Part 8 Estimate of Capital Cost Expenditure

Section 1 Estimate of Capital Cost Expenditure

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1. Preconditions

1.1 Division between import and domestic procurement

The division between import and domestic procurement is subject to the following established set of standards.

(1) Equipment to be purchased : Import
(2) Civil works, erection & installation : Domestic
(3) Construction materials : Domestic procurement is to be chosen if possible.

Besides, in order to increase the portion of domestic procurement, the results of field investigation has been considered.

1.2 Estimate bases

(1) Time of estimation
Import : October 1997 -International market price
Domestic Procurement : August 1997 -Vietnamese market price

(2) Currency and Exchange Rate
Currency Import : US$

Domestic Procurement : VND → exchange to US$

Exchange Rate : 1US$ = 11,700VND (August 1997)

1.3 Effect of commodity price fluctuation

The construction cost in this study is not an estimate that assumes a cost at the time when the construction work is actually carried out, but has been calculated by the prices of October 1997. The influence of price fluctuation to selling prices of products and purchasing prices of raw materials (including the prices of energy and utilities) does not appear at the same rate over any given period of the time. The profit ratio of this project is greatly effected by a relative connection in the increase ratio of prices rather than its absolute level. Therefore, in this study, in order to prevent an uncertain or unreliable estimate, the effect of commodity price fluctuation is not included in the study in accordance with the general rules of this kind of study.

2. Direct equipment and construction cost

2.1 Direct construction cost

Estimation of the direct equipment and construction cost is done for Step 1 (Table 1-1), 2 (Table 1-2) and 3 (Table 1-3) by the classification of the construction step.

Table 1-1 Total cost of direct construction

	Import (US$ mil.)	(%)	Domestic (US$ mil.)	(%)	Total (US$ mil.)
Step 1	594	61.9%	366	38.1%	961
Step 2	1,965	67.3%	957	32.7%	2,921
Step 3	978	72.5%	371	27.5%	1,349
Total	3,537	67.6%	1,694	32.4%	5,231

Table 1-2 Direct construction cost (Step 1)

(unit:US$million)

	Facilities	Imported	Domestic	Total
X 01	Port facilities for products	20	41	62
X 02	Material yard	0	0	0
X 03	Sintering	0	0	0
X 04	Coke oven	0	0	0
X 05	Blast Furnace	0	0	0
X 06	Burnt lime	0	0	0
X 07	Basic oxygen furnace	0	0	0
X 08	Slab CC	0	0	0
	Billet CC	0	0	0
X 09	Hot strip mill	223	104	327
X 10	Cold strip & coating plant	267	92	359
Y 13	Power plant	41	11	52
Y 15	Oxygen plant	0	0	0
Y 16	Steam	0	0	0
Y 17	Water treatment & sewerage	0	66	66
Y 20	Transportation	7	1	8
	Maintenance	29	15	44
	Service department	7	37	43
	Total	594	366	961

Table 1-3 Direct construction cost (Step 2)

(unit:US$millio

	Facilities	Imported	Domestic	Total
X 01	Port facilities for products	41	81	122
X 02	Material yard	167	43	210
X 03	Sintering	137	42	179
X 04	Coke oven	277	96	373
X 05	Blast Furnace	254	98	352
X 06	Burnt lime	23	8	32
X 07	Basic oxygen furnace	256	132	388
X 08	Slab CC	220	89	308
	Billet CC	0	0	0
X 09	Hot strip mill	96	31	127
X 10	Cold strip & coating plant	129	28	157
Y 13	Power plant	159	49	208
Y 15	Oxygen plant	88	23	111
Y 16	Steam	0	0	0
Y 17	Water treatment & sewerag	12	146	158
Y 20	Transportation	28	23	51
	Maintenance	65	33	98
	Service department	13	34	48
	Total	1,965	957	2,921

Table 1-4 Direct construction cost (Step 3)

(unit:US$millio

	Facilities	Imported	Domestic	Total
X 01	Port facilities for products	17	34	51
X 02	Material yard	73	21	94
X 03	Sintering	124	38	163
X 04	Coke oven	190	65	255
X 05	Blast Furnace	222	84	306
X 06	Burnt lime	15	4	19
X 07	Basic oxygen furnace	105	26	132
X 08	Slab CC	0	0	0
	Billet CC	27	15	42
X 09	Hot strip mill	0	0	0
X 10	Cold strip & coating plant	0	0	0
Y 13	Power plant	118	35	153
Y 15	Oxygen plant	47	12	59
Y 16	Steam	0	0	0
Y 17	Water treatment & sewerag	0	0	0
Y 20	Transportation	23	11	34
	Maintenance	16	8	24
	Service department	1	17	18
	Total	978	371	1,349

2.2 Other necessary investment

(1) Engineering Fee
Engineering fee varies with mutual roles between the new steelworks side and the engineering firm. A rough estimate is made on the basis of a level of fee generally considered viable and adopted.

(2) Initial organization costs
This cost consists of expenditures for founding the corporation, employment, construction management, training the personnel of the steelworks in operating techniques before the start up of the steelworks and others necessary to establish a set up by which the steelworks can start up smoothly.

(3) Operation spare parts
This indicates the required procurement value of the amount of spares and replacement parts for necessary machinery and equipment, and other materials which shall be prepared before the start up of the steelworks.

(4) Interest during construction
This cost is interest incurred by long term loans for payment of construction expenditure during the construction period.

(5) Contingency
For both domestic purchase and imports, 3% of direct construction cost is added for contingencies.

2.3 Total required capital investment

The total required capital investment including direct construction cost and other investment values (in Step 3) , and necessary cost per ton of crude cast steel are shown in Table 1-5. The total necessary investment is about US$5.8 billion.

Table 1-5 Total capital investment and cost per ton of crude steel

Categories		Amount US$ million	Cost per ton US$/t-steel	Make up percentage %
	Direct construction cost	5,231	1,211	89.8%
	Engineering fee	157	36	2.7%
	Initial organization	78	18	1.3%
	Interest during construction	99	23	1.7%
	Contingency	157	36	2.7%
Construction cost total		5,722	1,325	98.2%
	Operation spare parts	105	24	1.8%
Total required capital investment		5,827	1,349	100.0%

3. Allocation of construction cost to cost centers

Of the construction items, those which constitute the fixed asset acquisition cost should be allocated to cost centers for production cost calculation in Part 9.(Description of the cost centers will be given in Part 9). In order to enable this, an affirmation of amount to be transferred to the fixed asset should be established firstly.

3.1 Acquisition cost of fixed assets

Of the construction costs, the direct construction costs, engineering fee and interest during construction are regarded as constituting the acquisition cost of fixed asset. By correspondence to classification of machine life expectancy in the depreciation accounting, tangible fixed assets are divided into the civil, buildings, machinery and others. Meanwhile, the operational spare parts constitute the required capital investment for the construction. Nevertheless, they don't constitute fixed assets but inventories. Table 1-6 shows the acquisition costs of the fixed assets with the asset classifications.

Depreciation is applied to the items previously mentioned.

Table 1-6 Acquisition cost of fixed assets

(unit:US$ mil.)

Assets classification	Acquisition cost
Civil works	849
Building	353
Machinery	3,091
Others	938
Tangible Fixed Assets total	5,231
Engineering fee	157
Initial organization	78
Contingency	157
Total	5,466

3.2 Allocation of tangible fixed assets to cost centers

The fixed assets are applied with depreciation, and, therefore, the acquisition cost should be allocated to the cost centers for calculation of depreciation by cost centers.
The allocation of tangible fixed assets to cost centers is shown in Table 1-7.

Table 1-7 Allocation of construction cost of fixed assets to cost centers
(unit:US$ mil.)

	Facilities	Civil works	Building	Machinery	Others	Total
X 01	Port facilities for products	103	42	67	22	234
X 02	Material yard	21	9	205	69	304
X 03	Sintering	31	14	242	56	342
X 04	Coke oven	67	30	442	89	628
X 05	Blast Furnace	80	35	436	105	658
X 06	Burnt lime	5	2	33	11	51
X 07	Basic oxygen furnace	76	33	372	39	519
X 08	Slab CC	41	18	233	17	308
	Billet CC	7	3	25	5	42
X 09	Hot strip mill	67	24	273	91	455
X 10	Cold strip & coating plant	47	17	290	161	516
Y 13	Power plant	35	15	161	203	413
Y 15	Oxygen plant	12	5	104	49	170
Y 17	Water treatment & sewerage	150	60	12	3	224
Y 20	Transportation	19	8	58	7	93
	Maintenance	29	12	122	3	166
	Service department	61	24	16	8	108
	Total	849	353	3,091	938	5,231

Part 9 Estimate of Product Cost

Section 1 Preconditions

Contents

1. Basic philosophy of production cost accounting

1.1 Basic accounting conditions

(1) Reference date : October 1997
(2) Currency : US$
(3) VND exchange rate : 1US$ = 11,700VND
(4) Operating condition : Normal operating condition

The normal operating condition in this study means the operating condition in regular years after the steelworks start operation ; that is , the equipment which has been designed to be capable of producing crude cast steel of 4.5 million ton per year (this is the basic precondition of this study) produces crude cast steel of 4.5 million tons per year as expected. Therefore, for other years such as the starting-up and blast furnace repairing period, the cost accounting is corrected and stated separately in the financial analysis.

1.2 Cost accounting method

(1) Type of cost accounting method

The cost accounting in this study depends upon "Continuous process cost accounting method" which is generally utilized by the steel industry in advanced countries. Namely

- Total cost arising in each process (cost center) is estimated and allocated to subsequent processes according to the flows of semi-products or services, and then reflected in the final product cost.
- The cost of auxiliary department is estimated according to the reciprocal distribution method and finally allocated to the production department.

(2) Kinds of production cost

Two kinds of production cost accounting, "Variable cost" and "Full cost", were made.

(3) Division of variable cost and fixed cost

Labor cost, repair expenses excluding refractories, depreciation, interest on long-term loans, increase in reserve for blast furnace relining, plant administration expense and expense of transportation department are all considered as fixed costs.

All costs which can be determined by yield and unit consumption are considered as variable costs, and some consumable are also made variable cost because they can hardly be expressed in unit consumption.

(4) Handling of interest on long-term loans

"Full cost" includes interest on long-term loans. As a matter of course, payment of interest on long-term loans is highest in the early periods of operation and decreases with time. Therefore, to make it level off, capital recovery factor was used and the amount remaining after depreciation is deducted from annuity there is residual rate, it was taken into consideration of the capital recovery factor.

2. Estimation and method of element cost

For estimation method of unit prices and expenses , prerequisite to cost accounting, the following are estimated with supplements of expertise and experiences of the mission based on the field survey and information presented by the counterpart so as to enable a domestic procurement in Viet Nam as much as possible.

2.1 Principal first purchased cost

(1) Unit price of purchased raw materials

On the condition of this study, the source of raw materials is assumed for the most reasonable ore source in considerable cases.

The following is a table of unit prices of main raw materials(Table 1-1).

Table1-1 Unit price of raw materials, fuels and other materials

Materials and sources	Import or domestic procurement	Unit	C&F price	Landed price
Iron ores				
Ore fine	Import	US$/t	29.000	33.121
Lump ore (BOF)	Import	US$/t	29.000	33.121
Coal				
Hard coking coal	Import	US$/t	67.200	71.321
Coal with high fluidity	Import	US$/t	66.500	70.621
Semi coking coal	Import	US$/t	62.700	66.821
Soft coking coal	Import	US$/t	58.500	62.621
(Hongai)	Domestic	US$/t	58.500	62.621
PCI (import)	Import	US$/t	59.400	63.521
PCI (demestic)	Import	US$/t	37.600	41.721
Limestone (7%moisture)	Domestic	US$/t	9.600	13.721
Scrap	Import	US$/t		155.500
Ferro manganese	Import	US$/t		805.000
Aluminium	Import	US$/t		1,583.000
Fluorspar	Import	US$/t		115.000
Coolant	Import	US$/t		128.000
Refractory				
Furnace brick	Import	US$/kg		2.687
Molten steel ladle brick	Import	US$/kg		1.187
SN PP	Import	US$/kg		6.603
Tundish	Import	US$/kg		0.833
Heavy oil	Import	US$/1,000kcal		0.016
L.P.G.	Import	US$/1,000kcal		0.016
Rolls				
HSM		US$/kg		4.500
CSM		US$/kg		4.000
Plating raw material				
Tin		US$/kg		5.500
Zinc		US$/kg		1.600

(2) By-products

(a) Estimation standard of by-products

- Estimation of by-products is based principally on market prices and depends on the selling price or purchasing price.
- Gassers are assessed on the basis of heavy oil price by their calorific values.

(b) Appropriation standard of by-products

According to the material flow of the production plan, the appropriation standard restricts the by-products to those which can be reclaimed inside the integrated steelworks or which can be sold outside ; that is, those having commercial value. Other generated materials are discarded and not appropriated as a by-product.

(3) Labor cost

Based on the manning plan, personnel are to be classified by cost centers and job categories. Wages and salaries, shown in Table 1-2, are based mostly on recent Vietnamese wage and salary data and also party by estimation.

Welfare costs have been based on information available and estimation.

Table 1-2 Labor cost

Wage and salaries	US$/man Y	Employ within the works
General manager	3,000	7 men
Manager	2,400	47
Engineer	2,400	374
Foreman	2,100	342
Skilled worker	1,800	4,057
Un-skilled worker	1,200	1,528

2.2 Depreciation, amortization, etc.

The depreciation rate was settled by classification of assets according to the results of the field investigation. Therefore, depreciation is accounted on the basis of the fixed asset acquisition cost explained in Part 8.

Depreciation and amortization are highest in the early periods of operation and decrease with time. Therefore, the 20 year average repayment sum from 2010 to 2030 which is the computation period be entered into the production cost, it was taken into consideration of the capital recovery factor.

Table 1-3 Description and tangible fixed asset

(US$mil.)

Classification of assets	Acquisition cost of fixed assets	Description rate	Annual depreciation (ordinary year)
Civil	849	7%	162
Buildings	353	15%	47
Others	3,091	15%	32
Amortization	938	20%	17
	54	10%	11
Total	5,285		269

2.3 Reserve for special repair of blast furnaces

After normal operation, the blast furnace requires major repairs coincided with relining of most refractory at several year intervals. In this study, as usual case, and with our experience an estimation has been made as follows.

-Relining maintenance cost : 50% of direct construction costs
-Relining plan : every 15 years

2.4 Auxiliary department cost

The following will briefly explain auxiliary departments.

(1) Cost of maintenance and repair shop

The new steelworks has an independent maintenance and repair department equipped and manned sufficiently for carrying out ordinary repairs. The maintenance facilities consist of central maintenance station and local maintenance shops. Though the central maintenance station will be basically of a scale that will permit it to perform ordinary maintenance work, it will be so equipped that it can handle a complete range of jobs necessary for the manufacture of parts and repair of equipment including casting., forging, machining, steel fabrication, etc. Besides, direct repair materials are not assessed for the cost center of maintenance shop but individual cost center according to quantities required by them and included in their cost.

(2) Electricity

The BFG,BOFG and COG generated in the works are almost reused completely; therefore, adequate supply of fuel for the furnace of each

factory intra-works and fuel for generating electricity is available. The purchase price of electricity from outside, calculated at rates as of October 1997, is likely to rise sharply in the near future and care should be taken.

(3) Plant administration department cost

The plant administration cost covers such cost as accruing to the general superintendent office, safety and security, production scheduling, quality control, purchasing, order entry control, welfare and other administrative departments.

3. Results of production cost calculations

In this paragraph, based upon the calculations and premises of the former paragraph a summary of the calculation of the production cost can be realized.

3.1 Result of production cost accounting

Shown in the following tables (Table 1-4 through 1-6) are production cost by cost center and production cost of utilities. Cost output sheets are shown in Appendix.

Table 1-4 Summarized operating cost per ton of main factories by calculation basis

Cost NO.	(Cost center)	Product / Y	Material (Primary)	By-product	Refractry	Other variable	Energy Total US$/T	Variable Total	Dep. Total	BF relining maintenance	Maintenance Total	Interest Total	Labor Cost	Welfare Cost	Fixed Total (Primary) Unit Cost	Maintenance shop	Transportation	Service Depart	Fixed Total (Secondary) Unit Cost	Total Unit Cost	Material Cost	Production Cost
X 020	Material yard	######	36.7				0.2	0.2	1.4	0.0	0.8	0.9	0.0	0.0	3.1	0.2	0.2	0.3	0.7	4.1		40.8
X 030	Sintering	5,756.0 x1000t		-4.1			2.8	-1.3	3.3	0.0	1.8	2.2	0.1	0.0	7.4	0.4	0.2	0.5	1.2	7.3	40.2	47.5
X 040	Coke oven	1,843.0		-50.0			20.7	-29.3	18.7	0.0	10.2	12.8	0.5	0.2	42.4	2.5	0.2	4.0	6.7	19.7	108.3	128.0
X 05A	Blast Furnace	4,389.0		-19.9		2.1	21.3	3.6	8.2	5.0	0.0	5.6	0.1	0.1	19.0	0.0	0.2	1.0	1.2	23.7	130.8	154.5
X 05B	Cold pig iron	44.0				1.0	0.9	1.9	8.2	0.0	0.0	5.6	0.1	0.1	14.0	0.0	0.2	0.9	1.2	17.0	154.5	171.5
X 060	Burnt lime	294.0			1.9		24.2	26.1	9.5	0.0	5.2	6.4	0.3	0.2	21.6	1.3	0.2	2.7	4.2	51.8	19.2	71.0
X 070	Basic Oxygen Furnace	4,534.0	25.8	-19.9		2.1	9.9	17.9	6.0	0.0	3.4	4.3	0.2	0.1	14.1	0.8	0.2	1.6	2.7	34.7	177.1	211.7
X 08A	Slab CC	3,225.0	1.7	-3.5	1.9	2.2	2.8	5.0	4.8	0.0	2.9	3.5	0.2	0.1	11.5	0.7	0.2	1.9	2.8	19.3	222.8	242.1
X 08B	Billet CC	1,095.0	2.0	-2.6	1.7	0.2	3.2	4.4	2.3	0.0	1.1	1.5	0.3	0.2	5.4	0.3	0.2	2.6	3.2	13.0	220.4	233.4
X 09A	Hot strip mill	3,160.0		-1.2		4.7	11.8	15.3	5.8	0.0	3.9	4.7	0.1	0.1	14.6	0.9	0.2	1.1	2.3	32.1	247.1	279.2
X 09B	Heavy plate	120.0		-10.4		2.0	0.6	-7.8	1.9	0.0	1.2	1.5	0.4	0.2	5.1	0.3	0.2	3.1	3.6	1.0	302.5	303.5
X 09C	Hot shear line	240.0		-7.8		2.0	0.9	-4.9	1.9	0.0	1.2	1.5	0.4	0.2	5.1	0.3	0.2	3.0	3.6	3.8	299.3	303.1
X 09D	Hot skin-pass line	500.0		-2.0		1.0	0.3	-0.7	1.9	0.0	1.2	1.5	0.4	0.2	5.1	0.3	0.2	3.0	3.6	8.0	283.7	291.7
X 09E	Hot slit line	240.0		-5.2		2.0	0.3	-2.9	1.9	0.0	1.2	1.5	0.4	0.2	5.1	0.3	0.2	3.0	3.6	5.8	293.5	299.3
X 09Z	Hot finishing line	2,006.0				4.0		4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	4.2	290.7	295.0
X 10A	PL	1,268.1		-4.4		5.0	2.4	3.1	3.3	0.0	1.4	2.6	0.2	0.1	7.5	0.4	0.2	1.5	2.1	12.7	289.4	302.0
X 10B	TCM	1,054.3		-1.3	2.4	5.0	8.1	14.2	5.2	0.0	2.3	4.1	0.4	0.2	12.2	0.6	0.2	3.6	4.4	30.7	305.1	335.8
X 10C	ECL	836.5		-1.3		2.0	2.7	3.5	1.1	0.0	0.5	0.9	0.2	0.1	2.8	0.1	0.2	1.8	2.2	8.5	337.8	346.3
X 10J	BAF	836.5				2.0	3.8	5.8	6.2	0.0	2.8	4.9	0.4	0.2	14.4	0.7	0.2	3.0	3.9	24.1	353.0	377.1
X 10D	SPM	512.9		-1.3	0.9	5.0	0.8	5.4	1.7	0.0	0.7	1.3	0.2	0.1	4.0	0.2	0.2	1.5	1.9	11.3	371.5	382.8
X 10E	TPM	315.2		-1.3	2.9	5.0	2.3	8.9	2.7	0.0	1.2	2.1	0.3	0.1	6.5	0.3	0.2	2.5	3.0	18.4	396.2	414.6
X 10F	RCL	250.0		-3.8		5.0	0.8	2.0	0.8	0.0	0.4	0.6	0.4	0.2	2.4	0.1	0.2	3.1	3.4	7.8	302.7	310.5
X 10G	CPL	106.3		-3.8		3.0	0.8	0.0	3.1	0.0	1.4	2.4	0.9	0.4	8.2	0.3	0.2	7.3	7.8	16.0	493.7	509.7
X 10H	Shear line	350.0		-3.8		2.0	0.8	-1.0	2.2	0.0	1.0	1.7	0.3	0.1	5.4	0.2	0.2	2.2	2.7	7.0	471.5	478.6
X 10X	CR-finishing line	1,001.1				15.0		15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	15.2	447.6	462.8
X 11A	CGL	203.2	96.0	-3.8		7.0	11.4	110.7	15.3	0.0	6.4	11.3	2.0	1.0	35.9	1.5	0.2	16.7	18.5	165.0	352.0	517.0
X 11B	ETL	103.1	22.0	-3.8		12.0	15.2	45.4	17.0	0.0	7.1	12.5	2.4	1.2	40.1	1.7	0.2	19.9	21.9	107.4	525.5	633.0

Table 1-5 Utility production cost

(Unit : US$)

Utility	Unit	Production cost	(Variable cost)
Electricity	kwh	0.075	0.051
Steam	kg	0.016	0.015
Oxygen	Nm^3	0.131	0.051
Nitrogen	Nm^3	0.009	0.006
Industrial water	m^3	0.358	0.000
Sea walter	m^3	0.021	0.000

Table 1-6 Cost Structure

	Slab		Billet		Hot Rolling Coil		Cold Rolling Coil	
	US$/t	%	US$/t	%	US$/t	%	US$/t	%
Total Cost	247.9	100.0%	239.8	100.0%	286.5	100.0%	340.2	100.0%
Material total	145.7	58.8%	144.4	60.2%	148.7	51.9%	155.6	45.7%
Ore	100.0	40.3%	98.9	41.3%	102.0	35.6%	106.8	31.4%
Coal	8.3	3.4%	8.2	3.4%	8.5	3.0%	8.9	2.6%
Other material	37.4	15.1%	37.3	15.6%	38.1	13.3%	39.9	11.7%
Variable total	19.9	8.0%	20.0	8.3%	36.3	12.7%	54.5	16.0%
By-produc	-53.0	-21.4%	-51.6	-21.5%	-55.3	-19.3%	-63.3	-18.6%
Refractry	14.4	5.8%	14.1	5.9%	14.7	5.1%	17.2	5.1%
Energy	9.5	3.8%	8.6	3.6%	15.0	5.2%	27.1	8.0%
Other	49.0	19.8%	48.9	20.4%	61.9	21.6%	73.4	21.6%
Fixed cost	82.3	33.2%	75.4	31.4%	101.6	35.5%	130.1	38.2%
Dep.	35.2	14.2%	32.3	13.5%	43.0	15.0%	54.2	15.9%
BF relining	5.1	2.1%	5.0	2.1%	5.2	1.8%	5.4	1.6%
Maintenance	15.2	6.1%	13.3	5.6%	20.2	7.0%	27.2	8.0%
Interest	24.8	10.0%	22.6	9.4%	30.9	10.8%	39.6	11.7%
Labor	1.3	0.5%	1.4	0.6%	1.6	0.5%	2.4	0.7%
Welfare	0.7	0.3%	0.7	0.3%	0.8	0.3%	1.2	0.4%

3.3 Sensitivity analysis of production cost

The degree of effect of fluctuation of main cost elements on basic production cost under normal operation in Step 3 is shown Table 1-6

Table 1-7 Sensitivity analysis (Effect to operating cost)

(Unit : US$/t)

	Condition		Effects			
	Items	Variation	Slab	Billet	Hot Rolling coil	Cold rolling coil
Base case	Operation cost		247.9	239.8	286.5	340.2
Cost Change	Capital expenditure cost	±10%	±3.5	±3.2	±1.3	±5.1
	Iron ore price	±10%	±10.0	±9.9	±10.2	±10.7
	Coal price	±10%	±0.8	±0.8	±0.8	±0.9
	Variable	±10%	±7.3	±7.2	±9.2	±11.8
	Fixed	±10%	±8.2	±7.5	±10.2	±13.0
	Operation rate	-10%	+9.1	+8.4	+11.3	+14.5

Part 10 Financial Analysis

Section 1 Financial Analysis

Contents

1. Preconditions

1.1 Basic conditions

(1) Project period for financial/economic analysis
: 30years (including construction term)
(2) Currency : US$
(3) Time of estimation and currency used
: Domestic purchases: August 1997 ---VND (converted to US$)
: Imported purchases: August 1997 ---Yen (converted to US$)

2. Preconditions for profit and loss statement

2.1 Production sales plan

(1) All Products are deemed to be sold. However, goods in process and stocks of semi and finished products are treated separately as working capital.
(2) Production plan and sales plan are shown in Tables 1-1.

Table 1-1 Production and sales plan

(Unit : 1,000t)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016-29
Billet	0	0	0	0	0	0	0	0	657	876	1,095
As Rolled HC	42	81	200	200	770	729	803	803	803	803	803
Skin passed HC	166	216	250	250	347	385	400	400	400	400	400
Slit recoild HC	0	0	0	0	208	231	240	240	240	240	240
Plate	66	86	100	100	104	115	120	120	120	120	120
HR sheet	133	173	200	200	208	231	240	240	240	240	240
P/O coil	133	173	200	200	176	195	203	203	203	203	203
CR coil	200	250	250	250	280	350	350	350	350	350	350
CR sheet	200	250	250	250	280	350	350	350	350	350	350
CG coil	40	50	50	50	80	100	100	100	100	100	100
CG sheet	40	50	50	50	80	100	100	100	100	100	100
Tin sheet	0	0	0	0	80	100	100	100	100	100	100

2.2 Sales price

In construction of the steelworks, since a major objective is the replacement of imports, we will estimate the sales price of the steelworks via the current (October, 1997) Vietnamese import price for steel products. The process is, first estimating the average C&F price of steel production in the Vietnam, then adding the current 5% customs duty that allowed at AFTA and 2% custom clearance charge as the cost it would cost to obtain the goods. (i.e. land price), and then using the as the sales price.

However, as for semi-finished products, since the seller thereof tend to concentrate on certain special producer, the market is not perfect. Accordingly since the market information is not sufficient, price estimates are difficult. In the area we will try to compensate partially therefore in our estimates by taking the differences in general production costs of the advance countries.

(unit: US$/t)

Table 1-2 Selling price

	HRC	HRS	CRC	CRS	CG-S	ETS	Billet	Slab
Russia	280	285-290						
Korea	345		505	540	670	850		
Thailand	340							
China	325						260	
Japan				620		950-1050		
Turkey							270	
SSSC from JPN			476					
Metal Bulletin(FOB)							240	255
World Steel Dynamics(FOB)								240
Selling Price +7%(duty & charge)	369		509	539	717	910	268	265

AsRolledHC	Base	369	CR cioil	Base	509
Skin passed HC	+15US$	384	CR sheet	+30US$	539
Slit recoild HC	+40US$	409			
Plate	+60US$	429	Slab	Base	265
HR sheet	+60US$	429	Billet	-15$ +7%	268
P/O coil	+20US$	389			
CG sheet	Base	717			
CG coil	-30US$	687			

2.3 Cost of sales

Cost of sales applied in profit and loss statement for operation period is conceived as follows.

(1) Variable cost
Variable cost per ton by product x sales tonnage per year

(2) Fixed cost per year
a) Operating fixed cost
b) Depreciation and amortization
c) Interest on long-term and short-term loans
d) Increase in reserve for BF repair (relining)
Therefore, full cost in 9-2 is not applied as cost of sales for operation period.

(3) Sales transportation cost
In reference to selling conditions, since the study was conducted on C&F shipment at major ports to the consumers, the steelworks portion of the C&F shipment costs were estimated thereon.

(4) General administrative expense
Head office cost is estimated. Head office expense estimations are based on the organizations and manning plan of the new integrated steelworks as explained in Part 7.

(5) Corporate income tax and sales tax
Corporate income tax : 25%
Sales tax : 2%

(6) Validity of loss carry forward : 5 years

(7) Sales of by-products
Outside of steel products, the primary business of the new integrated steelworks, the external sales of by-products and surplus electricity are added to the non-operating profit-loss calculation. In these cases the selling price is equal to deduction for by-products (expense deduction in the case of electricity), the profit-loss is zero.

3. Preconditions for cash flow statement and balance sheet

3.1 Timing and amount of necessary fund

The fund necessary for the new integrated steelworks is estimated in Part 8. The timing and amount of funds are forecast as shown in Table 1-3.

Table 1-3 Raising of funds and payment forecasts during construction

		-5	-4	-3	-2	-5	-4	-3	-2	-5	-4	-3	-2	-1	1
						-1	1	2	3	-1	1	2	3	4	5
										4	5	6	7	8	9
	Total	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
	Machinery	447.8	0.0	44.8	89.6	223.9	89.6	0.0							
	Others	229.6	0.0	23.0	45.9	114.8	45.9	0.0							
	Civil	209.5	21.0	31.4	41.9	52.4	62.9	0.0							
	Building	73.6	0.0	7.4	29.4	29.4	7.4	0.0							
	Contingency	28.8	0.6	3.2	6.2	12.6	6.2	0.0							
	Engineering fee	28.8	5.8	5.8	5.8	5.8	5.8	0.0							
	Initial organization	14.4	0.7	0.7	0.7	2.2	2.9	7.2							
	Operation spare parts	19.2	0.0	0.0	0.0	0.0	19.2	0.0							
1st Step Total		1,051.8	28.1	116.2	219.5	441.1	239.7	7.2							
	Machinery	1,758.3					0.0	175.8	351.7	879.1	351.7	0.0			
	Others	478.9					0.0	47.9	95.8	239.5	95.8	0.0			
	Civil	478.3					47.8	71.7	95.7	119.6	143.5	0.0			
	Building	205.7					0.0	20.6	82.3	82.3	20.6	0.0			
	Contingency	87.6					1.9	9.7	18.9	38.4	18.8	0.0			
	Engineering fee	87.6					17.5	17.5	17.5	17.5	17.5	0.0			
	Initial organization	43.8					2.2	2.2	2.2	6.6	8.8	21.9			
	Operation spare parts	58.4					0.0	0.0	0.0	0.0	58.4	0.0			
2nd Step Total		3,198.7					69.5	345.5	664.0	1,382.9	715.0	21.9			
	Machinery	885.0									0.0	88.5	177.0	442.5	177.0	0.0
	Others	229.2									0.0	22.9	45.8	114.6	45.8	0.0
	Civil	161.7									16.2	24.3	32.3	40.4	48.5	0.0
	Building	73.3									0.0	7.3	29.3	29.3	7.3	0.0
	Contingency	40.5									0.9	4.5	8.7	17.7	8.7	0.0
	Engineering fee	40.5									8.1	8.1	8.1	8.1	8.1	0.0
	Initial organization	20.2									1.0	1.0	1.0	3.0	4.0	10.1
	Operation spare parts	27.0									0.0	0.0	0.0	0.0	27.0	0.0
3rd Step Total		1,477.3									26.2	156.6	302.3	655.7	326.5	10.1
Grand Total		5,727.8	28.1	116.2	219.5	441.1	309.2	352.7	664.0	1,382.9	741.1	178.5	302.3	655.7	326.5	10.1

3.2 Source of fund

The percentage of capital is assumed to be 30% of the total required fund. And the following condition is set up for the long and short term loans.

- Rate of interest
  - Long-term loan : 5.3%
  - Short-term loan : 15.0%

3.3 Net working capital

Table 1-4 Net working capital

Item	Premises of estimate
Current assets :	
Cash and Deposits	0.1 of one month's sales
Account Receivable	One month of sales
Other liquid assets	1/2 of one month's sales
Inventory	
Raw materials	2.5 months of average raw material costs
Semi-finished products	1/2 of one months average operating cost
Finished products	0.3 months average production cost
Current liabilities	
Account Payable	3 month of raw materials
Other liquid liabilities	0.5 months of sales
Reserve for tax	Taxes corresponding to the previous term's profit

4. Result of the financial forecast calculation

4.1 Results of the financial forecast calculation

Result of the financial forecast made on the various conditions as above are given below (Table 1-5 through 1-7).

- Profit occurs from the 4th year of operation.
- Possible income after tax occurs from the 10th year.

Table1-5 Project Profit & Loss (Base Case)

Calendar Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Project Year	-9	-8	-7	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6
Sales						480,977	621,908	707,293	707,293	1,181,075	1,331,191	1,377,200	1,377,200	1,552,947	1,611,530
Variable cost						364,648	472,669	542,046	542,046	732,502	727,063	729,555	693,825	721,413	730,610
Production fixed cost						27,368	27,368	27,368	27,368	120,779	120,779	120,779	120,779	120,779	120,779
Depreciation & Amortization						168,074	140,992	118,522	99,851	534,464	452,531	383,783	326,025	490,477	416,504
Prov. of Reserve for BF etc.										10,958	10,958	10,958	10,958	21,917	21,917
Production cost for Sales	0	0	0	0	0	560,089	641,028	687,935	669,264	1,398,704	1,311,331	1,245,076	1,151,587	1,354,586	1,289,810
Long term loan interests						45,418	58,413	82,914	134,048	160,557	165,552	174,743	196,340	203,880	198,649
Short term Loan & Deposit interests		0	0	0	0	0	3,500	0	0	1,663	0	0	0	0	0
Sales Tax	0	0	0	0	0	9,620	12,438	14,146	14,146	23,621	26,624	27,544	27,544	31,059	32,231
General administration expence															
Total cost	0	0	0	0	0	615,127	715,380	784,996	817,458	1,584,545	1,503,507	1,447,363	1,375,471	1,589,525	1,520,689
Operation Income	0	0	0	0	0	-134,149	-93,472	-77,703	-110,165	-403,470	-172,315	-70,164	1,729	-36,578	90,841
Non-operation Revenues		0	0	0	0	0	214	380	1,444	315	2,969	15,728	30,709	45,788	67,291
Non-operation Expenses															
Ordinary Income	0	0	0	0	0	0	214	380	1,444	315	2,969	15,728	30,709	45,788	67,291
Extraordinary Profits															
Extraordinary losses															
Net Income Before tax	0	0	0	0	0	-134,149	-93,258	-77,323	-108,721	-403,155	-169,346	-54,436	32,438	9,210	158,132
(Loss Forward)	0	0	0	0	0	0	-134,149	-227,407	-304,731	-413,452	-816,607	-851,804	-812,982	-703,221	-585,290
(Taxable Income)															
Reserve for Taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Income after taxes	0	0	0	0	-0	-134,149	-93,258	-77,323	-108,721	-403,155	-169,346	-54,436	32,438	9,210	158,132
Prov. of Leg. Retained Earnings	0	0	0	0	0	-134,149	-227,407	-304,731	-413,452	-816,607	-985,953	-1,040,389	-1,007,951	-998,741	-840,609
Disposable Income after Taxes	0	0	0	0	0	-134,149	-227,407	-304,731	-413,452	-816,607	-985,953	-1,040,389	-1,007,951	-998,741	-840,609

**Apropriation of Ret. Earn.

Table1-5 Project Profit & Loss (Base Case)

Calendar Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Project Year	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Sales	1,670,112	1,670,112	1,670,112	1,670,112	1,670,112	1,670,112	1,670,112	1,670,112	1,252,584	1,670,112	1,670,112	1,670,112	1,252,584	1,670,112
Variable cost	739,806	739,806	739,806	739,806	739,806	739,806	739,806	739,806	554,854	739,806	739,806	739,806	554,854	554,854
Production fixed cost	148,728	148,728	148,728	148,728	148,728	148,728	148,728	148,728	148,728	148,728	148,728	148,728	148,728	148,728
Depreciation & Amortization	354,255	301,804	257,552	220,168	188,544	161,755	139,030	119,725	103,301	89,308	77,367	67,161	58,423	50,931
Prov. of Reserve for BF etc.	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917
Production cost for Sales	1,264,705	1,212,254	1,168,002	1,130,618	1,098,994	1,072,205	1,049,480	1,030,175	828,800	999,758	987,817	977,611	783,922	776,430
Long term loan interests	192,815	186,604	179,575	172,138	164,688	157,239	149,789	142,340	134,890	127,441	119,991	112,542	105,092	97,642
Short term Loan & Deposit interests	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sales Tax	33,402	33,402	33,402	33,402	33,402	33,402	33,402	33,402	25,052	33,402	33,402	33,402	25,052	33,402
General administration expence														
Total cost	1,490,922	1,432,261	1,380,979	1,336,158	1,297,084	1,262,846	1,232,672	1,205,917	988,742	1,160,601	1,141,210	1,123,555	914,066	907,474
Operation Income	179,190	237,852	289,133	333,954	373,028	407,266	437,441	464,195	263,842	509,511	528,902	546,557	338,518	762,638
Non-operation Revenues	93,110	121,328	147,513	173,584	200,399	228,099	256,798	286,603	317,614	330,997	364,827	399,261	435,225	453,886
Non-operation Expenses														
Ordinary Income	93,110	121,328	147,513	173,584	200,399	228,099	256,798	286,603	317,614	330,997	364,827	399,261	435,225	453,886
Extraordinary Profits														
Extraordinary losses														
Net Income Before tax	272,300	359,179	436,646	507,538	573,427	635,365	694,239	750,798	581,456	840,508	893,728	945,819	773,743	1,216,524
(Loss Forward)	-24,002	0	0	0	0	0	0	0	0	0	0	0	0	0
(Taxable Income)														
Reserve for Taxes	62,074	89,795	109,161	126,884	143,357	158,841	173,560	187,700	145,364	210,127	223,432	236,455	193,436	304,131
Net Income after taxes	210,225	269,385	327,484	380,653	430,070	476,524	520,679	563,099	436,092	630,381	670,296	709,364	580,308	912,393
Prov. of Leg. Retained Earnings	-630,384	-360,999	-33,515	347,138	777,208	1,253,732	1,774,411	2,337,510	2,773,602	3,403,983	4,074,279	4,783,643	5,363,950	6,276,343
Disposable Income after Taxes	-630,384	-360,999	-33,515	347,138	777,208	1,253,732	1,774,411	2,337,510	2,773,602	3,403,983	4,074,279	4,783,643	5,363,950	6,276,343

**Apropriation of Ret. Earn.

Table 1-6 Project Balance Sheet (Base Case)

Calendar Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Project Year	-9	-8	-7	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6	7	8
ASSETS																	
Cash on hand in banks	0	0	0	0	0	4,008	7,095	26,995	5,894	55,502	293,974	574,008	855,851	1,257,783	1,740,365	2,267,812	2,757,247
Accounts Receivable	0	0	0	0	0	40,081	51,826	58,941	58,941	98,423	110,933	114,767	114,767	129,412	134,294	139,176	139,176
Other Liquid assets	0	0	0	0	0	20,041	25,913	29,471	29,471	49,211	55,466	57,383	57,383	64,706	67,147	69,588	69,588
Total Liquid assets	0	0	0	0	0	64,130	84,833	115,407	94,306	203,136	460,373	746,158	1,028,001	1,451,901	1,941,807	2,476,576	2,966,011
Finished products						5,107	6,607	7,532	7,532	12,488	14,031	14,532	14,532	16,910	17,792	18,495	18,495
Semi-finished products						9,568	12,464	14,545	14,545	24,513	27,079	28,208	28,208	28,208	28,208	28,208	28,208
Raw materials & supplies						27,380	35,594	41,069	41,069	63,160	66,988	69,503	69,503	80,622	84,329	88,035	88,035
Total Inventories						42,054	54,665	63,147	63,147	100,162	108,098	112,243	112,243	125,740	130,240	134,739	134,739
Total Current Assets	0	0	0	0	0	106,185	139,498	178,553	157,452	303,297	568,471	858,401	1,140,244	1,577,642	2,072,046	2,611,315	3,100,750
Buildings & Structures	20,952	59,738	131,077	212,892	330,937	397,549	552,471	733,671	895,325	845,838	835,038	839,884	837,474	762,789	695,742	635,436	581,092
Machinery & Equipment	629	48,609	144,384	380,925	478,577	592,179	901,549	1,767,069	2,094,189	1,872,738	1,791,179	2,024,216	2,016,778	1,713,817	1,456,301	1,237,411	1,051,355
Others	7,575	42,672	109,487	264,337	403,243	407,633	466,321	684,905	836,522	751,501	693,651	727,668	737,952	635,240	543,300	468,241	406,837
Total work. depreciable assets	29,156	151,020	384,948	858,153	1,212,757	1,397,361	1,920,341	3,184,745	3,826,036	3,470,076	3,319,868	3,591,769	3,592,204	3,111,846	2,695,343	2,341,088	2,039,284
Land																	
Construction in process																	
Defferd assets																	
Intagible Fixed assets																	
Othe Investments																	
Total Fixed Assets	29,156	151,020	384,948	858,153	1,212,757	1,397,361	1,920,341	3,184,745	3,826,036	3,470,076	3,319,868	3,591,769	3,592,204	3,111,846	2,695,343	2,341,088	2,039,284
TOTAL ASSETS	29,156	151,020	384,948	858,153	1,212,757	1,503,545	2,059,839	3,363,298	3,983,488	3,773,374	3,888,339	4,450,170	4,732,449	4,689,488	4,767,389	4,952,402	5,140,034
LIABILITIES & EQUITY																	
Accounts Payable						32,856	42,712	49,283	49,283	75,792	80,385	83,404	83,404	96,747	101,194	105,642	105,642
Accrued expence																	
Other current liabilities	0	0	0	0	0	20,041	25,913	29,471	29,471	49,211	55,466	57,383	57,383	64,706	67,147	69,588	69,588
Reserve for taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62,074	89,795
Short term loan	0	0	0	0	0	23,335	0	0	11,084	0	0	0	0	0	0	0	0
Total current liabilities	0	0	0	0	0	76,231	68,625	78,754	89,838	125,003	135,852	140,787	140,787	161,453	168,342	237,304	265,025
L-T Loan & Debt F.cost	20,409	105,714	269,464	600,707	848,930	1,091,834	1,549,800	2,505,575	3,001,060	3,094,425	3,266,233	3,669,902	3,810,846	3,713,057	3,604,020	3,487,929	3,356,539
Bonds																	
Reserve for BF relining etc.		0	0	0	0	0	0	0	0	10,958	21,917	32,875	43,833	65,750	87,667	109,583	131,500
Total Fixed liabilities	20,409	105,714	269,464	600,707	848,930	1,091,834	1,549,800	2,505,575	3,001,060	3,105,383	3,288,150	3,702,777	3,854,679	3,778,807	3,691,687	3,597,512	3,488,039
Legal Retained Earnings																	
Accumulated Depreciation																	
Total Reserves	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL LIABILITIES	20,409	105,714	269,464	600,707	848,930	1,168,064	1,618,425	2,584,329	3,090,898	3,230,387	3,424,001	3,843,564	3,995,466	3,940,260	3,860,028	3,834,817	3,753,064
Capital Stock	8,747	45,306	115,484	257,446	363,827	469,631	668,822	1,083,700	1,306,042	1,359,594	1,450,291	1,646,996	1,744,934	1,747,969	1,747,969	1,747,969	1,747,969
Surpluses																	
Ret. Earnings Brought forward																	
Disposable income after taxes	0	0	0	0	0	-134,149	-227,407	-304,731	-413,452	-816,607	-985,953	-1,040,389	-1,007,951	-998,741	-840,609	-630,384	-360,999
TOTAL STOCKHOLDER's EQUITY	8,747	45,306	115,484	257,446	363,827	335,481	441,415	778,969	892,591	542,987	464,338	606,606	736,983	749,228	907,360	1,117,586	1,386,970
TOTAL LIABILITIES & EQUITY	29,156	151,020	384,948	858,153	1,212,757	1,503,545	2,059,839	3,363,298	3,983,488	3,773,374	3,888,339	4,450,170	4,732,449	4,689,488	4,767,389	4,952,402	5,140,034

Table 1-6 Project Balance Sheet (Base Case)

Calendar Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Project Year	9	10	11	12	13	14	15	16	17	18	19	20
ASSETS												
Cash on hand in banks	3,244,559	3,745,776	4,263,535	4,799,971	5,357,071	5,936,707	6,186,857	6,819,188	7,462,829	8,135,049	8,483,853	9,405,751
Accounts Receivable	139,176	139,176	139,176	139,176	139,176	139,176	104,382	139,176	139,176	139,176	104,382	139,176
Other Liquid assets	69,588	69,588	69,588	69,588	69,588	69,588	52,191	69,588	69,588	69,588	52,191	69,588
Total Liquid assets	3,453,323	3,954,540	4,472,299	5,008,735	5,565,835	6,145,471	6,343,430	7,027,952	7,671,593	8,343,813	8,640,426	9,614,515
Finished products	18,495	18,495	18,495	18,495	18,495	18,495	18,495	18,495	18,495	18,495	18,495	18,495
Semi-finished products	28,208	28,208	28,208	28,208	28,208	28,208	28,208	28,208	28,208	28,208	28,208	28,208
Raw materials & supplies	88,035	88,035	88,035	88,035	88,035	88,035	88,035	88,035	88,035	88,035	88,035	88,035
Total Inventories	134,739	134,739	134,739	134,739	134,739	134,739	134,739	134,739	134,739	134,739	134,739	134,739
Total Current Assets	3,588,062	4,089,279	4,607,037	5,143,474	5,700,574	6,280,210	6,478,169	7,162,691	7,806,332	8,478,552	8,775,165	9,749,253
Buildings & Structures	532,031	487,662	447,469	410,997	377,851	347,681	320,181	295,081	272,141	251,149	231,918	214,281
Machinery & Equipment	893,208	758,782	644,521	547,398	464,844	394,674	335,028	284,330	241,236	204,606	173,471	147,006
Others	356,493	315,119	281,031	252,870	229,541	210,156	194,000	180,491	169,158	159,618	151,561	144,732
Total work. depreciable assets	1,781,732	1,561,564	1,373,020	1,211,266	1,072,236	952,511	849,209	759,901	682,534	615,374	556,950	506,019
Land												
Construction in process												
Defferd assets												
Intagible Fixed assets												
Othe Investments												
Total Fixed Assets	1,781,732	1,561,564	1,373,020	1,211,266	1,072,236	952,511	849,209	759,901	682,534	615,374	556,950	506,019
TOTAL ASSETS	5,369,794	5,650,843	5,980,058	6,354,739	6,772,810	7,232,721	7,327,378	7,922,592	8,488,866	9,093,926	9,332,115	10,255,273
LIABILITIES & EQUITY												
Accounts Payable	105,642	105,642	105,642	105,642	105,642	105,642	105,642	105,642	105,642	105,642	105,642	105,642
Accrued expence												
Other current liabilities	69,588	69,588	69,588	69,588	69,588	69,588	52,191	69,588	69,588	69,588	52,191	69,588
Reserve for taxes	109,161	126,884	143,357	158,841	173,560	187,700	145,364	210,127	223,432	236,455	193,436	304,131
Short term loan	0	0	0	0	0	0	0	0	0	0	0	0
Total current liabilities	284,392	302,115	318,587	334,071	348,790	362,930	303,197	385,357	398,662	411,685	351,269	479,361
L-T Loan & Debt F.cost	3,217,531	3,078,287	2,939,043	2,799,800	2,660,556	2,521,312	2,382,068	2,242,824	2,103,580	1,964,337	1,825,093	1,685,849
Bonds												
Reserve for BF relining etc.	153,417	175,333	197,250	219,167	241,083	263,000	120,562	142,458	164,375	186,292	43,833	65,750
Total Fixed liabilities	3,370,948	3,253,621	3,136,293	3,018,966	2,901,639	2,784,312	2,502,610	2,385,283	2,267,955	2,150,628	1,868,926	1,751,599
Legal Retained Earnings												
Accumulated Depreciation												
Total Reserves	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL LIABILITIES	3,655,339	3,555,735	3,454,880	3,353,038	3,250,429	3,147,242	2,805,807	2,770,640	2,666,618	2,562,313	2,220,195	2,230,960
Capital Stock	1,747,969	1,747,969	1,747,969	1,747,969	1,747,969	1,747,969	1,747,969	1,747,969	1,747,969	1,747,969	1,747,969	1,747,969
Surpluses												
Ret. Earnings Brought forward												
Disposable income after taxes	-33,515	347,139	777,208	1,253,732	1,774,411	2,337,510	2,773,602	3,403,983	4,074,279	4,783,643	5,363,950	6,276,343
TOTAL STOCKHOLDER's EQUITY	1,714,454	2,095,108	2,525,178	3,001,702	3,522,381	4,085,479	4,521,571	5,151,952	5,822,248	6,531,612	7,111,920	8,024,313
TOTAL LIABILITIES & EQUITY	5,369,794	5,650,843	5,980,058	6,354,739	6,772,810	7,232,721	7,327,378	7,922,592	8,488,866	9,093,926	9,332,115	10,255,273

Table 1-7 Cash Flow (Base Case)

Calendar Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Project Year	-9	-8	-7	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6	7
Investment.Pay for construction	28,064	116,208	219,512	441,067	309,186	352,678	663,972	1,382,926	741,142	178,505	302,322	655,684	326,460	10,119	0	0
In-or-Decrease of other investment																
Interest Pay During construction	1,092	5,656	14,416	32,138	45,418											
Total Acquisition of Fix assets	29,156	121,864	233,929	473,205	354,603	352,678	663,972	1,382,926	741,142	178,505	302,322	655,684	326,460	10,119	0	0
L-T Loan & D.F.C. repay		0	0	0	0	0	0	0	0	0	0	0	0	97,789	109,037	116,091
Reversal of Reserve for BF																
Total Repay of Fixed Liability	0	0	0	0	0	0	0	0	0	0	0	0	0	97,789	109,037	116,091
In-or-Decrease of Cash	0	0	0	-0	0	4,008	3,087	19,900	-21,101	49,607	238,472	280,034	281,843	401,931	482,583	527,446
In-or-Decrease of Debtors		0	0	0	0	60,122	17,616	10,673	0	59,223	18,765	5,751	0	21,968	7,323	7,323
Tax payment																
In-or-Decrease of Other Liq.Assets		0	0	0	0	42,054	12,611	8,482	0	37,015	7,937	4,145	0	13,497	4,499	4,499
S-T Loan Repayment		0	0	0	0	0	23,335	0	0	11,084	0	0	0	0	0	0
Total In-or-Decrease of Current Assets	0	0	0	-0	0	106,185	56,648	39,055	-21,101	156,929	265,174	289,930	281,843	437,397	494,405	539,268
TOTAL APPLICATIONS	29,156	121,864	233,929	473,205	354,603	458,863	720,620	1,421,981	720,041	335,434	567,496	945,615	608,303	545,305	603,441	655,359
Increase of Capital Stock	8,747	36,559	70,179	141,962	106,381	105,803	199,192	414,878	222,342	53,551	90,697	196,705	97,938	3,036	0	0
L-T Loan & D.F.C Borrow	20,409	85,305	163,750	331,244	248,222	242,904	457,966	955,775	495,485	93,365	171,808	403,669	140,944	0	0	0
Borrowing of L-T Loan Interest																
Total Income of Capital & Fixed liable	29,156	121,864	233,929	473,205	354,603	348,707	657,158	1,370,653	717,827	146,917	262,505	600,374	238,882	3,036	0	0
Disposal Income after Tax	0	0	0	0	-0	-134,149	-93,258	-77,323	-108,721	-403,155	-169,346	-54,436	32,438	9,210	158,132	210,225
Depreciation & Amortization	0	0	0	0	0	168,074	140,992	118,522	99,851	534,464	452,531	383,783	326,025	490,477	416,504	354,255
Fixed Assets Removed																
Prov.of Reserve for BF etc.		0	0	0	0	0	0	0	0	10,958	10,958	10,958	10,958	21,917	21,917	21,917
Total In-or-Decrease of Reserve Funds	0	0	0	0	-0	33,925	47,734	41,199	-8,871	142,268	294,143	340,305	369,421	521,603	596,553	586,396
In-or-Decrease of Creditors		0	0	0	0	32,856	9,857	6,571	0	26,509	4,593	3,018	0	13,343	4,448	4,448
In-or-Decrease of other current liability		0	0	0	0	20,041	5,872	3,558	0	19,741	6,255	1,917	0	7,323	2,441	2,441
Reserve for Taxes		0	0	0	0	-0	0	0	0	0	0	0	0	0	0	62,074
S-T Loan borrowing	0	0	0	0	0	23,335	0	0	11,084	0	0	0	0	0	0	0
Total In-or-Decrease of Current liabilitie	0	0	0	0	0	76,231	15,729	10,129	11,084	46,250	10,848	4,935	0	20,666	6,889	68,963
TOTAL RESOURCES	29,156	121,864	233,929	473,205	354,603	458,863	720,620	1,421,981	720,041	335,434	567,496	945,615	608,303	545,305	603,441	655,359

Table 1-7 Cash Flow (Base Case)

Calendar Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Project Year	8	9	10	11	12	13	14	15	16	17	18	19	20
Investment.Pay for construction	-0	0	-0	-0	0	0	0	0	-0	0	-0	0	0
In-or-Decrease of other investment													
Interest Pay During construction													
Total Acquisition of Fix assets	-0	0	-0	-0	0	0	0	0	-0	0	-0	0	0
L-T Loan & D.F.C. repay	131,390	139,008	139,244	139,244	139,244	139,244	139,244	139,244	139,244	139,244	139,244	139,244	139,244
Reversal of Reserve for BF								164,375				164,375	
Total Repay of Fixed Liability	131,390	139,008	139,244	139,244	139,244	139,244	139,244	303,619	139,244	139,244	139,244	303,619	139,244
In-or-Decrease of Cash	489,435	487,312	501,217	517,759	536,436	557,100	579,636	250,150	632,331	643,641	672,220	348,804	921,898
In-or-Decrease of Debtors	0	0	0	0	0	0	0	-52,191	52,191	0	0	-52,191	52,191
Tax payment													
In-or-Decrease of Other Liq.Assets	0	0	0	0	0	0	0	0	0	0	0	0	0
S-T Loan Repayment	0	0	0	0	0	0	0	0	0	0	0	0	0
Total In-or-Decrease of Current Assets	489,435	487,312	501,217	517,759	536,436	557,100	579,636	197,959	684,522	643,641	672,220	296,613	974,089
TOTAL APPLICATIONS	620,826	626,319	640,461	657,003	675,680	696,344	718,880	501,577	823,766	782,885	811,464	600,232	1,113,333
Increase of Capital Stock	0	0	0	0	0	0	0	0	0	0	0	0	0
L-T Loan & D.F.C Borrow	0	0	0	0	0	0	0	0	0	0	0	0	0
Borrowing of L-T Loan Interest													
Total Income of Capital & Fixed liabie	0	0	0	0	0	0	0	0	0	0	0	0	0
Disposal Income after Tax	269,385	327,484	380,653	430,070	476,524	520,679	563,099	436,092	630,381	670,296	709,364	580,308	912,393
Depreciation & Amortization	301,804	257,552	220,168	188,544	161,755	139,030	119,725	103,301	89,308	77,367	67,161	58,423	50,931
Fixed Assets Removed													
Prov.of Reserve for BF etc.	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917
Total In-or-Decrease of Reserve Funds	593,105	606,953	622,738	640,530	660,195	681,626	704,740	561,310	741,606	769,580	798,441	660,648	985,241
In-or-Decrease of Creditors	0	0	0	0	0	0	0	0	0	0	0	0	0
In-or-Decrease of other current liabilit	0	0	0	0	0	0	0	-17,397	17,397	0	0	-17,397	17,397
Reserve for Taxes	27,721	19,367	17,723	16,472	15,485	14,718	14,140	-42,336	64,763	13,305	13,023	-43,019	110,695
S-T Loan borrowing	0	0	0	0	0	0	0	0	0	0	0	0	0
Total In-or-Decrease of Current liabilitie	27,721	19,367	17,723	16,472	15,485	14,718	14,140	-59,733	82,160	13,305	13,023	-60,416	128,092
TOTAL RESOURCES	620,826	626,319	640,461	657,003	675,680	696,344	718,880	501,577	823,766	782,885	811,464	600,232	1,113,333

5. Profit and loss by product

The profit-loss by product type of the products to be sold by the new company are shown in Table 1-8.

The profit-loss break even point analysis and sensitivity analysis of IRROI are shown in Figure 1-1 and 1-2, respectively.

Table 1-8 Profit-loss by product type (Ordinary year)

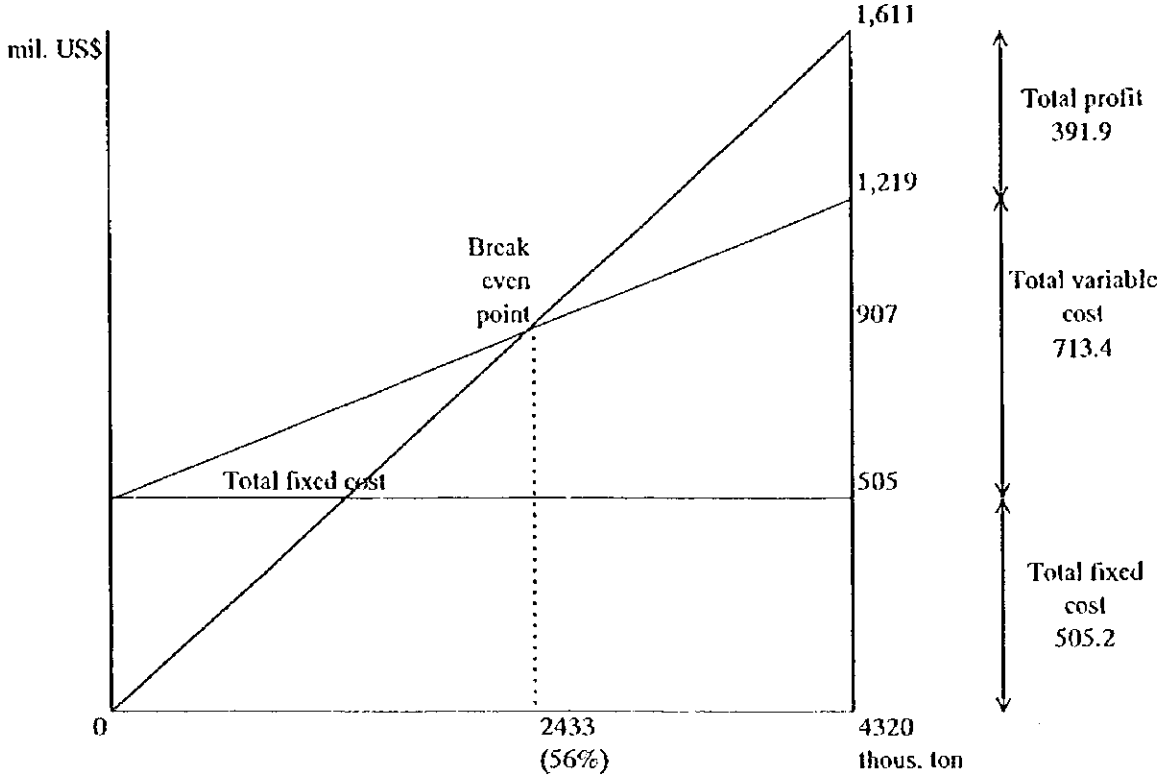
(unit:1,000t, US$/t)

	Shipment	Total Cost					Selling Price	Profit		
		Product cost	Transportation	General Administrative expenses	Interest	Total Cost		Per ton		Amount (mil US$)
Billet	1,095.0	233.4	28.5	0.1	-6.6	255.4	267.5	12.1	(4.5%)	13.2
AsRolledHC	802.9	283.5	28.5	0.1	-6.6	305.4	369.2	63.7	(17.3%)	51.2
Skin passed HC	400.0	295.9	28.5	0.1	-6.6	317.9	384.2	66.2	(17.2%)	26.5
Slit recoild HC	240.0	303.5	28.5	0.1	-6.6	325.5	409.2	83.7	(20.5%)	20.1
Plate	120.0	307.7	28.5	0.1	-6.6	329.7	429.2	99.5	(23.2%)	11.9
HR sheet	240.0	307.3	28.5	0.1	-6.6	329.3	429.2	99.9	(23.3%)	24.0
P/O coil	203.1	306.3	28.5	0.1	-6.6	328.3	389.2	60.9	(15.6%)	12.4
CR coil	350.0	405.4	28.5	0.1	-6.6	427.4	509.3	82.0	(16.1%)	28.7
CR sheet	350.0	417.4	28.5	0.1	-6.6	439.4	539.3	99.9	(18.5%)	35.0
CG coil	100.1	532.3	28.5	0.1	-6.6	554.2	686.9	132.7	(19.3%)	13.3
CG sheet	100.0	548.3	28.5	0.1	-6.6	570.3	716.9	146.6	(20.5%)	14.7
Tin sheet	100.0	667.8	28.5	0.1	-6.6	689.8	909.5	219.7	(24.2%)	22.0
Total	4,101.1									272.8

6. Investment effect analysis and sensitivity analysis (Internal Rate of Return)

Internal rate of return is calculated using the Cash Flow Tables.
Sensitivity analysis was made by making changes in factors which have big influence on investment efficiency. Description of cases involving changes and their influence on investment efficiency are given in Table 1-9.

Break even point : 2,433 thous.tons
Operation rate on break even point : 56%



Break even point of each year

Calendar Year		2016	2020	2025	2029
Break even point	1000ton	3,488	2,588	1,954	1,637
Operation rate	%	81%	60%	45%	38%

Figure 1-1 Profit-loss break even point analysis (Ordinary Year)

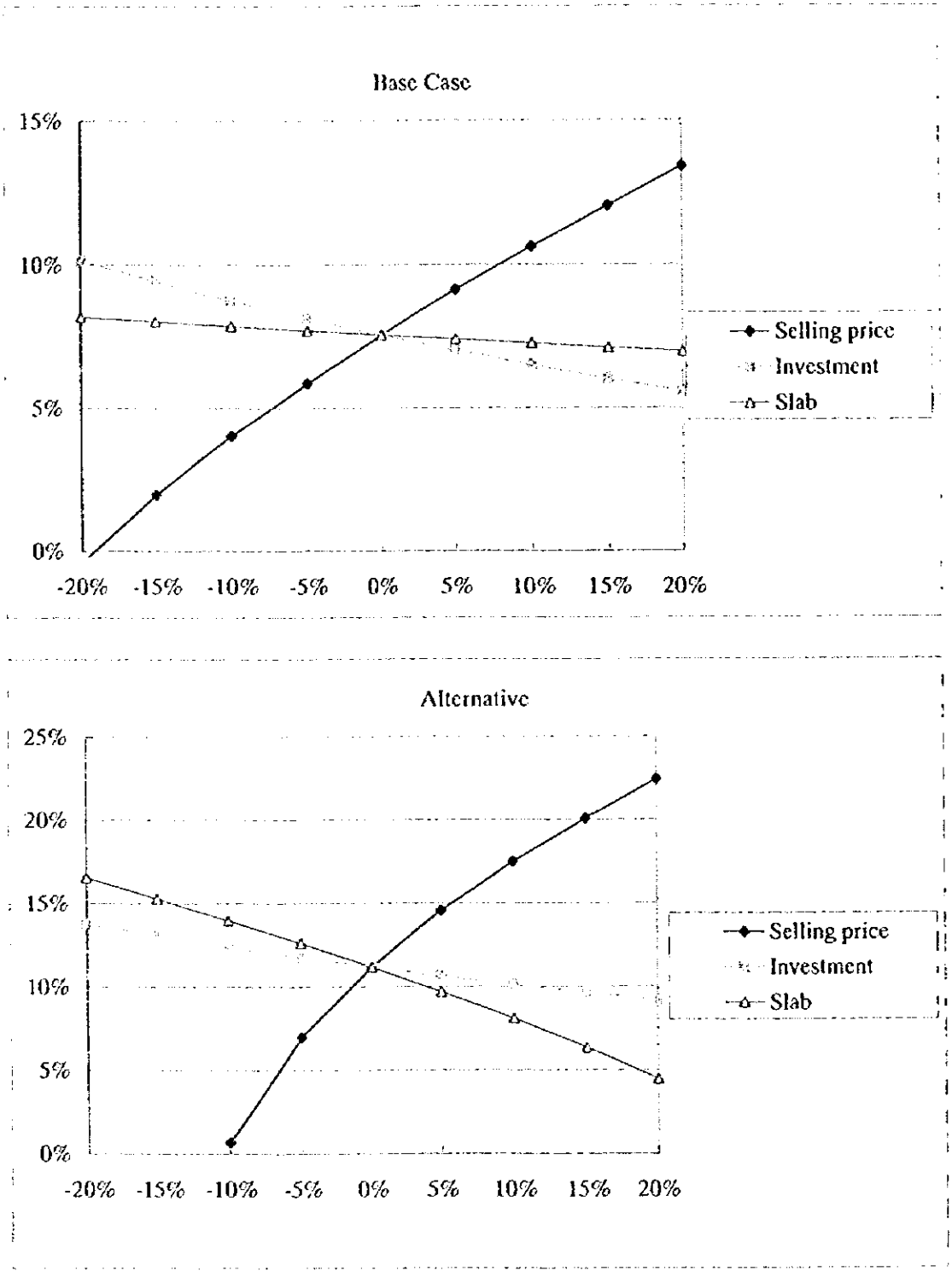


Figure 1-2 Sensitivity analysis of IRROI (Before tax)

Table 1-9 Investment effect analysis and sensitivity analysis

	Base Case	Alternative1
IRROI (After tax)	**6.67%**	**9.34%**
IRROI (Before tax)	**7.57%**	**11.18%**
IRROE	**12.00%**	**17.98%**
<Sensitivity analysis of IRROI (Before tax)>		
Selling price		
10%up	10.63%	17.48%
10%down	4.04%	0.67%
Variable cost		
10%up	5.85%	3.78%
10%down	9.22%	16.30%
Operating Fixed cost		
10%up	7.30%	11.00%
10%down	7.83%	11.37%
Total investment		
10%up	6.51%	10.13%
10%down	8.77%	12.40%
Slab import price		
10%up	7.27%	8.08%
10%down	7.88%	13.98%

Base case: Total of Steps 1, 2 and 3

Alternative 1: Construction of hot strip mill and cold strip mill including CGL

Table 1-10 Cash Flow (Base Case)

Calendar Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Project Year	-9	-8	-7	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6	7
Investment.Pay for construction	28,064	116,208	219,512	441,067	309,186	352,678	663,972	1,382,926	741,142	178,505	302,322	655,684	326,460	10,119	0	0
In-or-Decrease of other investment																
Interest Pay During construction	1,092	5,656	14,416	32,138	45,418											
Total Acquisition of Fix assets	29,156	121,864	233,929	473,205	354,603	352,678	663,972	1,382,926	741,142	178,505	302,322	655,684	326,460	10,119	0	0
L-T Loan & D.F.C. repay		0	0	0	0	0	0	0	0	0	0	0	0	97,789	109,037	116,091
Reversal of Reserve for BF																
Total Repay of Fixed Liability	0	0	0	0	0	0	0	0	0	0	0	0	0	97,789	109,037	116,091
In-or-Decrease of Cash	0	0	0	-0	0	4,008	3,087	19,900	-21,101	49,607	238,472	280,034	281,843	401,931	482,583	527,446
In-or-Decrease of Debtors		0	0	0	0	60,122	17,616	10,673	0	59,223	18,765	5,751	0	21,968	7,323	7,323
Tax payment																
In-or-Decrease of Other Liq.Assets		0	0	0	0	42,054	12,611	8,482	0	37,015	7,937	4,145	0	13,497	4,499	4,499
S-T Loan Repayment		0	0	0	0	0	23,335	0	0	11,084	0	0	0	0	0	0
Total In-or-Decrease of Current Assets	0	0	0	-0	0	106,185	56,648	39,055	-21,101	156,929	265,174	289,930	281,843	437,397	494,405	539,268
TOTAL APPLICATIONS	29,156	121,864	233,929	473,205	354,603	458,863	720,620	1,421,981	720,041	335,434	567,496	945,615	608,303	545,305	603,441	655,359
Increase of Capital Stock	8,747	36,559	70,179	141,962	106,381	105,803	199,192	414,878	222,342	53,551	90,697	196,705	97,938	3,036	0	0
L-T Loan & D.F.C Borrow	20,409	85,305	163,750	331,244	248,222	242,904	457,966	955,775	495,485	93,365	171,808	403,669	140,944	0	0	0
Borrowing of L-T Loan Interest																
Total Income of Capital & Fixed liable	29,156	121,864	233,929	473,205	354,603	348,707	657,158	1,370,653	717,827	146,917	262,505	600,374	238,882	3,036	0	0
Disposal Income after Tax	0	0	0	0	-0	-134,149	-93,258	-77,323	-108,721	-403,155	-169,346	-54,436	32,438	9,210	158,132	210,225
Depreciation & Amortization	0	0	0	0	0	168,074	140,992	118,522	99,851	534,464	452,531	383,783	326,025	490,477	416,504	354,255
Fixed Assets Removed																
Prov.of Reserve for BF etc.		0	0	0	0	0	0	0	0	10,958	10,958	10,958	10,958	21,917	21,917	21,917
Total In-or-Decrease of Reserve Funds	0	0	0	0	-0	33,925	47,734	41,199	-8,871	142,268	294,143	340,305	369,421	521,603	596,553	586,396
In-or-Decrease of Creditors		0	0	0	0	32,856	9,857	6,571	0	26,509	4,593	3,018	0	13,343	4,448	4,448
In-or-Decrease of other current liability		0	0	0	0	20,041	5,872	3,558	0	19,741	6,255	1,917	0	7,323	2,441	2,441
Reserve for Taxes		0	0	0	0	-0	0	0	0	0	0	0	0	0	0	62,074
S-T Loan borrowing	0	0	0	0	0	23,335	0	0	11,084	0	0	0	0	0	0	0
Total In-or-Decrease of Current liabilitie	0	0	0	0	0	76,231	15,729	10,129	11,084	46,250	10,848	4,935	0	20,666	6,889	68,963
TOTAL RESOURCES	29,156	121,864	233,929	473,205	354,603	458,863	720,620	1,421,981	720,041	335,434	567,496	945,615	608,303	545,305	603,441	655,359
	0	0	0	0	0	-0	0	0	-0	0	0	-0	0	0	-0	0

Table 1-10 Cash Flow (Base Case)

Calendar Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Project Year	8	9	10	11	12	13	14	15	16	17	18	19	20
Investment.Pay for construction	-0	0	-0	-0	0	0	0	0	-0	0	-0	0	0
In-or-Decrease of other investment													
Interest Pay During construction													
Total Acquisition of Fix assets	-0	0	-0	-0	0	0	0	0	-0	0	-0	0	0
L-T Loan & D.F.C. repay	131,390	139,008	139,244	139,244	139,244	139,244	139,244	139,244	139,244	139,244	139,244	139,244	139,244
Reversal of Reserve for BF								164,375				164,375	
Total Repay of Fixed Liability	131,390	139,008	139,244	139,244	139,244	139,244	139,244	303,619	139,244	139,244	139,244	303,619	139,244
In-or-Decrease of Cash	489,435	487,312	501,217	517,759	536,436	557,100	579,636	250,150	632,331	643,641	672,220	348,804	921,898
In-or-Decrease of Debtors	0	0	0	0	0	0	0	-52,191	52,191	0	0	-52,191	52,191
Tax payment													
In-or-Decrease of Other Liq.Assets	0	0	0	0	0	0	0	0	0	0	0	0	0
S-T Loan Repayment	0	0	0	0	0	0	0	0	0	0	0	0	0
Total In-or-Decrease of Current Assets	489,435	487,312	501,217	517,759	536,436	557,100	579,636	197,959	684,522	643,641	672,220	296,613	974,089
TOTAL APPLICATIONS	620,826	626,319	640,461	657,003	675,680	696,344	718,880	501,577	823,766	782,885	811,464	600,232	1,113,333
Increase of Capital Stock	0	0	0	0	0	0	0	0	0	0	0	0	0
L-T Loan & D.F.C Borrow	0	0	0	0	0	0	0	0	0	0	0	0	0
Borrowing of L-T Loan Interest													
Total Income of Capital & Fixed liable	0	0	0	0	0	0	0	0	0	0	0	0	0
Disposal Income after Tax	269,385	327,484	380,653	430,070	476,524	520,679	563,099	436,092	630,381	670,296	709,364	580,308	912,393
Depreciation & Amortization	301,804	257,552	220,168	188,544	161,755	139,030	119,725	103,301	89,308	77,367	67,161	58,423	50,931
Fixed Assets Removed													
Prov.of Reserve for BF etc.	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917	21,917
Total In-or-Decrease of Reserve Funds	593,105	606,953	622,738	640,530	660,195	681,626	704,740	561,310	741,606	769,580	798,441	660,648	985,241
In-or-Decrease of Creditors	0	0	0	0	0	0	0	0	0	0	0	0	0
In-or-Decrease of other current liabilit	0	0	0	0	0	0	0	-17,397	17,397	0	0	-17,397	17,397
Reserve for Taxes	27,721	19,367	17,723	16,472	15,485	14,718	14,140	-42,336	64,763	13,305	13,023	-43,019	110,695
S-T Loan borrowing	0	0	0	0	0	0	0	0	0	0	0	0	0
Total In-or-Decrease of Current liabilitie	27,721	19,367	17,723	16,472	15,485	14,718	14,140	-59,733	82,160	13,305	13,023	-60,416	128,092
TOTAL RESOURCES	620,826	626,319	640,461	657,003	675,680	696,344	718,880	501,577	823,766	782,885	811,464	600,232	1,113,333
	0	-0	0	-0	-0	0	0	-0	0	-0	-0	0	0

Table 1-10 Cash Flow (Base Case)

Calendar Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Project Year	-9	-8	-7	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6	7
CASH FLOW for IRROI(Before Tax)	-29,156	-121,864	-233,929	-473,205	-354,603	-312,996	-556,599	-1,254,073	-603,262	99,300	165,174	-133,780	236,135	685,836	755,207	838,720
7.57%																
Cash IN	0	0	0	0	0	86,821	63,463	51,328	-8,871	188,517	304,991	345,241	369,421	542,269	603,441	655,359
Cash OUT	29,156	121,864	233,929	473,205	354,603	454,855	694,199	1,402,081	741,142	274,743	329,023	665,580	326,460	45,585	11,822	11,822
Interest	0	0	0	-0	-0	45,418	61,699	82,535	132,604	161,904	162,582	159,016	165,630	158,092	131,357	99,706
CASH FLOW for IRROI(After Tax)	-29,156	-121,864	-233,929	-473,205	-354,603	-322,616	-569,037	-1,268,218	-617,408	75,679	138,550	-161,324	208,591	654,777	722,977	743,243
6.67%	-1,092															
4.8%																
CASH FLOW for IRROE	-8,747	-36,559	-70,179	-141,962	-106,381	-147,213	-257,804	-477,512	-376,047	-165,848	-14,807	-75,687	18,274	240,804	351,225	427,741
12.00%																
IRR(Before Tax)-Investment(-10%)	-26,349	-110,243	-211,977	-429,098	-323,685	-277,729	-490,202	-1,115,780	-529,148	117,151	195,406	-68,211	268,781	686,847	755,207	838,720
8.77%																
IRR(Before Tax)-Investment(+10%)	-31,962	-133,485	-255,880	-517,312	-385,522	-348,264	-622,996	-1,392,365	-677,376	81,450	134,942	-199,348	203,489	684,824	755,207	838,720
6.51%																
IRR(Before Tax)-VCost(-10%)	-29,156	-121,864	-233,929	-473,205	-354,603	-276,532	-509,332	-1,199,868	-549,058	172,550	237,880	-60,824	305,518	757,977	828,268	912,700
9.22%																
IRR(Before Tax)-VCost(+10%)	-29,156	-121,864	-233,929	-473,205	-354,603	-349,461	-603,866	-1,308,277	-657,467	26,050	92,468	-206,735	166,753	613,694	682,146	764,739
5.85%																
IRR(Before Tax)-FCost(-10%)	-29,156	-121,864	-233,929	-473,205	-354,603	-310,260	-553,862	-1,251,336	-600,526	111,378	177,252	-121,702	248,213	697,914	767,285	853,592
7.83%																
IRR(Before Tax)-FCost(+10%)	-29,156	-121,864	-233,929	-473,205	-354,603	-315,733	-559,336	-1,256,809	-605,999	87,222	153,096	-145,858	224,057	673,758	743,129	823,847
7.30%																
IRR(Before Tax)-Slab(-10%)	-29,156	-121,864	-233,929	-473,205	-354,603	-294,633	-532,727	-1,226,528	-575,718	122,863	178,773	-118,494	251,421	691,950	758,264	838,720
7.88%																
IRR(Before Tax)-slab(+10%)	-29,156	-121,864	-233,929	-473,205	-354,603	-331,359	-580,471	-1,281,617	-630,807	75,737	151,575	-149,066	220,849	679,721	752,150	838,720
7.27%																

Table 1-10 Cash Flow (Base Case)

Calendar Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Project Year	8	9	10	11	12	13	14	15	16	17	18	19	20
CASH FLOW for IRROI(Before Tax)	747,225	711,150	690,140	671,166	653,707	637,456	622,159	189,386	666,184	584,757	571,169	139,947	848,995
7.57%													
Cash IN	620,826	626,319	640,461	657,003	675,680	696,344	718,880	501,577	823,766	782,885	811,464	600,232	1,113,333
Cash OUT	-0	0	-0	-0	0	0	0	112,184	52,191	0	0	112,184	52,191
Interest	65,276	32,062	-1,446	-35,711	-70,860	-107,009	-144,264	-182,724	-203,556	-244,835	-286,720	-330,133	-356,244
CASH FLOW for IRROI(After Tax)	686,102	658,381	639,015	621,292	604,820	589,335	574,617	206,670	568,018	538,049	524,744	157,915	704,898
6.67%													
4.8%													
CASH FLOW for IRROE	424,159	455,250	502,663	553,469	607,296	664,109	723,900	432,873	835,887	888,476	958,940	678,937	1,278,141
12.00%													
IRR(Before Tax)-Investment(-10%)	747,225	711,150	690,140	671,166	653,707	637,456	622,159	189,386	666,184	584,757	571,169	139,947	848,995
8.77%													
IRR(Before Tax)-Investment(+10%)	747,225	711,150	690,140	671,166	653,707	637,456	622,159	189,386	666,184	584,757	571,169	139,947	848,995
6.51%													
IRR(Before Tax)-VCost(-10%)	821,205	785,131	764,121	745,147	727,687	711,436	696,139	244,871	740,164	658,737	645,150	195,433	904,481
9.22%													
IRR(Before Tax)-VCost(+10%)	673,244	637,170	616,160	597,186	579,726	563,475	548,178	133,900	592,203	510,776	497,189	84,462	793,510
5.85%													
IRR(Before Tax)-FCost(-10%)	762,098	726,023	705,013	686,039	668,579	652,328	637,031	204,259	681,056	599,629	586,042	154,820	863,868
7.83%													
IRR(Before Tax)-FCost(+10%)	732,352	696,277	675,267	656,294	638,834	622,583	607,286	174,513	651,311	569,884	556,296	125,075	834,123
7.30%													
IRR(Before Tax)-Slab(-10%)	747,225	711,150	690,140	671,166	653,707	637,456	622,159	189,386	666,184	584,757	571,169	139,947	848,995
7.88%													
IRR(Before Tax)-slab(+10%)	747,225	711,150	690,140	671,166	653,707	637,456	622,159	189,386	666,184	584,757	571,169	139,947	848,995
7.27%													

Table 1-11 Cash Flow (Alternative 1)

Calendar Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Project Year	-9	-8	-7	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6	7
Investment.Pay for construction	20,336	97,877	185,795	389,321	212,532	50,672	85,483	176,763	91,943	2,813	0	-0	0	-0	0	0
In-or-Decrease of other investment																
Interest Pay During construction	791	4,630	12,039	27,655	37,000											
Total Acquisition of Fix assets	21,127	102,508	197,834	416,976	249,532	50,672	85,483	176,763	91,943	2,813	0	-0	0	-0	0	0
L-T Loan & D.F.C. repay		0	0	0	0	0	0	0	0	23,821	26,972	28,967	33,091	35,237	35,302	35,302
Reversal of Reserve for BF																
Total Repay of Fixed Liability	0	0	0	0	0	0	0	0	0	23,821	26,972	28,967	33,091	35,237	35,302	35,302
In-or-Decrease of Cash	0	0	0	0	0	3,914	1,174	36,058	42,419	67,083	139,937	166,694	143,808	146,304	151,734	157,758
In-or-Decrease of Debtors		0	0	0	0	58,705	17,612	11,741	0	61,090	16,373	6,629	0	0	0	0
Tax payment																
In-or-Decrease of Other Liq.Assets		0	0	0	0	43,742	13,123	8,748	0	19,444	5,262	2,131	0	0	0	0
S-T Loan Repayment		0	0	0	0	0	24,390	8,345	0	0	0	0	0	0	0	0
Total In-or-Decrease of Current Assets	0	0	0	0	0	106,361	56,298	64,893	42,419	147,618	161,572	175,454	143,808	146,304	151,734	157,758
TOTAL APPLICATIONS	21,127	102,508	197,834	416,976	249,532	157,033	141,781	241,656	134,362	174,252	188,544	204,421	176,899	181,540	187,036	193,060
Increase of Capital Stock	6,338	30,752	59,350	125,093	74,860	15,202	25,645	53,029	27,583	844	0	0	0	0	0	0
L-T Loan & D.F.C Borrow	14,789	71,755	138,484	291,883	174,672	32,240	54,216	113,496	44,393	0	0	0	0	0	0	0
Borrowing of L-T Loan Interest																
Total Income of Capital & Fixed liable	21,127	102,508	197,834	416,976	249,532	47,442	79,861	166,525	71,975	844	0	0	0	0	0	0
Disposal Income after Tax	0	-0	0	0	0	-136,055	-90,209	-50,239	-34,976	70,800	113,456	107,340	121,809	134,457	146,405	157,837
Depreciation & Amortization	0	0	0	0	0	163,647	137,349	115,517	97,363	82,244	69,631	59,091	50,267	42,867	36,648	31,413
Fixed Assets Removed																
Prov.of Reserve for BF etc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total In-or-Decrease of Reserve Funds	0	-0	0	0	0	27,592	47,141	65,278	62,387	153,044	183,087	166,431	172,076	177,324	183,054	189,250
In-or-Decrease of Creditors		0	0	0	0	29,696	8,909	5,939	0	0	0	0	0	0	0	0
In-or-Decrease of other current liability		0	0	0	0	19,568	5,871	3,914	0	20,363	5,458	2,210	0	0	0	0
Reserve for Taxes		0	0	0	0	0	0	0	0	0	0	35,780	4,823	4,216	3,983	3,811
S-T Loan borrowing	0	0	0	0	0	32,735	0	0	0	0	0	0	0	0	0	0
Total In-or-Decrease of Current liabilitie	0	0	0	0	0	81,999	14,779	9,853	0	20,363	5,458	37,990	4,823	4,216	3,983	3,811
TOTAL RESOURCES	21,127	102,508	197,834	416,976	249,532	157,033	141,781	241,656	134,362	174,252	188,544	204,421	176,899	181,540	187,036	193,060
	0	0	0	0	-0	0	-0	0	-0	0	-0	-0	0	0	0	0

Table 1-11 Cash Flow (Alternative 1)

Calendar Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Project Year	8	9	10	11	12	13	14	15	16	17	18	19	20
Investment.Pay for construction	-0	0	0	0	-0	0	-0	0	-0	0	-0	-0	0
In-or-Decrease of other investment													
Interest Pay During construction													
Total Acquisition of Fix assets	-0	0	0	0	-0	0	-0	0	-0	0	-0	-0	0
L-T Loan & D.F.C. repay	35,302	35,302	35,302	35,302	35,302	35,302	35,302	35,302	35,302	35,302	35,302	35,302	35,302
Reversal of Reserve for BF													
Total Repay of Fixed Liability	35,302	35,302	35,302	35,302	35,302	35,302	35,302	35,302	35,302	35,302	35,302	35,302	35,302
In-or-Decrease of Cash .	164,276	171,267	178,716	186,612	194,950	203,730	212,951	222,619	232,740	243,324	254,381	265,925	277,968
In-or-Decrease of Debtors	0	0	0	0	0	0	0	0	0	0	0	0	0
Tax payment													
In-or-Decrease of Other Liq.Assets	0	0	0	0	0	0	0	0	0	0	0	0	0
S-T Loan Repayment	0	0	0	0	0	0	0	0	0	0	0	0	0
Total In-or-Decrease of Current Assets	164,276	171,267	178,716	186,612	194,950	203,730	212,951	222,619	232,740	243,324	254,381	265,925	277,968
TOTAL APPLICATIONS	199,578	206,569	214,018	221,914	230,253	239,032	248,253	257,921	268,042	278,626	289,684	301,227	313,271
Increase of Capital Stock	0	0	0	0	0	0	0	0	0	0	0	0	0
L-T Loan & D.F.C Borrow	0	0	0	0	0	0	0	0	0	0	0	0	0
Borrowing of L-T Loan Interest													
Total Income of Capital & Fixed liable	0	0	0	0	0	0	0	0	0	0	0	0	0
Disposal Income after Tax	168,896	179,705	190,366	200,968	211,586	222,287	233,128	244,160	255,429	266,977	278,841	291,057	303,657
Depreciation & Amortization	26,996	23,262	20,099	17,413	15,127	13,178	11,512	10,084	8,857	7,800	6,888	6,099	5,413
Fixed Assets Removed													
Prov.of Reserve for BF etc.	0	0	0	0	0	0	0	0	0	0	0	0	0
Total In-or-Decrease of Reserve Funds	195,892	202,967	210,464	218,380	226,713	235,465	244,639	254,244	264,286	274,777	285,729	297,155	309,070
In-or-Decrease of Creditors	0	0	0	0	0	0	0	0	0	0	0	0	0
In-or-Decrease of other current liabilit	0	0	0	0	0	0	0	0	0	0	0	0	0
Reserve for Taxes .	3,686	3,603	3,554	3,534	3,539	3,567	3,614	3,677	3,756	3,849	3,955	4,072	4,200
S-T Loan borrowing	0	0	0	0	0	0	0	0	0	0	0	0	0
Total In-or-Decrease of Current liabilitie	3,686	3,603	3,554	3,534	3,539	3,567	3,614	3,677	3,756	3,849	3,955	4,072	4,200
TOTAL RESOURCES	199,578	206,569	214,018	221,914	230,253	239,032	248,253	257,921	268,042	278,626	289,684	301,227	313,271
	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 1-11 Cash Flow (Alternative 1)

Calendar Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Project Year	-9	-8	-7	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6	7
CASH FLOW for IRROI(Before Tax)	-20,336	-97,877	-185,795	-389,321	-212,532	-29,871	1,339	-65,428	30,029	159,525	234,131	290,794	230,607	225,177	220,727	216,572
11.18%																
Cash IN	-0	-0	0	-0	0	76,856	61,920	75,131	62,387	173,408	188,544	204,421	176,899	181,540	187,036	193,060
Cash OUT	20,336	97,877	185,795	389,321	212,532	153,119	116,217	197,253	91,943	83,348	21,635	8,760	0	-0	0	0
Interest	0	0	0	0	0	37,000	43,425	42,605	45,496	45,601	40,738	31,808	21,341	11,876	2,164	-7,842
CASH FLOW for IRROI(After Tax)	-20,336	-97,877	-185,795	-389,321	-212,532	-39,264	-10,872	-79,517	15,940	135,662	207,647	227,470	198,240	193,417	189,201	185,218
9.34%	-0															
8.1%																
CASH FLOW for IRROE	-5,547	-26,122	-47,311	-97,438	-37,860	-48,288	-67,896	-59,576	-30,660	20,638	99,199	134,886	122,467	134,427	149,570	165,600
17.98%																
IRR(Before Tax)-Investment(-10%)	-18,303	-88,090	-167,215	-350,389	-191,279	-24,804	9,887	-47,752	39,223	159,807	234,131	290,794	230,607	225,177	220,727	216,572
12.40%																
IRR(Before Tax)-Investment(+10%)	-22,370	-107,665	-204,374	-428,253	-233,785	-34,938	-7,209	-83,104	20,835	159,244	234,131	290,794	230,607	225,177	220,727	216,572
10.13%																
IRR(Before Tax)-VCost(-10%)	-20,336	-97,877	-185,795	-389,321	-212,532	7,559	49,979	-9,315	86,142	253,583	338,507	399,348	339,161	333,731	329,281	325,126
16.30%																
IRR(Before Tax)-VCost(+10%)	-20,336	-97,877	-185,795	-389,321	-212,532	-67,300	-47,300	-121,541	-26,084	65,467	129,754	182,239	122,052	116,623	112,173	108,018
3.78%																
IRR(Before Tax)-FCost(-10%)	-20,336	-97,877	-185,795	-389,321	-212,532	-27,735	3,475	-63,292	32,165	162,535	237,140	293,803	233,616	228,186	223,737	219,582
11.37%																
IRR(Before Tax)-FCost(+10%)	-20,336	-97,877	-185,795	-389,321	-212,532	-32,007	-797	-67,564	27,893	156,516	231,121	287,784	227,597	222,167	217,718	213,563
11.00%																
IRR(Before Tax)-Slab(-10%)	-20,336	-97,877	-185,795	-389,321	-212,532	-175	39,943	-20,885	74,572	204,069	278,674	335,337	275,150	269,720	265,271	261,116
13.98%																
IRR(Before Tax)-Slab(+10%)	-20,336	-97,877	-185,795	-389,321	-212,532	-59,566	-37,265	-109,971	-14,514	114,982	189,587	246,250	186,063	180,634	176,184	172,029
8.08%																
						296,955	386,042	445,433	445,433	445,433	445,433	445,433	445,433	445,433	445,433	445,433

Table 1-11 Cash Flow (Alternative 1)

Calendar Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Project Year	8	9	10	11	12	13	14	15	16	17	18	19	20
CASH FLOW for IRROI(Before Tax)	212,638	208,868	205,216	201,642	198,114	194,602	191,082	187,532	183,933	180,270	176,526	172,689	168,745
11.18%													
Cash IN	199,578	206,569	214,018	221,914	230,253	239,032	248,253	257,921	268,042	278,626	289,684	301,227	313,271
Cash OUT	-0	0	0	0	-0	0	0	0	0	0	0	0	0
Interest	-18,171	-28,849	-39,900	-51,350	-63,222	-75,541	-88,329	-101,611	-115,409	-129,750	-144,656	-160,154	-176,270
CASH FLOW for IRROI(After Tax)	181,407	177,721	174,118	170,564	167,030	163,491	159,924	156,310	152,633	148,877	145,027	141,073	137,001
9.34%													
8.1%													
CASH FLOW for IRROE	182,447	200,116	218,616	237,962	258,173	279,270	301,280	324,229	348,149	373,074	399,037	426,079	454,238
17.98%													
IRR(Before Tax)-Investment(-10%)	212,638	208,868	205,216	201,642	198,114	194,602	191,082	187,532	183,933	180,270	176,526	172,689	168,745
12.40%													
IRR(Before Tax)-Investment(+10%)	212,638	208,868	205,216	201,642	198,114	194,602	191,082	187,532	183,933	180,270	176,526	172,689	168,745
10.13%													
IRR(Before Tax)-VCost(-10%)	321,192	317,422	313,770	310,196	306,668	303,156	299,636	296,086	292,487	288,824	285,080	281,243	277,299
16.30%													
IRR(Before Tax)-VCost(+10%)	104,084	100,314	96,662	93,088	89,560	86,048	82,527	78,978	75,379	71,716	67,972	64,134	60,191
3.78%													
IRR(Before Tax)-FCost(-10%)	215,647	211,877	208,225	204,652	201,123	197,611	194,091	190,541	186,943	183,279	179,535	175,698	171,754
11.37%													
IRR(Before Tax)-FCost(+10%)	209,628	205,858	202,206	198,633	195,104	191,592	188,072	184,522	180,924	177,260	173,517	169,679	165,736
11.00%													
IRR(Before Tax)-Slab(-10%)	257,181	253,411	249,759	246,186	242,657	239,145	235,625	232,075	228,477	224,813	221,069	217,232	213,288
13.98%													
IRR(Before Tax)-Slab(+10%)	168,094	164,324	160,672	157,099	153,571	150,059	146,538	142,988	139,390	135,726	131,983	128,145	124,202
8.08%													
	445,433	445,433	445,433	445,433	445,433	445,433	445,433	445,433	445,433	445,433	445,433	445,433	445,433

Part 11 Economic Analysis

Section 1 Economic Analysis

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1. Concept of economic analysis in industrial projects

1.1 General

Financial analysis is concerned with whether the project will be able to secure the funds it will need and be able to repay these and whether the project will be able to yield reasonable profits. Economic analysis is directed toward determining whether the project is likely to contribute significantly to the development of the economy as a whole and if the contribution of the project is likely to be great enough to justify the use of the scarce resources (including foreign exchange) which will be needed. The former evaluates the financial viability of the project based on the market prices, while the latter evaluates the economic viability of the project based on the economic values (shadow priced values) from a viewpoint of the national economy.

As mentioned above, all inputs and outputs are measured at market prices in financial analysis. If the conditions of "perfect competition" are present in transactions for commodities, the market values are exactly the same as the economic values. However, there are many cases in which the market values are different from the economic values. In such cases, it is said that the market values are distorted and such distortions stem from the following failures:

- Market failures
- Government failures

Market failures relate to situations in which markets for particular goods and services fail to meet the conditions of perfect competition. Examples of potential cause of market failure are as follows:

- Monopolistic prices
- Dumping prices due to over-supply of the market

In the case of market failure, the government intervenes in the economy to correct it. Government interventions may be viewed as "optimal" when they help restore the conditions needed to achieve economic efficiency.

Interventions which disrupt economic efficiency, or which do not fully restore the conditions for economic efficiency, may be viewed as "nonoptimal interventions", or government failures.

Government failures can be divided into the two categories:

- Interventions designed to correct for market failures but which, in practice, turn out to be inappropriate, insufficient, or excessive
- Interventions which disrupt otherwise efficiently functioning markets

Economic distortions caused by government failures will generally fall under the following two categories:

- Border distortions
- Domestic distortions

Border distortions include distortions such as export subsidies and import bans, which tend to sustain an overvalued exchange rate. Border distortions affect the relationship between "border prices" (i.e., CIF and FOB prices) and "domestic prices". Border distortions in developing countries tend to increase domestic prices relative to border prices.

The economic valuation process will have to somehow adjust for this distortion between border prices and domestic prices, because the distortion will affect the relative values of traded goods versus nontraded goods. Using the "shadow exchange rate" (instead of the "official exchange rate") in the economic analysis is one way of adjusting for the distortion between traded and nontraded goods.

Domestic distortions include distortions caused by factors such as a minimum-wage law and subsidized interest rates. Domestic distortions affect the relationships between domestic prices.

In economic analysis, shadow pricing is applied to correct for distortions that exist because of market and government failures. Shadow price can be defined as the price calculated and adjusted under the conditions of perfect competition. All cost and benefit in the financial analysis are converted to shadow prices and economic cash flow is then prepared using the shadow prices.

Taxes are a transfer payment which require special treatment in economic analysis.

1.2 Concept of shadow price

As mentioned before, markets are imperfect. There may be institutional rigidities, price controls, imperfect information about prices offered by competing sellers or buyers, monopoly elements, "traditional" prices, and so forth. Because these imperfections exist, the use of market prices may introduce a significant error into the economic analysis of a project. Factors that may cause this include foreign exchange, wages to pay labor, commodities protected by trade barriers, etc. To avoid these biases in the analysis of projects, a shadow price may be used instead of the market price, which is intended to reflect the "true" value of the commodity or service. For purposes of economic analysis, a shadow price may be defined as that price which would prevail in the economy if it were in perfect equilibrium under conditions of perfect competition.

In economic analysis, there are generally four subjects to be considered for the use of shadow prices rather than market prices. These involve the foreign exchange, commodities, land and unskilled labor.

1.2.1 Standard conversion factor (SCF)

Standard conversion factor (SCF) is the factor to be used in converting the market price (financial price) of nontraded goods to the border price. Different kinds of nontraded goods are used in a project and each conversion factor (CF) can be calculated for each nontraded good. However, it needs a lot of work to compute each CF. For countries where economic statistics are not well developed, it is difficult to calculate it.

Generally speaking, the nontraded goods used in a project is a small share of the total requirements in terms of value. Each nontraded good has a ratio of 10% or smaller in this project. In general, when the ratio of a nontraded good to the total requirements is 10% or less (20% or less in some cases), its border price can be calculated by using SCF which is considered the average of all the CFs. SCF can be calculated by the following formula:

$$SCF = \frac{\text{Border price}}{\text{Market price (Financial price)}}$$

$$= \frac{M + X}{(M + Tm) + (X - Tx + Sx)} \quad \cdots\cdots (1.1)$$

where:
M = total import
X = total export
Tm = total import tax
Tx = total export tax
Sx = total export subsidy

Equation (1.1) gives the border price of each nontraded good as follows:

$(NTB)_i = (NTM)_i \times SCF$ ・・・・(1.2)
where:
$(NTB)_i$ = border price of nontraded good (i)
$(NTM)_i$ = market price of nontraded good (i)

Assuming that the shadow price is equal to the border price, $(NTB)_i$ is equivalent to the shadow price of the nontraded good (i).

1.2.2 Shadow exchange rate (SER)

With SCF explained in 1.2.1, the border price is usually calculated in local currency. When economic analysis is made in foreign exchange (say US dollars), it should be converted in that exchange using a shadow exchange rate (SER).

SER is defined as below:

SER = SCF x OER ・・・・(1.3)
where:
SCF = standard conversion factor
OER = official exchange rate

1.2.3 Shadow prices of traded and nontraded goods

The following formula is used for the economic analysis:

(1) Traded goods
- Imported goods = CIF price
- Domestic goods = market price (in US$) in financial analysis

(Note) Tradable domestic goods may not be competitive in the international market in terms of quality, cost and delivery. Therefore, they have already been deflated in the financial analysis in this report, which seems to reflect the "willingness to pay" price.

(2) Nontraded goods = market price (in VND) x SER

(Note) The above can be used in case that each nontraded good shares less than 10% (or 20%) of total costs or benefits.

1.2.4 Shadow price of land

The shadow price of land (annual rent) is equivalent to the value of rice foregone which should have been harvested at the project site.

1.2.5 Shadow wage rate of unskilled labor

In Viet Nam, the population of farmers is as high as 70% of the whole population, whereas the size of agricultural land is relatively small. The productivity of farmers is low and their annual income is low as well. In this situation, if a farmer can get a job for the project as unskilled labor, the farming job he or she used to do can be easily made up by a remaining farmer or unemployed person. The labor market of unskilled labor can be said to be an uncompetitive market. Under this circumstance, the employer can pay a farmer a wage at least equivalent to the value of product foregone. The shadow wage rate is, therefore, equivalent to the value of product foregone by a farmer. If a farmer is employed by a wage higher than that as is the case in this project, it can be said that there is a distortion in the wage. In economic analysis, the shadow wage rate of unskilled labor will be calculated by eliminating this distortion.

1.3 Taxes

In financial analysis, all taxes are treated as a cost from the standpoint of an individual entity or enterprise and there is no analytical problem. In economic analysis, however, it is concerned with the benefit to the whole society or the whole economy. Taxes are a transfer payment--a part of the net return from the project which is turned over to the government to spend on behalf of the society as a whole. Hence, taxes in economic analysis are not deducted from the income stream as a cost. This applies to all forms of taxes: income taxes, duties on imported items, and any local taxes which may be levied.

2. Study flow for economic analysis

The study flow for the economic analysis is illustrated in Figure 1-1.

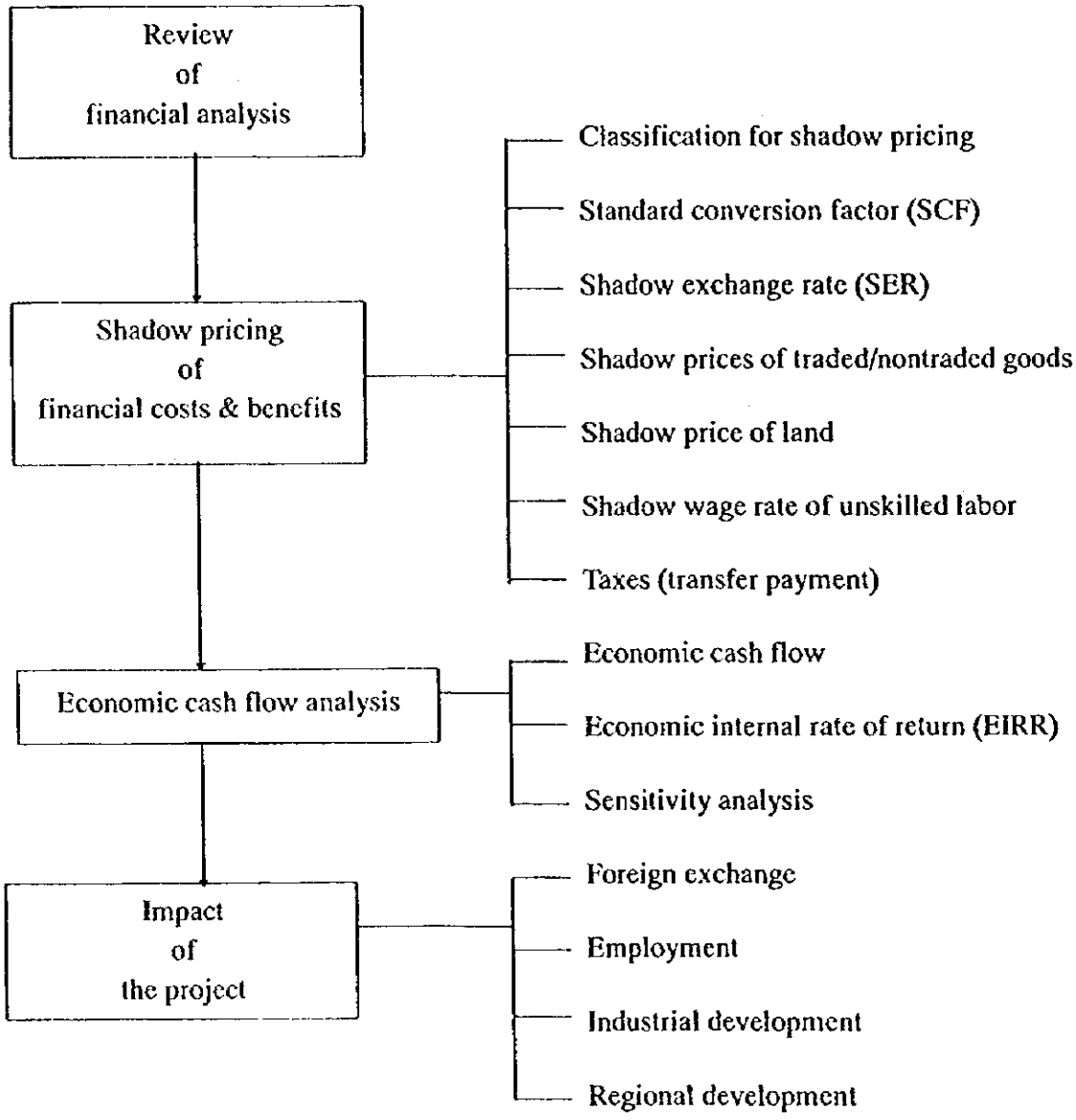


Figure 1-1 Study flow for economic analysis

Firstly, the financial analysis described in Part 10 is reviewed from the viewpoint of economic analysis.

Secondly, shadow pricing of the financial costs and benefits is carried out by the following procedures:

1) Classification of shadow pricing
2) Calculation of standard conversion factor (SCF)
3) Calculation of shadow exchange rate (SER)
4) Calculation of shadow prices of traded and nontraded goods
5) Calculation of shadow price of land
6) Calculation of shadow wage rate of unskilled labor
7) Identification of taxes applied to the project

Thirdly, economic cash flow analysis is undertaken to compute the economic internal rate of return (EIRR) by a DCF method. Sensitivity analysis is also made in this phase.

Finally, the impact of the project is assessed on:

- foreign exchange
- employment
- industrial development, and
- regional development.

3. Shadow pricing of financial cost & benefit

3.1 Classification for shadow pricing

3.1.1 Construction costs

Table 1-1 summarizes the classification of shadow pricing for construction costs.

Table 1-1 Classification of shadow pricing for construction costs

	Shadow pricing
1) Material and equipment	
a) Imported	No
b) Domestic (in VND)	Adjustment by SER
2) Labor	
a) Skilled labor (in US$)	No
b) Unskilled labor	Yes
3) Supervision	No
4) Engineering	No
5) Pre-operation cost	No
6) Initial inventory	
a) Imported	No
b) Domestic (in VND)	Adjustment by SER
7) Land (in VND)	Yes
8) Import duties	Transfer item
9) Interest during construction	Transfer item

3.1.2 Product prices and operation costs

Table 1-2 summarizes the classification of shadow pricing for product prices and operation costs.

Table 1-2 Classification of shadow pricing for product prices and operation costs

	Shadow pricing
1) Product (in US$)	No
2) Raw material	
a) Imported	No
b) Domestic (in VND)	Adjustment by SER
3) Labor	
a) Skilled labor (in US$)	No
b) Unskilled labor (in VND)	Yes
4) Depreciation & amortization	Transfer item
5) Taxes & import duties	Transfer item
6) Interest payment	Transfer item
7) Land (rent in VND)	Yes
8) Other costs (in US$)	No

3.2 Standard conversion factor (SCF)

As described in 1.2.1, the standard conversion factor (SCF) is calculated by the following formula:

$$SCF = \frac{M + X}{(M + T_m) + (X - T_x + S_x)} \quad \cdots\cdots (2.1)$$

where:
M = total import
X = total export
T_m = total import tax
T_x = total export tax
S_x = total export subsidy

SCF in Viet Nam is calculated using the corresponding data (1992-95 averages) of trade statistics as shown in Table 1-3.

$$SCF = \frac{4,947.3 + 3,705.0}{(4,947.3 + 621.0) + (3,705.0 - 64.2 + 0)} = 0.940$$

Table 1-3 Trade statistics in Viet Nam

(Unit: US$ million)

	1992	1993	1994	1995	1996	Av.(1992-95)
Total import (M)	2,540	3,924	5,825	7,500	n.a.	4,947.3
Total export (X)	2,581	2,985	4,054	5,200	n.a.	3,705.0
Total import tax (T_m)	198.0	572.5	767.8	945.5	128.5	621.0
Total export tax (T_x)	22.0	63.6	76.8	94.5	128	64.2
Total export subsidy (S_x)*	n.a.	n.a.	n.a.	n.a.	n.a.	-

*: Practically, no export subsidy has been applied in Viet Nam.
Source: data from VSC

The rates of import tax (T_m/M) and export tax (T_x/X) are 12.6% and 1.7% on average during 1992 and 1995, respectively. After the year 2006 when the existing trade barriers have to be basically taken away from Viet Nam in accordance with the AFTA agreement, the import tax will be reduced to 5% or less for the goods traded within ASEAN countries. It is, therefore, considered that SCF will shift closer to a value of one after the year 2006. The AFTA agreement does not refer to the trade with non-ASEAN countries, leaving the possibility that the import tax of 5% or more will be still applied to the trade with them. Therefore, it is safe to assume that the average import tax will be 5% and the export tax will be as it is after the year 2006 for the SCF calculation. SCF after the year 2006 is then calculated assuming that the ratio of import to export does not change as follows:

$M/X = 4,947.3 / 3,705 = 1.34$
$M = 1.34X$

$$SCF = \frac{1.34X + X}{1.34X + (1.34X \times 0.05) + (X - 0.017X)} = 0.980$$

$\therefore$ SCF = 0.940 before the year 2005
= 0.980 after the year 2006

3.3 Shadow exchange rate (SER)

The shadow exchange rate (SER) is calculated by the following formula:

SER = OER÷SCF
, where OER: official exchange rate (VND11,700/US$)

SER = VND12,447/US$ (before the year 2005)
= VND 11,939/US$ (after the year 2006)

3.4 Shadow price of traded and nontraded goods

All prices of traded and nontraded goods in VND are adjusted only by SER, because the value of each material or good comprises only a minor share of the total amount.

3.5 Shadow price of land

The shadow price of land is calculated based on the estimated value of crop (rice) lost by the execution of the project.

3.5.1 Assumption

The following assumption which was given by the interview survey is used for the calculation:

- Land requirement for the project: 440ha
- Agricultural land: 90% of the land requirement = 396ha
- Rice yield: 1t/ha/y
- Selling price of rice: VND 1,500,000/t

3.5.2 Shadow price of land

The shadow price of land is equivalent to the value of rice lost by the project as follows:

Shadow price of land = 396ha×1t/ha/y×VND1,500,000/t
= VND594,000,000/y
= VND594,000,000/y÷SER
= US$47,722/y (before the year 2005)
= US$49,753/y (after the year 2006)

3.6. Shadow wage rate of unskilled labor

The shadow wage rate of unskilled labor is calculated based on the current income from agriculture and relief work for the unemployed.

3.6.1 Assumption

The following assumption which was given by the interview survey is used for

the calculation:

- Families living in the project area: 330 families
- Workers in a family: 2 persons/family
- Yearly working days for agriculture: 105 days/y (including working days with 2-3 hours/d)
- Sideline: 15% of the income from rice
- Yearly working days for relief work for the unemployed:
  30% of available working days = 0.3×(365 – 105 – 365/7) d/y
  = 62 d/y
- Wage for the relief work: VND10,000/d

3.6.2 Shadow wage rate

Shadow wage rate of unskilled worker is then given by the following calculation:

1) Income from rice harvesting
   Rice harvest = 396ha×1t/ha/y
   = 396t/y
   Income from rice = 396t/y×VND1,500,000/t÷(330 families×
   2 persons/family) = VND900,000/person
2) Sideline
   Sideline = VND900,000/person×0.15
   = VND135,000
3) Relief work for the unemployed
   Annual wage = VND10,000/d×62d/y
   = VND620,000/y
4) Total income
   Total yearly income = VND900,000 + VND135,000 + VND620,000
   = VND1,655,000
   = VND1,655,000÷SER
   = US$133 (before the year 2005)
   = US$139 (after the year 2006)

4. Economic cash flow analysis

4.1 Economic cash flow

Table 1-4 shows the economic cash flow for the Base case.

Table 1-4 Cash Flow (EIRR)

			2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Calendar Year			-9	-8	-7	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6
Project Year																	
CASH FLOW for IRROI(Before Tax)			-29,156	-121,864	-233,929	-473,205	-354,603	-312,996	-556,599	-1,254,073	-603,262	99,300	165,174	-133,780	236,135	685,836	755,207
7.57%																	
Initial Investment			28,064	116,208	219,512	441,067	309,186	352,678	663,972	1,382,926	741,142	178,505	302,322	655,684	326,460	10,119	0
Number of unskilled worker			180	747	1,411	2,834	1,987	2,266	4,267	8,886	4,762	1,147	1,943	4,213	2,098	65	0
Un-skilled Labor of Investment			3,895	9,981	18,699	29,299	28,597	36,138	64,581	131,978	74,690	5,327	8,341	20,852	8,341	0	0
A <Conversion - SWR>	1200US$ / 139US$		451	1,156	2,166	3,394	3,313	4,186	7,481	15,287	8,652	617	966	2,415	966	0	0
Domestic goods			2,078	9,004	27,705	28,743	50,424	62,245	86,186	119,706	124,489	26,897	53,793	134,483	53,793	0	0
B Domestic goods total	0.940-0.980		125	540	1,662	1,725	3,025	1,245	1,724	2,394	2,490	538	1,076	2,690	1,076	0	0
Labor Cost								2,903	2,903	2,903	2,903	9,486	9,486	9,486	9,486	9,486	9,486
Un-skilled Labor								424	424	424	424	1,427	1,427	1,427	1,427	1,834	1,834
C <Conversion>	1200US$/139US$							49	49	49	49	165	165	165	165	212	212
Sales			0	0	0	0	0	460,569	598,740	690,853	693,793	1,269,395	1,429,268	1,512,210	1,512,210	1,603,181	1,633,505
Without duty			0	0	0	0	0	438,637	570,228	657,956	660,755	1,208,948	1,361,207	1,440,200	1,440,200	1,526,839	1,555,719
D <Conversion>			0	0	0	0	0	-21,932	-28,511	-32,898	-33,038	-60,447	-68,060	-72,010	-72,010	-76,342	-77,786
E Land rent	5730/49753US$		-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44
Coal (Hongai)												4,059	4,510	4,510	4,510	8,309	8,732
F Domestic goods total	0.940-0.980		0	0	0	0	0	0	0	0	0	81	90	90	90	166	175
A-G			532	1,652	3,784	5,074	6,294	-16,496	-19,302	-15,211	-21,891	-59,090	-65,807	-66,694	-69,757	-76,007	-77,443
Cash Flow for EIRR			-28,624	-120,212	-230,144	-468,131	-348,309	-329,492	-575,901	-1,269,284	-625,154	40,210	99,367	-200,473	166,379	609,828	677,764
6.08%																	

Table 1-4 Cash Flow (EIRR) (continued)

		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Calendar Year															
Project Year		7	8	9	10	11	12	13	14	15	16	17	18	19	20
CASH FLOW for IRROI(Before Tax)		838,720	747,225	711,150	690,140	671,166	653,707	637,456	622,159	189,386	666,184	584,757	571,269	139,947	848,995
	7.57%														
Initial Investment		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of unskilled worker		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Un-skilled Labor of Investment		0	0	0	0	0	0	0	0	0	0	0	0	0	0
A <Conversion - SWR>		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic goods		0	0	0	0	0	0	0	0	0	0	0	0	0	0
B Domestic goods total		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Labor Cost		11,003	11,003	11,003	11,003	11,003	11,003	11,003	11,003	11,003	11,003	11,003	11,003	11,003	11,003
Un-skilled Labor		1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834
C <Conversion>		212	212	212	212	212	212	212	212	212	212	212	212	212	212
Sales		1,663,829	1,663,829	1,663,829	1,663,829	1,663,829	1,663,829	1,663,829	1,663,829	1,247,871	1,663,829	1,663,829	1,663,829	1,247,871	1,663,829
Without duty		1,584,599	1,584,599	1,584,599	1,584,599	1,584,599	1,584,599	1,584,599	1,584,599	1,188,449	1,584,599	1,584,599	1,584,599	1,188,449	1,584,599
D <Conversion>		-79,230	-79,230	-79,230	-79,230	-79,230	-79,230	-79,230	-79,230	-59,422	-79,230	-79,230	-79,230	-59,422	-79,230
E Land rent		-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44	-44
Coal (Hongai)		8,732	8,732	8,732	8,732	8,732	8,732	8,732	8,732	8,732	8,732	8,732	8,732	8,732	8,732
F Domestic goods total		175	175	175	175	175	175	175	175	175	175	175	175	175	175
A-G		-78,887	-78,887	-78,887	-78,887	-78,887	-78,887	-78,887	-78,887	-59,079	-78,887	-78,887	-78,887	-59,079	-78,887
Cash Flow for EIRR		759,833	668,338	632,263	611,253	592,280	574,820	558,569	543,272	130,306	587,297	505,870	492,282	80,868	770,108
	6.08%														

4.2 Economic internal rate of return (EIRR)

Economic internal rate of return (EIRR) is 6.08% for the Base case. It is slightly lower than FIRR (financial IRR), mainly because of the shadow sales price of products which is lower than the sales price of products in the financial analysis.

4.3 Sensitivity analysis

Table 1-5 summarizes the EIRR by sensitivity analysis.

Table 1-5 EIRR by sensitivity analysis

(Unit: %)

	-10 %	Base case	+10 %
Variable cost	7.83 %	6.08 %	4.24 %
Fixed cost	6.37 %	6.08 %	5.79 %
Total investment	7.23 %	6.08 %	5.07 %
Slab import price	6.39 %	6.08 %	5.79 %

5. Impacts of the project

The project should be evaluated by taking other impacts into account. The major impacts of the project will involve the following:

- Savings of foreign exchange
- Improvement of unemployment situation
- Promotion of industrial development
- Promotion of regional development

5.1 Savings of foreign exchange

The project will greatly contribute to the savings of foreign exchange. The following preconditions are used for calculating the foreign exchange savings:

- Products from the project can substitute for products otherwise imported.
- Interest payments for borrowing foreign exchange is not considered for the calculation.

Table 1-6 summarizes the savings of foreign exchange. The net savings of foreign exchange will be totaled at US$14.4 billion for the whole project period.

5.2 Improvement of unemployment situation

An integrated steelworks will greatly contribute to the employment in the region not only in the construction phase but also in the operational phase. During the construction phase, the project will provide as many as 10,000 man-years of construction work for a peak period of the construction. Table 1-7 summarizes the estimated job creation for the plant operation.

Table 1-6 Saving of foreign exchange

	Total	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016-28
Spending of foreign exchange																	
Initial investment	4,028,788	0	67,742	135,485	338,712	135,485	223,720	447,439	1,118,598	447,439	111,417	222,833	557,083	222,833	0	0	0
Spare parts/ reinvestment	496,936	7,112	9,679	12,688	20,540	55,656	36,642	38,588	62,468	113,472	35,505	17,822	28,851	47,794	10,119	0	0
Purchase of Raw material	10,834,131	0	0	0	0	0	296,955	386,042	445,433	445,433	587,653	449,200	485,662	485,662	542,351	509,641	6,200,101
Total spending	15,352,743		77,422	148,173	359,252	191,141	557,316	872,069	1,626,499	1,006,344	734,574	689,855	1,071,596	756,289	552,470	509,641	6,200,101
																	0
Saving of foreign exchange																	
Sales of products (CIF)	29,723,493	0	0	0	0	0	438,814	570,458	658,221	661,021	1,115,125	1,237,539	1,287,102	1,287,102	1,451,352	1,506,102	19,510,655
Net saving of foreign exchange	14,370,750	0	-77,422	-148,173	-359,252	-191,141	-118,503	-301,611	-968,278	-345,323	380,551	547,684	215,506	530,814	898,883	996,462	13,310,555

Table 1-7 Estimated job creation for the plant operation

	Step*				Job creation (Man-year)
	0	1	2	3	
2002	(Preparation)				
2003	Start	(Preparation)			
2004	|	Start			
2005	End	|			
2006		End	(Preparation)		2,056
2007			Start		2,056
2008			|		2,056
2009			End	(Preparation)	2,056
2010				Start	5,436
2011				|	5,436
2012				|	5,436
2013				|	5,436
2014				End	5,436
onward					6,515

* Step 0: Land preparation and berth construction
Step 1: Hot and cold rolling plants
Step 2: BF x 1 unit + BOF x 2 units
Step 3: BF x 1 unit + BOF x 1 unit

When all the plant construction is completed in 2014, it will create an opportunity of new employment for about 6,500 people for the plant operation and about 15,000 people including employment for the supporting industry. A new community will be built around the steelworks, consisting of about 50 to 60 thousand people which will include their families.

5.3 Promotion of industrial development

It is necessary for establishment of the steel industry to develop the supporting industry. It involves industrial sectors of machine manufacturing, machining, refractory manufacturing, etc. Contractors and subcontractors for undertaking plant maintenance and expansion works are also considered to be grouped in the supporting industry. Without such a supporting industry, smooth operation of the integrated steelworks seems difficult.

Most of the supporting industry will become more capable through the introduction of foreign technologies and/or training by foreign companies and are located around the integrated steelworks.

On the other hand, a transportation industry will be developed for conveying a big volume of raw materials and final products of the integrated steelworks and a shipbuilding industry will take place along with its development. It is also expected that heavy industries as well as a metal manufacturing industry will mature by using quality steel products from the integrated steelworks.

5.4. Promotion of regional development

A lot of people will work in the integrated steelworks. A new community will be necessary for not only the workers but also their families. Services for drinking water supply and sewage treatment will be well established and available for the community, where such facilities as schools, hospitals, parks and a public hall will be also constructed.

In addition, wide roads and networks for electricity supply and communication will be well constructed in connection with the project, which will benefit the community as well.

The construction of the integrated steelworks will, therefore, greatly contribute to the promotion of regional development.

Part 12 Environmental Protection

Section 1 Environmental Protection

Contents

1. Environmental control measures of new steel plant

1.1 Production process and output

1) The new steel plant is to be constructed in three stages and the environmental load of the steelworks is the greatest in Step 3 when all facilities are constructed.
2) herefore, the environmental control measures and environmental load of the new steel plant are examined in the case of Step 3.
3) The production process and production balance in Step 3 are shown in Figure 1-1.

1.2 Environmental control measures

1.2.1 Concept of environmental control measures

1) Environmental control measures that meet Viet Nam's regulatory standards are taken. However, when Japan's regulatory standards are more strict than those of Viet Nam, measures that meet the former are taken.
2) The application of technologies for environmental control measures is examined on the basis of the measures taken in the present Japanese steel industry.
3) For the environmental control measures and energy-saving measures considered necessary in the future, a layout that can be possible as the future concept is considered.

1.2.2 Environmental control measures

The environmental control measures related to air and water quality in the principal processes are shown in Table 1-1.

(1) Fuels

1) By-product gases generated (BOG, BFG and LDG) are recovered and used in the combustion equipment within the steel plant.
2) By-product gases and heavy oil are used as the fuels for the power plant. As SOx control measures, however, the heavy oil to be used is heavy oil A (sulfur content = about 0.7%) as low-sulfur heavy oil.

(2) Exhaust gases

- Exhaust gases of heavy environmental load from the steelworks are SOx, NOx, soot and dust.
- In equipment with large SOx and NOx emission, high stacks are installed to conduct atmospheric diffusion.

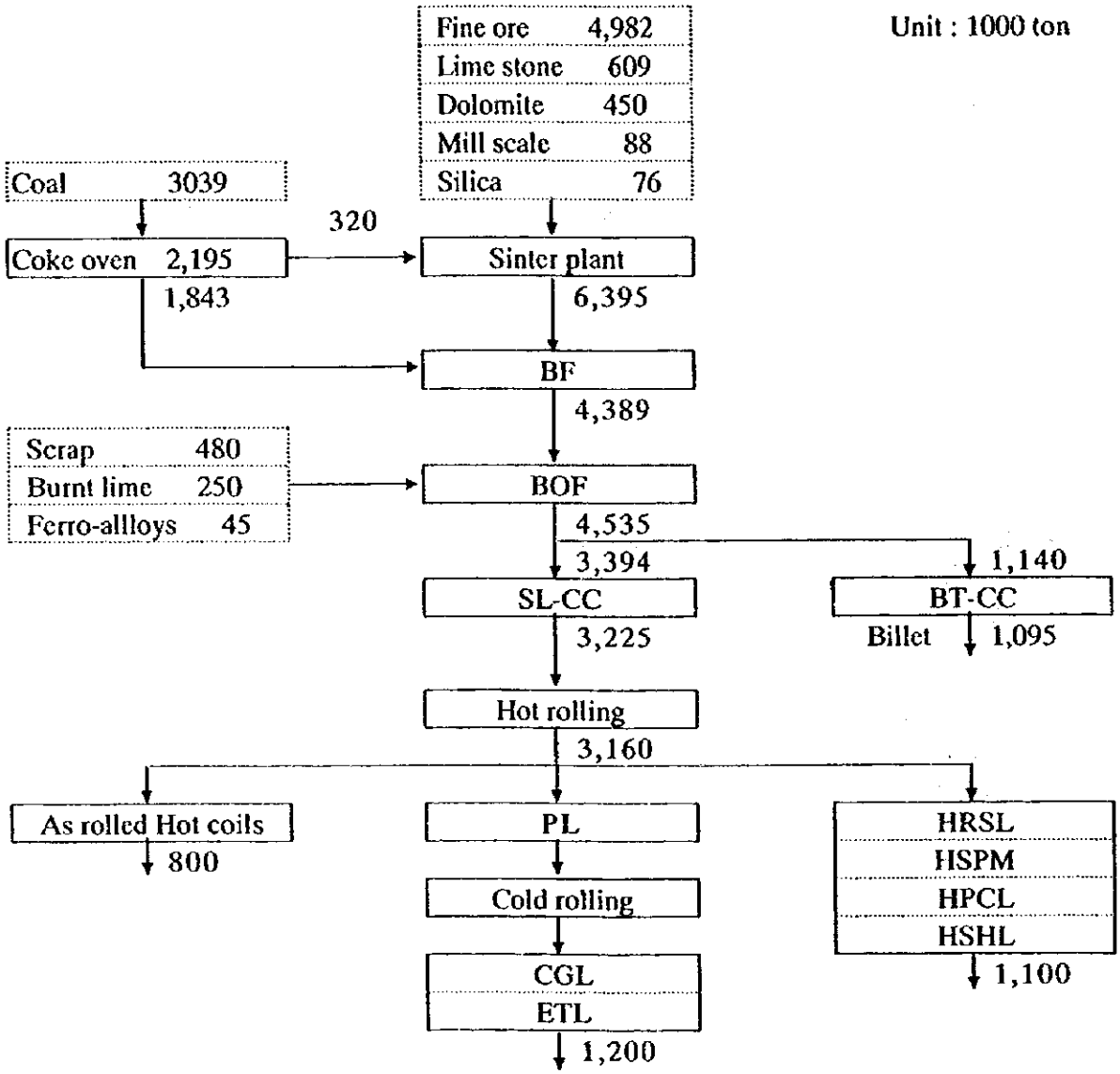


Figure 1-1 Material balance

Table 1-1 Environmental control measures

Process & measure	Adoptability	Future provision	Remarks
1. Raw materials yard			
(1).Iron ore and coking coal water spraying	Yes		
(2).Yard spraying	Yes		
2. Sintering machine			
(1).Main exhaust gas desulfurization	Yes		
(2).Main exhaust gas denitration		Future plan	Space provided
3. Coke oven			
(1).Activated sludge process for ammonia water	Yes		
(2).Waste water chemical clarification	Yes		
(3).Coke oven gas desulfurizing	Yes		
(4).Smokeless charging, charging car dust collection, etc	Yes		
(5).Coke oven door seal	Yes		
4. Blast furnace			
(1).Granulated slag equipment		Future plan	Space provided
(2).Waste water chemical clarification	Yes		
(3).Water recycling system	Yes		
5. Steelmaking			
(1).Roof evacuation		Future plan	Space provided
(2).Water recycling system	Yes		
6. Hot rolling			
(1).Reheating furnace low-Nox combustion control	Yes		
(2).Oily waste effluent treatment	Yes		
8. Cold rolling & Galvanizing			
(1).CAPL low-Nox combustion control		At time of CAPL installation	
(2).Oily waste effluent treatment	Yes		
(3).Closed system of electrolyte etc. in electrogalvanizing line	Yes		

Process & measure	Adoptability	Future provision	Remarks
(4).Weak acid effluent treatment	Yes		
(5).Closed system for weak acid effluent	Need study		
(6).Recovery of magnetic materials from strong acid effluent		Future plan	Space provided
9. Power plant			
(1).Low-sulfur fuels (heavy oil)	Yes		
(2).Boiler low-Nox combustion control	Yes		
10.Others (standard installation)			
(1).Dust collection at screens and belt-conveyor transfers	Yes		
(2).Sedimentation of scale in waste water	Yes		
(3).BFG dust collection	Yes		
(4).Thickener treatment of BF and LD waste water	Yes		

1) SOx control measures
   - SOx is generated due to the combustion of the sulfur contained in raw materials and fuels. The amount of SOx emission from sintering machines is especially large. Therefore, the amount of SOx emission is controlled by installing exhaust gas desulfurizing equipment in the exhaust gas system equipment of sintering machines.
   - COG is desulfurized for SOx control measures and used as combustion gas.

2) NOx control measures
   - Low-NOx burners are adopted as the burners in combustion equipment such as reheating furnaces in order to reduce NOx.
   - Two-stage combustion burners, exhaust gas recalculating burners, etc. are adopted as low-NOx burners

3) Particulates, soot and dust
   - The principal sources of generation of particulates, soot and dust are the handling and transportation processes of ore and coal, ironmaking processes such as raw material yards, sintering machines, coke ovens and blast furnaces, and steelmaking processes such as converters (especially during tapping).
     The ironmaking and steelmaking processes account for the greater part of the generation of particulates, soot and dust.
   - Measures, such as water sprinkling and installation of dust-proof covers, are taken as the measures to control the dust and particulates from the handling and transportation processes of ore and coal and material yards.
     For the soot and dust generated from each facility, measures are taken by installing various kinds of dust collector.

(3) Effluents

1) The suspended particles contained in the effluents of wet type dust collectors installed in each process, effluents of BFG rinse water, and effluents of continuous casting machines and continuous hot rolling mills are treated by thickeners, the coagulation and sedimentation process, etc.
2) Oil is contained in coke-oven gas liquid (ammonia liquor), effluents of continuous hot rolling mills and cold rolling mills, etc. and treated by the pressure floatation process.
3) Cyanogen, phenol, etc. are contained in the coke-oven gas liquid (ammonia liquor) and are treated by the activated sludge process, coagulation and sedimentation process, dilution of effluents, etc.
4) Hydrochloric acid is contained in the effluents of pickling rinse water and chromic acid is contained in the plating effluents.
   These substances are treated by neutralization, etc.

(4) Noise
Principal sources of noise are blast-furnace septum valves (valves for raising the pressure of hot-stove gas), main blowers of sintering machines, large-size dust-collection blowers, fans, etc. General noise control measures are taken.

(5) Planting
Along the boundaries of site except the hill zone in the north part of the steel plant and in the grounds of the steel plant, trees suitable for this district are planted.

2. Regulatory standard

2.1 Air

1) Table 1-2 gives an overview of the emission control of Viet Nam's VIETNAM STANDARD (TCVN5940-1995) related to the prevention of air pollution and Japan's Air Pollution Control Law.
2) In the regulation of Viet Nam's VIETNAM STANDARD, the regulatory standard for exhaust gas from factories is Level B.
In Viet Nam's regulation, the same emission control is applied to all facilities.
3) In Japan's regulation, the same emission control is not applied to all facilities.
The contents of the regulation are as follows, especially for the following three items:
   - The K-value control is adopted for SOx and this is the regulation of total emission.
   - For NOx, regulatory standards for emission are specified according to facilities and exhaust gas volumes.
   - For soot and dust, regulatory standards for emission are specified according to exhaust gas volumes.

2.2 Water quality

1) Table 1-3 gives an overview of the effluent control of Viet Nam's VIETNAM STANDARD (TCVN5945-1995) related to the prevention of air pollution and Japan's Water Pollution Control Law.
2) In the regulation of Viet Nam's VIETNAM STANDARD, the regulatory standard for waste water from factories is Level B.
In Viet Nam's regulation, the same effluent control is applied to all facilities.

Table 1-2 Emission standard

No	Parameter	Unit	Viet Nam		Japan
			A	B	
1	Particulate in smoke of:				*1
	·heating of metals	mg/m^3	400	200	
	·asphalt concrete plant	mg/m^3	500	200	
	·cement plant	mg/m^3	400	100	
	·other sources	mg/m^3	600	400	
2	Dust:				
	·containing silica	mg/m^3	100	50	
	·containing asbestos	mg/m^3	none	none	
3	Antimony	mg/m^3	40	25	
4	Arsenic	mg/m^3	30	10	
5	Cadmium	mg/m^3	20	1	1
6	Lead	mg/m^3	30	10	10, 20, 30
7	Copper	mg/m^3	150	20	
8	Zinc	mg/m^3	150	30	
9	Chloride	mg/m^3	250	20	20
10	HCl	mg/m^3	500	200	80, 700
11	Fluoride, HF(any source)	mg/m^3	100	10	1, 10, 15, 20
12	H2S	mg/m^3	6	2	
13	CO	mg/m^3	1,500	500	
14	SO2	mg/m^3	1,500	500	*2
15	NOx(any source)	mg/m^3	2,500	1,000	*3
16	NOx(acid manufacturing)	mg/m^3	4,000	35	
17	H2SO4(any source)	mg/m^3	300	70	
18	HNO3	mg/m^3	2,000	70	
19	Ammonia	mg/m^3	300	100	

VIET NAM : VIET NAM STANDARD (TCVN5940-1995)
APAN : Air Pollution Control Law
*1 : Soot and dust dischage volume regulates by gas emission volume and the facility
*2 : SOx K-value regulation
*3 : NOx dischage volume regulates by gas emission volume and the facility

Table 1-3 Effluent standard

No	Parameters and substances	Unit	Viet Nam			Japan	
			A	B	C	Max	Mean
1	Temperature	℃	40	40	45		
2	pH value	—	6～9	5.5～9	5～9	5～9	
3	BOD5 (20℃)	mg/l	20	50	100	160	120
4	COD	mg/l	50	100	400	160	120
5	Suspended solids	mg/l	50	100	200	200	150
6	Arsenic	mg/l	0.05	0.1	0.5	0.1	
7	Cadmium	mg/l	0.01	0.02	0.5	0.1	
8	Lead	mg/l	0.1	0.5	1	0.1	
9	Residual Chlorine	mg/l	1	2	2		
10	Chromium (Ⅵ)	mg/l	0.05	0.1	0.5	0.5	
11	Chromium (Ⅲ)	mg/l	0.2	1	2	2	
12	Mineral oil and fat	mg/l	Not	1	5	5	
13	Animal-vegetable fat and oil	mg/l	5	10	30	30	
14	Copper	mg/l	0.2	1	5	3	
15	Zinc	mg/l	1	2	5	5	
16	Manganese	mg/l	0.2	1	5	10	
17	Nickel	mg/l	0.2	1	2		
18	Organic phosphorous	mg/l	0.2	0.5	1	1	
19	Total phosphorous	mg/l	4	6	8	16	8
20	Iron	mg/l	1	5	10	10	
21	Tetrachlorethylene	mg/l	0.02	0.1	0.1	0.1	
22	Tin	mg/l	0.2	1	5		
23	Mercury	mg/l	0.005	0.005	0.01	0.005	
24	Total nitrogen	mg/l	30	60	60	120	60
25	Trichlorethylene	mg/l	0.05	0.3	0.3	0.3	
26	Ammonia (as N)	mg/l	0.1	1	10		
27	Fluoride	mg/l	1	2	5	15	
28	Phenol	mg/l	0.001	0.05	1	5	
29	Sulfide	mg/l	0.2	0.5	1		
30	Cyanide	mg/l	0.05	0.1	0.2	1	
31	Coliform	MPN/ml	50	100	—	3,000	
32	Gross α activity	Bg/l	0.1	0.1	—		
33	Gross β activity	Bg/l	1.0	1.0	—		
34	Alkylmercury	mg/l				Not	
35	Polychlorinated biphenyl	mg/l				0.003	

No	Parameters and substances	Unit	Viet Nam			Japan	
			A	B	C	Max	Mean
36	Dichloromethane	mg/l				0.2	
37	Carbon tetrachloride	mg/l				0.02	
38	1,2-Dichloroethane	mg/l				0.04	
39	1,1-Dichloroethylene	mg/l				0.2	
40	Sys1,2-Dichloroethlene	mg/l				0.4	
41	1,1,1-Trichloroethane	mg/l				3	
42	1,1,2-Trichloroethane	mg/l				0.06	
43	1,3-Dichloropropene	mg/l				0.02	
44	Tetramethylthiuram disulfide	mg/l				0.06	
45	2-chloro-4,6-bis(ethylamino) -1,3,5-triazine	mg/l				0.03	
46	S-4-chlorobenzyl diethythiocarbamate	mg/l				0.2	
47	Benzene	mg/l				0.1	
48	Selenium	mg/l				0.1	

VIET NAM : VIET NAM STANDARD TCVN5945-1995
JAPAN : Water Pollution Control Law

3. Energy-saving measures of new steelworks

3.1 Concept of energy-saving measures

1) O_2 control of combustion exhaust gas necessary for ordinary combustion control, waste heat recovery of hot stoves equipped with standard facilities, installation of recuperators in reheating furnaces, etc. are conducted as general energy-saving measures. Furthermore, the control of rotation number of OG necessary for operation, hot charge rolling in the reheating furnaces of hot strip mill, etc. are also conducted.
2) Large-size energy-saving facilities, such as sensible heat recovery from sinter main exhaust gas and CDQ of coke ovens, are not installed in the initial stage of the new steel plant. These facilities are to be installed after the economical efficiency is evaluated in terms of energy-saving cost and equipment investment after the start of the operation of the steelworks. However, equipment layouts are considered in a manner that these large-size energy-saving facilities can be installed in the future.

3.2 Energy-saving measures

The energy-saving measures in the principal processes are shown in Table 1-4. Table 1-5 shows the energy balance in case where the initial energy-saving measures are taken and a case where large-scale energy-saving measures are taken after the start of operation of the steel plant.

(1) Energy-saving measures taken in the step-3
Principal facilities are hot-stove waste heat recovery, blast-furnace pulverized-coal injection, OG-induced draft fan rotation control, hot-rolling hot charge rolling and hot direct rolling, recuperator (air heating), and boiler waste-heat recovery.

(2) Energy-saving measures taken after the start of operation of the steel plant
Principal facilities are sensible heat recovery from the main exhaust gas of sintering machines, sinter sensible heat recovery, coke dry quenching, BF top-pressure recovery turbines, oxygen-converter gas recovery boiler (OG boiler), and continuous annealing and processing line.

(3) Unit energy consumption
The unit energy consumption in a case where the initial energy-saving measures are taken is $6,072 \times 10^3$ kcal/t-s.
The unit energy consumption in a case where large-scale energy-saving measures are taken after the start of operation of the steelworks is $5,787 \times 10^3$ kcal/t-s, which leads to an energy saving of about 5.3%. From an environmental standpoint, it is desirable to carry out the large-scale energy-saving measures early after the start of operation of the steel plant.

Table 1-4 Energy saving measures

Process & measure	Adoptability	Future provision	Remarks
1. Sintering machine			
(1) Main exhaust gas sensible heat recovery		Future plan	Space provided
(2) Sinter sensible heat recovery		Future plan	Space provided
2. Coke oven			
(1) Coke dry quenching		Future plan	Space provided
(2) Advanced coal chain system		Future plan	Space provided
(3) Coke oven gas sensible heat recovery		Future plan	Space provided
(4) Coal moisture control		Future plan	Space provided
3. Blast furnace			
(1) Hot stove waste heat recovery	Yes		
(2) Pulverized-coal injection	Yes		
(3) BF top-pressure recovery turbine		Future plan	Space provided
(4) Dry-type dust collection		Future plan	Space provided
(5) Top pressure equalizing gas recovery		Future plan	Space provided
4. Steelmaking			
(1) Oxygen-converter gas recovery boiler (OG boiler)		Future plan	Space provided
(2) OG-induced draft fan ratation control	Yes		
5. Hot rolling			
(1) Direct hot charge rolling	Yes		
(2) Recuperator(Air heating)	Yes		
6. Cold rolling & Galvanizing			
(1) Continuous annealing and processing line		Future plan	Space provided
7. Industrial owned power generation			
(1) Boiler waste-heat recovery	Yes		

Table 1-5 Energy balance

Process	Fuel		Step-3		Future Plan *1	
		Gas cal ($kcal/Nm^3$)	Unit fuel consumption	Consumption	Unit fuel consumption	Consumption
1.Sintering	COG	4,800	14.4×10^3 kcal/t-sin	10.5×10^6 kcal/h	14.4×10^3 kcal/t-sin	10.5×10^6 kcal/h
2.Coke oven	Mix Gas	1,070	552×10^3 kcal/t-Coal	190.6×10^6 kcal/h	540×10^3 kcal/t-Coal	186.5×10^6 kcal/h
3.Blast furnace (Hot stove)	Mix Gas	970	464×10^3 kcal/t-P	232.5×10^6 kcal/h	464×10^3 kcal/t-P	232.5×10^6 kcal/h
4.Steelmaking	COG	4,800	42.2×10^3 kcal/t-s	21.5×10^6 kcal/h	42.2×10^3 kcal/t-s	21.5×10^6 kcal/h
5.Hot rolling (Reheating furnace)	COG	4,800	200×10^3 kcal/t-s	73.6×10^6 kcal/h	200×10^3 kcal/t-s	73.6×10^6 kcal/h
6.Cold Rolling	COG	4,800	96×10^3 kcal/t-s	12.1×10^6 kcal/h	96×10^3 kcal/t-s	12.1×10^6 kcal/h
7.Continuous galvanizing line	COG	4,800	384×10^3 kcal/t-s	9.2×10^6 kcal/h	384×10^3 kcal/t-s	9.2×10^6 kcal/h
8. Power plant	COG,BFG LDG,Oil	—		687.2×10^6 kcal/h		603.2×10^6 Kcal/h
9.Others	COG	4,800		65.6×10^6 kcal/h		64.9×10^6 kcal/h
Total			$6,072\times10^3$ kcal/t-s		$5,787\times10^3$ kcal/t-s	

*1 Large-scale energy-saving measures incorporated in the future plan
(1) Sensible heat recovery from main exhaust gas (Recovery of steam)
(2) Coke dry quenching (Recovery of electric power)
(3) Coil moisture control (Reduction in the unit calorie consumption)
(4) BF top-pressure recovery turbine + dry-type dust collection (Recovery of electric power)
(5) Oxygen-converter gas recovery boiler (OG boiler) (Recovery of steam)

4. Air

4.1 Emission standards for regulatory substances

1) The emission standards for regulatory substances are shown in Table 1-6.
2) The above emission standards are to be met at the new integrated steel plant.

Table 1-6 Emission standards for regulatory substances

No	Parameter	Unit	Value
1	Particulate in smoke:	mg/m^3	200
2	Dust:	mg/m^3	--
3	Antimony	mg/m^3	25
4	Arsenic	mg/m^3	10
5	Cadmium	mg/m^3	1
6	Lead	mg/m^3	10
7	Copper	mg/m^3	20
8	Zinc	mg/m^3	30
9	Chloride	mg/m^3	20
10	HCl	mg/m^3	200
11	Fluoride, HF	mg/m^3	10
12	H2S	mg/m^3	2
13	CO	mg/m^3	500
14	SO2	mg/m^3	500
15	NOx	mg/m^3	1,000
17	H2SO4	mg/m^3	70
18	HNO3	mg/m^3	70
19	Ammonia	mg/m^3	100

4.2 Emission condition of SOx, NOx, soot and dust

1) Substances of heavy environmental load from the integrated steel plant are SOx, NOx, soot and dust, and the emission concentrations of these substances differ from facility to facility. Their emission condition is shown in Table 1-7.
2) The dimensions of the stacks of principal combustion facilities are shown in Table 1-8.
3) All of the facilities meet the emission standards for SOx, NOx, soot and dust.
4) About 90% of SOx emissions is reduced by installing desulfurizing equipment for the exhaust gas of the sintering plant, which has the

Table 1-7 Emission at new integrated steel plant

Process	Fuel		Consumed fuel		Exhaust gas	SOx	NOx	Soot and dust
		Gas Cal ($Kcal/Nm^3$)		Unit fuel consumption	(Nm^3/h)	(ppm)	(ppm)	(mg/Nm^3)
1.Sintering	COG	4,800	10.5×10^6 Kcal/h	14.4×10^3 Kcal/t-sin	1,383.000	13	≦220～260	≦150
2.Coke oven	Mix Gas	1,070	190.6×10^6 Kcal/h	552×10^3 Kcal/t-Coal	392,900	30	≦170～350	≦150
3.Blast furnace (Hot stove)	Mix Gas	970	232.5×10^6 Kcal/h	464×10^3 Kcal/t-p	493,400	25	≦100	≦ 50
4.Steelmaking	COG	4,800	21.5×10^6 Kcal/h	42.2×10^3 Kcal/t-s	34,100	110	≦100～180	—
5.Hot rolling (Reheating furnace)	COG	4,800	73.6×10^6 Kcal/h	200×10^3 Kcal/t-product	116,300	110	≦100～180	≦100～200
6.Cold rolling	COG	4,800	12.1×10^6 Kcal/h	96×10^3 Kcal/t-product	19,200	110	≦100～180	≦100～200
7.Continuous galvanizing line	COG	4,800	9.2×10^6 Kcal/h	384×10^3 Kcal/t-product	14,300	110	≦100～180	—
8.Power plant	COG,BFG LDG, Oil 1	—	687.2×10^6 Kcal/h		1,271,600	40	≦ 60～150	≦ 50
9.Others	COG	4,800	65.6×10^6 Kcal/h		104,300	110		—
Total				$6,072\times10^3$ Kcal/t-s		120 Nm^3/h	390 Nm^3/h	

largest amount of SOx emission. As a result, the amount of SOx emission from the integrated steel plant can be reduced by about 55%.

Table 1-8 Dimensions of stacks of principal combustion facilities

Process	Stack		
	height	diameter	radix
1. Sintering	150 m	4.5 m	1
2. Coke oven	120 m	3.5 m	4
3. Blast furnace (Hot stove)	80 m	2.0 m	2
4. Hot rolling (Reheating furnace)	80 m	2.0 m	3
5. Power plant	100 m	4.0 m	2

4.3 Effects of SOx and NOx on neighborhood of steel plant

(1) Conditions for Investigation

1) The combustion exhaust gas from the steel plant is diffused in the air through high stacks. An investigation is made as to what kind of effect the SOx and NOx in the combustion exhaust gas have on the neighborhood of the steel plant.
2) In conducting this examination, the diffusion simulation of the SOx and NOx emitted from the steel plant was carried out.
3) For the wind directions in Muiron, there are two seasonal winds: east-north winds and west-south winds. An examination was made into the case of east-north winds that affect land and in a windless case.
4) For lack of long-period meteorological data, the short-time average diffusion concentration is used for the diffusion simulation and the atmospheric stability is assumed to be "neutral".

(2) Effect of SOx

1) Figure 1-2 and Figure 1-3 show the ground concentrations of SOx emitted from the steel plant in the surrounding district in a windless case and in a case where the wind velocity is 4 m/s, respectively. The relationship between wind velocity and maximum ground concentration of SOx (Cmax) is shown in Table 1-9.
2) In the windless case, the maximum ground concentration Cmax is 0.0017 ppm within the steel plant.
3) The maximum ground concentration Cmax is highest at a wind velocity of 4 m/s and is 0.00353 ppm at a point 11,700 m distant from the boundary of steel mill (distance of maximum ground concentration = Dcmax).

4) In Japan's environmental quality standard for SOx, the daily average value of hourly values is 0.04 ppm and less and the hourly value is 0.1 ppm and less.
In consideration of this environmental quality standard, it might be thought that there is no problem in the effect of SOx emissions from the steel mill.

Table 1-9 Wind velocity and maximum ground concentration

Wind velocity	0 m/s	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s
Cmax (ppm)	0.0017	0.00348	0.00353	0.00352	0.00346	0.00337
Dcmax (m)	–	13,100	11,700	11,300	10,600	9,900

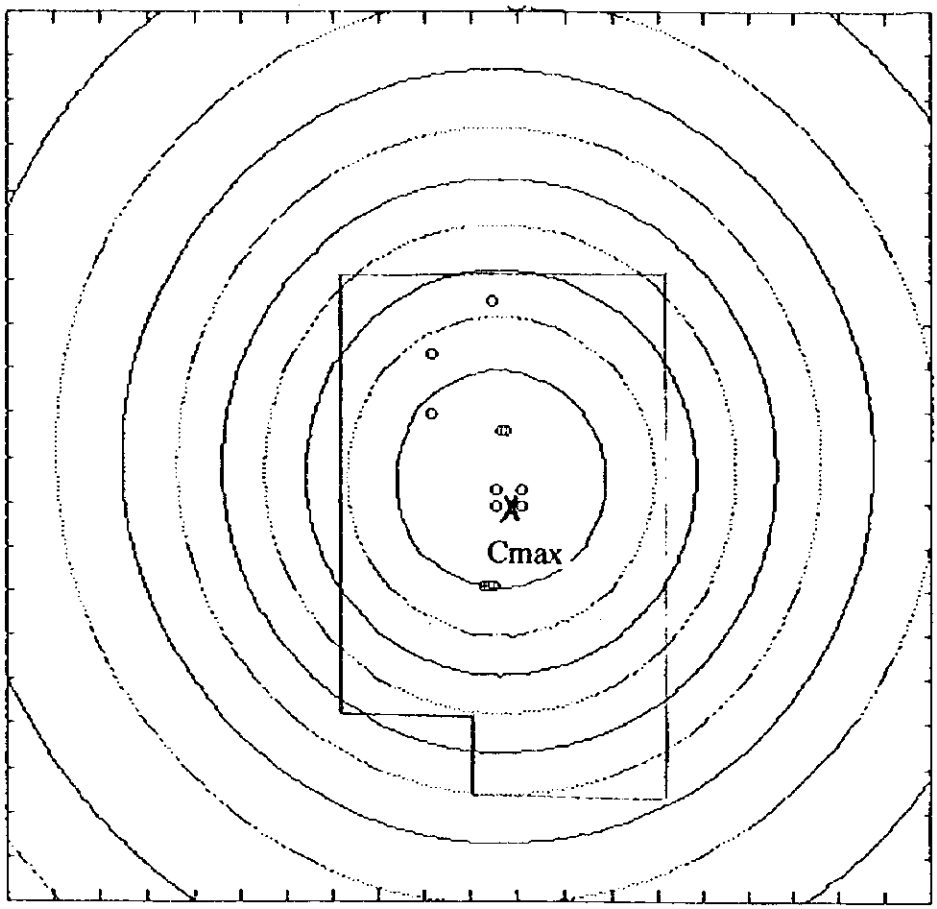
(3) Effect of NOx

1) Figure 1-4 and Figure 1-5 show the ground concentrations of NOx emitted from the steel plant in the surrounding district in a windless case and in a case where the wind velocity is 7 m/s, respectively. The relationship between wind velocity and maximum ground concentration of NOx (Cmax) is shown in Table 1-10.
2) In the windless case, the maximum ground concentration Cmax is 0.0028 ppm within the steel plant.
3) The maximum ground concentration Cmax is highest at a wind velocity of 5 m/s and is 0.00653 ppm at a point 15,600 m distant from the boundary of steel mill (distance of maximum ground concentration = Dcmax).
4) As environmental standard for NOx in Japan, the daily average value of hourly values is 0.04～0.06 ppm and less, it might be thought that there is no problem in the effect of NOx emissions from the steel mill.

Table 1-10 Wind velocity and maximum ground concentration

Wind velocity	0 m/s	2 m/s	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s
Cmax (ppm)	0.0028	0.00552	0.00623	0.00647	0.00653	0.00650	0.00641
Dcmax (m)	–	22,600	19,800	17,000	15,600	14,100	12,700

Wind velocity : windless



Distance : 5,000m all sides

Concentration ratio to Cmax (0.0017ppm)

9.00E-01	8.00E-01
7.00E-01	6.00E-01
5.00E-01	4.00E-01
3.00E-01	2.00E-01
1.00E-01	5.00E-02

Figure 1-2 Ground level concentration distribution of SOx

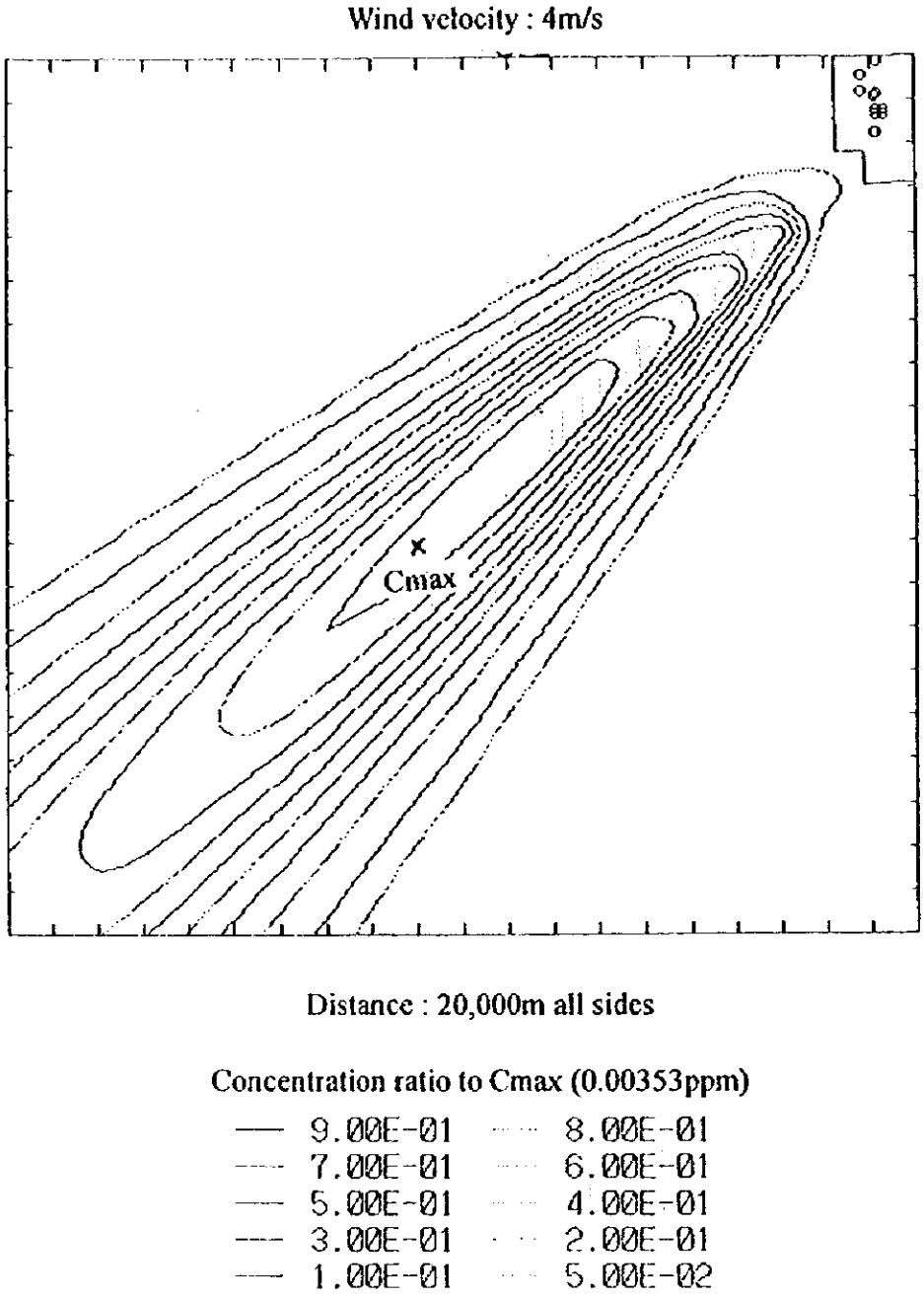
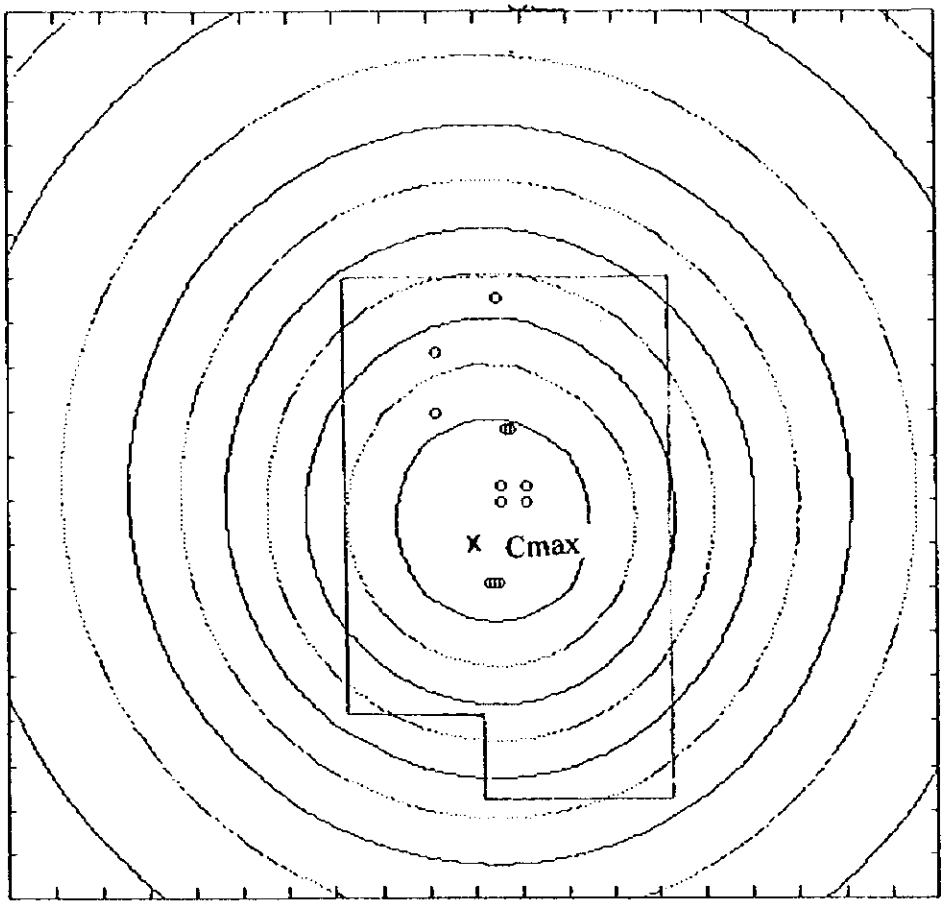


Figure 1-3 Ground level concentration distribution of SOx

Wind velocity : windless



Distance : 5,000m all sides

Concentration ratio to Cmax (0.0028ppm)

9.00E-01	8.00E-01
7.00E-01	6.00E-01
5.00E-01	4.00E-01
3.00E-01	2.00E-01
1.00E-01	5.00E-02

Figure 1-4 Ground level concentration distribution of NOx

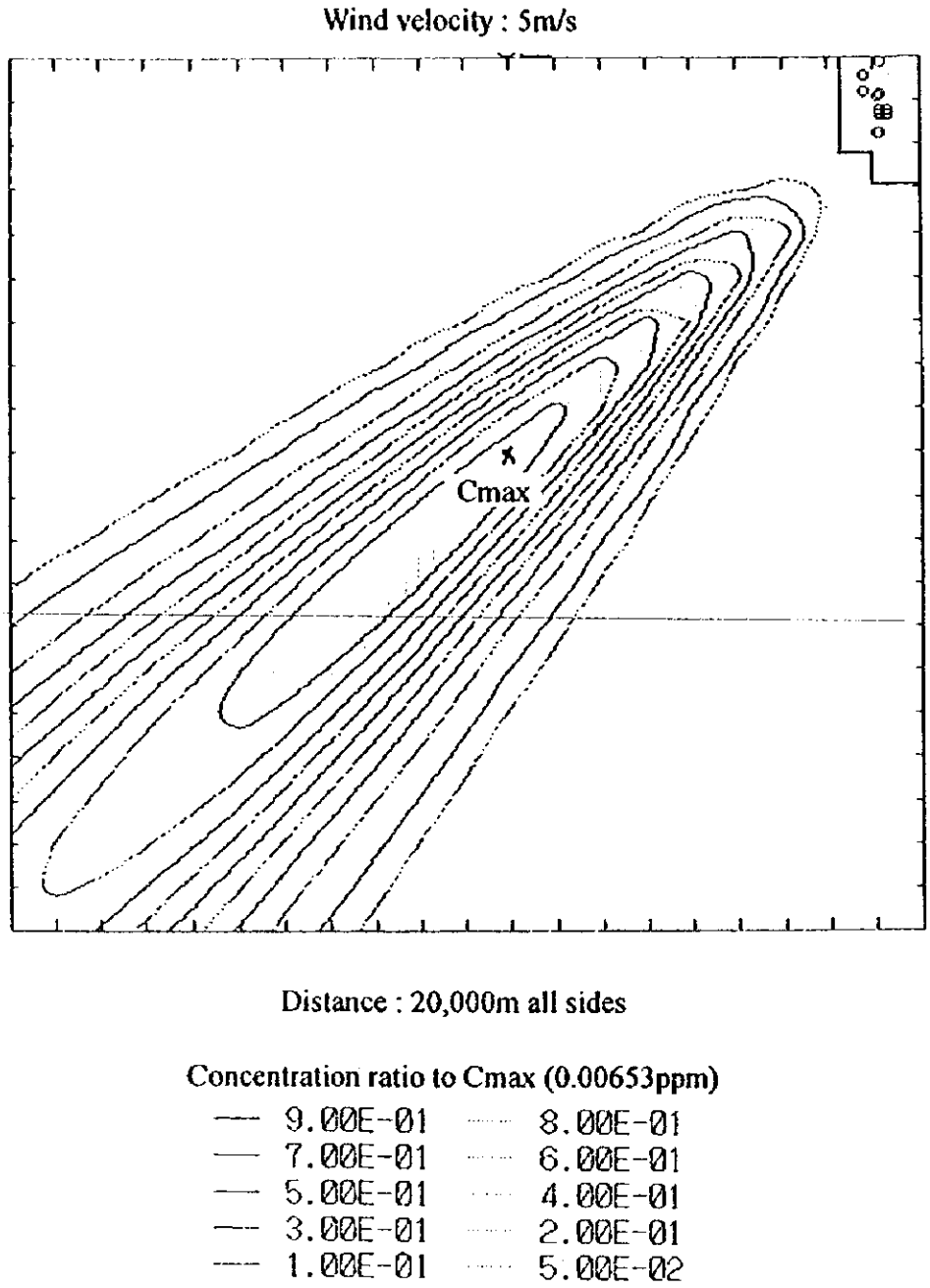


Figure 1-5 Ground level concentration distribution of NOx

5 Water quality

5.1 Effluent standards for regulatory substances

1) The effluent standards for regulatory substances are shown in Table 1-11.
2) The above effluent standards are to be met in the new integrated steel plant.

5.2 Water balance

1) The water balance at the new integrated steel plant is shown in Table 1-12.
2) The seawater included in the necessary quantity is used in the following applications;
   - Cooling water in the production process (blast furnaces and COG)
   - Cooling water of power plant
3) The greater part of the fresh water used in each process of the steel plant is circulated and reused. The circulation ratio of fresh water is 94% and the quantity of circulated fresh water is 620×10^6 m^3/Y.

5.3 Effluents from steel plant

1) Fresh water and seawater are discharged from the steel plant and the quantity of these effluents is 630×10^6 m^3/Y
2) These effluents are discharged to the sea from drainpipes and the above effluent standards are met.

Table 1-11 Effluent at new integrated steel plant

No	Parameters and substances	Unit	Value	No	Parameters and substances	Unit	Value
1	Temperature	℃	40	26	Ammonia (as N)	mg/l	1
2	pH value	—	5.5～9	27	Fluoride	mg/l	2
3	BOD5 (20℃)	mg/l	50	28	Phenol	mg/l	0.05
4	COD	mg/l	100	29	Sulfide	mg/l	0.5
5	Suspended solids	mg/l	100	30	Cyanide	mg/l	0.1
6	Arsenic	mg/l	0.1	31	Coliform	MPN/ml	100
7	Cadmium	mg/l	0.02	32	Gross α activity	Bg/l	0.1
8	Lead	mg/l	0.1	33	Gross β activity	Bg/l	1.0
9	Residual Chlorine	mg/l	2	34	Alkylmercury	mg/l	Not
10	Chromium (Ⅵ)	mg/l	0.1	35	Polychlorinated biphenyl	mg/l	0.003
11	Chromium (Ⅲ)	mg/l	1	36	Dichloromethane	mg/l	0.2
12	Mineral oil and fat	mg/l	1	37	Carbon tetrachloride	mg/l	0.02
13	Animal-vegetable fat and oil	mg/l	10	38	1,2-Dichloroethane	mg/l	0.04
14	Copper	mg/l	1	39	1,1-Dichloroethylene	mg/l	0.2
15	Zinc	mg/l	2	40	Sys1,2-Dichloroethlene	mg/l	0.4
16	Manganese	mg/l	1	41	1,1,1-Trichloroethane	mg/l	3
17	Nickel	mg/l	1	42	1,1,2-Trichloroethane	mg/l	0.06
18	Organic phosphorous	mg/l	0.5	43	1,3-Dichloropropene	mg/l	0.02
19	Total phosphorous	mg/l	6	44	Tetramethylthiuram disulfide	mg/l	0.06
20	Iron	mg/l	5	45	2-chloro-4,6-bis(ethylamino)	mg/l	0.03
21	Tetrachlorethylene	mg/l	0.1		-1,3,5-triazine	mg/l	
22	Tin	mg/l	1	46	S-4-chlorobenzyl	mg/l	0.2
23	Mercury	mg/l	0.005		diethythiocarbamate	mg/l	
24	Total nitrogen	mg/l	60	47	Benzene	mg/l	0.1
25	Trichlorethylene	mg/l	0.3	48	Selenium	mg/l	0.1

Table 1-12 Water balance

Item		Quantity
(1) Necessary quantity	Seawater	600 $\times 10^6$ m^3/Y
	Fresh water	42.6$\times 10^6$ m^3/Y
	Total	642.6$\times 10^6$ m^3/Y
(2) Circulating fresh water		620 $\times 10^6$ m^3/Y
(3) Circulating ratio of fresh water		94 %
(4) Quantity of effluent water		630 $\times 10^6$ m^3/Y

6. Noise

6.1 Conditions for examination

1) Because detailed specifications of equipment and buildings are not determined at the present stage, past sound source data were referred to.
   - Total number of sound sources: About 360 (Small sound sources were aggregated and counted as one.)
   - Condition of noise control measures for sound sources:
     Noise control measures are taken for the blast-furnace septum valves (valves for raising the pressure of hot-stove gas), main blowers of sintering machines, large-size dust collection blowers, fans, etc.
2) Aggregation of sound sources
   - Facilities are aggregated for each plant (blast-furnace plant, steelmaking plant, etc.) and the power level (PWL) of the whole plant was obtained by adding the power level of each facility.
   - The noise simulation was conducted by locating sound sources almost at the center of the planned construction site of the steel plant and regarding the size of a sound source as the size of a building.
   - The results of aggregation of sound sources are shown in Table 1-13.

Table 1-13 Results of aggregation of sound sources

Sound source	PWL(dB)
Yard Ⅰ	119.4
Yard Ⅱ	118.0
Yard Ⅲ	114.7
Sintering machine Ⅰ	122.7
Sintering machine Ⅱ	122.7
Blast furnace Ⅰ	124.0
Blast furnace Ⅱ	124.0
Coke oven Ⅰ	118.3
Coke oven Ⅱ	118.3

Sound source	PWL
Power plant	119.0
Oxygen plant	109.6
Steekmaiking Ⅰ	113.7
Steekmaiking Ⅱ	113.7
Steekmaiking Ⅲ	113.7
Hot strip mill (Hot) Ⅰ	109.8
Hot strip mill (Hot) Ⅱ	109.8
Cold strip mill (Cold)	105.4

6.2 Results of noise simulation

1) The results of noise simulation of the surrounding district including the steel plant are shown in Figure 1-6.
2) The highest noise level on the line of site boundary is at point W-5.

This is because blast furnaces and sintering machines of high power level are near this region.

3) Because the power level of the equipment of blast furnaces and sintering machines (sound sources) is higher than that of other plants, sounds are diffused from the blast furnaces, sintering machines and power plant as centers of sound sources in the diagram of sound level contours (dB).
4) The effects of the oxygen plant and steelmaking plants are also observed in the diagram of sound level contours (dB). However, their effects on the line of site boundary are not so great as those of the blast furnaces, sintering machines and power plant.
5) Although the hot strip mills and cold strip mill are located near the site boundary, their effects on the line of site boundary are slight because there are few outdoor facilities and for other reasons.

6.3 Noise control measures

1) When the steel plant is constructed in Muiron, the target noise level on the line of site boundary is set at 65 dB, considering that this steel plant area is an industrial district.
2) Table 1-14 shows the main sound sources that have a great effect on point W-5 where the noise level is highest on the line of site boundary.
3) The sound level at point W-5 is 66.3 dB, which exceeds the target value. The particular sound source that has a great effect are the blast furnaces. Point W-5 is nearest to the blast furnaces on the line of site boundary and the sound level is about 65 dB with the blast furnaces only (BF Ⅰ + BF Ⅱ).
4) Therefore, the sound level is lowered to below 65 dB, the target value, by enhancing noise control measures in the septum valves of blast furnaces, large-size dust collection blowers, etc. For example, installation of the silencer with sound absorbing materials will be effective.

Table 1-14 Effects of each sound source at evaluation point W-5

Contribution order	Main sound source	Single sound	Complex sound
1	Blast furnace Ⅱ	61.9 (dB)	66.3 (dB)
2	Blast furnace Ⅰ	61.6 (dB)	64.4 (dB)
3	Sintering machine Ⅱ	55.8 (dB)	61.1 (dB)
4	Sintering machine Ⅰ	55.6 (dB)	59.6 (dB)
5	Power plant	51.3 (dB)	57.4 (dB)

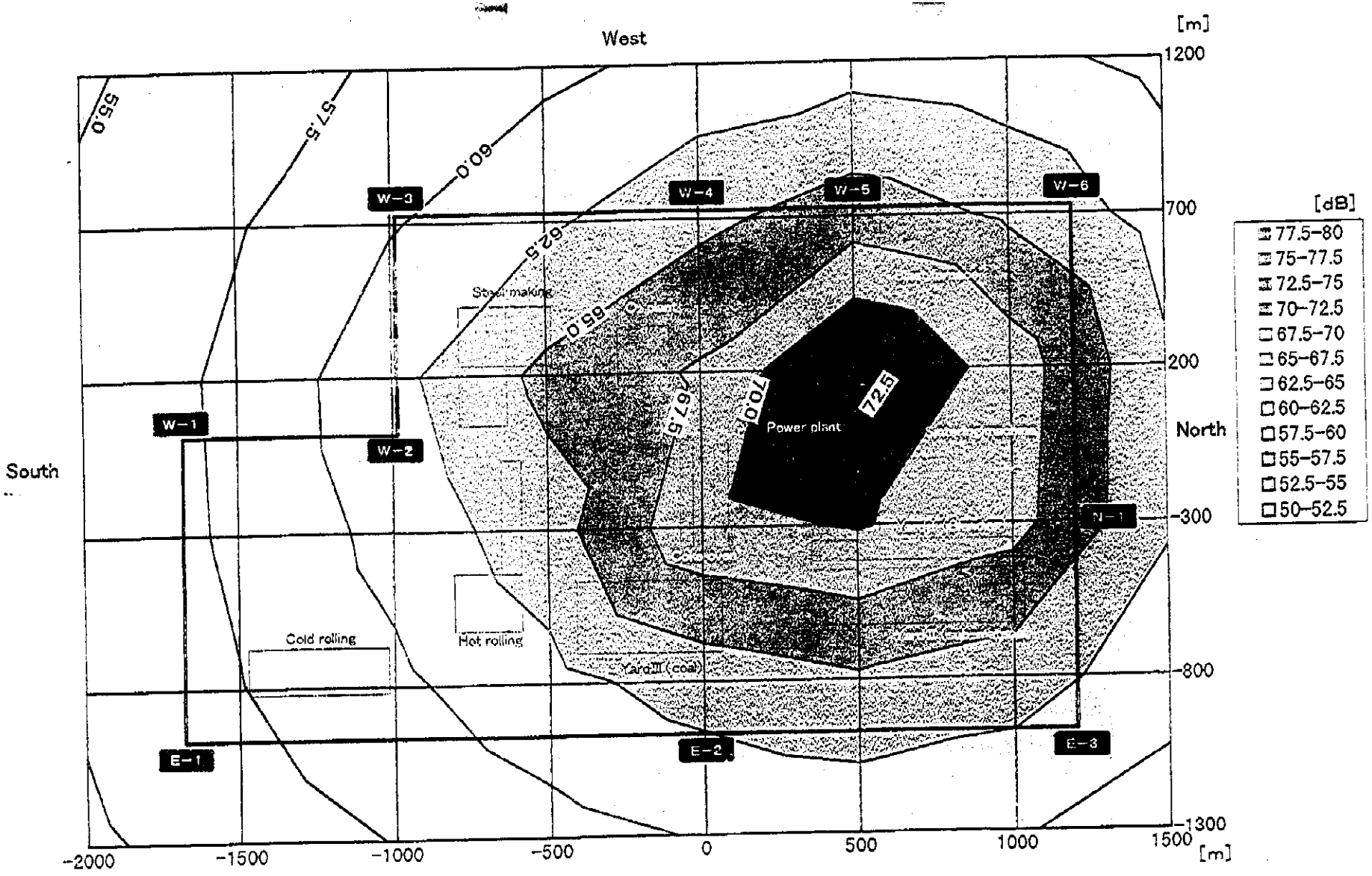


Figure 1-6 Noise simulation result