with broader economic development objectives of the country. It is here where the linkage of the project with the overall economy is of crucial importance. An internal rate of return (IRR) is defined as that discount rate which reduces the net present value of a series of different cost and benefit streams to zero. The IRR is an important test for assessing the quality of a project in financial and economic terms and is widely used by decision makers in governments, financial institutions and industry to determine whether a project is financially and economically viable. While the financial IRR (FIRR) measures whether a project is likely to be profitable enough to cover the average cost of capital of lenders and sponsors, the economic IRR (EIRR) indicates whether the project is efficiently using the country's resources, i.e., whether its EIRR is higher than the opportunity cost of capital. The difference between financial analysis and economic analysis is shown in Table 16-1-1.

(2) Procedure

Standard procedure for economic cost benefit analysis is as below.

1) Preparatory Work -- Forecasting

Both input and output with the implementation of the Project will be forecast and be listed up through the whole project life.

Table 16-1-1 Economic and Financial Analysis
- A comparison -

	Financial Cost Benefit Analysis	Economic Cost Benefit Analysis
i) Standpoint	Private sector	Government (Local public bodies)
ii) Purpose	Profit maximization	Optimum economic growth (Optimal distribution of resources)
iii) Price adopted	Market price	Shadow price = Opportunity cost of resources used
iv) Result	Absolute estimation	Relative estimation
v) Linkage	Micro-based project has consistency with macro-based governmental economic development project	

2) Cost Calculation

a) All input will be classified to tradeable goods, labor force and untradeable goods.

b) Tradeable goods will be estimated by "border prices"

c) "Standard conversion factor" (SCF) will be calculated for the assessment of labor cost and untradeable good.

$$SCF = \frac{M + X}{M (1 + t) \times (1 + s - tx)}$$

where M: Total import amount (CIF)
X: Total export amount (FOB)
t: Weighted average value of import duty
s: Weighted average value of export subsidey
tx: Weighted average value of export duty

d) Labor force will be classified into skilled labor and unskilled labor.

e) Land cost will be firstly estimated as opportunity cost. Then it will be converted into international market price by multiplying "SCF".

3) Benefit Calculation

a) Specify physical output

In case output can not be estimated, accountable output must be substituted in accordance with the "with and without" principle.

b) Divide output into tradeable goods and untradeable ones. Tradeable goods will be estimated by "border price" and untradeable ones will be broken down as far as possible.

4) Estimation of Economic Profitability

a) In order to carry out economic cost benefit appraisal, minimum acceptable EIRR for a project should be decided by the opportunity cost of a government expenditure.

b) In order to assess the economic efficiency of a project, arrange cash flow table and calculate EIRR using discount cash flow method.

c) Implementation of sensitivity analysis.

(3) Assumptions

Assumptions and preconditions adopted for the calculation of EIRR of the Project are as follows;

1) Conversion Factors Adopted

Conversion factors adopted for the Project are offered by the World Bank as below.

a) Standard conversion factor = 0.93
(* Calculated using the data obtained in Indonesia - see Table 16-1-2)

b) Conversion factor for unskilled labor cost = 0.65

c) Conversion factor for skilled labor cost = 1

d) Conversion factor for local materials = 0.80

where conversion factor

$$= \frac{\text{Border price of input in local currency}}{\text{Domestic price of input in local currency}}$$

(The World Bank, August 1, 1988)

2) Labor Cost Shadowpriced

(Principally in accordance with information from the World Bank)

General Manager	=	1
Manager	=	1
Assistant manager	=	1
Engineer	=	1
Foreman	=	0.9
Operator	=	0.65
Foreign technical expert	=	1

3) Operator Training Cost

Overseas training cost is included, while the cost required for domestic training is excluded as a transfer item from the economic analysis point of view.

4) Cost other than mentioned above are based on the data adopted in the financial analysis.

Table 16-1-2 Shadow Exchange Rate in Indonesia

(Unit: Million US$)

	1982	1983	1984	1985	1986	Average
Export: X (CIF)	22,328.3	21,145.9	21,887.8	18,586.7	14,805.0	19,750.7
Import: M (FOB)	16,858.9	16,351.7	13,882.1	10,259.1	10,718.4	13,614.0
Import duty: Mt	521.9	557.0	530.1	607.2	960.1	635.3
Export duty: Xtx	82.5	104.0	91.0	50.5	78.8	81.3
Subsidy: Xs	1,315.4	1,388.4	1,784.6	2,590.4	2,639.7	1,943.7

Shadow Exchange Rate

$$= \frac{M(1+t) + X(1+s-tx)}{M+X} = \frac{M + Mt + X + Xs - Xtx}{M+X}$$

$$= \frac{13{,}614.0 + 635.3 + 19{,}750.7 + 1{,}943.7 - 81.36}{13{,}614.0 + 19{,}750.7}$$

$$= 1.075$$

16-1-2 Result of Calculation

(1) Data for Economic Internal Rate of Return

1) Capital Cost Streams

Based on the previous assumptions, Capital Cost Streams for economic analysis with reference to financial analysis data are calculated as shown in Table 16-1-3.

Table 16-1-3 Capital Cost Streams

(Unit : 1,000 US$)

Year	Economic Analysis				Capital Cost for Financial Analysis
	Equipment	Working Capital	Others	Total	
1996	44,842	0	0	44,842	49,796
1997	66,241	0	0	66,241	70,469
1998	200,967	0	0	200,967	220,710
1999	65,152	3,272	1,985	70,409	86,426
2000	64,738	0	0	64,738	68,872
2001	111,007	0	0	111,007	118,444
2002	92,819	3,272	1,985	98,076	110,259
2003	85,210	0	0	85,210	90,931
2004	33,180	3,272	1,985	38,437	45,430
2005	0	0	0	0	0
~	~	~	~	~	~
2024	0	0	0	0	0
Total	764,156	9,816	5,955	779,927	861,336

2) Benefit Streams

Benefit Streams ranging from year 2000 to 2034 also are calculated based on the previous assumptions as shown in Table 16-1-4.

Table 16-1-4 Benefit Streams

(Unit : 1,000 US$)

Year	Sales (A)	Variables (B)	Fixes (C)	Admin. (D)	Benefit (A)-[(B)+(C)+(D)]
2000	61,250	13,740	23,616	338	23,556
2001	78,750	17,666	21,216	338	39,530
2002	87,500	19,629	19,103	450	48,318
2003	148,750	33,369	22,797	229	92,355
2004	166,250	37,295	22,116	229	106,610
2005	236,250	53,009	24,457		158,784
2006	253,750	56,924	22,067		174,759
2007	262,500	58,887	22,067		181,546
2008	262,500	58,887	22,067		181,546
2009	262,500	58,887	22,067		181,546
2010	262,500	58,887	22,067		181,646
2015	282,500	58,887	22,067		181,546
2020	262,500	58,887	22,067		181,546
2024	262,500	58,887	22,067		181,546

(Note) Benefit = Sales - (Valiables + Fixes + Admin.)

(2) Result of Calculation of EIRR

1) Case Study

Economic Internal Rate of Return (EIRR) is calculated in accordance with the cases adopted in Financial Internal Rate of Return (FIRR) calculation. Assumptions of case study are shown in Fig. 16-1-1. Thus EIRR in the base case [(2)-(B) - (ii)] as shown in Table 16-1-6 is estimated at 14.95%, about 3% higher than FIRR (11.90%).

Table 16-1-5 Economic Internal Rate of Return
- Base Case -

(Unit : 1,000 US$)

Year	Capital streams	Benefit Streams	Net Benefit Streams
1995	44,842	-231	-45,073
1997	66,241	-676	-66,917
1998	200,967	-2,617	-203,584
1999	70,409	-9,317	-79,726
2000	64,738	23,556	-41,182
2001	111,007	39,530	-71,477
2002	98,076	48,318	-49,758
2003	85,210	92,355	7,145
2004	38,437	106,610	68,173
2005	0	158,784	158,784
2006	0	174,759	174,759
2007	0	181,546	181,546
2008	0	181,546	181,546
2009	0	181,546	181,546
2010	0	181,546	181,546
2011	0	181,546	181,546
2012	0	181,546	181,546
2013	0	181,546	181,548
2014	0	181,546	181,546
2015	0	181,546	181,546
2016	0	181,546	181,846
2017	0	181,546	181,546
2018	0	181,546	181,546
2019	0	181,546	181,546
2020	0	181,546	181,546
2021	0	181,546	181,546
2022	0	181,546	181,546
2023	0	181,546	181,546
2024	-3,272	181,546	184,818

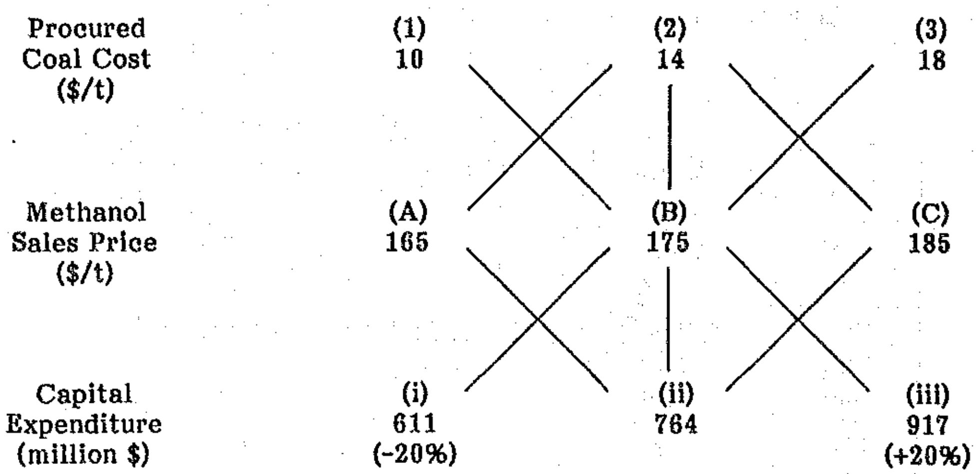


Fig. 16-1-1 Cases for Sensitivity Analysis

Table 16-1-6 Results of Sensitivity Analysis

		EIRR (%)	FIRR (%)
Base Case	(2) - (B) - (ii)	14.95	11.90
Case 1	(2) - (A) - (ii)	13.84	10.86
Case 2	(2) - (C) - (ii)	16.01	12.89
Case 3	(1) - (B) - (ii)	16.00	12.88
Case 4	(3) - (B) - (ii)	13.86	10.87
Case 5	(2) - (B) - (iii)	12.68	10.03
Case 6	(2) - (B) - (i)	17.93	14.34
Average Financial Cost (%)		10.83	

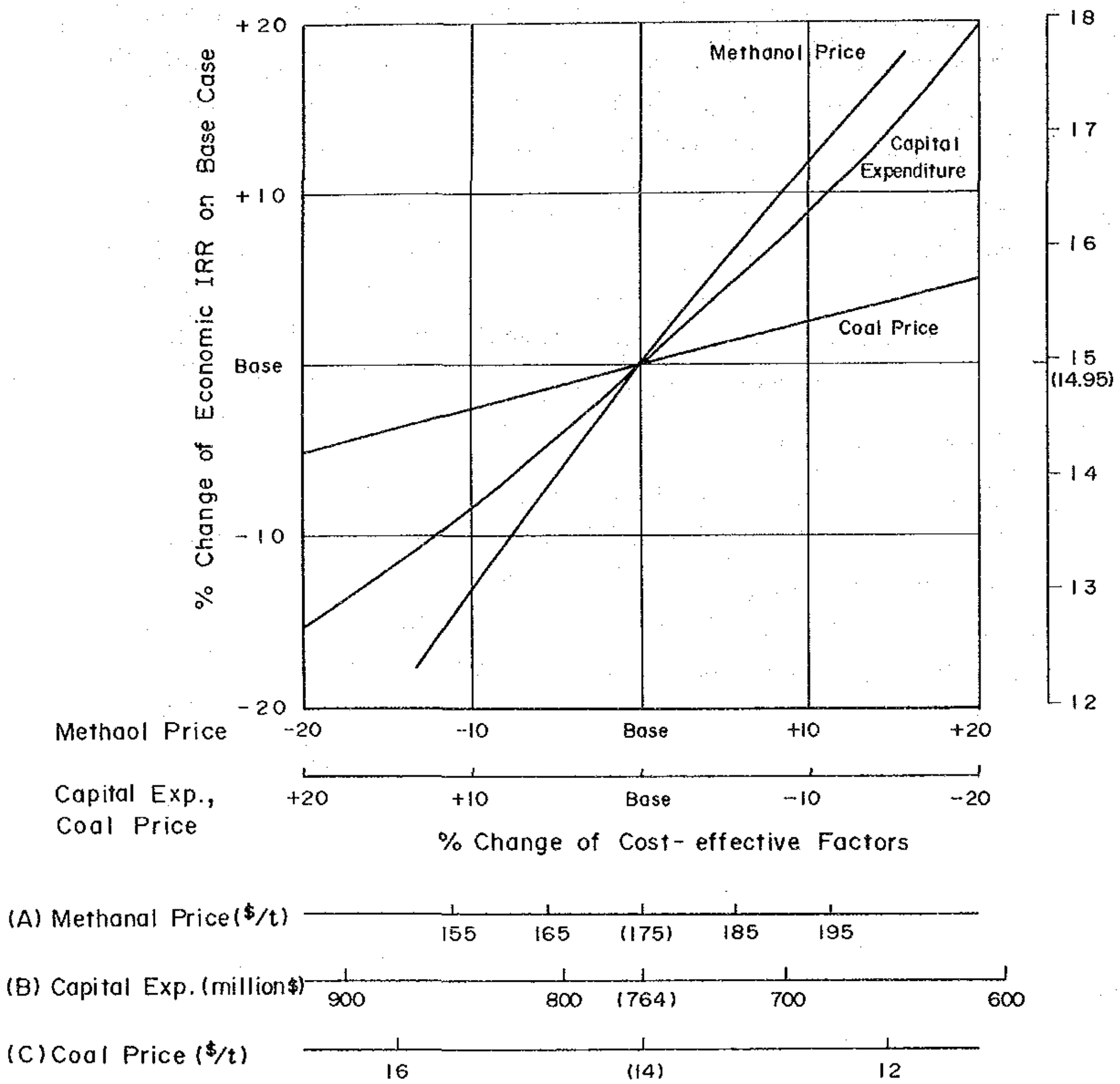
2) EIRR Analysis

EIRR is a criterion of attaining a country's optimal distribution of resources, namely for the EIRR all costs and benefits are measured from the viewpoints of the economy of the country as a whole. If the EIRR of a project is equal to or greater than the opportunity cost of capital in the country, the project is considered acceptable.

As has been seen in Chapter 15, the calculated result of FIRR is considerably low ranging from 10.03% to 14.34%. Thus the Project is not so attractive for a project sponsor. However, judging from a country viewpoint, the Project would be acceptable since the EIRR ranging from 12.68% to 17.93% surpasses capital cost of 10.83% for the Project.

3) Sensitivity Analysis

Results of sensitivity analysis are shown in Table 16-1-6.
Same as described in Section 15-2-3, coal cost procured, methanol sales price and capital expenditure are crucial factors for the sensitivity of the Project. Methanol sales price shows the highest sensitivity to EIRR followed by construction cost and coal cost procured, as shown in Fig. 16-1-2.



Note: (A), (B), (C) and (D) are absolute value of each factor.

Fig. 16-1-2 Economic IRR Sensitivity of Cost-effective Factors

16-2 IMPLICATIONS TO ENERGY SECTOR

Though current Repelita IV comes to an end in 1989, basic energy policy guidelines will be carried on by Repelita V. The proposed Project has been developed in line with these guidelines, i.e., "intensification", "diversification", "conservation" and "indexation."

(1) Intensification

As was mentioned in Chapter 5, the "intensification" guideline aims at accelerating and intensifying exploration and development of all energy resources and to identify additional resource potential for the country's economic development program.

Implementation of the Project will promote the survey of brown coal resources in Indonesia, particularly in South Sumatra. Moreover, efforts in pursuing the Banko coal utilization scheme will help increase public awareness for other potential energy sources which have not been fully utilized so far.

(2) Diversification

The "diversification" guideline aims at reducing the dependency on oil in overall energy consumption while shifting to other energy sources, thereby conserving oil for export. Thus, priorities were set to develop non-exportable and renewable sources of energy for domestic consumption.

The domestic demand for energy, particularly for petroleum products, is expected to grow rapidly, due to the country's continued industrialization efforts. The implementation of the Project will expedite the promotion of substitues for petroleum products. The extent of such substitution will rest upon future crude oil prices as well as methanol prices. The LP model study provides that 13% of gasoline and 2% of kerosene demand in 2000 can be met by methanol under the "H Scenario." If the price of methanol is maintained at 175$/t and the crude oil prices further rises to 36$/bbl and 45$/bbl in the years 2005 and 2010, respectively, methanol will be able to replace an even larger share of gasoline, kerosene and ADO demand in those years (see Section 5-5 and also Attachment 5-5). Although such figures of course reflect only theoretical potential under a set of assumptions, the Project represents an informed and reasonable scheme for reducing the dependency on oil in the domestic market. The Project proposes to maximize the potential with a modest but effective production scheme.

(3) Energy Conservation

The "conservation" guideline aims at economizing the energy use as well as at ensuring its more efficient and wiser use.

Methanol use in existing gas turbine and diesel engine power generator will result in higher energy efficiency through their modification into reformed-type methanol engines.

The methanol production technology under the Project will also introduce the most modern energy conservation technology into Indonesia.

(4) Indexation

The "indexation"guideline aims at allocating the best and most efficient energy source for particular energy needs in the country. This guideline could be paraphrased as "efficient allocation of energy sources."

The "indexation" guideline has a close relationship with pricing policy, since it is generally assumed that efficient allocation of resources should be established through price mechanisms. Thus, implementation of the Project requires a special consideration as to pricing of various energy sources in general, and methanol in particular.

(5) Energy Pricing

Pricing is one of the major tools in implementing energy policy, involving the appraisal of investment projects and management of supply and demand. Investment decisions hinge upon setting appropriate prices for energy inputs in proposed projects. For supply management, adequate price incentives are necessary to stimulate exploration and development of indigenous energy sources. For demand management, prices should be regulated at a level which encourages efficient use of energy and selection of the appropriate form of energy for particular needs.

There are a number of objectives to aim for through energy pricing policy:

- Financial Objective
- Economic Efficiency Objective
- Social Objective
- Energy Conservation Objective
- Price Stability Objective
- Promoting Special Objectives

The "financial objective" relates to the viability and autonomy of the Project. According to the financial analysis of this report, the Financial Internal Rate of Return of the Project is 11.9%, slightly above the calculated financial cost of 10.83% (Chapter 15). On the basis of the financial analysis, the project was appraised as marginally viable. Since the FIRR off the Project is highly sensitive to the methanol sales price (Base case set at 175$/t), the capital expenditure (844.18 million$), and the cost of Banko coal (14$/t), detailed study is essential to assess the ways in which the financial viability of the Project might be affected by changes in those factors.

The "economic efficiency objective" requires that pricing policy should promote economically efficient allocation of resources, within the energy sector and between it and the rest of the economy. Assuming the same methanol sales price and cost of Banko coal as used in the financial analysis, but using shadow prices for capital expenditure (764 million$), higher rate for Economic Internal Rates of Return may be expected, as indicated in Section 16-1.

The "social objective" recognizes every citizen's basic right to the fulfillment of certain minimum energy needs. Given the existence of a large number of low-income consumers, this normally implies subsidized prices for certain fuels, although loopholes and abuse of subsidies by non-targeted consumer groups are often difficult to control.

In the case of Indonesia, the social objective is clearly established in Repelita IV:

> "To guarantee the domestic energy supply in amount and quality according to the demand and with a price affordable to the public, with the objective of improving the welfare of the Indonesian people and providing the necessary support for rapid socioeconimic growth."

Thus, kerosene for lighting and cooking as well as automotive and industrial diesel oil had been subsidized until recently. In addition, cross-subsidies exist between different geographic regions, since the national policy of uniform prices of petroleum products and electric power requires subsidization of energy users in remote areas.

In many countries, "energy conservation" is one of the objectives of energy pricing. In the case of Indonesia, the Government has been cautious about using price mechanisms as a tool for conserving energy; however, the energy demand pattern of the last several years indicates that consumers are responsive to fluctuations in energy prices.

"Price stability" is also an important objective to protect consumers from large fluctuation of prices. In fact, the gradual abolishment of subsidies for petroleum products was undertaken step-by-step for this reason in Indonesia, as was discussed in Section 5-2-3.

The last item, "promoting specific objectives," refers to the need for considering special circumstances and needs. In the case of the Project, it should be diversification of energy sources (See Section 16-2-2).

The approach adopted in this report does not specify the most likely (or most efficient) price structure of petroleum products in the future domestic market. Future petroleum product prices are assumed to increase, on the whole, in proportion to the average OPEC crude oil prices. In addition, the assumptions for fuel methanol price (175$/t at Palembang) may deviate from the efficient prices reflecting changes in crude oil prices. Further, future transportation costs of petroleum products and methanol are assumed to be stable and relatively immune to future fluctuation of crude oil prices. However, in reality, there should be reasonable options available to attain the optimal allocation of energy sources in future years while taking various objectives of pricing policy into consideration.

(6) Energy Research

Repelita IV includes a guideline for human resources in the industrial sector:

> "The contribution by Indonesian people to industrial development should be increased through improvement of designing capability, business management capability, production management methodology and development capability. The program for speeding up in technology transfer should be continually promoted."

Implementation of the Project will improve the capability of Indonesian experts in the utilization of brown coal resources. Experience obtained by those experts should be valuable for other developing countries with abundant brown coal resources.

16-3 EFFECTS ON REGIONAL ECONOMY

16-3-1 Changes in Land Use

1) Present State

Banko area as the mining site lies at 104° east longitude and 3°41' south latitude, stretching for 10~20 km in gentle undulation with a clump of bushes in South Sumatra Province.

The nearest town to the mining site is Tanjung Enim with a populaton of 5,000, lying 10~15 km northwest away from it. Desa Muara Enim as the plant site of gasification and methanol production is located 20km north of Tanjung Enim with its population of 44,000. The district office of Muara Enim which covers seven subdistricts is located in Desa Muara Enim.

The land planned for the plants is of forest now.

These areas are in a tropical climate having two seasons through a year; a dry season from May to October, and a rainy season from November to April.

2) Asahan Smelter as an Example

As a proper referrence to the Banko Project, Asahan Project, now noteworthy for its successful result, gives a hint for the study of the regional economy impact analysis.

Asahan Project constructed smelting plants at Kuala Tanjung and a company town at Tebing Tinggi 15km away from Kuala Tanjung. Both of them occupied 200 ha each. Kuala Tanjung used to be a swamp with no resident. In order to develop land, a lot of sea sand was mounded. Now it is a promising industrial area. Tebing Tinggi was a higher land for farming than Kuala Tanjung. Farmers had used the land under thirty year's lease. The lease has discontinued with compensation of some amount of money after the central government decided. Today, it has been changed into a beautiful town with a population of 5,000. There is a primary school, secondary school, church, mosque, hospital, kindergarten, post office, four banks and a beautiful park as well as 1,350 living houses for employees. Most of these facilities are open to not only employees and their families but also other regional residents.

3) Change in Muara Enim

The Project needs 46 ha of land for the factories and about 1,000 personnel. Referring to Asahan Project, it is necessary for the Project to construct a company town extending about 100 ha. The town should have a school, church, mosque, hospital, bank, post office and park as well as about 600 living houses for employees. Because employees will be gathered from much wider area including some transmigrants, Desa Muara Enim is a rather big town than Tebing Tinggi of Asahan.

As to the mining site, since about 2,000 people will be supposed to work, the company town should have 2,000 living houses and many public facilities as well. It will be located between Tanjung Enim and Banko of the mining site.

16-3-2 Personnel Consideration

1) Employment Plan

The number of employees for the Project is planned to increase as follows;

year	personnel
2,000	732
2,003	874
2,005	1,012

Most of the above number would be employed as operators from the regional area. Staff numbers with high qualifications will be recruited from much wider areas.

In addition to the above numbers, many part-time workers would be expected to support the plants and the new town.

2) Considerations on Personnel Matter

In case of Asahan Project, it has eventually been a successful story but there were many troubles concerning personnel matter and there still exists problems listed below at power plant site.

Most of staff coming from Java with engineering background quitted their jobs after being trained in Japan. Their retirement is reported to be for family reasons such as children's education and their wives' opposition to staying in remote area.

Therefore the company had a serious problem in technology transfer. The operators have well settled in the company.

They work very well if managers are capable and job descriptions are prepared well. The next big trouble was theft. Many thefts happened during the construction period and beginnings of operation. Therefore, the company has had to employ 50 people for security of the power plant site where only 300 people as a total have been working. At the new town of Tebing Tinggi, the town was not surrounded with fence. But guards were not able to keep the town from thefts and requested the company to make fence. The town has been fenced since then. The problem of thefts has been solved nowadays. The third one came from the regional people, complaining that their children have not been employed. The company recruited people from wider areas to get capable operators. In addition, the number of operators to be employed was smaller than that of the regional people's expectation, although the company took a policy to keep the level of automation in the system of production line low to hire as many people as possible.

So it resulted in giving no chance of employment in the company for many people living near the factory. As to welfare, as mentioned at Section 16-3-1, the company built many schools, church, mosque, hospital, park etc. These facilities are available for not only the employees but also the general public living in the regional area. The company also has held many events such as showing movies, athletic meetings and so on.

These experiences in Asahan Project give a good lesson in consideration of personnel matters in the Project.

16-3-3 Change in Income Structure

1) Present Situation

According to the INTERIM REPORT, APRIL 4, 1988 of REPELITA V FORMULATION SPECIAL STUDIES, average monthly household incomes in rural areas in 1985 prices are Rp67,000 in sending migrants provinces and Rp91,000 in receiving provinces and Rp59,000 at transmigration sites.

Applying the above data to Muara Enim Subdistrict;

Population (in 1988)	44,128 persons	8,800 families
Total yearly income	Rp91,000 × 8,800 × 12	
	= Rp9,609, 600,000	
	= US$5,653,000 (Rp1,700/US$)	

The total yearly income of Muara Enim Subdistrict is estimated at about US$5,653,000.

2) New Income

The Project is assumed to start in 1996 with the first train construction. It will last for four years till year 2000.

Construction of the second train will subsequently be going beside the operating plant till 2003. Construction of the third train will start in 2002 and be completed by 2005. The Project would be completed and get into stationary states in 2005. During the construction period, there will be a big variation of population in Muara Enim Subdistrict.

The following table shows such a variation of population along the years.

Table 16-3-1 Variation of Population in Muara Enim

Year	Schedule	Number of Worker for Construction	Number of Personnel for Operation	Total
1996	ο	2,000		2,000
97	1st train	4,000		4,000
	&			
98	Infrastructure	6,000		6,000
99		6,000		6,000
2000	ο ο ◁Start (1st)	3,000	814	3,814
01	2nd train	3,000	814	3,814
02	ο	5,000	814	5,814
03	◁Start (2nd)	3,000	887	3,887
04	ο 3rd train	3,000	887	3,887
05	ο ◁Start (3rd)		1,017	1,017
06			1,017	1,017

(Note) Number of workers for construction was estimated from the data of Asahan Project.

Total amounts of wages to be paid each year are estimated as follows;

Construction : Although an amount of wage ranges widely from general manager to unskilled labor, US$1,000/y is adopted as an average amount.

Operation : The figures in Section 15-1 are adopted.

Table 16-3-2 Amount of Wages

(Unit : Thousand US$)

Year	Construction	Operation	Total	50% of Total
1996	2,000	-	2,000	1,000
97	4,000	-	4,000	2,000
98	6,000	-	6,000	3,000
99	6,000	-	6,000	3,000
2000	3,000	1,299	4,299	2,150
01	3,000	1,299	4,299	2,150
02	5,000	1,299	6,299	3,150
03	3,000	1,477	4,477	2,240
04	3,000	1,477	4,477	2,240
05	-	1,650	1,650	825
06	-	1,650	1,650	825

About 50% of the total amount of wages could be spent in Mura Enim Subdistrict and remaining 50% for outside because most of the workers leave their families outside of Muara Enim.

3) Impact on the Regional Economy

The new income given to Muara Enim Subdistrict by the Project will be very large in comparison with the existing total income of the area.

Table 16-3-3 Impact of Wages Spent

(Unit : Thousand US$)

Year	A Existing Income	B New Income	C Total	% Ratio (B/C)
1996	5,653	1,000	6,653	15.0
97	5,653	2,000	7,653	26.1
98	5,653	3,000	8,653	34.7
99	5,653	3,000	8,653	34.7
2000	5,653	2,150	7,803	27.6
01	5,653	2,150	7,803	27.6
02	5,653	3,150	8,803	35.8
03	5,653	2,240	7,893	28.4
04	5,653	2,240	7,893	28.4
05	5,653	825	6,478	12.7
06	5,653	825	6,478	12.7

In 1996 of the first year of the Project implementation, the new income reaches US$1 million and 15.0% of the total income. The maximum ratio comes in 2002 with 35.8%. Not only the increase of income but also that of population stimulates the regional economy very much and makes it vivid for ten years.

Bright and vivid economy will raise the standard of living, improved conditions of infrastructures including road, hospital and so on.
Educational level of the regional people will be also raised year by year.
The regional people, however, have to understand in advance that after the construction has finished, the new income and population will decrease significantly and the opportunities to get part time works also will decrease.

4) Annunal Fee

A company may need to pay the central government an annual fee as a comprehensive tax of which the amount should be calculated by a certain formula related to the company's performance. In case of Asahan aluminium the central government takes 25% of the fee and returns the remaning 75% to the local government.
Thus the amount of annual fee in Asahan Project started from US$3 million and now has come to more than US$5 million.
The local government of South Sumatra Province that governs Muara Enim would receive a considerable amount of money from the central government, depending on the performance of the company to be established for the Project.
Annual fee to be returned back to the local government will help enhancing the welfare of the region, thus contributing to the social and economic development of the district.

16-3-4 Effects on Regional Industry

1) Present Situation

Muara Enim Subdistrict is an agricultural area and more than 90% of the residents engage in agriculture. There is no other noteworthy business except small shops for articles of daily use.
According to the data of Provincial Statistical Office of South Sumatra, the population of South Sumatra Province was 5,670,000 in 1986 and number of labor force in it was 2,170,000. The number of people who are working for non-agricultural industry is about 65,000. It is only 3.2% of the total labor force in the province.

2) In Case of Asahan Project

A socio-ecomonic report on Asahan Project written by North Sumatra University, "ANALISA DAMPAK LINGKUNGAN PROYEK ASAHAN" shows the change of occupation before and after the Asahan Project around the power plant site and the smelter site as follows. In the area around the power plant site, 66.1% of all the samples did not change its occupation. 10.8% was newly employed by Asahan. 6.2% changed from farmer to combination of farmer and marchant. 7.7% changed from farmer to marchant. And 9.2% became unemployment (see Table 16-3-4).

On the other hand, the area of Smelter site showed a different pattern from the power plant site. 77.5% of all the samples did not change, but 18.0% was employed by Asahan. Its ratio is bigger than that of the power plant site. It means that as far as occupational structure is concerned, the effect in the smelter site was bigger than that in the power plant site (see Table 16-3-5).

3) Estimation of Muara Enim

There are about 8,800 families in Muara Enim Subdistrict in 1988 and most of them are reported to be farmers. A company for the Project will employ about 1000 people. Therefore, the region could expect change of occupation of about 7~9% of all families to be employed in the Project and about 2~3% to be merchants.

In the mining area of Banko, there is only one small village, Tanjung Enim, having about 1,000 families. Therefore, the coal mining company linked with the Project will employ workers from wider area including Muara Enim because it will need about 2,000 people. Then, the employment ratio to the total number of families in Muara Enim could be expected to reach about 14~18%.

Another point to be worthy of notice for the Project is that the Project will be located not in Java but in outer island, thus it helps develop the regional economy through deconcentration.

According to the data by BKPM (Investment Coordinating Board), about 61% of PMDN (Domestic Investment) was concentrated in Java Island and 33% of PMA (Foreign Investment) was for Java among which 60% was located in Jakarta and East Java.

Such an excessive concentration of industry to Java Island not only brings unevenness of development but also causes the socio-economic friction among the nation. In this point of view, the implementation of the Project is quite significant for the equitable regional development.

Table 16-3-4 Change of Occupation by Income Source before and after Asahan Project
Around Power Plant Site

Name of Village	Sample Total	Category of Change						
		Farmer ↓ Farmer & Merchant	Farmer ↓ Merchant	Farmer ↓ Employee	Farmer ↓ Un-employment	Farmer ↓ Farmer	Merchant ↓ Merchant	Fisher ↓ Fisher
Kecamatan Porsea								
1. Parparean II	10	–	2	2	–	6	–	–
2. Parparean III	10	–	1	1	2	5	1	–
3. Lumban Manurung	5	1	–	–	–	4	–	–
4. Lumban Sirait	10	1	–	2	1	5	1	–
5. Dolok Nauli	5	1	–	–	1	3	–	–
6. Narumonda IV	5	–	–	–	–	5	–	–
7. Narumonda III	5	1	–	–	1	3	–	–
8. Gala-Gala Pangkailan	5	–	1	–	–	3	–	1
9. Siantar Utara	5	–	1	–	1	3	–	–
Subtotal	60	4	5	5	6	37	2	1
Kecamatan Bandar Pulau								
Kacamatan Habinsaran								
1. Tangga	5	–	–	2	–	3	–	–
Total	65	4	5	7	6	43		
Ratio (%)	100.0	6.2	7.7	10.8	9.2	66.1		

Table 16-3-5 Change of Occupation by Income Source before and after Asahan Projcet

Around Smelter Site

Name of Village	Sample Total	Category of Change						
		Farmer ↓ Farmer & Merchant	Farmer ↓ Merchant	Farmer ↓ Employee	Farmer ↓ Un-employment	Farmer ↓ Farmer	Merchant ↓ Merchant	Fisher ↓ Fisher
Kecamatan Air Putih								
1. Kwala Tanjung	15	–	2	–	–	1	5	7
2. Simodong *	15	–	–	1	–	9	2	2
3. Perkebunan Sipare-pare	15	–	–	9	–	4	2	–
4. Suka Deras	15	–	1	–	–	8	6	–
Kecamatan Medang Deras								
1. Kampung Pakam	15	–	–	2	–	7	4	2
2. Kampung Lalang	15	–	1	4	–	1	5	4
Total	90	0	4	16	0	69		
Ratio (%)	100.0	0	4.5	18.0	0	77.5		

* Sample total should be 14 instead of 15. The original data has an error.

16-3-5 Contribution to the Region

As mentioned in the previous sections, a big industrial project makes much contribution to the regional economy. Asahan Project is one of the typical forerunning examples for the Project. Therefore, what have been studied on the contribution of Asahan Project are summarized here in order to estimate the Project.

1) Electric Power Supply

50 MW is constantly supplied to the region in accordance with a contract. Furthermore, an extra amount of power has been supplied occasionally by the regional government's request.

2) Fresh Water Suply

Drilling six deep wells of 220 m depth, the company has been supplying fresh water to the region, displacing river water.
It has much improved the regional sanitary condition.

3) Improvement of Infrastructure

The company built many public facilities such as a hospital, clinic, school, church, mosque, post office, public hall, sports center as well as many living houses for its employees. It also constructed a lot of bridges, roads and parks.

4) Creation of Employment Opportunity

The company employed about 3,000 people in total for both power plants site and smelter site. In addition, it created many part-time jobs as well.

5) Local Procurement

Foods and daily necessities are purchased from the adjacent area.

6) Annual Fee

Three quarters of the annual fee paid by the company to the central government is returned to the local government.

16-4 NATIONAL ECONOMY IMPLICATIONS

16-4-1 Effects on Industrial Structure

1) Industrial Structure in Indonesia

Indonesia might be characterized as an agricultural country endowed with oil, natural gas and other mineral resources. Industrial structure in terms of Gross Domestic Product (GDP) in 1986 shows that agriculture and fishery sector shared 25.8%, followed by trade, hotel and restaurant (16.7%), manufacturing (14.4%) and mining (11.1%) (see Table 16-4-1). Compared these figures with those of 1970, ratio of agriculture and fishery sector declined to less than a half while the ratio of mining increased by more than three times. This is because of rapidly accelerated industrialization after the "oil boom" in 1973 and 1979. Although the ratio of manufacturing sector went up steadily, the level of manufacture industrialization is still low among ASEAN countries. It is reported that the characteristics of the industrial sector are that capital goods industry is as yet small in number and the supporting industries for machinery is still in the developing stage..

2) Employment Structure in Indonesia

1985 Population Census shows that labor force is too much dependent upon agriculture and fishing (54.7%) followed by trade and restaurant (15.0%). Share of labor force in industrial sector is still low though increased to 9.3% in 1985 from 6.6% in 1971 (see Table 16-4-2). As for the labor force, due to rapid increase of population, it is estimated that labor force of 52.4 million in 1980 will increase to 72 million in 1990 and 101.6 million in 2000. This implies that average yearly increase ratio will be 3.8% during 10 years from 1980 to 1990. Ministry of Man Power estimates that new entry to labor market exceeds 2.4 million yearly during the REPELITA V (1989/90 - 1994/95) while the number of opportunity for new employment in 1985 counted only 1.5 million. It shows the necessity of creating new employment opportunities in order to absorb a new labor force mainly consisting of younger generation.

Table 16-4-1 Trends in Industrial Structure

(Unit: billion Rupiah)

	1970		1980		1984		1985		1986	
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
(nominal market price)										
Agriculture, forestry & fishery	1,575.0	48.6	11,290.3	24.8	20,333.9	23.4	22,412.0	23.7	24,921.6	25.8
Mining	173.0	5.3	11,672.5	25.7	15,085.8	18.4	15,403.6	16.3	10,740.9	11.1
Manufacturing	293.0	9.0	5,287.9	11.6	11,081.6	12.7	12,713.3	13.5	13,899.9	14.4
Electricity, gas & water supply	15.0	0.5	225.1	0.5	655.2	0.8	781.3	0.8	858.0	0.9
Construction	100.0	3.1	2,523.8	5.6	4,756.8	5.5	5,301.8	5.6	5,242.6	5.4
Transportation & communication	96.0	3.0	1,965.3	4.3	5,112.5	5.9	6,149.0	6.5	6,392.0	6.6
Trade					13,973.5	16.1	14,561.4	15.4	16,081.2	16.7
Banking & financing					2,691.8	3.1	2,802.4	3.0	3,279.5	3.4
House renting	986.0	30.5	12,480.8	27.5	2,275.9	2.6	2,443.0	2.6	2,631.5	2.7
Public administration					6,469.9	7.4	7,925.1	8.4	8,308.3	8.6
Services					3,717.9	4.3	3,998.6	4.2	4,134.8	4.3
Gross domestic product	3,283.0	100.0	45,445.7	100.0	87,054.8	100.0	94,491.5	100.0	96,489.3	100.0

(Source) Statistik Indonesia 1987

Table 16-4-2 Change in Employment Structure

Item \ Year	1971		1976		1980		1985	
	Thousand people	%	Thousand people	%	Thousand people	%	Thousand people	%
I. Population aged to 10 and over	80,502	100.0	88,867	100.0	104,353	100.0	120,380	100.0
A. Working population	41.261	51.3	54,490	61.3	52,421	50.2	63,826	53.0
(1) Employment	40,422	50.2	53,433	60.1	51,553	49.4	62,457	51.9
(2) Applicants for employment	839	1.1	1,047	1.2	868	0.8	1,368	1.1
B Non working population	39,246	48.7	34,377	38.7	51,931	49.8	56,554	47.0
(1) Student			12,837	14.4	18,771	18.0	26,174	21.7
(2) House keeping			15,762	17.7	22,176	21.3	20,774	17.3
(3) Others			5,777	6.5	10,985	10.5	9,607	8.0
II. Employment in each industrial sectors	40,422	100.0	53,443	100.0	51,553	100.0	62,457	100.0
Agriculture, forestry & fishery	26,473	65.5	35,258	66.0	28,834	55.9	34,142	54.7
Mining	85	0.2	44	0.1	387	0.8	416	0.7
Manufacturing	2,681	6.6	3,560	6.7	4,680	9.1	5,796	9.3
Electricity, gas & water supply	36	0.1	34	0.1	66	0.1	70	0.1
Construction	678	1.7	1,098	2.1	1,657	3.2	2,096	3.3
Trade & Restaurant	4,261	10.5	6,253	11.7	6,679	13.0	9,345	15.0
Transportation & Communication	951	2.4	1,112	2.1	1,468	2.8	1,958	3.1
Banking, real estate & services	93	0.2	74	0.1	302	0.6	250	0.4
Public service	4,119	10.2	5,157	9.6	7,145	13.9	8,317	13.3
Others.	1,039	2.6	853	1.6	334	0.6	67	0.1

(Source) Population Census (1971, 76, 80, 85)

3) Target of REPELITA V in Terms of Industrial Sector

According to the President Soeharto's address in August 16, 1988 as regards to the coming Fifth National Economic Development Plan (REPELITA V), the growth of industrial sector has the top priority among various sectors. He stressed on the importance of commercializing non oil/gas industry which will absorb a large number of labor force. The President also emphasized the necessity of developing energy from coal as it is essential to reserve precious crude oil as long as possible.

4) Significance of the "Banko Project"

It is quite clear that the "Banko Project" responds greatly to the industrialization promotion policy of Indonesia. Of particular significance is the transfer of technology and managerial/financial strengthening, which will occur at the working level of the entities undertaking the Project through the training progress and operational assistance included in each of the Project components. As this Project is only a first step in development activities of coal gasified methanol in Indonesia, the experience gained during the preparation and implementation of the Project will enhance the implementation of subsequent coal gasified methanol plans.

The Project gives the opportunity of employment for about 1,000 people in the methanol production and about 2,000 people in the field of mining together with offering workplace for the construction totaling about 35,000 people for 9 years. The other effects the Project gives are that it helps to prevent industrial sector from suffering fuel shortage in the 21st century. The project also will give a spreading effect on machinery equipment production and downstream sectors.

16-4-2 Effects on Transport Sectors

Economic growth in accordance with the progress of industrialization causes increase of demand for petroleum products. Yearly demands for motor gasoline and diesel oil are estimated at 6,840 thousand kl and 8,946 thousand kl respectively in the year 2000 according to the MARKAL report (See Chapter 5). Provided Indonesia will not introduce methanol plant for fuel use at the proposed time, it will be necessary for the nation to import 880 thousand kl of gasoline and 195 thousand kl of diesel oil. The substitution of methanol for the above conventional motor fuels will give the following socio-economic impacts on the coming 21st century of Indonesia.

1) To provide domestic energy for use in transport sector, resulting prevention against fuel shortage which might occur unless methanol will be introduced.

2) Air pollution caused by exhaust gas from automobiles is becoming a point of serious issue in recent years. Introduction of methanol either for gasoline blending or for its 100% filling will improve lead content, decrease NOx and smoke content as well.

16-4-3 Effects on Transmigration Policy

1) Transmigration Policy

Generally speaking, the policy of transmigration development is aimed at the distribution of manpower from one area to another for improving regional development and concurrently for the equal distribution of development among the regions in Indonesia.

Priority will be given to the areas in which the people/manpower must be distributed to other areas including Java and Bali, where 62% of the population of the country totalling 170 million people are living, in spite of the fact that these two islands represent only 7% of the total land mass.

In the Third Five-Year Development Plan (REPELITA III), approximately 527,000 families have been moved as a result of the transmigration program. About 10 to 15% of the program is reserved for the population in surrounding areas of transmigration settlements. In REPELITA IV it is expected that 750,000 families can be moved through the transmigration program.

Owing to the restricted availability of funds, the policy of the program puts more emphasis on integration with other development sectors. The existence of the Development and Operation of the Banko Project will so lead to opening the opportunity for participation of the transmigration program in the activities of this Project.

During the previous REPELITAs, the pattern of activities of the transmigrants put stress on agriculture. However, in the coming REPELITAs the pattern will be expanded to include the industrial sector, services and trade. As such, the activities of the transmigration program will not only consist of creating employment opportunities in a horizontal way, but also vertically, so that the regional economic structure can be improved.

In REPELITA V, the pattern for the basic activities will comprise:

- Primary sector : foodcrop agriculture, tree crop planting, fishery, livestock, forestry and mining
- Secondary sector: industry
- Tertiary sector : services and trade

In the pattern for basic activities, the transmigrants are directly involved in various activities. In the context of large scale project using huge capital and high technology, like in the Banko Project, the transmigration program which may support this kind of activity consists of:

a) Foodcrop agriculture which can meet the requirements for consumption including the mining and plants operations (transmigration foodcrop pattern).

b) Construction work using manpower employed for the mining and plants construction work. The workers will be permanent residents (transmigration construction services pattern).

   Note: In case that workers are employed on a contract basis for a certain duration, upon their return to the sending area they will be managed through the AKAD (Angkatan Korja Antar Daerah/Inter-Regional Manpower) of the Ministry of Manpower.

c) Mining and plants operators employed in the operation of the mining and plants activities (transmigration services pattern).

Taking into consideration that the Banko Project will need manpower during the construction period as well as during the operation, the availability of manpower from the regional area would not be sufficient. In order to overcome this problem, it is advisable that this be solved by means of the transmigration program. In this context, a decision on the rights and obligations, that are valid for the respective patterns of transmigration will be applied to each transmigration, in which each participating transmigrant will be given the opportunity to own at least a house plus home-yard (through a soft credit system).

2) In case of Asahan Project

Asahan Project is one of the biggest industrial development projects in Indonesia. The investment was more than ¥400 billion (US$3.2 billion). The project consisted of hydraulic power plants and aluminum smelting plants. The change of employees for construction and operation of these plants are shown in Table 16-4-3.

Indonesian staff gathered nationwidely, especially from Java, but workers were employed locally. The company was able to choose enough number of quality workers out of the regional residents. The company also has had a policy to employ as many people as possible around the plant site for the development of the local areas.

Looking at the change of population in the whole area of the smelting plants, a significant increase of population can be observed as shown in Table 16-4-4.

These figures include natural increase by new born babies, moving in from adjacent area and spontaneous transmigrants from Java.

There was no idea of political transmigration for the project in the category of secondary sector (industry) at that time.

Table 16-4-3 Change of Employees for Asahan Project

Year	Power Plant				Smelter				Total			
	Staff		Worker	Total	Staff		Worker	Total	Staff		Worker	Total
	Japanese	Indonesian			Japanese	Indonesian			Japanese	Indonesian		
Sept. 1978	95	276	1,310	1,681	57	143	973	1,173	152	419	2,283	2,854
Dec. 1978	108	194	1,236	1,538	81	317	2,395	2,793	189	511	3,631	4,331
March 1979	117	130	1,213	1,460	88	353	2,476	2,917	205	483	3,689	4,377
Sept. 1979	242	226	3,068	3,536	170	426	4,289	4,885	412	652	7,357	8,421
March 1980	230	217	3,366	3,813	155	643	6,861	7,659	385	860	10,227	11,472
Sept. 1980	255	284	3,308	3,847	177	717	7,324	8,218	432	1,001	10,632	12,065
March 1981	260	301	4,444	5,005	330	726	6,479	7,535	590	1,027	10,923	12,540
Sept. 1981	291	315	4,279	4,885	313	483	3,360	4,156	604	798	7,639	9,041
Dec. 1981	212	245	2,973	3,430	247	440	3,403	4,090	459	685	6,376	7,520

Source: Laporan Penelitian
Analisa Dampak Lingkungan Proyek Asahan
Universitas Sumatra Utara 1984

Table 16-4-4 Change of Population around Smelter

District	1977		1982	
	people	family	people	family
Kabupaten Asahan				
1. Air Putih	49,979	10,845	66,364	11,769
2. Medang Deras	24,040	5,167	27,281	5,549
Total	74,019	16,012	94,645	17,318
	100	100	129	108

Source: Laporan Penelitian
Analisa Dampak Lingkungan Proyek Asahan

3) Estimation on the Project

The Project on Effective Utilization of Banko Coal links up with mining coal in Banko area which will need about 2,000 workers. Therefore the project will create about 3,000 jobs in combining gasification and methanol production project with coal mining plan.

It is expected that many native residents with special abilities such as driving coal mining equipment, operating mechanical and electric machinery in the process plants, and maintaining such an equipment will be employed by the company. However, such a necessity of skilled labor force will need many spontaneous migrants as well as government sponsored transmigrants in the mining area and the plant site.

The room for farming made by the residents' job hopping to the Project might also be filled up by the government sponsored migrants.

Roughly speaking, it can be expected that about 1,000 skilled technicians and 2,000 farmers would migrate into the mining area and the plant site.

To support such a good circumstance, a large number of industrial transmigration by a governmental budget should be studied as one of prospective projects for the category of secondary sector (industry).

16-4-4 Foreign Exchange Benefits

Introduction of fuel methanol into the fuel market of Indonesia will help prevent substantial volume of petroleum from importing, and promote export of crude oil and kerosene as well. Thus fuel methanol production will bring foreign exchange benefits as described below.

1) Foreign Exchange Saving

Table 16-4-5 shows that Indonesia will be able to decrease imports of petroleum products such as motor gasoline, kerosene and diesel oil with the Banko Project, thus provides substantial amount of foreign exchange saving according to the calculated result by LP model (see Chapter 5). The total amount of the foreign exchange saved for the project period (35 years) is estimated at around 6,676 million US$.

2) Foreign Exchange Earning

Table 16-4-6 shows that Indonesia will be able to increase export of crude oil and a certain kind of petroleum products with the Project, by which foreign exchange totaling 6,441 million US$ will be earned according to the result by the said LP model.

3) Foreign Exchange Benefits

As has seen in section (1) and (2), the Project brings significant foreign exchange benefits to Indonesia. Thus average annual incremental foreign exchange benefits are estimated at 375 million US$ ((6,676 mil. US$ + 6,441 mil. US$)/35 yrs.).

Table 16-4-5 Foreign Exchange Saving

(unit: 10^3 kl, 10^3 US$)

Year	(A) Methanol Production by the Project	(B) Demand for Fuel Methanol	(C) (A)/(B) Rate of Contribution	(D) Import Saved by Introduction of Fuel Methanol	(E) Foreign Exchange Saved (C)×(D)×K	(F) Crude ($/bbl)
2000	350	1,660	0.21	881	46,501	
2001	450	~	0.27	~	59,787	
2002	500		0.30		66,430	28
2003	850		0.51		112,931	
2004	950	1,660	0.57	881	126,217	
2005	1,350	5,800	0.23	2,927	209,854	
2006	1,450	~	0.25	~	228,107	
2007	1,500		0.26		237,231	36
2008	1,500		0.26		237,231	
2009	1,500	5,800	0.26	2,927	237,231	
2010	1,500	18,800	0.08	6,736	204,591	
	~	~	~	~	~	45
2035	1,500	18,800	0.08	6,736	204,591	
				Total	6,676,295	

(Note) 1. K = Crude price ($/bbl) × 6.29 bbl/kl × 1.2 + Transportation cost ($40/kl)

2. (B), (D) and (F) are data of high scenario case

Table 16-4-6 Foreign Exchange Earning

(unit: 10^3 kl, 10^3 US$)

Year	(A) Methanol Production by the Project	(B) Demand for Fuel Methanol	(C) (A)/(B) Rate of Contribution	(D) Incremental Export by Introduction of Fuel Methanol	(E) Foreign Exchange Earned (C)×(D)×K	(F) Crude ($/bbl)
2000	350	1,660	0.21	Heavy oil (–7)	(–) 207	
2001	450		0.27		(–) 266	
2002	500	~	0.30		(–) 295	28
2003	850		0.51		(–) 503	
2004	950	1,660	0.57		(–) 562	
2005	1,350	5,800	0.23	Crude 2,139	45,878	
2006	1,450		0.25	Naphtha (–) 804	53,399	
2007	1,500	~	0.26	Heavy oil (–) 376	59,332	36
2008	1,500		0.26		100,865	
2009	1,500	5,800	0.26		112,731	
2010	1,500	18,800	0.08	Crude 5,257 Naphtha (–) 59 Kerosene 4,601 Heavy oil (–) 685	242,822	
	~	~	~		~	45
2035	1,500	18,800	0.08		242,822	
				Total	6,440,922	

(Note) 1. K stands coefficient (Naphtha = 1, Gasoline, Kerosene and Diesel oil = 1.2, Heavy oil = 0.8 multiplied against the Crude oil price given.

2. (B), (D) and (F) are data of high scenario case

16-5 PROPOSED POLICY AND MEASURES FOR INTRODUCING FUEL METHANOL

16-5-1 Proposed Policy for Introducing Fuel Methanol

(1) Energy Policy

1) Intensification for Fuel Methanol

The energy policy of Indonesia has suggested to accelerate and intensify the survey and exploration of all energy resources.

Fuel methanol, which is derivative of Banko coal, could be a very important alternative energy source to petroleum in the transportation and electricity generation sectors.

As shown in Chapter 15, the financial viability of fuel methanol is proven, providing that the oil price climbs higher than 30 \$/bbl.

At present time, the oil price is around 15 \$/bbl.

However, it is estimated that the oil price will reach about 30 \$/bbl in the year 2000, according to the estimation by studies done by USDOE and IEE (The Institute of Energy Economics, Japan).

The export of oil plays the most important role in providing both foreign exchange and government revenue to finance economic development.

To secure the supply of oil to export, and to guarantee the domestic energy supply, the development of alternative energy sources which are useful in the transportation sector should be an urgent program in Indonesia, if one considers that the commercial scale production of fuel methanol requires a long time (about 10 years) for preparation and construction of a plant. It is proposed that the Project should be accelerated and intensified as one of energy policies for a better identification of fuel methanol's true potential.

2) Diversification by Fuel Methanol

To reduce the dependence on oil and to apply the best and most efficient energy to each particular energy demand are also indicated by the energy policy of the Indonesian Government. Notwithstanding efforts to move into alternative energy sources, however, 100% of the energy used in the transportation sector and the diesel generator for electricity generation depend on oil.

Oil is the best and most efficient energy for the transportation sector, and therefore oil will have the role of being the nation's prime source of transportation energy in long term.

However, fuel methanol is expected to be the most prospective alternative energy in the transportation sector because of its excellent performance as fuel for internal combustion engines.

It is believed that the diversification of oil in the transportation sector as well as in the electricity generation sector (diesel generators) can be achieved by fuel methanol in long term.

It is proposed that Indonesia Government put priority on fuel methanol as an alternative energy for internal combustion engines in transportation and electricity generation sectors.

(2) Industrial Development Policy

1) Export of Fuel Methanol

Fuel methanol can be evaluated as clean energy for the environment, especially in OECD countries where NOx emissions are severely controlled by standards. To export fuel methanol derived from non-exportable coal such as Banko coal would contribute to foreign exchange and help to develop high technology industries in Indonesia.

It is proposed that the survey of fuel methanol from Banko coal should be intensely evaluated in an effort to better identify the potential of exportable goods derived from non-exportable energy resources.

2) Pricing and Tax Policy

The industrial development program of fuel methanol must lean toward improving overall national economic structure.

In order to do so, a close relationship between the Ministry of Mine and Energy, Ministry of Industry, Ministry of Transmigration and BPPT as well as BAPPENAS will be required.

The pricing and tax policy of petroleum for domestic consumption and the tax policy of the fuel methanol industry should be examined in order to assist the development of the fuel methanol industry especially during the penetration stage of fuel methanol into domestic and foreign markets.

(3) Transmigration Policy

1) Transmigration Pattern

The development of the fuel methanol industry as well as the coal mining industry will increase opportunity for employment and assist regional development.

To assist contribution by Indonesian people to such opportunity for employment, it is proposed that a concrete model study of transmigration patterns for industry and mining should be examined.

2) Infrastructure for Transmigration

Infrastructures required for the fuel methanol industry will be prepared by the fuel methanol Project.

However infrastructures required for immigrants will be put in place through transmigration program. The above mentioned transmigration pattern and the range of infrastructures to be prepared by the industrial program and transmigration program will be studied.

16-5-2 Measures for Introducing Fuel Methanol

(1) Steering Committee for Introduing Fuel Methanol

The development of the fuel methanol industry and application of fuel methanol in the domestic market are completely new trial project in Indonesia.

Therefore the assessment and application of fuel methanol must be pursued jointly among relavant organizations such as the Government and private sectors.

In order to do so, it is recommended to organize a Steering Committee which would be authorized by the Government.

Technical assessment for fuel methanol production and its utilization, financial and economic evaluation of the Project, and related matters to energy policy, industrial policy and transmigration policy will be discussed in the Steering Committee.

The results of a study by the Steering Committee will be reported to BAKOREN through the Energy Resources Technical Committee who is charged with formulating the nation's energy plan and providing assessments on energy matters.

(2) A Pilot Test for Fuel Methanol Engines

New technology on fuel methanol engines has been developed in many countries such as West Germany, U.S.A. and Japan.
However, for application in Indonesia, a pilot test of fuel methanol engines will be required to confirm the durability of engines in Indonesia, to demonstrate the operability to users and to establish a fuel methanol supply system.
It is recommended that the program and funds for the tests should be studied by the Steering Committee and include the following:

i) Gas turbine generators (Modification of an existing one)
ii) Fuel methanol-diesel engine generators
iii) High way/express buses
iv) City buses in large cities
v) Mining equipment such as dozer, dump truck and power shovel in Bukit Assam

17. CONCLUSION AND RECOMMENDATION

17-1 CONCLUSION

1) Export of oil plays the most important role in providing both foreign exchange and government revenue to finance economic development.
   To secure the supply of oil for export and to guarantee the domestic energy supply, particularly for the transportation sector, the development of an alternative energy which is useful in internal combustion engines will be an urgent program among the nation's energy policies. This feasibility study was proposed by the State Minister for Research and Technology of Indonesia, Prof. Dr. Ing. B.J. Habibie.

2) Technical reliability of Banko coal gasification by a molten iron bath process was proven by the coal gasification test facilities installed in PUSPIPTEK, JAKARTA.
   20 kinds of Banko coal sampled from various areas and seams were successfully gasified.

3) It was confirmed in the coal sampling study that Banko coal is a non-exportable coal with low calorific value, 3150 - 4650 kcal/kg as mined, but abundant in reserves and low in mining cost at around 14.0 $/ton as mined.

4) The Proposed Project is as follows:

Coal resources	N. W. Banko
Coal consumption	3.7 million t/y as mined
Methanol production	1.5 million t/y
Utilization of methanol	Fuel for internal combustion engines
Start of operation	Year 2000
Build-up of plant	Three phases of each 0.5 million t/y

5) Initial fixed capital investment is appr. 860 million US$.

6) Financial IRR is 11.9% and Economic IRR 15.0%, in case of 175 US$/t of fuel methanol sales price.

7) The financial analysis and economic evaluation show that the fuel methanol production from Banko coal is financially viable and economically feasible, if the oil price is higher than about 30 $/bbl.

Note: According to the reports by USDOE and IEE, Japan it is estimated that the oil price will be increased to around 30 $/bbl in the year 2000.

8) Banko coal effective utilization Project will require more than 10 years for finacing, organizing of the entity and construction work of the facilities.

17-2 RECOMMENDATION

1) Political measures for introduction of fuel methanol should be studied.

2) To formulate the nation's fuel methanol plan and to pursue assessments of fuel methanol matters, a Steering Committee authorized by the Government should be organized among relavant organizations in Indonesia.

3) A pilot test for fuel methanol utilization in taxies, buses, trucks, diesel engine generators and gas turbine generators should be carried out.

APPENDIX

APPENDIX I

List of Organizations and Personnel Visited

by the Japanese Study Team

FY 1984

Organization	Name
BPPT	Dr. Wardiman Djojonegoro
	Mr. Subagio Imam Bakri
	Mr. Bambang Suwondo Rahardjo
	Ms. Indyah
	Mr. Maskan Abdullah
	Mr. Djoko Sulaksono
	Mr. Sulaiman Kurdi
	Dr. Harsono
	Dr. Zuhal
	Mr. Achmad Setiadi
	Mr. Kunarso
	Dr. Lolo M. Panggabean
	Mr. Suharjono
	Mr. Hasnedi
BAPPENAS	
	Mr. Rezy
	Mr. Sudradjat Djiwandono
	Mr. Eko
MIGAS	Mr. Marzuan
	Ms. Siti Djuharmi
	Mr. Harzun
	Mr. Widartomo
	Mr. Woro RH.
	Ms. Etty S.
	Ms. Tobing
DGP	Mr. T. Roesad
	Mr. Pandjaitan
	Mr. Supriyo
	Mr. Agus Martono

Organization	Name
DGBCI	Mr. Sunario
	Mr. J. Purba
	Mr. S. Sinambela
	Mr. Finayati
	Mr. Soemarni
PLN	Mr. Mengah Sudja
	Mr. Edi Trisna
	Mr. C.S. Hutzsoit
	Mr. Sudjahadi
	Mr. Sjahroels
	Mr. Sitompul S.
PTBA	Mr. Omar Hassan
	Mr. Abdillar M.
	Mr. A. Hakim M
	Mr. Andi Masso
	Mr. Sufatri Arief
	Mr. Ahdma Marian
	Mr. Benyamin
	Mr. Andi Massalagka
	Mr. Soetjipto Wijadi
	Mr. Japran
	Mr. Soebastedjo
	Mr. Airidelle
	Mr. Anwar Hassan
	Mr. Nasibi
PNTB	Mr. Kusna
	Mr. Sunardi
	Mr. Ridwan
	Mr. Senosoendjojo
	Mr. Adeng Sunardi

Organization	Name
LEMIGAS	Mr. Hendro Prawoto
	Mr. Effendi Husin
	Mr. Hirwan Effendi
	Mr. Pangkat S.
	Mr. A.S. Nastion
PUSPIPTEK	
	Mr. Gunawan Sakri
	Mr. Sulaiman Kurdi
	Mr. Chandra Prawiro
	Mr. Rustamadji
PERTAMINA	
	Mr. Sumantri
	Mr. Surjanto
	Mr. Soedarno Martosewojo
	Mr. Emir Siregar
	Mr. Indraman Akman
	Mr. Ruslan Siregar
	Mr. Parmono
	Mr. P. Agus Budiarto
PUSRI	Mr. Suyatbo
	Mr. Nasli N.
	Mr. Kusno Sunarto
	Mr. S.P.M. Simandjuntak
	Mr. Starto B.
Ministry of Transmigration	
	Mr. Rofiq Ahmad, Es
	Mr. Buyung Syafei
	Mr. Harry H. Saleh
	Mr. Siswanto
	Mr. Margono

Organization	Name
Ministry of Communication	
	Mr. G. Soedjantoko
	Mr. Yunus
DGM	Mr. Johannes
PT Petrokimia Gresik	
	Mr. Sutrisno
	Mr. A. Budiono
	Mr. H.H. Gaol
	Mr. Agus Ismail
	Mr. B. Setiobroto
	Mr. Bandung Djoko W.
	Mr. Bowo L.
ITB	Mr. Ambyo
	Mr. Maide
	Mr. Alwi
	Mr. Theopilus
PPTM	Mr. Bambang Sulasmoro
	Mr. Mohamad Adnan
	Mr. Bathoni
	Mr. Komar P.A
	Mr. D. Wejaongarjja
	Mr. Y. Basyuni
	Mr. Samza
	Mr. Hadi Nursaya
DMR	Mr. Hardjono
DPU	Mr. Said Kadir
	Mr. Hasan Nuh

FY 1985

Organization	Name
BBPT	Dr. Wardiman Djojonegoro
	Mr. Subagio Imam Bakri
	Mr. Bambang Suwondo
	Mr. Achmad Setiadi
	Mr. Djoko Sulaksono
	Mr. Herry Supriyanto
	Mr. Suharjono
	Mr. M. Harsono
PUSPIPTEK	
	Mr. Rustamadji
	Mr. Sulaiman Kurdi
PPTM	Mr. Bambang Sulasmoro
	Mr. Komar P.A.
	Mr. Zurni M. Nur
	Mr. J.K. Massora
	Mr. Yuyun Basyuni
	Mr. Samsa
	Mr. Arifin Karim
	Mr. Hadi Nursarya
	Mr. Burhandin
	Mr. Kusunawan
	Mrs. Nunung N.
PTBA	Mr. Soetjipto Wijodi
	Mr. A. Suhatri Arif
	Mr. Andi Massalangka
	Mr. Rachmen Soekandi
	Mr. C.S. Jauary
DOC	Mr. Brawi Hendarto
PLN	Mr. R.M. Sayid Budihardjo
	Mr. Sugeng Pribadi
	Mr. Lumbangaol

Organization	Name
PERTAMINA	
	Mr. H. Arifin Abubaka
	Mr. R. Siregar
	Mr. Susilo Martodiwirjo
	Mrs. T. Indrawanti Pudiyanto
	Mr. P. Agus Budiasto
	Mr. Imam Soeharto
	Mr. Abdul Gani
	Mr. Yan Iskandar
	Mr. M.S. Mustafa
Ministry of State for Population and Environment	
	Prof. Dr. Koesnadi Hardjasoemantri
D.G. of Sea Communication	
	Mr. Zainal Abidin
	Mr. M. Soewignjo

FY 1986

Organization	Name
BPPT	Dr. Wardiman Djojonegoro
	Mr. Subagio Imam Bakri
	Mr. Bambang Suwondo Rahardjo
	Mr. Achmad Setiadi
	Mr. Djoko Sulaksono
	Mr. Herry Supriyanto
	Mr. Suharjono
	Mr. M. Harsono
	Mr. Untung Sumotarto
	Mr. Unggul Priyanto
	Mr. Prapto Heljono
	Mr. Amiral A.
	Mr. Helmy Said
	Mr. Joko Prihiastoto
	Ms. Saraswati
	Mr. Indra Budi Susetyo
	Mr. Ayusak Lubis
	Mr. Fathor Rahman
	Mr. Eddy
	Mr. Teddy
PUSPIPTEK	
	Mr. Sulaiman Kurdi
PPTM	Mr. Komar P.A.
	Mr. Yuyun Basyuni
	Mr. Koen Mabsora
	Mr. Endang Yuyu Wiraatmadja
	Mr. Mochammad Rochim
PTBA	Mr. Soetjipto Wijodi
	Mr. Ardi Massalangka
	Mr. Rachman Soekandi
	Mr. Zulyadin

Organization	Name
DOC	Mr. Subandoro
	Mr. Parigan
PLN	Mr. Sudjanadi
	Mr. P. Oka
	Mr. A. Soetjipto
	Mr. Krisno Pandito
	Mr. Sofyan Taca
CV RENE	Mr. Thalib Nasution
PERTAMINA	
	Mr. H. Sudradjat
	Mr. Torie Setiawan
	Mr. L.M.L. Tobing
	Mr. Djoko Hernowo
	Mr. Ibrahim L. Chaniago
	Mr. Hardono
	Mr. Bambang Pitoyo
	Mr. Javed Sumbung
	Mr. Santoso Koerdi
Ministry of State for Population and Environemnt	
	Ms. Sri Hudyastuti
	Mr. Hendra Setiawan
D.G. of Electric Power & New Energy	
	Ms. Maritje Hutapea
	Mr. Maraudin Panjaitan
	Mr. Pemayun

Organization	Name
C.B. of Statistics	
	Mr. Soewondo
	Mr. T.H. Suprono
	Ms. Supati
	Mr. L. Gintung
D.G. of MIGAS	
	Mr. T. Sitanggang
	Mr. Widartomo
	Mr. E.E. Hantoro Ariadji
	Mr. Gono Soedimo
	Mr. Hasyim
D.G. of Basic Chemical Industries	
	Mr. Soenaryo Danusaputro
	Mr. Jaweldin Purba
	Mr. H. Silaen
D.G. of Industry	
	Mr. J. Purba
	Mr. Waluyo
LEMIGAS	Mr. Hendro Prawoto
	Dr. Rachman Subroto
	Mr. Hirwan Effendi

Organization	Name
Ministry of Communication	
	Mr. Maskur Effendi
	Mr. Mahdi Siahaan
	Mr. Soemanto
	Ms. Amala Nurhaida
	Mr. Panal S.
	Mr. Toga Hutabarat
Ministry of Transmigration	
	Dr. Soedjino

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Organization	Name
BPPT	Dr. Wardiman Djojonegoro
	Dr. Lolo M. Panggabean
	Dr. Zuhal
	Dr. Hotma Tobing
	Mr. J. Morsito
	Mr. Subagio Imam Bakri
	Mr. Bambang Suwondo Rahardjo
	Mr. Suharjono
	Mr. E.S Sudirahardja
	Mr. Mahally Kudsi
	Mr. Dwi Husodo
	Mr. Herry Supriyanto
	Mr. Bungkus Prihadi
	Mr. A. Setiadi
	Mr. Suardi
	Mr. Hasnedy
	Mr. Amiral A.
	Mr. Novianto
PUSPIPTEK	
	Mr. Sulaeman Kurdi
	Ms. Yusunitati
	Mr. Heru Kuncoro
	Mr. Herman A.
	Mr. Riyanto M.
	Mr. Roy Indra
	Mr. Darmawan
	Mr. Soni S.
	Mr. Didik BT
	Mr. Roughman
	Mr. Taufik S.

Organization	Name
PPTM	Mr. Bambang Sulasmoro
	Mr. Komar Priatna Anwar
	Mr. Soedjoko
	Dr. U.W. Soelistijo
	Mr. Yuyun Basyuni
	Mrs. Nunung N.
	Mr. Wahju K.
	Mr. Engkos Kosasih
	Mr. Machmmad Rochim
PTBA	Mr. Rachman Soekardi
	Mr. Soetjipto Wijodi
DOC	Mr. Johannas
	Mr. Sbandro
	Mr. Abderhachman
PTB	Dr. M. Kusna
	Mr. Soehandojo
	Mr. Adeng Sumardy

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Organization	Name
BPPT	Dr. Ing. Wardiman Djojonegoro
	Dr. Ir. Zuhal
	Mr. Subagio Imam bakri
	Mr. Bambang Suwondo Rahardjo
	Mr. Suharjono
	Mr. Herry Supriyanto
	Mr. Bungkus Prihadi
	Mr. Dwi Husodo
	Mr. Pranefo Maaruf
	Mr. Hutomo
	Mr. Nyoman Sueta
	Ms. Indyah
	Mr. Erwin
	Mr. Sumartono
	Mr. Riyanto Marosin
	Mr. M.S. Boedoyo
	Mr. Mahally Kudsy
	Mr. Hasnedi
	Mr. Eddy Sjahbuddin
	Mr. J. Moersito
	Mr. Agus Purnomo
	Mr. Ichiro Kuga
LSDE	Mr. Rianto Marosin
BAPPENAS	
	Dr. Bambang Purnomo
	Dr. Astrid Susanto Sunario

Organization	Name
BAKOREN	
	Dr. A. Arismunandar
	Dr. A.J. Surjadi
	Mr. Tangkas Roesad
	Mr. P. Lingga
PUSPITEK	Mr. Alikaton
	Mr. Gunawan Sakri Soemargono
MIGAS	Mr. T. Sitanggang
	Dr. Kabayan W.
	Mr. Yasin Ahmad
	Mr. Dwi Astuti
	Mr. Rockyat
	Mr. Bintara
	Mr. Hendro Utomo
	Mr. Shahabudin
	Mr. Marzuan
	Mr. Widartomo
	Ms. Siti Djuharmi
PERTAMINA	
	Mr. Sadono
	Mr. T.D. Wiria
	Mr. M.H. Situmorang
	Mr. Torie S.
	Mr. Samto Utomo
	Mr. Soewito B.P.
	Mr. A. Pulunggono
	Mr. Sembodu
	Mr. A. Partakoesoema
	Mr. Tjiptowargono

Organization	Name
Ministry of Finance (DG of Taxation)	
	Mr. Nuryanto
	Mr. Muhamad
	Mr. Edwin Kasim
	Mr. Waluyo Daryadi
Ministry of Transmigration	
	Mr. Darwin Nasution
	Mr. Kusubandio
	Mr. Sjamsuddin AS
	Mr. Rubaman
	Mr. M.P. Simatupang
PPTM	Mr. Bambang Sulasmoro
	Mr. M. Chanan
	Mr. Didi Haryadi
	Mr. Moch. Rochim
	Mr. R.A. Sunardi
	Mr. Soedjoko
	Mr. Ukar Soelistijo
	Mr. Basyuni
	Mr. Komar PA
DOC	Mr. Johannes
	Mr. Abrar Manan
	Mr. N. Yamamoto
PLN	Mr. Mustafa
	Mr. Hisori
PTBA	Mr. M. Andi
	Mr. Kanto
	Mr. Suparno
	Mr. T. Isnutomo
	Mr. Tommy

Organization	Name
PLN BA	Mr. Ilham
	Mr. Bambang P.
	Mr. Hamdi Hamid
P.T. Krakatau Steel	
	Mr. Murti Wibowo
	Mr. Sudarto
P.T. Barturaja Portland Cement	
	Mr. Akhiruddin Pohan
Muara Enim Subprovincial Office	
	Mr. Mangali Solichin
	Mr. Soejono Al
PERTAMINA Prabumuli	
	Mr. M. Assegaf
	Mr. S.A. Bukit
	Mr. Moels
	Mr. Budi Santoso
P.T. Waskita Kareya	
	Mr. Asiyanto
Varuna Tirta Prakasya	
	Mr. Eddy Hadiana
	Mr. Sukiman Ardgalima
Port of Palembang	
	Mr. H. Koyid S
BAPPEDA	
	Mr. Baktiar
IHE Bandung	
	Mr. Soewarno

Organization	Name
PTB	Dr. Achmad Prijono
	Mr. Soehandojo
	Mr. Sapari Sutisnawinata
	Dr. M. Kusna
World Bank	
	Ms. Priscilla Z. Urbano
	Mr. John Wilton
BKPM	Mr. Andung A Nuimimaraja
	Mr. H. Tanaka
	Mr. Syofyan S.
	Mr. Benny Rusbon
	Mr. Soegiyantz
	Mr. Rustanto
MINISTRY OF INDUSTRY (BCI)	
	Mr. Soenaryo
	Mr. Waluyo Sukarto
	Mr. Tambunan
	Mr. Warfuddin M.
	Mr. Sri Ambar Suryosunarko
BKPMD, North Sumatera Office	
	Mr. H.M. Abduh Pane
AMSC	Mr. Tanzo Jizaimaru
	Mr. Hideya Tanaka
Price Waterhouse (Drs. Hadi Sutanto)	
	Mr. Leonard van Hien
	Mr. Philip J. Shah
	Ms. Yoshiko Wakui

Organization	Name
Otorita Asahan	Mr. F.X. Samidjan
INALUM	Mr. Nusa J. Toendan
	Mr. Zaini Bachrie
	Mr. H. Torii
	Mr. K. Kondo
	Mr. Takeshi Maki
	Mr. M. Kimura
BAPPEDA, Sumatera Utara Office	
	Mr. Syahmerdan Hudis
	Mr. Amir Toga L. Tobing

APPENDIX II

Member List of the Japanese Study Team

FY 1984

Name	Undertaking	Area of Expertise
T. Sato	Team Leader	Registered Consulting Engineer in Mechanical Engineering
Y. Hara	Assistant Leader, Chief, Market Group	Energy Economist
Y. Araki	Chief, Technical Group	Project Manager in Process
Y. Ogawa	Prospects of Energy Demand in Indonesia	Energy Model for Demand and Supply
T. Tomitate	Energy Demand/Supply for Electricity Generation	Energy Economist
O. Hongo	Ditto	Utilization of Energy
T. Kimura	Energy Demand/Supply for Transportation	Energy Economist
T. Hayashi	Energy Demand/Supply for Gasification	Evaluation of Alternative Energy
K. Matsui	Technology	Energy Engineering
T. Takakura	Ditto	Ditto
M. Suzuki	Ditto	Ditto
K. Watanabe	Synthesis Technology	Planning and Evaluation of New Technology
T. Sakamoto	Ditto	Ditto
N. Taniguchi	Ditto	Ditto
K. Haitani	Economics of Electricity Generation	Cost Evaluation of Electricity Generation
M. Funatsu	Technology on Electricity Generation	Engineering of Power Plant
H. Takahashi	Mining Technology and Cost	Mining Engineering
T. Johno	Mining Cost	Ditto
K. Muta	Chief, Resources Group	Geological Engineering
K. Sato	Resources	Evaluation of Coal Reservoir
T. Oda	Coal Quality	Evaluation of Coal Quality
R. Suzuki	Basic Design of Civil and Architecture	Design and Engineering of Civil and Architecture
S. Sakata	Ditto	Ditto
T. Oka	Neat Methanol Engine	Mechanical Engineering
S. Ida	Coal Mining	Mining Engineer
N. Nire	Pilot Plant Building	Authorized Building Engineer
K. Ishihara	Ditto	Ditto
T. Yanagi	Ditto	Ditto
Y. Yamada	Ditto	Ditto
M. Fukuda	Ditto	Ditto
M. Tachibara	Ditto	Ditto
K. Udagawa	Ditto	Ditto
Y. Hata	Ditto	Ditto
S. Okamura	Ditto	Ditto

FY 1985

Name	Undertaking	Area of Expertise
T. Sato	Team Leader	Registered Consulting Engineer in Mechanical Engineering
S. Ida	Assistant Leader, Chief, Resource Group	Mining Engineering
T. Hayashi	Chief, Energy Demand/Supply for Transportation	Energy Economist
M. Yoshida	Energy Demand/Supply for Transportation	Chemical Engineering
S. Nakajima	Chief, Mining Technology	Mining Engineering
T. Kikuchi	Mining Technology	Ditto
T. Johno	Coal Sampling	Ditto
Kimihiko Ito	Ditto	Ditto
Y. Hatano	Ditto	Ditto
K. Muta	Resources Group	Geological Engineering
K. Sato	Resources Group	Evaluation of Coal Reservoir
Y. Kanbayashi	Coal Quality	Evaluation of Coal Quality
R. Suzuki	Basic Design of Civil and Architecture	Design and Engineering of Civil and Architecture
A. Ikezawa	Technical Group	Project Engineering in Process Industries
M. Miyazaki	Ditto	Mechanical Engineering
N. Nire	Ditto	Coal Gasification Technology
K. Watanabe	Synthesis Technology	Planning and Evaluation of New Technology
Koichiro Ito	Technical Group	Mechanical Engineering
Y. Ishizuki	Ditto	Ditto
S. Okamura	Chief, Coal Gasification Test Group	Coal Gasification Technology
Y. Yamada	Coal Gasification Test Group	Ditto
K. Ishihara	Ditto	Ditto
H. Nishimura	Ditto	Ditto
Y. Hata	Ditto	Ditto
T. Yanagi	Ditto	Ditto
M. Tachihara	Ditto	Ditto
K. Udagawa	Ditto	Ditto
M. Fukuda	Ditto	Ditto
Y. Hatakeyama	Ditto	Ditto
A. Nakai	Equipment Installation	Chemical Analyst

FY 1986

Name	Undertaking	Area of Expertise
T. Sato	Team Leader	Registered Consulting Engineer in Mechanical Engineering
S. Ida	Assistant Leader, Chief, Resource Group	Mining Engineering
T. Hayashi	Chief, Energy Demand/Supply	Energy Economics
T. Kikuchi	Mining Technology	Mining Engineering
H. Nozaki	Geology	Geological Engineering
K. Masumoto	Mining Technology	Mining Engineering
A. Nakai	Coal Analysis	Analysis of Coal Quality
T. Yanagi	Coal Gasification Test	Coal Gasification Technology
Y. Hatakeyama	Ditto	Ditto
T. Yonemitsu	Mining Cost of Coal	Mining Engineering
S. Hiraki	Economic Analysis	Economic & Financial Analysis
K. Ito	Mining Cost of Coal	Geological Engineering
R. Suzuki	Production & Distribution System of Fuel Methanol	Chemical Engineering
S. Nishiyama	Production & Distribution System of Fuel Ethanol	Ditto
H. Hayashi	Safety & Environmental Impact of Fuel Alcohol	Applied Chemistry
K. Takase	Utilization Technology of Fuel Alcohol	Mechanical Engineering
M. Soga	Demand Estimation of Fuel Alcohol	Chemical Engineering
A. Ikezawa	Cost Estimation of Urea Production	Process Design
M. Tsunetoshi	Cost Estimation of Electricity Generation	Electricity Generation
H. Sasaguri	Leader of Test Plant Construction	Mining Planning
I. Taniwaki	Mechanical Construction	Mechanical Engineer
T. Murakami	Control of Electrical Work and Instrumentation	Electrical Engineer
Y. Nakashita	Design of Electric System	Ditto
K. Tanaka	Test Plant Operation	Mechanical Operation
S. Sugimoto	Instrumentation	Electrical Engineer
S. Yamaguchi	Furnace Construction	Furnace
K. Otani	Melting Furnace Control	Ditto
N. Endo	Melting Furnace Operation	Operation of Blast Furnace
M. Kobatake	Gasification Furnace Operation	Operaiton of Gas Furnace
S. Okamura	Analysis of Test Results	Authorized Building Engineer
M. Fukuda	Ditto	Ditto

FY 1987

Name	Undertaking	Area of Expertise
T. Sato	Team Leader	Registered Consulting Engineer in Mechanical Engineering
S. Ida	Assistant Leader, Chief, Integrated Evaluation	Mining Engineering
H. Sasaguri	Assistant Leader, Chief, Coal Gasification Test	Mining and Mechanical Engineering
T. Hayashi	Chief, Energy Demand/Supply	Energy Economics
T. Kikuchi	Mining Technology	Mining Engineering
R. Suzuki	Production & Distribution System of Fuel Methanol	Chemical Engineering
H. Chihara	Chief, Utilization Technology of Products	Nuclear and Chemical Engineering
Y. Kawasaki	Master Planning for Power Station	Electrical Engineering
Y. Sawada	Master Planning for Factory	Civil Engineering
H. Nozaki	Geology	Geological Engineering
M. Fukuda	Process Analysis	Coal Gasification Technology
K. Okane	Ditto	Ditto
Y. Hatakeyama	Coal Gasification	Ditto
T. Yanagi	Ditto	Mechanical Engineer
K. Tanaka	Gasification Plant Operation	Gasification Plant Operation
M. Kobatake	Ditto	Ditto
N. Endo	Ditto	Ditto
C. Sakimura	Ditto	Ditto
K. Nishimura	Ditto	Ditto
K. Kitagawa	Ditto	Ditto
M. Aoyama	Iron and Slag Analysis	Analyzing Technology
I. Taniwaki	Mechanical Maintenance	Mechanical Engineering
T. Murakami	Electrical Maintenance	Electrical Engineering
H. Okada	Instrument Maintenance and Gas Analysis	Instrumentation
K. Otani	Furnace Adjustment	Electrical Engineering
A. Ikezawa	Methanol Production	Process Design
K. Hiraki	Economic Analysis	Economic and Financial Analysis
Y. Ishizuki	Methanol Engine	Utilizaiton Technology
H. Ishii	Supporting Facilities	Mechanical Engineering
S. Aoki	Master plan	Physical Engineering
H. Yamada	Supporting Facilities	Chemical Engineering
M. Itagaki	Supporting Facilities	Architectual Engineering

FY 1988

Name	Undertaking	Area of Expertise
T. Sato	Team Leader	Registered Consulting Engineer in Mechanical Engineering
R. Suzuki	Group Leader for Planning and Coordination, Financial and Economical Study	Chemical Engineering
S. Nakamura	Group Leader for On-site Facilities	Mining Engineering
S. Aoki	Group Leader for Off-site Facilities	Physical Engineering
H. Hirasawa	Group Leader for Coal Mining Faicilities	Mining Engineering
M. Fukuda	Gasification Process	Coal Gasification Technology
Y. Hatakeyama	Ditto	Ditto
K. Okane	Ditto	Ditto
T. Yanagi	Mechanical Facilities	Mechanical Engineering
Y. Hata	Ditto	Ditto
K. Morita	Electrical Engineering	Electrical Engineering
T. Matada	Instrumentation System	Applied Physics
K. Yorifuji	Ditto	Instrumentation
S. Ishimatsu	Gasifier	Metal Engineering
Y. Amemiya	Ditto	Civil Engineering
A. Ikezawa	Methanol Facilities	Process Design
M. Karasaki	Ditto	Engineering for Chemical Industries
Y. Kawasaki	Electricity Generation Facilities	Electrical Engineering
M. Inabe	Boiler	Thermal Mechanics
H. Ishii	Utility Facilities	Mechanical Engineering
Y. Ohnishi	Ditto	Ditto
K. Iwasa	Product Pipeline	Civil Engineering
T. Kobayashi	Ditto	Chemical Engineering
K. Nomura	Power System	Electrical Engineering
M. Mitsuoka	Tank Yard	Mechanical Engineering
K. Suzuki	Maintenance Facilities	Mechanical Engineering for Industries
M. Sakudoh	Ditto	Instrumentation Engineering
T. Kikuchi	Coal Mining Plan	Mining Engineering
H. Nozaki	Geology	Geology
S. Ida	Management Plan	Mining Engineering
K. Michinobu	Safety and Environment	Ditto
N. Ashida	Finance Source and Borrowing Terms	Economics
Y. Fukuzawa	Ditto	Ditto

Name	Undertaking	Area of Expertise
S. Hiraki	Enterprise Form Plan	Economic and Financial Analysis
T. Ogura	Economic Evaluation	International Trading
T. Hattori	Local Economy	Chemical Engineering
T. Inoue	National Economy	Applied Mathematics
T. Kimura	Energy Economy	Economics
Y. Yano	Methanol Introduction Policy	Ditto
T. Iguchi	Construction Cost Estimation	Economic Analysis
N. Morita	*Environmental Impact Assessment*	*Mechanical Engineering*

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