NEWS RELEASE

JCR Sustainable Evaluation

24-D-1421
December 19, 2024

Japan Credit Rating Agency, Ltd. (JCR) announces the reviewed Climate Transition Bond Evaluation Results as follows.

The Government of Japan

Japan Climate Transition Bond (FY2023)

Affirmation

Overall Evaluation	Greenness / Transition Evaluation (Use of Proceeds)	Management, Operation, and Transparency Evaluation
Green 1(T)	gt1	m1

Issuer	The Government of Japan
Subject	10-year Japan Climate Transition Bonds (1st) 5-year Japan Climate Transition Bonds (1st)
Type	Interest-bearing government bonds
Issue Amount	10-year bonds: JPY 799.5 billion 5-year bonds: JPY 799.8 billion
Interest Rate	10-year bonds: Nominal Coupon 0.7% (per annum) 5-year bonds: Nominal Coupon 0.3% (per annum)
Auction Date	10-year bond: February 14, 2024 5-year bond: February 27, 2024
Redemption Date	10-year bond: December 20, 2033 5-year bond: December 20, 2028
Method of Redemption	Lump-sum redemption at maturity
Use of Proceeds	Businesses that meet the eligibility criteria identified in the Japan Climate Transition Bond Framework based on the GX Promotion Strategy

Evaluation Overview

The purpose of this evaluation report is to review the status of funding allocation and impact related to the 10-year Japan Climate Transition Bonds (1st) and the 5-year Japan Climate Transition Bonds (1st) issued by the Government of Japan in FY2023 (collectively, or individually referred to as the "Japan Climate Transition Bonds (FY2023)", or the "Bonds").

JCR assigned Green 1(T)(F) to the Japan Climate Transition Bond Framework (the "Framework") developed by the Government of Japan on November 7, 2023 and an overall rating of Green 1(T) to the Bonds issued under the Framework on February 27, 2024. In addition, the Bonds have obtained CBI certification. The main outline is as follows:

The Government of Japan declared "Carbon Neutrality by 2050" in October 2020, based on the goals set out in the Paris Agreement (substantially reduce global greenhouse gas (GHG) emissions to hold global temperature increase to well below 2°C above pre-industrial levels and pursue efforts to limit it to 1.5°C above pre-industrial levels,) and legalized it by amending the Act on Promotion of Global Warming Countermeasures in 2021. In April 2021, the Government of Japan expressed that it aimed to reduce GHG by 46% from FY2013 levels in FY2030 and continue to challenge ourselves to raise this figure to 50% in an ambitious manner consistent with our 2050 target.

It is therefore significant to steadily take concrete measures for decarbonization in the industrial, commercial, transport and residential sectors, based on the Strategic Energy Plan and the national energy mix to achieve the 2030 target. The Government of Japan launched "Green Transformation (GX)" that is to transition industrial and social structures—historically reliant on fossil energy since the Industrial Revolution—into a clean energy-centered society in the 6th Strategic Energy Plan decided in the cabinet in October 2021. The Government of Japan has held the GX Implementation Council chaired by the Prime Minister, which is comprised of experts from the government, private sector, and academia, since 2022. And the council compiled the Basic Policy for the Realization of GX. The GX Promotion Act and the GX Decarbonization Electricity Act were enacted in 2023, and a system to promote the initiatives toward the “Pro-Growth Carbon Pricing Concept” was materialized. "GX Promotion Strategy" was decided in the cabinet in July 2023, based on the GX Promotion Act as a concrete strategy for implementing a series of policies.

The proceeds of the Bonds will be used to subsidize research and development and capital investment that the Government of Japan secured in the FY2022-FY2023. All of these proceeds are intended for businesses that significantly contribute to reducing GHG emissions in Japan, and are included in the Sector-Specific Investment Strategy formulated based on the GX Promotion Strategy.

The report published by the Government of Japan on December 19, 2024 is limited to the status of funding allocation and the impact related to five projects. And the impact report for all the projects is scheduled to be published in FY2025.

JCR confirmed the status of the allocation of proceeds and confirmed that JPY 1,564.7 billion out of the total amount of JPY 1,594.7 billion[1] raised through the Bonds was allocated to projects that were evaluated as eligible at the time of the initial evaluation by the end of November 2024.

[1] Proceeds raised by the government from the market through the issuance of the Bonds (cash proceeds). The amounts of bids accepted to raise the Bonds is JPY 1,599.3 billion, and the difference from the proceeds is due to the variance between the face value and the issue price.

In addition, JCR evaluates that the management of unallocated proceeds is appropriate because it is planned to allocate the proceeds to the use of eligible proceeds as soon as possible.

Furthermore, JCR confirmed that although all the five cases of impact in the report included the estimations of the assumptions and parameters, the GHG emission reduction effects were calculated in a reasonable manner based on the scenario assumed by the Government of Japan. In addition, the calculations show that these five projects have a potential to substantially reduce GHG emissions, and thus JCR considers that they will contribute to Japan's GHG emission reduction target and to strengthening Japan's industrial competitiveness by creating new demand and markets in the field of decarbonization.

After the review, JCR evaluated the Bonds at "gt1" for "Green/Transition Evaluation (Use of Proceeds)" and "m1" for "Management, Operation and Transparency Evaluation," and "Green 1(T)" for the overall “JCR Climate Transition Bonds Evaluation” based on JCR's Green Finance Evaluation Methodology. As a result, JCR concluded that the Bonds met the standards for the items required in the Green Bond Principles[2], the Green Bond Guidelines[3], the Climate Transition Finance Handbook[4] and the Basic Guidelines for Climate Transition Finance[5].

[2] International Capital Market Association (ICMA), *Green Bond Principles (2021)*
https://www.icmagroup.org/sustainable-finance/the-principles-guidelines-and-handbooks/green-bond-principles-gbp/

[3] Ministry of the Environment *Green Bond Guidelines (2022)*
https://www.env.go.jp/content/000062495.pdf

[4] International Capital Market Association (ICMA), *Climate Transition Finance Handbook (2023)*
https://www.icmagroup.org/sustainable-finance/the-principles-guidelines-and-handbooks/climate-transition-finance-handbook/

[5] Financial Services Agency, Ministry of Economy, Trade and Industry, Ministry of the Environment, *Basic Guidelines for Climate Transition Finance (2021)*
https://www.meti.go.jp/press/2021/05/20210507001/20210507001-1.pdf

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Review Items

This section describes items that JCR confirms in reviewing bonds. And in the review, JCR mainly looks into the following changes from the previous evaluation:

1. Japan's Economic Policy and Transition Strategy;

Japan's medium- to long-term economic policy and transition strategy, which the Government of Japan referred to when implementing Transition Finance, remain unchanged from the time of Evaluation of the Climate Transition Finance. If there are any changes, JCR will examine whether they are important environmental issues in Japan and are appropriate.

2. Use of Proceeds;

The classification of the eligibility criteria for the Transition Finance and the use of proceeds remain unchanged from what the issuer specified at the time of evaluation of the Climate Transition Finance. If there are any changes, JCR will examine whether they retain the eligibility of transition after the changes.

3. Selection Criteria and Processes for Use of Proceeds;

The objectives of the Transition Finance, the selection criteria and processes and other relevant processes remain appropriate.

4. Management of Proceeds;

The Government of Japan continues to have a system and internal functions in place to ensure to allocate the proceeds raised through the Transition Finance to eligible projects and to easily track and manage the allocation status.

5. Reporting;

The status of funding allocation is or will be properly disclosed. The impact of projects that the proceeds of the existing bonds is used for are or will be properly calculated and disclosed in the way specified by the issuer at evaluation of the Climate Transition Finance.

Review Contents

1. Japan's Economic Policy and Transition Strategy

1-1. Japan's Economic Policy and Transition Strategy

JCR confirmed through interviews with the Government of Japan that since the initial evaluation[6], there had been no major changes in the Basic Policy for the Realization of GX, the Act for Promoting a Smooth Transition to a Decarbonized Growth-Oriented Industrial Structure (GX Promotion Act), and the GX Promotion Strategy (including Sector-Specific Investment Strategy (roadmaps)) which incorporates them into the strategies of respective fields which are the basis for the issuance of the Bonds. Based on these strategies, the Government of Japan is steadily making efforts to achieve the goal of Carbon Neutrality by 2050. The following is an overview of the efforts to mitigate climate change announced by the Government of Japan after the initial evaluation:

- Establishment of GX Acceleration Agency and publication of the support standards

Based on the GX Promotion Act, GX Acceleration Agency was established as an authorized corporation (meaning a juridical person which is incorporated by a special act and which requires the approval of a governmental agency for its incorporation) on May 15, 2024 and began its operation on July 1 of the same year. Provision of financial support such as debt guarantees for GX projects, collection of "GX-Surcharge" (Surcharge on fossil fuel supply) and operation of carbon emissions trading system are its business activities. On August 15, 2024, the support standards for the financial support operations of the GX Acceleration Agency were established and published[7].

- GX2040 Vision

During the GX Implementation Council on May 13, 2024, a policy was indicated to comprehensively examine the industrial structure, industrial locations, and energy, and to present a vision for the GX2040 from a longer-term perspective. This is to increase the predictability of the business environment as much as possible, in light of various changes in the situation, such as the stable supply of energy and uncertainty from the perspective of economic security, as the GX initiative progresses and to boost domestic investment, which will maintain and strengthen high-value-added industrial processes essential for Japan's growth.

The GX 2040 Leaders Panel will be held to create the visions of (1) energy, (2) GX industrial locations, (3) GX industrial structure and (4) GX market creation based on the opinions of experts.

Considering that the Strategic Energy Plan and the Plan for Global Warming Countermeasures will be revised within FY2024, JCR confirmed that the Framework was also expected to be updated within FY2024 or in early FY2025 based on these revisions.

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[6] For the description of "since the initial evaluation" in this review, please refer to the JCR's Evaluation Report (23-D-1631) for the 1st Japan Climate Transition Bonds (the first edition) published on February 27, 2024.

[7] https://www.meti.go.jp/english/press/2024/0813_001.html

1-2. Alignment with the items required in the Climate Transition Finance Handbook

JCR confirmed that the status of compliance with the four elements required by CTFH had remained unchanged since the initial evaluation.

2. Use of Proceeds

JCR confirmed that the proceeds from the Bonds were allocated to projects that JCR had evaluated as appropriate at the time of the initial evaluation as follows:

Table 1: Projects to be Funded by the Bonds[8]

	Budget Year*	Business Type	Allocated Projects	Green Category
(1) Green Innovation (GI) Fund *1	FY2022 Supplementary / FY2023 Initial	R&D	* Refer to the initial evaluation report for candidate projects.	・Renewable energy ・Low-carbon and decarbonized energy ・Clean transportation ・Circular economy adapted products, production technologies and processes ・Environmentally sustainable management of living natural resources and land use, Circular economy
(2) Research and development support other than the GI Fund	FY2022 Supplementary	R&D	1. Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure	・Energy efficiency
	FY2022 Supplementary	R&D	2. Innovative GX Technology Creation Project (GteX)	・Clean transportation ・Circular economy adapted products, production technologies and processes
	FY2023 Initial	R&D	3. Development Project for Fast Reactor Demonstration Plant	・Low-carbon and decarbonized energy
	FY2023 Initial	R&D	4. Development Project for High-Temperature Gas Reactor Demonstration Plant	・Low-carbon and decarbonized energy
(3) Subsidy program	FY2022 Supplementary	Subsidy	5. Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation	・Energy efficiency
	FY2022 Supplementary / FY2023 Initial	Subsidy	6. Subsidy for Promoting the Introduction of Clean Energy Vehicles (BEV, PHEV, FCV)	・Clean transportation
	FY2022 Supplementary	Subsidy	7. Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses / Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows	・Energy efficiency
	FY2022 Supplementary	Subsidy	8. Support Project for Strengthening the Manufacturing Supply Chain of Batteries	・Energy efficiency

[8] Prepared by JCR from materials provided by the Ministry of Economy, Trade and Industry. Regarding the budget year, "FY2022 Supplementary" indicates the supplementary budget projects for FY2022, "FY2023 Initial" indicates the initial budget projects for FY2023, and "FY2023 Supplementary" indicates the supplementary budget projects for FY2023 (the same applied to the following).

	FY2022 Supplementary	Subsidy	9. Support Project for Strengthening the Semiconductor Manufacturing Supply Chain for Achieving GX	・Clean transportation ・Renewable energy
	FY2023 Initial	Subsidy	10. Grant for Decarbonization Transition Acceleration for Specific Regions	・Renewable energy
	FY2023 Initial	Subsidy	11. Promotion Project for the Electrification of Commercial Vehicles	・Clean transportation

*1 At the time of this review, the projects executed in the Green Innovation (GI) Fund were "Hydrogen Utilization in Iron and Steelmaking Processes," "Achieving Carbon Neutrality in the Waste and Resource Circulation," "Next-generation Aircraft Development," and "Decarbonization of Thermal Processes in the Manufacturing."

3. Selection Criteria and Process for the Use of Proceeds

At the time of the initial evaluation, JCR concluded that the selection criteria for the use of proceeds and the process were appropriate. As a result of conducting interviews with the Government of Japan for this review, JCR confirmed that the selection criteria were not changed from the assumption at the time of the initial evaluation, and that the selection procedure was carried out according to the assumed process.

4. Management of Proceeds

At the time of the initial evaluation, JCR evaluated the management of proceeds as reasonable. And JCR also confirmed that JPY 1,564.7 billion out of the proceeds raised through the Bonds was allocated in accordance with the established procedures set forth in the Framework. Unallocated proceeds will be allocated to projects that were evaluated as appropriate at the time of the initial evaluation (including the FY2023 supplementary budget-funded projects with the same content[9]), and are expected to be fully allocated by the end of the FY2024. JCR believes that the management of the unallocated proceeds is appropriate because they will be allocated to eligible projects as soon as possible.

5. Reporting

5-1. Reporting on the Status of Allocation of Proceeds

The total amount of the proceeds raised through the Bonds was JPY 1,594.7 billion[1], of which JPY 1,564.7 billion was allocated to each eligible business as follows. The Government of Japan has disclosed this on its website, as well as plans to allocate unallocated proceeds. JCR concluded that the content of the disclosure met the requirements set forth in the Framework and was appropriate.

[9] The Government of Japan has established a plan for the allocation of unallocated proceeds as described in Note (*2) of Table 2. Among them, in addition to the supplementary budget project for FY2022 and the initial budget project for FY2023, it is indicated that the amount raised by the Bonds will also be used for the "Subsidy for Promoting the Introduction of Clean Energy Vehicles (BEV, PHEV, FCV)," the supplementary budget project for FY2023, where the proceeds were not scheduled to be allocated at the time of the initial evaluation. JCR confirmed that the project is the same as the Subsidy for Promoting the Introduction of Clean Energy Vehicles (BEV, PHEV, FCV), which is a supplementary project for FY2022 and an initial budget project for FY2023 that was evaluated as appropriate at the time of the initial evaluation.

Table 2: Amount Allocated for Each Business (as of the end of November 2024) [10]

	Budget Year	Allocated Projects	Amount Allocated (billion yen)
(1) GI Fund	FY2022 Supplementary / FY2023 Initial	GI Fund	756.4*1
(2) Research and development support other than the GI Fund	FY2022 Supplementary	1. Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure	75.0
	FY2022 Supplementary	2. Innovative GX Technology Creation Project (GteX)	49.6
	FY2023 Initial	3. Development Project for Fast Reactor Demonstration Plant	7.4
	FY2023 Initial	4. Development Project for High-Temperature Gas Reactor Demonstration Plant	2.1
			134.1
(3) Subsidy program	FY2022 Supplementary	5. Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation	2.5
	FY2022 Supplementary / FY2023 Initial	6. Subsidy for Promoting the Introduction of Clean Energy Vehicles (BEV, PHEV, FCV)	86.8
	FY2022 Supplementary	7. Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses / Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows	90.1
	FY2022 Supplementary	8. Support Project for Strengthening the Manufacturing Supply Chain of Batteries	331.6
	FY2022 Supplementary	9. Support Project for Strengthening the Semiconductor Manufacturing Supply Chain for Achieving GX	152.3
	FY2023 Initial	10. Grant for Decarbonization Transition Acceleration for Specific Regions	0
	FY2023 Initial	11. Promotion Project for the Electrification of Commercial Vehicles	10.9
			674.2
Total			**1,564.7**
Total Issuance Amount of the Bonds (cash proceeds)			**1,594.7**
Amount of Unallocated Proceeds (cash proceeds - amount of proceeds allocated)			**30.0*2**

*1 With regard to the GI Fund, the allocation of proceeds to the GI Fund was completed at the time of the payment out of the special account for energy measures to NEDO, the implementing entity. At the time of this review, the projects executed among the GI Fund projects were "Hydrogen Utilization in Iron and Steelmaking Processes," "Achieving Carbon Neutrality in the Waste and Resource Circulation," "Next-generation Aircraft Development," and "Decarbonization of Thermal Processes in the Manufacturing."

*2 The allocation plan for the unallocated balance of JPY 30 billion is as follows, and the full amount will be allocated by the end of FY2024.

Approx. JPY 2.6 billion: Initial budget project for FY2023 "4. Development Project for High-Temperature Gas Reactor Demonstration Plant"

Approx. JPY 0.3 billion: Initial budget project for FY2023 "10. Grant for Decarbonization Transition Acceleration for Specific Regions"

Approx. JPY 1.3 billion: Initial budget project for FY2023 "11. Promotion Project for the Electrification of Commercial Vehicles"

Approx. JPY 25.8 billion: Supplementary budget project for FY2023 "6. Subsidy for Promoting the Introduction of Clean Energy Vehicles (BEV, PHEV, FCV)"[9]

[10] Prepared by JCR from materials provided by the Ministry of Economy, Trade and Industry

Before the issuance of the Bonds, proceeds from government bonds instead of JCTBs[11] were allocated to a portion of the supplementary budget projects for FY2022 (allocation of JPY 908.7 billion) that were to be financed with the proceeds from the Bonds, but such projects were refinanced by the Bonds. As this was done with the initial intention of refinancing through JCTBs issued in FY2023, JCR considers that all projects will generate new environmental improvement effects after the issuance of the Bonds and provide the market with additionality.

5-2. Impact Reporting

The report released by the Government of Japan this time shows the calculation of the impact of some projects as case studies. JCR examined the method for all of these impact calculations announced this time as follows. The impact report for all projects is scheduled to be released in FY2025.

[GI Fund Project: "Development of Hydrogen Reduction Technology Using Blast Furnaces"]

Due to its abundant reserves, iron can be mass-produced at a low cost, and because it is highly recyclable, it is used for a variety of purposes as a base material that supports people's lives and society. As a material for reducing environmental negative impact, new demand for iron is emerging to apply to eco-products such as NEV[12] and transformers for expanding renewable energy power transmission and distribution networks and offshore wind power generation facilities. According to the IEA, global crude steel production is expected to be 1,970 million tons in 2030 and 1,960 million tons in 2050, a slight increase from 1,880 million tons in 2022[13].

On the other hand, the blast furnace method, which is currently the mainstream manufacturing process, generates about 2t-CO_2 per ton of steel during production, so the CO_2 emissions of the Iron and Steel industry are large. The CO_2 emissions of the Iron and Steel industry in Japan are 134 million tons (FY2022), accounting for about 38% of the industrial sector (about 14% of the total in Japan[14]). The global CO_2 emissions of the Iron and Steel industry are 2,623 million tons (FY2022[13]). Accordingly, the industry needs to further reduce the total amount of CO_2 emissions. In addition, steel is also used as a material for the construction industry. Further decarbonization in the Iron and Steel industry will also lead to a reduction of the Scope 3 emissions in other industries. Based on the above, it is essential to reduce CO_2 emissions in the Iron and Steel industry, which is integral to maintaining social functions, toward carbon neutrality not only in Japan but also in the whole world.

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[11] JCTBs or Japan Climate Transition Bonds are labelled bonds of Decarbonized Pro-Growth Economic Structure Transition Bonds (GX Economy Transition Bonds) issued under the GX Promotion Act.

[12] NEV stands for New Energy Vehicle: Battery Electric Vehicle stands (BEV), Plug-in Hybrid Electric Vehicle (PHEV), and Fuel Cell Vehicle (FCV).

[13] IEA "Net Zero Roadmap: A Global Pathway to Keep the 1.5°C Goal in Reach" https://iea.blob.core.windows.net/assets/4d93d947-c78a-47a9-b223-603e6c3fc7d8/NetZeroRoadmap_AGlobalPathwaytoKeepthe1.5CGoalinReach-2023Update.pdf

[14] Japan's National Greenhouse Gas Emissions Data (FY2022) provided by the Ministry of the Environment (https://www.env.go.jp/content/000216745.pdf (English, executive summary), https://www.env.go.jp/content/000216816.pdf (Japanese full text)). The value shows the proportion of the Iron and Steel industry emissions (after allocation of power and heat) to Japan's energy-related CO_2 emissions.

The GI Fund project is being carried out under such circumstances. The project supports development of hydrogen reduction technology using blast furnaces (blast furnace hydrogen reduction technology), and development of direct hydrogen reduction technology that reduces iron ore with hydrogen only. The target technologies are consistent with the measures outlined in the Technology Roadmap for "Transition Finance" in Iron and Steel Sector formulated and announced by the Ministry of Economy, Trade and Industry in October 2021. In order to decarbonize the Iron and Steel industry, it is essential to make multiple efforts, considering the timelines of events: the establishment of innovative technologies and the development of social infrastructure such as hydrogen supply. Therefore, it is significant for the Government of Japan to support the development of technologies by companies through the GI Fund project.

Each R&D item is subdivided by theme and aimed at establishing technologies by 2030. Since the impact has not actually occurred at the time of this review, the Government of Japan has described the expected GHG reduction effect as a case study for the allocation reporting. When the Working Group on the Field of Energy Structure Transformation of the Green Innovation Project Subcommittee under the Industrial Structure Council of the Ministry of Economy, Trade and Industry held a meeting in September 2023[15], it reported that the project was generally progressing as planned, and that the expected impact remained unchanged from what had been assumed in the Social Implementation Plan[16].

Table 3: Progress of the GI Fund Project Development of Hydrogen Reduction Technology Using Blast Furnaces" [17]

R&D items	At the start of business	Progress	Goal
1. Development of hydrogen reduction technology using blast furnaces	TRL[18]4	TRL4	FY2030 TRL 6 to 7
(1) Development of hydrogen reduction technology utilizing on-site hydrogen	The design and production of equipment for the demonstration test has moved forward as planned. The test of a hydrogen gas injection technology based on coke gas (COG) generated from the steel mill is scheduled to begin in January 2026.		
(2) Development of low-carbon technologies utilizing external hydrogen and CO_2 contained in blast furnace exhaust gas	For the first time in the world, a 22% CO_2 reduction was achieved in a test using a small test blast furnace.		
R&D items	**At the Start of Business**	**Progress**	**Goal**
2. Development of direct hydrogen reduction technology that reduces iron ore with hydrogen only	TRL3 to 4	TRL4	FY2030 TRL6 to 7
(1) Development of direct hydrogen reduction technology	Conditions setting and scale-up calculation of the process for elemental technology development are being carried out by bench tests and mathematical models.		

[15] Since the project (2)-3 started in FY2024, JCR examined its progress at the time of this review and confirmed that it was progressing smoothly in accordance with the Social Implementation Plan.

[16] R&D and Social Implementation Plan (the Ministry of Economy, Trade and Industry, December 22, 2023) for the "Development of Hydrogen Reduction Technology Using Blast Furnaces" project of the GI Fund projects https://www.meti.go.jp/policy/energy_environment/global_warming/gifund/pdf/gif_05_randd_r2.pdf (Japanese)

[17] Prepared by JCR based on interviews with the Ministry of Economy, Trade and Industry and published materials (NEDO reports by the Working Group on the Field of Energy Structure Transformation of the Green Innovation Project Subcommittee under the Industrial Structure Council of the Ministry of Economy, Trade and Industry, the Social Implementation Plan, etc.)

[18] Technology Readiness Level: A metric made by NASA that is used to assess the maturity level of a given technology. The technology maturity levels of TRL1 to 9 are set according to the practical application stage of the technology. TRL 1 is closest to the basic research level and TRL 9 is closest to commercialization. (In some cases, the status after commercial operation is indicated as TRL10 or 11.)

(2) Development of technology to remove impurities in electric arc furnaces using directly reduced iron	The specifications of the small test electric furnace have been decided and the order has been placed. At the same time, laboratory experiments and simulations of peripheral element technology development were conducted.
(3) Development of high-efficiency melting technologies by an electric smelting furnace utilizing directly reduced iron	The examination of the medium-scale test reactor is being carried out.

The Government of Japan indicates the amount of CO_2 emission reduction by the Development of a hydrogen reduction technology (COURSE50) utilizing on-site hydrogen (R&D item 1-(1)): approximately 2 million t-CO_2 per year[19] as the envisaged environmental improvement effect by 2030. This was calculated based on the general crude steel production of domestic blast furnaces (4 million tons), CO_2 emission intensity per 1 ton of crude steel of conventional blast furnaces, R&D targets and the number of COURSE50 blast furnaces to be installed by 2030 (1 unit), and JCR concluded that each parameter and calculation formula were reasonable.

This reduction in CO_2 emissions is equivalent to one blast furnace, that is, 4 million tons of crude steel produced at the COURSE50 blast furnace, so it is only equivalent to 1.5% of the CO_2 emissions in the Japanese Iron and Steel industry: 134 million t-CO_2 (FY2022), but if the technology is introduced at all the existing blast furnaces (20 furnaces[20]) in Japan, it is expected to reduce GHG emissions to a certain extent. In addition, the GI Fund project comprehensively covers measures to decarbonize the Iron and Steel industry, such as a hydrogen reduction technology in blast furnaces using external hydrogen, a technology to directly reduce low-grade iron ore with hydrogen, and a technology to efficiently utilize directly reduced iron with hydrogen in electric furnaces, etc. It is expected that environmental improvement effects will be realized by the social implementation of these projects by 2050. As for technologies other than COURSE50, although the specific number of units planned to be introduced has not been clearly determined yet, the Social Implementation Plan estimates a CO_2 reduction potential to be 1.3 billion t-CO_2 (worldwide) per year if innovative steelmaking technologies supported by the GI Fund project become widespread worldwide as of 2050.

[19] Note that the figure is a comparison of the one-year operation of the conventional blast furnace and the one-year operation after switching to the COURSE50 blast furnace, and that it does not mean that CO_2 will be reduced by 2 million t-CO_2 every year after the introduction of the COURSE50 blast furnace.

[20] As of November 2024, the disclosure materials of Nippon Steel Corporation, JFE Holdings, and Kobe Steel, Ltd.

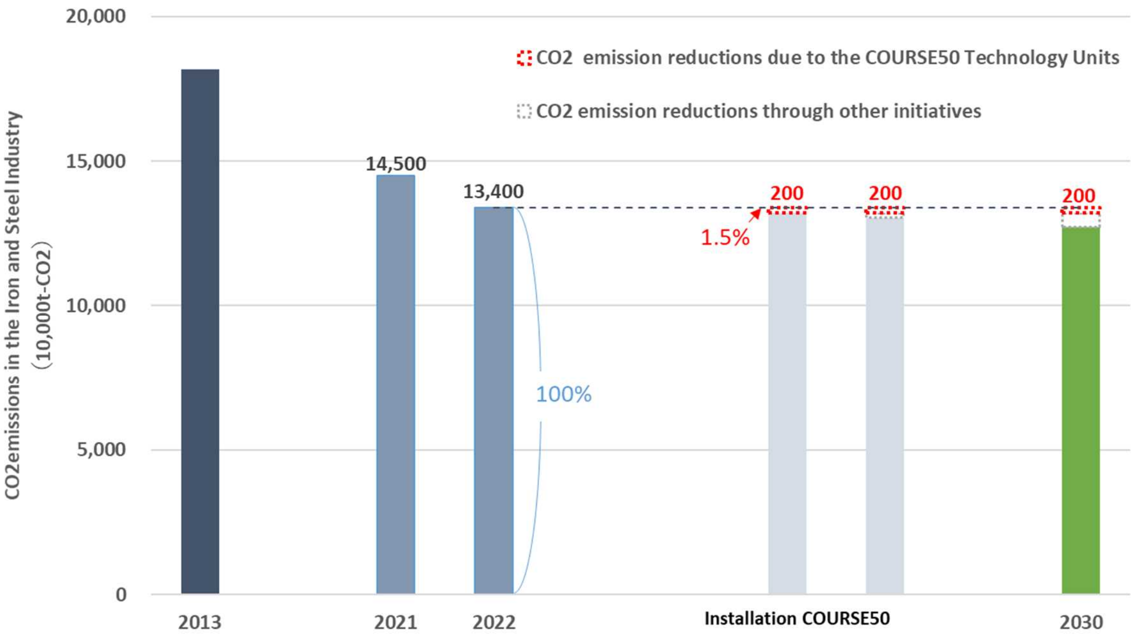

Figure 1: Impact of this GI Fund project on CO_2 emissions in the Iron and Steel Industry (expected) [21]

Based on the above, the technological development through the GI Fund project is steadily progressing toward the FY2030 target, and environmental improvement effects that will contribute to carbon neutrality not only in Japan but also around the world would be expected.

[GI Fund Project: "Decarbonization of Thermal Processes in the Manufacturing"]

Industrial furnaces are a generic term for "furnace" equipment used in heating processes such as melting, smelting, heat treatment, drying, and deodorization in industrial fields such as steel, automobiles, electricity and electronics, and account for the majority of demand for industrial high- temperature furnaces. They are used for a wide range of thermal processes from upstream to downstream in the manufacturing supply chain, and are a core machine of the machine parts and tooling industry (iron casting manufacturing industry, forgings manufacturing industry, metal heat treatment industry, etc.) which supply essential metal components for Japan's key industries, such as automobiles and industrial machinery. The market for industrial furnaces, which support industry, is expected to grow worldwide, and the global market size in 2028 will be around JPY 2 trillion (JPY 1.2 trillion for combustion furnaces and JPY 0.8 trillion for electric furnaces)[22].

CO_2 emissions from 37,000 industrial furnaces in Japan[23] are 150 million tons, which accounts for more than 40% of those in the industrial sector, and decarbonization of industrial furnaces is urgently required. However, many of the machine parts and tooling industries are small and

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[21] Prepared by JCR based on Japan's National Greenhouse Gas Emissions and Removals in Fiscal Year 2022, etc. published by the Ministry of the Environment

[22] "Domestic and Overseas Trends on "Decarbonization of thermal processes in the manufacturing sector" provided by Machine Parts and Tooling Industries Office, Manufacturing Industries Bureau, Ministry of Economy, Trade and Industry (Material 3 complied by Industrial Structure Conversion Working Group of the 26th Green Innovation Project Subcommittee Meeting held by the Industrial Structure Council on October 2, 2024) https://www.meti.go.jp/shingikai/sankoshin/green_innovation/industrial_restructuring/pdf/026_03_00.pdf (Japanese)

[23] Excludes blast furnaces, converters, and electric furnaces used in steelmaking processes. The same shall apply hereinafter.

medium-sized enterprises, which makes it difficult for them to proceed with decarbonization efforts on their own.

The GI Fund project is being carried out under such circumstances, and is supported by the development of technologies for ammonia and hydrogen combustion industrial furnaces for handling metal products, as well as technologies to reduce the capacity of electric furnace receiving equipment and increase efficiency. Since industrial furnaces are made-to-order products that are designed to optimize combustion methods and control technologies, depending on the product, it is necessary to establish decarbonization technologies that support furnaces with a wide variety of shapes and ways of use. Therefore, the GI Fund project, which the Government of Japan provides with comprehensive support, is significant.

There are several types of industrial furnaces whose innovative technologies need to be established: ammonia industrial furnaces, hydrogen industrial furnaces and electric furnaces. Based on its decision that the industry should work together on its common issues, such as the impact on metal product quality and the elucidation of its mechanism, and the simulation and digital twin technology, it plans to develop a common basic technology that can be applied to any industrial furnace until FY2026 and subsequently drive efforts focused on respective furnaces, brushing up on the basic technology, toward the goal to establish the technologies in FY2031. Since this project is a research and development project and its impact was not actually realized at the time of this review, the Government of Japan describes expected GHG reduction effects as a case study for the allocation reporting. At the time of the meeting of the Working Group on the Field of Energy Structure Transformation of the Green Innovation Project Committee under the Industrial Structure Council of the Ministry of Economy, Trade and Industry in October 2024, the project was generally progressing as planned, and the expected impact remains unchanged from what was expected in the Social Implementation Plan.

Table 4: Progress of the GI Fund Project "Decarbonization of Thermal Processes in Manufacturing"[24]

R&D Items	At the Start of Business	Progress	Target*
1. Development of common base technology for carbon- neutral industrial furnaces	TRL2 to 3 (TRL1, 4, 5 for some businesses)	TRL3 to 4	FY2026 TRL3 to 4 (5 to 6 for some businesses)
1-A Development of common elemental technologies	It was confirmed that flame testing and material analysis can be linked through the observation of metal pieces that have been heated by introducing testing and analysis equipment necessary for elucidating the effects of the object to be heated. In the investigation of detailed chemical reaction mechanisms, candidate mechanisms are searched and selected. The combustion model will be examined in the future.		
1-B Establishment of technology for ammonia combustion industrial furnaces	Ammonia combustion test of one pair of regenerative burners is planned for the steel heating furnace. In order to achieve both rapid heating and temperature uniformity in steel forging furnaces, samples of heatable materials and refractory materials under ammonia co-firing/combustion are being investigated. A test facility for the aluminum melting furnace is under construction.		
1-C Establishment of technology for hydrogen combustion industrial furnaces	For the steel process furnace, a test using a burner for laboratory testing was planned, and combustion tests will be carried out in the future. Various simulations are being conducted for the heat treatment furnace.		

[24] Prepared by JCR based on interviews with the Ministry of Economy, Trade and Industry and published materials (NEDO reports by the Working Group on the Field of Energy Structure Transformation of the Green Innovation Project Committee under the Industrial Structure Council of the Ministry of Economy, Trade and Industry, the Social Implementation Plan, etc.)

1-D Establishment of technologies to reduce power receiving capacity and other requirements and improve efficiency in electric furnaces	For the hybrid furnace, a preliminary heating experiment of induction heating (rapid heating) in the previous stage was conducted. For steel process furnaces, a preliminary experimental model has been introduced to examine the shape of the coil. In the high-temperature process furnace, a small test machine of induction heating-type Acheson furnace was produced.
1-E Research and survey on the ongoing decarbonization efforts of industrial furnace users	An interim summary of the survey results is planned within 2024

* Move to the phase 2 after the development of a common base technology (target: FY2031 TRL6 or higher)

The Government of Japan estimates that the annual amount of CO_2 emission reduction of the GI Fund project will be approximately 2.6 million t-CO_2 from FY2032 to FY2040, and approximately 5.2 million t-CO_2 from FY2041 to FY2050. This is based on the assumption that ammonia and hydrogen combustion furnaces and electric furnaces will become widespread after FY2032, and is calculated based on CO_2 emissions per conventional industrial furnace, R&D targets (CO_2 emission reduction rate: 50% compared to that of conventional industrial furnaces by FY2040, 100% from FY2041 onwards), and the number of low-carbon and decarbonized industrial furnaces to be introduced (1,300 each year). JCR considers that each parameter and calculation formula is reasonable. The amount of CO_2 emission reduction is equivalent to 8% as of FY2040 and 26% as of FY2050, compared to CO_2 emissions of 289 million tons (FY2030 = before the introduction of low-carbon, decarbonized industrial furnaces) in the Japanese industrial sector.

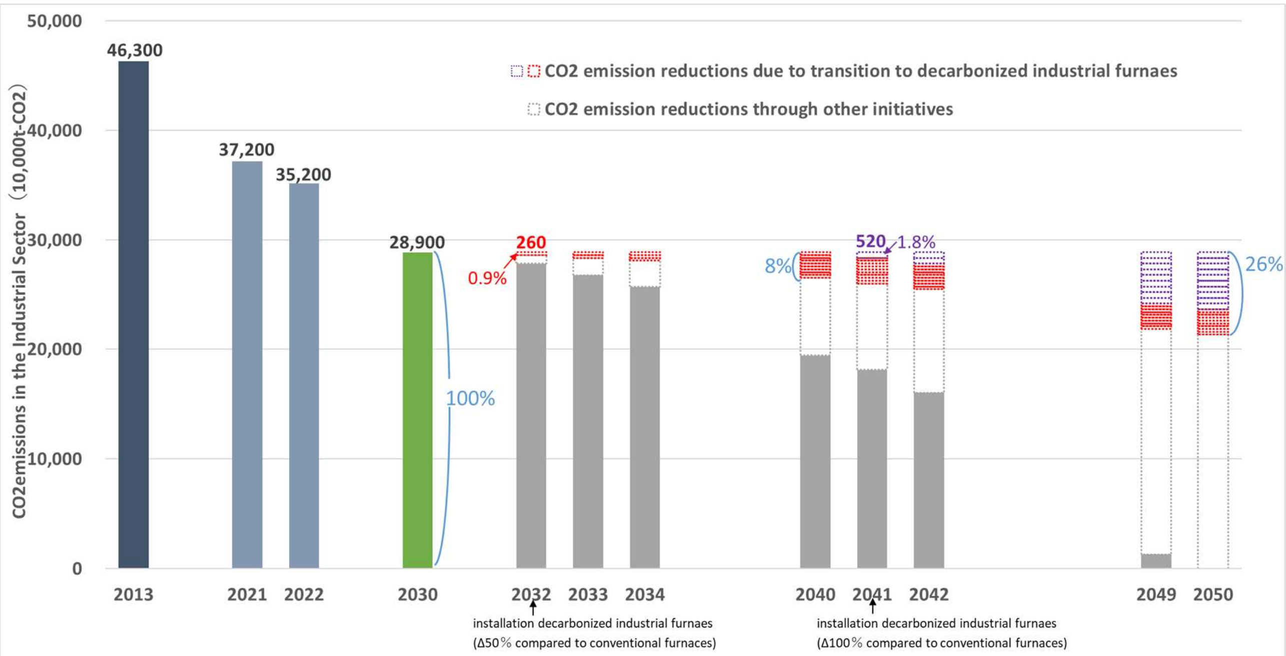


Figure 2: Impact of this GI Fund project on CO_2 emissions in the Industrial Sector (expected)[25]

[25] Prepared by JCR based on Japan's National Greenhouse Gas Emissions and Removals in Fiscal Year 2022, the Plan for Global Warming Countermeasures, etc. published by the Ministry of the Environment

Based on the above, the technological development through the GI Fund project is steadily progressing toward the FY2031 target, and environmental improvement effects that will contribute to carbon neutrality in Japan would be expected.

[Project for Enhancing the Resilience of the Battery Manufacturing Supply Chain Essential for a Green Society]

Batteries are indispensable for maintaining the foundation of a future electrified and digitalized society, as they are utilized for adjusting the power supply and demand to make renewable energy a primary power source for electrifying mobility such as automobiles, and as backup power for 5G communication base stations. Accordingly, they are considered to be one of the important supplies for Japan's Carbon Neutrality by 2050. Since the disruption of the supply of batteries will lead to the suspension of many manufacturing industries such as the automobile industry and services and businesses related to power supply, the Government of Japan designated batteries as specified critical products based on the Economic Security Promotion Act and provides support to strengthen the manufacturing supply chain of batteries in Japan. In the Battery Industry Strategy formulated in August 2022, the Government of Japan sets a goal of establishing manufacturing capacity of 150 GWh/year in Japan and 600 GWh/year worldwide by 2030 in order to strengthen the competitiveness of the battery industry.

Globally, the size of the battery market is expected to increase from roughly JPY 5 trillion in 2019 to nearly JPY 40 trillion in 2030 and JPY 100 trillion in 2050[26]. Although domestic battery manufacturers initially overwhelmed the market with their technological advantage, the share of Chinese and Korean manufacturers has increased as the market expands, whereas that of domestic companies has declined. As governments are significantly strengthening their policy support for batteries in response to their increasing strategic importance, the Government of Japan considers it necessary to improve cost competitiveness while maintaining and increasing their strengths such as battery performance and safety in order for the Japanese battery industry to be competitive[26].

The support program is being carried out under such circumstances, and it grants approval and provide support for business operators who intend to secure a stable supply of batteries based on the Economic Security Promotion Act. The support targets are capital investment and technological development related to batteries and their parts and materials. As a result of the project, 15 Ensuring supply plans were approved in FY2023. Two of them plans to produce the battery itself, and they are expected to increase the production capacity by 45 GWh/year. According to these plans, the production and supply of batteries are scheduled to begin in sequence from FY2026 to FY2027. In addition, the project will continue to be included in the supplementary budget for FY2023 and the initial budget for FY2024, and a request to include it in the initial budget for FY2025 has been made. As a production base for batteries, it is expected to secure 120 GWh/year by now[27].

[26] Reference to the Sector-Specific Investment Strategy (Batteries), Ministry of Economy, Trade and Industry https://www.meti.go.jp/press/2023/12/20231222005/20231222005-06.pdf (Japanese)

[27] The proceeds from the Bonds, which is the subject of the review, will be used for the Ensuring supply plans approved in FY2023. As for the supplementary budget for FY2023 and the initial budget for FY2024, proceeds will come from JCTBs issued or to be issued in FY2024 or later.

The environmental improvement effect was calculated based on the two plans to produce the battery itself[28] out of the 15 plans to secure supply, which were approved in FY2023. These two plans are related to the establishment of the production base for in-vehicle batteries. The estimation shows that approximately 13.5 million t-CO_2 is expected to be reduced over the life cycle of the battery-mounted vehicles. This is the reduction effect of replacing internal combustion engine vehicles with BEVs under the assumption that batteries equivalent to 100% production capacity are manufactured, and all the manufactured batteries are installed in BEVs. The parameters used in the calculation (battery capacity per BEV, life cycle GHG emissions of BEVs and internal combustion engine vehicles) are the values as of 2035 quoting the IEA[29], and the life cycle GHG emissions are from the STEPS scenario. As the life cycle GHG emissions of BEVs, the IEA assumes that well-to-tank emissions (emissions related to electricity used to charge BEVs) decrease by 55% thanks to power grid decarbonisation between 2023 and 2035. However, the life cycle GHG emissions of BEVs used in this case study are conservative values that estimate the effect of power grid decarbonization (emissions reduction of well-to-tank) to be around half. JCR considers that the above parameters and the calculation formula using them are reasonable.

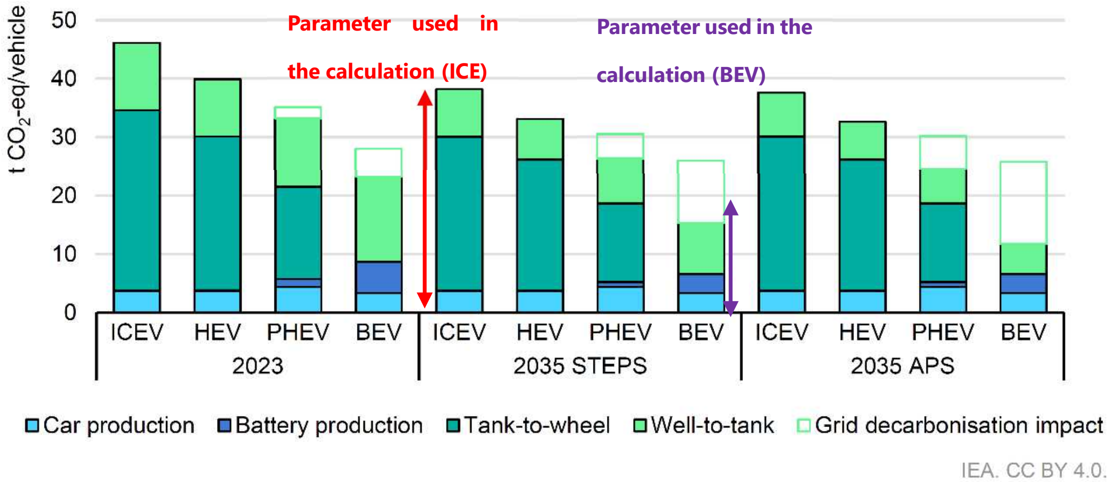


Figure 3: IEA's Life Cycle GHG Emissions of Internal Combustion Engine Vehicles, BEVs, etc. Used in the Calculation[30]

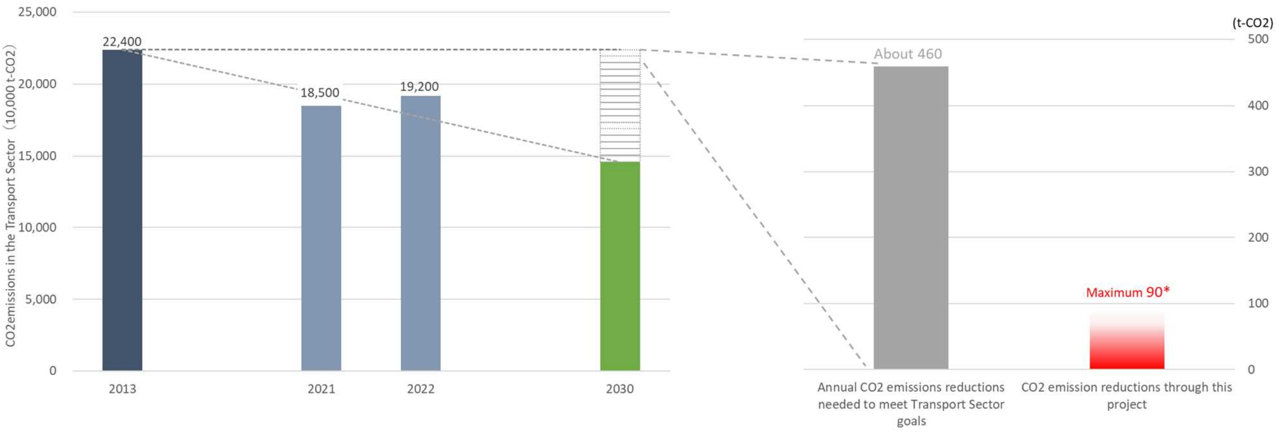
The IEA assumes the useful life of automobiles to be 15 years, which is equivalent to 0.9 million t-CO_2 per year when the GHG emission reduction of the project are converted into annual reduction[31]. In the Plan for Global Warming Countermeasures, the Government of Japan sets a target of reducing GHG emissions in the transport sector by 78 million t-CO_2 over 17 years from FY2013 to FY2030, which is approximately 4.6 million t-CO_2 per year. The annual GHG emission reduction of the project is 0.9 million t-CO_2, which corresponds to about 20% of the amount.

[28] Other 13 plans are related to the production of parts and materials. Their environmental improvement effects are combined into those of the plans related to the production of batteries. In order to avoid double counting, the environmental improvement effects of the plans related only to the production of batteries were calculated.

[29] IEA, *Global EV Outlook 2024 (2024)* https://iea.blob.core.windows.net/assets/a9e3544b-0b12-4e15-b407-65f5c8ce1b5f/GlobalEVOutlook2024.pdf

[30] Prepared by JCR based on IEA, 2024 and Global EV Outlook 2024.

[31] Note that, since GHG emission reduction over the life cycle was converted into an annual rate using the useful life, the difference in GHG emissions during manufacturing and related to disposal is divided proportionally into 15 years of useful life.



* The bar chart indicates the reduction effect (potential) of replacing internal combustion engine vehicles with BEVs under the assumption that batteries equivalent to 100% production capacity are manufactured, and all the manufactured batteries are installed in BEVs.

Figure 4: Impact of the Project on CO_2 Emissions in the Transport Sector (expected)[32]

In addition, the annual battery production capacity of 45 GWh, which will be expanded by the project, is equivalent to 750,000 units per year when converted into the number of BEVs[33]. The number of electric vehicles sold in Japan was approximately 88,000 as of FY2023[34], equivalent to approximately 8.5 times as many as that number. In the IEA scenario, the number of EVs sold, including PHEVs and FCEVs, is expected to triple in 2030 and more than quadruple in 2035, from that of 2023. And it is expected to meet the growing demand for EVs worldwide.

From the above, the project can be evaluated as an initiative that contributes to carbon neutrality not only in Japan but also around the world.

[Project for Enhancing the Resilience of the Semiconductor Supply Chain to Achieve GX through Improved Power Performance]

Semiconductors, especially power semiconductors which are responsible for current and voltage control, are used as power control components for a wide range of devices, including EVs and wind power generation, and are considered to be one of the important supplies for achieving Japan's Carbon Neutrality by 2050. The Government of Japan designated semiconductors as specified critical products based on the Economic Security Promotion Act and supports to strengthen the semiconductor supply chain.

Up until now, Silicon (Si) has been used as wafers for power semiconductors, but recently, attention has been focused on next-generation power semiconductors (such as silicon carbide (SiC)) with better energy-saving performance. And SiC is expected to reduce energy losses by

[32] Prepared by JCR based on Japan's National Greenhouse Gas Emissions and Removals in Fiscal Year 2022, the Plan for Global Warming Countermeasures, etc. Note that not all the batteries manufactured in the project will be installed in BEVs running in Japan. Therefore, although it is not simply comparable to the GHG emission reduction target of the transportation sector in Japan, it was created for the purpose of explaining the image of the impact.
[33] Battery load capacity per BEV: Calculated using 60 kWh/unit
[34] IEA, Global EV Data Explorer https://www.iea.org/data-and-statistics/data-tools/global-ev-data-explorer

approximately 55% compared to conventional Si power semiconductors[35]. In order to achieve global carbon neutrality, demand especially for SiC power semiconductors with excellent energy-saving performance is expected to expand, and the Ministry of Economy, Trade and Industry anticipates that it would grow about 24 times (about JPY 140 billion to about JPY 3.4 trillion) over the next 10 years.

Japanese companies account for more than 20% of the global share of power semiconductors, but the share of each company is less than 10%. In order to prevail in intensifying international competition, the Government of Japan aims to achieve overall improvement in competitiveness of Japan's power semiconductors and make Japan a global hub for the production along with Europe and the United States, by encouraging collaboration and restructuring of individual companies in Japan, leveraging the technical advantages of each Japanese companies.

The support program is being carried out under such circumstances. This project supports businesses aiming to secure a stable supply of semiconductors by approving ensuring supply plans for semiconductors and related components created by these businesses based on the Economic Security Promotion Act. As conditions of support, equipment and machinery introduced must demonstrate state-of-the-art performance, and they are limited to custom-made products or products in the latest catalog of manufacturing equipment companies or equivalent products. An achievement of the project is that three companies are expected to have a supply capacity equivalent to 1.008 million wafers per year in terms of SiC wafers (6 inch caliber) and 1.68 million wafers per year in terms of Si wafers (6 inch caliber). The proceeds of the Bonds were allocated to two ensuring supply plans for semiconductors out of those approved in FY2023. The three companies implement their respective plans. In these plans, the production and supply of semiconductors are scheduled to begin sequentially from FY2025 to FY2027.

Assuming that full supply capacity is used for BEVs, an environmental improvement effect was estimated on the case where conventional Si power semiconductors are replaced with SiC power semiconductors or energy-efficient next-generation Si power semiconductors. The estimation shows that the total annual reduction potential of the three companies is expected to be approximately 1.8 million t-CO_2. Among the parameters used in the calculation, the power loss reduction of SiC power semiconductors and the next-generation Si power semiconductors compared to conventional Si power semiconductors is 50% and 25%, respectively. The Ministry of Economy, Trade and Industry set the parameter with reference to information provided by each company. The power loss reduction effect of SiC power semiconductors (50%) seems to be reasonable as current cutting-edge performance covered by the project as there are cases where a reduction of about 55% was achieved assuming an inverter for railway vehicles[36] and the power loss of SiC inverters for BEVs can be reduced by less than half under specific driving conditions[37]. In addition, the power loss reduction effect of next-generation Si power semiconductors (25%) is generally reasonable as the development of Si power semiconductors with performance close to that of SiC power semiconductors is progressing[38].

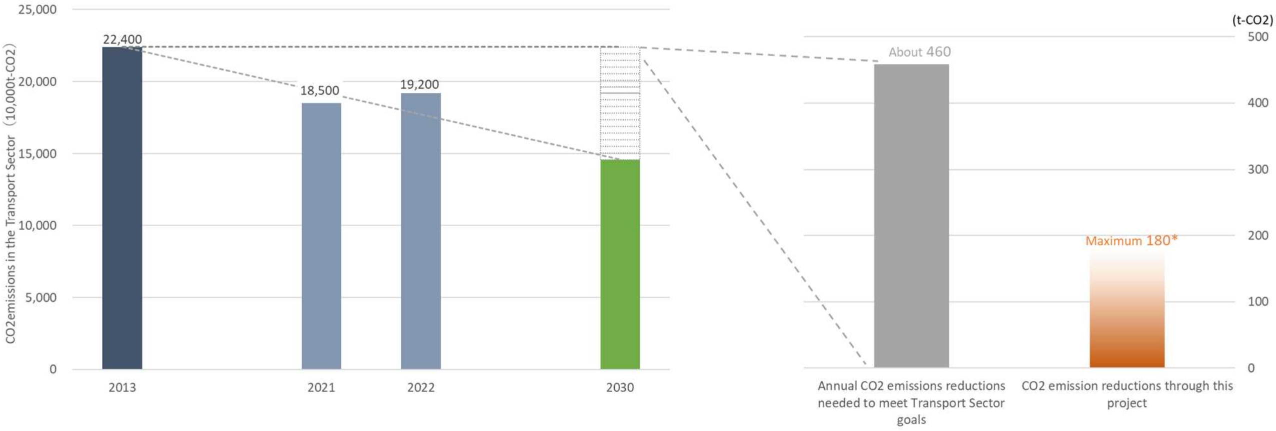
[35] Reference to the Sector-Specific Investment Strategy (Semiconductors) compiled by the Ministry of Economy, Trade and Industry https://www.meti.go.jp/press/2023/12/20231222005/20231222005-12.pdf (Japanese)

[36] NEDO web magazine: "SiC power semiconductor" responsible for the next generation of electric power society put into practical use in inverters for railway vehicles https://webmagazine.nedo.go.jp/practical-realization/articles/201706sic/ (Japanese)

[37] DENSO Corporation Develops First Inverter Using SiC Power Semiconductor (March 31, 2023) https://www.denso.com/global/en/news/newsroom/2023/20230331-g01/

[38] Nikkei xTECH's performance approaching SiC with Si power elements is also low loss due to improved structure and control (August 7, 2024) https://xtech.nikkei.com/atcl/nxt/column/18/00001/09600/ (Japanese)

As the power loss ratio of power semiconductors in BEVs is estimated to be about 20%[39], BEVs equipped with SiC power semiconductors or the next-generation Si power semiconductors, using the aforementioned ratio, are expected to have a 10% and 5% energy saving effect, respectively, compared to those equipped with the conventional Si power semiconductors. The reduction potential shown in the case study was calculated, taking into account the energy-saving effect of this BEV and the supply capacity of each operator, and is equivalent to about 40% of the annual emission reduction amount of 4.6 million t-CO_2 necessary to achieve the aforementioned target of Japan's transport sector.



* The bar chart indicates the reduction effect of BEVs under the assumption that semiconductors equivalent to 100% production capacity are manufactured, and all the manufactured semiconductors are installed in BEVs. In effect, semiconductors are used in a variety of electronic devices, such as data centers, other than BEVs, and each electronic device is expected to demonstrate an energy-saving effect.

Figure 5: Impact of the Project on CO_2 Emissions in the Transport Sector (expected) [40]

Although not all of the power semiconductors produced by the project's target companies will be used for BEVs, the above-mentioned supply capacity (a total of 2.68 million per year, combining that of SiC wafers and Si wafers) will be approximately 38.3 million units per year, converted to the number of BEVs. As of 2023, the number of new EVs (BEVs, PHEVs, and FCEVs) sold worldwide was approximately 15 million[34], equivalent to approximately 2.6 times that number.

From the above, the project can be evaluated as an initiative that contributes to carbon neutrality not only in Japan but also around the world.

[39] Toyota Motor Corporation, High Efficiency SiC Power Semiconductor (May 20, 2014) https://global.toyota/jp/download/3519696

[40] Prepared by JCR based on Japan's National Greenhouse Gas Emissions and Removals in Fiscal Year 2022, the Plan for Global Warming Countermeasures, etc. Note that not all the semiconductors manufactured in the project will be installed in BEVs running in Japan. Therefore, although it is not simply comparable to the GHG emission reduction target of the transportation sector in Japan, it was created for the purpose of explaining the image of the impact.

[Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses / Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows]

The CO_2 emissions of the residential sector are 158 million t-CO_2, accounting for about 15% of the total emissions in Japan[41]. In order to reduce these emissions, the Government of Japan compiled "Energy Efficiency Measures, etc. in Housing and Buildings toward a Decarbonized Society" in August 2021 and set a goal of ensuring energy-saving performance at the 2050 stock average ZEH and ZEB standard levels[42]. On the other hand, around 82% of existing housings do not meet the current energy conservation standard[43], which makes energy efficiency of existing residential buildings an essential initiative toward decarbonizing the residential sector.

In particular, thermal insulation renovations that reduce heat transfer within and outside homes directly leads to improvement of operating efficiency of air conditioning and heating, and greatly contributes to reducing energy consumption. Among residential equipment, windows have a particularly large amount of heat loss. Accordingly, improving the insulation performance of windows directly leads to improved operational efficiency of heating and cooling systems and contribute to a reduction in energy consumption.

The support program is being carried out under such circumstances. The project supports renovation projects to improve the insulation performance of windows of detached houses and apartments. An achievement of the project is the provision of subsidies for the renovation of the windows of 203,365 detached houses and 40,301 apartments. The number of renovations by the project is approximately 3% of that of residential renovations and renewals in FY2023 (7,062,950)[44].

As an environmental improvement effect, the annual CO_2 emission reduction in FY2023 was approximately 71,000 t-CO_2 (approximately 63,000 t-CO_2 for detached houses and approximately 0.8 million t-CO_2 for apartments). The calculation is based on the classification of renovation works according to the type of housing (detached houses / apartments (corner unit or non-corner unit)), the thermal insulation performance of windows after renovation, the number of renovated windows (all windows in the living-dining-kitchen area/ just window in living area), and the climatic characteristics of the region where the house is located, , and the environmental improvement effect of each renovation pattern using the "Program Meeting the Energy Efficiency Standards for Houses (WEB program)[45]." JCR confirmed that reasonable parameters were used for basic information (floor area, floor plan, etc.) other than renovation work with general residential units assumed. Comparing the value with 0.13 million t-CO_2[46] to achieve the FY2030 target, which is indicated in the Plan for Global Warming Countermeasures,

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[41] Japan's National Greenhouse Gas Emissions Data (FY2022) provided by the Ministry of the Environment (https://www.env.go.jp/content/000216745.pdf (English, executive summary), https://www.env.go.jp/content/000216816.pdf (Japanese full text)). The value shows the proportion of the residential industry emissions (after allocation of power and heat electricity and heat allocation) to Japan's energy-derived related CO_2 emissions.

[42] "Ensuring energy-saving performance at the stock average ZEH and ZEB standard levels" means that the primary energy consumption of houses is reduced by about 20% from the energy efficiency standard on stock average, and that of buildings is cut by about 30% or 40%, depending on the application.

[43] The 1st meeting on Energy Efficiency Measures, etc. in Housing and Buildings toward a Decarbonized Society held by Ministry of Land, Infrastructure, Transport and Tourism (April 19, 2021)

[44] Ministry of Land, Infrastructure, Transport and Tourism "Building Renovation and Renewal Survey Report (Overview)" (published on June 11, 2024)

[45] https://house.app.lowenergy.jp/#/select

[46] Calculated by JCR based on the expected amount of emissions reduction (2.23 million t-CO_2) for improvement of energy efficiency of housing (renovation and reconstruction of existing housing) in the Plan for Global Warming Countermeasures (https://www.env.go.jp/content/000249336.pdf). Note that, since about two-thirds of CO_2 emissions from residential sector come from electricity, the measures for the residential sector described in the Plan for Global Warming Countermeasures are based on the assumption that the reduction in the GHG emission intensity of electricity will be carried out in parallel.

the contribution of the project is approximately 54%, accounting for more than half of the total. Since the project is a continuing project, it would generate environmental improvement effects going forward[47].

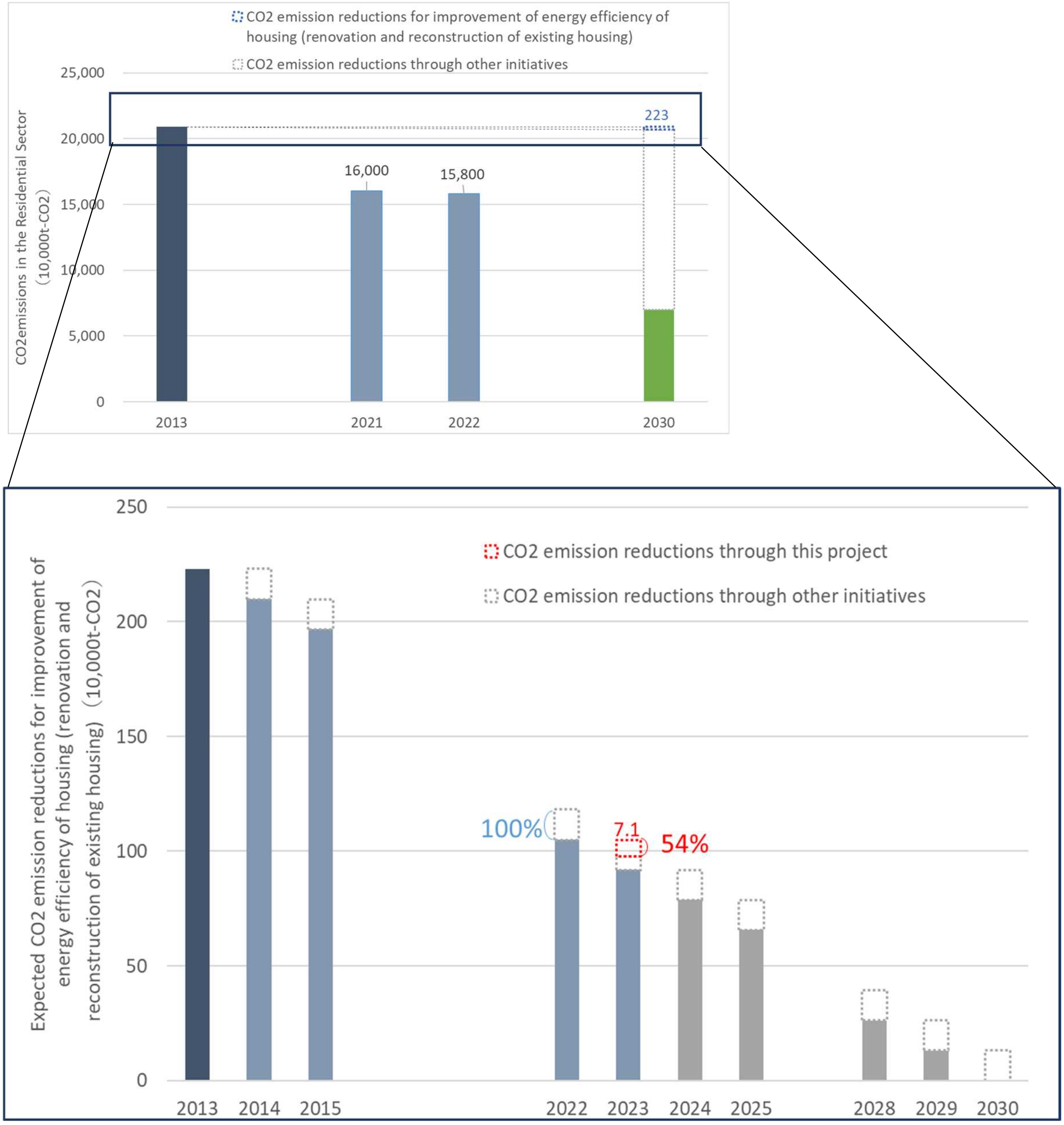

Figure 6: Impact of the project on CO_2 emission reduction (estimation) from energy efficiency (renovation) of houses in the residential sector[48]

In addition to the project, the Government of Japan also provides support for new construction and renovation, as well as energy efficiency water heaters, as measures to reduce emissions in the household sector. Through these comprehensive supports, the Government of Japan aims to achieve the GHG emission reduction target for FY2030 (approximately 138 million t-CO_2 reduction from that of FY2013) in the residential sector.

[47] Reference to the Sector-Specific Investment Strategy (Life-related Industry) indicates that in FY2024, the project plans to support more than 400,000 units, which is twice as many as then

[48] Prepared by JCR based on FY2022 GHG emissions and absorption (details), the Plan for Global Warming Countermeasures, etc. published by the Ministry of the Environment

Based on the above, JCR considers that the project has steadily produced environmental improvement effects as one of the initiatives to reduce emissions in the residential sector, and that the effects will contribute to the sector's reduction plan. In addition, JCR believes that the project is important because it is one of the measures to encourage consumers to understand energy efficiency initiatives and to change their behavior.

As stated above, JCR confirmed that although the assumptions and parameters included estimations, the environmental improvement effect was calculated in a reasonable manner based on the scenario assumed by the Government of Japan. In addition, JCR considers that it is an initiative that contributes to Japan's GHG emission reduction target since each case study can be expected to have a significant GHG emission reduction effect. At the same time, it is expected to contribute to strengthening Japan's industrial competitiveness by creating new demand and markets in the field of decarbonization.

Review Results (Conclusion) Green 1(T)

After the review, JCR evaluated the Bonds at "gt1" for "Green/Transition Evaluation (Use of Proceeds)" and "m1" for "Management, Operation and Transparency Evaluation," and "Green 1(T)" for the overall "JCR Climate Transition Bonds Evaluation" based on JCR's Green Finance Evaluation Methodology. As a result, JCR concluded that the Bonds met the standards for the items required in the Green Bond Principles, the Green Bond Guidelines, the Climate Transition Finance Handbook and the Basic Guidelines for Climate Transition Finance.

		Management, Operation, and Transparency Evaluation				
		m1	m2	m3	m4	m5
Green and Transition Evaluation	gt1	Green 1(T)	Green 2(T)	Green 3(T)	Green 4(T)	Green 5(T)
	gt2	Green 2(T)	Green 2(T)	Green 3(T)	Green 4(T)	Green 5(T)
	gt3	Green 3(T)	Green 3(T)	Green 4(T)	Green 5(T)	Not qualified
	gt4	Green 4(T)	Green 4(T)	Green 5(T)	Not qualified	Not qualified
	gt5	Green 5(T)	Green 5(T)	Not qualified	Not qualified	Not qualified

（Responsible analysts for this evaluation）Atsuko Kajiwara, Tomohiko Inamura, Haruna Goto

Important explanations of this Evaluation

1. Assumptions, Significance and Limitations of JCR Climate Transition Bond Evaluation

   JCR Climate Transition Bond Evaluation, which is determined and provided by Japan Credit Rating Agency, Ltd. (JCR), covers the policies set out in the Climate Transition Finance Framework, and expresses JCR's comprehensive opinion at this time regarding the appropriateness of the Green/Transition Project as defined by JCR and the extent of management, operation and transparency initiatives related to the use of funds and other matters. Therefore, JCR Climate Transition Finance Framework Evaluation is not intended to evaluate the effects of specific environmental improvements and the management, operation and transparency of individual bonds and borrowings, etc. to be implemented based on these policies. In the event an individual bond or individual borrowing based on this Framework is subject to a green/transition finance evaluation, a separate evaluation is needed. JCR Climate Transition Finance Framework Evaluation does not prove the environmental improvement effects of individual bonds or borrowings implemented under this Framework, and does not assume responsibility for their environmental improvement effects. JCR confirms the environmental improvement effects of funds procured under the Climate Transition Finance Framework measured quantitatively and qualitatively by the issuer/borrower or by a third party nominated by the issuer/borrower, but in principle it does not directly measure such effects.

2. Method used to conduct this evaluation

   The methodologies used in this assessment are described in "JCR Green Finance Evaluation" on the "Sustainable Finance ESG" section of the JCR website (https://www.jcr.co.jp/en).

3. Relationship with Acts Concerning Credit Rating Business

   JCR Climate Transition Finance Framework Evaluation is determined and provided by JCR as a related business, which is different from its activities related to the credit rating business.

4. Relationship with Credit Ratings

   The Evaluation is different from the Credit Rating and does not assure to provide or browse a predetermined credit rating.

5. Third-Party Evaluation of JCR Climate Transition Finance Framework Evaluation

   There are no capital and/or personnel relationships that may result in a conflict of interests between the subject of this evaluation and JCR.

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■ Glossary

JCR Climate Transition Finance Framework Evaluation: This evaluates the extent to which the funds procured through Green/Transition Finance are appropriated for green/transition projects as defined by JCR and the degree to which the management, operation and transparency of the Green/Transition Finance are ensured. Evaluations based on a 5-point scale are given from top to bottom using the Green 1(T), Green 2(T), Green 3(T), Green 4(T), and Green 5(T) symbols.

■ Status of Registration as an External Evaluator of Sustainability Finance

・Registered as an External Reviewer of Green Bonds by the Ministry of the Environment
・ICMA (registered as an observer with the Institute of International Capital Markets)

■ Status of registration as a credit rating agency, etc.

・Credit Rating Agency: the Commissioner of the Financial Services Agency (Rating) No.1
・EU Certified Credit Rating Agency
・NRSRO: JCR has registered with the following four of the five credit rating classes of the U.S. Securities and Exchange Commission's Nationally Recognized Statistical Rating Organization (NRSRO): (1) financial institutions, broker-dealers, (2) insurance companies, (3) general business corporations and (4) governments and municipalities. If the disclosure is subject to Section 17g-7 (a) of the Securities and Exchange Commission Rule, such disclosures are attached to the news releases appearing on the JCR website (https://www.jcr.co.jp/en/).

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