— R E V I E W —

1959 PERSPECTIVE OF PRODUCTION AND TECHNIQUE
OF IRON AND STEEL IN JAPAN

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I. Introduction

On looking backward, the year of 1959 was probably the most fortunate year. By favor of a rapid recovery of the world economy, the depressed conjuncture of iron and steel industry in Japan through the year of 1958 was immediately changed into better circumstances at the beginning of 1959. Besides, benefited by situations of raw materials, the industry passed the year without narrow pass. During the while, the iron and steel industry stood under full-operation conditions also by the reason of starting the new equipments based on the rationalization program. Was this prosperity due to only a simple fortune? It may be said, however, that incessant efforts upward and accumulation of technical improvements were the origin of this prosperity and its conservation. The iron and steel production technique in 1959 may be reviewed as follows from aspects of production, technique and equipment :

II. Production

(1) Advance to the World's Fifth Position.

In 1958, Japan kept the 6th position in steel production following U. S. A., U. S. S. R., West Germany, United Kingdom and France. In 1959, however, Japan finally surpassed France, occupying the 5th position in the world. The production trend showed a continuous increase from the beginning of the year and attained to 16.63 million tons on crude steel basis through the year. At the beginning of 1959, some manufacturers encountered a strike in the rolling department and it caused a temporary slow down in rolled steel production. Nevertheless, because there was no deceased production in the steelmaking field, the recovery was easy. This increased production was presumably made possible by a smooth extension of pig iron production and unexpected mitigation of scrap situations.

In the mean time, the "open sales" system was modulated since July 1959 from a depression counter measure to a boom counter measure and well revealed its function for a smooth supply of steel products and a prevention of price increase during the boom time. Table I showed the pro-

Table I. Production trends of blast furnace pig, steel ingots
and hot-rolled steel products of ordinary steel

(Unit : t)

		Jan. 1959	Feb.	Mar.	Apr.
Blast furnace pig.		662,749	627,345	657,062	674,412
Steel ingots		1,157,515	1,151,021	1,217,556	1,224,741
Hot-rolled steel ingots of ordinary steel (in general)		799,644	815,508	714,364	780,156
Species for open sales	Heavy plates (incl. medium)	184,966	190,661	155,319	176,043
	Middle sections.	33,123	35,744	33,278	40,642
	Middle bars.	5,349	7,219	7,511	7,458
	Light bars.	109,290	121,581	102,012	113,296
	Ordinary wire rods.	64,690	63,840	63,361	54,051
	Sheets	156,922	158,779	132,211	140,215

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Table I-Continued

(Unit : t)

		May	June	July	Aug.	Sept.
Blast furnace pig.		740,766	732,377	748,173	742,654	755,867
Steel ingots		1,391,554	1,358,797	1,411,209	1,493,096	1,456,738
Hot-rolled steel ingots of ordinary steel (in general)		1,004,857	985,741	993,047	1,024,775	1,058,605
Species for open sales.	Heavy plates (incl. medium)	245,088	229,899	234,111	254,128	266,519
	Middle sections.	53,731	52,422	55,907	54,314	59,799
	Middle bars.	8,775	9,156	8,159	9,173	10,089
	Light bars.	131,060	136,266	126,510	122,365	129,770
	Ordinary wire rods.	70,339	73,378	70,353	70,183	76,621
	Sheets	175,997	168,930		577,780	

Table I-Continued

(Unit : t)

		Oct.	Nov.	Dec.	Total
Blast furnace pig.		839,219	850,061	880,000	8,910,685
Steel ingots		1,575,001	1,580,514	1,650,000	16,667,742
Hot-rolled steel ingots of ordinary steel (in general)		1,144,515	1,126,087	1,150,000	11,597,299
Species for open sales.	Heavy plates (incl. medium)	274,205	264,617	270,000	2,745,556
	Middle sections.	61,274	64,128	65,000	609,362
	Middie bars.	8,976	10,240	11,000	103,105
	Light bars.	145,148	147,842	150,000	1,535,640
	Ordinary wire rods.	85,060	79,773	80,000	851,649
	Sheets	207,790	207,790	210,000	2,136,414

Remarks : Export is contained in production of steel products.

duction of ordinary steel products in 1959.

(2) Future Steel Demand.

At present, the trend of iron and steel industry was given much stress as forerunner of economic movements in general. Above all, investment trend of iron and steel industry would attract much interest sometimes as indicator to an overheating or a drop of conjuncture. Supposition of the future steel demand has a significance as a milestone of future iron and steel industry. As part of this supposition, the Japan Iron and Steel Federation studied and projected "The Review of Iron and Steel Demand in the Fiscal Year of 1970." Its conclusion told that the steel demand in the year of 1970 should be 34 million tons for domestic consumption, 4 million tons for export and 38 million tons for total demand on crude steel

basis. As compared with the actual figures of 1959, the steel demand would be more than double after 11 years. Incidentally, the predicted crude steel production of Japan (37.5 million tons for the years 1972-1975) supposed previously by Steel Committee of Economic Commission of Europe remarkably agrees with the aforementioned.

In order to continue production in correspondence with thus increasing steel demand, many problems are involved such as securing the overseas raw materials, rational investment to equipments and development of new techniques. More and more efforts in future would be needed assuredly along this line.

III. Technique

Much progress was observed in 1959 with variety

Table II. Operational results of blast furnaces

	1958 Monthly Average	Sept. 1950	Oct.	Nov.	Dec.	Jan. 1959	Feb.
Ore ratio.	1.530	1.530	1.544	1.529	1.528	1.529	1.522
Coke ratio (mean)	664	651	646	640	638	645	639
Coke ratio (minimum among respective furnaces)	525	576	585	525	546	557	551
Use of imported ores (%)	44.9	42.5	41.0	45.1	45.3	45.1	46.4
Use of sinter (%)	52.6	55.5	57.2	52.5	52.3	52.7	51.4

	Mar. 1959	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1959 Monthly Average
Ore ratio	1.530	1.524	1.515	1.512	1.513	1.517	1.538	1.524	1.503	1.553	1.519
Coke ratio (mean)	648	635	627	621	629	633	636	628	623	639	632
Coke ratio (minimum among respective furnaces)	553	545	546	543	533	550	567	549	550	551	533
Use of imported ores (%)	47.9	49.2	47.7	49.4	47.8	48.3	49.8	51.3	54.1	52.8	49.4
Use of sinter (%) (Include pellet)	50.1	48.6	50.2	48.7	50.2	49.5	48.3	46.7	44.1	45.3	48.6

Table III. Operational results of open hearth furnaces

Months	Heat consumed per ton sound ingot				Pig ratio (excl. iron scraps) (%)				Production of sound ingots per steelmaking time				Oxygen used per ton steel pro- duced m³/t
	Total ave- rage	Coke- gas fired (Molten pig)	Oil-fired		Total ave- rage	Coke- gas fired (molten pig)	Oil-fired		Total ave- rage	Coke- gas fired (Molten pig)	Oil-fired		
			(Molten pig)	(Cold pig)			(Molten pig)	(Cold pig)			(Molten pig)	(Cold pig)	
1958 Average	859	669	704	1, 293	58. 1	65. 9	65. 2	35. 4	15. 2	21. 6	19. 0	9. 1	18. 0
1958 July	845	663	692	1, 299	57. 1	63. 6	65. 1	34. 2	15. 4	21. 7	19. 7	8. 7	17. 9
Aug.	810	650	627	1, 297	57. 1	61. 7	66. 5	33. 8	15. 6	21. 1	20. 7	8. 9	19. 4
Sept.	807	651	632	1, 267	56. 8	63. 7	65. 7	32. 1	15. 8	21. 1	21. 0	9. 3	18. 7
Oct.	788	548	637	1, 288	57. 6	67. 1	64. 8	34. 0	15. 6	24. 3	20. 3	9. 0	22. 5
Nov.	813	555	651	1, 300	57. 6	63. 9	66. 1	34. 2	15. 6	22. 7	20. 2	9. 3	20. 8
Dec.	792	637	622	1, 324	58. 5	64. 4	66. 0	33. 9	16. 4	23. 1	20. 8	9. 4	20. 2
1959 Jan.	805	692	618	1, 326	57. 4	64. 6	64. 2	34. 5	16. 3	22. 8	20. 9	9. 4	20. 8
Feb.	797	643	601	1, 320	53. 8	61. 0	60. 3	33. 7	16. 0	24. 0	20. 5	9. 3	20. 3
Mar.	802	574	626	1, 272	53. 5	67. 3	58. 5	35. 6	16. 2	27. 6	20. 3	9. 9	21. 3
Apr.	813	533	692	1, 249	53. 2	70. 0	57. 0	33. 1	15. 6	28. 7	17. 9	9. 9	18. 8
May	760	500	640	1, 253	54. 5	72. 1	58. 0	32. 7	16. 4	28. 3	19. 5	9. 6	21. 2
June	771	567	659	1, 256	54. 9	67. 5	58. 3	33. 1	16. 4	25. 5	18. 7	9. 8	20. 2
July	784	549	622	1, 280	54. 1	64. 4	58. 2	33. 4	16. 4	26. 7	19. 4	9. 8	20. 8
Aug.	744	523	632	1, 255	54. 0	63. 3	57. 1	33. 7	16. 6	29. 2	18. 1	9. 7	22. 5
Sept.	762	519	691	1, 273	53. 3	61. 6	55. 6	34. 3	16. 5	31. 0	16. 5	9. 6	22. 0
Oct.	736	508	640	1, 222	54. 9	65. 2	56. 5	37. 4	16. 9	30. 1	18. 3	9. 9	22. 9
Nov.	745	588	613	1, 223	55. 3	60. 6	59. 9	37. 1	17. 2	24. 9	20. 4	10. 1	22. 1
Dec.	764	568	642	1, 283	54. 5	63. 0	57. 7	37. 2	17. 0	27. 0	18. 6	9. 9	21. 5
1959 Average	771	555	643	1, 267	54. 5	64. 1	58. 4	34. 7	16. 5	27. 4	19. 1	9. 7	21. 2

of technique surrounding iron and steel industry. At first, enforcement of the metric system at the beginning of the year brought a change in measuring technique, while eventually occurred problems of water pollution became a great stimulus to technique of waste-water disposal. In continuation to the last year, invigoration of research facilities was performed successively in respective firms as well as efforts were made to develop new techniques and new products. The main problems common to respective firms were disposal of waste water from plants, effective utilization of waste gas from blast furnaces or coke ovens and research or investigation into "direct reduction" process. Vacuum-melting and -casting technique entered a stage of actual utilization, proving good results. Besides, in Autumn, a research mission was dispatched to study actualities of iron and steel technique in Europe. This mission performed a systematic investigation into the research organization, control technique and development of new techniques, achieving much crops.

As for the siderurgical technique, in the pig iron field, the ratio of imported ore consumption was gradually increased in reflection of the tendency of production increase, while the production of domestic sinter revealed a trend of the flattened curve. On the other hand, the oxygen-enriched operation with self-fluxed sinter made more progress, while the coke ratio was, although a little, lowered. Moreover, the coefficient of furnace-utilization was gradually increased, until it became a common sense to drop down below 1.0 m^3 . (Table II).

The use of oxygen in open hearth furnaces reached a level of $20 \text{ m}^3/\text{t}$ through the year and the unit consumption of fuel revealed a tendency of decrease. The number of converters operated by pure oxygen amounted to 6 units and the techniques of oxygen utilization in steelmaking was eventually reaching the stage of perfection. (Table III). As for the rolling technique, a progress was made with instrumentation and, in company with starting operation of new equipments, an advancement was shown in improvement of heat efficiency and in promoting efficiency of rolling operation. Moreover, in the field of products, progress of new products was prominent. Therefore, the light-weight sections advanced rapidly and also

expanded metals, corrugated pipes, spiral pipes surface-treated steel sheets were successively transferred to production.

(3) Activities of Steel Technology Joint Research Society.

The Steel Technology Joint Research Society (Tekko Gijutsu Kyodo Kenkyukai) made active joint study also in 1959 and its 8 divisions such as Pigmaking, Steelmaking, Steel Products, Special Steel, Heat-Economy Technique, Quality Control, Research and New Technique Development performed investigations and discussions respectively based on their themes. Activities of respective divisions were reviewed as follows:

The Pigmaking division progressively examined the utilization of self-fluxing sinter and the oxygen-enriched operation, while the Steelmaking division performed synthetic investigation into the technique to use oxygen. The Steel Products division made examinations around quality of products and improvement in the yield, while the Special Steel division proceeded examinations around ingot-making technique. On the other hand, the Quality Control division achieved the purpose of popularization of quality-control technique and then proceeded studies on new themes, while the Heat-Economy Technique division discussed various measures of automation. Moreover, the Research division examined the status of utilization of plant water, while the New Technique Development division receeded basic studies on two themes of direct production and vacuum metallurgy.

(3) Importation of Overseas Technique.

Nine themes (A-class) were signed in contract for importation of overseas technique during 1959. (Table IV). Three contracts were counted for importation of technique relating to a Sendzimir mill, among which two contracts concerned manufacture of small-size electromagnetic materials. Importation of the vacuum-casting method based on Dortmund process was expected for its development because of its possibility of treating the molten steel on a large scale. As shown in introduction of various techniques into Japan such as relating to the manufacture of Unionmelt compositions, sintering equipments, cans, wheel-abrators, and steel-tube structures, it was observed that most of importations of overseas techni-

Table IV. Importation of overseas technique in 1959 (A-Class)

Japanese Firms in Contract	Overseas Firms in Contract	Contents of Contract	Terms	Date of Authorization
Osaka Transformer Co.	Union Carbide Co.	Technique relating to manufacture of Unionmelt compositions.	5 years	9, May. 1959
Yawata Iron & Steel Co., Ltd.	Dortmund-Hölder Hüttenunion.	Technique of degasing and simultaneously refining molten steel in vacuum.	Until 31. Dec. 1970	7, July. 1959
Iwai & Co., Ltd and Nippon Metal Industry Co., Ltd	Tadeuz Sendzimir.	Technique relating to use of the Sendzimir cold-rolling mill.	During term of patent.	21, July. 1959
Iwai & Co., Ltd and Nippon Kogyo Co., Ltd	ditto.	ditto.	ditto.	ditto.
Iwai & Co., Ltd and Sumitomo Metal Industries, Ltd.	ditto.	ditto.	ditto.	ditto.
Iwai & Co., Ltd and Sumitomo Machinery Co., Ltd.	ditto.	ditto.	ditto.	ditto.
Sumitomo Machinery Co., Ltd.	Koppers International Co.	Technique relating to continuous sintering equipment.	8 years.	18, Aug. 1959
Toyo Seikan Co., Ltd and Hokkai Seikan Co., Ltd	Continental Can Co.	Technique relating to manufacture of cans.	Until 31. Dec. 1969	1, Sept. 1959
Kubota Iron & Machinery Works, Ltd	Wheel Abrator Co.	Technique relating to manufacture of wheel abrator.	9 years.	6, Oct. 1959
Sumitomo Metal Industries, Ltd.	Mannesmann Co.	Technique relating to manufacture of steel-tube structures.	10 years.	6, Oct. 1959

ques had changed their purposes to the field of fabrication processes. On the other hand, importations of techniques of B-type (Table V), amounted to about 40 items with reference to purchase of blue prints and invitation of engineers, among which were contained those items of technical importance such as continuous galvanizing technique and technique of manufacturing Corten steel. Typical items among them are cited in Table V.

With respect to exchange of techniques, the visits to Japan of Mr. James B. Austin, vice-president of United States Steel Corporation (May 1959) and Mr. Marc Allard, director general of l'Institut des Recherches Sidérurgiques of France (Oct. 1959) were memorable facts for us.

IV. Equipments

(1) Progress of the Second Rationalization Program.

Equipment programs of respective firms in the

Second Rationalization Program showed a smooth progress by favor of a high boom and their important parts were perfected to add new powers in iron and steel industry of Japan. For instance, Tobata Works of Yawata Iron and Steel Co., Ltd. finished its first stage constructions and prepared itself for its behavior of integrated steel manufacture by starting operation of a 1,500 t blast furnace and two units of LD converters (Sept. 1959). Besides, the Mizunoé Iron Works of Japan Steel and Tube Co., Ltd. started operations of a blooming mill, a hot-strip mill and a cold-reversing mill (Sept. 1959) and thus will finish the initial program in first months of 1960. On the other hand, the Hirohata Iron Works of Fuji Iron and Steel Co., Ltd. was equipped with a continuous annealing equipment (June 1959), while Fukiai Works of Kawasaki Steel Corporation, Ltd. completed a Sendzimir mill for rolling silicon steel

Table V. Importation of overseas techniques in 1959 (B-Class)

Japanese Firms in Contract	Overseas Firms in Contract	Contents of Overseas Techniques
Daido Steel Sheet Mfg. Co., Ltd.	Armco International Corp.	Manufacturing technique of galvanized sheets by means of a continuous process.
Sumitomo Metal Industries, Ltd.	Gutehoffnungshütte Aktiengesellschaft.	Blue prints of 5 units of the hot-metal mixer cars.
Yawata Iron and Steel Co., Ltd.	Draver Co.	Blue prints, materials list and technical data relating to heat-treating equipment for heavy gauge plates.
Fuji Iron and Steel Co., Ltd.	United States Steel Corp.	Manufacturing technique of high-tensile low-alloy Corten steel.
Sumitomo Metal Industries, Ltd.	Friedrich Krupp A. G.	Technique relating to design and manufacture of 2 units of 40-t pureoxygen-top-blown converters.
Yawata Iron and Steel Co., Ltd.	Blaw-Knox Co.	Construction of a Sendzimir system continuous galvanizing line.
Osaka Shipbuilding Co., Ltd.	O. Sullivan Rubber Co.	Manufacturing technique of laminated plates of vinyl and metals.
Kawasaki Steel Corp.	Electric Furnace Co.	Installation, setting-up and adjustment of a continuous annealing equipment; and technical guidance relating to start operations,
Ishikawajima Heavy Industry Co., Ltd.	U. S. Steel Export Co.	Blue prints of AB-type electric furnaces.

strip (Nov. 1959). The Rolling Stock, Foundry and Forging Division of Sumitomo Metal Industries, Ltd. completed a rolling equipment for solid wheels (May 1959), while the Wakayama Works of the same firm started operation of a blooming mill (Dec. 1959). In Toyo Kohan Co., Ltd., moreover immediately after starting operation of a tandem cold mill, an electrolytic tinning line No. 2 commenced operation (Dec. 1959).

As for special steel equipment, following a start of operation of a 30-t electric arc furnace in Mitsubishi Steel Co., Ltd. a number of new electric furnaces successively commenced their operation, while a Sendzimir mill was completely installed at Kawasaki Plant, Nippon Yakin Kogyo Co., Ltd. for rolling stainless sheets (July 1959). Hot-extrusion equipments were completed respectively at Steel Tube Plant of Sumitomo Metal Industries, Ltd. (Jan. 1959), Shikama Plant of San'yo special Steel Co., Ltd. (Dec. 1959) and Yawata Works of Yawata Iron and Steel Co., Ltd. (Dec. 1959), cutting open a new road for steel tube manufacture.

In the field of foundry and forging equipment, vacuum casting equipments were respectively

commenced for operation at Wakihamma Plant of Kobe Steel Works, Ltd., Nagasaki Plant of Mitsubishi Steel Mfg Co., Ltd. and Muroran Plant of the Japan Steel Works, Ltd. (June 1959).

Beside these equipments, it was characteristic of 1959 that new installation of electric furnaces for ordinary steel and perfection or going into commission of ore carriers were marked. New installation of electric furnaces was owing to a favor of good boom and comparatively better conditions of scraps and electric power, while such tendency would leave some problems in future. As for ore carriers, in addition to 11 ships (among which 10 ships were bulk carriers) in 1958, more 5 ships went into commission anew during 1959.

(2) Supplementation of the Second Rationalization Program and the Third Rationalization Program.

As aforementioned, a considerable part of the initial target of the Second Rationalization Program was completed during 1959, while all of these equipments were only basic, but had not become perfect. In consequence, at the stage today, it is urgently necessary to make further addition

thereto in order to realize perfect pictures. Under such circumstances, the additional project to the Second Rationalization Program as well as the succeeding Third Rationalization Program were planned up and released in public by respective firms. These various programs were supposed to be difficult as they were because of difficulties in fields of financing and raw materials. Therefore, their coordination were expected to be carried over to the year of 1960.

V. Hopes for 1960

When we observe the iron and steel industry today that have made a rapid development and when we dream of a future dash forward of Japan as iron and steel producing country of the first class in the world, we would like to entertain some hopes of a steel engineer. They are nothing but a development of techniques of Japanese origin as well as a promotion of joint research concerned.

Promotion of vivid research activities is a sup-

port of a long prosperity of iron and steel industry and its importance has become higher and higher. We would like to invigorate further the research activities which have been promoted now in various fields and, if desirable, to expect for development of new techniques or, further, development of Japanese original techniques.

From the perspective of research behaviors, we would like to proceed, if a little forward, the behavior of joint research. A number of learned persons have already laid stress on advantage of joint research. Nevertheless, various difficulties to be met on the way toward there shall be exactly recognized and thus a steady progress shall be performed. We would like to maintain a long prosperity of iron and steel industry by keeping friendly cooperations in the research behaviors, the production techniques, the procurement of raw materials and the performance of production.