4. 6 Micro (Commodity-wise) Forecast

4.6.1 Iron Ore

(1) Reserves of Iron Ore

Reserves of four iron mines under exploitation at present were estimated 633.8 million tons in 1997 as shown in Table 4.6.1. On the assumption that 20 million tons per year of iron ore is continuously excavated, these four mines can provide up to the year 2028.

Development and excavation activities are programmed for a 1996-2000 mining plan. During this period, extensive work will be done in the development of Altamira and San Joaquin mines. These mines will also feed the future low grade ore for the concentration plant. However, these reserves are not included in the mining plan because they are in a preliminary stage of design.

Table 4.6.1 Reserves of Iron Ore Mines

Name of Mine	Volume (Mill. Tons)
San Isidro	162.0
Las Pailas	46.0
Los Barrancos	278.7
Cerro Bolivar	147.1
(Total)	633.8

Source; Ferrominera

(2) Venezuelan Situation in the World Market

World iron ore production volume was 912.0 million tons in 1997. Compared with that in1990, production slightly increased 24.5 million tons with an average growth rate 0.55 %. While 474.8 million tons was internationally transported, 423.0 million tons was transported as seaborne cargo in 1997. Iron ore was second biggest volume seaborne dry cargo next to coal. The share of international trade among production was 52.1% and that of the seaborne cargo share was 46.4%. Both shares have been steadily increasing since 1990 (see Fig. 4-6-1).

In 1997 production volume of Venezuela was 17.558 million tons and its share in the world production was 1.9% (Fig. 4-6-2). On the other hand, exportation volume of Venezuela was 9.320 million tons and its share was 2.0% (Fig. 4-6-3).

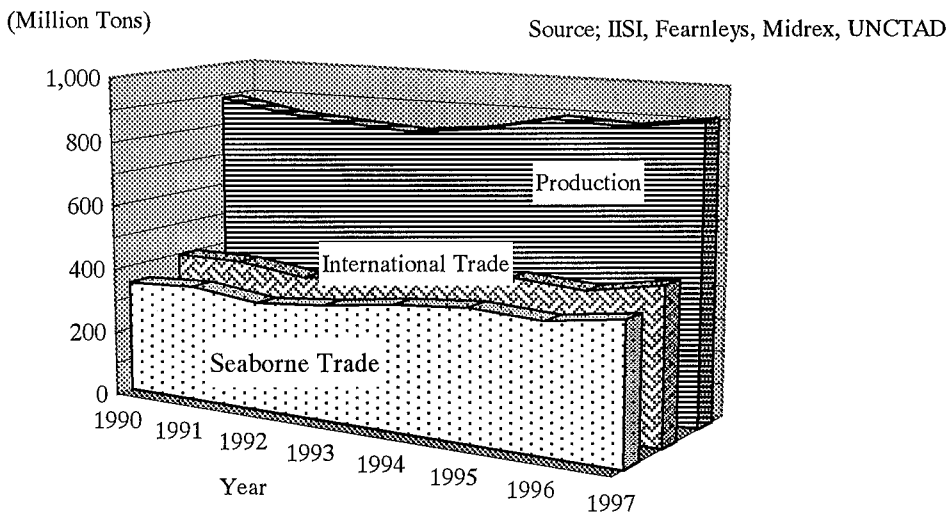
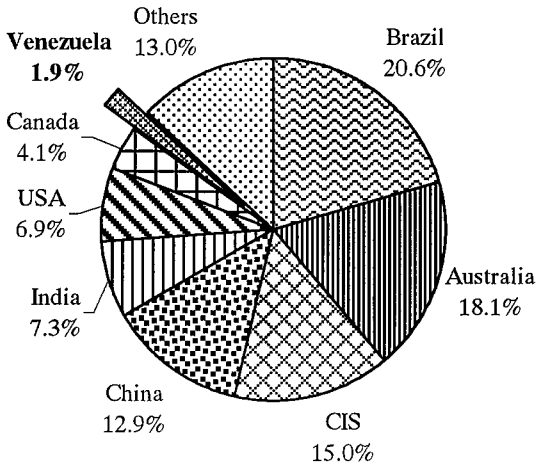


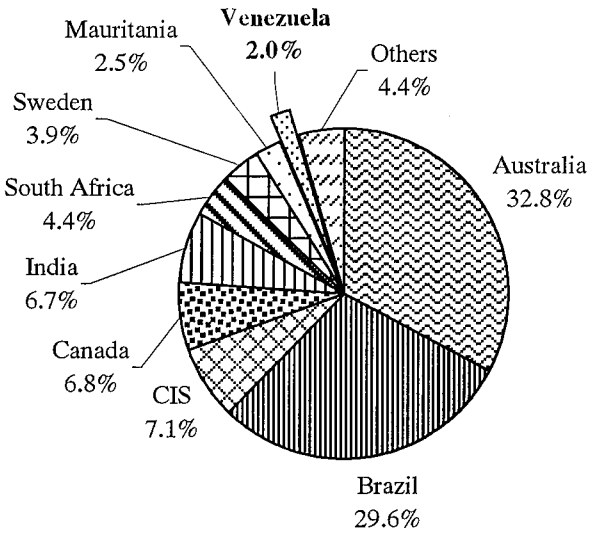
Fig. 4-6-1 Production/Transportation Trend of Iron Ore



Total Production Volume
912.0 million tons

Source; UNCTAD Trust Fund

Fig. 4-6-2 Production Share of Iron Ore in 1997



Total Exportation Volume
474.8 million tons

Source; UNCTAD Trust Fund

Fig. 4-6-3 Exportation Share of Iron Ore in 1997

(3) Seaborne Trade

Origin/Destination matrix of regional-wise seaborne trade is given in Table 4.6.2. The biggest route is Australia/New Zealand ~ Japan which holds a 15.4% share, followed by Australia/New Zealand ~ Other Far East (13.5%), South America Atlantic ~ U.K./Continental (10.3%), South America Atlantic ~ Japan (7.0%) and South America Atlantic ~ Other Far East (6.4%).

Table 4.6.2 Origin/Destination of Seaborne Trade of Iron Ore in 1997

(Unit; Thousand Tons)

To; / From;	U.K./ Cont.	Mediter-ranean	Other Europe	USA	Japan	Other Far East	Others	(Total)
Scandinavia	12,705	392	576	235		2,258	2,893	19,059
Other Europe	1,284	70	73	68	1		11	1,507
West Africa	6,838	3,526	498			112	918	11,892
Other Africa	4,412	1,351	2,999	12	4,862	6,413	711	20,760
North America	16,149	1,596	354	6,633	1,005	3,432	630	29,799
S.America Atl.	44,343	10,655	10,317	7,386	30,079	27,726	19,953	150,459
S.America Pac.	477		68	493	3,681	5,330	425	10,474
Asia	1,308	1,062	490		20,933	10,091	2,893	36,777
Australia/N.Z.	20,578	1,904	1,243	742	66,069	57,969	963	149,468
(Total)	108,094	20,556	16,618	15,569	126,630	113,331	29,397	430,195

Note; Imports to USA from Canada via Great Lakes are excluded
"Others" are partly estimated
Source; World Bulk Trades 1998/Fearnleys

(4) Importation Share and the Japanese Market

World importation volume was 468.8 million tons in 1997. Japan accounts for 27.0% of the total importation volume, followed by China (11.8%), Germany (9.0%), Korea (8.2%), U.K. (4.5%), France (4.3%) and USA (4.0%) as shown in Fig. 4-6-4.

In 1997 Japan imported 127.489 million tons of iron ore, of which two largest supply countries, Australia and Brazil account for 73.21% of total importation volume while Venezuela accounts for 0.85% as shown in Table 4.6.3. Venezuelan iron ore exportation to Japan by steel mill is given in Table 4.6.4. The importation volume has been decreasing. NKK and Kobe Steel had been continuously purchasing Venezuelan iron ore but in 1999 only NKK has a contract to purchase 600 thousand tons.

Table 4.6.3 Iron Ore Importation in Japan

(Unit; Thousand Tons)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	
Australia	54,849	55,730	56,541	54,166	51,421	57,694	58,054	61,694	63,949	*50.16%*
Brazil	29,586	28,616	29,368	26,630	27,373	28,429	27,735	26,543	29,390	*23.05%*
India	20,377	21,683	18,962	16,333	16,644	16,422	17,045	16,120	17,417	*13.66%*
South Africa	4,878	4,645	4,978	4,201	4,583	4,834	4,686	4,248	5,149	*4.04%*
Philippine	4,777	5,161	4,589	3,691	4,204	4,992	4,426	4,524	4,388	*3.44%*
Chile	5,008	3,428	4,389	3,219	3,799	3,248	2,777	3,314	3,181	*2.50%*
Venezuela	**840**	**1,513**	**1,828**	**1,499**	**1,434**	**893**	**1,130**	**934**	**1,086**	***0.85%***
New Zealand	1,395	1,196	1,451	1,353	1,458	1,159	1,151	1,505	1,047	*0.82%*
Canada	1,954	2,145	1,362	1,186	1,261	1,125	1,237	905	998	*0.78%*
Peru	1,034	541	630	678	698	448	600	646	814	*0.64%*
Korea	125	165	79	86	155	78	77	78	36	*0.03%*
West Samoa			95			53		41		
Malaysia	39	68	58	12	27	16		16		
Mauritania	342	393		181	122	121				
Thailand					123					
Sweden	918	296								
Liberia	152									
Others		49		21		43	25	138	34	*0.03%*
(Total)	126,274	125,629	124,330	113,256	113,302	119,555	118,943	120,706	127,489	*100.00%*

Source; Ministry of Finance/Japan-Custom Statistics

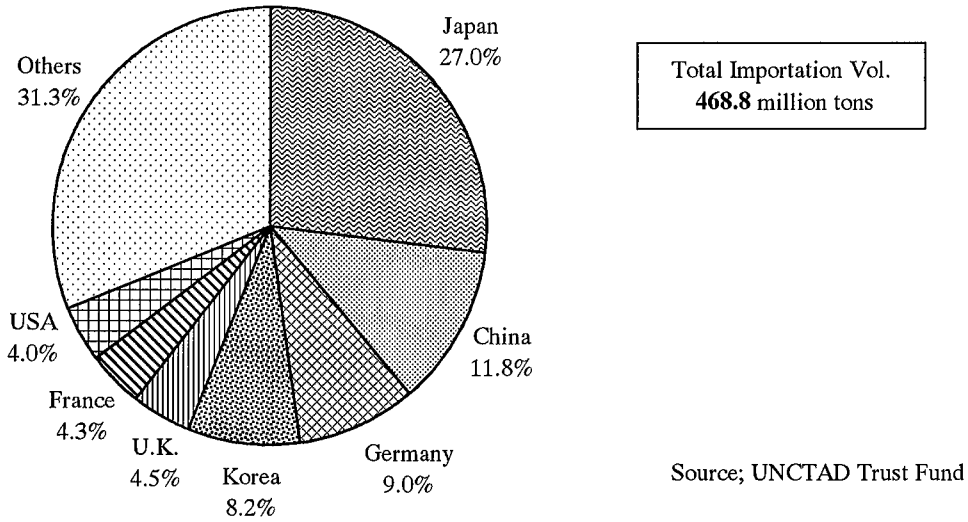


Fig. 4-6-4 Country-wise Importation Share of Iron Ore in 1997

Table 4.6.4 Venezuelan Iron Ore Exportation to Japan Steel Mills

(Unit; Thousand Tons)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
NKK	580	730	790	690	690	600	700	800	900	900
NSC	150	280	540	360	360					
Kawasaki Steel	148	130	130	130						
Kobe Steel	345	350	480	480	360	240	360	260	260	130
Sumitomo Steel		40								
(Total)	1,223	1,530	1,970	1,660	1,410	840	1,060	1,060	1,160	1,030

Note ; Statistics from April to March
Source ; Iron Ore Manual 1998

The Japanese market employs a price formula in which special consideration is given to iron ore that travels a long distance from Japan, on the grounds that Japan steel mills need to import a large quantity of iron ore constantly from many areas of the world. This is the fundamentally different point from the price formula of the European market in which FOB price is set as to be equal to CIF price for all import brands, regardless of the seaborne transport distance.

Recently in the Japanese market, a movement has been strengthened that the traditional purchasing method on the basis of price competitiveness of European style. Thus, Brazil, Venezuela and Peru which are a long distance from Japan have been forced to enter hard price competition. Accordingly, Japan steel mills may be reluctant to import iron ore from Venezuela in the future.

(5) Exportation/Sales Plan of Ferrominera

In 1997 Ferrominera produced 17,558 thousand tons of iron ore, of which 9,320 thousand tons was exported as referred in section 4.5.1. As to the foreign and domestic market share, Ferrominera plans to decrease foreign share and increase domestic share for providing new direct reduced iron plats, namely COMSIGUA, POSVEN and ORINOCO IRON. According to Ferrominera, exportation volume is planned to be 7,420 thousand tons in 1999, 5,436 thousand tons in 2001 and 4,000 thousand tons after 2003.

On the other hand, production volume of iron ore is estimated to be 19,137 thousand tons in 2003 based on above exportation plan and providing volume for new direct reduced iron plants (see Fig. 4-6-5). Production volume after 2003 is examined in section 4.6.3 (4).

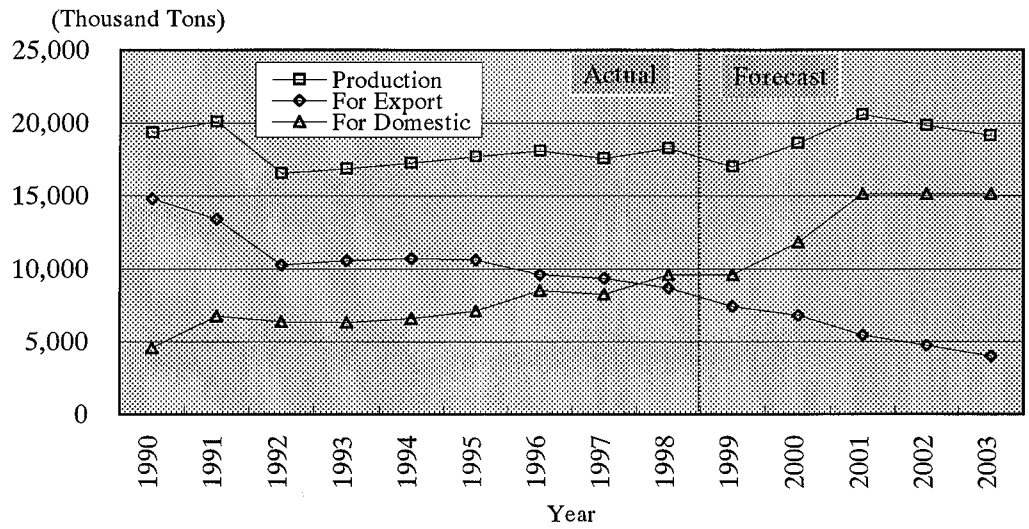


Fig. 4-6-5 Production/Exportation Forecast of Iron Ore

(6) Concentration Plant

Several laboratory tests have proven the capacity of the friable and hard low grade ores from Ferrominera's mine, to produce high grade concentrates. Based on the results obtained on the preliminary concentration tests, Ferrominera is planning the construction of a concentration pilot plant in order to perform continuous tests. The commercial plant will produce around 8 million tons per year of concentrates, with a total estimated investment of 300 million US dollars.

4.6.2 Direct Reduced Iron

(1) Venezuelan Situation in the World Market

Direct reduced iron production volume has sharply increased since the beginning of the 1990s as shown in Fig. 4-6-6. World production volume was 36.18 million tons in 1997, of which Venezuela accounts for 14.8% of the total production volume, followed by India (14.5%), Mexico (12.5%), Iran (12.1%) and Saudi Arabia (5.8%) as shown in Fig. 4-6-7. Producing countries in the world are primarily located in regions richly blessed in resources such as iron ore or natural gas. The largest producing country, Venezuela, has both resources which is advantageous in producing direct reduced iron.

Materials for electric furnace are scrap, pig iron and direct reduced iron. Especially in the USA and Asia, demand of direct reduced iron is forecast to increase due to several construction or expansion plans of the electric furnace and the shortage of scrap for these plans.

(2) Production Capacity of Existing and Planned Plant

The production capacity of five existing enterprises and two planned enterprises is given in Table 4.6.5. Construction of POSVEN and ORINOCO IRON is in progress. Total logical production capacity will be 10,860 thousand tons in 2001.

As to SIDOR, actual production capacity is about 3,300 thousand tons per year due to the poor condition of the plant at present. Plant improvement to realize maximum production capacity (4,060 thousand tons per year) and an expansion program to increase the production capacity to 6,000 thousand tons per year are planned in the future.

Table 4.6.5 Production Capacity of Direct Reduced Iron

Enterprise	Operation Beginning year	Production Capacity (Thousand Tons per year)
SIDOR	1976	4,060
FIOR	1976	400
VENPRECAR	1990	700
OPCO	1990	1,000
COMSIGUA	1998	1,000
POSVEN	2000	1,500
ORINOCO IRON	2001	2,200
(Total)		10,860

Source; Iron Ore Manual 1998

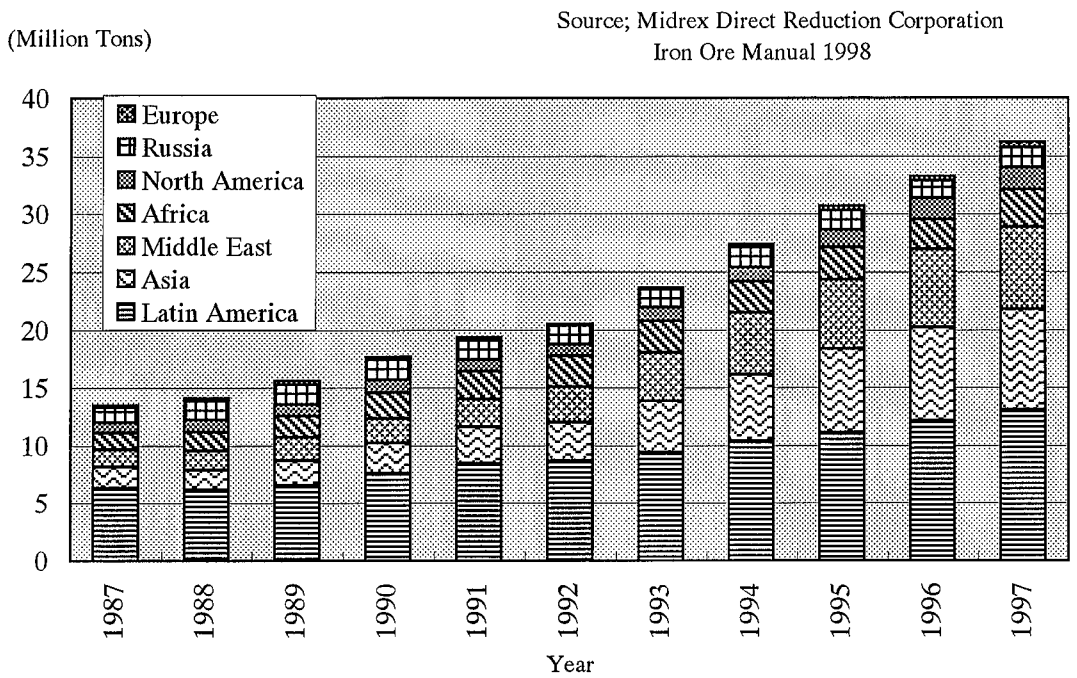


Fig. 4-6-6 Direct Reduced Iron Production Trend and Regional Share

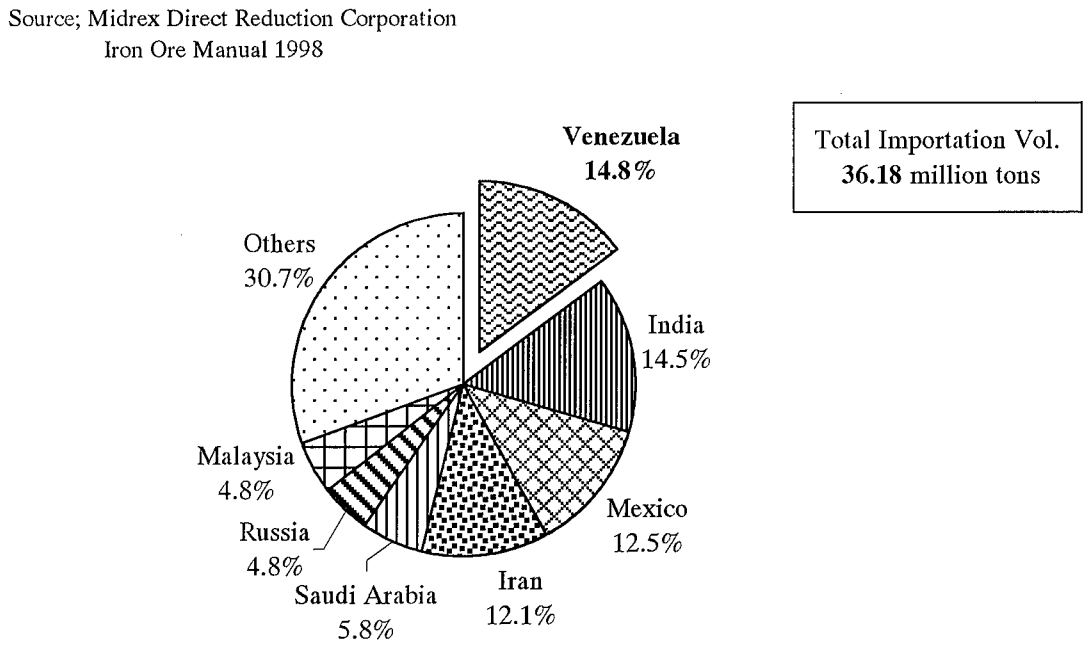


Fig. 4-6-7 Country-wise Production Share of Direct Reduced Iron in 1997

4.6.3 Steel Products

(1) SIDOR

In 1997 SIDOR produced 3,290 thousand tons (estimate) of steel products such as coil, wire, steel bar and cobble plate, of which 1,439 thousand tones was exported mainly to America, 339 thousand tons was transported mainly to Puerto Cabello. On the other hand, 495 thousand tons of raw materials such as dolomites, limestone and coke was imported. Both production/exportation volume of steel products and importation volume of raw materials will increase with improvement and expansion plan of direct reduced iron plant as referred in section 4.6.2 (2). It is estimated that 611 thousand tons of raw materials is required to produce 4,060 thousand tons of steel products, and 903 thousand tons is required to produce 6,000 thousand tons.

(2) SIDETUR

In 1997 SIDETUR produced 448 thousand tons of steel bar and all of them were exported. Production capacity is 450 thousand tons per year at present and they plan to expand production to 550 thousand tons per year in 2003.

(3) Slab Plant

Ferrominera and SIDOR plan to construct the slab plant using concentrates as referred in 4.6.1 (6). Production capacity of these plants is around 2,700 thousand tons per year and it is estimated that 406 thousand tons of raw materials is required for slab production.

(4) Product Flow of Steel Related Products

Future product flow of iron ore, direct reduced iron and steel products are assumed as shown in Fig. 4-6-8, Fig. 4-6-9 and Fig. 4-6-10 based on production plan of enterprises. Here, assumption of plant schedule is shown in Table 4.6.6 and each Stage i.e., operation starting year of each plant, is examined in section 4.7.2 (2).

Table 4.6.6 Assumption of Plant Schedule

Plant Project	Stage I	Stage II	Stage III
Direct Reduced Iron Plant (POSVEN)	Operation	Operation	Operation
Direct Reduced Iron Plant (ORINOCO IRON)	Operation	Operation	Operation
Direct Reduced Iron Expansion Plant (SIDOR)	Operation	Operation	Operation
Slab Plant (Ferrominera)	Preparation	Operation	Operation
Slab Plant (SIDOR)	Preparation	Preparation	Operation

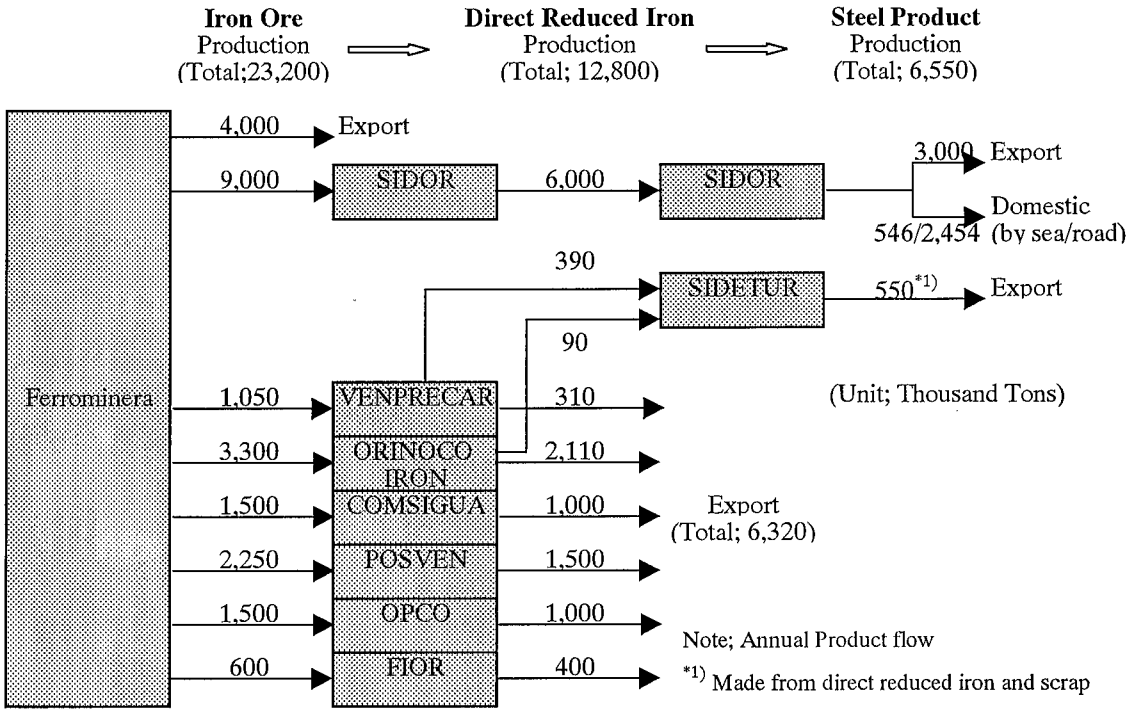


Fig. 4-6-8 Product Flow at Stage I

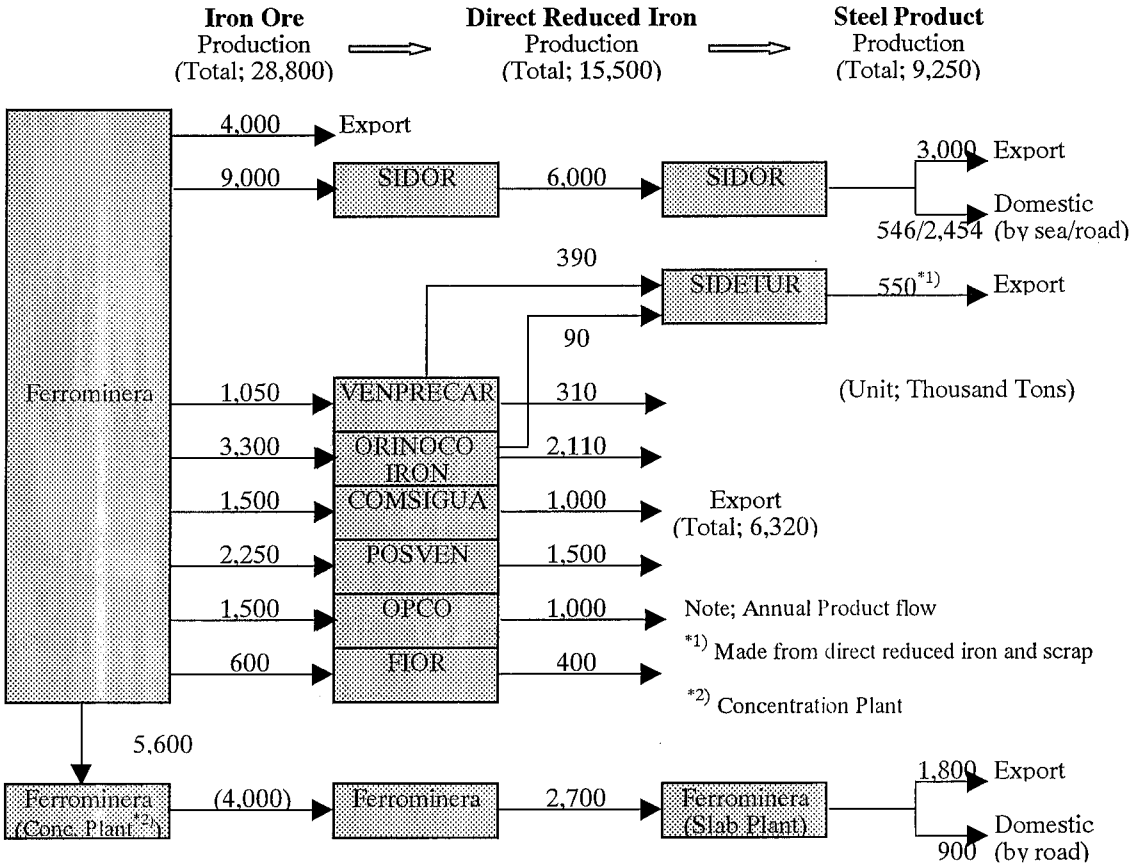


Fig. 4-6-9 Product Flow at Stage II

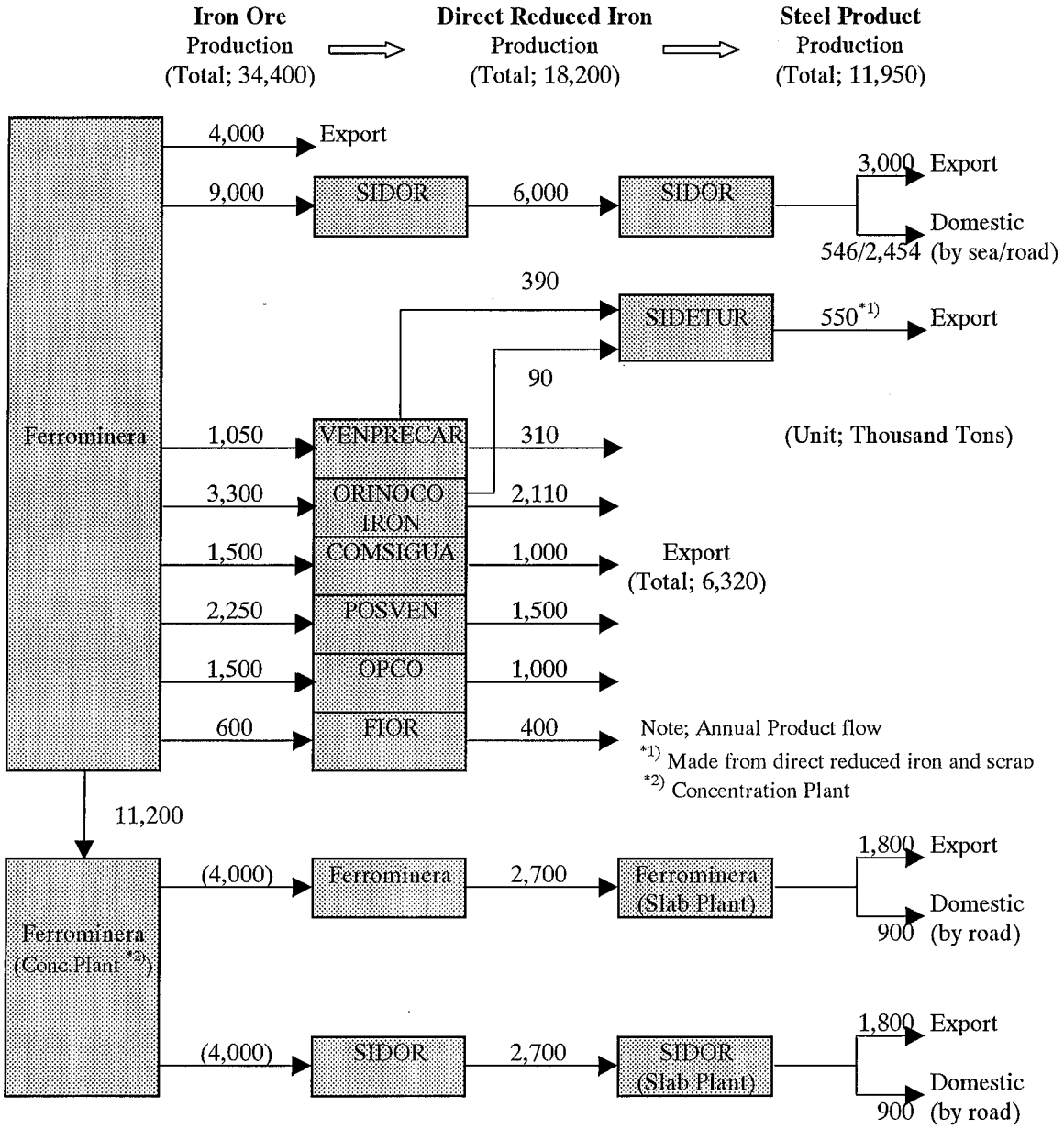


Fig. 4-6-10 Product Flow at Stage III

4.6.4 Aluminum Related Products

(1) Venezuelan Situation in the World Market

In 1996 world bauxite, alumina and aluminum ingot production volume was 122.72 million tons, 44.50 million tons and 20.99 million tons and average growth rate from 1985 to 1996 was 3.0%, 2.1% and 2.2% respectively as shown in Fig. 4-6-11.

Venezuelan production share of each product in the world market in 1996 is given in Fig. 4-6-12, Fig. 4-6-13 and Fig. 4-6-14. Its production share was 4.6% for bauxite, 4.0% for alumina and 3.0% for aluminum ingot.

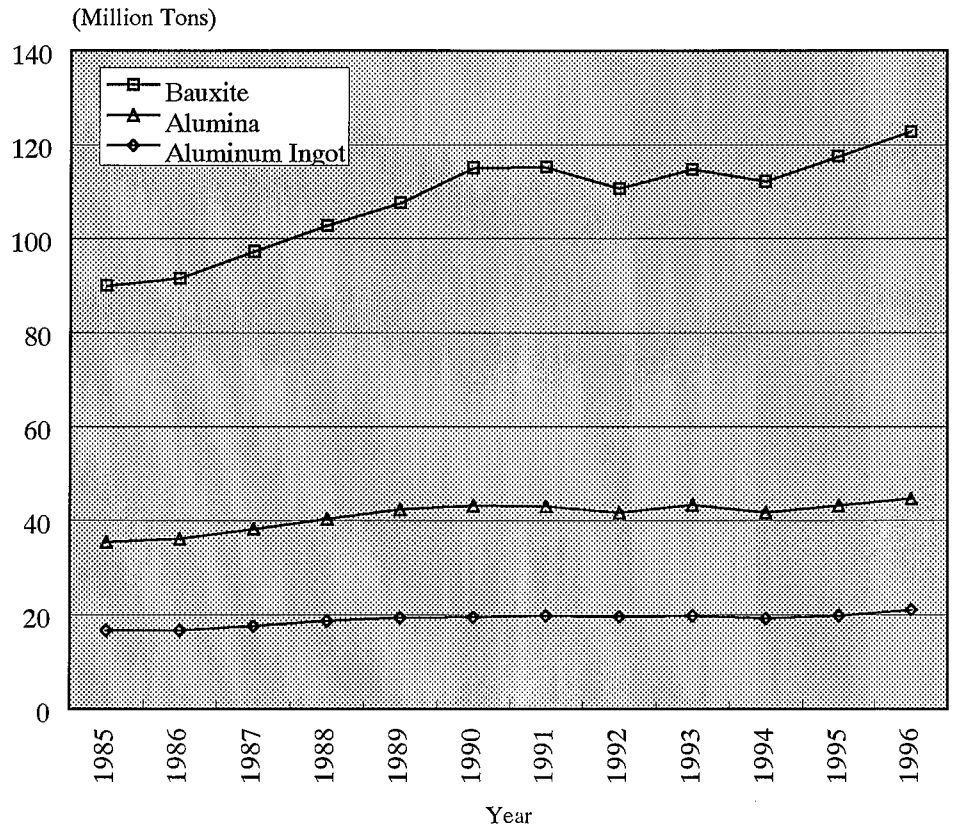
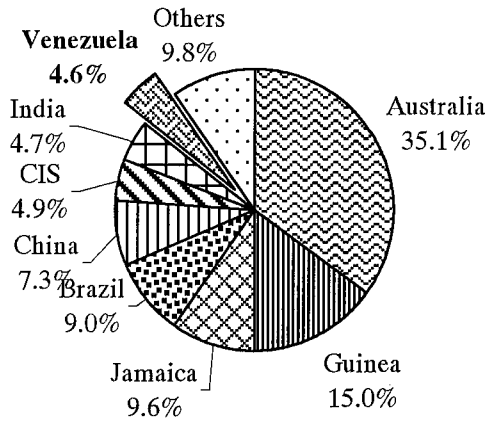


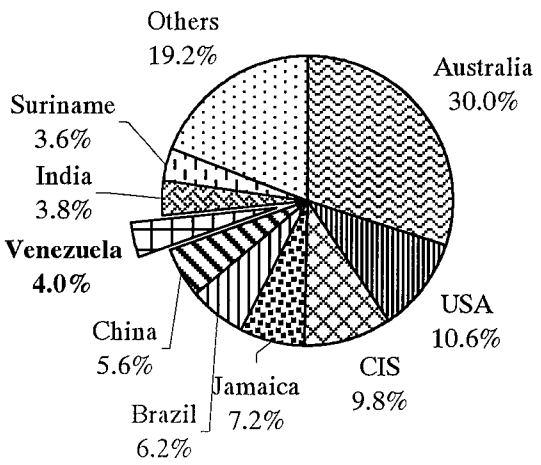
Fig. 4-6-11 Production Volume of Aluminum Related Products

Source; Metal Statistics 1986~1996



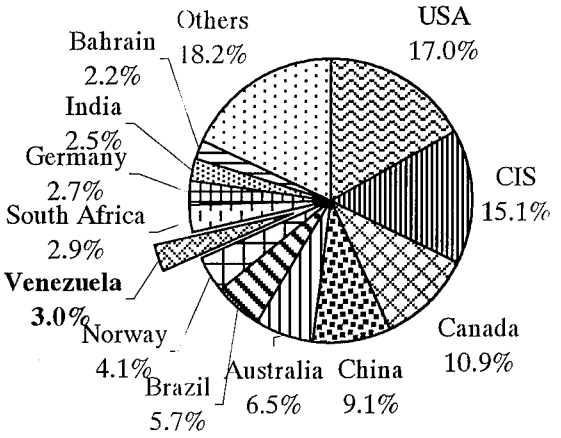
Total Production Vol.
122.72 million tons

Fig. 4-6-12 Production Share of Bauxite



Total Production Vol.
44.50 million tons

Fig. 4-6-13 Production Share of Alumina



Total Production Vol.
20.99 million tons

Fig. 4-6-14 Production Share of Aluminum Ingot

(2) Production Capacity and Future Plan

Production capacity of the Group of Aluminum Industry which is composed of BAUXILUM, VENALUM, ALCASA and CARBONORCA is given in Table 4.6.7. In 1997 production ratio (Divided production volume by production capacity) was 81.8% at BAUXILUM (Bauxite), 88.7% at BAUXILUM (Alumina), 93.5% at VENALUM, 96.2% at ALCASA and 91.4% at CARBONORCA.

In 1997 CARBONORCA provided 110 thousand tons of anode (materials for aluminum ingot) to VENALUM and ALCASA while remaining, 18 thousand tons of anode was exported mostly by truck. Thus, it is not necessary to considering the seaborne cargo transportation.

Group of Aluminum Industry plans to increase the production volume up to full capacity of plants in 2003. Furthermore, ALCASA plans to construct a new aluminum ingot plant with a production capacity is 250 thousand tons per year.

Table 4.6.7 Production Capacity of Existing Plants

(Unit; Thousand Tons)

Product	Enterprise	Production Capacity (per year)	Production Volume in 1997
Bauxite	BAUXILUM	6,000	4,907
Alumina	BAUXILUM	2,000	1,773
Aluminum Ingot	VENALUM	430	402
Aluminum Ingot	ALCASA	210	202
Anode	CARBONORCA	140	128

Source; Group of Aluminum Industry

(3) Product Flow of Bauxite/Alumina/Aluminum Ingot

Future Product flow of Bauxite/Alumina/Aluminum Ingot is assumed as shown in Fig. 4-6-15 and Fig. 4-6-16 based on production plan. Here, the assumed plant schedule is shown in Table 4.6.8. Stage I' i.e. , operation starting year, is examined in section 4.7.2 (1).

Table 4.6.8 Assumption of Plant Production Schedule

Plant Project	2003	Stage I'
Existing Plant (Group of Aluminum Industry)	Full Capacity	Full Capacity
Aluminum Ingot Plant (ALCASA)	Preparation	Operation

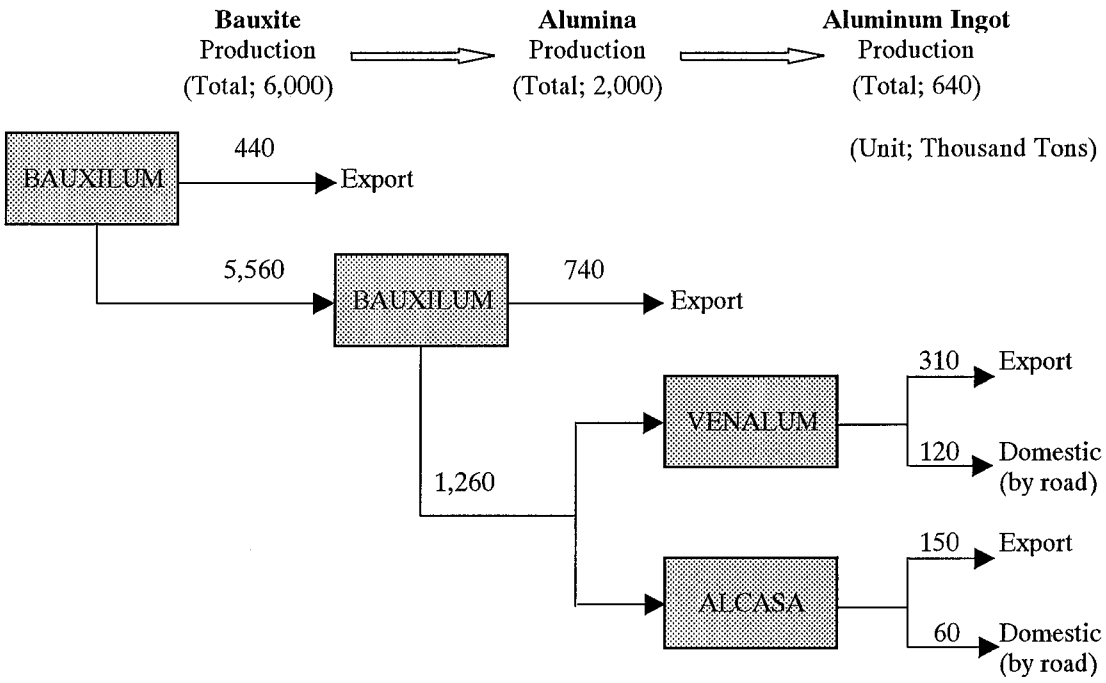


Fig. 4-6-15 Product Flow in 2003

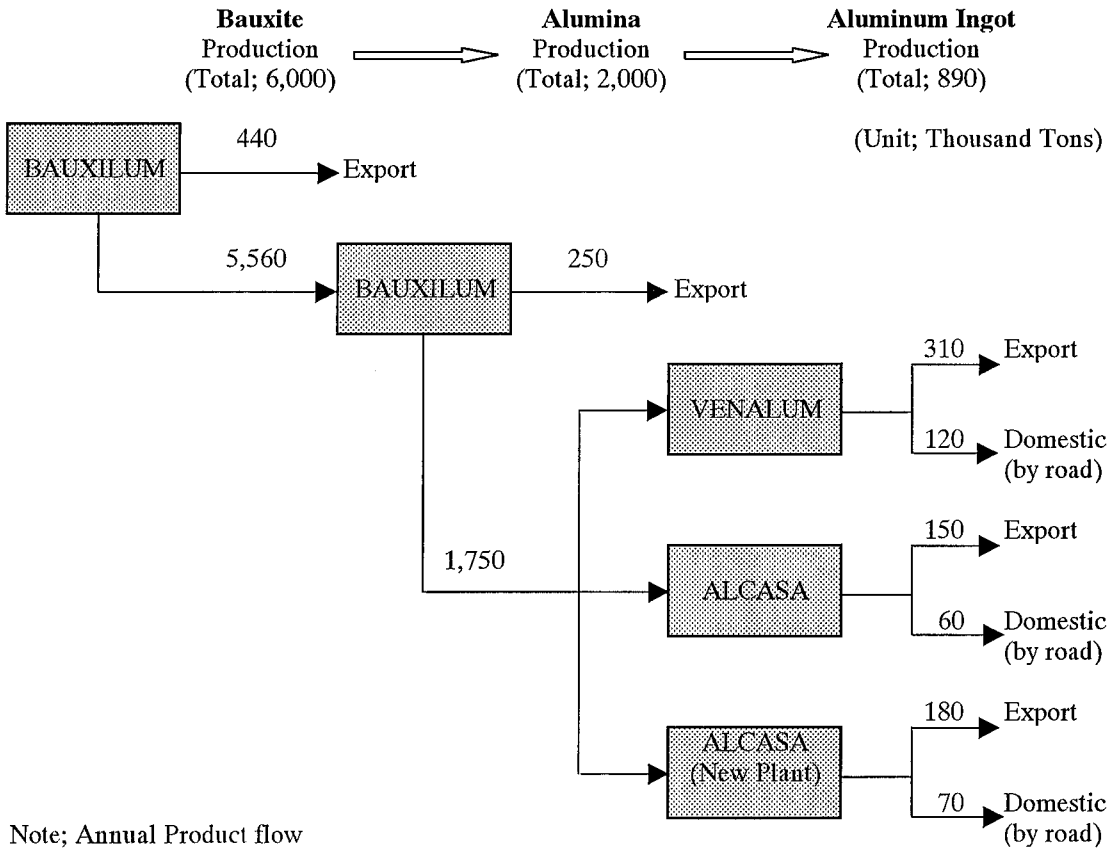


Fig. 4-6-16 Product Flow at Stage I'

(4) Materials for Aluminum Related Products and Other Aluminum Products

VENALUM, ALCASA, CARBONORCA and INMCO imported 502 thousand tons of raw materials such as coke, tar and carbon in 1997. Importation volume of raw materials will be increased with the production increase of these enterprises. It is estimated that 520 thousand tons per year of raw materials will be needed in 2003 and 645 thousand tons per year at Stage I'.

BAUXILUM imported 247 thousand tons of caustic soda as raw materials for alumina in 1997. It is estimated that 279 thousand tons per year of caustic soda is required to produce alumina in 2003 and Stage I'. Raw materials volume in 2003 is equivalent to Stage I' because the production volume of alumina is not expected to change.

On the other hand SURAL and other enterprises exported 50 thousand tons of aluminum products and INMCO exported 29 thousand of anode in 1997. Exportation volume of aluminum products is estimated to increase to 65 thousand tons per year with the production increase of aluminum ingot for domestic at Stage I'. Exportation volume of anode is estimated to stay at 29 thousand tons per year because there is no expansion plan at present.

4.6.5 Other Industrial Products

(1) Wood Chip

Venepal-Stone Forestal of Venezuela (Veneston) was established in May of 1993 to operate a Caribbean pine project. Veneston is responsible for harvesting and chipping Caribbean pine, and manages the port facilities at Punta Piedra in Monagas State which will export Caribbean pine chips to the world market.

Construction of wood chip plant and port for exportation is scheduled to begin production and exporting in early 1999. They plan to export 450 thousand tons per year of wood chip in the first stage (1999~2001) and increase up to 1,200 thousand tons per year (production capacity) after finding a new market in the next stage.

(2) Clinker

CEMEX has produced around 380 thousand tons per year of cement in recent years. As to share of raw materials, clinker accounts for 95 % and gypsum and other materials account for 5%. Clinker is transported from Pertegalete (located near Puerto La Cruz) by ship (about 50%) and by truck (about 50%) and gypsum and other materials is carried by truck. Thus, seaborne transportation volume of clinker is around 180 thousand tons per year in recent years.

They plan to transport all of clinker by ship from 1999, accordingly seaborne transportation volume of clinker will increase to 360 thousand tons per year. They plan to expand the production capacity up to 520 thousand tons per year in around 2005, and seaborne transportation volume of clinker will increase to 490 thousand tons per year following the expansion plan.

(3) Silicon

FESILVEN and other enterprises exported 35 thousand of silicon in 1997. Silicon production capacity of FESILVEN is 50 thousand tons per year. Exportation volume of silicon is estimated to stay at 35 thousand tons per year because there is no expansion plan at present.

(4) Petroleum

Orinoco tar which is called "Orimulsion" was exported from Corpoven Port (Punta Cuchillo) in Puerto Ordaz until 1994. In 1994 an exporting terminal for Orimulsion was constructed at Jose which faces the Caribbean Sea and is located near the industrial area of Barcelona and Puerto La Cruz. Consequently all Orimulsion has been exported from Jose since 1994.

Export volume of crude oil was 3,940 thousand tons in 1997 according to MTC-INC statistics. In the future export volume is estimated to more or less maintain this volume considering the present loading capacity (3,000 thousand tons per year) at Corpoven Port.

(5) Others

In 1997 exportation volume of "Others" (see Table 4.4.7) was 27 thousand tons and importation volume of that was 81 thousand tons. Its commodity is not distinct but it is assumed to be industry related products or raw materials judging from enterprise name; VENALUM, CARBONORCA, HEVENSA and etc. Forwarding volume is estimated to stay at the same volume in 1997 because there are no particular projects or expansion plans of above enterprises.

4.6.6 Other General Cargo

(1) Consumer Products

Ciudad Bolivar Port along Orinoco River formerly handled consumer products. Angostura Suspension Bridge (toll bridge, four lanes, length:1,678 meter) was spanned across the Orinoco River at Ciudad Bolivar in 1967. Consequently, general cargo including consumer products turned to be transported by vehicle from Guanta Port which faces the Caribbean Sea through