

Japanese governmental policy and initiatives toward Carbon Neutrality

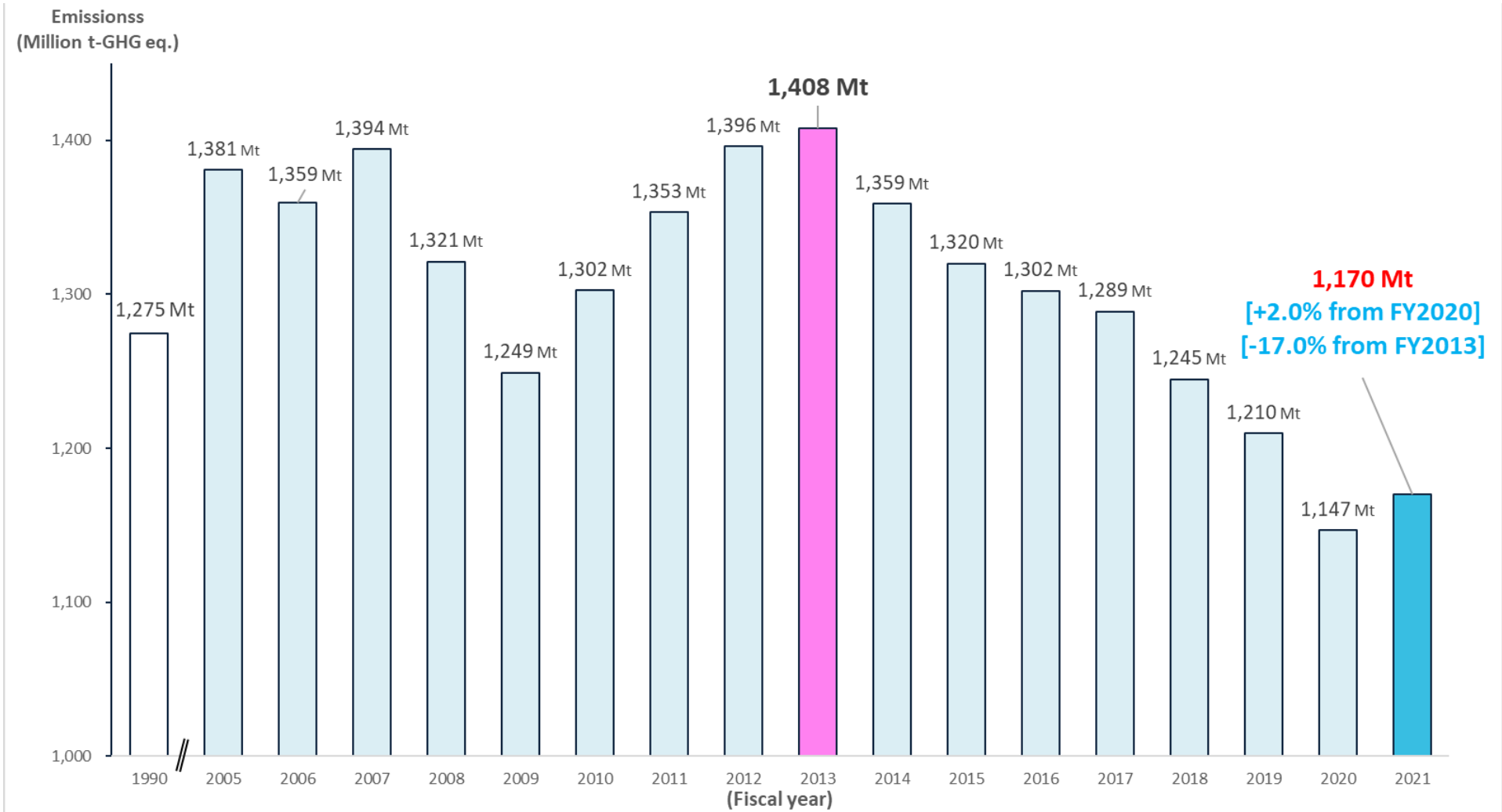
February 2024

Ministry of Economy, Trade and Industry

Government policy toward Carbon Neutrality

Japan's total GHG emissions

- Total GHG emissions in 2021 decreased by 17.0% from 2013. Compared to 2020, it has increased by 2% due to the effects of COVID-19 fading.

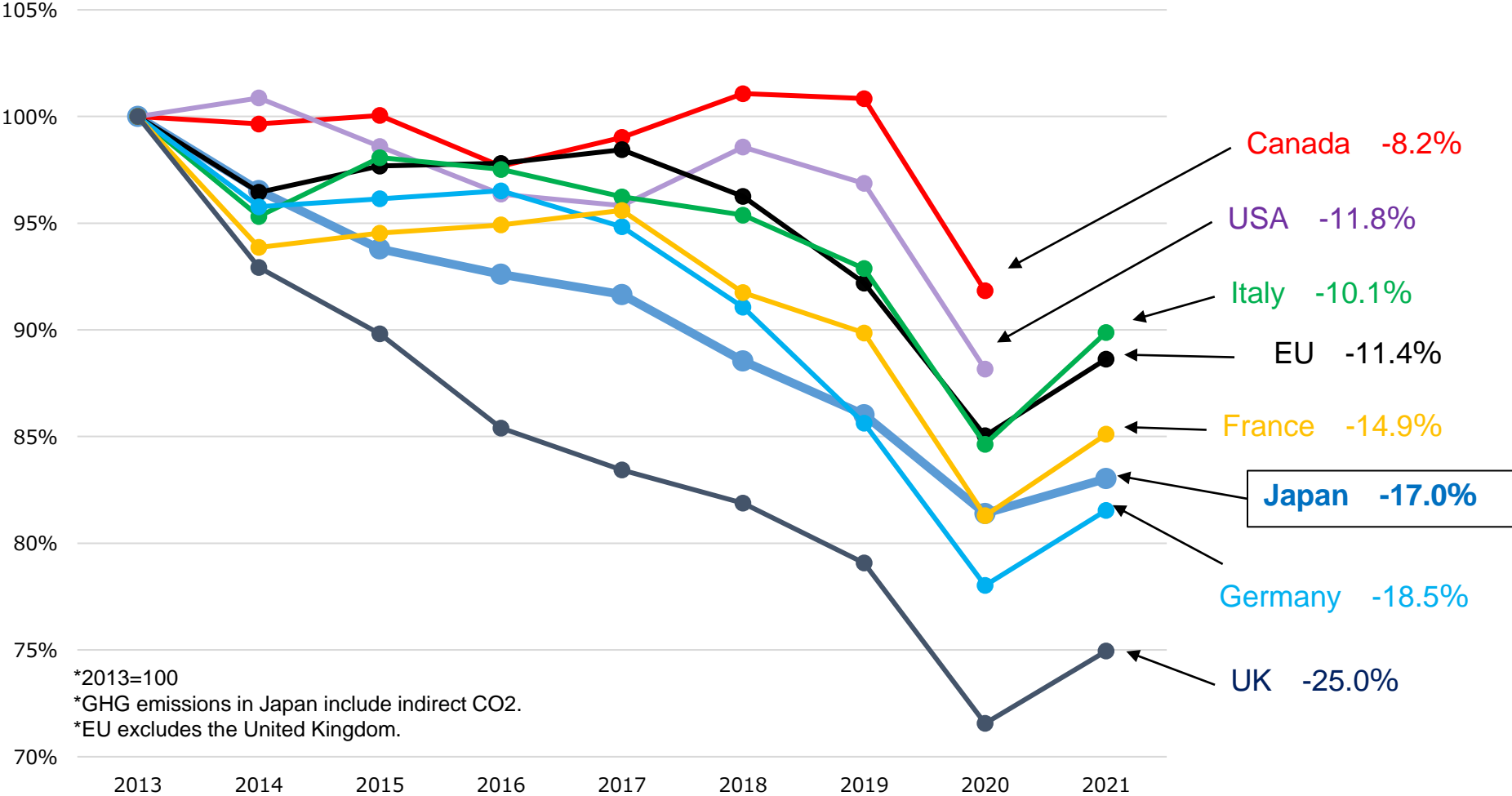


Source : National Institute for Environmental Studies, The GHG Emissions Data of JAPAN

<https://www.nies.go.jp/>

Japan's total GHG emissions

● Japan's reduction rate is equal to or higher than other developed countries.



Source: Greenhouse Gas Inventory Data (UNFCCC) 、 EEA 「Approximated estimates for greenhouse gas emissions」、 UK「 Net greenhouse gas emissions on a territorial basis」、 Ministry of the Environment : FY2021Created based on greenhouse gas emissions (confirmed values)

Declaration of “Carbon neutrality in 2050”

Japanese former prime minister Suga’s Speech (Oct. 26, 2020)

My administration will devote itself to the greatest possible extent to bring about a green society, while focusing on a virtuous cycle of the economy and the environment as a pillar of our growth strategy.

We hereby declare that **by 2050 Japan will aim to reduce greenhouse gas emissions to net-zero, that is, to realize a carbon-neutral, decarbonized society.**

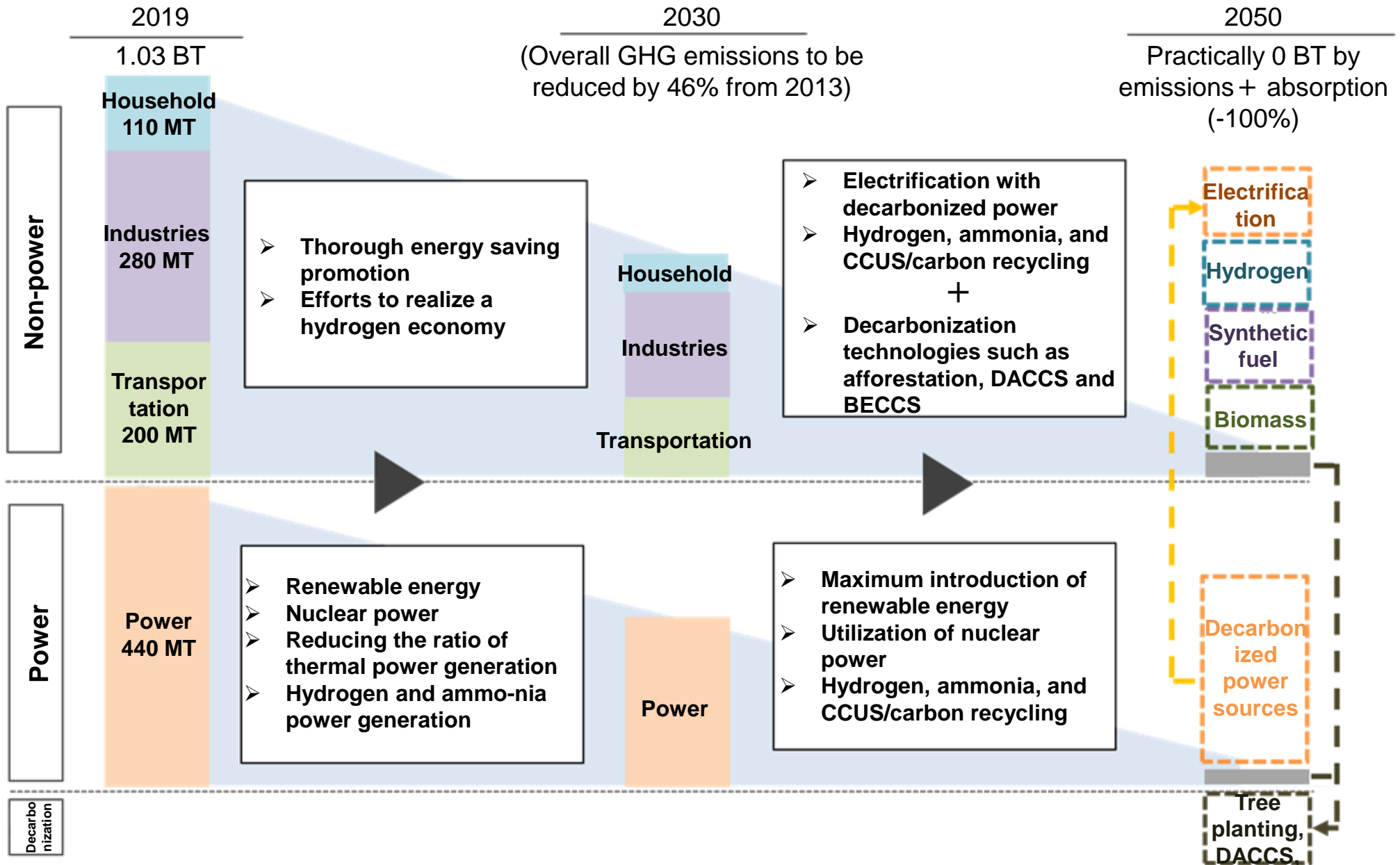
Addressing climate change is no longer a constraint on economic growth. We need to adjust our mindset to a paradigm shift that proactive climate change measures bring transformation of industrial structures as well as our economy and society, leading to dynamic economic growth.

The key here is revolutionary innovations, such as next-generation solar cells and carbon recycling. We will accelerate research and development aimed at realizing utilization of such technologies in society. We will make our utmost efforts in this area, such as establishing a forum for the national and local governments to conduct a review towards realizing a decarbonized society, while making green investment more common through the full mobilization of regulatory reforms and other policy measures. Also, we will advance green transformation more efficiently and effectively through digital transformation in fields related to the environment. We will lead the green industry globally and realize a virtuous cycle of the economy and the environment.

Green Growth Strategy (Released on 18th June 2021)

- Green Growth Strategy, an industrial policy towards a “Positive cycle of economic growth and environmental protection”, was developed in response to the declaration of “Carbon neutrality in 2050”.
- This strategy constitutes a list of 14 sectors with high growth potential, for which the Government will provide necessary policy measures and show ambitious goals.
- Regarding particularly important projects, once the public and private sectors share bold and specific goals, continuous support will be provided to companies from technology development through demonstration to social implementation over the next 10 years. (Green Innovation Fund)

Energy outlook for CN in 2050



14 sectors with high growth potential



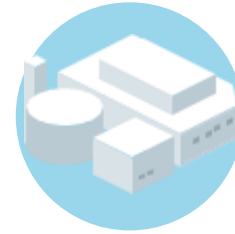
Offshore wind/
solar/
geothermal power



Hydrogen/
fuel ammonia



Next-generation
thermal energy



Nuclear



Automobile/
storage battery



Semiconductor/
information and
communication



Ship



Logistics/people flow/
civil engineering
infrastructure



Food, agriculture,
forestry and fisheries



Aircraft



Carbon recycling/
material



Housing and building/
next-generation power
management



Resource
circulation



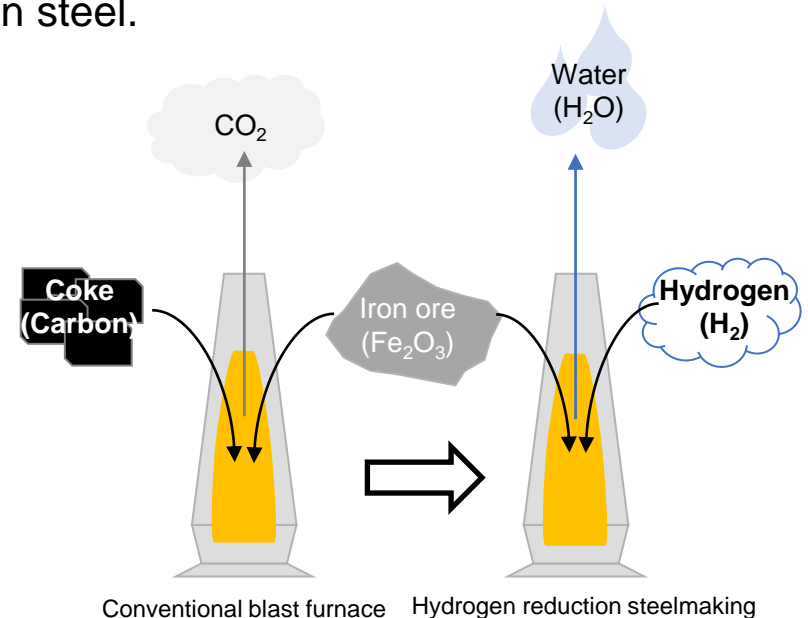
Life style



Material (carbon recycling/material industry)

<Main future efforts>

- Developing and demonstrating technologies to realize “zero-carbon steel”.
 - For hydrogen reduction steelmaking, establishing the following technologies:
 - (1) Furnace heat compensation technology necessary for iron ore reduction
 - (2) Technology for securing airflow due to the reduced use of coal
 - (3) Technology for advancing electric furnaces and removing impurities, which is essential for melting reduced iron.
 - Aiming to capture a maximum of approx. 500 million tons per year (approx. 40 trillion yen per year) in 2050, considering a global market prospect for green steel.



Initiatives toward Carbon Neutrality

Current Status of CO₂ Emissions in the Steel Industry

- CO₂ emissions from the steel sector accounted for 39% in the industrial sector (14% of CO₂ emissions in the country) in fiscal 2021.

CO₂ emissions

Total in Japan : 1,064 Mt

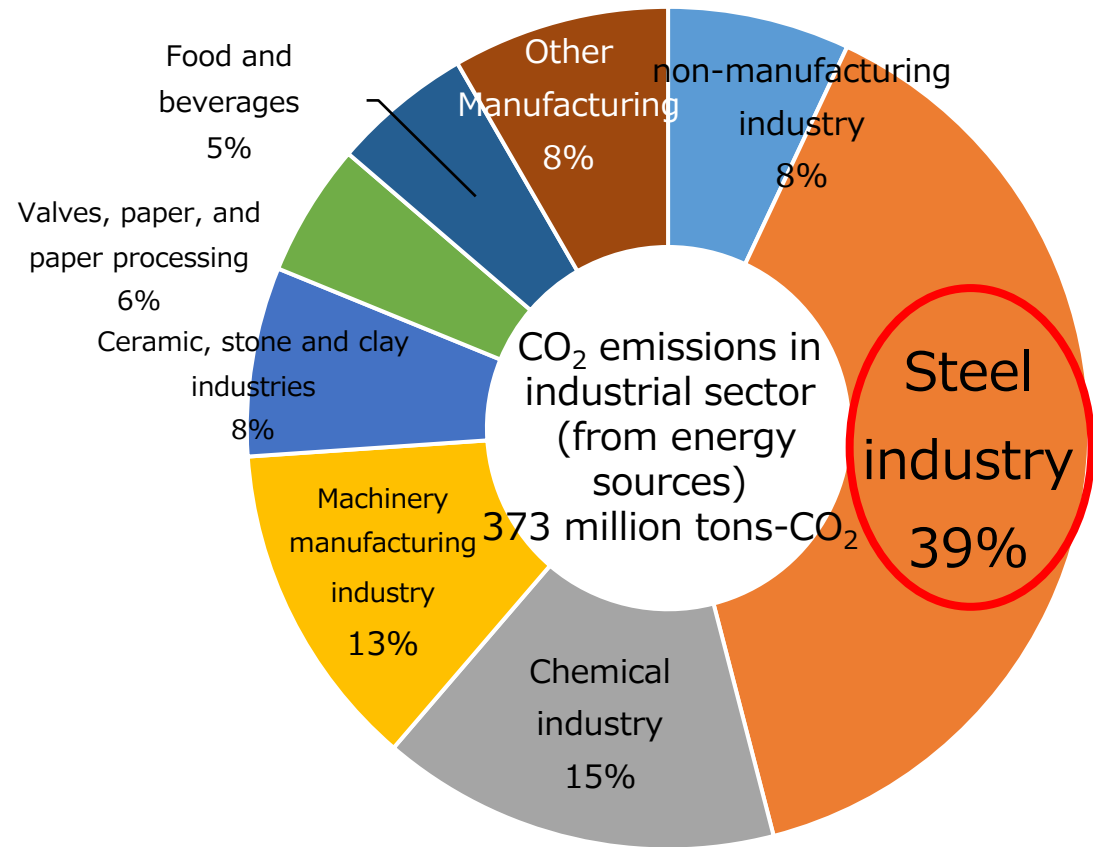
The industrial sector : 373 Mt

Steel industry : **145 Mt**



In particular, **the ironmaking process (upstream process)** accounts for approximately 80% of CO₂ emissions from all processes.

Industrial sector (FY2020)

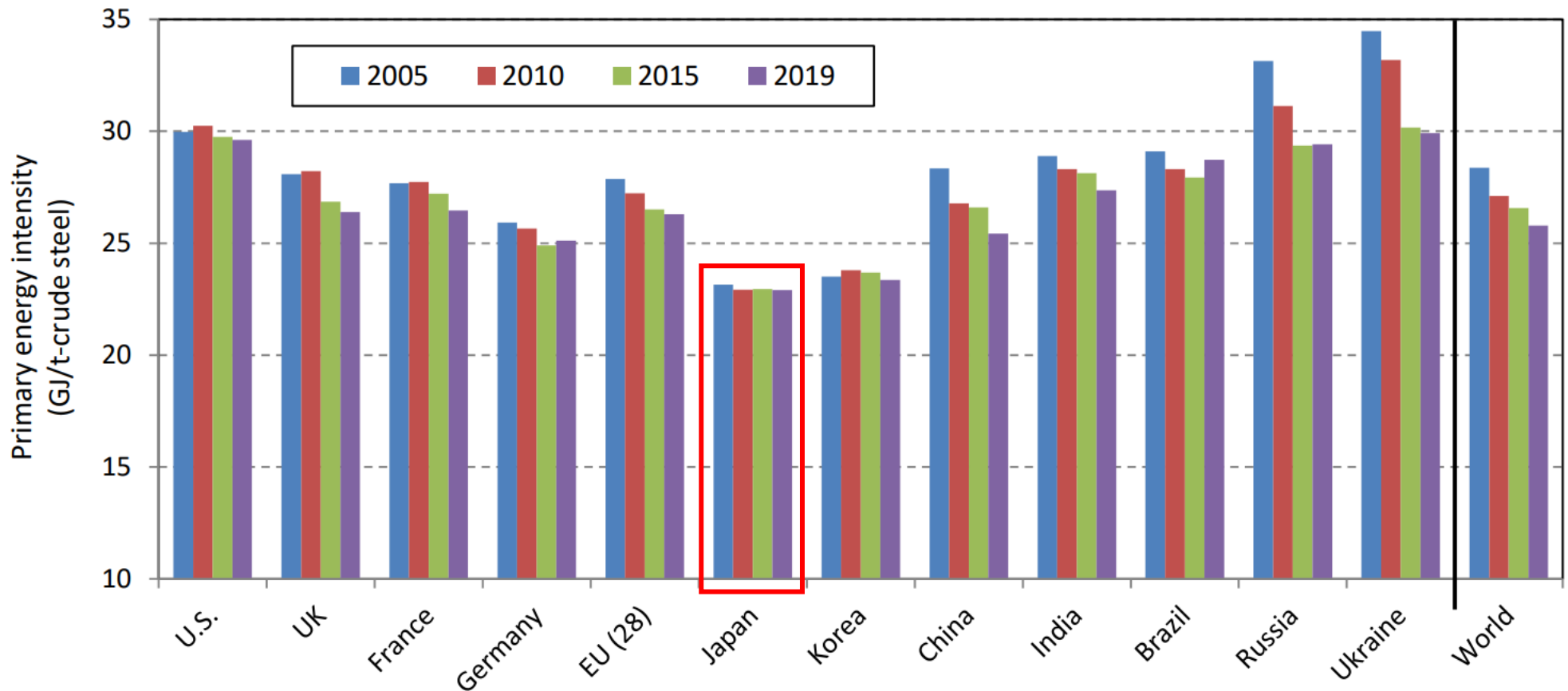


※CO₂ emissions (unit:1 million tons) are shown in the middle column.

Energy Intensity for Steel Manufacturing

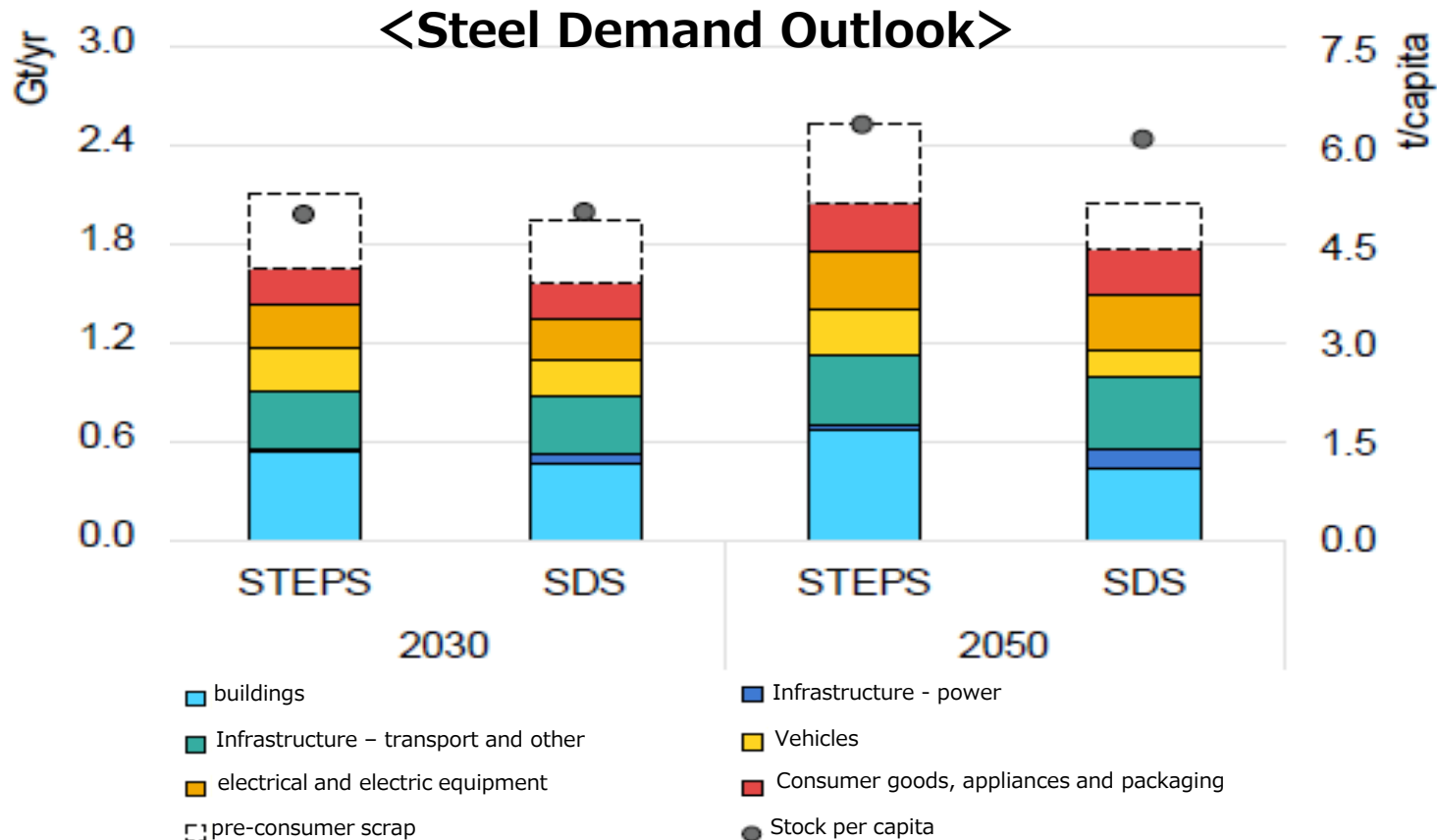
- Japan has the lowest primary energy intensity in the manufacturing of blast furnace steel.

International Comparison of Primary Energy Intensity of Steel Manufacturing



Steel Demand Outlook

- The IEA forecasts that there will be significant steel demand for vehicles, infrastructure, electrical and electric equipment in 2050.
- Steel remains an essential material in a carbon-neutral society.



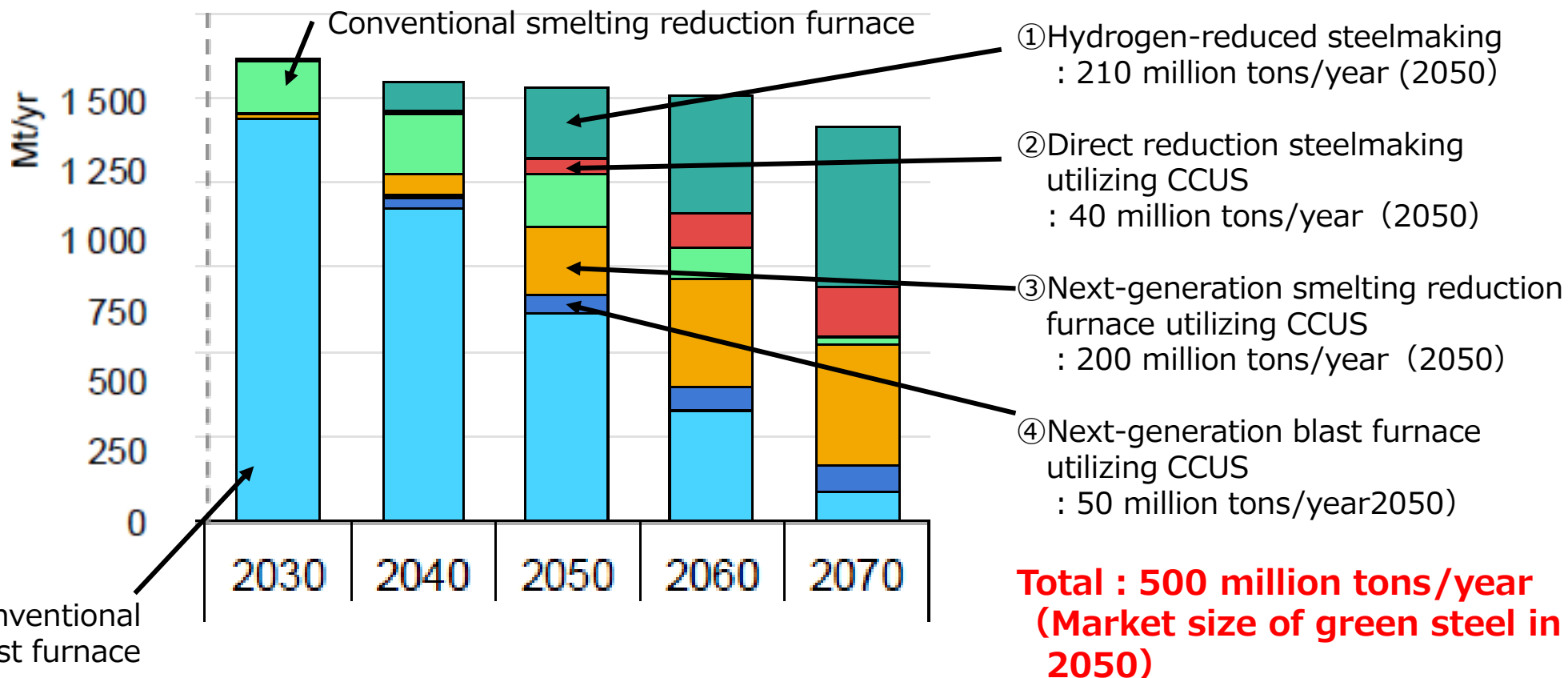
Source: Iron and Steel Technology Roadmap (2020) IEA

※ STEPS: Stated Policies Scenario, SDS: Sustainable Development Scenario

Market size of green steel

- IEA estimates that the market for "green steel," which achieves virtually zero CO2 emissions from its manufacturing processes, will be about 500 million tons in 2050 (almost replaced by green steel in 2070).

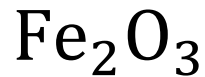
**Global iron production by technology
in the Sustainable Development Scenario**



Source: IEA Energy Technology Perspectives 2020

Hydrogen reduction steelmaking

Iron ore

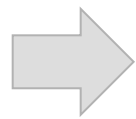


2 tons of CO₂ in
making 1 ton of iron

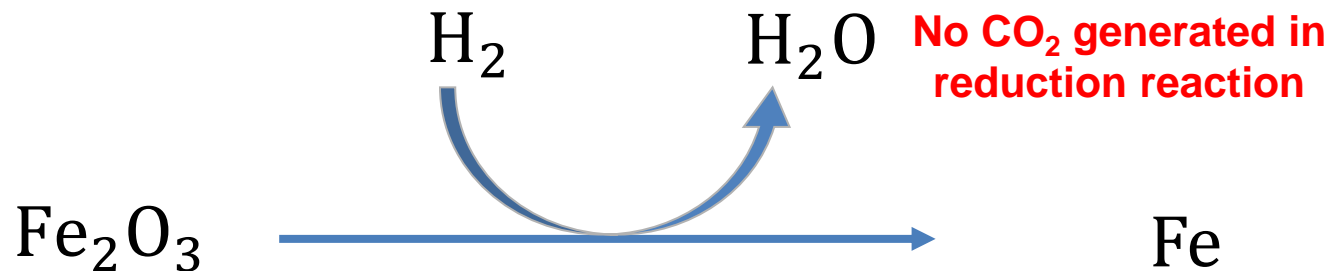


Reduction reaction
(Remove O with C)

Steel products



Reduction with hydrogen rather than carbon:
Hydrogen reduction steelmaking



Possible Innovative Technologies for Achieving Carbon Neutrality

- **The blast furnace method** : For decarbonization, **technologies such as direct injection of hydrogen** and **carbon recycling in which methane generated by the reaction of hydrogen with CO₂ is injected** are assumed.
- **The direct reduction method** : For decarbonization, **a technology to remove impurities contained in low-grade iron ore, which is a raw material, by electric arc furnace method after reducing with hydrogen** is assumed.

	Blast furnace method		Direct reduction method
	COURSE50 technology	Carbon recycling technology	hydrogen direct reduction technology
configuration			
features	<ul style="list-style-type: none"> • hydrogen direct injection • hydrogen preheating 	<ul style="list-style-type: none"> • hydrogen indirect injection • pure oxygen injection 	<ul style="list-style-type: none"> • hydrogen direct injection

“Hydrogen utilization in iron and steelmaking processes” project

- The government is using the Green Innovation Fund to support R&D to decarbonize the iron and steelmaking processes. The fund will support up to 449.9 billion yen over a 10-year period.

【 1 –①】Development of hydrogen reduction technology utilizing on-site hydrogen

Demonstrate the technology to reduce CO₂ emissions in ironmaking processes by 30% or more by 2030 through technologies such as hydrogen reduction in blast furnaces using on-site hydrogen and CO₂ separation and capture.

【 1 –②】Development of low-carbon technologies using CO₂ contained in external hydrogen and blast furnace exhaust gas

Demonstrate the technology to reduce CO₂ emissions in ironmaking processes by 50% or more in medium-scale experimental blast furnaces (larger than 500m³) by 2030.

【 2 –①】Development of direct hydrogen reduction technology

Demonstrate the technology to reduce CO₂ emissions by 50% or more in a medium-scale direct reduction furnace (1/25 to 1/5 of the actual furnace) compared with the current blast furnace method, by the technology which directly reduces low-grade iron ore with hydrogen, by 2030.

【 2 –②】Development of technology to remove impurities in electric arc furnaces using directly reduced iron

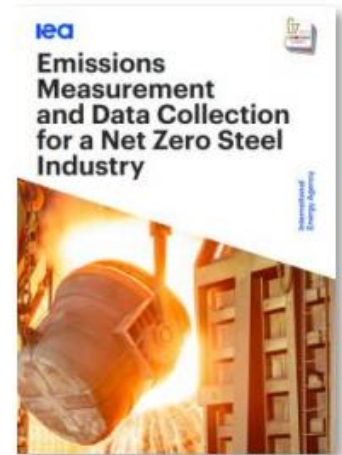
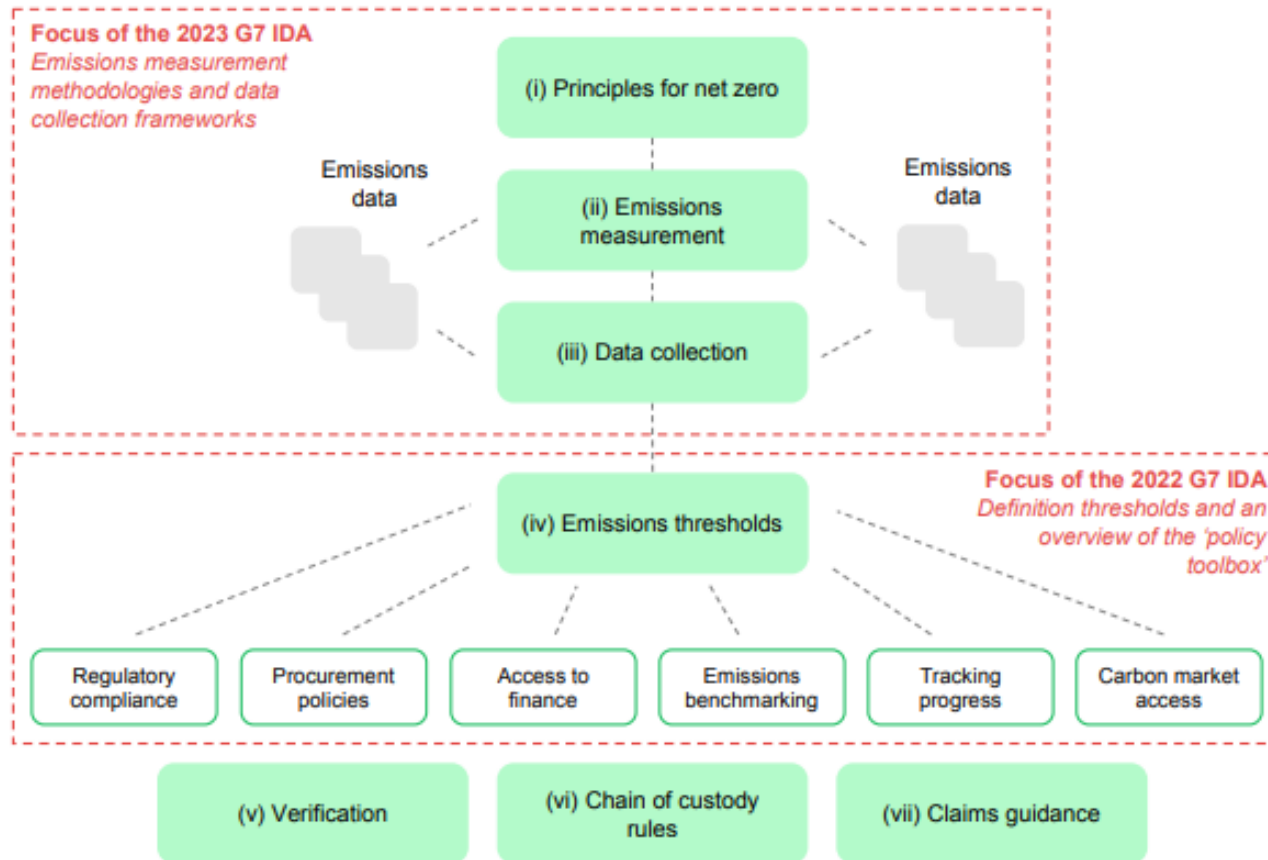
Demonstrate the technology to control the concentration of impurities to the level of blast furnace method in a large-scale experimental electric arc furnace (processing capacity of about 300 tons) by 2030.

【 2 –③】Development of high-efficiency melting technology using an electric melting furnace that utilizes direct-reduced iron

Demonstrate technology to achieve production efficiency that can replace the blast furnace process (pig iron production of 100 tons/hour or more) and control the concentration of impurities in the iron produced to the same level as the blast furnace process (e.g., phosphorus of 0.015% or less) through an integrated hydrogen direct reduction - electric melting furnace - converter process for low-grade iron ore, by 2030.

Work toward achieving net zero heavy industry sectors in G7 members

Figure 1 The key building blocks for implementing standards in support of decarbonisation policies

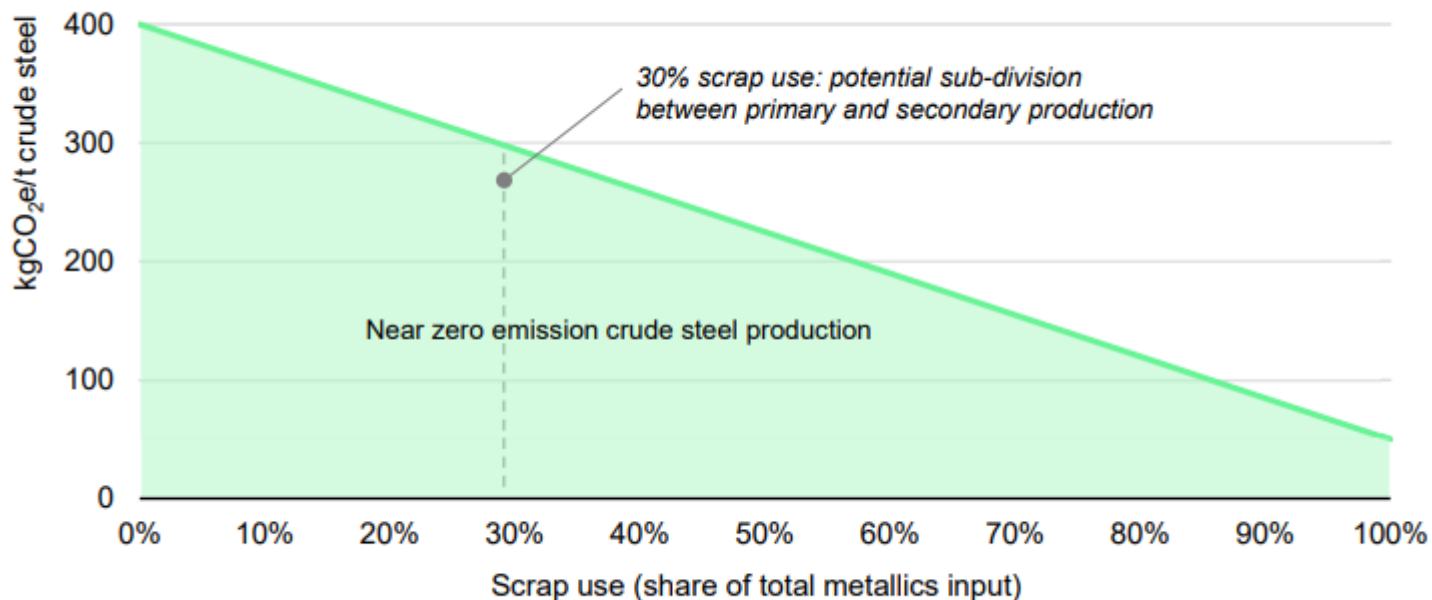


Source: IEA, Emissions Measurement and Data Collection for a Net Zero Steel Industry

IEA. CC BY 4.0.

G7 have begun work on a definition of near-zero emission steel, measurement methodologies, and a data collection framework to expand the market for green steel.

Figure 3.2 Near zero emission crude production threshold as a function of scrap use



IEA. All rights reserved.

- Source: IEA, Achieving Net Zero Heavy Industry Sectors in G7 Members

G7 members recognized the definitions in the IEA report as a robust starting point for a common understanding of ambitious general definitions for near-zero emission steel.

Thank you for your attention!