

Value To Green Society 2030

- Daido Steel's Approaches to Help Prevent Global Warming -

December 19, 2022



Daido Carbon Neutral Challenge 2030

Beyond the Special

Daido Steel's Carbon Neutrality Vision for 2030

We will contribute to the "realization of a green society" through the creation of high-performance specialty steel!

Through our overall business activities:

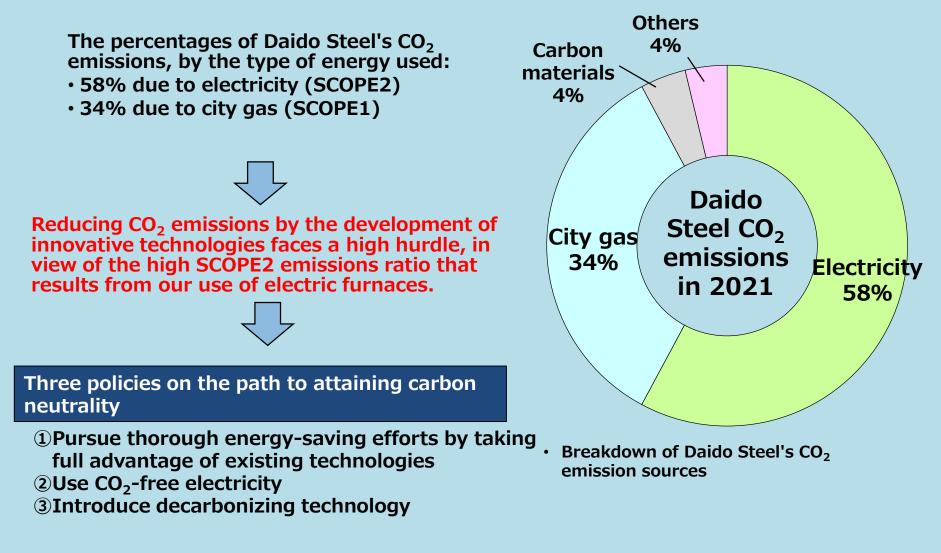
- Reducing CO₂ emissions to 50% of the 2013 figures
- Contributing to the realization of a recycling-oriented society

By supplying high-performance products:

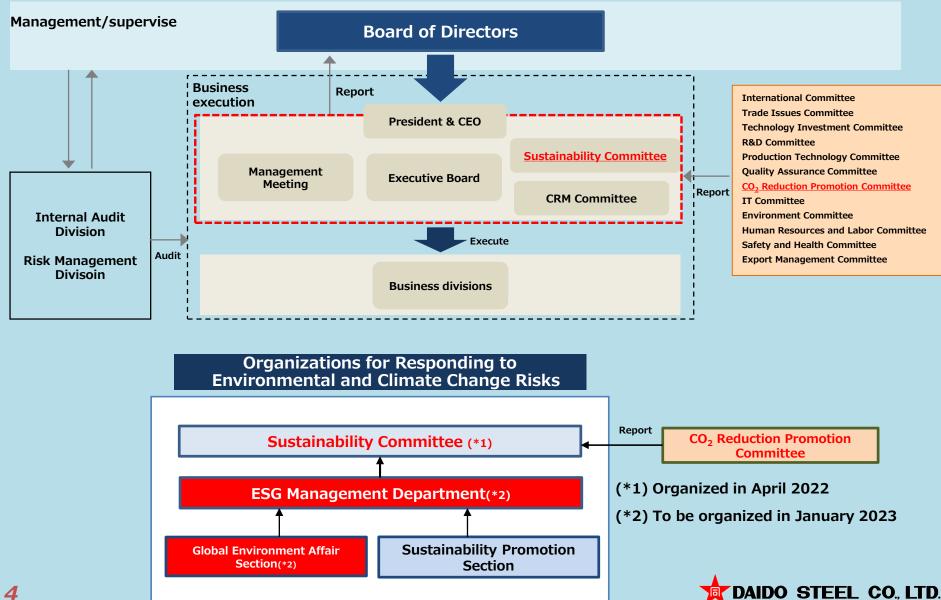
- Promoting energy conversion (to meet the needs created by the trend toward CASE)
- Manufacturing high-performance materials to contribute to the realization of a hydrogen-powered society
- Engineering accomplishments that foster energy-savings



Daido Steel's CO2-reduction scenario



CO₂-reduction management for 2023



CO2 reduction targets (2030, 2050)

Toward 2030

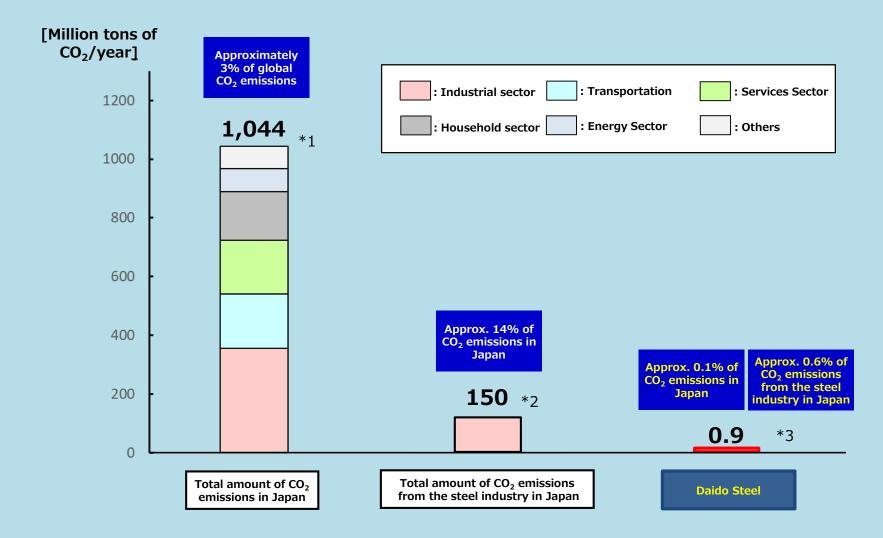
Reduce CO₂ emissions by 50% compared to FY2013

Toward 2050

Aim to achieve carbon neutrality in line with the development of decarbonization technologies and infrastructure



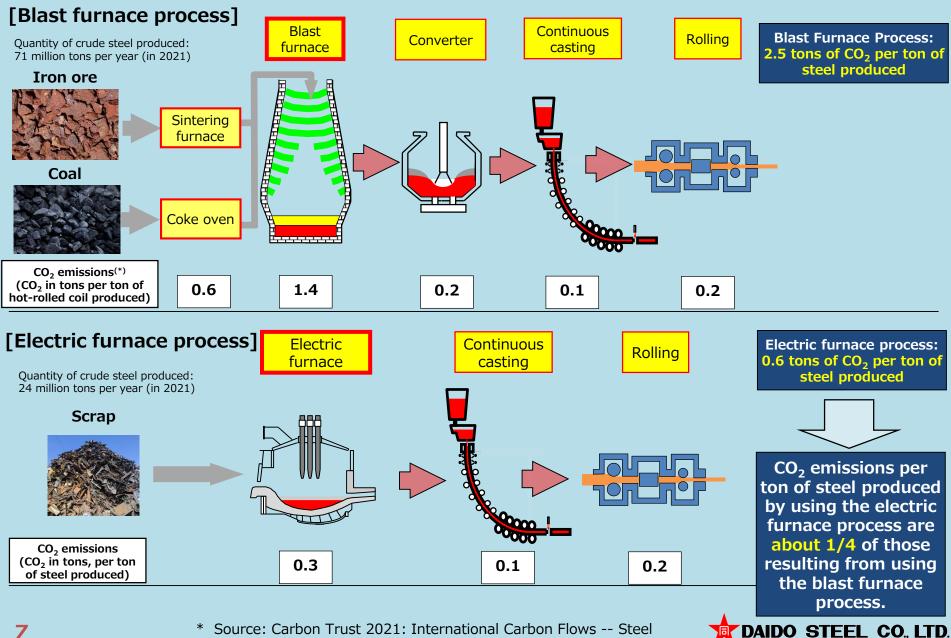
Domestic CO₂ emissions status (in 2020)



- *1 Source: Greenhouse Gas Inventory Office of Japan from the National Institute for Environmental Studies, Data on CO₂ Emissions (as a share of CO₂ emissions from public electricity and heat production, in 2020) (from the website of the Ministry of the Environment)
- *2 Source: Report on Carbon Neutrality Activities Plan (Low Carbon Society Action Plan), Japan Iron and Steel Federation (FY2020 Results)
- *3 Source: FY2020 Results of CO₂ Reduction Activities at Daido Steel (SCOPE1 and 2)

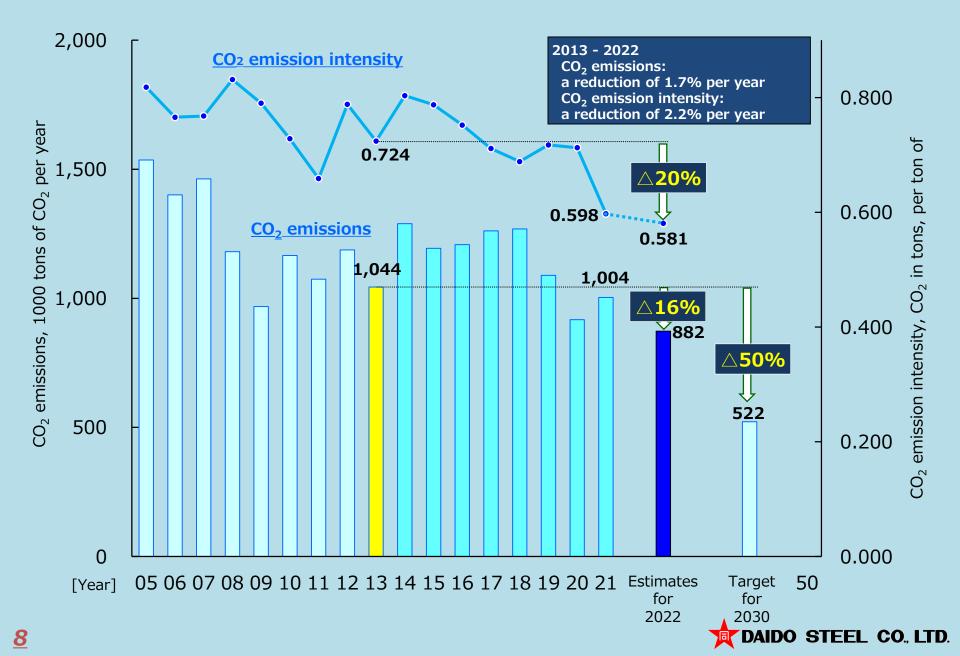


Blast Furnace and Electric Furnace Processes



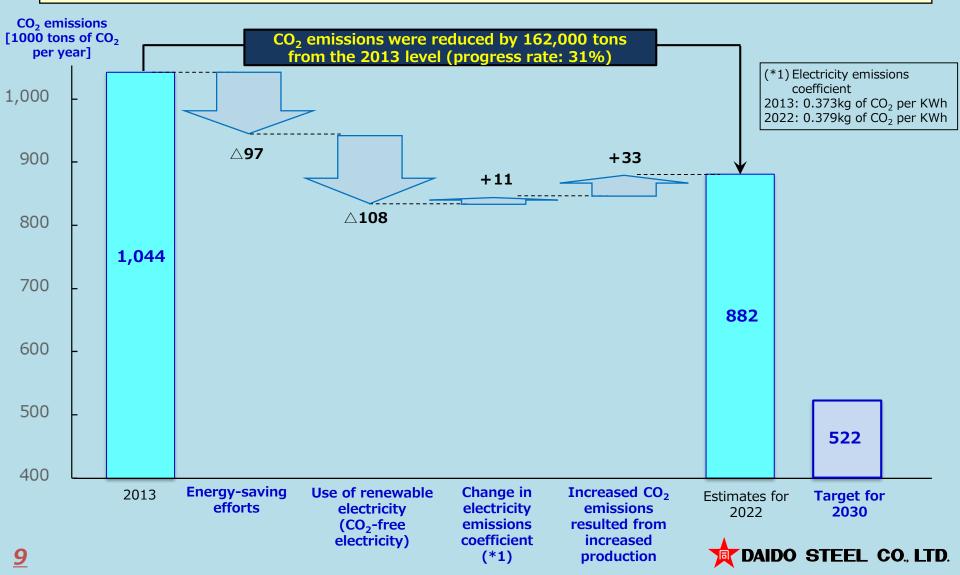
Source: Carbon Trust 2021: International Carbon Flows -- Steel *

Changes in Daido Steel's CO2 emissions



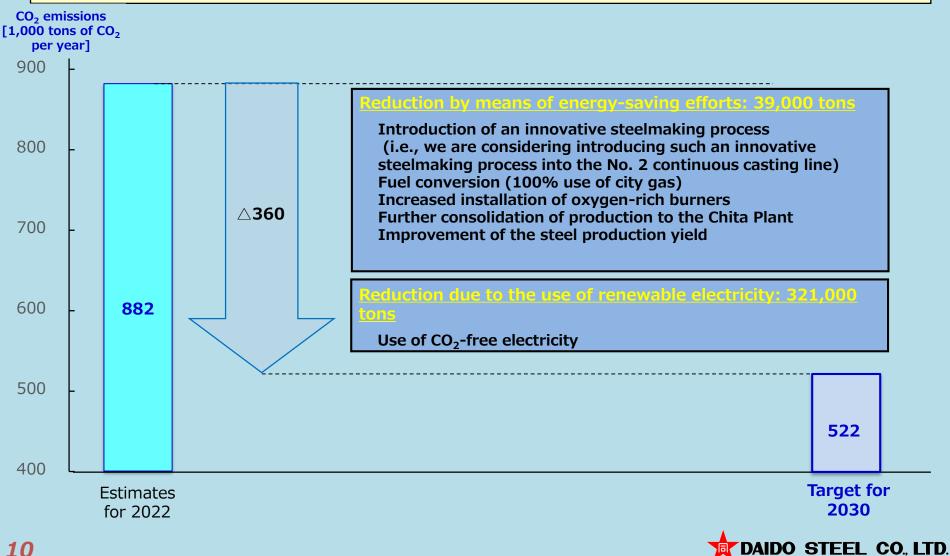
Estimates for CO₂ emissions in 2022

- CO₂ emissions in 2022 are expected to be lower by 162,000 tons of CO₂ than in 2013 (that is, a reduction of 16%).
- In addition to 97,000 tons less of CO_2 emitted due to energy-saving efforts, another 108,000 tons less of CO_2 emissions resulted from our beginning to use CO_2 -free electricity, starting in 2021.



Our approach to attaining the 2030 target

- To achieve the 2030 target (a 50% reduction from the 2013 year level), we will need to reduce our CO₂ emissions by 360,000 tons for the span of years from 2023 until 2030.
- We are planning to attain that target by eliminating 39,000 tons of CO₂ emissions through our energy-saving efforts and 321,000 tons through the use of CO₂-free electricity.



Daido's Carbon Neutrality Attainment Strategy

<u>Carbon neutrality attainment process</u>

We will promote CO₂ reduction by integrating energy-saving technologies into our manufacturing processes.

<u>Carbon neutral products</u>

We contribute to the realization of a green society by developing a variety of innovative products that lead to energy conversion.

<u>Carbon neutrality attainment solutions</u>

We promote CO₂ reduction for our customers with products that incorporate innovative energy-saving technologies based on our engineering design and steelmaking technical knowhow.



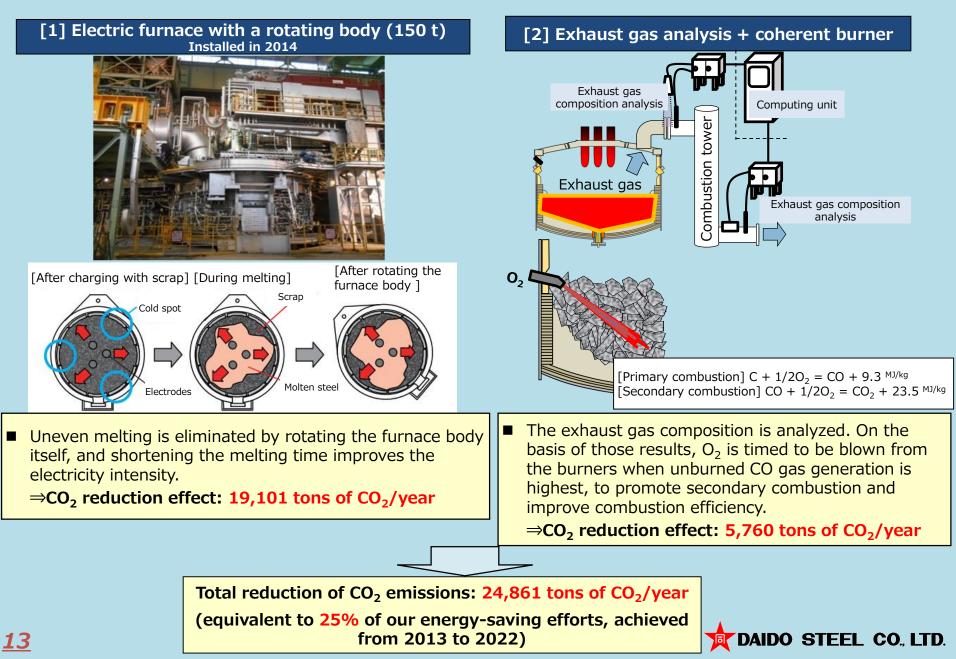
Carbon neutrality attainment process

We will promote CO₂ reduction by integrating energy-saving technologies into our manufacturing processes.

	Manufacturing Technology	Technology applied	CO ₂ reduction effect
1.	Innovative steelmaking process	 Introduced on the No.1 CC line Introduction on the No.2 CC line is being considered. 	 The melting time is shortened by using a large rotary furnace. Better efficiency of secondary combustion due to in-furnace burners
2.	Oxygen-rich burner	Heating furnaceLadle preheating or other	Reduction in fuel intensity through changing from a combination of (city gas + air) to (city gas + oxygen).
3.	Further consolidation of production (to the Chita Plant)	 Melting process at Shibukawa Plant Rolling process at Hoshizaki Plant 	Promotion of energy savings by further consolidating production at the Chita Plant, which features high productivity and production yield.
4.	Fuel conversion	Heating furnaceHeat treatment furnace	Promotion of energy savings by converting the type of fuel from fuel oil to city gas.
5.	Improvement of the steel production yield	 Production of heavier weight steel 	Production of heavier weight billets and wire rods (Shift from two 1-ton billets to one 2-ton billet)
6.	Use of renewable energy	• CO ₂ -free electricity	Procurement of CO_2 -free electricity from Chubu Electric Power Miraiz Co. (starting in 2021)



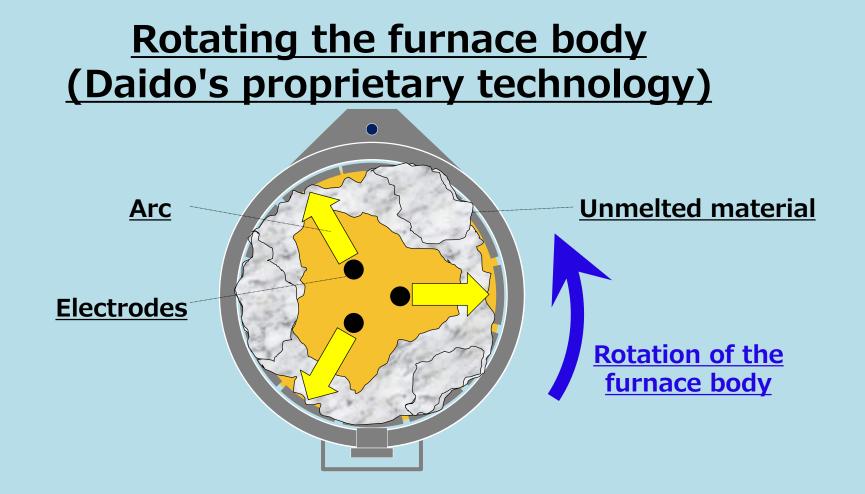
Innovative steelmaking process (Chita Plant)



Rotating the furnace body (Daido's proprietary technology)



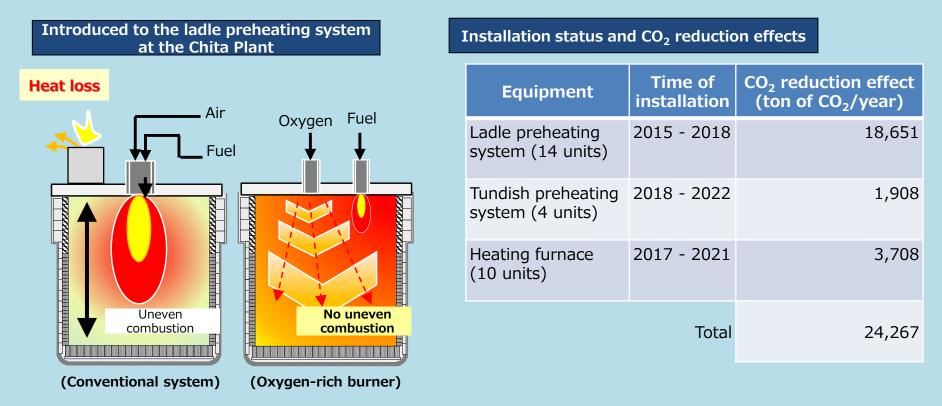




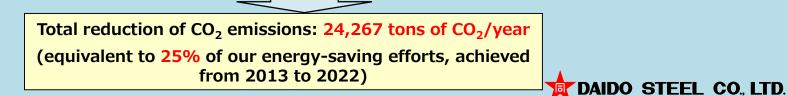
- The furnace body itself is rotated to change the location of any hot and cold spots that develop inside the furnace, eliminating non-uniform melting.
- The energy lost at the hot spots is directed into the cold spots, thereby reducing energy intensity.
 - ⇒ The energy intensity of Chita Plant's 150-ton arc furnace has been improved by 15%, as compared with our conventional furnace.



Installation of energy-rich burners

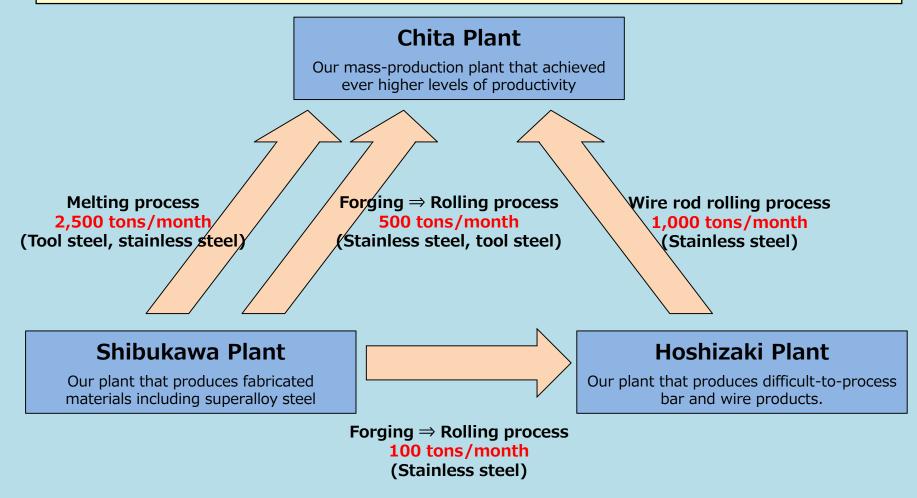


- The amount of energy required to increase the temperature of the nitrogen contained in the air was reduced by changing the type of combustion from air combustion to oxygen combustion.
- Uniform combustion throughout the inside of the entire furnace is achieved by injecting and diffusing oxygen and fuel at high speed, reducing preheating time.



Further consolidation of production to the Chita Plant

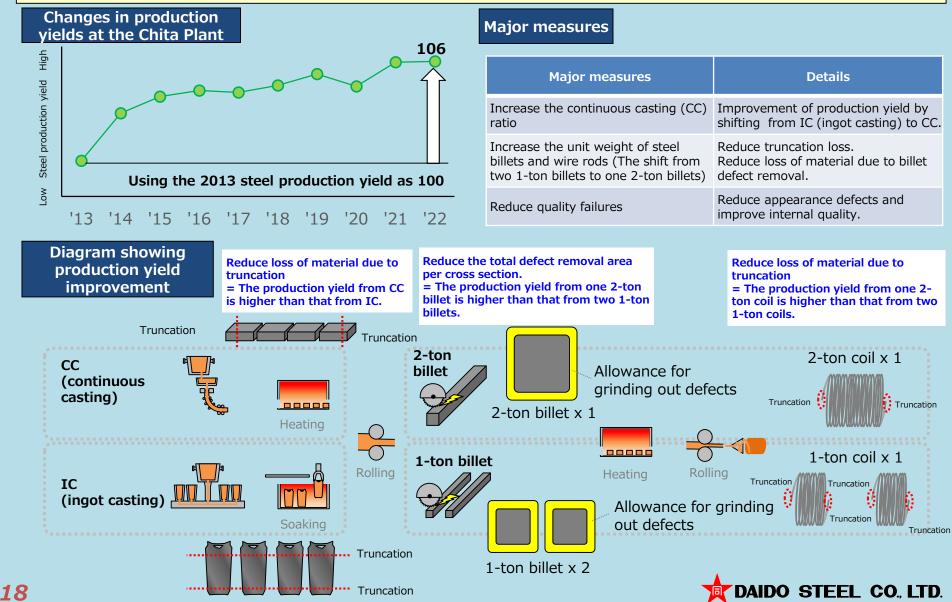
- We are going to reduce CO₂ emissions by further consolidating production to the Chita Plant, which has achieved high productivity and production yields through the development of melting and rolling technology.
- We plan to shift a 2,500 tons per month of melting process and a 1,500 tons per month of rolling process to the Chita Plant.





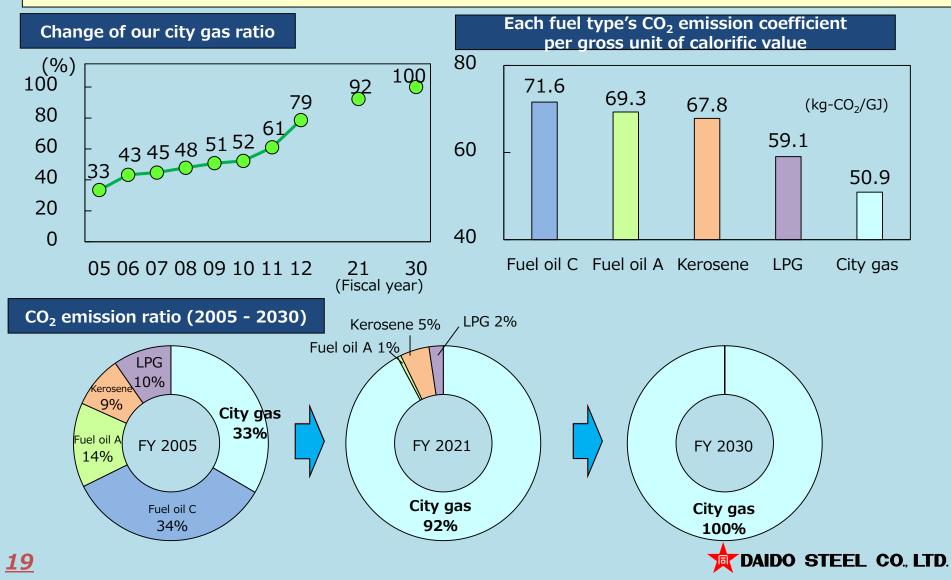
Improvement of our steel production yield

We aim to reduce CO₂ emissions by improving our steel production yields, such as by increasing the unit weight of steel billets and wire rods, and improving our continuous casting ratio.



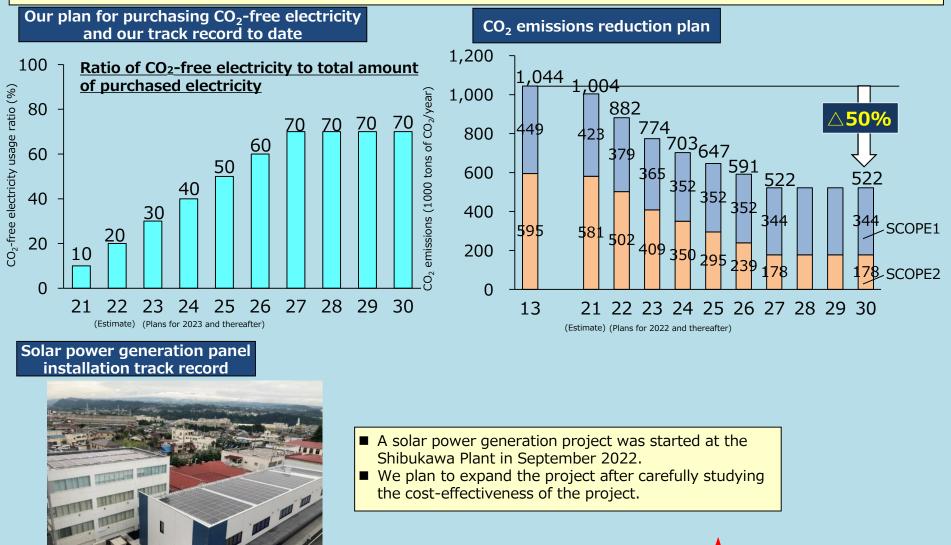
Fuel conversion (fuel oil \Rightarrow city gas)

- We have been working continuously to improve our fuel use and raised our city gas ratio to 92% in 2021.
- We are working on fuel conversion with the goal of using 100% city gas by 2030, and we're looking hard at the use of hydrogen or ammonia combustion in the future.



Our use of renewable energy

- We plan to gradually increase the purchase of CO₂-free electricity to achieve the 2030 50% reduction target.
- If we seem likely to fail to attain that target even after applying our energy-saving efforts, for example, due to an increase in our crude steel production, we are going to attain the 50% reduction target by increasing our purchase of CO₂-free electricity.



DAIDO STEEL CO., LTD.

Carbon neutral products

We contribute to the realization of a green society by developing a variety of innovative products that lead to energy conversion.

<Providing products that respond to the mobility revolution>

Product	Used for	Contribution to the realization of a green society
1. Magnets	Automotive traction motor	Magnets with a special magnetic field orientation that do not rely on heavy rare-earth materials, but provide strong magnetism and high heat resistance.
2 Comi magnetic materiale	Current sensors, etc.	Extend cruising ranges thanks to reduced EV power consumption.
2. Semi-magnetic materials	Motor core materials	Realize compact and light-weight high torque motors
3. High-performance magnetic metal powder	Reactors (voltage boosters)	Compactness and high efficiency of the entire EV control system through variable voltage control.
4. SUS steel that resists brittleness caused by hydrogen	FCV components	Prevents brittle FCV parts caused by hydrogen
5. Si alloy for LiB negative electrode	Automotive batteries	Extends cruising range by improving LiB performance

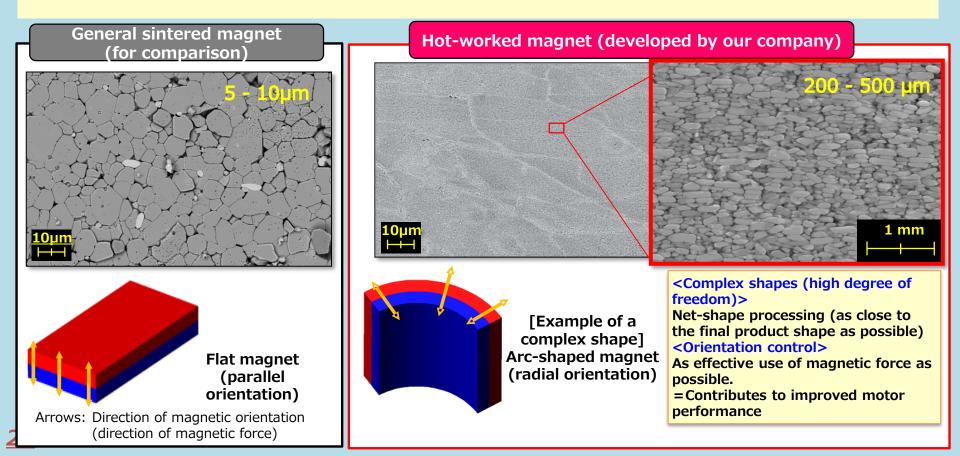


Hot-worked magnets (for automotive traction motors)

Free of heavy rare-earth elements (no dysprosium (Dy) or terbium (Tb)) High heat resistance (retains coercive force) and magnetic properties (retains magnetic flux density) by the achievement of a fine nano-level crystal structure.

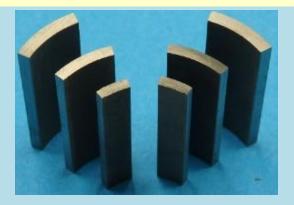
Control of complex shapes and orientation

A high degree of freedom of shape (net-shape processing) due to hot-working process and orientation control (easy determination of the direction of magnetic force) are accomplished by using hot processing, contributing to customers' improved motor performance.



Hot-worked magnets (for automotive traction motors)

High <u>magnetic force</u> and <u>excellent shape & orientation control</u> (control of the magnetic flux direction to maximize motor performance) contribute to dramatic improvements in the performance of traction motors for EVs.



Arc-shaped magnets (Example of a magnet manufactured through the ability to control complex shape and orientation)

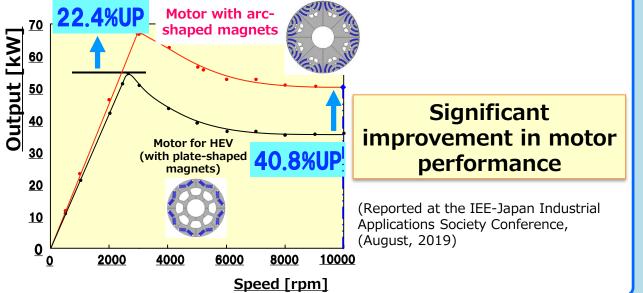


Motor rotor using arc-shaped magnets

Motor-testing equipment



Large-capacity motor performance demonstration equipment (Nakatsugawa Advanced Magnetic Materials Development Center)

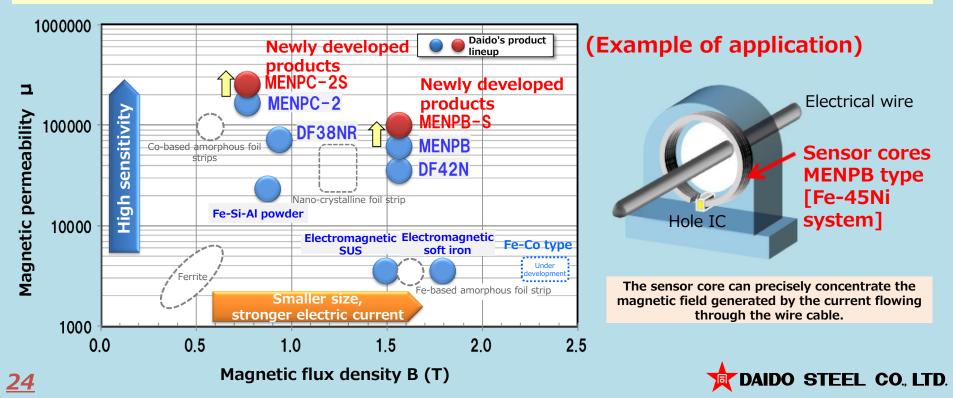


Development of permalloy strip steel

Based on our 100 years of steelmaking experience and the latest technology, including our special melting method, we have developed permalloy strip steels (MENPC-2S and MENPB-S) with the world's highest level of magnetic permeability. The manufacturing process was made possible by our ability to optimize the balance of major/minor components contained in conventional steel.

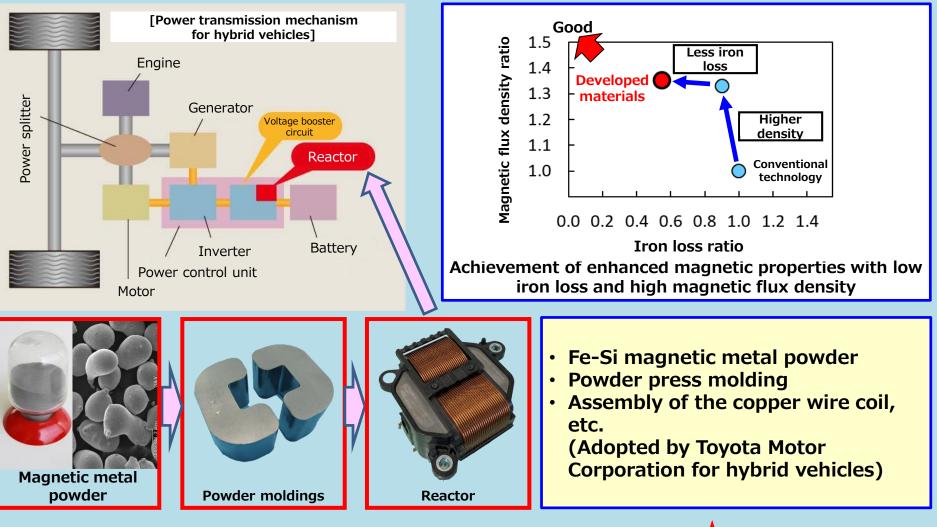
Contributing to reduced EV electricity consumption

High magnetic permeability makes it possible to control the amount of electric current with high precision, contributing to reduced electricity consumption (longer cruising ranges) for EVs.



High-performance magnetic metal powder (for reactors)

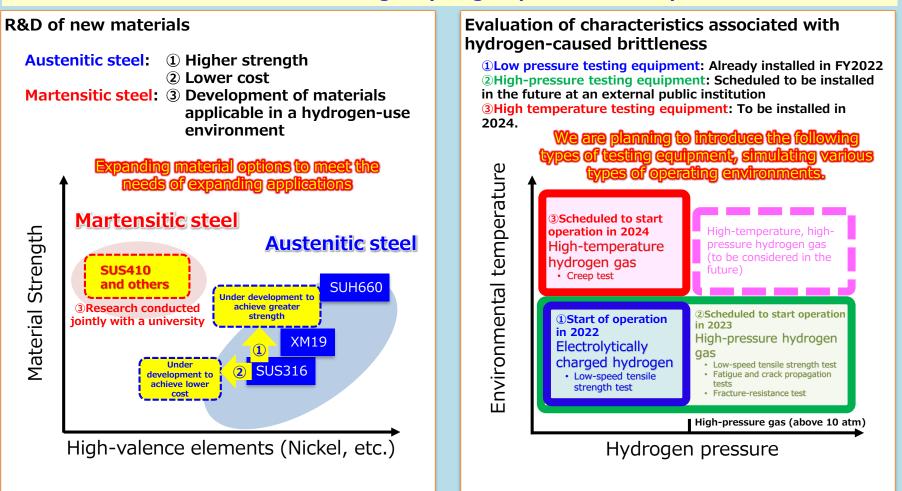
Improved magnetic properties help downsize the EV control system, thus contributing to improved fuel efficiency and reduced CO₂ emissions from hybrid electric vehicles (HEVs).



DAIDO STEEL CO., LTD.

SUS steel that resists brittleness caused by hydrogen (for FCV)

We are working on the development of a new grade of brittleness-resistant steel that can be used in a wide range of environments, in collaboration with universities and research institutes that possess the world's most advanced hydrogen evaluation technology, while creating our own testing facilities. FCV parts that are resistant to brittleness will contribute to achieving a hydrogen-powered society.



DAIDO STEEL CO., LTD.

Carbon neutrality attainment solutions

We promote CO₂ reduction for our customers with products that incorporate innovative energy-conservation technologies based on our engineering design and steelmaking technical know-how, accumulated at the Machinery Division.

Innovative energy- conservation product	Solution	CO ₂ Reduction Effects
1. Electric arc furnaces with rotating drives STRAQ®	Uniform melting of scrap by rotating the furnace body.	The electricity intensity is improved 15% due to the shorter melting time (as compared with our conventional electric furnace).
2. Premium STC® furnace	Equipped with a high- performance energy- conservation system	 Combustion gas consumption is reduced 15%. CO₂ emissions are reduced 11%.
3. Highly efficient combustion system DINCS®	With high thermal radiation material and a highly efficient heat exchanger	The preheating air temperature is increased because of the double heat-exchanger's working area, substantially improving heat recovery.
 Next-generation sewage sludge carbonization system 	High-temperature sludge pyrolysis	Sewage sludge is recycled as a carbonized product through high-temperature pyrolysis. CO ₂ reduction is also possible.
5. Hydrogen burner	Radiant tube hydrogen burner	It is possible to install the device as-is to existing furnaces (STC furnaces). CO_2 -free combustion is possible.



Conserving energy

Energy-conserving industrial furnace products from Daido Steel

11 Daido Steel Group energy-conservation products

were chosen as one of the Advanced Equipment and System for the 2022 Advanced Energy Conservation Investment Promotion Support Program,

among the 122 products from diverse manufacturers approved in all.

• In this program, energy-conservation equipment and systems submitted by various manufactures in Japan are evaluated against the examination items determined by the Technology Evaluation Committee of the Agency for Natural Resources and Energy. If they are approved, they become eligible for financial support by the Program.

Steelmaking equipment

- 1. Electric arc furnaces with rotating drives (STARQ®)
- 2. Electric arc furnace equipped with scrap preheater in movable furnace top
- 3. Environmentally friendly scrap preheater
- 4. Meltdown determination system(E-adjust®)
- 5. Electric arc furnace direct dust collection Controller
- 6. High-efficiency control system for steelmaking plant building dust collection system

Heat treatment equipment

- 7. ModulTherm
- 8. SyncroThermo®
- 9. Premium STC® furnace (2nd generation type)
- 10. Highly efficient combustion system (DINCS®)
- 11. Rotary furnace/COMPACT



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Steelmaking equipment



Electric arc furnaces with rotating drives(STARQ®) operating at Daido Steel's Chita Plant

Heat treatment equipment



Premium STC® furnace, operating at our Hoshizaki Plant



Spirocore, a high thermal radiation material that is used in the DINCS®



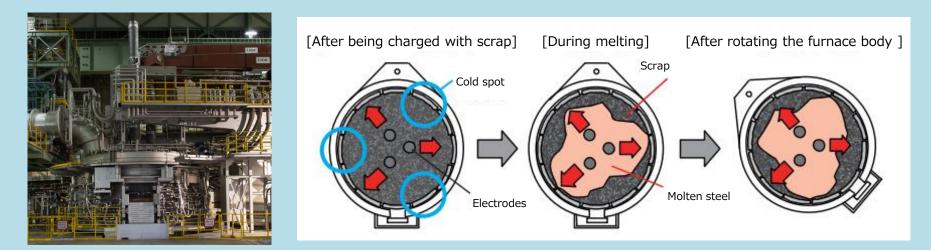
Heatcore, a highly efficient heat exchanger that is used in the DINCS®



Conserving energy Electric arc furnaces with rotating drives STRAQ®

Rotating the furnace's body will attain the utmost in energy conservation.

• **Uniform melting of scrap** attained by rotating the furnace body delivers energy conservation and reduces CO₂ emissions.



- ◇ Uneven distribution of hot and cold spots inside the furnace is eliminated by rotating the furnace body itself.
- The energy delivery time is shortened by optimizing the rotation pattern of the furnace body

Energy conservation

CO₂ emissions reduction

◇ The energy intensity of Chita Plant's 150-ton arc furnace has been improved by 15%, as compared with our conventional furnace.

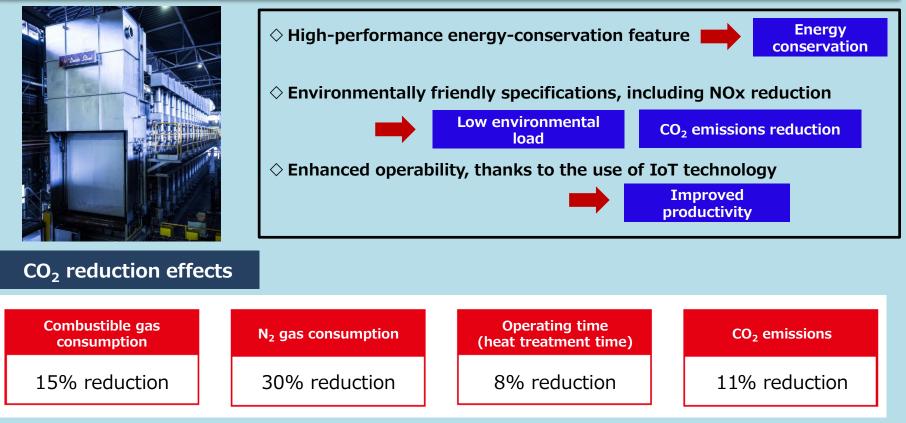


Conserving energy

Premium STC® furnace (the second generation type)

Equipped with a high-performance energy-conservation system

- The STC® furnace is our **best-selling** product, developed on the basis of our extensive technical know-how, accumulated as a specialty steel manufacturer.
- The premium STC® furnace is our recently developed second generation STC® furnace, which features **highly efficient operation and low** environmental load.



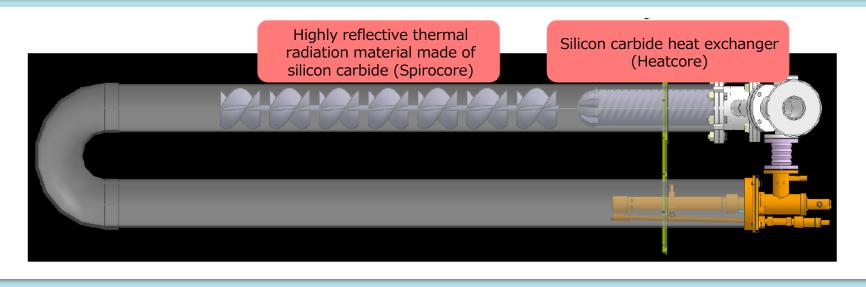
These figures are based on our test results (as compared with conventional STC furnaces (20t/ch))

DAIDO STEEL CO., LTD.

Highly efficient combustion system (DINCS®)

Contributes to energy conservation and the reduction of CO₂ emissions

- DINCS® conserves energy through its effective recovery of heat retained in the exhaust gas
- Its very reflective thermal radiation material and highly efficient heat exchanger are installed inside the tubing used for indirect heating, to achieve the industry's top-level heat recovery rate.



Heat exchanger area

Approximately twice the size of conventional models Preheating increases air temperature.

Significantly improves the heat recovery rate



Daido Future Technology

- We are considering introducing yet another innovative steelmaking process:
 We plan to initiate a substantial energy-conservation measure by introducing a quite large rotating furnace into the Chita Plant's No.2 continuous casting line.
- We are working on the development of the next-generation sewage sludge carbonization system:

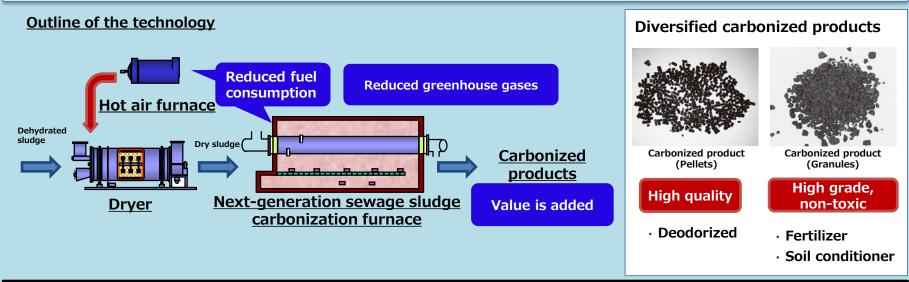
This system will <u>add higher value to our carbonized products</u> and <u>reduce greenhouse gas emissions</u>, by carbonizing sludge at higher temperatures than conventional methods.



Development of next-generation sewage sludge carbonization system

Conversion of sewage sludge into carbonized products, through pyrolysis treatment

- This system **converts** sludge generated from treated sewage into **carbonized products** through heat decomposition (pyrolysis) in a low-carbon state.
- This carbonization system is **very profitable** because it combines the **considerable value added** to sewage sludge with energy conservation and energy creation.



This next-generation sewage sludge carbonization system converts sludge to carbon at higher temperatures than conventional systems, <u>producing higher value-added</u> <u>carbonized products</u> and simultaneously <u>reducing the emission of greenhouse gases</u>.

Daido's carbon neutrality partnerships

- Participation in the Green Innovation Fund Project: Development of an innovative motor core material
- Industry-academia co-creation project: Tohoku University Co-Creation Research Center (Development of next-generation semi-magnetic materials)
- Participation in various initiatives
- Natural environment-protecting activities: Kutcharo Natural Forest Daido



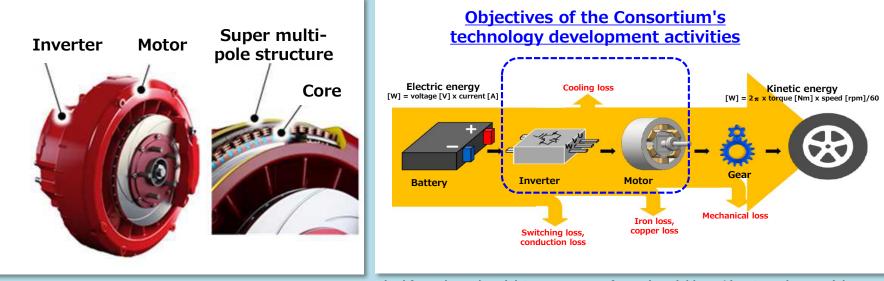
Participation in the Green Innovation Fund Project: Development of an innovative motor core material

To achieve the goal of carbon neutrality, we will participate in the GI Fund Project launched by the NEDO during the period from FY2022 to FY2030. Our role will be to develop innovative motor system technologies, such as new materials, motor designs, inverters, and cooling systems, thus contributing to more efficient use of electricity in the field of mobility.

<Consortium>

36

- Hitachi, Ltd. (the lead company)
- Hitachi Astemo Corporation
- Hitachi Industrial Products, Ltd.
- Tohoku Special Steel Co., Ltd.
- Daido Steel Co., Ltd.



NEDO: New Energy and Industrial Technology Development Organization Cited from the outline of the "Development of Next-Generation

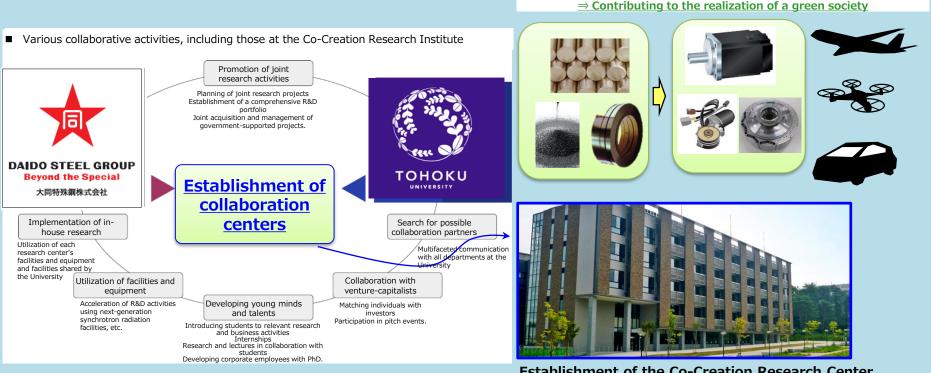
Storage Batteries and Next-Generation Motors" project (Courtesy of Hitachi, Ltd.) Cited from the Industrial Structure Transformation Field Working Group's materials (Green Innovation Project Subcommittee, Industrial Structure Council, Ministry of Economy, Trade and Industry)



Industry-academia co-creation project: Tohoku University Co-Creation Research Center (Development of next-generation semi-magnetic materials)

We established the "Daido Steel and Tohoku University Co-Creation Research Center" in July 2022, with a view to promoting research activities for the creation of a green society.

In collaboration with Tohoku University, we launched the Co-Creation Research Center for the purpose of contributing to CASE-related technological innovation. Through cross-divisional collaboration between corporate engineers and university researchers, we will be accelerating joint research activities into technological issues related to the development of semi-magnetic materials, in areas from basic research to the development of new materials.



https://www.tohoku.ac.jp/japanese/newimg/pressimg/tohokuuniv-press20220701_01web_daido.pdf

Establishment of the Co-Creation Research Center Tohoku University Rare Metals and Green Innovation Center

Innovation in everything from materials to components



Participation in various initiatives

Status of our participation in various initiatives



Social Evaluation Scores



Aichi Biodiversity Certified Companies ^(*2)



Certified in Nov. 2022

(*1) The 30 by 30 Alliance for Biodiversity

This is a coalition of companies, local governments, and NPOs to finance and promote domestic efforts to achieve the "30 by 30 target", an international goal of conserving the biodiversity of at least 30% of the land masses and seas by 2030.

(*2) Aichi Biodiversity-Certified Companies

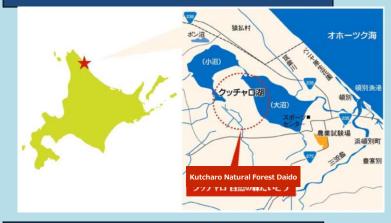
Aichi Prefecture launched the "Aichi Biodiversity-Certified Company System" this fiscal year. It certifies companies that are implementing excellent practices, with the aim of promoting corporate initiatives for the conservation of biodiversity and spreading excellent initiatives within the prefecture.



Natural environment protection activities: Kutcharo Natural Forest Daido

- The Kutcharo Natural Forest Daido is our company-owned forest on the shores of Lake Kutcharo in Hamatombetsu, Hokkaido.
- Lake Kutcharo and its surroundings are a wetland listed in the Ramsar Convention, which protects wetlands that are valuable habitats for waterfowl.
- In cooperation with a local NPO, the Lake Kutcharo Ecoworkers, we are working to protect the ecosystem and engage in nature conservation activities.

Kutcharo Natural Forest Daido



Nature Conservation Activities



Wildlife Protection Merit Award in 2018 (A Commendation by the Minister of the Environment)



Kutcharo Natural Forest Daido: Green space area: approximately 3.73 million square meters



Tree-planting festival in 2022 500 saplings and commemorative trees were planted



End

