— REVIEW —

A REVIEW OF PRODUCTION AND TECHNIQUE OF IRON AND STEEL INDUSTRY IN JAPAN 1956

Takeshi YAMAOKA

(Chief Secretary, Steel Technology Joint Research Society)

I. Introduction

The year of 1956 (Showa-31) that was benefited by the stel boom the highest since the end of the War-II was an epoch-making period for iron and steel industry in Japan. This is the first year when iron and steel industry of Japan determined to make an evolutionary jump and set out the first step. It means that the iron and steel industry as basis of industries in Japan began to perform the Second Iron and Steel Rationalization Program which consisted in expansion and rationalization of production equipment in response to enhancement of iron and steel demand.

Looking backward, the so-called First Iron and Steel Rationalization program that startd in 1951 (Showa-26) invested about 120 billion yens in total and the equipments in aim had been completed by turns and begun to operate since 1951 until 1955 (Showa-30). During this period, the First Program suffered a censure of "superfluous equipment" and was suppressed under so many difficulties. Nevertheless, it achieved the original ideal and perfectly developed its mighty potentiality. It must be remembered, moreover, that the prime power of development of Japanese iron and steel industry was derived from the sublime efforts of iron and steel engineering made for modernization of equipments, enhancement of product-quality, improvements in operation-efficiency and reduction of costs during this period. Anyone should confirm that the same situation would be met also in the new jump upward which began in 1956. A review of iron and steel industry in 1956 may be described as follows from the viewpoint of production and technique.

* Tetsu-to-Hagané (Jul. Iron & Steel Inst. Japan), Vol. 43, No. 1, pp. 77~80.

II. Iron and Steel Production in 1956

(A) Increasing demand for iron and steel:

A rapid rise of demand for iron and steel in 1956 was mentioned in the previous section. The fact

must be remarked, however, that it was not simply a temporary phenomenon but an anomaly which should be presumed an ordinary appearance and that the normal development of industries in Japan should be expected just by such situations.

The direct causes of enhancement of iron and steel demand are possible an extension of investment to equipments and an increased production of architectural and other durable consumable goods in parallel with general activities of Japanese economy in 1956. The fact that such causes brought an elevation of rapid rise of iron and steel demand is distinctly shown by various statistical indices in Table I.

Table I. Economic indices of Japanese indstries

	Monthly average in 1955 (A)	Monthly average Jan. to Sept. 1956 (B)	Sept. 1956	Ratio of Sept. vs. Monthly average 1955 (A/B)
1) Production index of mining industries (1934 ~1936=100%)	180.7	208.2	228.2	123.8
2) Production index of mecha- nical industries (1934~1936= 100%)	249.7	325.4	396.4	158.7
3) Orders accept- ed of machinery (Unit: million yen)	30,871	54,983	51,083 (Aug.= 75,640)	164
4) Number of tsubo (1.8m ²) area of houses built: Unit: 1,000 yen):				
a) Residence	445	356	535	120.2
b) Nonresidential	399	492	540	136

Note: 1), 2) and 3): data by Research Section, Economic Planning Board; and (4) data by Residence Bureau, Construction Ministry.

(*) Tetsu-to-Hangé (Jnl. Iron & Steel Inst. Japan). Vol. 43, No. 1, pp. 77~80.

(B) On the long-term iron and steel program:

The iron and steel industry should keep its stability and development so that it may fulfil its responsibility as the basis of Japanese industry and may contribute to smooth development of the latter. For such purpose, the iron and steel industry should proceed with a long-term perspective, but should not depend on a destiny like in the past. It was of significance from this viewpoint, that the Ministry of International Trade and Industry (MITI) planned to draft the "Long-Term Iron and Steel Program" (cf. Table II). This long-term program was based on an idea that the prospected demand of ordinary steel products should be limited at the expansion ratio of 6% per annum (provided that the expansion ratio per annum during years 1951~1955 would be 11.8%); and that an enhancement of iron and steel demand should be answered by expansion of the production.

According to this program, the scale of iron and steel industry in Japan should be expanded to about double of the present in 1965 (Showa-40) and to about triple in 1975 (Showa-50). When one recollects that the iron and steel industry today has been built up by toilsome labor of predecessors in the past some ten years, one would suppose how it would be difficult to expand this industry to double within only about ten years. Nevertheless, as far as it is an absolute imperative of the nation, the iron and steel industry of Japan are obliged to make efforts for its achievement with an extraordinary decision. Besides, this program reveals so many problems in future such as the supply of iron ore and other materials, the necessity of rapid establishment of increased blast furnaces and the enhanced dependence on converters.

Table II. Long-term program for iron and steel demand and supply (a draft)

Heavy Industries Bureau, MITI

15, May 1956

(Unit: 1,000 tons)

II-a: Prospect for pig demand and supply

Years	Demand		
	For steel-making	For foundry	Total
1956 (Showa-31)	5,350	750	6,100
1960 (Showa-35)	7,460	950	8,410
1965 (Showa-40)	10,650	1,270	11,920
1975 (Showa-50)	16,600	2,000	18,600

Years	Supply			
	B.F. pigs	Electric pigs	Other pigs	Total
1956 (Showa-31)	5,820	300	80	6,100
1960 (Showa-35)	7,980	350	80	8,410
1965 (Showa-40)	11,240	600	80	11,920
1975 (Showa-50)	17,520	1,000	80	18,600

II-b: Prospect for steel-ingot demand and supply. (Unit: 1,000 tons)

Years	Demand					
	Ordinary steel			Special steel		
	Dome- stic de- mand	Ex- port	Total	Dome- stic de- mand	Ex- port	Total
1956 (Showa-31)	7,390	1,950	9,340	533	37	570
1960 (Showa-35)	9,330	1,950	11,280	700	70	770
1965 (Showa-40)	12,480	1,950	14,430	980	100	1,080
1975 (Showa-50)	20,180	1,950	22,130	1,750	100	1,850

Years	Demand		Supply			
	Casting & forg- ings	Total	O.H. furn- ace	Con- ver- ters	Elec- tric furn- ace	Total
1956 (Showa-31)	510	10,420	8,700	420	1,300	10,420
1960 (Showa-35)	620	12,670	8,900	2,140	1,630	12,670
1965 (Showa-40)	790	16,300	9,850	4,300	2,150	16,300
1975 (Showa-50)	12,100	25,190	13,660	8,100	3,430	25,190

Note: (1) The ratio of domestic demand increase until the year of 1965 was supposed to be 6% for ordinary steel; 7% for special steel; 5% for for castings and forgings; and 6% for special steel.

(2) The export of ordinary steel is supposed to be unchanged in the year of 1956; The export of special steel, however, is presumed to be 10% of domestic demand in principle, but to become stable at 100,000 tons in the years of 1965 and later.

(C) Production:

As aforementioned, the actual and potential demand for iron and steel in 1956 (Showa-31) was very strong. On the contrary, on the side of supply Japan had recourse to a production increase by

1.7 million tons of ordinary steel products and a shipment increase by 0.7 million tons of steel products for domestic demands in parallel with lowering of iron and steel import as well as a supply increase depending on import promotion. However, since the effect of such increase of supply had appeared first in December, the year of 1956 may be said a year of steel-product shortage as a whole year.

II-c: Prospect of demand and supply of ordinary steel products by different species. (Unit: 1,000 tons)

Years	Bars & sec-tions	Wire rods	Strips	Plates	Sheets
1956 (Showa-31)	2,425 (419)	791 (231)	124 (50)	1,930 (180)	1,371 (435)
1956 (Showa-35)	2,924 (419)	848 (231)	144 (50)	2,175 (180)	1,805 (435)
1965 (Showa-40)	3,523 (421)	1,076 (248)	176 (51)	2,591 (180)	2,672 (465)
Years	Silicon steel sheets	Tin-plate	Tubes	Tyers	Total
1956 (Showa-31)	59 (1)	200 (24)	525 (100)	77	7,430 (1,440)
1960 (Showa-35)	74 (1)	281 (24)	636 (100)	93	8,980 (1,440)
1965 (Showa-40)	99 (1)	438 (24)	817 (100)	119	11,520 (1,490)

Note: (1) As for the domestic total demand is supposed to be 6% of the ratio of expansion for each year is supposed to be 6%.

(2) The numerals in parentheses are the quantity exported and included in the total.

(3) The export as a whole is supposed to have a trend on the level of the export prospect for year of 1956.

(4) The export of galvanized sheets is supposed to be made in the form of blank sheets and included within the export quantity of sheets.

With respect to situations of production increase, Table III indicates a comparison with the data of 1955 (Showa-30). By such wide increase of production, a supply enhancement of about 1.7 million tons (by steel products) was achieved.

Within the past some years, the iron and steel industry has established its position as an export industry and the iron and steel export presented a smooth extension, but under oppression of prosperous domestic demand incurred a decrease of export at last. While about 2 million tons of steel products were exported in 1955, the export situations such as

Table III. Iron and steel production

		1955 (A)		1956 (B)		Ratio of 1956/ 1955 (A/B) %
		Produc- tion	%	Produc- tion	%	
Pig Iron	B. F. Pigs	5,039,004	97	5,703,910	95	113
	Other pigs	177,762	3	283,194	5	165
	Total	5,216,766	100	5,937,104	100	115
	Pigs for steel-making	4,600,585	88	5,286,759	88	114
	Pigs for foundry	616,181	12	700,345	12	111
	Total	5,216,766	100	5,987,104	100	115
Ferro-alloys		209,648		276,415		132
Steel	Ordinary steel	8,852,342	94	10,252,525	92	116
	Special steel	555,353	6	853,861	8	154
	Total	9,407,695	100	11,106,384	100	118
	O. H. furnace steel	7,813,606	83	8,966,939	81	115
	Converter steel	406,690	4	448,937	4	112
	Electric furnace steel	1,187,399	13	1,690,510	15	143
	Total	9,407,695	100	11,106,386	100	118
	For rollings	8,993,115	96	10,524,384	95	117
	For foundry and forgings	414,530	4	582,002	5	140
	Total	9,407,695	100	11,106,386	100	118
	Ordinary hot-rolled steel products (incl. rerollings)	6,931,752		8,183,470		118
	Special steel rolled products	318,616		494,765		156
	Cast steel	144,390		209,723		143
	Forged steel	137,596		165,556		120

100,000 tons per month continued in 1956, totaling only to about 1.3 million tons per year. Besides, in June 1956, there occurred a really unexpected circumstance for iron and steel industry in Japan to take measures of an urgent importation of steel products for the sake of stabilization of steel demand.

Other than the aforementioned, some dispositions were done as counter-measures of supply and demand. Every measures, however were nothing but "some water poured on a heated stone" (a Japanese proverb). In fine, it was reconfirmed that the stabilization of supply and demand could be kept first by establishing a long-term program in future. Thence, the future measure were described as follows:

(1) Extension of equipments especially increased establishment of blast furnaces and converters, be-

cause the demand for iron and steel is being rapidly expanded year by year.

(2) The preservation of iron ore materials is projected by making investment to equipments in mines of South-eastern Asia, India, and Central and South America at the same time with extension of equipments.

(3) In future, Japan has a necessary tendency to acquire the iron ore in more distant places gradually. Therefore, iron ore carriers shall be constructed and freightage shall be cut in order to strengthen the international competition power of the iron and steel industry of Japan.

(4) Sand iron and pyrrhotite that have not been used as domestic iron resources shall be utilized for strenuous confirmation of iron resources.

It is expected to promote the aforementioned measures with all our might.

III. Iron and Steel Technique of Japan

(A) A review of iron and steel technique of Japan 1956:

When one observes the side of production and technique of iron and steel industry in Japan, preponderance has been laid mainly on production increase by reflection of a shortage of iron and steel. Therefore, in pig-iron making division, the operation record generally presented scarce change and the ore ratio as well as the coke ratio showed an upward tendency as a whole (Table IV).

Table IV. Operational records of blast furnaces (1956)

	Jan.	Feb.	Mar.	Apr.	May	June
Ore ratio	1,546	1,543	1,555	1,558	1,563	1,544
Coke ratio (mean)	717	707	723	718	729	729
Coke ratio (minimum among different furnaces)	662	617	651	672	671	660
Ratio of imported ore consumption	55.6	51.2	52.0	52.0	54.7	55.7
Ratio of sinter consumption	45.5	44.6	44.5	44.6	41.7	40.6
	July	Aug.	Sept.	Oct.	Nov.	Dec.
Ore ratio	1,564	1,573	1,568	1,568	1,535	1,541
Coke ratio (Mean)	736	736	738	740	723	721
Coke ratio (minimum among different furnaces)	671	615	691	691	687	651
Ratio of imported ore consumption	56.8	56.8	56.0	56.9	56.1	55.2
Ratio of sinter consumption	40.6	40.6	41.2	40.3	4.1	42.3

Operational record of open hearth furnaces

Month 1956	Heat consumed per ton sound ingots 10 ³ K cal/T			
	Total mean	C-gas fired (molt. pig)	Oil-fired	
			(molt. pig)	(cold pig)
Jan.	1,072	877	959	1,345
Feb.	1,035	820	912	1,299
Mar.	1,054	834	941	1,302
Apr.	1,019	801	905	1,294
May	1,033	831	934	1,300
June	1,040	810	930	1,290
Jan.	1,065	840	922	1,318
Aug.	1,053	775	931	1,325
Sept.	1,057	832	928	1,335
Oct.	1,053	833	948	1,279
Nov.	1,021	827	907	1,216
Dec.	1,039	902	930	1,890
Month 1956	Pig ratio (excluding pig scraps)			
	Total mean	C-gas fired (molt. pig)	Oil-fired *	
			(molt. pig)	(cold pig)
Jan.	48.3	58.5	53.6	30.1
Feb.	47.9	59.4	53.9	30.5
Mar.	48.3	59.0	54.8	31.4
Apr.	46.0	53.5	51.5	30.5
May	47.3	54.8	53.6	31.2
June	48.4	59.5	53.3	33.0
July	47.6	58.1	53.1	32.4
Aug.	49.6	65.6	54.4	32.2
Sept.	49.7	64.1	54.3	31.3
Oct.	49.6	60.8	56.2	32.8
Nov.	50.7	66.0	57.4	31.7
Dec.	51.2	64.4	57.6	34.6
Month 1956	Sound ingot production per hr steelmaking time (t/H)			
	Total mean	C-gas fired (molt. pig)	Oil-fired (*)	
			(molt. pig)	(cold pig)
Jan.	11.7	17.4	12.9	8.4
Feb.	11.8	17.1	13.6	8.6
Mar.	11.8	17.9	13.1	8.6
Apr.	12.1	18.5	18.3	8.5
May	12.0	18.4	13.1	8.5
June	11.9	17.9	13.9	8.5
July	11.7	17.4	14.0	8.5
Aug.	11.9	18.5	14.1	8.5
Sept.	11.9	17.1	14.3	8.5
Oct.	12.1	17.7	14.6	4.0
Nov.	12.5	18.6	14.9	9.4
Dec.	12.6	17.6	14.9	9.7

Note: (*) Excluding "acid furnaces".

* On the side of materials, pretreatment (beneficiation) of ores was preferred and efforts were made to utilize domestic iron resources such as pyrite which the heretofore silica ceiling was modified into "zebra"

laying and basic-brick structure. Besides, the technique of steelmaking with top-blown converters attracted extraordinary attention, because of establishment of technical cooperation concerned. On the side of finished products, production of electrolytic tin-plate was smoothly extended and light-weight sections appeared and so the fields of steel product demand were further expanded.

Moreover, instrumentation for production process in general was more distinctly popularized and the way of automatic control was strikingly extended so that one can observe that an enhanced rationalization of quality control and operational control had been accelerated. Besides, in special steels, the technique of high-quality heat-resisting steel showed progress in company with development of aircraft industry.

Furthermore, in the division of electric pig manufacture, gas utilization with the tightly closed furnace was performed and thus presumably a new way for the pig-making with an electric furnace was opened. Also, as for utilization of atomic power, fairly positive projects were realized in research division of various fields.

(B) The Steel Technology Joint Research Society:

The Steel Technology Joint Research Society (Tekko-Gijutsu-Kyodo-Kenkyukai) became full of more potentialities. Many research meetings were held by respective divisions of Pig-making, Steel-making, Steel Products, Special Steel, Quality Control and Heat Economy to make research and discussions on respective central themes. Besides, in autumn 1956, a Research division was established and entered a study of iron ports. Some subjects of atomic power utilization are under examination so that they may be dealt with by the same division. Besides, in order to make research on overseas situations relating to technical controls (such as quality control, production control, energy control, inspection and technical service), a Steel Technical Control Study Team decided to be despatched overseas in January 1957 in the form of a team of Japan Productivity Center as cooperator.

(C) Technological Cooperation:

Introduction of overseas steel-production techniques showed some activities in 1956. Examples are a cooperation of Nippon Kokan K.K. (Nippon Steel & Tube Co., Ltd.) with Alpiné-Montan A.G. (Austria) relating to the steelmaking with a top-blown converters, a cooperation of Sumitomo-Kinzoku-Kogyo K.K. (Sumitomo Metal Industries, Ltd.) and K.K.

Kobé-Seikoshō (Kobe Steel Works, Ltd.) with Compoir d'Étirage et Profilage des Métaux (France) relating to hot extrusion with glass lubricant, a cooperation of Yawata Seitetsu K.K. (Yawata Iron & Steel Co., Ltd.) with American Can Co. relating to can-making technology in general, a cooperation of Nihon Teppan K.K. (Japan Iron Sheet Co., Ltd.) with Tadeusz Sendzimir (U.S.A.) and, as for refractories, cooperations between Shinagawa-Shiorenka (Shinagawa White Bricks Co., Ltd.) and Merz A.G. (German) and between Kurosaki Yogyo K.K. (Kurosaki Ceramic Industry Co., Ltd.) and Didia Werke (Germany). These technological cooperations are an introduction of the world's top technologies for iron and steel production and presumably contribute much to improvement in engineering.

At the occasion of technical importation of the top-blown oxygen steelmaking process, all steel firms showed a cooperative behavior and Nippon Kokan K.K. as representative made negotiations to acquire a general licency. By such means, the purpose of technology introduction was achieved with much benefit from the viewpoint of the nation. Such examples indicated a new way of technological cooperations that had been liable to lead to competitions of no use, and simultaneously expressed a cooperative attitude of Japanese iron and steel industry towards Japanese and foreign countries. Really their significance was so marvellous. The introduction of hot extrusion technique had been a problem for the past some years and a new domain was opened in steel fabrication engineering by importation of this process. Besides, technological cooperations were projected with respect to continuous steel-casting process and vacuum ingot-making process but could not reach an agreement and were brought over to 1957.

IV. Equipments for Iron and Steel Making

(A) Extended rationalization program:

The basic counter-measures for rapid enhancement of iron and steel demand are additional establishment and rationalization of equipments for long-term increasing production. This is the single measure that can respond to economic development of Japan. Along the world's tendency of increasing demand for iron and steel, all of steelmaking countries making progress in projects of equipment expansion. As for the iron and steel industry in Japan, the new expansion program is indispensable condition for the sake of securing its position in the international market as well as for the sake of securing the supply of necessary basic materials for expansion and development of Japanese economy. The year of 1956

(Showa-31) was the year to establish and to invest for this new equipment rationalization program. Although the whole aspects had not been distinct, it was predetermined in general that about 200 billion yens should be invested until 1960 (Showa-36) among which about 40 billion yens should be paid by March 1957.

(B) Equipment constructions in 1956:

What were the equipment capacities of iron and steel industry in Japan when the realization of First Rationalization Program had been completed. To indicate the approximate figures at the end of 1955 (Showa-30), the capacity of pig iron production was stated 6.29 million tons, that of steelmaking 9.67 million tons, and that of rolling 10.14 million tons for semi-finished products, 14.53 million tons for finished products and cold-rolled sheets.

As aforementioned, a new rationalization and increased establishment were started in 1956, of which the details are as follows: The equipments perfected in 1956 are the rolling mill for special wire rods in Kobe, and the reversible cold-strip mill in Daido Kohan K.K. (Daido Steel Plate Co., Ltd.) The equipments under construction in pig iron making field are No. 2 blast furnace of Amagasaki Seitetsu K.K. (Amagasaki Iron Mfg. Co., Ltd.) to be newly established and No. 2 blast furnace of Kokura Plant of Sumitomo Metal Industries, Ltd. The equipments under construction in steelmaking field are top-blown converters to be newly installed by Yawata Iron and Steel Co. and Nippon Steel & Tube Co. The equipments under construction in rolling field are the plate mill for new establishment in Yawata Iron & Steel Co., the hot-strip mill for new installation in Muroran Works of Fuji Iron & Steel Co., the heavy section mill to be rear-ranged by Kamaishi Works of the same Company, the medium tube mill to be newly established by Nippon & Steel Tube Co., the hot- and cold-strip mills for new installation in Chiba Works of Kawasaki Seitetsu K.K. (Kawasaki Steel Corp., Ltd.) and the Sendzimir mill to be newly built

by Nihon Teppan K.K. All of them were continued to accelerate construction. In the special steel field, every firm renovated or additionally established the equipments at once by instigation of the boom and showed brilliant activities. Besides, in the field of electric pig iron, some additional installations, especially construction of large-type electric furnaces were set out.

The aforementioned are only the outline of main equipments that showed distinguished construction, all of which had been projected with the long-term perspective. Moreover, they have a great significance characterised not by a simple repairing of equipments, but by their aiming at a fundamental rationalization so that their perfection is expected.

V. Problems for 1957

The year of 1956 was a year of decision for and the start of renewed jump upward of iron and steel industry of Japan. Now, 1957 would be the year for actual performance. There are so much bright perspective in the situations around iron and steel industry in continuation to last year. At the same time, its responsibility imposed is important.

The problems for 1957 are imposed as follows:

(a) In order to answer for increasing demand for iron and steel, it is must rapidly take an attitude of production enhancement.

(b) In response to the rapidly proceeding side-rrgical technique of the world, it must make efforts to rationalize equipments and to improve techniques for the sake of producing iron and steel of lower cost and better quality.

(c) It must began to develop overseas for the sake of securing the material of iron and steel.

Against the aforementioned difficult problems, every one should believe in that the iron and steel engineers who have supported iron and steel industry of Japan for the past some ten years would fulfil their responsibility also in the year of 1957.