MAMBERAMO NOW

QUARTERLY NEWSLETTER

ENVIRONMENT, INNOVATION, AND DEVELOPMENT OF ENERGY INTENSIVE INDUSTRIES (E.I.D)
MAMBERAMO RIVER PROJECT

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CONTENTS

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MAMBERAMO NOW welcomes articles, commentaries or reviews for publication.

EDITORIALS

In the second issue, we have a brand new format and look of our newsletter. In this third issue, we once again are able to put a new feature, that is ISSN. In doing so, the editorial committee is trying to show their commitment on the continuation of this newsletter.

In this third issue, we present an article, entitled "The Search of the Betting Horse". This article describes our new approach to the development of the project, which was summarized by the editors from two "brainstorming" meetings, one in June and the last one in September. In the second article, the hydropower potentials in Mamberamo River are briefly discussed. This includes some scheme and tabulation on the cost of electricity on several discount rate. The regular section, "BRIEFS", gives some related activities. While some sections, such as "What's Next" and "MIC News" remain. Once again, with your support, we believe that this newsletter will visit you regularly in every April, July, October, and January.

Editor-in-Chief

Meirios Moechtar, Ph.D., P.E. ♣

THE SEARCH OF THE BETTING HORSE

Background

The 650 km long Mamberamo River has a potential to produce between 15-20 GW of electricity. This abundant supply of electricity can serve the needs of various industrial complexes, such as mineral industries (aluminum, steel, copper and nickel), Petrochemical industry, Agro-industry and water electrolysis. Hydrogen produced from the electrolysis process, is an environmentally friendly fuel for a sustainable future. By combining H_2 with CO_2 from either Natuna or Wiriagar gas field, we can produce methanol as a fuel or a feed stock of other chemical products.

In doing so, the Mamberamo River Catchment Area (RCA) will become a potential and a huge growth center in the Eastern Part of Indonesia. It will become a mega project of the 21st century. Subsequently, it becomes a model for sustainable development in the next century, producing clean and renewable energy to guarantee an ecologically sustainable environment. The Mamberamo River will not only become one of the potential Economic Growth Centers for Indonesia, but also for the Asia Pacific region and the world as well.

However, since the whole catchment area of Mamberamo River is so huge (100,000 sq. km) and the Mamberamo River is very long (650 km), three dam sites will be selected for detailed study and construction during the initial stages. These sites are Mamberamo 1, Mamberamo 2 and Edi Valen (see Figure 1), which can produce 5,695 MW, 930 MW and 650 MW of electricity, respectively.

Objectives

1. To look for partner(s) who are willing to develop the Mamberamo industrial complex, which contains energy intensive industries, powered by hydroelectric power generation. Interested partner(s) are expected to be capable of stimulating the establishment of a large scale industrial estate, such as aluminium, steel and copper industries.
2. To define the scope of works and responsibilities among the interested parties.

Potentials

A preliminary study on Mamberamo hydroelectric power conducted by PLN in 1983 showed that the cost to produce electricity in Mamberamo 1 and Mamberamo 2 are 1.81 US¢/kWH and 3.72 US¢/kWH, respectively. While for the Edi Valen power plant, it will need more details study to calculate its cost of electricity. It is also concluded that Mamberamo 1 is feasible to be developed as hydroelectric power dam, while Mamberamo 2 is feasible to be developed as multipurpose dam. In the case of Edi Valen, it can also facilitate as the river transportation, as long it is provided with a river canal.

Mamberamo river can provide an inexpensive hydroelectric power, such that the prospective industry should take this advantage. One of the most energy intensive industries, which can be selected as a prime mover, is the metal smelter industry that produces metal from its mineral. According to the required energy to process the mineral and the location of Mamberamo, there are some metals that can take this advantage, i.e. aluminum, steel, copper and nickel. The energy demand to produce these metals can be seen in Table 1.

Table 1: Energy Consumption of Several Mineral Industries

METAL	ENERGY DEMAND (MWh/Ton)	REMARKS
Aluminum	13.6-14.7*)	Alumina to aluminum
Steel	4.7-5.32**)	Iron ore to steel
Copper	8.8-11.7	Copper concentrate to metal
Nickel (laterite ore)	0.46 ***)	Hydrometallurgy
	1.39 ***)	Pyrometallurgy

*) Based on the operation data of PT. Inalum, 1997.
**) Based on the operation data of PT. Krakatau Steel, 1997
***) Calculated from Slamet, Development of Nickel Industry in Eastern Part of Indonesia, Seminar & Workshop on Mamberamo RCA Development, 1997.
Source: Kesler, Mineral Resource, Economic and the Environment, Macmillan, 1994 page 101.

The situations of the metal industry are as follows:

Due to the increasing demand on light metal for automobile component and on soft drink can, the aluminum demand will increase in the future. Based on the study by AME Mineral Economics, the demand for aluminium will increase about 4.0% per annum. With the rate of production is around 2.16 Mt/y, it is predicted that it will be around 2.85 Mt/y by the year 2003. Therefore, any additional capacity to produce aluminum will have market to absorb its production. Mamberamo which is located between Australia, a major producer of bauxite and alumina, and Japan, a major consumer of Aluminum, can take advantage of inexpensive hydroelectric power to produce aluminum from alumina (or from bauxite to alumina as well).

The demand of steel in Indonesia is predicted to increase up to 11 Mt by the year 2010. This demand certainly cannot be fulfilled by the current installed capacity (the major steel producer is PT. Krakatau Steel with its current production is of about 2.5 Mt/y). A new plant will be expected, if the Indonesian want to locally produce the steel. Furthermore, Mamberamo can also produce steel for consumer in Korea, Taiwan and Japan by using iron ore, ingot or pellet from Australia. By doing so, our customer in Far East can save a lot in the iron-ore transportation cost, that is from Australia to Far East compare to from Australia to Mamberamo. A saving in the amount of US$ 30/ton can be expected from this scheme, on top of the lower energy cost generated by the Mamberamo power plants.

PT. Freeport Indonesia (PTFI) which currently produces 600,000 tpy copper concentrate, will increase its production up to 2,600,000 tpy by the year 2000. Meanwhile, the smelter capacity in Gresik is expected to increase up to 700,000 ton. The additional copper concentrate product can be potentially smelted in Mamberamo area. In addition, several copper/gold explorations are going on in Irian Jaya. Their products by the year 2004/2005 can also be smelted in the copper smelter in Mamberamo area.

There are several nickel resources located around Mamberamo. The available nickel ore from these resources most likely needs the hydrometallurgy process. This process requires sulfuric acid, which is a by product of a copper concentrate smelter. In addition, the nickel industry may be located in Mamberamo area to take advantage of inexpensive hydroelectric power.

Metal industries that will utilize raw materials from the areas nearby Mamberamo or Australia, can then export their products to the consumers in the far distance, such as in Japan, Taiwan, Korea or any other part of Pacific region. They will even get more benefit, especially if they can produce final products (metals) rather than middle product (such as copper concentrate). An export price list of several mineral products from Indonesia quoted from Central Bureau of Statistic (BPS) in 1992 and AME Mineral Economics Study in 1996 can be seen in Table 2.

Table 2: Price of several mineral products (1992 US $)***)

MATERIAL	METAL CONTENT	PRICE ($/kg) *)
Copper		
Ore	1.61 % Cu	
Cu. Concentrate		0.76
Copper	32.08 % Cu	
Gold	22.84 gr. Au/ton	
Silver	71.78 gr. Ag/ton	
Bar		
Copper		2.73**)
Gold		11,000
Silver		150
Nickel		
Ore	2.1 % Ni	$1.1x10^{-5}$
Nickel matte	78 % Ni	10.00**)
Plate		66.46
Iron		
Ore	25 % Fe	0.04
Steel Bar & Rod	97 % Fe	0.34
Aluminum		
Bauxite	25 % Al	0.014
Alumina	54 % Al	0.195
Metal	100 % Al	1.50**)

*) All prices are export from Indonesia, except alumina price is import from Australia.
**) Based on the AME Mineral Economics, 1996.
***) Sources: BPS, 1992.

Opportunity

Suppose that the metal concentration of the processed mineral and the quality of produced metal are the same as the current products (see

Table 2), and the capacities of the metal industries in Mamberamo are as follows:

- Aluminum is 225,000 tpy (current capacity of Asahan aluminum smelter),
- Steel is 5.5 million tpy (half of Indonesian steel demand in 2010),
- Copper is 2.6 Mtpy of concentrate (PT. Freeport Indonesia production capacity in the year 2000),
- Nickel is 45,000 tpy of matte (current capacity of PT. International Nickel Indonesia)

The estimated annual revenue that might be generated in this area are:

Copper	= US $ 2,271 million
Gold	= US $ 653 million
Silver	= US $ 28 million +
Subtotal copper industry	= US $ 3,024 million
Aluminum industry	= US $ 338 million
Steel industry	= US $ 1,870 million
Nickel industry	= US $ 450 million +
Total	= **US $ 5,682 millions**

Support

There will be two kinds of support provided by the Government of Indonesia to any investor who wants to invest in Mamberamo. The supports are in the form of incentives in investment, such as tax-holiday, and in the form of support in the basic infrastructure. Mamberamo that is located in the Eastern Part of Indonesia (Kawasan Timur Indonesia = KTI) will become one growth center in which it will also get incentives at least similar to the ones offered to the integrated economic growth center of Biak.

The Government through an authority created in Mamberamo will also provide the basic infrastructure such as road and harbor. With this scenario, the investor should not have to invest any money for the access road from its facility to harbor.

Estimated Investments

The amount of fund required to develop the Mamberamo RCA Project during its initial stage, depends on how many industries that we should establish. Subsequently, this also depends on how many prospective investors are interested in investing their money in this area. However, in the case that all of the prospective metal industries can be realized, the required investment is estimated in the Table 3.

Table 3: Estimated Investment

DESCRIPTION	FUNDED BY	ESTIMATED COST (million US$)
I. Dam & Hydroelectric PP		
• Hydro Electric PP, 5 GW	BOT	5,000 – 7,500
II. Pioneer Industries		
• Alumina-Aluminum	Investor	1,000 – 1,500
• Steel-Hydrogen Industry	Investor	2,500 – 5,000
• Copper Conc. Smelter	Investor	2,500 – 5,000
• Petrochemicals	Investor	1,000 – 2,000
• Pulp & Paper	Investor	1,000 – 2,000
• Shipyard	Investor	1,000 – 2,000
III. Basic Infrastructure	Government	400 – 600
IV. Industrial Estate	Developer	200 – 300
	Total	**14,600 – 25,900**

M. Moechtar, Ph.D., P.E. and
Dr. Hari Suharyono ♣

HYDROELECTRIC POTENTIALS IN MAMBERAMO 1, MAMBERAMO 2, AND EDI VALEN

Mamberamo River in Irian Jaya has an abundant hydroelectric potential with installed capacity of about 12,284 MW. The Mamberamo 1, Mamberamo 2, and Edi Vallen have the prospect to be developed at the early stages if some energy intensive industries can also be developed in this region. Mamberamo 1 (with installed capacity of 5,695 MW) has been consider as a single purpose dam (for hydroelectric power only), Mamberamo 2 (with installed capacity of 930 MW) as a multipurpose dam, and Edi Vallen (with installed capacity of 650 MW) as a run-off river hydroelectric power plant.

Hydroelectric power development in Mamberamo River shall be integrated with other sectors, i.e. industry, agricultural, residential, and other commercial sectors. The economic and environmental aspects shall also be taken into account in the development of the project.

The Mamberamo River development has several potentials to be developed as a growth center in Eastern Indonesia. It can be foreseeable to develop various industries in and around the basin area. The industrial development will also contribute to labor employment opportunity to significant extent other than the transmigration program.

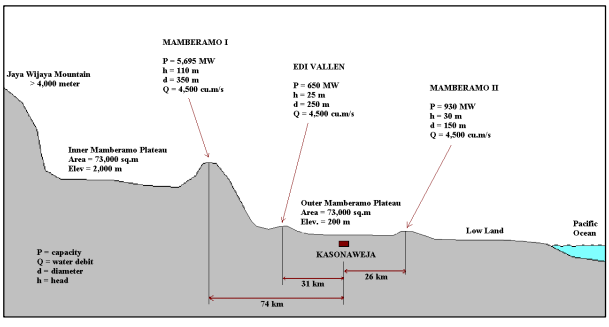

Figure 1: Schematic Illustration of Mamberamo I, Mamberamo II, and Edi Vallen

Comparing with diesel power plant, hydroelectric power plant has advantage because the cost of electricity is quite low. Using the investment cost of 2,000 US$/kW and discount rate of 10 %, the cost of electricity is estimated at around 3.65 US¢/kWh. Calculation result for each discount rate is shown in Table 4 and the basic input data is shown in Table 5.

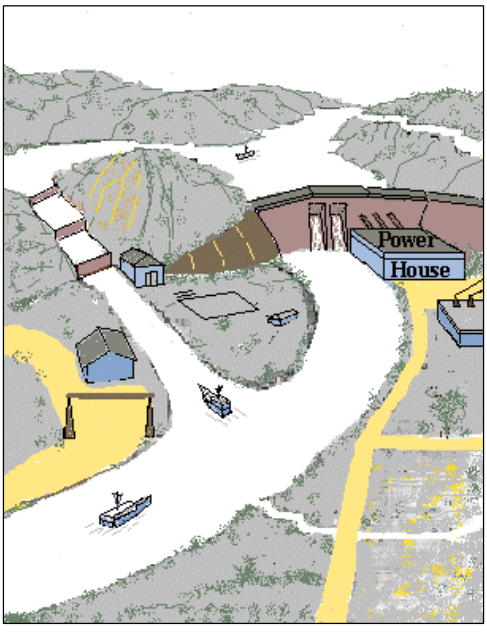

Figure 2: Artist View of Run-off River Hydroelectric Power Plant in Edi Vallen

Table 4: The Cost of Electricity of Hydroelectric Power Plant

	Discount Rate (%)				
	4	6	8	10	12
US¢/kWh	1.71	2.25	2.90	3.65	4.52

Table 5: Basis Input Data

	Unit					
Installed Capacity	MW	1,000				
Availability Factor	%	95				
Economic Life Time	Year	30				
Construction Time	Year	5				
Foreign Investment	US $/kW	1,600				
Domestic Investment	US $/kW	400				
O&M Cost	US $/kWy	10				
Foreign Disbursement	%	24	54	14	06	02
Domestic Disbursement	%	27	28	36	08	01

Agus Sugiyono, M.Eng ♣

BRIEFS

Brainstorming Meeting

As a continuation of our first brainstorming meeting in June 1997, we conducted the second meeting on September 1997. It was attended by Prof. Zuhal, the new Vice Chairman of BPPT; Mr. Ukar Soelistijo, to represent the Secretary General of Department of Mines and Energy; Prof. Suryono, Vice Chairman of Asahan Authority; Prof. M.T. Zen, Chairman of Working Committee of Mamberamo Project – BPPT; Prof. Harijono Djojodihardjo, Vice Chairman of the Committee; Drs. Komarudin, MA, Deputy Chairman for System Analysis; Dra. Trulyanti Sutrasno, MPsi, Deputy Chairperson of Administrative Affairs; and some members of the committee. The most important issue discussed in the meeting was about the "prime mover" for the project.

The meeting was opened by Prof. Harijono Djojodihardjo, which briefed the participants with the prospective prime movers for the project, that is aluminum, steel, copper-nickel, and titanium based industries. Then it was

followed by the brief explanation by Prof. M.T. Zen about the Indo-Australia Energy & Mineral Community. He also explained about the mineral deposits in Northern Territory of Australia, and some other locations. Of those, bauxites and iron ores are potentially exported to Mamberamo to be processed, utilizing the abundant source of environmentally friendly energy, that is hydropower from Mamberamo River. Then, the brief from Prof. Dr. Zuhal about two possible approach for the project development, that is soliciting and non-soliciting approaches. The first approach has been proposed so far by requesting some support to conduct all feasibility studies (12 studies as appeared in TOR). Obviously, this is not the appropriate approach. After a more detail explanation by Dr. Meirios Moechtar, Secretary General of the Working Committee, the participants were agreed to take the second approach. Therefore, the committee will prepare a draft of basic concept of master plan to be proposed and discussed with the prospective manufacturing and financial investors. Of course, we got many input from the experts who participated in this meeting. The basic result of the meeting is as summarized in the first article, prepared by Dr. Meirios Moechtar and Dr. Hari Suharyono.

CO_2 Fixation and Utilization

In return to the Prof. Harijono Djojodihardjo and Dr. Meirios Moechtar of BPPT visit to Tokyo, Japan in March 1997, a small delegation from Japan visited BPPT office on September 18, 1997. The main purpose of this visit is to further discuss the possible utilization and fixation of natural gas associated CO_2. The meeting was attended by Prof. M.T. Zen of BPPT, and the experts from Department of Industry and Trade; Oil & Natural Gas R&D Institute (LEMIGAS); PT. Kaltim Methanol Industri; Natuna Gas Project – BPPT; and the Mamberamo Project Team members. It was opened by Prof Harijono Djojodihardjo to welcome the Japanese delegation of Dr. M. Akai of Mechanical Engineering Lab. – MITI, Mr. Y. Tanaka of NEDO – MITI, Mr. S. Maezawa of RITE (Research Institute of Innovative Technology for the Earth), and Mr. T. Tanaka of Institute of Applied Energy, Japan. After the discussion, we concluded that the contribution of the Mamberamo Project to the Natuna Gas Project maybe very insignificant. It is only about 3-4% of Natuna CO_2 that can be utilized in Mamberamo. Even with this scheme, the cost of methanol will be about 3 times of the conventional methanol production process. The major production cost components for this methanol process are the cost of electricity, the hydrogen production cost and the methanol process, which is amounted to about 80% of the total cost. While the cost of handling and transportation of CO_2 are less than 20% of the total cost. Another constraints for that figure above (3-4%) is the required power for the electrolysis plant. At this rate, the power generation capacity is around 800 MW. So if we want to handle all the available Natuna CO_2, we will need a power plant with capacity of about 33,000 MW, which is very unrealistic. On the other hand, the annual methanol production will be about 30 million tons (MT), while the total worldwide consumption of methanol is around 33 MT.

Dr. Surat Indyarso of Natuna Project also pointed out that the reinjection of CO_2 to the aquifer is still the most economical solution. He also explained that the Natuna gas is proposed to be pipelined to the Java island to generate electricity. Therefore, its dependency to the Mamberamo project is most likely none. Despite the less possible integration of Natuna – Mamberamo project, the expert from Department of Industry & Trade; LEMIGAS and BPPT are still interested in developing the fixation and utilization of gas CO_2, as proposed by the Japanese delegation, especially the catalytic methanol process. Further information exchange and cooperation between two countries need to be established.

Visit to Bontang, East Kalimantan

After the meeting in Jakarta, the Japanese delegation on the CO_2 Fixation and Utilization Project above continued their trip to Bontang, East Kalimantan. They were accompanied by Dr. Meirios Moechtar and Dr. M.A.M. Oktaufik to visit the methanol plant owned by PT. Kaltim Methanol Industri (PT. KMI). The main purpose of this trip is to get first hand

explanation on the methanol production process from the experts at PT. KMI, which consists of some experts from LURGI (consultant), project advisors (independent consultant from Singapore), engineers (from PT. Kaltim Fertilizers and PT. KMI).

This will be the second methanol plant, but will have the largest production in Indonesia. The other plant is located in Bunyu with capacity of 700 tons of methanol per day. While this one is designed to produce about 2000 ton per day or around 660,000 tons of methanol per year. Although the latter can produce as many as three times of the former one, the size of the plant itself is almost the same. The main difference is on the technological process, which is designed by Lurgi GmbH, Germany. By visiting this methanol plant, we from the Mamberamo Project should be able to collect more information about the possibility of utilizing Natuna CO_2 and Mamberamo H_2 to produce methanol, which is one of our proposed twelve studies, appeared in our Terms of Reference of the project.

Visit to PT. Krakatau Steel (PTKS), Cilegon

In August 1997, a Mamberamo team visited PTKS. PTKS is an integrated steel industry, which started from iron making, steel making to various product of steel construction, i.e. steel plate and steel bar. The iron making plant of PTKS utilizes natural gas as reductor. The feed stock of the plant, iron ore pellet, is imported from Brazil, Sweden and India. An increase of natural gas price from US $ 0.65 per MMBTU to US $ 2.0 per MMBTU leads to the changing of reductor from natural gas to coal in 1998. A blast furnace that will use coal with a capacity of three million ton is under construction now. A sintering plant and a cooking plant are also built to support the blast furnace.

The steel making plant, which utilizes an electric arc furnace (EAF), is fed by Direct Reduced Iron (DRI) from the iron making plant or the one imported from Australia. The EAF of the steel making plant consumes about 76 % of total electric power consumed by PTKS.

The total capacity of PTKS power plant is 400 MW. However, the electric demand of PTKS is higher than the available electric supply. Therefore, PTKS must buy some of the electric required from PT. PLN. The price of electricity is Rp 129/ kWh (1 US $ = Rp 3600). The electric demand for residential is only about one percent of total electric demand of PTKS. An average of energy intensity in 1995 can be seen in Table 6.

Tabel 6: The average of energy intensity in 1995

	IRON MAKING	STEEL MAKING	ROLLING MILL
Total (Gcal/ton)	3.75	2.87	0.45
Natural gas (Nm^3/ton)	444.58	23.94	17.51
Electric (kWh/ton)	59.98	902.06	105.60

In addition to its usage as a reductor, natural gas is also used as a preheater in slab reheating furnace and a medium of heat transfer in continuous annealing furnace at cold roll mill plant. Other than reductor agent, demand of natural gas can be replaced by fuel oil.

A steel making plant consumes a higher electric power than an iron making plant (see Table 6). Therefore, the steel making plant is more suitable to be built in area which has an abundant inexpensive electric power. In addition, to construct the steel making plant is much more attractive than to construct the iron making plant, because the steel making plant can generate more revenue.

Miscellaneous

In the last quarter, we already consult, discuss, and present the Mamberamo project to several interested and concerned parties. They include Kilborn SNC-Lavalin; PT. SUCOFINDO (state-owned company under Department of Industry and Trade); PT. Rekayasa Industri (a state-owned consulting and contracting company); BCEOM, a French Consulting Group; BRGM, a French Geology & Mining Company; University of Cenderawasih, Irian Jaya; PII/KADIN (Indonesian Engineers Association / Indonesian Chamber of Commerce and Industry); Indonesian Secretariat of German Indonesian Forum (GIF); etc. We also visited

the aluminum smelter plant in Kuala Tanjung, North Sumatera (owned by PT. Inalum) and Sigura-gura Hydroelectric Power Plant (owned by Asahan Autorithy); steel making plant in Cilegon (owned by PT. Krakatau Steel); and methanol plant in Bontang, East Kalimantan (owned by PT. KMI). These efforts are maintained to be conducted in order to refine and reshape on the master-plan of the project when we think it is necessary. ♣

MIC NEWS

We are very sorry to inform you that our homepage was down in the last two weeks. This was due to some technical difficulties, especially in the backbone of network and the switching to our new server software. Now we are very please to let you know that we're back to the cyberspace again.

Welcome to the New MIC Membership 1997

- MIC Corporate Membership

Name	Institution
G. Turkstra	Boskalis International BV
Harald W. Williges	Hochtief AG
Duliar Abdullah	PT ELNUSA
Sulistianto	PT Rekayasa Industri
Charles E. Watson	PT Indo Mineratama
Hermann Bernard	VOITH AG, Germany

- MIC Individual Membership

Name	Institution
Hidayatul Mukmin	PT Transfera Infranusa
Jean-Daniel Chabas	French Advisor to Minister of State for R&D
Hartmut Keune	German Embassy

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WHAT'S NEXT

Indonesian Institution of Engineers (PII) and Australian Institution of Engineers Joint Conference

On August 19, 1997, Prof. M.T. Zen as the chairman of Mamberamo Working Committee, accompanying by Dr. Meirios Moechtar set a meeting with Mr. I. Sucipto Umar, the Secretary General of PII and Indonesian Chamber of Commerce and Industry (KADIN). The purpose of this meeting is to consolidate the necessary effort to be done by the Indonesia side to anticipate the joint conference between PII and Australian Institution of Engineers on the development of the Eastern Part of Indonesia (Kawasan Timur Indonesia – KTI), which will include Mamberamo Project. It was agreed that the Mamberamo Team will prepare TOR on several prospective industries to be proposed to the Australian investors, while the PII and KADIN will enhance this TOR with some financial incentives and other non-fiscal related issues. This combined TOR will be submit to the forum as the Indonesian TOR for the Mamberamo River Catchment Area Development Project.

GIF III in Berlin, Germany

On August 1997, a preliminary meeting for the German Indonesian Forum (GIF) III was conducted in Surabaya. Unfortunately, none of the members of the Mamberamo could make it. Despite the absent of any representative from Mamberamo project, some members of the German delegation still requested about the current status of the project. This is due to the fact that Mamberamo Project is already in the agenda of the meeting since the second GIF meeting in Jakarta last October 1996. Therefore, the forum through the Indonesian Coordinator for the Energy in the GIF, Mr. Kodyat Samadikun, already asked and met Prof. Zen and Dr. Meirios Moechtar to prepare a more detail and current status of the project, which is expected to be presented in the next meeting in Berlin on December 2, 1997. For the time being, the Mamberamo committee is already in contact with the Ferrostaal AG and Linde AG. Next we will contact Siemens AG, Hochtief, and other interesting parties. ♣