IV History of Iron and Steel Slag Use and the Changing Market Environment

1 From 1910: Commencement of Blast-Furnace Slag Cement Production

Steel products have been produced as essential materials supporting social infrastructure. Iron and steel slag, which is a by-product of steel production, has been effectively utilized through years of research. Today, iron and steel slag is being used in various fields as a valuable material. Below is an overview of the history of the use of iron and steel slag in Japan.

Japan has a long history of recycling iron and steel slag, spanning nearly 100 years. Following the start of integrated steelmaking at the government-operated Yawata Steel Works in 1901, the production of slag bricks began in 1907 by mixing hydrated lime with granulated slag. The test production of blast-furnace slag cement started in 1910, and full-scale production began in 1913. Initially, most of the blast-furnace slag cement was used for construction projects within the steelworks. In 1926, the Japanese Engineering Standards for blast-furnace slag cement (JES No. 29) were established.

Blast-furnace slag cement factory in the early Showa Period

Steelworks

2 The High Economic Growth Period: Iron and Steel Slag as Reclamation and Land Development Materials

During the high economic growth period of the 1960s, steel production increased dramatically, and iron and steel slag was used in large quantities for land reclamation to expand existing steelworks and for the construction of a series of new coastal steelworks. During this period, know-how for the effective use of iron and steel slag as a material for civil engineering works was accumulated. Additionally, the use of iron and steel slag as a base course material for general roads began during this period.

3 After the Oil Crisis: Ongoing Technological Development for Resource Recycling of Iron and Steel Slag

In the first half of the 1970s, when crude steel production exceeded 100 million tons, the need for recycling the large quantities of iron and steel slag became evident. Recognizing the recycling of iron and steel slag as a critical business challenge, steel companies began technological development for iron and steel slag products and activities to develop markets for them. Steel companies worked to establish a system to guarantee the qualitative and quantitative stability of iron and teel slag products, treating slag not as "waste," but as "a new category of products."

After the oil crisis in 1973, the recycling of iron and steel slag progressed significantly as social awareness of the importance of energy and resource saving grew.

Systematic resource recycling activities in the steel industry advanced to a new stage by the dissolution of the "Japan Slag Association," which was primarily composed of sales companies, and the establishment of the "Nippon Slag Association" in 1978, bringing together steel companies to work on public recognition activities, including standardization under the JIS system. Recently, the association's activities have been strengthened in collaboration with the Japan Iron and Steel Federation to expand the use of iron and steel slag in port and marine applications, as well as in environmental areas.

In the course of establishing a system to promote the recycling of iron and steel slag, steel companies have worked to enhance their quality, develop utilization technologies, and ensure a stable supply, positioning them as high value-added industrial products that leverage their superior characteristics as opposed to merely using slag products as substitutes for natural resources. Thanks to the technologies and trust cultivated over the past 100 years, iron and steel slag is now used in a wide range of applications—including materials for cement, roads, civil engineering works, port construction, and concrete aggregate—and plays an important role in enhancing social infrastructure. Furthermore, even today, when 99% of all iron and steel slag produced is being recycled, efforts are actively being made to develop new utilization technologies and improve production techniques in order to respond to changes in the social environment.

Chubu Centrair International Airport (Aichi Prefecture)

4 Responding to Environmental Changes: Striving for Further Advancements in Iron and Steel Slag

Iron and steel slag products are primarily used in the construction sector as raw materials for cement and road construction materials. However, with the maturation of the economy in Japan, construction demand has been stagnating for many years. Considering the future decline in the working-age population and the entry of competing materials into the construction market, the sales environment for iron and steel slag products has become extremely challenging, with no expectation of demand growth.

On the other hand, looking at the world, there have been significant movements related to the environment that can be seen as a turning point in this era.

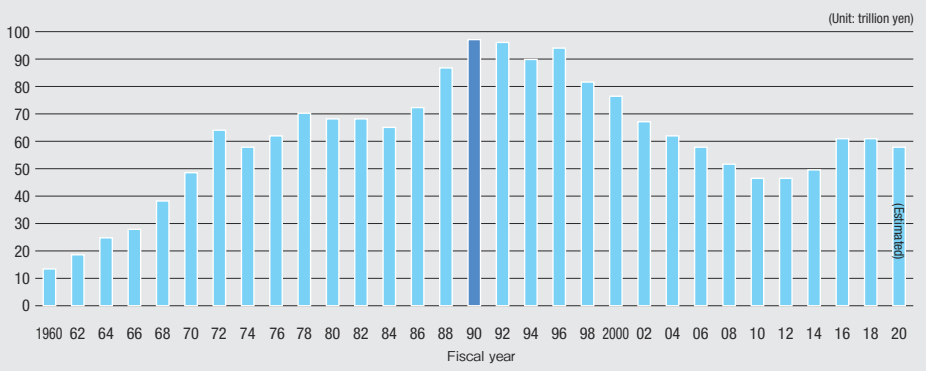
At the United Nations Summit in September 2015, the "2030 Agenda for Sustainable Development" was adopted, setting 17 Sustainable Development Goals (SDGs) and 169 targets to be achieved by 2030. Goal 12, "Ensure sustainable consumption and production patterns," calls for the use of resources with lower environmental impact, focusing on sustainable production and consumption, and minimizing waste. This goal addresses the depletion of finite natural resources and the indirect increase in environmental impact caused by resource utilization. In Japan, the SDGs Promotion Headquarters, led by the Prime Minister, has been established, with the "development of a circular society" identified as one of its priority issues. This presents an additional opportunity to recognize the value of iron and steel slag products, which are produced and processed using iron and steel slag, a by-product, as a raw material.

Additionally, in addressing the climate change issue, Japan has set a long-term goal of achieving net-zero greenhouse gas emissions by 2050. Furthermore, in the Cabinet decision made in October 2021, a target of a 46% reduction in emissions compared to FY 2013 was established as part of the "2030 Greenhouse Gas Reduction Target" plan. These efforts are related to iron and steel slag products. To promote the use of blast-furnace slag cement, the Ministry of Economy, Trade and Industry has examined "Measures to Promote and Expand the Use of Blended Cement." Additionally, the "Expanded Use of Mixed Cement" was incorporated as one of the measures in the "Global Warming Countermeasures Plan," which was adopted in the Cabinet decision in May 2016.

In Japan, the concept of recycling resources was introduced with the enactment of the "Basic Act on Establishing a Sound Material-Cycle Society" in 2000, which spurred efforts toward realizing a recycling-oriented society. Additionally, under the "Act on the Promotion of the Effective Utilization of Resources," also enacted in 2000, the steel industry was selected as a Specific Resources-Saving Industry, requiring further utilization of iron and steel slag. The steel industry has worked to standardize iron and steel slag products and develop user manuals. Additionally, in the "Act on the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities" (Act on Promoting Green Procurement) enacted in 2001, many iron and steel slag related products are selected as designated procurement items (products contributing to the reduction in environmental impact) in public projects, thereby promoting the use of iron and steel slag products.

In the future, efforts will be needed to further strengthen existing initiatives and enhance the value of iron and steel slag products through more comprehensive approaches, such as promoting the international use of these products in line with global market trends, and contributing to CO_2 absorption through the development of blue carbon ecosystems.

Trend in Japanese Construction Investment



∗ The real value was calculated from the Construction Coost Deflators (FY 2015 base).
Source: The Ministry of Land, Infrastructure, Transport and Tourism