Value of Steel

Appealing Qualities of Steel that Create Safe, Comfortable Lives for a Prosperous Global Future

Iron makes up approximately 30% of the Earth's mass and as much as 86% of its metal resources (200 billion tonnes). Because of its rich reserves, steel can be mass produced at very low cost. Compared to other materials, the environmental impact of its production is extremely low, and it has excellent recyclability. Steel can also be recycled repeatedly and reborn as various products (closed-loop recycling) with little to no environmental impact, contributing to the sustainable growth of our society.

Life Cycle Assessment of Steel

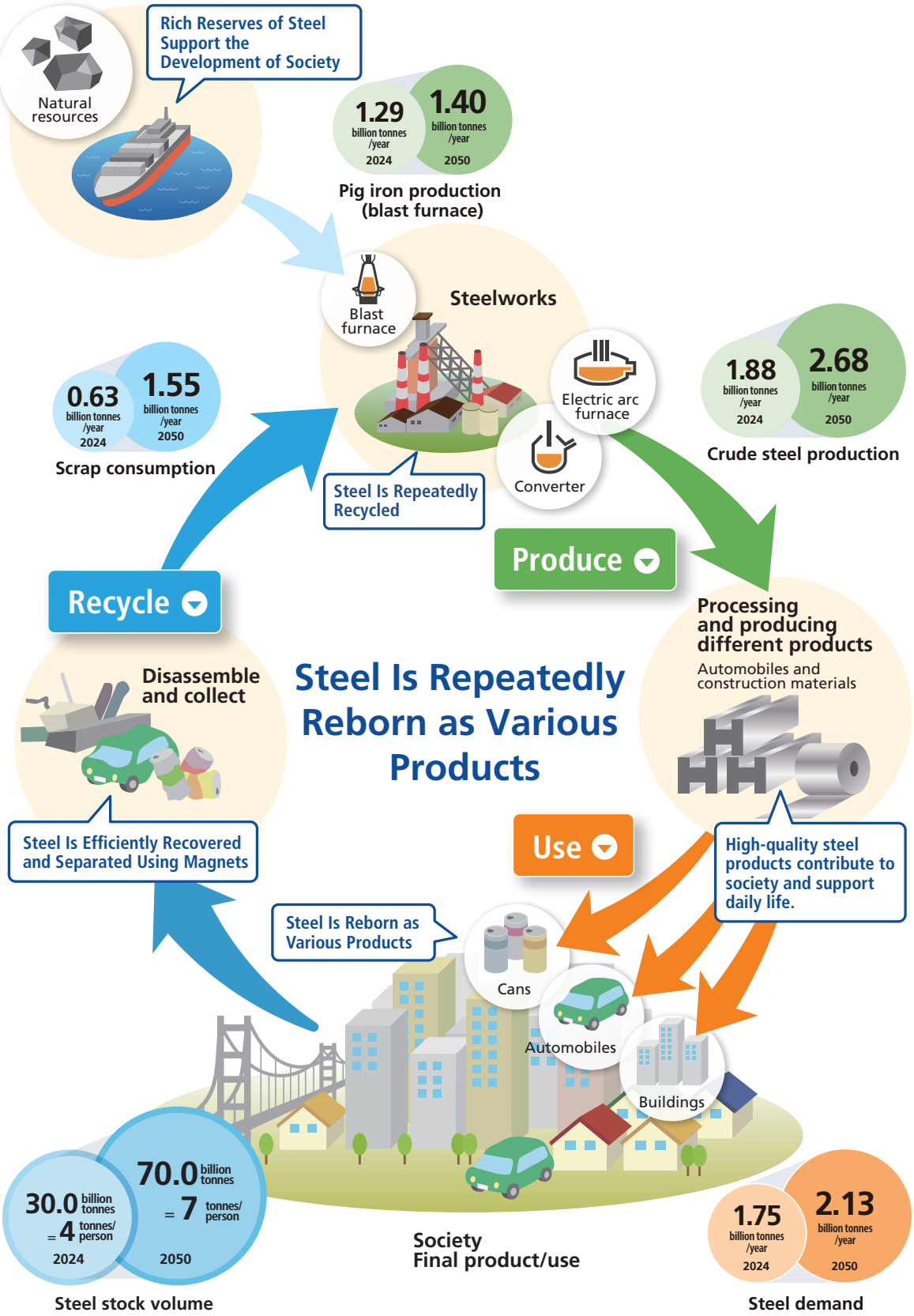
Steel's excellent recyclability contributes to the creation of a sophisticated value chain (P. 28) encompassing three components: produce, use, and recycle. Steel products can be repeatedly reborn as various products. The recycling rate for steel products has reached 93.7%. To properly assess the environmental value of steel, it is important to evaluate its entire life cycle, extending beyond production to use and recycling. In addition, global steel demand is expected to increase from 1.75 billion tonnes in 2024 to 2.13 billion tonnes in 2050. Over the same period, crude steel production is projected to rise from 1.88 billion tonnes to 2.68 billion tonnes per year, while steel scrap use is expected to rise from 0.63 billion tonnes to 1.55 billion tonnes per year. Against this backdrop, steel stock in society is projected to increase from 30 billion tonnes (4 tonnes per person) to 70 billion tonnes (7 tonnes per person), with further advances in resource circulation expected.

To properly assess this environmental value of steel, JFE Steel participated as a key member in an initiative led by the Japan Iron and Steel Federation (JISF) to quantify the environmental impact of the entire life cycle of steel products and developed the ISO/JIS standard* calculation methodology. Corresponding to this standard, materials with higher recyclability are found to have lower environmental impact such as on global warming.

Fourteen blast furnace and electric arc furnace steel manufacturers operating in Japan, including JFE Steel, have compiled and published the national average value for life cycle inventory (LCI) data for different types of steel products for FY2022.

*ISO 20915: Life cycle inventory calculation methodology for steel products (November 2018)
JIS Q 20915: Life cycle inventory calculation methodology for steel products (June 2019)

› **Efforts to Assess the Environmental Impact of the Excellent Recyclability of Steel Products** (P. 106)



Adapted from the Japan Iron and Steel Federation's long-term vision for climate change mitigation.

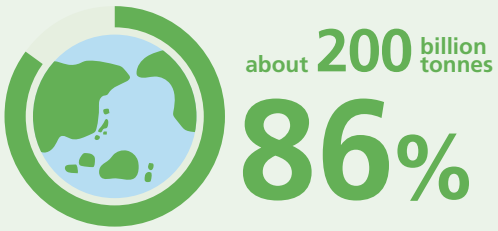
Produce High Economic Efficiency and Low Environmental Impact

The stable mass production of steel serves as the foundation for daily life and society. CO_2 generated by the manufacturing process of steel is extremely low compared to other materials, making it an environmentally sound material. Steel is essential for society's sustainable development and to create safe, comfortable lives for people everywhere.

Earth, a Planet of Iron (Abundant Resources)

As much as 86% of the Earth's metal resources are iron ore (200 billion tonnes).

Recoverable Reserves of Iron Ore on the Earth

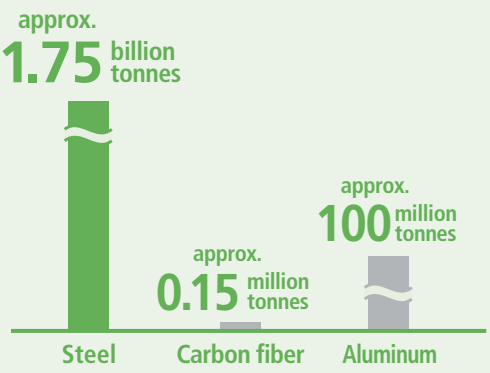


Source: Mineral Commodity Summaries (2026)

Mass Production at Low Cost

With rich reserves and a long history of technological development, iron is mass produced at reasonable prices and supplied stably, thereby contributing to the sustainable growth of society.

Global Demand (2024)



Research: JFE Holdings

Price*



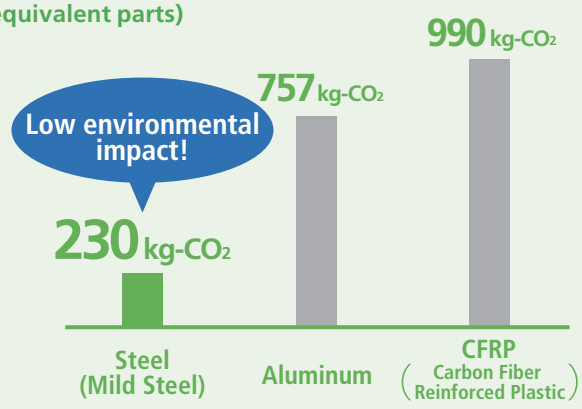
Research: JFE Holdings

*Cost of producing one unit weight of iron is indexed at 1 for comparison with other materials.

Extremely Low Environmental Impact at the Manufacturing Stage when Compared to Other Materials

Greenhouse gas (GHG) emissions from steel manufacturing are approximately one-fourth to one-fifth those from aluminum and carbon fiber for equivalent functionality*.

GHG Emissions at the Manufacturing Stage of Materials (CO_2 equivalent) ($kg\text{-}CO_2$/100 kg of steel-equivalent parts)



	Steel (Mild Steel)	Aluminum	CFRP (Carbon Fiber Reinforced Plastic)
GHG emissions per unit weight (CO_2 equivalent) ($kg\text{-}CO_2$/kg)	2.3	11.3	22.0
Functional equivalent weight (kg)	100	67	45

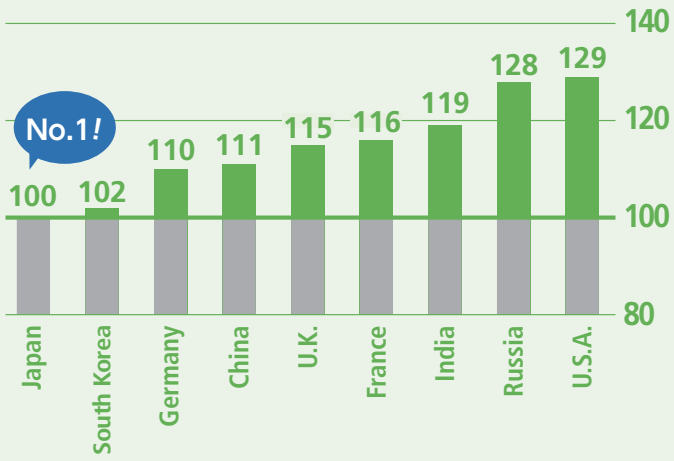
Source: Compiled from data disclosed by WorldAutoSteel and the Japan Iron and Steel Federation

*Ability to meet the same operational and performance requirements

Japan's Steel Industry Boasts the Highest Energy Efficiency in the World

Japan's steel industry (converter steel) produces steel with the lowest environmental impact compared to other major countries. This is a result of its longstanding efforts toward environmental conservation, including developing and spreading the use of energy-saving technologies.

Energy Efficiency by Country, with Japan at 100 (2019)



Source: Research Institute of Innovative Technology for the Earth (RITE)

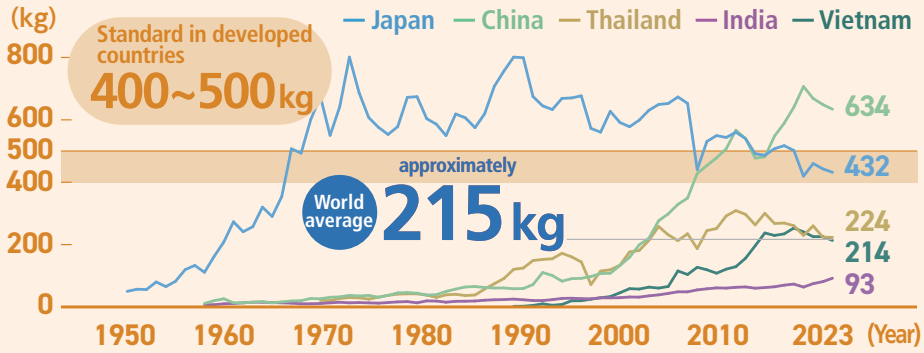
Use Foundation of Daily Life and Society

The use of steel supports daily life while helping to reduce our impact on the environment. For example, making automobile frames with high-tensile-strength steel sheets, which have a reduced thickness but retain their strength, considerably decreases vehicle weight while maintaining crash performance, thereby helping to reduce GHG emissions for society as a whole.

Potential to Grow on a Global Scale

Global average of annual consumption of steel is approximately 215 kg per capita. The long-term global demand for steel is expected to keep growing alongside the economic development of emerging countries.

Trends in Annual Steel Consumption per Capita by Country (kg/person/year)

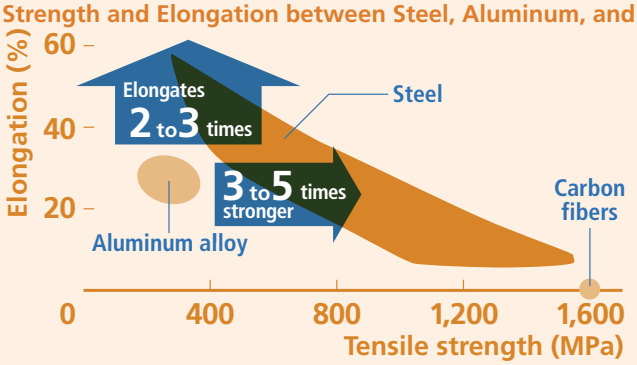


Source: World Steel Association

Potential for Evolution

Steel can be elongated two to three times more than aluminum at the same rigidity and is three to five times stronger at the same extended rate, making it the optimal material for new world-class structures such as TOKYO SKYTREE. And yet there is still potential for further evolution. The emerging needs of society will advance the development of steel and contribute to a productive future.

Comparison of Strength and Elongation between Steel, Aluminum, and Carbon Fiber



Research: JFE Holdings

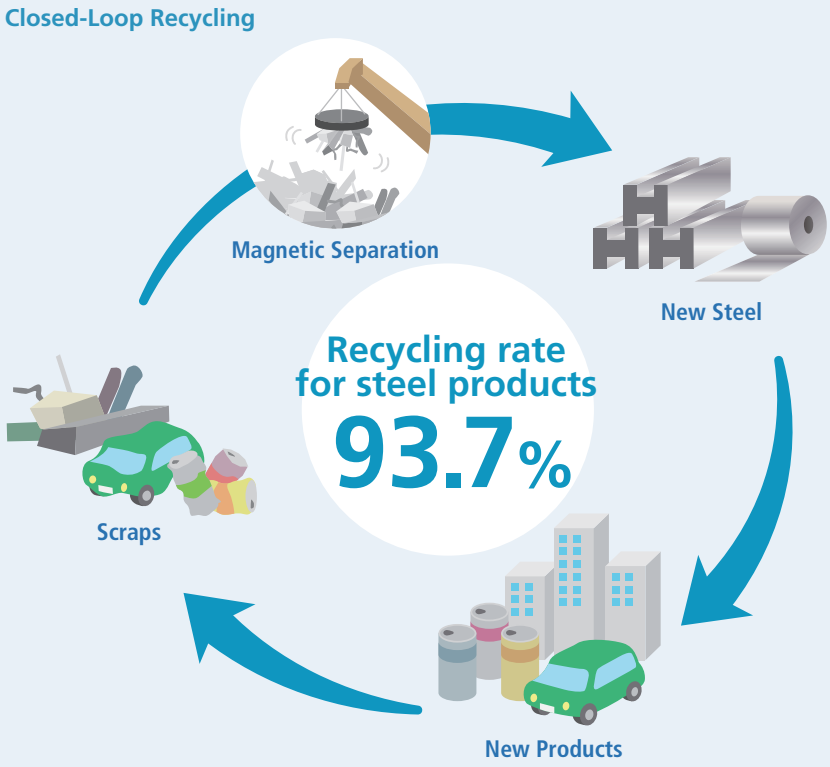
Recycle Helping Society Transition to a Circular Economy

Steel is a highly recyclable material that can be easily separated and collected using its magnetic properties. It can be efficiently separated, collected, and recycled into high-quality, high-functioning products over and over again through closed-loop recycling.

Closed-Loop Recycling of Steel

Steel can be recycled a number of times as a raw material for steel products while retaining its original properties. Closed-loop recycling is superior to open-loop recycling* in terms of sustainability because closed-loop recycling reduces the consumption of natural resources, as well as the amount of environmentally hazardous substances and waste.

*In open-loop recycling, the material recycling process involves two types of finite recycling: thermal recycling and cascade recycling. Thermal recycling means that heat generated by incineration is recovered, while cascade recycling indicates recycling the material accompanied by the degradation or alteration of the material's properties.



Source: The Japan Iron and Steel Federation