Trends and Initiatives Toward Carbon Neutrality in the Steel Industry in Japan

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New Energy and Industrial Technology Development Organization
Green Innovation Fund Projects Coordination Office
Chief Officer

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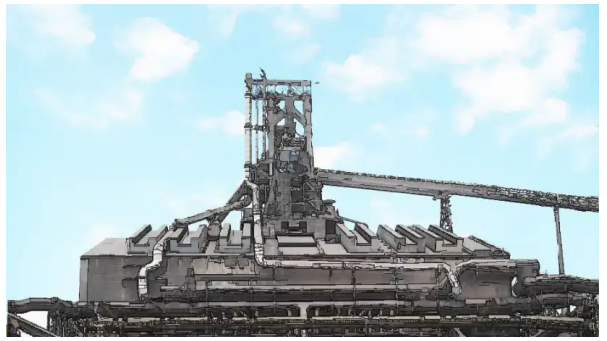
Introduction of NEDO

■ New Energy and Industrial Technology Development Organization

Our Missions

✓ **Addressing energy and global environmental problems**

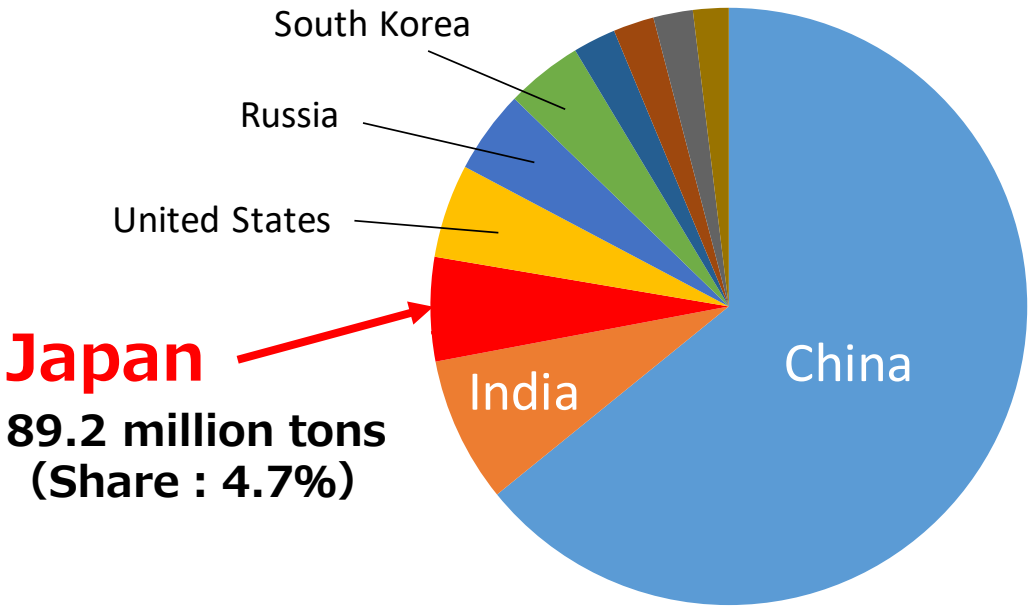
✓ **Enhancing industrial technology**



Presence of Steel Industry in Japan

- ✓Japan is **the world's third largest producer of crude steel** after China and India.
- ✓It contributes to manufacturing industries in Japan and abroad by supplying high-quality steel products.

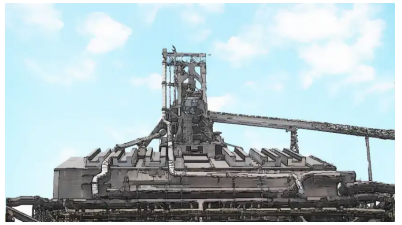
Crude Steel Production in 2022 (World)



Source : World Steel Association

Japanese Steel Industry

Steel industry (Production)
$141 billion 250,000 people



Construction Industry
$851 billion
4,730,000 people

Automotive Industry
$513 billion
1,300,000 people

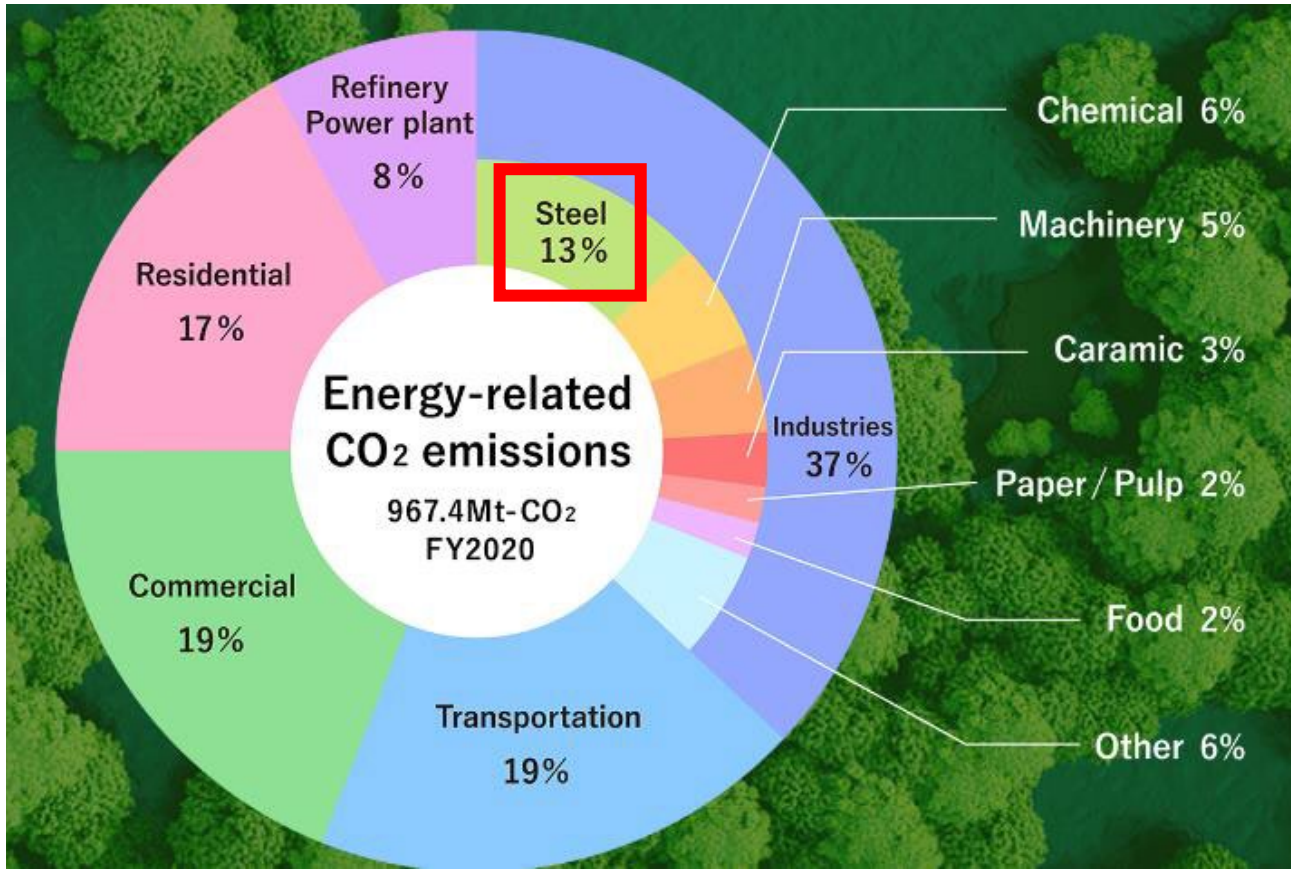
Source: Statistics Bureau, Ministry of Internal Affairs and Communications

CO2 Emissions from the Japanese Steel Industry

✓ The Japanese steel industry accounts for **13% of the 967.4 million tons of energy- related CO_2 emissions in Japan**.

Energy-related CO_2 Emissions in Japan

(FY2020, fuel combustion emissions allocated to energy)



Source : Challenges towards Carbon Neutrality
https://www.carbon neutral steel.com/en/about/

Societal CO_2 Reduction Needs

- ✓ Consumer awareness of global warming has been increasing, and a specific CO_2 reduction target for supply chains is being proposed by steel users.
- ✓ Japanese steelmakers have been **selling green steel that allocates CO_2 reduction efforts on a mass balance basis**.

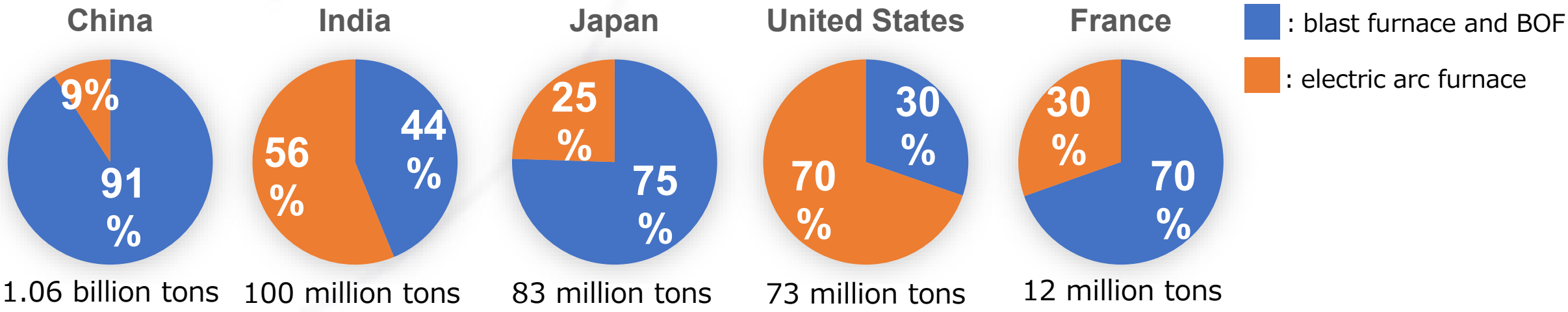
Steel manufacturers have launched their own green steel brand

Virtual	EAF-offsets	Authentic
JGreeX	NET-ZERO STEEL · ECONIQ · NET-ZERO STEEL	HYBRIT FOSSIL-FREE STEEL
NSCarbolex™ Innovative action for sustainability	verdeX	H2 green steel
Kobenable Steel	XCarb® Towards carbon neutral steel	greentec steel
XCarb® Towards carbon neutral steel		
bluemint		

Features of the Japanese Steel Industry

- ✓ In Japan, **75% of steel is produced by blast furnace and BOF methods**, but in countries such as the United States and India, the use of electric arc furnaces is higher.
- ✓ In order to promote the carbon neutralization of the steelmaking process, it is important to **develop hydrogen reduction technology using blast furnaces** and to **expand the use of electric furnaces**.

Production Ratio of BOF and Electric arc Furnace in Major Steel Producing Countries in 2020

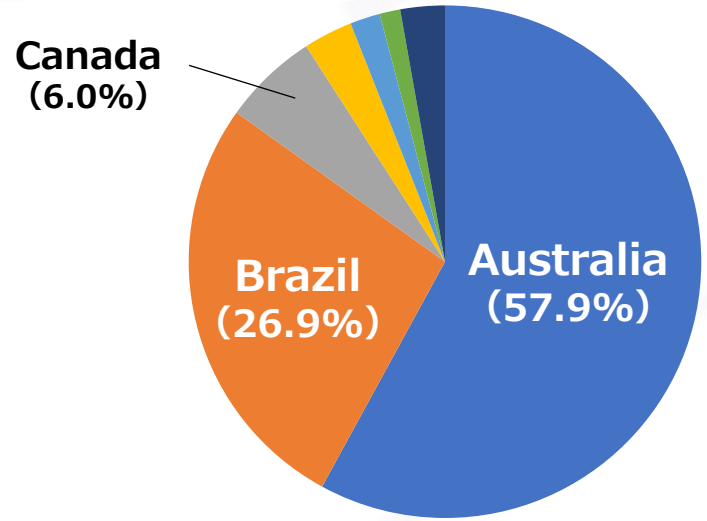


Source : World Steel in Figures 2021

Features of the Japanese Steel Industry

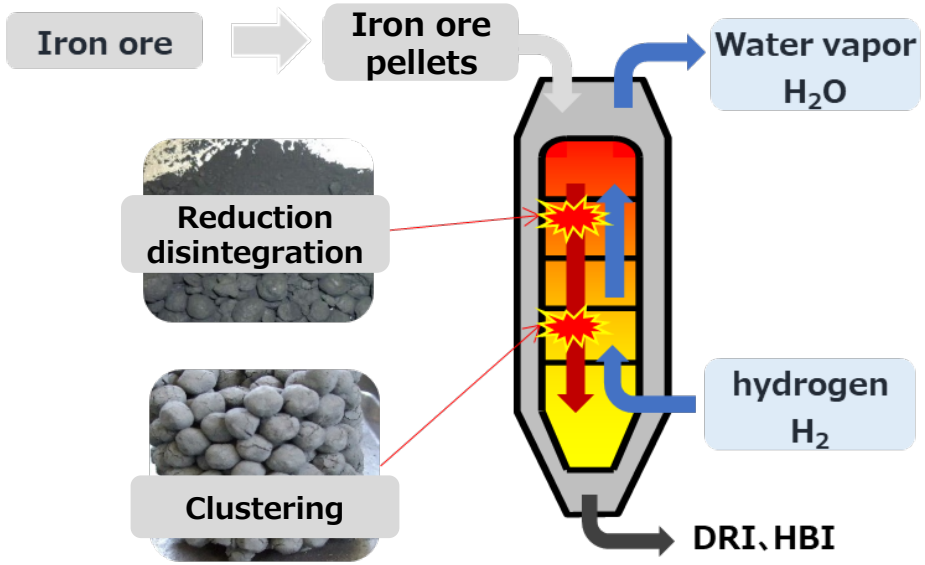
- ✓ Japan **imports low-grade iron ore with high amounts of impurities**, which are produced mainly in Australia and Brazil.
- ✓ When low-grade iron ore is used, it is necessary to develop technologies to counteract **Reduction disintegration and Clustering in the shaft furnaces** and to **remove impurities （components that affect the product） from directly reduced iron and scrap in the electric arc furnaces**.

Japan's Iron Ore Import Sources in 2020



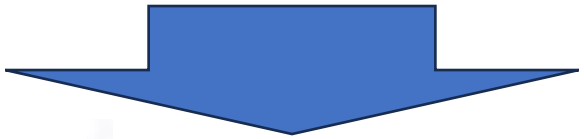
Source : Statistical data
https://www.daiichi-g.co.jp/geo/contents/data/toukei/toukei.pdf

Reduction disintegration and Clustering in shaft furnaces



Direction to be Taken by Japanese Steel Industry

- The manufacturing process of "green steel" has not yet been established technically, including hydrogen reduction, but **the R&D of the decarbonization process are difficult to achieve only by the private sector** because it is not related to the quality of iron itself.
- Based on the trends of other countries, the development will be promoted in **multiple approaches, and technologies will be selected based on our country's research results and strengths**.

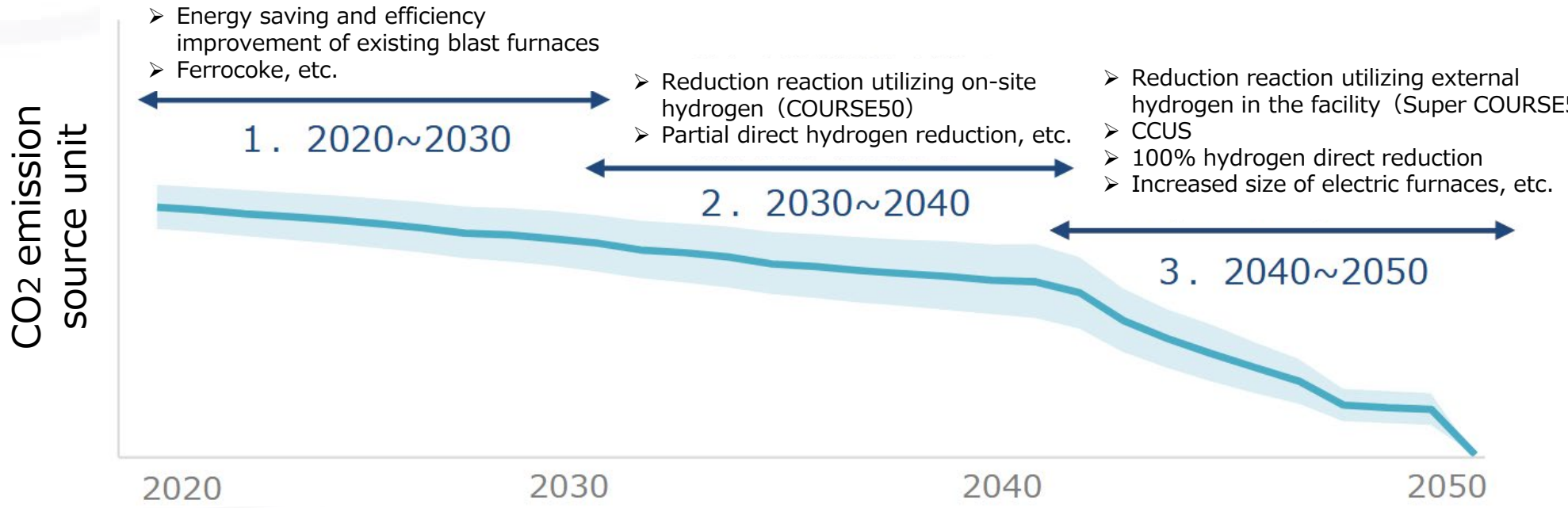


- The “winning strategy” for Japanese iron and steel industry is to be the first in the world to **establish super innovative technologies such as hydrogen reduction iron and steelmaking** and **establish a system to specialize in the production and supply of high-grade green steel**.
- In order for the Japanese iron and steel industry to survive the international competition, it is necessary for each steel company to develop a sustainable business model by mobilizing all approaches, including **effective use of hydrogen generated in steelworks**, **control of hydrogen consumption by utilizing CCUS**, **cooperation with overseas bases where raw materials and hydrogen procurement** are easy and business transformation.

Reduction Targets Set by the Japanese Steel Industry

- ✓ The goal is to **reduce CO_2 emissions derived from energy by 30%（approx. 57.9 million tons）by 2030** compared with 2013.
- ✓ While maintaining and strengthening the competitiveness of Japanese steel industry, **carbon neutrality by 2050** will be realized.

CO2 Emissions Reduction Image（※）



（※）This is the image of the reduction of our national steel industry as a whole. In reality, each steel company will seek to achieve carbon neutrality under its own long-term strategy, so we do not expect each company to match the above pathway image.

Source : Ministry of Economy, Trade and Industry
https://www.meti.go.jp/policy/energy_environment/global_warming/transition/transition_finance_technology_roadmap_iron_and_steel_jpn.pdf

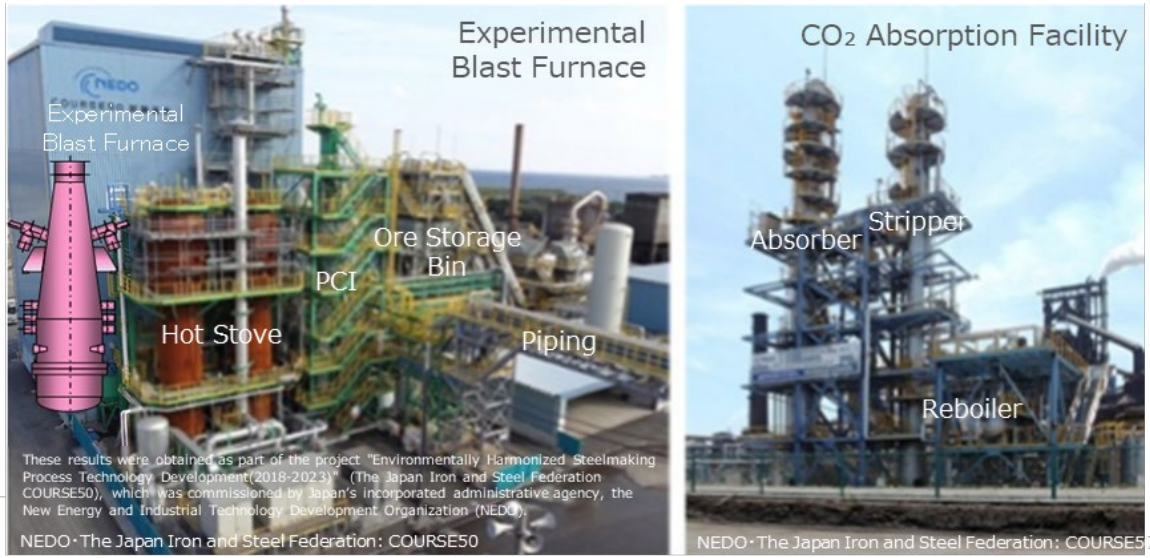
NEDO's Support for the Steel Sector

- ✓ Japan is **the first country to start developing hydrogen reduction ironmaking technology**.
- ✓ Testing using a 12m³ experimental blast furnace (about 1/400 of an actual furnace) has been carried out since FY2013, and it **has been verified for the first time in the world that a 10% reduction of CO_2 emissions in the reduction process can be achieved**. Technologies to further reduce CO_2 emissions are under development.
- ✓ **Technology has also been established to reduce the external energy required for separating and capturing CO_2 (chemical absorption method)** using unused exhaust heat in steelworks. Further energy-saving is being promoted.

COURSE 50

CO_2 Ultimate Reduction System for Cool Earth 50

Experimental Blast Furnace and CO_2 Absorption Facility（COURSE50）

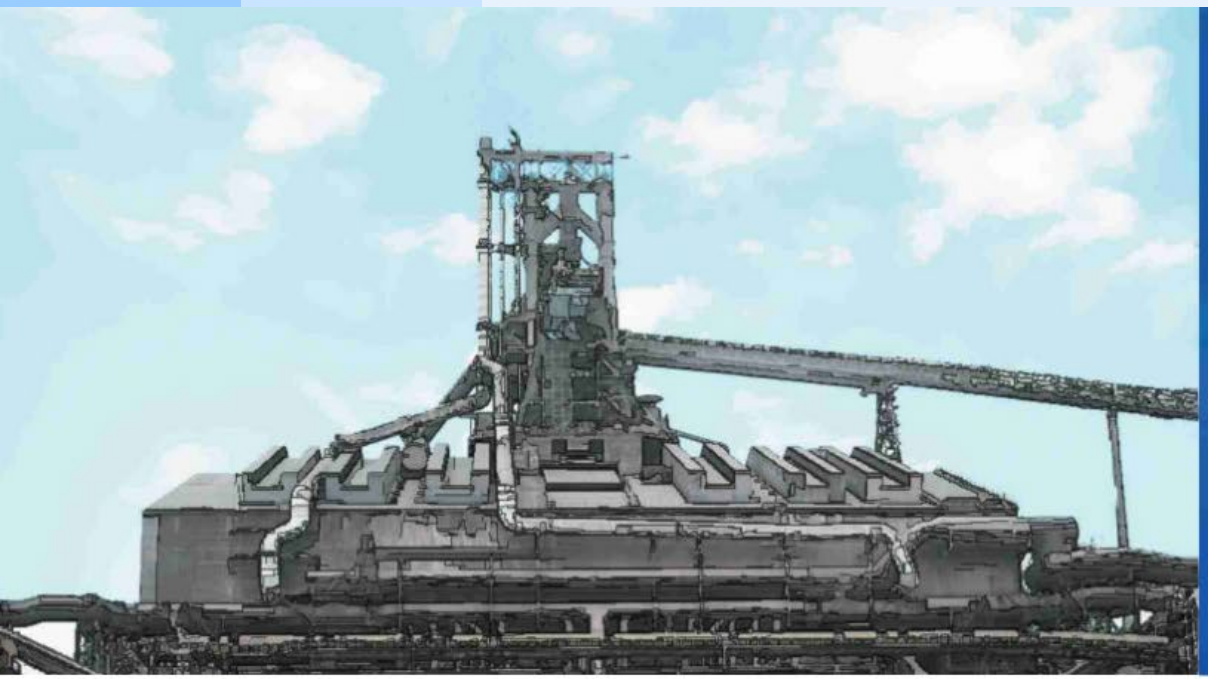


Green Innovation Fund Projects

■ Green Innovation Fund Projects

- ✓ METI has established a **2.8 trillion-yen (EUR 17.5 billion) fund** as part of NEDO that began in 2021
- ✓ Aiming for **carbon neutrality by 2050**
- ✓ Supporting companies committed to ambitious goals
- ✓ Continuous support for **up to 10 years**, from **research, development, and demonstration** to social implementation, in **20 priority fields (including steelmaking)** as set forth in the Green Growth Strategy

Green Innovation Fund Projects



Field of Energy Structure Transformation

Hydrogen Utilization in Iron and Steelmaking Processes

Budget up to
450 billon-yen(※)
(EUR 2.8 billon)

Project Overview

i. **Development of hydrogen reduction technology using blast furnaces**

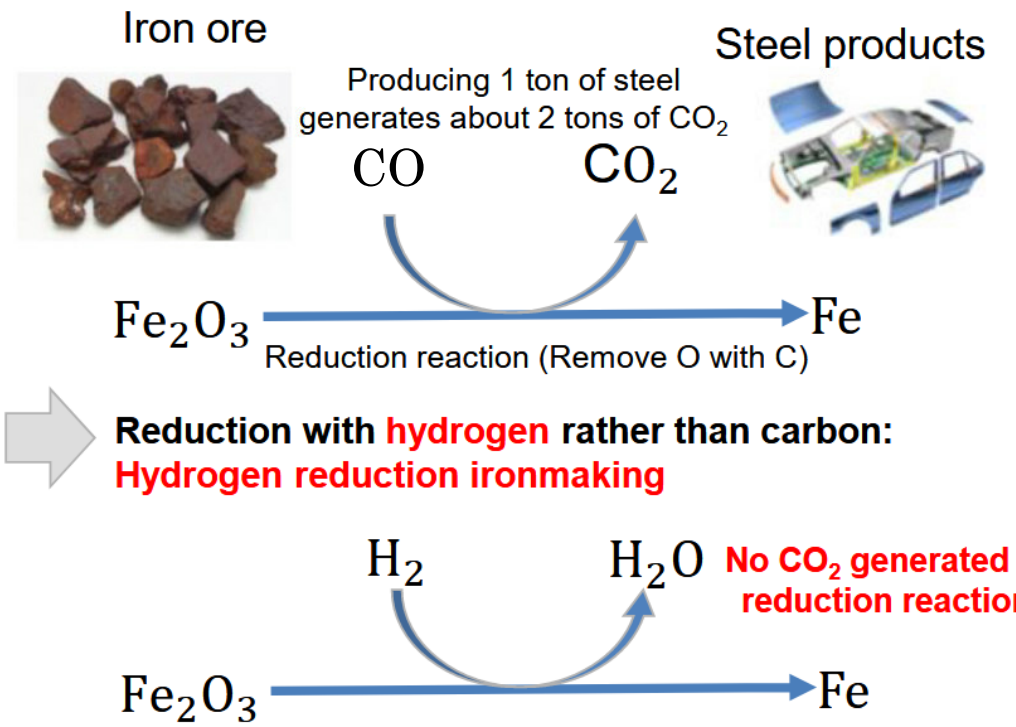
ii. **Development of direct hydrogen reduction technology that reduces iron ore with hydrogen only**

(※) The budget is currently under consideration to increase this amount.

Green Innovation Fund Projects

✓ Based on the time frame for the development of social infrastructure such as hydrogen supply, NEDO will promote multiple technological development approaches for the **"blast furnace method"** and the **"direct reduction method and electric furnace method"**.

Image of hydrogen reduction ironmaking



Technical challenges

<Development of hydrogen reduction technology using blast furnaces>

- The blast furnace method is highly energy efficient, and can manufacture high-quality steel. Japan's iron and steel industry has a technological advantage.
- Aim to decarbonize blast furnaces by developing technology for reducing iron ore with hydrogen, and for using the generated CO_2 as a reducing agent, etc.

  Note: Using the test blast furnace, test the technology for reducing the CO_2 emissions from the iron and steelmaking process by more than 50%

<Development of direct hydrogen reduction technology that reduces iron ore with hydrogen only>

- The direct reduction method will decarbonization without the need for CCU and other peripheral technologies by replacing all the reduction gases with hydrogen.
- Aim to manufacture high-quality steel in a direct hydrogen reduction furnace by developing technology for directly reducing iron ore with hydrogen, and for removing impurities using electric arc furnaces.

Merci de votre attention !