Circulation of Steel Resources in 2030

Estimation of scrap supply and demand, electric furnace domestic demand ratio, and circular steel ratio

Tokyo Steel Scrap Research Team

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<Preface>

Japan has a long history of being the world's largest producer of steel. This has led to its accumulation of 1.4 billion tons of steel, which is referred to as "urban mines." Because of this huge steel accumulation, a large amount of scrap iron that the country should be proud of before the world is produced every day.

However, not a few research institutes are pessimistic rather than proud of this extremely favorable environment. They say, "The amount of scrap generated in Japan (44 million tons[1]) is only about half of the amount of crude steel produced (87 million tons)." Even industry associations and state agencies stress the shortage of scrap, saying, "From the viewpoint of scrap procurement, there will be a limit to future expansion of electric furnaces."

However, the domestic demand for steel raises the suspicion that this is a one-sided view. This is because domestic demand for steel in fiscal 2023 was 54 million tons, while the amount of scrap generated was 44 million tons. Although a simple comparison cannot be made, the amount of scrap generated in Japan is as high as 81% of the domestic demand for steel.

Therefore, we decided to examine in detail whether there is a sufficient supply of scrap to meet the demand for scrap, taking into account the types of scrap, when scrap is not exported (about 7 million tons are actually exported every year); that is, when scrap generated in Japan is fully utilized.

Tokyo Steel is an electric furnace steel manufacturer that purchases the largest amount of scrap iron from the market in Japan and is also a steel manufacturer that can recycle scrap iron into a wide variety of products. It is proud that it has more knowledge about recycling scrap iron than any other company.

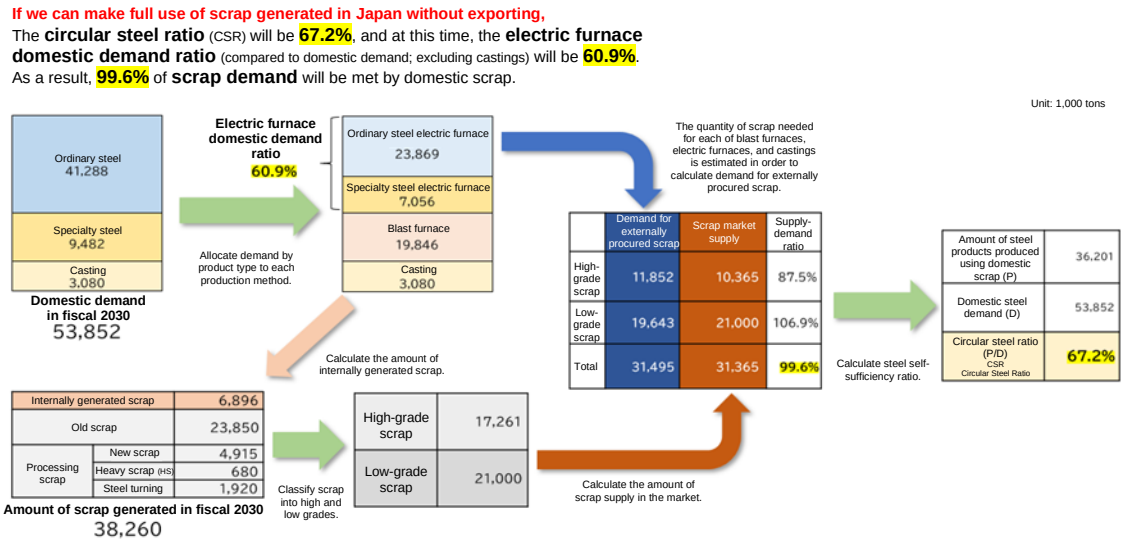
In this report, we estimated scrap supply and demand, the electric furnace domestic demand ratio, and the circular steel ratio (CSR) in detail, taking advantage of our expertise in understanding both the types of scrap needed for each type of steel and the types of scrap that are generated daily in Japan. CSR is a concept uniquely defined by Tokyo Steel and represents the percentage of steel products produced domestically that are derived from domestically generated scrap iron[2].

Our calculations, described below, revealed that CSR in fiscal 2030, taking into account the announced investments in electric furnace equipment, would be 67.2%. This means that 67.2% of steel products in Japan can be made from domestically generated scrap iron. Considering that CSR in the United States is about 60-70%, it is clear that CSR in Japan and the potential of electric furnaces are high. At this time, 99.6% of the total demand for scrap iron is supplied, and when broken down into high and low grades, the supply rate is 87.5% for high-grade scrap and 106.9% for low-grade scrap.

We hope that this report will help you to recognize once again that electric furnace steel products with low carbon dioxide emissions during production have great potential in terms of domestic resource recycling and contribute to the formation of a better country.

[1] This is a figure for fiscal 2023. All figures shown in the preface are for fiscal 2023 unless otherwise specified.
[2] CSR represents how much steel products are produced from domestic scrap iron (numerator) relative to domestic steel demand (denominator). CSR is an indicator that emphasizes the degree of resource recycling. For example, steel products manufactured from overseas sourced raw materials (iron ore, coking coal, and imported scrap) are excluded from the numerator (production volume). For details, see text "2-C."

Circulation of Steel Resources in Japan in 2030



1. Introduction

<Purpose of this report>

In October 2024, the Ministry of Economy, Trade and Industry established the Study Group on Green Steel to consider issues toward decarbonization of the steel industry. It is generally known that smelting scrap using an electric arc furnace (EAF) is a promising method for decarbonization of the steel industry, and it is actually mentioned at meetings of the Study Group on Green Steel as well.

On the other hand, the Study Group on Green Steel argues that the amount of scrap supplied is a bottleneck in promoting decarbonization through the electric furnace process[3].

Since scrap iron is used as a raw material in the current electric furnace process, the amount of steel production is limited by the supply of scrap iron.

The annual amount of scrap iron supplied in Japan is approximately 44 million tons, of which 6.85 million tons are exported overseas. Even if there were no overseas exports, the amount would be half of crude steel production in Japan (approximately 87 million tons), and the electric furnace process alone would not be able to meet steel demand in the country.

[3] *Summary by Study Group on Green Steel for Green Transformation*. Study Group on Green Steel.https://www.meti.go.jp/shingikai/mono_info_service/green_steel/pdf/20250123_2.pdf(Accessed November 18, 2025)

In this report, we defined steel demand as domestic steel demand[4] and discussed it from the perspective of domestic steel self-sufficiency.

The self-sufficiency rate is generally calculated by dividing domestic supply by domestic demand[5]. However, when considering the self-sufficiency rate of steel products, it is necessary to consider how to define the numerator (supply) as well. First of all, it is necessary to distinguish whether scrap is imported or generated domestically as shown in the fact that the numerator of the self-sufficiency rate by food item is “domestic” production volume (this point is also taken into consideration by the Study Group on Green Steel). In general, the supply of scrap tends to increase in developed countries, and there is a shortage of scrap in emerging economies. Even if steel products are made from scrap, it cannot be said that they are self-sufficient if the scrap is imported.

The fact that the numerator of the food self-sufficiency rate is domestic production volume means that it is measured by the amount of final products, not by the amount of seeds and seedlings for food. Since the denominator is the amount of final products, a correct comparison cannot be made unless the numerator is also the amount of final products. Therefore, the numerator in this report is not the amount of scrap supplied, which is the raw material for steel products, but the amount of products made from domestic scrap.

Moreover, scrap iron is used not only in electric furnaces but also in blast furnaces and foundries. About 12-18% of crude steel produced by blast furnaces comes from scrap iron, and many castings also come from scrap. Using the amount of products made from domestic scrap for the numerator practically allows us to takes into account the proportion of domestic raw materials used to produce steel products using manufacturing methods such as blast furnaces which use both scrap and iron ore (most of which is imported).

Based on this awareness, we proposed an indicator called circular steel ratio (CSR).

The numerator is the quantity of recyclable steel products produced from scrap iron generated in Japan, and the denominator is domestic steel demand in Japan. This shows how much of Japan’s steel demand can be self-sufficient through scrap.

In general, the self-sufficiency rate of rice is a major indicator for the primary industry as a quantitative criterion for determining national independence. On the other hand, data on the self-sufficiency rate of secondary industries are rare. This is probably because the idea that since Japan has no resources, it imports them from overseas, processes them, and exports products, or so-called processing trade, was generally accepted.

[4] When steel products made in blast furnaces and electric furnaces are processed into cars and home electric appliances in Japan and exported, they are treated as domestic demand (part of 45 million tons).

[5] For example, the Ministry of Agriculture, Forestry and Fisheries’ formula below is used for calculating the self-sufficiency ratio by food item: self-sufficiency ratio by food item = domestic production volume/quantity destined f or domestic consumption. The quantity destined for domestic consumption is calculated from the following formul a: quantity destined for domestic consumption = domestic production volume + import volume - export volume - increase in inventories (or + decrease in inventories); in other words, it represents domestic demand. For more information on how the Ministry of Agriculture, Forestry and Fisheries calculates self-sufficiency, see “What is foo d self-sufficiency?,” *Ministry of Agriculture, Forestry and Fisheries*, https://www.maff.go.jp/j/zyukyu/zikyu_ritu/011.ht ml (Accessed July 22, 2025).

However, this view is no longer valid in the 21st century. Through economic growth from the 19th to 20th centuries, Japan came to have sufficient iron and steel resources as urban mines. It is now a big mistake to say that Japan has no resources.

In addition, the circular economy is attracting attention from the perspective of economic security and decarbonization as well. As a nation built on the manufacturing industry, Japan must establish and protect an independent economic structure. Furthermore, smelting scrap to make steel products produces less carbon dioxide emissions than reducing iron ore, which is an iron oxide, and contributes significantly to the decarbonization of the economy. Raising the steel industry's self-sufficiency rate is very meaningful for the future Japanese economy and for the decarbonization of Japan and the world.

The purpose of this report is to estimate three indicators in fiscal 2030: scrap supply and demand, electric furnace domestic demand ratio, and circular steel ratio.

<Flow of study>

First, the research team attempted to accurately understand the domestic demand for steel products and the demand for and supply of scrap, which form the basis for calculating the circular steel ratio. Scrap is roughly classified into high-grade scrap and low-grade scrap, and the ratios of high-grade and low-grade scrap vary depending on the steel types to be manufactured. Therefore, unless the demand for steel products is grasped by product type, the demand for and supply of scrap cannot be accurately examined[6].

As described above, it is difficult to calculate the circular steel ratio because various values are interrelated. In this report, the calculation was actually carried out. To conclude, the circular steel ratio in fiscal 2030, calculated using only realistic assumptions, was 67.2%. The calculation process leading to the three important indicators of scrap supply and demand, electric furnace domestic demand ratio[7], and circular steel ratio is shown below.

This study has two characteristic in comparison with previous studies.

One characteristic is that it examined the demand for high-grade scrap and low-grade scrap for each type of steel material. Scrap can be classified into high-grade scrap and low-grade scrap, and the ratio required for each steel materials differs. As the largest buyer of scrap iron in Japan and a company that knows the nature of scrap iron well, we decided to take a unique approach.

[6] Not only is the demand for scrap used as a raw material calculated from the demand for steel products, but scrap is also generated in-house during the production of steel products, and for this reason, the demand for steel products affects the supply of scrap.

[7] Many people may think of the electric furnace ratio (the amount of steel produced by electric furnaces in the total amount of steel production) as an indicator of a country's steel self-sufficiency rate. While electric furnaces melt domestically generated scrap to make products, blast furnaces reduce almost totally imported iron ore to make products, so the electric furnace ratio can certainly indicate the degree of steel self-efficiency. However, in order to understand the electric furnace ratio as the steel self-sufficiency ratio, there are three issues. First, in general, the denominator in the equation for the electric furnace ratio is crude steel production volume, which includes exports. Second, the fact that blast furnaces and foundries use scrap is not captured. Third, electric furnaces use both domestically generated scrap and imported scrap, and this fact is not taken into consideration. As described above, the self-sufficiency rate is calculated to know where it is now in light of some purpose or other. In this report, based on the fact that Japan has a large amount of steel resources and the normative importance of circulation of scrap iron, we define the calculation formula for the circular steel ratio, accurately determine it, and argue the significance of increasing the circular steel ratio for a society as a whole.

The other characteristic is that it tried to calculate the circular steel ratio after considering the distinction between high-grade and low-grade scrap iron, and domestic and foreign origin of scrap. As far as we know, there is no previous study which used a concept like the circular steel ratio and calculated it strictly. In addition, if the circular steel ratio is presented in a convincing manner, the current status of Japan's economic security and decarbonization can be accurately grasped. It is also crucial in drawing up a national vision.

2. Calculation of scrap supply and demand, electric furnace domestic demand ratio, and circular steel ratio

<Research method>

Scrap supply and demand, electric furnace domestic demand ratio, and circular steel ratio (hereinafter "Three Indicators") were calculated as shown below (fig. 1).

First, domestic steel demand (production volume) for fiscal 2030 is calculated (A in fig. 1).

A-1 clarifies domestic steel demand (including indirect exports of products made of steel and exported to foreign countries such as automobiles). Next, for each type (sections, steel plates, etc.), a model is created assuming maximum production of circular steel (ordinary steel electric furnaces, specialty steel electric furnaces, and castings) (A-2), and the electric furnace domestic demand ratio is estimated (C). From the ratio of scrap iron used in electric furnaces, castings, and blast furnaces, the total amount of scrap iron required becomes clear, and the amount obtained by subtracting the amount of internally generated scrap therefrom (B-1) is the amount of demand for externally procured scrap (B-3).

On the supply side, the total amount of scrap generated in Japan in fiscal 2030 can be estimated by summing the amount of scrap generated in-house (B-1) and the amount of old scrap and processing scrap estimated by previous studies (B-2). In this report, internally generated scrap was estimated from the amount of steel materials produced to meet domestic demand.

A model is assumed in which internally generated scrap is not supplied to the market but is consumed in-house. Therefore, the amount of scrap supplied from the market is the sum of old scrap and processing scrap.

Based on the above, the supply-demand ratio of scrap (the ratio of demand for externally procured scrap to market supply) and the circular steel ratio are obtained (C).

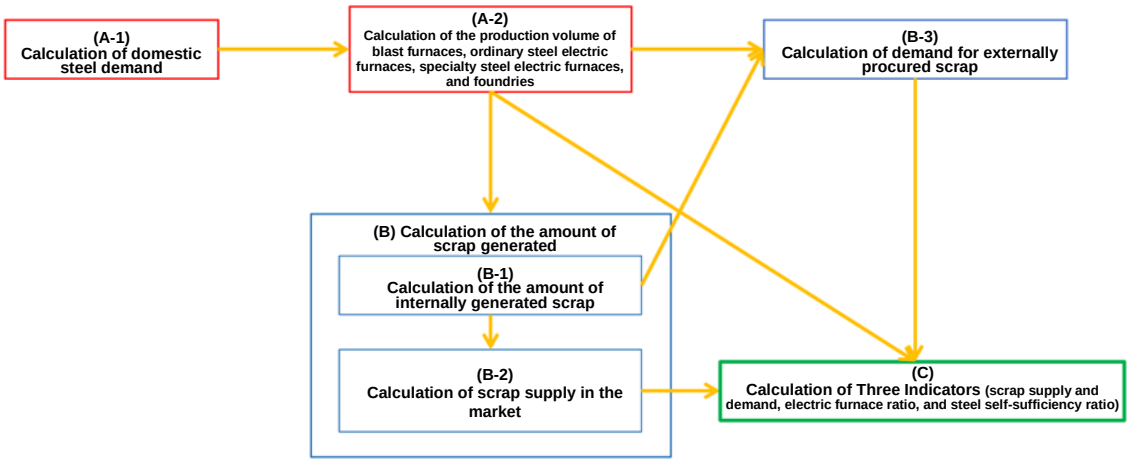


Fig. 1. Flow of Verification (Numerical Relationship of Calculation Models)

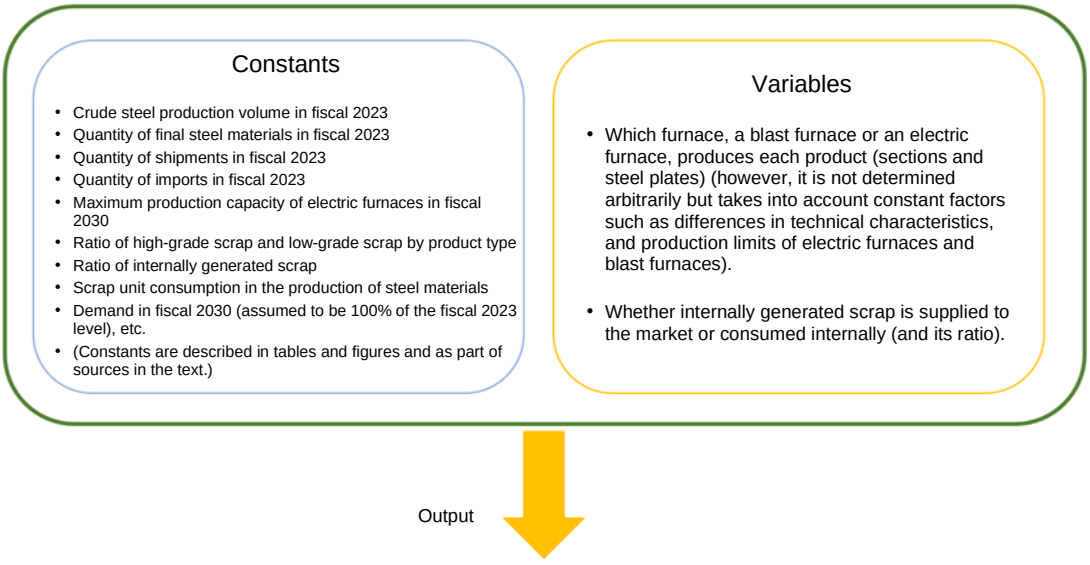


Fig. 2. Concept of Calculation Models

A-1. Domestic steel demand

Domestic steel demand (domestic demand) is assumed to be as follows: domestic steel demand (domestic demand) = quantity of domestic shipments + quantity of imports. Domestic demand for fiscal 2030 is calculated by summing up the quantity of domestic shipments and the quantity of imports.

(Products covered by domestic demand)

Steel demand is considered by dividing steel into steel materials to be rolled and castings for analysis. The starting point for steel materials is figures for domestic shipments, which account for domestic demand. The current figures are confirmed as listed below (fig. 3).

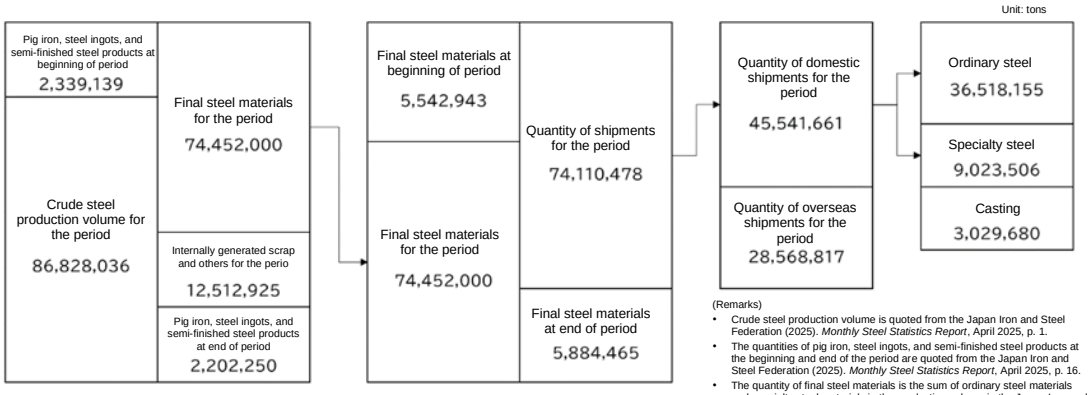


Fig. 3. Quantity of Domestic Shipments (Fiscal 2023)

(Remarks)

- Crude steel production volume is quoted from the Japan Iron and Steel Federation (2025). *Monthly Steel Statistics Report*, April 2025, p. 1.
- The quantities of pig iron, steel ingots, and semi-finished steel products at the beginning and end of the period are quoted from the Japan Iron and Steel Federation (2025). *Monthly Steel Statistics Report*, April 2025, p. 16.
- The quantity of final steel materials is the sum of ordinary steel materials and specialty steel materials in the production volume in the Japan Iron and Steel Federation (2025). *Monthly Steel Statistics Report*, April 2025, p. 1.
- Internally generated scrap and others for the period is the difference between debit and credit.
- The quantity of shipments is the sum of shipments of ordinary steel materials and specialty steel materials. The figure for ordinary steel is quoted from the Japan Iron and Steel Federation (2025). *Monthly Steel Statistics Report*, April 2025, p. 20. The figure for specialty steel is quoted from the same as above, p. 17.
- The figure for products at end of period is the sum of the inventory of ordinary steel materials and the inventory of specialty steel materials. The figure for ordinary steel is quoted from the Japan Iron and Steel Federation (2025). *Monthly Steel Statistics Report*, April 2025, p. 30. The figure for specialty steel is quoted from the same as above, p. 17.
- The final steel materials at beginning of period is the difference between debit and credit.
- The quantity of domestic shipments for the period is the difference between the quantities of overseas shipments and shipments for the period.
- The quantity of overseas shipments for the period is the sum of exports of ordinary steel and specialty steel materials in the Japan Iron and Steel Federation (2025). *Monthly Steel Statistics Report*, April 2025, p. 37.
- The quantities of ordinary steel and specialty steel to domestic shipments for the period are obtained by multiplying domestic shipments for the period by the ratio of ordinary steel and specialty steel to shipments.
- The figure for castings is calculated by subtracting the export volume (Ministry of Finance statistics) from the production volume (quoted from the Japan Ferrous Raw Materials Association, *Annual Report on Ferrous Raw Materials*, No. 35, 2024, p. 11).

In fiscal 2023, the quantity of domestic shipments of ordinary steel was 36.52 million tons, and the quantity of domestic shipments of specialty steel was 9.02 million tons. The figure obtained by subtracting the export volume from the production volume of foundries (applied as domestic shipments in fiscal 2023) was 3.03 million tons.

(Quantity of imports)

In fiscal 2023, 4.77 million tons of ordinary steel, 460,000 tons of specialty steel, and 50,000 tons of castings were imported (fig. 4).[8]

[8] Source: Ministry of Finance statistics

(Estimation of steel demand in fiscal 2030)

Based on the above, it was confirmed that in fiscal 2023, domestic demand for ordinary steel was 41.29 million tons (table 1), domestic demand for specialty steel 9.48 million tons (table 2), and domestic demand for castings 3.08 million tons, and that domestic demand for steel was 53.85 million tons in total (fig. 4).

In this report, steel demand in fiscal 2030, which is the denominator of the circular steel ratio, was set at 53.85 million tons, assuming that domestic demand in fiscal 2023 would be maintained.[9]

Unit: 10,000 tons

	Total	Sheet pilings	Sections (including rails)	Wide flange beams	Cold-formed sections	Bars	Wire rods	Plates	Hot-rolled strips	Hot-rolled sheets	Cold-rolled sheets and strips (including electromagnetic steel sheets)	Galvanized sheets	Other metallic-coated sheets	Pipes and tubes
Fiscal 2023 Quantity of shipments (A)	3,652	39	193	236	29	602	100	573	571	2	384	543	153	228
Fiscal 2023 Quantity of imports (B)	477	2	0	9	3	2	25	43	146	0	101	124	10	12
Fiscal 2023 (→ Fiscal 2030) Domestic demand for ordinary steel (A+B)	4,129	41	193	244	32	604	125	616	717	2	485	667	163	240

Table 1. Domestic Demand for Ordinary Steel (Fiscal 2023 and Fiscal 2030)

(Remarks)
- Domestic demand for ordinary steel in fiscal 2030 was calculated as follows:

(1) Orders received by product type in fiscal 2023 were quoted from the Japan Iron and Steel Federation. *Statistics on Order Booked,* April 2025.
(2) The percentage of export shipments by product type in fiscal 2023 was calculated.
(3) The export portion of orders received by product type was multiplied by (2).
(4) The percentage of orders received by product type in fiscal 2023 (domestic portion) was calculated from the difference between (1) and (3) to obtain the percentage of orders received by product type.
(5) The quantity of domestic shipments for the period (ordinary steel) in fig. 2 was multiplied by the ratio in (4) to obtain the quantity of shipments by product type.
(6) The quantity of imports by product type in fiscal 2023 was quoted from Japan Iron and Steel Federation. *Steel Imports and Exports Year 2024.*
(7) Domestic demand for ordinary steel in fiscal 2023 is the sum of (5) and (6). This is assumed to be domestic demand in fiscal 2030.

Unit: 10,000 tons

	Total	Tool steel	Structural steel	Spring steel	Bearing steel	Stainless Steel	High-tensile-strength steel	Others
Quantity of shipments in fiscal 2023 (A)	902	12	433	15	46	104	231	60
Quantity of imports in fiscal 2023 (B)	46	1	22	1	2	5	12	3
Fiscal 2023 (→ fiscal 2030) Domestic demand for specialty steel (A+B)	948	13	455	16	49	109	243	63

Table 2. Domestic Demand for Specialty Steel (Fiscal 2023 and Fiscal 2030)

(Remarks)
- Domestic demand for specialty steel in fiscal 2030 was calculated as follows:

(1) Orders received by product type in fiscal 2023 were quoted from the Japan Iron and Steel Federation. *Statistics on Order Booked,* April 2025.
(2) The ratio by product type was obtained from (1).
(3) The quantity of domestic shipments for the period in fig. 2 was multiplied by the ratio in (2) to obtain the quantity of shipments by product type.
(4) The quantity of specialty steel materials imported in fiscal 2023 was quoted from the Japan Iron and Steel Federation. *Steel Imports and Exports Year 2024.* The quantity of imports was multiplied by the ratio in (2) to obtain the quantity of imports by product type.
(5) Domestic demand for specialty steel in fiscal 2023 was obtained from the sum of (3) and (4). This is assumed to be the domestic demand for specialty steel in fiscal 2030.

[9] A look at the transition of apparent crude steel consumption as an approximation of domestic steel demand indicates that the consumption was about 100 million tons in 1990, but that it consistently decreased to about 80 million tons in 2000, about 70 million tons in 2010, and about 56 million tons in 2020 (quoted from the Japan Iron and Steel Federation. *Monthly Steel Statistics*, Section 1. *Major Iron and Steel Indicators*). Since the decline in domestic steel demand is assumed to be due to structural factors, it is natural to predict that steel demand in fiscal 2030 will be lower than that in fiscal 2023. The circular steel ratio is calculated by dividing the amount of steel products made from domestically generated scrap iron by the amount of domestic demand, so keeping the amount of steel demand in fiscal 2030 the same as that in fiscal 2023 means that the denominator will be overestimated. In other words, it can be said that the estimation is conservative in the sense that the circular steel ratio is calculated to be smaller.

Unit: tons

Foundry production volume (fiscal 2023)	3,039,000
Quantity of imports (fiscal 2023)	50,674
Quantity of exports (fiscal 2023)	9,320
Fiscal 2023 (→ fiscal 2030) Domestic demand for castings (production volume + imports - exports)	3,080,354

Table 3. Domestic Demand for Castings (Fiscal 2023)

(Remarks)

- Foundry production volume is quoted from Japan Ferrous Raw Materials Association. *Annual Report on Ferrous Raw Materials*, No. 35, 2024, p. 11.
- The quantity of exports and imports is based on Ministry of Finance statistics.

Unit: tons

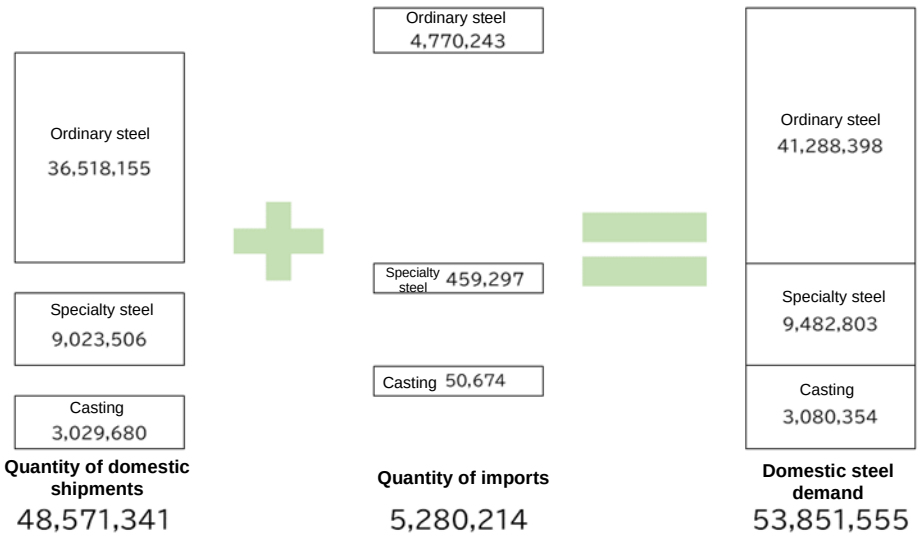


Fig. 4. Domestic Steel Demand (Fiscal 2023 to Fiscal 2030)

A-2. Production volume of blast furnaces, ordinary steel electric furnaces, specialty steel electric furnaces, and foundries

The purpose of this report is to show what kind of model would be built if circular steel, which contributes to decarbonization, is utilized as much as possible while promoting resource recycling.

So far, blast furnace manufacturers and electric furnace manufacturers have announced their intention to build new electric furnaces and expand existing ones by fiscal 2030. Therefore, in this part, we created a model to cover domestic demand as much as possible with circular steel, assuming that these investments are to be realized. In B-1 and subsequent parts, we will use the model to analyze whether domestically generated scrap meets the model.

Comparing blast furnace steel and electric furnace steel, the latter contains alloying elements in the scrap used, which may affect the strength of steel. Considering this characteristic, we tried to expand the production range of circular steel as much as possible by classifying ordinary steel and specialty steel by product type (such as sheet pilings, sections, and plates).

On the other hand, there are steel products that can be produced at lower cost in a blast furnace from iron ore and coking coal such as some steel products classified as mild steel, electromagnetic steel sheets, and ultra-high tensile strength steel, which were not actively included in the scope of circular steel due to the installation status of manufacturing facilities at each manufacturer during the period up to 2030. Specifically, 9.01 million tons of some of mild steel (table 4), 550,000 tons of electromagnetic steel sheets (table 5), and 260,000 tons of casting pig iron (table 5) were included. In addition, it is assumed that 7.85 million tons of domestic demand for steel plates, a product type with the largest demand for ordinary steel, cannot be converted to circular steel in fiscal 2030, even taking into account factors such as the already announced new installation plans (fig. 5).

As a result of the above calculation, the ratio of circular steel to satisfy domestic demand was 67.2%. The breakdown of production is 23.87 million tons for ordinary steel electric furnaces [10](fig. 6), 7.06 million tons for specialty steel electric furnaces [11](fig. 6), 3.08 million tons for castings (table 5 and fig. 6[12]), and 19.84 million tons for blast furnaces (fig. 6).

Unit: tons

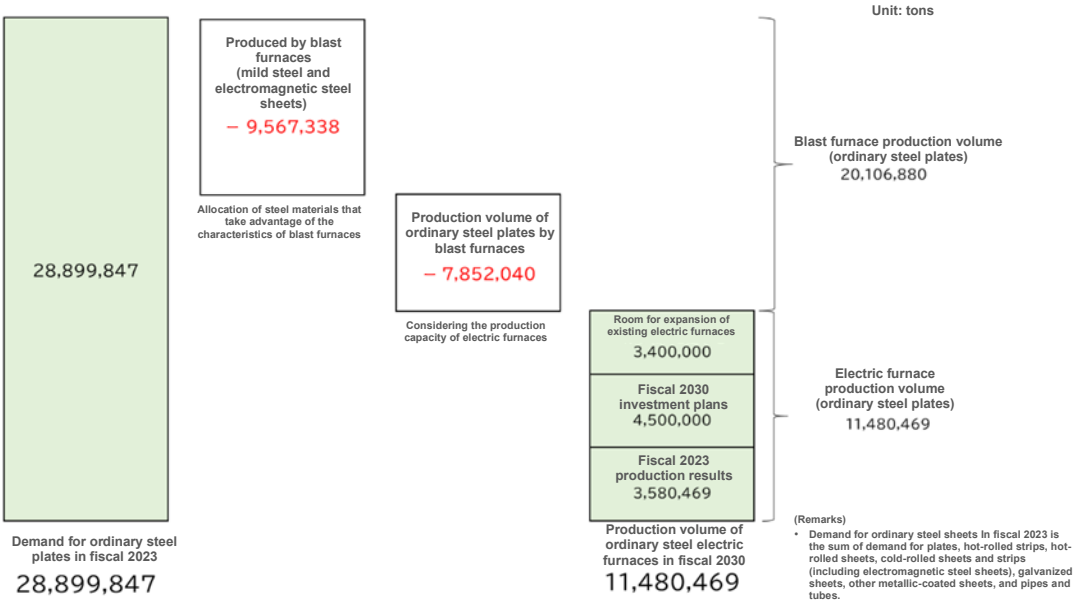
	Total	Building	Civil engineering	Other construction	Industrial machinery and equipment	Electrical machinery and equipment	Home and office appliances	Shipbuilding and marine equipment	Automobiles	Railway rolling stocks	Other transport equipment	Containers	Others
Fiscal 2023 Orders received by application	34,949,363	8,008,968	2,734,986	2,837,277	1,926,711	2,036,493	480,983	4,478,960	11,219,446	34,828	33,186	1,061,808	95,717
Ratio of orders received by application (r)	100%	23%	8%	8%	6%	6%	1%	13%	32%	0%	0%	3%	0%
Fiscal 2023 Quantity of ordinary steel shipments* (r)	36,518,155	8,368,471	2,857,753	2,964,635	2,013,196	2,127,906	502,573	4,680,010	11,723,060	36,391	34,676	1,109,470	100,014
Mild steel ratio	-	0%	0%	0%	10%	70%	70%	10%	50%	50%	50%	50%	50%
Fiscal 2023 (→ Fiscal 2030) Quantity of mild steel	9,012,461	0	0	0	201,320	1,489,534	351,801	468,001	5,861,530	18,196	17,338	554,735	50,007

Table 4. Domestic Demand for Mild Steel (Fiscal 2023)

(Remarks)
- Domestic demand for mild steel in fiscal 2030 was calculated as follows:

(1) Orders received by application in fiscal 2023 were quoted from the Japan Iron and Steel Federation. *Statistics on Order Booked*. The sum of the amounts for the following processes, for reprocessing for unknown final uses, and for sellers (including shearing dealers) was allocated to each use according to the ratio of each use to the total of items for which the final use was known (approximately 22.53 million tons).
(2) The ratio of orders received by application was obtained.
(3) The quantity of ordinary steel shipments in fiscal 2023 was multiplied by (2) to obtain the quantity of shipments for each application.
(4) Mild steel content for each application was obtained through interviews with industry associations.
(5) The value in (3) was multiplied by (4). This is assumed to be the domestic demand for mild steel plates in fiscal 2030.

[10] Difference between domestic demand for ordinary steel in table 1, and the sum of mild steel and electromagnetic steel sheets.
[11] Difference between domestic demand for specialty steel and high-tensile-strength steel in table 2.
[12] Since pig iron for casting is used as a material in foundries, it is necessary to subtract 260,000 tons of pig iron for casting (table 5) from 20.17 million tons of blast furnace production (table 5) if domestic demand for casting is considered to include it, resulting in 19.91 million tons of blast furnace production (table 5).



(Remarks)

- Demand for ordinary steel sheets in fiscal 2023 is the sum of demand for plates, hot-rolled strips, hot-rolled sheets, cold-rolled sheets and strips (including electromagnetic steel sheets), galvanized sheets, other metallic-coated sheets, and pipes and tubes.
- The figures for fiscal 2023 production results, fiscal 2030 investment plans, and room for expansion of existing electric furnaces are based on or estimated from the figures published on the website of each company. These represent the amounts of steel plates that can actually be produced. Fiscal 2023 production results, fiscal 2030 investment plans, and room for expansion of existing electric furnaces were surveyed by Tokyo Steel.

Fig. 5. Production Volume of Ordinary Steel Plates (Electric Furnaces and Blast Furnaces) (Fiscal 2030)

Unit: tons

	Total	Mild steel	Electromagnetic steel sheets	High-tensile-strength steel	Casting pig iron	Ordinary steel plates (excluding mild steel and electromagnetic steel sheets)
Production volume of steel other than circular steel (fiscal 2030)	20,106,880	9,012,461	554,877	2,426,576	260,926	7,852,040

Table 5. Production Volume of Steel Other than Circular Steel (Fiscal 2030)

(Remarks)

- The fiscal 2030 blast furnace production volume was calculated as follows:

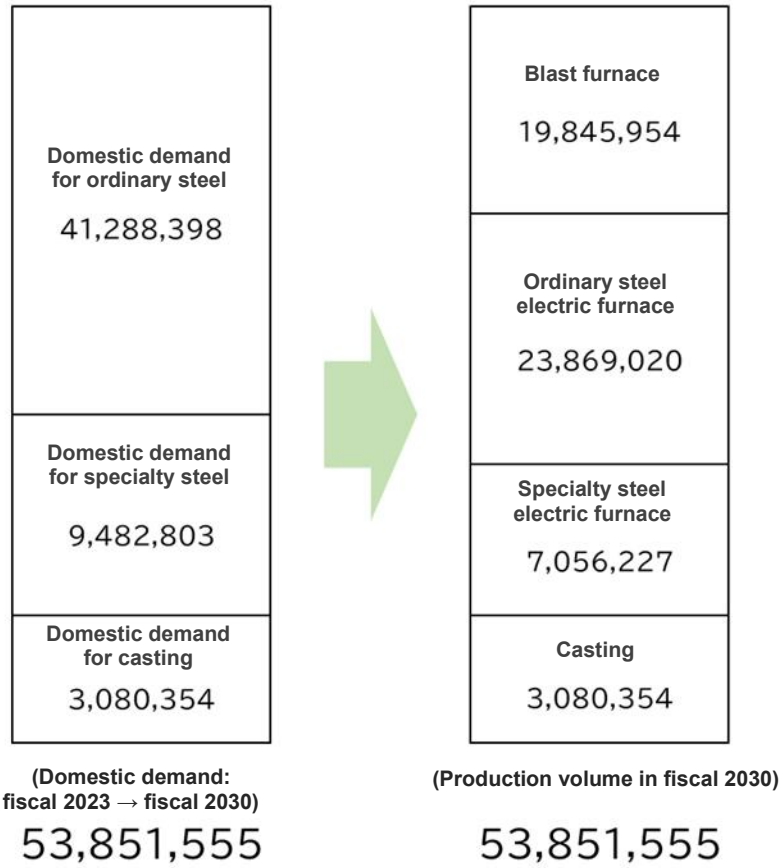
(Electromagnetic steel sheets)
(1) The production volume of cold-rolled electrical sheets and strips in fiscal 2023 was quoted from the Japan Iron and Steel Federation. *Monthly Steel Statistics Report*, p. 19.
(2) The quantity of imports and exports by product type in fiscal 2023 were taken from the Japan Iron and Steel Federation. *Steel Imports and Exports Year 2024.*
(3) The quantity of exports in (2) was deducted from the production volume in (1), and the quantity of imports in (2) was added.
(4) The 243,000 tons of electromagnetic steel sheets manufactured by Nippon Steel Hirohata [the Japan Iron and Steel Federation (2025). "Total Production of Cold-Galvanized and Cold-Rolled Ordinary Steel in 2023," *Iron and Steel Industry Reference Materials (by Factory)*, p. 31] was deducted, and this is assumed to be the production volume of electromagnetic steel sheets other than circular steel in fiscal 2030.

(Ultra-high tensile strength steel)

- Quoted from table 2.

(Casting pig iron)
(1) The production volume in fiscal 2023 was quoted from the Japan Iron and Steel Federation. "2023 Total," *Iron and Steel Industry Reference Materials (by Factory)*, p. 2.
(2) The quantity of exports for fiscal 2023 was quoted from the Ministry of Finance, *Trade Statistics of Japan*.
(3) The quantity of imports for calendar year 2023 was quoted from the Japan Ferrous Raw Materials Association. *Annual Report on Ferrous Raw Materials*, No. 35, 2024, p. 28. The quantity of imported pig iron was calculated by subtracting sponge iron from total imports.
(4) The quantity of exports in (2) was deducted from the production volume in (1), and the quantity of imports in (3) was added. This is assumed to be the production volume of casting pig iron in fiscal 2030.

Unit: tons



(Domestic demand: fiscal 2023 → fiscal 2030)

53,851,555

(Production volume in fiscal 2030)

53,851,555

Fig. 6. Domestic Demand and Production Volume in Fiscal 2030

(Remarks)

- Since casting pig iron is used as a raw material for foundries, casting pig iron is deducted from blast furnace production.

B. Amount of scrap

B-1. Amount of internally generated scrap

Production of steel products generates in-house scrap in blast furnaces, electric furnaces, and foundries[13]. As mentioned above, in this report, the amount of scrap generated from steel production in proportion to domestic demand was calculated. As a result, it was estimated that blast furnaces would generate 2.19 million tons, ordinary steel electric furnaces would generate 2.28 million tons, specialty steel electric furnaces would generate 570,000 tons, and foundries would generate 1.85 million tons, for a total of 6.89 million tons (table 6). All internally generated scrap is considered to be high-grade scrap.

Here, we would like to explain the definitions of high-grade and low-grade scrap. High-grade scrap consists of a variety of types such as HS, new scrap, shredder, and cast scrap iron which have a large bulk specific gravity of scrap, and uniform and stable components. On the other hand, low-grade scrap comprises a variety of types such as heavy scrap and steel turning which have a small bulk specific gravity of scrap and whose components are not uniform.

Unit: tons

	Production to meet domestic demand	Ratio of internally generated scrap	Amount of internally generated scrap (high-grade scrap)
Blast furnace	20,106,880	10.91%	2,193,661
Ordinary steel electric furnace	23,869,020	9.57%	2,284,265
Specialty steel electric furnace	5,962,363	9.57%	570,598
Foundry	3,080,354	59.97%	1,847,288
Total			6,895,812

Table 6. Amount of Internally Generated Scrap (Fiscal 2030)

(Remarks)
- The ratio of internally generated scrap was calculated as follows:

(1) The production volume of crude steel from blast furnaces and electric furnaces from fiscal 1993 to fiscal 2023 was quoted from the Japan Iron and Steel Federation. *Monthly Steel Statistics Report*, p. 1. Production volume by casting was quoted from the Japan Ferrous Raw Materials Association. *Annual Report on Ferrous Raw Materials*.
(2) The amount of internally generated scrap from fiscal 1993 to fiscal 2023 was quoted from the Japan Ferrous Raw Materials Association. *Annual Report on Ferrous Raw Materials*.
(3) (1) was divided by (2) in each fiscal year to obtain the average.

- The amount of specialty steel electric furnaces out of the production to meet domestic demand (production volume related to internally generated scrap) is the amount obtained by subtracting the production volume of stainless steel from the production volume of specialty steel electric furnaces.
- Blast furnaces include casting pig iron production (260,000 tons) as the production that meets domestic demand (production volume related to internally generated scrap).

[13] Steelmakers produce steel products from scrap, iron ore, and other materials, but in this process, a certain percentage of internally generated scrap is produced. Since steelmakers make steel products using internally generated scrap, scrap procured from outside, iron ore, etc., the internally generated scrap is reused for the next production. From a cost accounting point of view, it can be considered that debit and credit almost balances when entering (internally generated scrap carried forward in the previous production lot + input material in the current lot) to the debit side and (crude steel production volume + internally generated scrap carried forward in the next production lot) to the credit side. Therefore, in this report, the amount of internally generated scrap is calculated by multiplying the production volume in fiscal 2030 by a certain percentage. In reality, however, on a monthly basis, the internally generated scrap used for production in April 2030 can be considered to be the amount of internally generated scrap brought forward from production in March 2030 in the following month.

B-2. Scrap supply in the market

The status of scrap supply in fiscal 2030 is summarized below (table 7). Market supply of old scrap in fiscal 2030 is estimated to be 23.85 million tons[14]. It consists of 4.77 million tons of high-grade scrap and 19.08 million tons of low-grade scrap.

In terms of processing scrap, 4.92 million tons of new scrap and 680,000 tons of pig scrap iron are generated. A total of 5.6 million tons of new scrap and pig scrap iron is regarded as high-grade scrap. In addition, processing scrap includes 1.92 million tons of steel turning generated, and this entire amount is considered to be low-grade scrap.

Furthermore, assuming a steel production volume that meets domestic demand, and assuming that at steel manufacturers, scrap iron is generated in-house from that volume, as described in B-1, the figure is 6.91 million tons. Since internally generated scrap is consumed at each factory (blast furnaces, ordinary steel electric furnaces, specialty steel electric furnaces, and foundries), it is not distributed in the market.

In summary, 38.26 million tons of scrap will be generated in Japan in fiscal 2030, of which 31.37 million tons will be supplied to the market. Of the 31.37 million tons of scrap supplied to the market, 10.37 million tons are high-grade scrap and 21 million tons are low-grade scrap.

Unit: tons

Internally generated scrap		6,895,812	High-grade scrap	6,895,812
Old scrap		23,850,000	High-grade scrap	4,770,000
			Low-grade scrap	19,080,000
Processing scrap	New scrap	4,915,000	High-grade scrap	5,595,000
	Pig scrap iron (HS)	680,000		
	Steel turning	1,920,000	Low-grade scrap	1,920,000
Total				38,260,812
Market supply (Total - internally generated scrap at ordinary steel electric furnaces, specialty steel electric furnaces, and foundries)				31,365,000 High-grade scrap 10,365,000 Low-grade scrap 21,000,000

Table 7. Scrap Market Supply (Fiscal 2030)

(Remarks)
- The quantity of old scrap was quoted from Iron Recycling Research (2022). "The New Electric Furnace Expansion Plan Is an Opportunity to Review the Recycling of Resources in Japan – The Key to Success Is How to Use Old Scrap." *Research Report,* no. 66, January 31, 2022, p. 3.
- The quantity of processing scrap was quoted from the same as above (p. 2).
- It was assumed that the ratio of high-grade old scrap to low-grade old scrap was 20% to 80%.

[14] This is calculated by multiplying the amount of accumulated steel by the collection rate of 1.7%. The average collection rate between 2014 and 2020 was 1.783%, and it gradually decreased to 1.76% between 2018 and 2020. Therefore, 1.7% in fiscal 2030 is considered to be a realistic figure. For details, see Iron Recycling Research (2022). "The New Electric Furnace Expansion Plan Is an Opportunity to Review the Recycling of Resources in Japan – The Key to Success Is How to Use Old Scrap." *Research Report,* no. 66, January 31, 2022.

B-3. Demand for externally procured scrap

The reason why scrap is classified into high grade and low grade when calculating the amount of scrap generated is that the mix ratio of high-grade and low-grade scrap is different in each type of ordinary steel and specialty steel.

For ordinary steel electric furnaces, specialty steel electric furnaces, foundries, and blast furnaces, the portion of scrap demand that cannot be met by internally generated scrap (all high-grade scrap) is procured from outside (externally procured scrap demand). Since blast furnace manufacturers also use internally generated scrap and purchase market scrap, the ratio of scrap iron to molten iron was estimated to be about 18%. Therefore, when calculating the circular steel ratio described below, it should be noted that a part of the blast furnace manufacturer's production is included according to the amount of scrap iron used.

At this time, the demand for externally procured scrap was given as follows:

For ordinary steel electric furnaces, 4.37 million tons for high-grade scrap and 17.81 million tons for low-grade scrap

For specialty steel electric furnaces, 3.71 million tons of high-grade scrap and 1.83 million tons of low-grade scrap

For foundries, 2.39 million tons of high-grade scrap and 0 tons of low-grade scrap

For blast furnaces, 1.38 million tons of high-grade scrap and 0 tons of low-grade scrap

Therefore, the external procurement demand is 11.85 million tons of high-grade scrap and 19.64 million tons of low-grade scrap for a total of 31.5 million tons (table 8).

Unit: tons

	Scrap demand (high grade) (A)	Scrap demand (low grade) (B)	Internally generated scrap (high grade)	Utilization rate of internally generated scrap (high grade)	Amount of internally generated scrap (high grade) used (S)	Amount of externally procured scrap (high grade) (A - S)	Amount of externally procured scrap (low grade) (B)
Ordinary steel electric furnace	6,658,921	17,809,211	2,284,265	100%	2,284,265	4,374,656	17,809,211
Specialty steel electric furnace	4,278,413	1,833,605	570,598	100%	570,598	3,707,815	1,833,605
Casting	4,499,473	0	1,847,288	100%	1,847,288	2,391,259	0
Blast furnace	3,572,272	0	2,193,661	100%	2,193,661	1,378,611	0
Total	19,009,078	19,642,817	6,895,812		6,895,812	11,852,340	19,642,817
Total		38,651,895					31,495,157

Table 8. Demand for Externally Procured Scrap (Fiscal 2030)

(Remarks)

- The initial demand for scrap was calculated as follows:

(Blast furnaces)
The initial demand for high-grade scrap was calculated by multiplying the production volume of mild steel, electromagnetic steel sheets, high-tensile-strength steel, and ordinary steel plates (excluding mild steel and electromagnetic steel sheets) by 18%. The average amount of blast furnace scrap used from 2009 to 2023 was about 13% of the main raw materials (the sum of the amount of molten iron and scrap), but according to JFE Steel, its DRP has achieved 18%. Therefore, in this report, the blast furnace production volume was multiplied by 18% in order to examine the scrap supply and demand strictly.

(Ordinary steel)
For sheet pilings, sections, wide flange beams, cold-formed sections, bars, and wire rods (product types for building materials), the ratio of high-grade scrap is 20%, and the ratio of low-grade scrap is 80%. For other product types (for steel plates), the ratio of high-grade scrap is 35%, and the ratio of low-grade scrap is 65%. The initial demand for scrap is calculated by multiplying domestic demand by product type by the ratio of high-grade scrap and low-grade scrap, and then multiplying the product by 102.51% (scrap unit consumption). The ratio of high-grade scrap to low-grade scrap was surveyed by Tokyo Steel.

(Specialty steel)
With the exception of stainless steel (using stainless steel scrap) and ultra-high tensile strength steel (produced by blast furnaces), the high grade is 70% and the low grade is 30%. The initial demand for scrap is calculated by multiplying domestic demand by product type by the ratio of high-grade scrap and low-grade scrap, and then multiplying the product by 102.51% (scrap unit consumption). The ratio of high-grade scrap to low-grade scrap was surveyed by Tokyo Steel.

(Castings)

- The initial demand for scrap is calculated by multiplying the production volume by 146.07%.

* The amount of scrap procured from outside foundries is calculated by subtracting the amount of internally generated scrap (S) from the initial scrap demand (A), and then subtracting the quantity of pig iron for casting produced by blast furnaces.

C. Scrap supply and demand, electric furnace domestic demand ratio, and circular steel ratio

(Scrap supply and demand)

Based on the above, scrap supply and demand is compared as described below (excluding internally generated scrap and its use) (table 9):

Demand for externally procured high-grade scrap is 11.85 million tons, and its supply is 10.37 million tons (supply-demand ratio: 87.5%).

Demand for externally procured low-grade scrap is 19.64 million tons, and its supply is 21 million tons (supply-demand ratio: 106.9%).

The total demand of externally procured scrap is 31.5 million tons, and the total supply is 31.37 million tons (supply-demand ratio: 99.6%).

Demand for externally procured scrap generally matches its supply. The supply of scrap accounts for 99.6% of the total demand. When broken down into high-grade and low-grade scrap, high-grade scrap accounts for 87.5% of its demand, while low-grade scrap accounts for 106.9% of its demand. Therefore, there is a slight surplus of low-grade scrap and a shortage of high-grade scrap.

However, the bulk specific gravity can be improved by processing low-grade scrap, and its components can be grasped by sorting, which enables low-grade scrap to be used as high-grade scrap in some cases. For this reason, the supply-demand ratio for high-grade scrap may actually be closer to 100% than currently estimated.

	Demand for externally procured scrap	Scrap market supply	Supply-demand ratio
High-grade scrap	11,852,340	10,365,000	87.5%
Low-grade scrap	19,642,817	21,000,000	106.9%
Total	31,495,157	31,365,000	99.6%

Table 9. Scrap Supply and Demand (Fiscal 2030)

(Electric furnace domestic demand ratio)

In fiscal 2030, while the domestic steel demand (excluding castings) is 50.77 million tons, the production volume of ordinary steel electric furnaces and specialty steel electric furnaces is 30.93 million tons[15], and the electric furnace domestic demand ratio is estimated to be 60.9% (= 3,093/5,077).

Unit: tons

	Domestic production volume	Ratio
Ordinary steel electric furnace	23,869,020	47.0%
Specialty steel electric furnace	7,056,227	13.9%
Blast furnace	19,845,954	39.1%
Total	50,771,201	100.0%

Electric furnace domestic demand ratio

Table 10. Electric Furnace Domestic Demand Ratio (Fiscal 2030)

(Remarks)
Blast furnace production volume does not include casting pig iron.

[15] The production volume of crude steel by electric furnaces was 33.19 million tons in fiscal 1997 and 26.5 million tons on average for each fiscal year from 1997 to 2023 (calculated from the Japan Ferrous Raw Materials Association (2024). *Annual Report on Ferrous Raw Materials*, No. 35, 2024, p. 2).

(Circular steel ratio)

The circular steel ratio was calculated according to the following formula:

The product $p \cdot s \cdot c$ is obtained for each factory, where the amount of steel produced for domestic use is p, the percentage of manufactured products derived from scrap is s, and the percentage of domestic scrap is c.

At this time, the circular steel ratio (CSR) (%) can be obtained using the formula listed below.

Circular steel ratio (CSR) (%) =

$$\frac{(p_{\text{blast furnace}} \cdot s_{\text{blast furnace}} \cdot c_{\text{blast furnace}}) + (p_{\text{ordinary steel electric furnace}} \cdot s_{\text{ordinary steel electric furnace}} \cdot c_{\text{ordinary steel electric furnace}}) + (p_{\text{specialty steel electric furnace}} \cdot s_{\text{specialty steel electric furnace}} \cdot c_{\text{specialty steel electric furnace}}) + (p_{\text{casting}} \cdot s_{\text{casting}} \cdot c_{\text{casting}})}{\text{Domestic steel demand } D}$$

p is an abbreviation of production, s is scrap, c is circulation, and D is demand.

As a result of the calculation, the circular steel ratio in fiscal 2030 was estimated to be 67.2%.

Unit: tons

Amount of domestic steel products produced from domestic scrap ($P = \Sigma p \cdot s \cdot c$)	36,200,908
Domestic steel demand (D)	53,851,555
Circular steel ratio (P/D) CSR: Circular Steel Ratio	67.2%

Table 11. Circular Steel Ratio (CSR) (Fiscal 2030)

(Remarks)
Product $p \cdot s \cdot c$ were calculated as follows:

- **The figures for domestic steel production volume p (blast furnaces, ordinary steel electric furnaces, specialty steel electric furnaces, and castings) referred to A-2.**
- **The scrap utilization rate s was 18% for blast furnaces (scrap unit consumption), 100% for ordinary steel electric furnaces and specialty steel electric furnaces, and 94% for castings obtained by calculating (scrap demand - casting pig iron)/scrap demand.**
- **The domestic origin rate of scrap c was calculated from the supply and demand balance of high-grade scrap and the supply and demand balance of low-grade scrap. From the viewpoint of decarbonization efficiency, priority was given to electric furnaces for external procurement, and the remainder was allocated proportionally to blast furnaces and castings according to the demand. Next, the shortage (import volume) was calculated from the difference between the demand for externally procured high-grade scrap and the actual amount of externally procured high-grade scrap. Then, the ratio of scrap of domestic origin was obtained by dividing the shortage of high-grade scrap and low-grade scrap (however, there will be no shortage of low-grade scrap and no surplus will be purchased by any party) by the total amount of utilized scrap and subtracting the value from 1.**
It is assumed that all stainless steel is manufactured from domestic stainless steel scrap.

The above calculation was carried out for each of blast furnaces, ordinary steel electric furnaces, specialty steel electric furnaces, and castings.

It is assumed that, as mentioned above, steel demand (D) in fiscal 2030 is the same as that in fiscal 2023, but domestic demand is actually on a gradual decline. Because conservative assumptions are made in this report, the circular steel ratio in fiscal 2030 may be higher than 67.2%, depending on the declining trend in domestic steel demand.

3. Conclusion

This report assumed that the production capacity of electric furnaces could be maximized in order to promote decarbonization at the same time as resource recycling. It also assumed that domestic production by steelmakers would be limited to domestic demand. In addition, domestic demand for steel products in fiscal 2030 is estimated to be 100% of the fiscal 2023 level, and scrap supply and demand and the ratio of circular steel is conservatively estimated. From these assumptions, it was found that the potential of urban mines, expressed as the circular steel ratio, reached 67.2%. Based on this assumption, it was concluded that the electric furnace domestic demand ratio would be 60.9%. This is consistent with previous studies on resource circulation in the steel industry[16].

As an advanced country, Japan boasts of its large steel accumulation (approximately 1.4 billion tons[17]), and we must recognize that there are significant advantages to recycling this precious iron resource domestically. One reason for Japan's rise to the status of an advanced country is the stable supply of steel products, which were used as raw materials for various products such as automobiles, ships, construction, and home electric appliances, to users during the period of rapid economic growth in the 20th century. Almost all of the iron ore and coal used in the blast furnace process, which accounts for 73% of Japan's current steel production, is imported from overseas. As shown in this report, it would be a good idea to actively look at the potential of steel accumulation in Japan, which has entered a mature stage, and to increase the degree of economic independence by effectively circulating scrap iron in the country.

The ratio of electric furnaces in the United States is 71.8%, and that in the EU is 44.0% (2024[18]), indicating that the shift to electric furnaces is progressing faster in advanced Western countries than in Japan. Considering that the circular steel ratio can be increased by increasing the ratio of electric furnaces to domestic demand as long as domestically generated scrap is utilized, the high ratio of electric furnaces in each country is an indication of the importance placed on domestic resource recycling.

[16] For example, according to Watari et al. (2025), "Global stagnation and variations in steel recycling," *Resources, Conservation & Recycling*, 220 (108363), countries like Japan can "theoretically meet the bulk of domestic steel demand from recycled materials," but "at present, they place priority on the production of sheet plates in excess of domestic demand through steelmaking using iron ore as the main raw material and on their export to other countries" [quoted from "How Circular Is the World Steel Industry?" *National Institute for Environmental Studies,* 2025, https://www.nies.go.jp/whatsnew/2025/20250602/20250602.html (Accessed October 30, 2025)].

[17] Japan Iron and Steel Recycling Institute (JISRI). 2024. "Scrap Iron in Japan."https://www.meti.go.jp/shingikai/mono_info_service/green_steel/pdf/003_05_00.pdf(Accessed June 26, 2025)

[18] Non-Integrated Steel Producers' Association. 2024. "Market Share of Electric Furnace Steel." https://www.fudenkou.jp/about/post_2.html(Accessed June 26, 2025)

The ability of electric furnaces to cover much of Japan's domestic demand for steel products means that precious iron resources can be circulated domestically and that economic security can be ensured. Moreover, further utilization of electric furnaces is also significant for decarbonization in Japan. We sincerely hope that the government, which is the owner of the largest steel accumulation due to the accumulated public works, will take some action to realize the vision presented in this report in an effort to expand the demand for circular steel materials.

Some local governments have already introduced systems to create demand for recyclable materials ahead of the national government. For example, if limited to steel materials, the Tokyo Metropolitan Government has introduced a system to report the input of recycled steel materials such as electric furnace steel in the Tokyo Metropolitan Government Environmental Products Procurement Policy.

However, it is felt that the national government has not clearly set out a mechanism to promote steel recycling. In the Act on Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities, which was revised in April 2025, steel is positioned for the first time as a common standard of judgment in the procurement of environmental goods, etc. However, it is very regrettable that the act does not specify electric furnace steel materials, which are produced from scrap as the main raw material, in order to promote resource recycling. It is hoped that the government authorities, which have "owned" iron in the form of buildings and infrastructure through past public investments, will take the lead in promoting the effective use of urban mines by announcing a policy on actively using circular steel in public projects and procurement.