THE PRE-FEASIBILITY STUDY REPORT ON THE NATIONAL IRON AND STEEL DEVELOPMENT FOR THE SECOND GENERATION IN THE REPUBLIC OF INDONESIA

(SUMMARY)

DECEMBER 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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CONTENTS

1. Introduction

1-1. Object and background of dispatch of the study mission

The Government of Indonesia felt strongly necessity of the soonest possible expansion of self-supply capacity of steel as it was foreseen from the study made through cooperation of UNIDO and others on steel demand that the present shortage of domestic steel supply as against steel demand would further increase rather than decrease in future. Believing that the condition would be more crucial in 1990s particularly, the Government decided that a study be undertaken on a plan for an early realization of a project to construct an integrated steel works as the national iron and steel development for the second generation in the Republic of Indonesia.

With the above background the Government of Indonesia made a request to the Government of Japan in February 1983 to cooperate in a study for the plan.

For execution of the study, the Government of Japan decided to have Japan International Cooperation Agency (JICA) carry out the study concretely, and JICA sent study missions three times, namely, preliminary study mission for the plan for the national iron and steel development for the second generation in the republic of Indonesia (August 24 to September 3, 1983), the second preliminary study mission (March 4 to 14, 1984) and the preparatory study mission (July 23 to August 1, 1984), and concluded the scope of works with the Ministry of Industry of Indonesia. JICA dispatched Step I and II study missions to the Republic of Indonesia in conformity to the S/W.

1-2. Outline of Step I (demand study) study

Step I study aimed at the study of steel demand and supply in Indonesia and a mission was dispatched to Indonesia from November 14 to December 11, 1984. Also, as the Indonesian side requested strongly at the time of the preparatory study in July 1984 that Ombilin, one of major coal mining area in South Sumatera, be added as one of the proposed sites for a new steel works and that study be made on possibility of utilization of natural gas, experts on coal and natural gas joined the mission.

Incidentally, the S/W gives 1990 as the target year for demand and supply balance, but to help understanding of future and portraying of the steel works for the second generation, the mission decided to forecast the balance in 1995 and 2000 just for reference.

Although there were some other study outlooks for steel demand conducted by third parties such as BSC and A.D.L., it was agreed by and between MOI and JICA Step III mission that the Pre-F/S be proceeded with on the assumption that the demand for non-flat products would increase as per the study results of Step I in some years after 1990.

1-3. Outline of Step II (site survey) study

Step II study was made by field survey from July 11 to August 30, 1985, with the purpose of studying the six sites proposed by the Indonesian side for construction of the integrated steel works for the second generation in the aspects of area available, port location, transportation, fuel, cooling water, manpower, supporting industries, etc.

In making selection of the sites, the following were made premises.

1) Production scale:	An integrated steel works specializing in production of non-flat products to the extent of 2 million tons a year, max.	
2) Production process:	DR - EAF - CC - Rolling (Non-flat products)	
3) Site area:	Site for steel works	300 ha.
	Site for welfare	300 ha.
4) Port and approach channel:		
	Iron ore	60,000DWT
	Product & scrap	5,000DWT
5) Electricity:	For steel works	400MW
	Back-up power	400MW
6) Water:	For steel works (fresh water)	8,000 m^3/h
	For power plant (sea water)	80,000 m^3/h

As a result of the above field survey and the work in Japan, the six proposed sites were classified as below and the areas which are suited for construction of the integrated steel works or have at least technical possibility are given below.

(1) An area which is to be studied separately

Cilegon Area:

Since expansion plan of existing P.T. Krakatau Steel is unknown, the area needs a separate study from the availability of site area and industrial water, etc.

(2) Areas which are considered unsuited, namely too early to be selected as the site

Bontang Area and Tanjung Enim Area:

Due to the absence of electricity for back-up in those areas.

Yogyakarta Area:

Due to the difficulties for port construction.

(3) Areas which permit the project technically

Pare Pare Area and Lhokseumawe Area.

As regards Pare Pare Area and Lhokseumawe Area selected by the study mission, it was decided to conduct the F/S of the project at either site as Step III study after the Indonesian side selected one from the two.

1-4. Step III (Pre-F/S) study

The Indonesian side examined the above two areas of Pare Pare Area and Lhokseumawe Area selected by the Step II study mission, but the Indonesian side requested a review of utilization of iron sands of Yogyakarta in selection of the sites.

To this, the Japanese side explained that use of iron sands is technically impossible, and the Indonesian side withdrew the request and made a new request containing Pre-F/S for the two areas, Cilegon Area and Lhokseumawe (Arun) Area.

To consult the contents of Step III study, the Japanese Government dispatched a study team to Indonesia from December 15 to 21, 1986. As a result of the consultation, it was confirmed that the study is to be Pre-F/S for the two areas of Cilegon and Lhokseumawe (Arun), the contents of which includes rough estimation of construction cost, but excludes financial analysis and that the study is to terminate with the Pre-F/S of Step III study.

Step III study was made by field survey from March 1 to 12, 1987, with the main purposes of preparing the conceptional design and estimating roughly the cost for the construction of the integrated steel works for the second generation.

2. Selection of Plant Site

2-1. Planned sites in Step III

The study in this Step III took up Lhokseumawe (Arun) area and the Cilegon Industrial Estate as the planned plant sites.

In the recommendation of the Step II mission, evaluation of the Cilegon Industrial Estate as plant site ranked low as question was raised about availability of industrial water and natural gas in the area.

However, in compliance with the request of the Ministry of Industry of Indonesia and in expectation that completion of a planned dam in future will ensure supply of industrial water in the quantity as required for operation of the new steel works in the Cilegon area and that as described in the full report, though it is difficult to expect demand and supply of natural gas to balance even in future, natural gas may be made available by cutting its consumption at P.T. Krakatau Steel and by changing to other fuels at P.T. Krakatau Steel and neighboring plants (cement factory, etc.), the site in Cilegon Industrial Estate was added as one of the planned site in the Step III.

2-2. Characteristics of the two planned sites

(1) Arun area

1) Advantages

a) Not much problem in ensuring necessary land
b) No problem in availability of industrial water and natural gas

2) Disadvantages

a) Large expenditures required for port construction
b) With no power consumption in neighboring areas at present, a great care called for construction plan of power stations
c) With no supporting industries in the area at present, difficulty expected in availability of materials and spares at the time of construction and start-up of the new steel works
d) Recruitment of manpower for construction as well as for operation of the works most likely a problem
e) Far from steel consuming centers in Indonesia

(2) Cilegon area

1) Advantages

a) Necessary infrastructure complete now serving P.T. Krakatau Steel mainly
b) Easy to recruit manpower
c) Close to steel consuming centers
d) No special problem as to land and sea transportation

2) Disadvantages (questionable points)

a) Necessity of further study on supply of industrial water
b) Necessity of detailed study on demand/supply balance of natural gas

3. Product Mix, Production Scale and Production Process

3-1. Conditions of production of the project

1) Production scale --- 1,500,000 t/y (in rolled steel)

2) Production and product size range by mill

Mill	Production (1,000 t/y)	Product Size Range (mm)
Sections	250	L50-120, I75-125 FB70-125, [75-125 T100-125
Bars	650	10-50 ø
Wire rods	600	5.5-16.0 ø

3) Scrap and scale generated in the works are to be recycled as much as possible in the works.

4) The ratio of lump ore:pellet at DR plant is to be as follows:

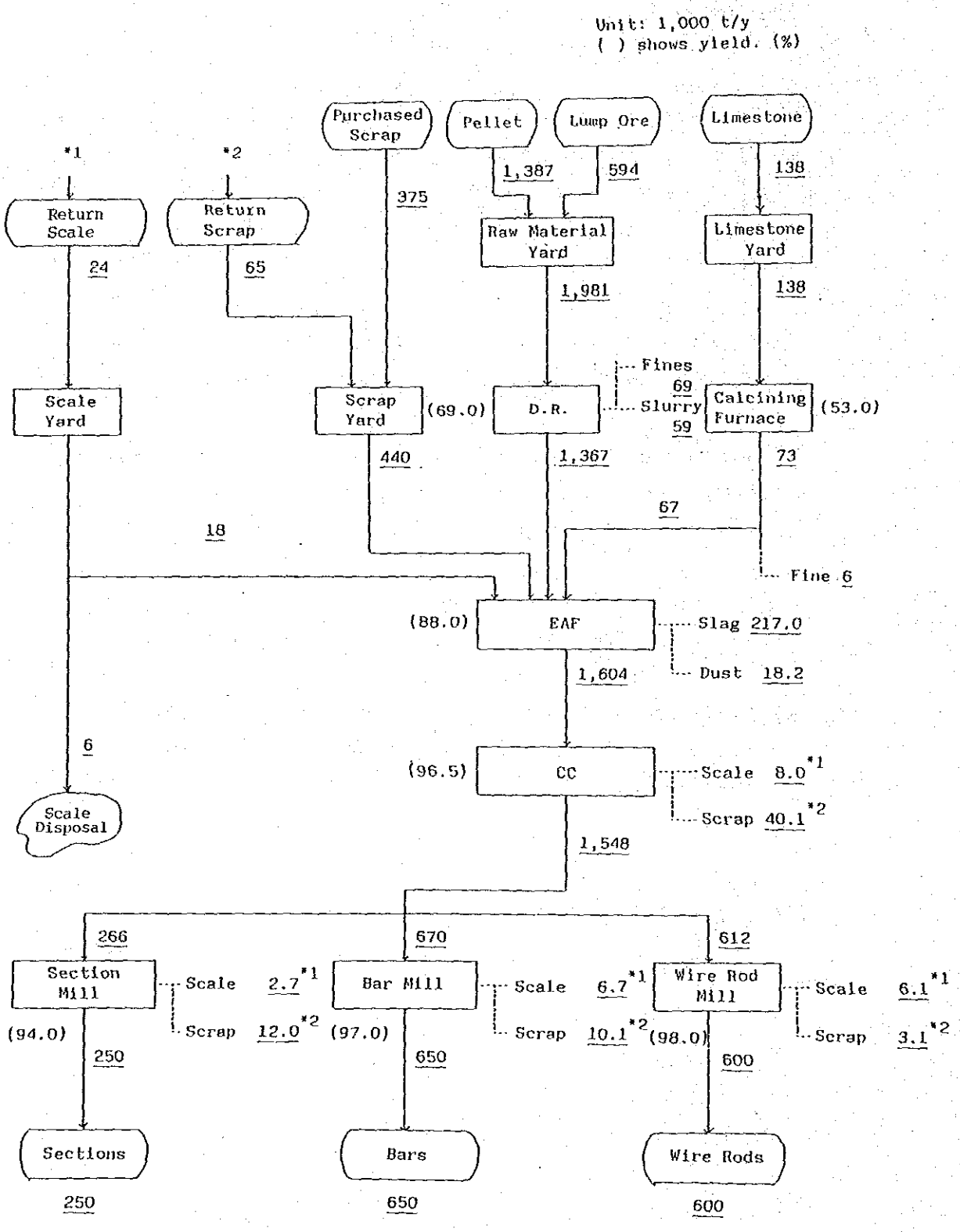
Lump ore:Pellet = 30:70

5) DRI blending ratio at EAF is to be as follows:

DRI:Scrap+Scale = 75:25

6) Billets produced at CC plant are to be all used in rolling mills of the steel works and no outside sale is planned.

3-2. Material balance



Material Balance at Products 1,500,000 T/Y

3-3. Production process adopted in Step III study

From the points of production scale of the steel works and availability of raw materials and fuel, the gas based Direct Reduction Process using natural gas produced in quantity in Indonesia as reducing agent is a natural conclusion.

On the other hand, DR process based on solid reducing agent may be used only when there are coal mines developed in the vicinity of the steel works as mentioned in the full report.

Also as a result of market research, the steel works is planned to have the final production scale not exceeding two million t/y.

As it is judged from the above that adoption of natural gas based DR process is most realistic as compared with the other processes, natural gas based DR process is to be adopted in the present Pre-F/S.

4. General Layout of the Steel Works

4-1. Basic policy in planning the layout

1) Draft layout is to be prepared for the two sites of Cilegon and Arun areas.
2) Site conditions (land shape, soil condition, etc.) for the steel works in those two areas are to be set up on the basis of the study of Step II and Step III study missions.
3) The major part of raw materials and sub-raw materials are to be brought to the steel works by sea.
4) Shipping of products from the steel works in respective areas is to be made by the following methods:

	Sea Transport	Land Transport
a) Cilegon area	25%	75% (rail & truck)
b) Arun area	82%	18% (truck only)

5) Production scale of the steel works is to be 1.5 million t/y (in rolled steel), but the facilities are to be laid out so as to permit expansion of production scale by about 50% in the future.
6) Power plant, water reservoir and slag disposal area are to be installed in the compound of the steel works.
7) Green belt in width 50 m min. is to be created around the steel works.

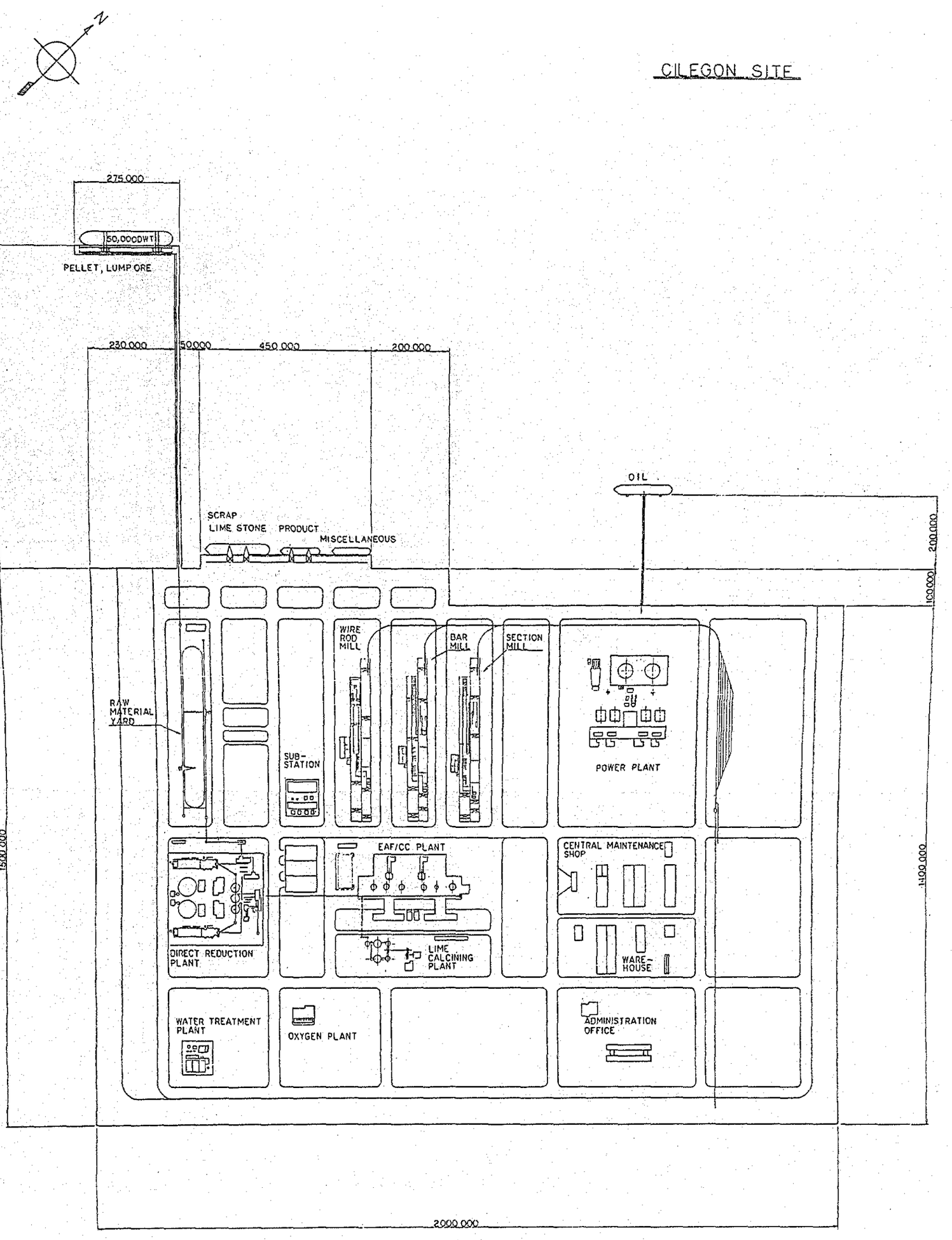
4-2. General layout

1) In view of flow of goods such as flow between major processes, carrying in and out of raw materials and products, in-plant vehicle movement, etc., the flow of production process at both Cilegon and Arun areas is considered best if it is from berths to inland to berths.
2) Assuming that natural gas and raw water are brought to the steel works from inland area, the reservoir and raw water treating facilities are to be laid out, together with oxygen plant, at the inland side of the steel works and close to DR plant and EAF plant which consume much water and oxygen.

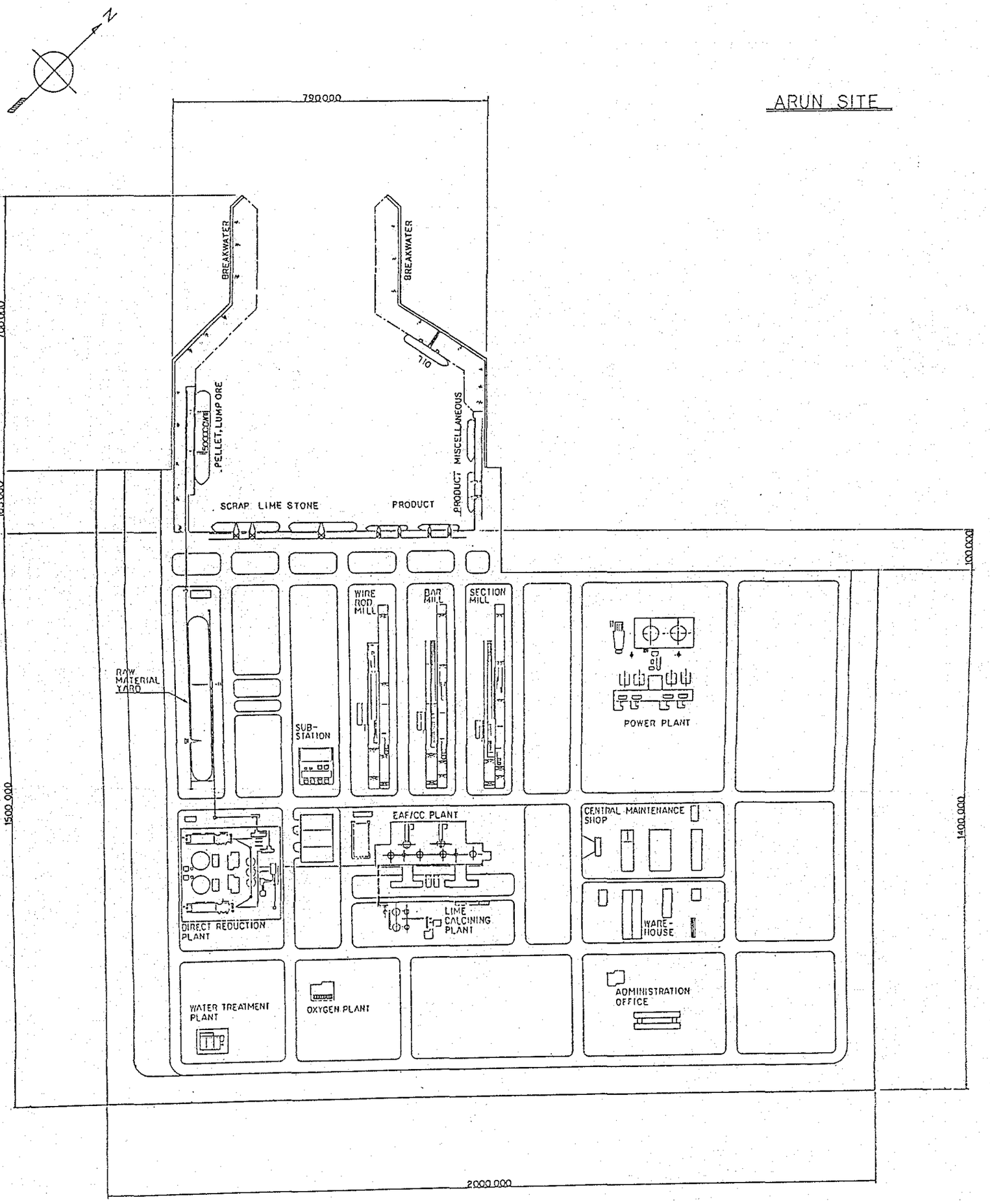
Assuming its fuel oil is carried in by sea and in view of its facilities being cooled by sea water, the power plant and substation are to be laid out at the sea side of the steel works.

3) EAF plant and rolling mill plant are arranged so that hot charge can be made.
4) As central maintenance shop and central material warehouse are closely related each other, they are to be built close each other and also relatively close to EAF plant and rolling mill plant whose weight in maintenance jobs is high.
5) Facilities related to administration are to be built at the inland side of the steel works for the convenience of visitors and so laid out that the facilities are kept from effect of dust from raw materials and scrap yards, etc. as much as possible.

CILEGON SITE



General Layout (CILEGON)



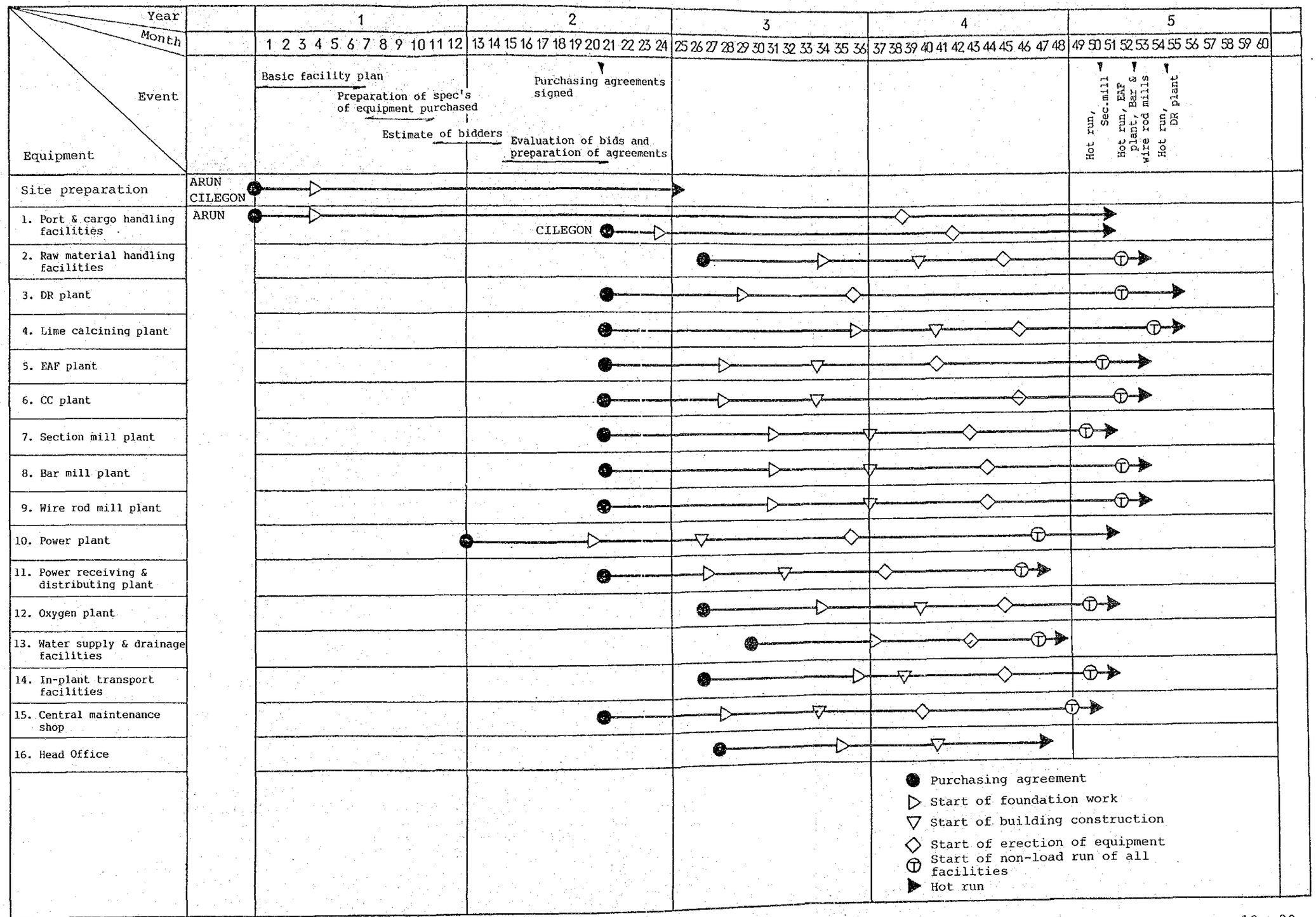
General Layout (ARUN)

5. Personnel Plan and Overall Construction Schedule of the Steel Works

5-1. Personnel plan

Facilities	Manager level	Staff level	Operator level	Total
Raw materials	2	2	38	118
DR plant		4	72	
Lime calcining plant	7	25	508	540
EAF plant				
CC plant				
Section mill plant	2	8	Cilegon 250 Arun 258	Cilegon 260 Arun 268
Bar mill plant	2	8	Cilegon 264 Arun 272	Cilegon 274 Arun 282
Wire rod mill plant	3	8	Cilegon 287 Arun 295	Cilegon 298 Arun 306
Power plant	3	11	356	370
Power rec. & distri.				
Oxygen plant				
Water supply & drainage				
Instrumentation maintenance	3	10	137	150
Transport (incl. port)	4	4	Cilegon 419 Arun 493	Cilegon 427 Arun 501
Test & analysis	3	6	56	65
Maintenance	21	16	877	914
Warehouse	4	2	76	82
Administration	52	248		300
Total	106	352	Cilegon 3,340 Arun 3,472	Cilegon 3,798 Arun 3,930

5-2. Overall construction schedule



6. Outline of Plant Description

Equipment	Outline of Plant Description
1. Port & cargo handling facilities	Material (pellet) berth 120,000 DWT ore carrier Material (scrap) berth 35,000 DWT cargo vessel Product berth 5,000 DWT cargo vessel
2. Raw material handling facilities	Ore storage capacity 300,000 tons
3. DR plant	DR plant 2 units Capacity 1,400,000 t/y
4. Lime calcining plant	120 t/d 2 units
5. EAF plant	130 t EAF x 2 units 130 t LF x 1 unit } x 2 units Capacity 1,600,000 t/y
6. CC plant	Billet CC (150φ) 6 st 2 units Capacity 1,550,000 t/y
7. Section mill plant	Reheating furnace 70 t/h 1 unit Mill ..... 2-high tandem Product mix ..... angles, channels, I beams, Tees, flat bars Capacity 250,000 t/y
8. Bar mill plant	Reheating furnace 130 t/h 1 unit Mill ..... 2-high tandem Product mix ..... plain bars, deformed bars (∿φ50) Capacity 650,000 t/y
9. Wire rod mill plant	Reheating furnace 130 t/h 1 unit Mill ..... block mill with 100m/sec of finishing speed Capacity 600,000 t/y
10. Power plant	100 MW x 4 units (oil firing)
11. Utilities Transport facilities (inc. port)	Power receiving & distributing plant Ar, N_2 and O_2 supply facilities Water supply, drainage & natural gas supply facilities Intraworks transportation facilities

Equipment	Outline of Plant Description
12. Maintenance facilities	Central maintenance shop Central material warehouse
13. Others	Material testing and analysis facilities Administration facilities
14. Civil & building work	Quantity of fill material for reclamation Cilegon : 6 million m^3 Arun : 9 million m^3

7. Rough Estimate of Investment

Total Investment

(Unit: Rp.Million)

	Cilegon		Arun	
	Amount	%	Amount	%
1. Site preparation	58,395	2.3	46,530	1.8
2. Civil engineering & building works	343,872	13.8	456,253	17.4
3. Machinery & equipment	1,443,981	57.8	1,461,540	55.6
4. Erection works	187,338	7.5	189,395	7.2
5. Transportation & insurance	225,420	9.0	228,191	8.6
(Total of direct construction costs)	(2,259,006)	(90.4)	(2,381,909)	(90.6)
6. Engineering fee	99,866	4.0	105,082	4.0
7. Pre-operating costs	7,517	0.3	7,909	0.3
8. Spares & stores	58,694	2.4	59,717	2.3
9. Contingency	72,202	2.9	73,079	2.8
(Total of other investment)	(238,279)	(9.6)	(245,787)	(9.4)
Total investment	2,497,285	100.0	2,627,696	100.0
(Per ton of crude steel)	($Rp.1,557 \times 10^3$)		($Rp.1,638 \times 10^3$)	

8. Conclusion of the Pre-F/S

(1) Simplified line-up of facilities

Very simplified line-up of production facilities with DR furnace x 2 -- EAF x 4 -- LF x 2 -- CC x 2 -- Rolling mills (section mill, bar mill and wire rod mill) was planned.

(2) Compact layout and consideration for future expansion

Layout of the facilities is so planned that material flow can be smooth and that operation of hot charge connecting CC and rolling mills and others can be made for energy saving. If expansion of facilities becomes necessary in future, the layout can easily accomodate it.

(3) Facilities plan of the latest technological level

Facilities are planned to include the latest technology appropriate to the new steel works for the second generation. Namely,

1) High efficiency

Full consideration is given to have most economical productive facilities from DR furnace through rolling mills.

2) Production of quality products

High grade steels such as special steel are out of the scope of this Pre-F/S, but it is planned that production of those products, if required in future, is possible by installing a few additional facilities such as degassing facilities and billet conditioning facilities.

3) Low production cost

Factors which have effect on production cost such as basic consumption units of various materials and

services required for operation, material/product yield, etc. are planned on the basis of actual performance of operation of similar facilities in Japan.

4) Automated & computerized facilities

In planning the facilities, consideration is given to automation and computerization from the viewpoint of ensuring personnel economy and stable quality.

5) Environmental preservation

In the facilities plan, pollution control facilities (air pollution, noise, effluent, etc.) are planned with reference to the present level of pollution control facilities in Japan, which are the highest level in the world.

(4) High labor productivity

Labor productivity of the new steel works calculated on the number of personnel directly engaged in production activity only is about 400 t/man-year.
The number does not include the personnel of so-called indirect departments such as head office and others, but even if those personnel are included, the productivity is high as compared with that of similar steel mills in Japan.

(5) Effective capital investment

As one of criteria of effectiveness of capital investment in constructing a new steel works at a new site, there is the amount of investment per ton of crude steel produced annually. In this project, it is about $1,100.

Though no suitable comparative example is available in recent years, it can safely be said it is an effective investment in the light of the instances of steel works constructed in the past.

9. Recommendations

The object and preconditions of this Pre-F/S are as mentioned already.

If the Government of Indonesia contemplates promotion of this project in future, the matters enumerated below would require further study and consideration.

(1) Review of market study

Although the interim conclusion of Step I study forecast some supply shortage of long products (non-flat products) in 1990 and crude steel shortage in 1995 and thereafter, there are some other studies for steel demand forecast conducted by other consultants.
Accordingly, a further study for future steel demand will be required.

(2) Selection and detailed field survey of the site

Two sites at Arun area and Cilegon Industrial Estate are proposed in this instance and either site must be selected finally as the site for the new steel works and detailed field survey conducted. Such survey should be made with reference to the items mentioned in Chapter VI of the full report.

(3) Detailed study of natural gas, industrial water & power

(4) Review of required construction funds by field survey

Such review should be necessary especially for civil engineering (incl. port) and equipment erection works.

(5) Curtailment of construction period

Any delay in the general construction schedule has a big effect on profitability of this project.

(6) Financial analysis and economic analysis

In implementing this project, study should be made on its profitability on the basis of required construction funds as reviewed above.

(7) Study of alternate plans

In view of natural gas production and power condition as well as infrastructure in the vicinity of the sites proposed, the idea to construct DR plant at Arun site and EAF plant and subsequent facilities at Cilegon Industrial Estate is very realistic.

In that case, stepwise construction of facilities also should be studied in order to decrease initial investment.