



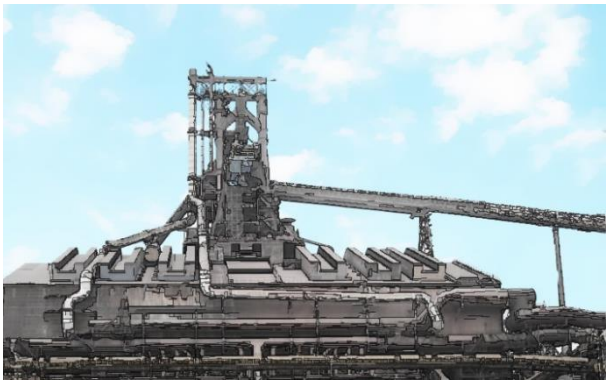

Japan Climate Transition Bonds

Allocation Report for FY2023 Issuance

December 2024

Cabinet Secretariat / Financial Services Agency (FSA) /
Ministry of Finance (MOF) / Ministry of Economy, Trade and Industry (METI) /
Ministry of the Environment (MOE)

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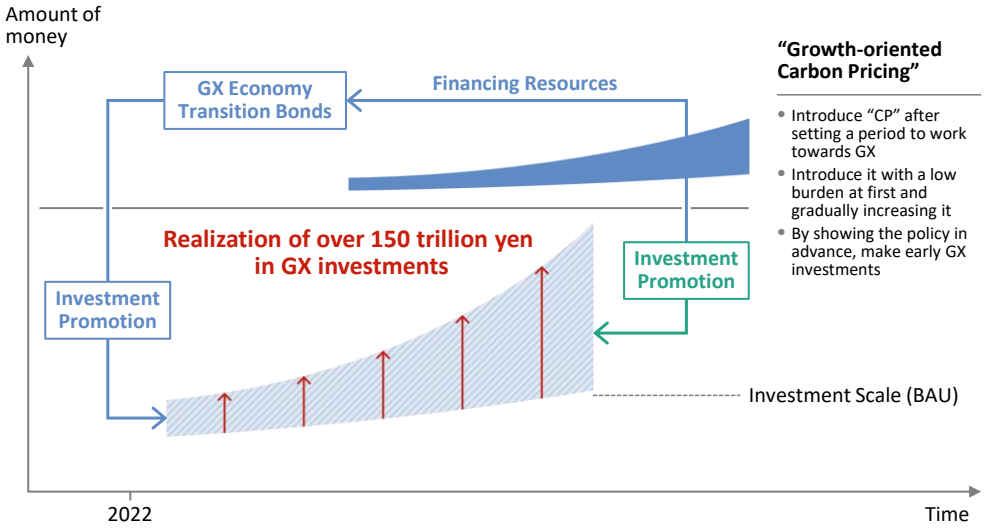
chapter 1

Positioning and Significance of Japan Climate Transition Bonds

Amid the escalating occurrence of extreme weather events and the shared challenge of addressing climate change, the Japanese government has introduced the concept of Green Transformation (GX). This initiative seeks to transition industrial and social structures—historically reliant on fossil energy since the Industrial Revolution—into a clean energy-centered society, aiming to simultaneously achieve economic growth, emissions reduction, and stable energy supply. The GX Implementation Council, chaired by the Prime Minister, has deliberated on the direction of GX policies since 2022. In February 2023, it adopted the Basic Policy for the Realization of GX,[1] which was subsequently approved by the Cabinet. Under this policy, the Act for Promoting a Smooth Transition to a Decarbonized Growth-Oriented Industrial Structure (hereinafter referred to as the GX Promotion Act) was enacted in May 2023. In July 2023, the Cabinet approved the Strategy for Promoting Structural Transition Based on Decarbonization (hereinafter referred to as the GX Promotion Strategy) as a framework under the GX Promotion Act.[2]

The GX Promotion Strategy outlines two main initiatives: 1) pursuing decarbonization initiatives for GX by ensuring a stable energy supply through energy conservation and transitioning to decarbonized power sources, including renewable energy and nuclear energy, contributing to improved energy self-sufficiency; and 2) promoting GX through the implementation of the Pro-Growth Carbon Pricing Concept, which includes bold support for upfront investments utilizing the Decarbonized Pro-Growth Economic Structure Transition Bonds (hereinafter referred to as GX Economy Transition Bonds), incentivizing proactive GX investments through carbon pricing (hereinafter referred to as CP), and adopting innovative financial mechanisms to accelerate transformation. A key element of the Pro-Growth Carbon Pricing Concept is the GX Economy Transition Bonds. By issuing GX Economy Transition Bonds, bold upfront investment support of 20 trillion yen for a 10-year period will be provided, establishing a focused period for GX initiatives and enabling the introduction of CP with initially low burdens, which will be incrementally increased over time. Through these initiatives, over 150 trillion yen in public and private GX investments is expected to be achieved over 10 years starting in FY2023, with the aim of achieving emissions reductions, including carbon neutrality by 2050, while simultaneously fostering economic growth and enhancing industrial competitiveness (Figure 1).

Figure 1: Pro-Growth Carbon Pricing Initiative



[1] Cabinet Decision on the Basic Policy for the Realization of GX METI News Release; February 10, 2023 (https://www.meti.go.jp/english/press/2023/0210_003.html)
[2] Strategy for Promoting Transition to a Decarbonized Growth-Oriented Economic Structure Adopted by the Cabinet; METI News Release; July 28, 2023(Japanese only) (https://www.meti.go.jp/press/2023/07/20230728002/20230728002.html)

Under this strategy, it was determined that GX Economy Transition Bonds would not only be integrated into a single financial instrument, like traditional government bonds (e.g., Construction bonds, Special deficit-financing bonds, and Reconstruction bonds), but also would be issued as individual securities called Japan Climate Transition Bonds (hereinafter referred to as JCTBs), based on a framework that outlines the use of proceeds and reporting etc. with second party opinions from independent external reviewers for its alignment with international standards. Based on this decision, the Japan Climate Transition Bond Framework (hereinafter referred to as the Framework) for individual securities issuance was established in November 2023, and the issuance of JCTBs under this Framework began in February 2024. The Framework is aligned with the ICMA's Green Bond Principles and the Climate Transition Finance Handbook, the Ministry of the Environment (MOE)'s Green Bond Guidelines, and the Basic Guidelines on Climate Transition Finance issued by the Financial Services Agency (FSA), the Ministry of Economy, Trade and Industry (METI), and MOE, and is certified by independent external reviewers.[3]

This report serves as the annual Allocation Reporting referred in the Framework, and reports on the proceeds allocated and the use of proceeds from the JCTBs issued in February 2024, corresponding to the issuance period for FY2023 (April 2023 to March 2024).

Column Japan's Pioneering Initiatives in Transition Finance

To address climate change through finance, Japan has proactively developed the environment for sustainable finance, including the formulation of the Green Bond Guidelines[4] for the first time in March 2017, consistent with international principles. In particular, recent efforts have focused on promoting "Transition Finance." In pursuit of the goals of the Paris Agreement and from the perspective of steadily reducing global emissions, it is essential not only to further promote green investment in renewable energy and other areas, but also to encourage efforts toward steady decarbonization, including promoting energy efficiency, in hard-to-abate sectors (industrial and energy conversion sectors that currently face challenges in decarbonization), long-term research and development (R&D) initiatives for decarbonization, and other transition-supportive efforts. To this end, in May 2021, the FSA, METI, and MOE jointly developed the Basic Guidelines on Climate Transition Finance.[5] Additionally, to facilitate transition finance for greenhouse gas (GHG) intensive sectors, the government established the Sector-Specific Technology Roadmaps, which outline specific transition pathways for eight sectors to achieve carbon neutrality by 2050. The government has also implemented model projects and subsidy programs to promote the adoption of transition finance, accumulate best practices, and disseminate these examples, thereby supporting

[3] The Framework and its second party opinions are available on the MOF website. (https://www.mof.go.jp/english/policy/jgbs/topics/JapanClimateTransitionBonds/index.html)
[4] The guidelines are aligned with the ICMA's Green Bond Principles. Subsequently, in November 2024, the "Green Bond and Sustainability-Linked Bond Guidelines (2024 Edition)" and the "Green Loan and Sustainability-Linked Loan Guidelines (2024 Edition)" were published.
[5] Basic Guidelines on Climate Transition Finance Formulated; METI, FSA, and MOE Joint Press Release; May 7, 2021 (https://www.meti.go.jp/english/press/2021/0507_001.html). These guidelines were developed with reference to the ICMA's Climate Transition Finance Handbook (December 2020), and deliberations on potential revisions are currently underway by the government's Transition Finance Development Study Group.

private issuers in executing transition finance. Furthermore, in June 2023, the FSA, METI, and MOE formulated the "Follow-up Guidance on Transition Finance"[6] for bond investors and other stakeholders, summarizing key follow-up points after providing proceeds through transition finance. In October 2023, it also released "Addressing the Challenges of Financed Emissions",[7] was also released addressing concerns that transition finance for GHG-intensive industries may temporarily increase financed emissions. These initiatives have contributed to enhancing the credibility of financing labeled as transition finance and have supported its steady adoption and expansion in Japan, particularly as a financing tool for Hard-to-Abate sectors.

Globally, the recognition of the importance of transition finance has been growing. At the G7 Hiroshima Summit in May 2023, chaired by Japan, it was emphasized that "transition finance has a significant role in advancing the decarbonization of the economy as a whole." Under the Asia Zero Emission Community (AZEC) established in 2023, interest and expectations for transition finance have also been expressed. Against this backdrop, the issuance of the world's first sovereign transition bonds—the recently issued JCTBs—is expected to contribute to the expansion of transition finance markets abroad, including in Asia.

To further expand the transition finance market, it is essential to enhance the credibility and transparency of transition finance. The formulation of transition plans (or transition strategies) is one of the fundamental elements of transition finance. In August 2024, domestic disclosure initiative the TCFD Consortium developed the "Transition Plan Guidebook", which supports enhancing disclosure practices.[8] The JCTBs currently issued by the Japanese government aim to support transition investments by private businesses, promote transition finance by private financial institutions, and establish a robust framework for steadily implementing decarbonization measures by facilitating dialogue with investors and markets and conducting regular reporting. For the current issuance of JCTBs, an impact report will be published in addition to this report. Through these initiatives, the government aims to enhance the credibility and transparency of transition finance while also contributing to developing both domestic and international markets.

[6] Formulation of the Transition Finance Follow-up Guidance - Guidance for an effective dialogue with fundraisers -; METI, FSA, and MOE Joint Press Release; June 16, 2023 (https://www.meti.go.jp/english/press/2023/0616_003.html).
[7] Paper Titled "Addressing the Challenges of Financed Emissions" Compiled; METI News Release; October 2, 2023 (https://www.meti.go.jp/english/press/2023/1002_002.html).
[8] TCFD Consortium has published the "Transition Plan Guidebook"; TCFD Consortium News Release; August 30, 2024 (https://tcfd-consortium.jp/en/news_detail/24091801). The guidebook outlines an overview of discussions on transition plans, the three fundamental concepts of such plans, the companies that should develop them, the required organizational structures, the content to include, and methods for disclosure. The TCFD Consortium, a private initiative established in May 2019, aims to promote effective corporate disclosure related to climate change and to support its use by financial institutions for informed investment decisions. METI, FSA, and MOE have participated in it as observers since its establishment.

chapter 2

Status of Japan Climate Transition Bond Issuance

Figure 2 presents the auction results for ten-year bonds on February 14, 2024, and five-year bonds on February 27, 2024.

Figure 2: Auction Results for JCTBs (FY2023 Issuance)

Issue	10-Year Japan Climate Transition Bonds (1st)	5-Year Japan Climate Transition Bonds (1st)
Auction date	February 14, 2024	February 27, 2024
Issue date	February 15, 2024	February 28, 2024
Maturity date	December 20, 2033	December 20, 2028
Nominal coupon	0.7%	0.3%
Offering amount	Approximately 800 billion yen	Approximately 800 billion yen
Amounts of competitive bids	2,321.2 billion yen	2,714.5 billion yen
Amounts of bids accepted	799.5 billion yen	799.8 billion yen
Yield to maturity	0.740%	0.339%

The proceeds raised through the auctions are intended for allocation to the designated projects, as outlined in Figure 3.

Figure 3: Projects to be Funded by JCTBs (FY2023 Issuance)[9]

Classification	Fiscal year	Projects to be funded
(1) Green Innovation Fund (GI Fund)	FY2022 Supplementary Budget	Green Innovation Fund
	FY2023 Initial Budget	
(2) R&D Support other than GI Fund	FY2022 Supplementary Budget	Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure
	FY2022 Supplementary Budget	Innovative GX Technology Creation Project (GteX)
	FY2023 Initial Budget	Development Project for Fast Reactor Demonstration Plant
	FY2023 Initial Budget	Development Project for High-Temperature Gas Reactor Demonstration Plant
(3) Subsidy	FY2022 Supplementary Budget	Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation
	FY2022 Supplementary Budget	Subsidy for Promoting the Introduction of Clean Energy Vehicles
	FY2023 Initial Budget	
	FY2022 Supplementary Budget	Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses
	FY2022 Supplementary Budget	Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows

[9] Furthermore, the possibility of proceeds being applied to continuing projects under the FY2023 supplementary budget are mentioned. See: https://www.mof.go.jp/jgbs/topics/JapanClimateTransitionBonds/UoP_FY2023.pdf (Japanese only).

	FY2022 Supplementary Budget	Support Project for Strengthening the Manufacturing Supply Chain of Batteries
	FY2022 Supplementary Budget	Support Project for Strengthening the Semiconductor Manufacturing Supply Chain for Achieving GX
	FY2023 Initial Budget	Grant for Decarbonization Transition Acceleration for Specific Regions
	FY2023 Initial Budget	Promotion Project for the Electrification of Commercial Vehicles

chapter 3

Selection of Eligible Projects for Japan Climate Transition Bonds

3.1. | Eligibility Criteria for Use of Proceeds

3.1.1 Approach to Classification of Eligibility Criteria Based on Energy Supply and Demand

Regarding the eligible use of proceeds for JCTBs, the Framework organizes 14 initiatives outlined as Decarbonization Initiatives towards GX based on the Premise of Ensuring a Stable Energy Supply in the GX Promotion Strategy as mid-level eligibility criteria (Figure 4). It should be noted that some initiatives, such as promoting thorough energy efficiency, can align with multiple eligibility criteria, while others, such as R&D projects, startup support, and promoting a just transition, can span multiple eligibility criteria.

Figure 4: The approach for classifying eligibility criteria based on energy supply and demand

Energy supply and demand classification	Sector classification	Eligibility criteria
Energy supply side	GX in the Energy Transition Sector	② Making renewable energy a major power source ③ Utilization of nuclear power ④ Facilitating introduction of hydrogen and ammonia ⑤ Establish electricity and gas markets to achieve carbon neutrality ⑦ Battery industry
Energy demand side	GX in daily life	① Promotion of thorough energy efficiency improvement and restructuring the manufacturing industry (through fuel and feedstocks transition) ⑦ Battery industry ⑨ GX in transport sector ⑩ Digital investment aimed at decarbonization ⑪ Houses and buildings ⑫ Infrastructure
	GX in industry	① Promotion of thorough energy efficiency improvement and restructuring the manufacturing industry (through fuel and feedstocks transition) ④ Facilitating introduction of hydrogen and ammonia ⑦ Battery industry ⑧ Resource circulation ⑨ GX in transport sector ⑩ Digital investment aimed at decarbonization ⑪ Houses and buildings ⑫ Infrastructure ⑬ Carbon recycling and CCS ⑭ Food, agriculture, forestry, and fisheries industry

Note: The initiatives numbered ① to ⑭ correspond to the 14 “Future Measures” outlined in the GX Promotion Strategy in the order specified. Initiative ⑥, Strengthening National Engagement in Resource Diplomacy to Secure Resources, does not fall under the mid-level classification.

3.1.2 Basic Conditions in the Selection of the Use of Proceeds

Regarding the selection of eligible projects for the use of proceeds from JCTBs, the Framework specifies that those that meet the Basic Conditions for investment promotion measures—as outlined in Figure 5—informed by the fundamental principles of upfront investment support for GX Economy Transition Bonds will be selected from the eligibility criteria shown in Figure 4.

Figure 5: GX Economy Transition Bond “basic conditions” in the selection of the use of proceeds (overview)

Basic conditions
Ⅰ. Efforts that are truly difficult to make investment decisions solely by the private sector
Ⅱ. Efforts that contribute to strengthening industrial competitiveness, economic growth and emission reduction, which are essential for achieving GX
Ⅲ. Integration with regulatory regime and system that change corporate investment and demand-side behaviour
Ⅳ. Efforts that contribute to the expansion of domestic investment including for human capital

In addition to the above principles, projects that fulfill at least one requirement related to industrial competitiveness and economic growth, along with one requirement related to emissions reduction, are prioritized as candidates for support based on these criteria (Figure 6).

Figure 6: Two categories of requirements that candidate projects for support must meet

Enhancing industrial competitiveness & economic growth		Emission reduction
(A) Growth investments for technological or business innovation to acquire external demand or expand domestic demand, or (B) Growth investments for advanced technologies contribute to both the reduction of fossil fuel & energy consumption and enhancement of the profitability (such as consolidation, restructuring and markup), or (C) Measures to address domestic demand in the initial stage of introducing key products with the potential for nationwide market (limited to the case involves investment on the supply side)	×	(1) Investment for R&D to contribute to future domestic emission reduction through technological innovation, or (2) CAPEX with high technological emission reduction effect that contributes for direct domestic emission reduction, etc., or (3) Measures to address domestic demand in the initial stage of introducing key products with the nationwide demand and long-term high reduction effect

3.1.3 Classification of the Use of Proceeds for Japan Climate Transition Bonds

Figure 7 reorganizes the 14 eligibility criteria previously outlined into six green categories based on the ICMA Green Bond Principles and illustrates representative uses of proceeds for each category. These uses of proceeds represent major economic activities currently being identified as part of the government’s proactive initiatives to achieve carbon neutrality by 2050 and will be updated as GX-related initiatives progress.

Figure 7: Japan Climate Transition Bonds: Classification of the use of proceeds

Main category (Green category)		Sub-category (Eligibility criteria)	Typical use of proceeds (Eligible projects)
1	Energy efficiency	① Promotion of thorough energy efficiency improvement	●Promote the spread of energy-efficient appliances
		⑪ Houses and buildings	●Support for building new houses and buildings with high energy efficiency and retrofitting to improve energy efficiency ●Replacing windows with thermal insulated models with higher energy efficiency
		⑩ Digital investment aimed at decarbonization	●Facilitating the development of and investment in energy efficient semiconductors, photonics electronics convergence technologies
		⑦ Battery industry	●Investments in plants manufacturing batteries together with their parts and materials
2	Renewable energy	② Making renewable energy a major power source	●Floating Offshore wind ●Next-generation solar cells (perovskite)
		⑫ Infrastructure	●Development of cities and communities contributing to decarbonization
3	Low-carbon and decarbonized energy	③ Utilization of Nuclear Power	●Next-generation advanced reactors with built-in new safety mechanisms
		⑤ Establishing electricity and gas markets to achieve carbon neutrality	●Promoting zero-emission thermal power ●Development of submarine DC transmission systems
4	Clean transportation	⑨ GX in transport sector	●Support for the introduction of next-generation vehicles ●Developing demonstration aircraft by 2030s and spreading the use of zero-emissions ships
		⑫ Infrastructure(repost)	●Development of cities and communities contributing to decarbonization
5	Circular economy adapted products, production technologies and processes	① Restructuring the manufacturing industry (fuel and feedstocks transition)	●Development and introduction of innovative technologies such as hydrogen reduction steelmaking ●Conversion to carbon recycling production systems
		④ Facilitating introduction of hydrogen and ammonia	●Building supply chain both domestically and internationally ● Research and development as well as the introduction support of production and usage of hydrogen derived from excess renewable energy sources
		⑬ Carbon recycling and CCS	●Support for research and development of carbon recycling fuel
6	Environmentally sustainable management of living natural resources and land use, circular economy	⑭ Food, agriculture, forestry, and fisheries industry	●Decarbonization of agriculture, forestry and fisheries
		⑧ Resource circulation	●Investment to accelerate resource circulation including plastics, metals, sustainable aviation fuel (SAF)

3.1.4 Japan Climate Transition Bonds: Eligibility Criteria and Examples of Use of Proceeds (Eligible Projects)

Framework 3.1.3 outlines an overview of the eligibility criteria and examples of the representative use of proceeds (eligible projects) included under these criteria.

Regarding specific target projects, the Expert Working Group for Realizing GX,[10] established under

[10] The Expert Working Group for Realizing GX was established in September 2023 to facilitate GX implementation through Pro-Growth Carbon Pricing Concept. It aims to define sector-specific investment strategies and other measures by analyzing emission reduction potential informed by technological advancements and economic impacts shaped by market trends.

the GX Implementation Council in September 2023, conducted in-depth examinations focusing on emissions reduction effects based on technological development trends and economic impacts reflecting market trends, among other factors. As a result, the Sector-Specific Investment Strategy was compiled in December 2023.[11] This strategy outlines the fundamental principles and policies for implementing "investment promotion measures" leveraging GX Economy Transition Bonds, as well as the conceptual framework for commitments expected from supported businesses and the execution principles. It is applied to 16 sectors, including Steel, Chemicals, Paper and Pulp, Cement, Automobiles, Batteries, Sustainable Aviation Fuel (SAF), Ships, Life-related Industry, Resource Circulation, Semiconductors, Hydrogen and its derivates(including ammonia, synthetic methane, and synthetic fuels), Next-generation Renewable Energy (such as advanced solar cells and floating offshore wind power), Nuclear Power (next-generation advanced reactors), and CCS. The strategy presents the direction of GX and specific investment promotion measures for each sector. The eligibility of each project is determined based on the relevant Sector-Specific Investment Strategy.

In addition, proceeds procured based on the Framework will not be allocated to businesses related to the following:

- Projects involved in manufacturing, sale or distribution of mass destruction weapons such as nuclear weapons, chemical weapons, biological weapons, and inhumane weapons such as anti-personnel landmines and projects involved in manufacturing and providing services of products that support the manufacturing or sale of mass destruction weapons such as nuclear weapons, chemical weapons, biological weapons, and inhumane weapons such as antipersonnel landmines
- Projects involved in mining, refining and transportation of coal
- Projects involved in the ownership or operation of gambling facilities or businesses
- Projects involved in forced labor
- Projects involved in unfair trade practices, bribery, corruption, extortion, embezzlement and other inappropriate relationships that do not comply with the laws of the country where they are located
- Projects involved in transactions that may cause human rights, environmental, or other social issues

3.2. Project Evaluation and Selection Process, and Management of Proceeds

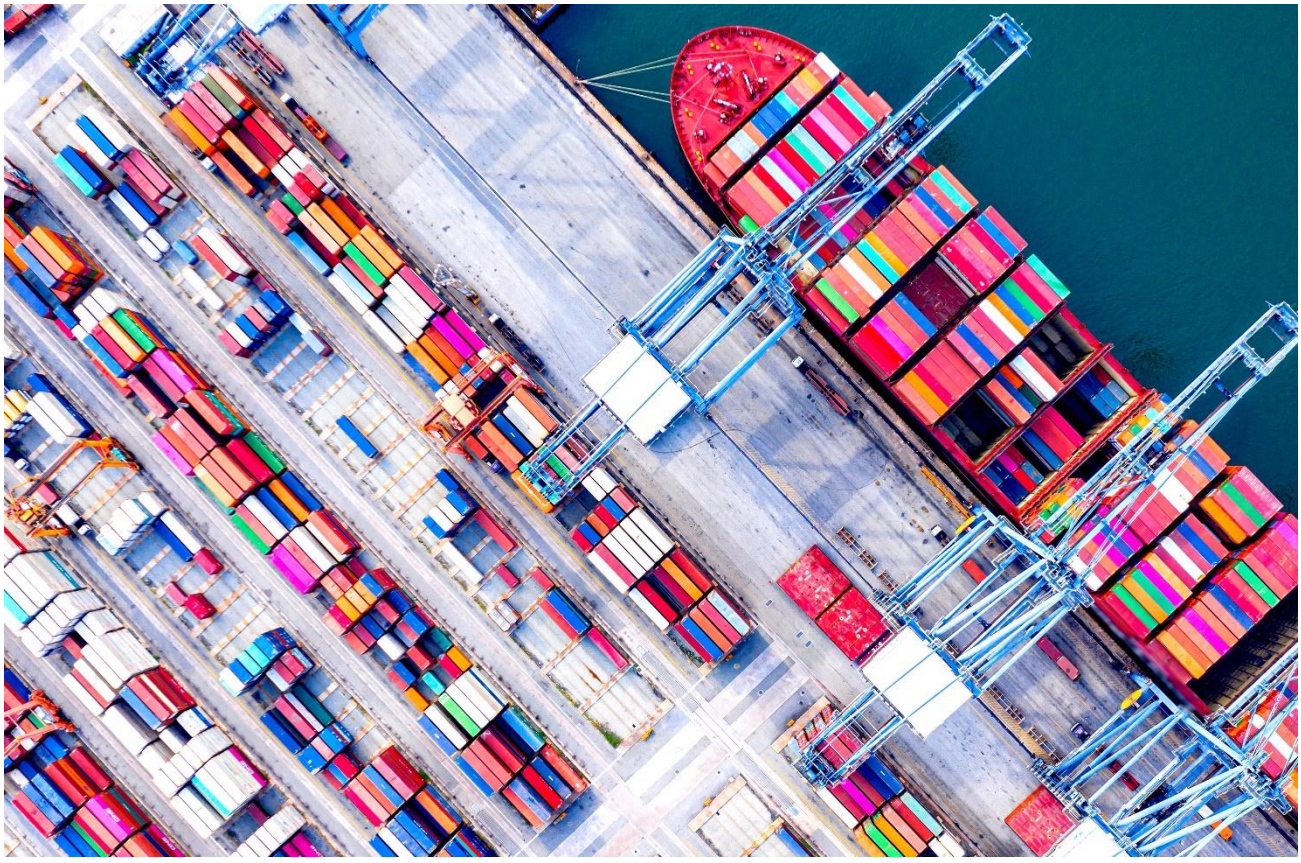
The projects to which the proceeds are allocated are reviewed within the responsible ministries and agencies to confirm their compliance with the eligibility criteria defined in the Framework Section 3.1: Use of Proceeds. When necessary, this compliance is further reviewed by the Government-Related Ministries and Agencies Liaison Conference on GX Economy Transition Bond Issuance (hereinafter referred to as Liaison Conference),[12] composed of director-level officials, based on the eligibility criteria defined in the Framework Section 3.1. The conference also holds consultations with other relevant ministries, agencies and related organizations before reporting to the GX Implementation Council as needed. Additionally, each project is determined as part of the government budget and approved annually by the National Diet.

[11] "Sector-Specific Investment Strategies" Compiled as Effort for Specifying Investment Promotion Measures for the Realization of GX; METI News Release; December 22, 2023 (https://www.meti.go.jp/english/press/2023/1222_002.html).
[12] Members of the Liaison Conference include the Cabinet Secretariat, FSA, MOF, METI, and MOE.

The proceeds can be allocated to the eligible projects that commence operations or are executed during the fiscal year (FY)[13] that includes the implementation date of funding under the Framework, as well as projects that have started operations or executed in subsequent FYs and the previous FY. The allocated projects are managed within the Energy Supply and Demand Account in the Special Account for Energy Measures, separate from other accounts. Within this account, the budget related to GX (allocated projects) will be categorized, and METI track and monitor the amount of the proceeds to match the actual expenses on an annual basis using an internal management system. Until full allocation of the proceeds, the unallocated proceeds will be managed in cash.

The actual allocation status of proceeds is reviewed and evaluated by the aforementioned Liaison Conference through allocation reporting and, if necessary, reported to the GX Implementation Council.

For the JCTBs (FY2023 issuance), the use of proceeds was reported at the GX Implementation Council in December 2023, and later, more details were provided at the Liaison Conference in February 2024. Before issuance, certification was obtained from the Climate Bonds Initiative (CBI),[14] and a second party opinion[15] was acquired from the Japan Credit Rating Agency (JCR). Additionally, the proceeds raised have been managed according to the management methods stipulated in the Framework.



[13] In the GX Promotion Act, it is stated that "the issuance of GX Economy Transition Bonds can be carried out until June 30 of the following year for each FY. In this case, the revenue related to GX Economy Transition Bonds issued after April 1 of the following FY shall be attributed to the revenue of the respective FY". Therefore, for example, proceeds raised from April 1 to June 30 in FY X may be attributed to the revenue of FY X-1. In this case, the FY X-1 becomes the "relevant FY" in this provision.

[14] https://www.mof.go.jp/english/policy/jgbs/topics/JapanClimateTransitionBonds/UoPArchive/Certificate_Government_of_Japan_5_10-year.pdf

[15] https://www.jcr.co.jp/download/d5b6151a81daa72b5d2ba009b145e0712d6c0abae252a18a12/23d1371en_4.pdf

chapter 4

Projects to be Funded and Amount of Proceeds Allocated

The proceeds from the JCTBs issued in FY2023 were allocated to projects under the Japanese government's FY2022 supplementary budget and FY2023 budget,[16] which were deemed eligible uses of proceeds under the Framework as of November 2023.

The total issuance amount (cash proceeds[17]) of the JCTBs (FY2023 issuance) was 1,594.7 billion yen, while the budgeted amount for the projects planned for allocation from these bonds was 1,608.9 billion yen. The proceeds were allocated as shown in Figure 8. Among these, 908.7 billion yen was allocated to the projects under FY2022 supplementary budget during FY2022 which ended before the FY2023 JCTB issuance.[18]

[16] Refers to cases where grant decisions or consignment contracts have been made between the government and businesses, and government expenditures have been fixed.
[17] Proceeds raised by the government from the market through the issuance of JCTBs.
[18] The 908.7 billion yen was financed in FY2022 through non-JCTB government bonds as a transitional measure until the issuance of JCTBs commenced under the GX Promotion Act. This was done with the initial intention of refinancing through JCTBs issued in FY2023.

Figure 8: Allocation of FY2023 Eligible Expenditures and JCTB Proceeds (by Project and Green Category)

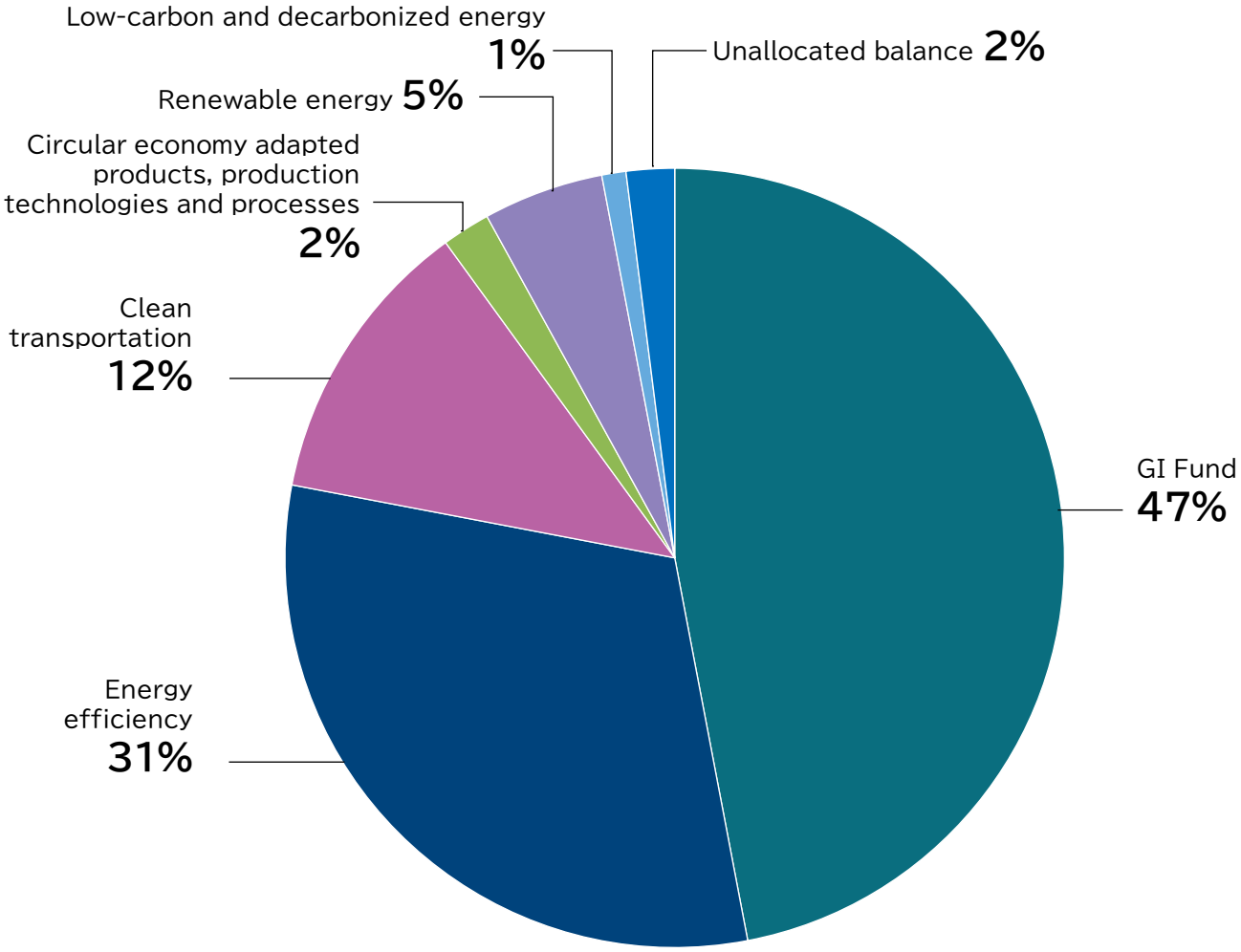
(As of the end of November 2024)

Classification	Fiscal year	Project name	Overview	Budget (Billion yen)	Allocated (Billion yen)	Green category
(1) Green Innovation Fund (GI Fund)	FY2022 Supp.	Green Innovation Fund	Support aimed at serving as a catalyst for advancing and expanding R&D and capital investment by private sector entities and others to further accelerate the development and societal implementation of innovative technologies critical for achieving carbon neutrality by 2050	300.0	300.0	●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
	FY2023 Initial			456.4	456.4	
(2) R&D Support other than GI Fund	FY2022 Supp.	Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure	Support for the development of core technologies for post-5G information and communications systems, aimed at strengthening Japan's development and manufacturing foundation for post-5G systems	75.0	75.0	●Energy efficiency
	FY2022 Supp.	Innovative GX Technology Creation Project (GteX)	Support for advancing basic research at universities and other institutions, including initiatives to create "innovative GX technology" aimed at achieving carbon neutrality by 2050	49.6	49.6	●Clean transportation/●Circular economy adapted products, production technologies and processes
	FY2023 Initial	Development Project for Fast Reactor Demonstration Plant	Expansion of elemental technology development addressing common issues of fast reactors, including infrastructure and safety improvement, to establish key technologies critical to future fast reactor development, and support for enhancing testing and research facilities to assist private-sector development	7.6	7.4	●Low-carbon and decarbonized energy
	FY2023 Initial	Development Project for High-Temperature Gas Reactor Demonstration Plant	By 2030, develop the technology to connect high-temperature heat sources and hydrogen production plants, and enable the demonstration of hydrogen production. Additionally, undertake efforts to assess the technical feasibility of carbon-free hydrogen production methods	4.8	2.1*1	●Low-carbon and decarbonized energy
(3) Subsidy	FY2022 Supp.	Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation	Support for the introduction of innovative energy-saving equipment and devices for factories and workplaces, including upgrading to equipment and devices with high energy-saving performance, encouraging collaboration among multiple businesses, and transitioning to non-fossil energy	25.0	2.5	●Energy efficiency
	FY2022 Supp.	Subsidy for Promoting the Introduction of Clean Energy Vehicles *4	Support for partial subsidies for the purchase costs of EVs and fuel cell vehicles in the early stages of adoption to create initial demand and promote cost reductions through mass production effects. Additionally, support for companies' investment in production facilities and R&D to anticipate increased demand	70.0	69.0	●Clean transportation
	FY2023 Initial			20.0	17.8	
	FY2022 Supp.	Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses	Improving the thermal insulation performance of windows in existing housing with high heat-loss windows to contribute to an approximately 70% reduction in CO_2 emissions from the household sector in FY2030 (compared to FY2013), and to ensure energy-saving performance at the ZEH standard level for the average stock in 2050 Note: METI project targeting detached houses	90.0	80.6	●Energy efficiency
	FY2022 Supp.	Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows	Same as the above project Note: MOE project targeting apartments	10.0	9.5	●Energy efficiency
	FY2022 Supp.	Support Project for Strengthening the Manufacturing Supply Chain of Batteries	Support for ensuring a stable supply of critical materials such as semiconductors and batteries—including those addressing social challenges such as decarbonization—through measures to improve production infrastructure; diversify supply sources; ensure stockpiling; introduce, develop, and improve production technologies; and develop alternative materials	331.6	331.6	●Energy efficiency
	FY2022 Supp.	Support Project for Strengthening the Semiconductor Manufacturing Supply Chain for Achieving GX		152.3	152.3	●Clean transportation/●Renewable energy
	FY2023 Initial	Grant for Decarbonization Transition Acceleration for Specific Regions	Support for local governments to promote decarbonization in regional and residential sectors by creating new demand and expanding investment in decarbonization products and technologies, such as renewable energy, energy conservation, and energy storage	3.0	0.0*2	●Renewable energy
	FY2023 Initial	Promotion Project for the Electrification of Commercial Vehicles	Intensive support for businesses with ambitious BEV and FCV introduction targets, and businesses affected by the transition to non-fossil energy, to support vehicle introduction costs	13.6	10.9*3	●Clean transportation
Total				**1,608.9**	**1,564.7**	
Total issuance amount of the JCTBs issued in FY2023 (cash proceeds)				-	**1,594.7**	
Amount of unallocated proceeds (cash proceeds - amount of proceeds allocated)				-	**30.0 (Note)**	

Note: Of the unallocated 30.0 billion yen, approximately 2.6 billion yen is expected to be allocated to the Development Project for High-Temperature Gas Reactor Demonstration Plant*1 under the FY2023 initial budget, approximately 0.3 billion yen to the Grant for Decarbonization Transition Acceleration for Specific Regions,*2 and approximately 1.3 billion yen to the Promotion Project for the Electrification of Commercial Vehicles.*3 Additionally, approximately 25.8 billion yen unallocated under the FY2022 supplementary budget and FY2023 initial budget is expected to be allocated to the Subsidy for Promoting the Introduction of Clean Energy Vehicles,*4 a continuing project under the FY2023 supplementary budget. The proceeds from the FY2023 JCTBs are expected to be fully allocated by the end of FY2024.

For each of the above projects, the allocation percentages for the Green Innovation Fund and by green category under the ICMA Green Bond Principles are shown below (Figure 9).

Figure 9: Allocation Percentages for the Green Innovation Fund and by Green Category under the ICMA Green Bond Principles



Column

The Green Innovation Fund Projects

The Green Innovation Fund (hereinafter referred to as GI Fund), managed by the New Energy and Industrial Technology Development Organization (hereinafter referred to as NEDO), provides continuous support for up to 10 years for projects, especially in high-impact policy areas requiring long-term efforts through to social implementation. The fund targets companies and organizations committed to achieving ambitious 2030 goals, supporting initiatives from R&D to demonstration and social implementation.

The Green Innovation Project Subcommittee is established under the Industrial Structure Council.[19] METI, NEDO, and related organizations implement fund projects in line with the Basic Policies for the Green Innovation Fund, deliberated by this subcommittee. To ensure proper and efficient execution of the GI Fund, the subcommittee formulates the Policy for Allocation of Funds for each Field, based on which Field-Specific Working Groups, established under the subcommittee, evaluate the prioritization and appropriateness of funding amounts for each project. Subsequently, the relevant ministries' project divisions formulate each project's details as R&D and Social Implementation Plans, and initiate public calls for applications in a phased manner.

This plan sets ambitious 2030 output targets, including performance, cost, productivity, deployment volume, and CO_2 reduction levels. It also defines outcome goals, such as CO_2 reduction effects and broader economic ripple effects, calculated as the total economic impact generated by each project (including overlaps between projects). The Field-Specific Working Groups monitor how the ongoing GI Fund projects are being run, such as the top management's commitment to the projects and the progress of the initiatives.

The JCTBs issued in FY2023 dedicated 756.4 billion yen to the GI Fund. Details are shown below (Figure 10).

Figure 10: Projects to be Funded by JCTBs (FY2023 Issuance): Detailed Overview of the GI Fund

Budget year	Project type	Allocated projects (including partial allocation candidates)	Target area
FY2022 Supp.	R&D	1. Development of Next-Generation Solar Cells	Electricity
FY2023 Initial			
FY2022 Supp.	R&D	2. Cost Reductions for Offshore Wind Power Generation	Electricity
FY2022 Supp.	R&D	3. Large-Scale Hydrogen Supply Chain Establishment (Demonstration of Hydrogen Power Generation Technology [High-Mixture Combustion] Using Large Gas Turbines)	Electricity
FY2022 Supp.	R&D	4. Next-generation Aircraft Development	Transportation
FY2022 Supp.	R&D	5. Next-generation Ships Development	Transportation
FY2022 Supp.	R&D	6. Development of Technologies for Producing Fuel Using CO_2, etc.	Transportation
FY2022 Supp.	R&D	7. Hydrogen Utilization in Iron and Steelmaking Processes	Heat/Manufacturing
FY2022 Supp.	R&D	8. Decarbonization of Thermal Processes in the Manufacturing	Heat/Manufacturing
FY2022 Supp.	R&D	9. Large-Scale Hydrogen Supply Chain Establishment (Demonstration for Commercialization of the Liquid Hydrogen and MCH Supply Chain and Research into Dehydrogenation Technologies from Ammonia for Large-Scale Hydrogen Transport)	Electricity and heat/Manufacturing
FY2022 Supp.	R&D	10. Hydrogen Production through Water Electrolysis Using Power from Renewables	Electricity and heat/Manufacturing
FY2022 Supp.	R&D	11. Achieving Carbon Neutrality in Waste and Resource Circulation	Waste
FY2022 Supp.	R&D	12. Development of Technology for Producing Raw Materials for Plastic Using CO_2 and Other Sources	Waste/ Manufacturing(chemical)
FY2022 Supp.	R&D	13. Promotion of Carbon Recycling Using CO_2 from Biomanufacturing Technology as a Direct Raw Material	Manufacturing(chemical)

[19] The Industrial Structure Council, established under Article 7 of the Act for Establishment of the Ministry of Economy, Trade and Industry, is a public body that investigates and deliberates on key METI policies, particularly those related to enhancing private-sector economic capabilities and facilitating smooth international economic relations, in response to consultations by the Minister of METI.

chapter 5

Case Studies

The following section provides case studies showcasing five projects funded by the proceeds of JCTBs issued in FY2023.

When selecting projects, representative cases were identified from among the categories of Research and Development, Capital Investment, and Implementation Support, taking into account factors such as the scale of allocated proceeds, the impact on domestic emissions, and other relevant considerations within the FY2023 bond-funded projects.

The case studies provide details on the significance and objectives of each project, their details, current outcomes (outputs), future outlook, and the CO_2 emission reduction (impact) achieved through these projects. Regarding the CO_2 emission reduction impact, the studies outline the calculated results, including the reductions already realized, those expected in the future, and avoided emissions, together with explanations of the calculation approach, parameters used, and formulas applied.

The CO_2 emission reduction impact varies depending on the nature of the project, including the timeline over which the effects materialize and the availability of data needed for calculations. Research and development projects, such as those under the GI Fund, often span long durations and involve innovative technologies that do not yet exist, making it challenging to accurately calculate CO_2 reduction impacts at this stage. For this evaluation, the potential for CO_2 reduction was estimated based on the assumption that the innovative technologies addressed by these projects will be commercialized and widely adopted in the future.

Column Avoided Emissions and Reduced Emissions of Product

Integrating climate change measures into business activities and promoting corporate investment in decarbonization require linking emission reduction outcomes directly to the added value of products and services. Building a market in which consumers actively prefer and pay fair value for these enhanced offerings is critical in achieving this goal. To advance discussions on these ideas, METI established the Study Group on GX Product Markets for Strengthening Industrial Competitiveness and Achieving Emission Reductions through Demand Creation (hereinafter referred to as the Study Group on GX Product Markets).[20] The group focuses on organizing key approaches to link emission reduction outcomes with the added value of products and services, aiming to create GX markets. In its interim summary, the group outlined concepts for visualizing product-level GHG emission reductions, introducing the ideas of “reduction achievements” and “reduction contributions” as metrics derived from corporate decarbonization investments.

“Reduced Emissions of Product” is a metric that quantifies the GHG emission reductions achieved within a company (Scope 1 and 2) on a per-product basis, and highlights efforts to reduce emissions during processes such as raw material production and assembly. This metric was proposed by METI during the Study Group on GX Product Markets. “Avoided Emissions” measure the extent to which a product or service contributes to reducing emissions across its entire lifecycle and within society as a whole. Unlike reduction achievements, this metric is not limited to emissions reductions during the manufacturing process but encompasses the broader impact of the product or service on societal emissions. By utilizing these metrics, it becomes possible to accelerate the development and adoption of products and services that contribute to decarbonization. In particular, regarding “Avoided Emissions,” the World Business Council for Sustainable Development (WBCSD)[21] established a Working Group on Avoided Emissions in 2022 and published a guidance in March 2023. The GX League,[22] a public-private initiative in Japan, also outlined its approach to avoided emissions in its Basic Guidelines for Disclosure and Evaluation of Climate-related Opportunities, released in March 2023.

Prioritizing the procurement of products with significant Avoided Emissions and Reduced Emissions of Product can help stabilize demand growth and enhance supplier investment predictability. By actively promoting the importance of these products, momentum can be generated to expand demand for offerings that contribute to GX-related goals.

This report calculates the impact of five projects through case studies in Chapter 5. Among them, for two specific projects—the Project for Enhancing the Resilience of the Battery Manufacturing Supply Chain Essential for a Green Society and the Project for Enhancing the Resilience of the Semiconductor Supply Chain to Achieve GX through Improved Power Performance—the impact is estimated based on the concept of avoided emissions. For

[20] https://www.meti.go.jp/shingikai/energy_environment/gx_product/index.html (Japanese only)
[21] The World Business Council for Sustainable Development (WBCSD) is a coalition of CEOs from companies committed to sustainable development, working together to contribute to the transition toward a sustainable society.
[22] The GX League was established as a collaborative platform for companies implementing GX initiatives while striving for sustainable growth in both current and future societies. It aims to achieve carbon neutrality by 2050 and foster social transformation through collaboration with like-minded companies, government, and academia. The basic concept was announced in February 2022, with full-scale activities commencing in April 2023.(https://gx-league.go.jp/en/)

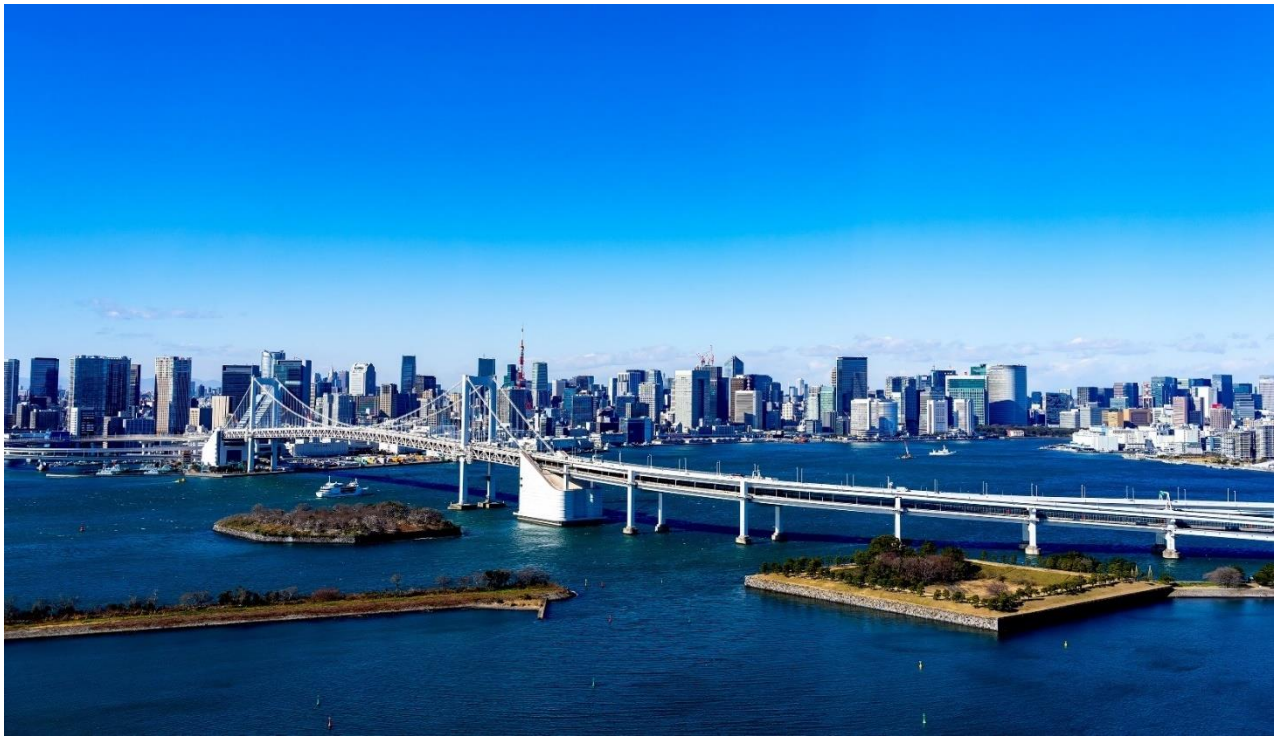
these two projects, the analysis assumes a scenario in which products produced under these initiatives replace conventional products (baseline) in the market and compares the emissions difference between the two.

- **Project for Enhancing the Resilience of the Battery Manufacturing Supply Chain Essential for a Green Society:**

Comparison of the lifecycle emissions of internal combustion engine vehicles (ICEVs) with those of electric vehicles (EVs) equipped with batteries produced under this project.

- **Project for Enhancing the Resilience of the Semiconductor Supply Chain to Achieve GX through Improved Power Performance:**

Comparison of the driving emissions of EVs equipped with previous-generation power semiconductors and those equipped with next-generation power semiconductors produced under this project.



5.1. GI Fund Project: Hydrogen Utilization in Iron and Steelmaking Processes

Significance and Objectives of the Project

The steel industry forms the backbone of all industries. Even in a carbon-neutral society to be achieved by 2050, sectors like automobiles, infrastructure, and electronic devices will continue to rely heavily on steel. However, the steel manufacturing process generates significant CO_2 emissions, creating a major challenge. In FY2022, Japan's steel industry emitted approximately 134 million metric tons of CO_2 annually, accounting for about 40% of the total emissions from the country's industrial sector.

To reduce CO_2 emissions from the steel manufacturing process, it is essential to lead the world in developing innovative technologies such as hydrogen-reduction steelmaking, and to establish a production and supply system specializing in green, high-grade steel. Achieving this goal requires further accelerating technological development to quickly bring these innovations to fruition.

This project focuses on R&D to establish and socially implement decarbonization technologies for steelmaking processes, including hydrogen reduction ironmaking. It also envisions the establishment of an affordable, large-scale hydrogen supply infrastructure to support these efforts.

Project Details

This project aims to adapt flexibly to domestic and international changes in the environment by considering overseas companies' initiatives, uncertainties in future technologies, and market trends. To achieve this, it is concurrently developing two technologies: 1) Development of hydrogen reduction technology using blast furnaces (blast furnace hydrogen reduction technology), and 2) Development of direct hydrogen reduction technology that reduces iron ore with hydrogen only.[23]

①Development of Hydrogen Reduction Technology Using Blast Furnaces

The hydrogen reduction method for blast furnaces involves partially replacing the coke used in blast furnaces with hydrogen in order to reduce iron ore. The hydrogen reduction reaction absorbs heat, making it necessary to establish large-scale heat compensation technologies to supply the heat required for reduction and melting in a blast furnace while reducing the use of coal as a heat source. Additionally, advanced ventilation technologies are needed to ensure that the reducing gas is evenly distributed within the blast furnace.

This project aims to implement technologies that reduce CO_2 emissions from steelmaking processes by more than 30% and to demonstrate technologies capable of achieving reductions of over 50% by 2030. To achieve these goals, the project is pursuing two R&D initiatives: 1-① Development of hydrogen reduction technology utilizing on-site hydrogen, and 1-② Development of low-carbon

[23] Details of technologies in the iron and steel sector aimed at achieving carbon neutrality by 2050 are summarized in METI's Technology Roadmap for Transition Finance in Iron and Steel Sector (October 2021).
Japanese version:
https://www.meti.go.jp/policy/energy_environment/global_warming/transition/transition_finance_technology_roadmap_iron_and_steel_jpn.pdf
English version:
https://www.meti.go.jp/policy/energy_environment/global_warming/transition/transition_finance_technology_roadmap_iron_and_steel_eng.pdf

technologies using external hydrogen and CO_2 contained in blast furnace exhaust gas. The Technology Readiness Level (TRL) for the Utilization of Hydrogen in Steelmaking Processes Project is outlined in the R&D and Social Implementation Plan published by METI as currently at TRL 4 (initial prototype demonstration under test conditions). The goal for 2030 is to reach TRL 6–7 (integrated prototype demonstration under expected operating conditions to pre-commercial demonstration of solutions).

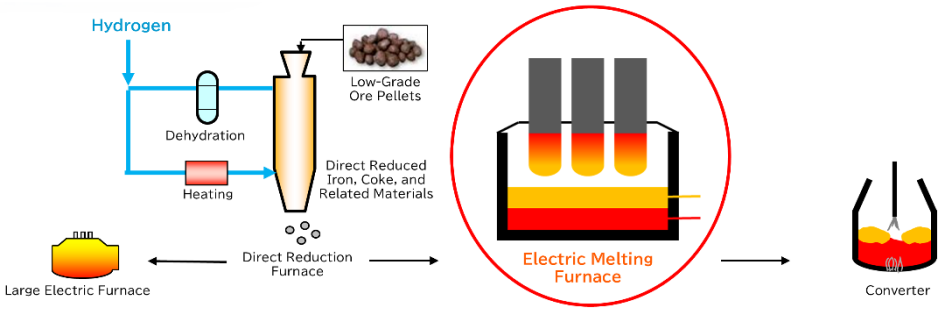
②Development of Direct Hydrogen Reduction Technology That Reduces Iron Ore with Hydrogen Only

The direct hydrogen reduction method uses hydrogen, rather than natural gas, to reduce iron ore, with melting performed in an electric furnace or comparable equipment. However, the need for separate furnaces for reduction and melting not only lowers energy efficiency but also poses challenges such as the inability to remove impurities and restrictions on raw material selection, limiting its current use. Therefore, it is essential to broaden its applicability to low-grade iron ore.

This project aims to establish direct hydrogen reduction technology to achieve more than a 50% reduction in CO_2 emissions by 2030. To meet this goal, the project is pursuing three R&D initiatives: development of direct hydrogen reduction technology (R&D Item 2-①), development of technology to remove impurities in electric arc furnaces using directly reduced iron (R&D Item 2-②), and development of high-efficiency melting technologies by an electric smelting furnace using directly reduced iron (R&D Item 2-③). When the R&D and Social Implementation Plan was established, the TRL was at 4, and the intention is to reach TRL 6–7 by 2030.

R&D Item 2-③ is a new initiative that began in FY2024, fully funded by the GI Fund Project through resources procured entirely via JCTBs issued in FY2023. The goal of this initiative is to develop a direct hydrogen reduction furnace, an electric smelting furnace, and a converter integrated process for low-grade iron ore that can achieve production efficiency comparable to the blast furnace process. Additionally, it aims to control the impurity concentration of the produced iron to levels equivalent to those achieved by the blast furnace method.

▌Figure 11: Project Concept for R&D Item 2-③



Direct Outcomes (Outputs) and Future Outlook

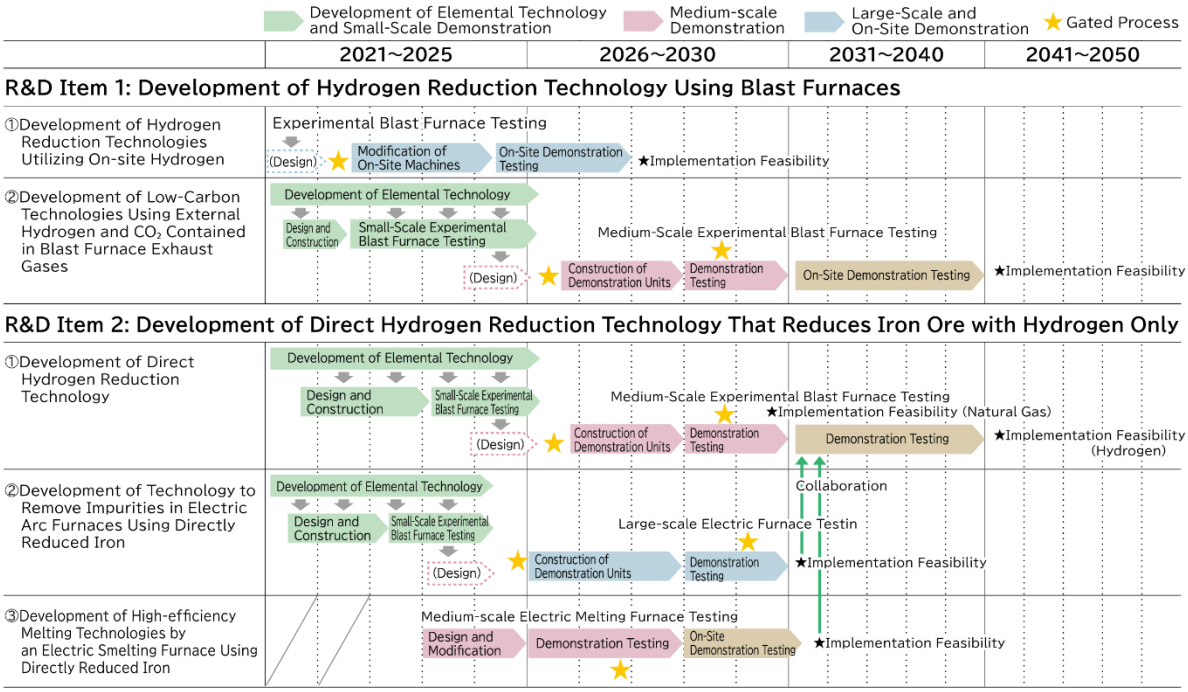
As of September 2023, the overall project has been progressing mainly as planned. The development of hydrogen reduction technologies and related innovations utilizing in-house hydrogen as part of the blast furnace hydrogen reduction technology development initiative has transitioned to the demonstration phase. Additionally, the development of low-carbon technologies using external hydrogen and CO_2 contained in blast furnace exhaust gas has achieved a CO_2 reduction rate of 22%. For the development of direct hydrogen reduction technology, the project is conducting fundamental studies and experiments on the process for developing elemental technologies, along with various tests,

including melting tests for reduced iron under the development of impurity removal technology for electric furnaces.

Additionally, the development of high-efficiency melting technologies by an electric smelting furnace using directly reduced iron —a new initiative launched in FY2024—is currently progressing with studies on a medium-scale test furnace (TRL 4).

The diagram below shows the assumed schedule for this project.

Figure 12: Estimated Schedule for Research, Development, and Social Implementation



GHG Reduction Impact

Commercializing and widely adopting the blast furnace hydrogen reduction steelmaking technology (COURSE50) developed in this project could reduce CO_2 emissions in Japan by approximately two million metric tons annually by 2030.

The following outlines the methodology for calculating CO_2 emission reductions, including the parameters used and the calculation formula.

Method of Estimation	The CO_2 reduction potential of the COURSE50 technology, targeted by this project, if implemented at domestic steel plants by 2030

Parameters Used	①Crude steel production volume per blast furnace: Approximately four million metric tons/year (The estimated value for a typical domestic blast furnace capacity of around 5,000 m³) ②Current CO_2 emissions per metric ton of crude steel: Approximately 1.5–2 tCO_2/metric ton (This estimate is based on the CO_2 emission intensity in 2015, as detailed in the Japan Iron and Steel Federation's report titled Long-term Climate Change Mitigation Vision: Challenge Toward Carbon Neutrality) (For calculation purposes, the value is assumed to be approximately 1.7 metric tons) ③CO_2 reduction rate with COURSE50 technology: 30% (Target value stated in the R&D and Social Implementation Plan) ④Number of COURSE50 technology units to be implemented by 2030: One unit (Target value stated in the R&D and Social Implementation Plan)
Calculation Formula	①×②×③×④=Approximately two million metric tons/year

This amount of CO_2 emission reduction includes contributions achieved not only through proceeds procured via JCTBs but also through general revenue and expenditures from R&D entities. The planned contribution from JCTBs proceeds is 256.4 billion yen out of this project's national funding cap of 449.9 billion yen.

The innovative steelmaking technology developed in this project features a 50% CO_2 reduction rate, and if it is put to practical use and adopted worldwide, it has the potential to reduce global CO_2 emissions by about 1.3 billion metric tons per year by 2050. This estimate assumes a 50% cut in the steel industry's global CO_2 emissions, which totaled roughly 2.6 billion metric tons in 2019.

Output		Impact	
Indicator	Actual Results/ Future Expectations (Unit)	Amount of Energy Reduction or Reduction Rate Actual Results/ Future Expectations (Unit)	Amount of GHG Reduction or Avoided Emissions Actual Results/ Future Expectations (Unit)
Number of COURSE50 Technology Units to be Introduced	【Future Expectations】 By 2030: One unit	【Future Expectations】 —	【Future Expectations】 Approximately two million tCO_2/year of reduction is possible with technologies feasible for implementation by 2030, resulting in a 30% CO_2 reduction rate. Note: Technologies planned for implementation beyond 2030 may enable additional reductions

5.2. GI Fund Project: Decarbonization of Thermal Processes in Manufacturing

Significance and Objectives of the Project

CO_2 emissions from industrial furnaces (excluding blast furnaces, converters, and electric furnaces used in steelmaking processes, hereinafter the same) used in metal heating processes, which rely on fuels such as natural gas, account for over 40% of Japan's industrial sector emissions. Casting, forging, and other Machine Parts and Tooling industries, which supply essential metal components for Japan's core industries, such as automobiles and industrial machinery, significantly contribute to regional economies and employment. However, these industries, which emit substantial amounts of CO_2 from industrial furnaces and are mainly composed of small and medium-sized enterprises, have been slow to consider and implement decarbonization measures.

This project focuses on R&D to establish and socially implement technologies essential for decarbonizing thermal processes in the manufacturing sector. These efforts aim to address challenges such as adopting zero-emission fuels that produce no CO_2 during combustion and transitioning to electric furnaces, which emit no CO_2 during operation.

Project Details

①Establishment of Ammonia and Hydrogen Combustion Industrial Furnace Technology for Handling Metal Products

This project is developing industrial furnaces and related technologies to overcome technical challenges associated with using ammonia and hydrogen as fuels for industrial furnaces, such as maintaining the quality of metal products, reducing NOx emissions, ensuring combustion stability and control precision, and achieving long-term operational stability. Enhancing the resilience of supply chains also requires establishing alternative combustion furnace options and promoting the diversification of energy sources for industrial furnaces, which is strategically essential.

The R&D goal is to establish a 50% co-firing industrial furnace using existing fuels such as natural gas along with ammonia and hydrogen by FY2031 and to achieve a TRL of 6 or higher for 100% ammonia and hydrogen exclusive firing technology, with demonstration conducted in a system model or prototype (expected to be at a fraction of the actual scale).

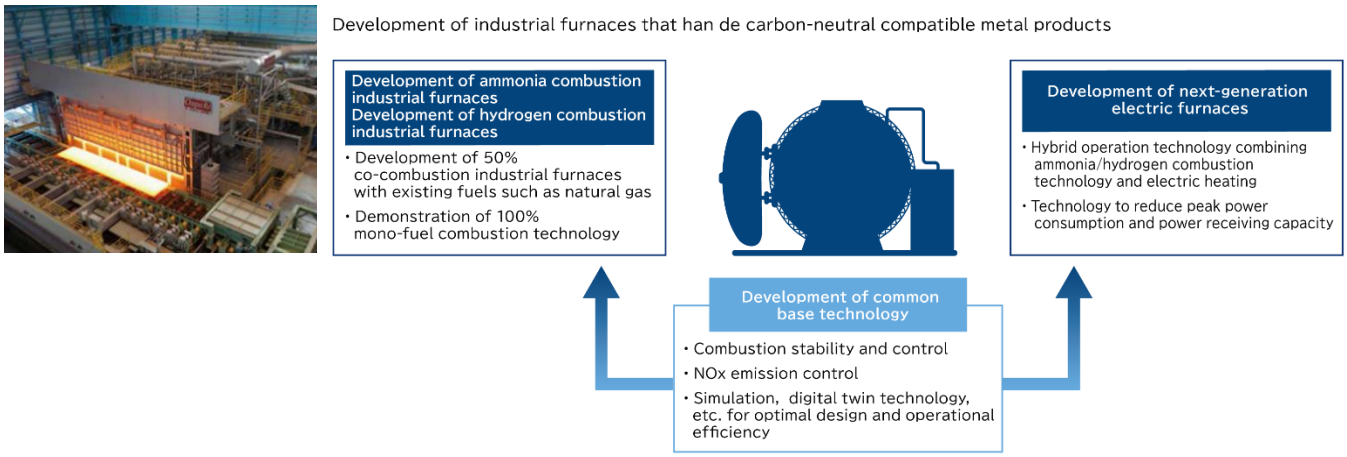
②Establishment of Technology to Reduce the Capacity of Electric Furnace Receiving Equipment and Increase Efficiency

To enable small and medium-sized enterprises, the primary users of industrial furnaces in Japan, to transition from combustion furnaces to electric furnaces, the project is developing technologies to minimize power receiving capacity and improve the overall efficiency of electric furnaces. These technologies include hybrid systems combining ammonia and hydrogen combustion with electric heating, high-output heaters, and technologies to prevent degradation and extend the lifespan of resistors.

The R&D goals are to establish technologies by FY2031 that can reduce peak power consumption and power receiving capacity by more than 30% compared to replacing combustion furnaces with

existing electric furnaces, and to establish energy-saving technologies that achieve more than a 15% reduction in energy use compared to existing electric furnaces by FY2028. The TRL target is six or higher by FY2031.

Figure 13: Project Image



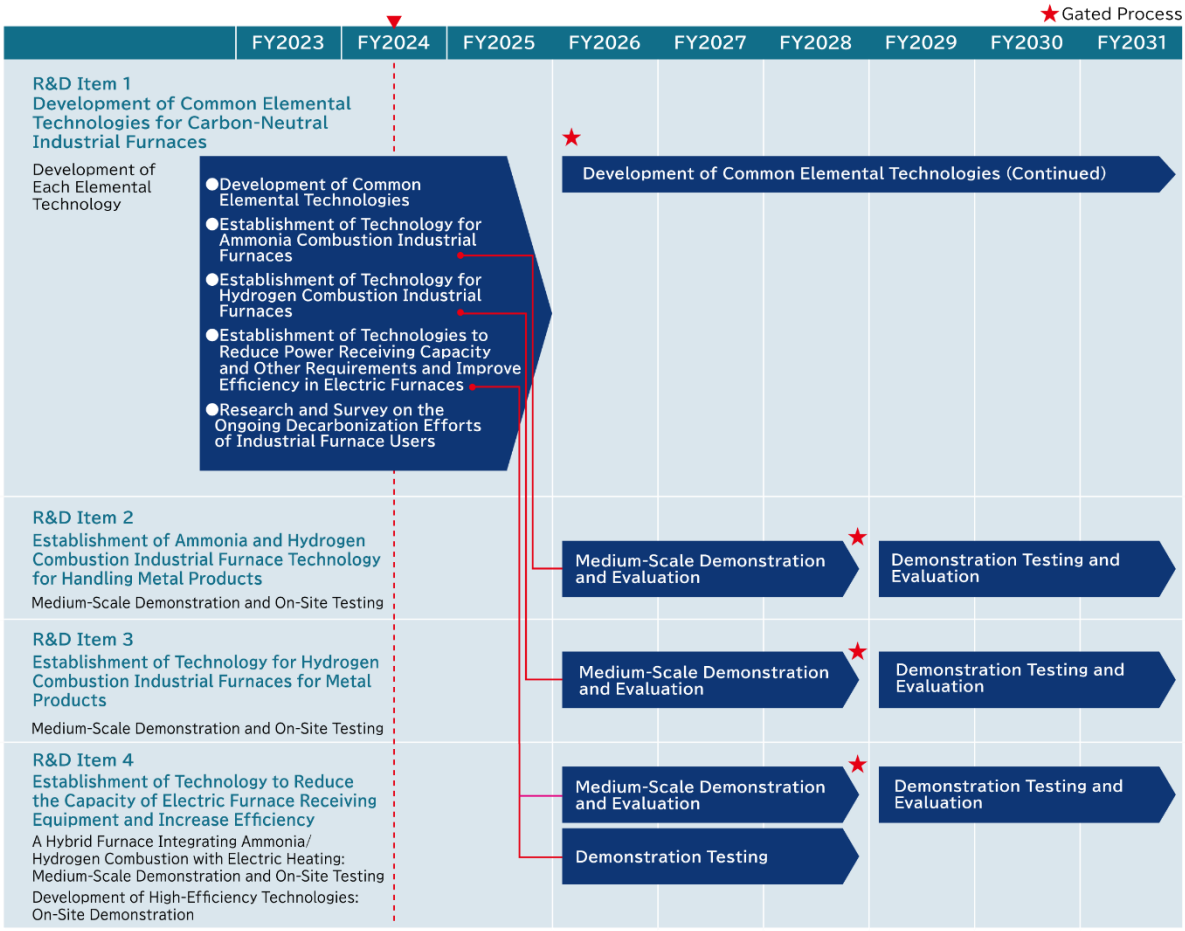
Direct Outcomes (Outputs) and Future Outlook

As of October 2024, the overall project is progressing as planned, with the TRL ranging from 3 to 4 (experimental proof of the technology concept to initial prototype demonstration under test conditions).

Regarding the establishment of technologies for ammonia/hydrogen combustion industrial furnace, the project has collected various data using a basic combustion device, and combustion tests will begin progressively with companies that have completed the fabrication of their test furnaces. Regarding the establishment of electric furnace technologies, the team has completed the design studies and will now start fabricating the equipment.

The schedule for this project is shown in the diagram below. For each technology development, the design specifications for the medium-scale demonstration units will be reviewed by FY2025. Following a stage-gate review (which involves evaluating the progress and status of R&D to determine whether to continue or revise the project), the demonstration using medium-scale furnaces is scheduled to begin in FY2026.

Figure 14: Estimated Schedule for Research, Development, and Social Implementation



GHG Reduction Impact

If the main technological developments in this project, ammonia and hydrogen 50% co-firing combustion furnaces (or equivalent electric furnaces), are socially implemented and gradually adopted after FY2032, an annual increase of approximately 2.6 million metric tons in CO_2 reduction is expected in Japan. By FY2040, a CO_2 reduction of around 23.4 million metric tons per year compared to FY2031 is anticipated. Furthermore, assuming that 100% ammonia and hydrogen combustion furnaces (or equivalent electric furnaces) will gradually be adopted after FY2041, an annual increase of approximately 5.2 million metric tons in CO_2 reduction is expected in Japan from FY2041 onward. By FY2050, a CO_2 reduction of around 75.4 million metric tons per year compared to FY2031 is anticipated.

The following outlines the methodology for calculating CO_2 emission reductions, including the parameters used and the calculation formulas.

Method of Estimation	The calculation assumes that the government targets for ammonia, hydrogen, and related supply will proceed as planned, without considering potential constraints on energy supply. The calculation also assumes that the number of industrial furnaces in Japan, approximately 37,000 units, will remain constant. Using the average CO_2 emissions per furnace as a baseline, the estimation projects that starting in FY2032, a set number of furnaces will be replaced annually with units capable of 50% co-firing of ammonia and hydrogen (or equivalent electric furnaces) and, from FY2041 onwards, the furnaces will be progressively replaced with units capable of 100% exclusive firing of ammonia and hydrogen (or equivalent electric furnaces).

Parameters Used	①CO_2 Emissions per Industrial Furnace (Current): Approximately 4,000 metric tons/year (Based on METI's "FY2014 Energy Efficiency Promotion and Infrastructure Development Project (Survey on Energy-Saving Technologies for Industrial Furnaces, etc.)" report.) ②CO_2 Emission Reduction Rate Compared to Existing Industrial Furnaces (FY2032–FY2040): 50% (Estimated based on industrial furnaces capable of 50% co-firing of ammonia and hydrogen, or equivalent electric furnaces.) ③Annual Installation of Industrial Furnaces for 50% Co-Firing of Ammonia and Hydrogen (or Equivalent Electric Furnaces): Approximately 1,300 units per year from FY2032 to FY2040, reaching a penetration rate of about 30% by FY2040. (Estimated based on the annual replacement rate of industrial furnaces from METI's "FY2014 Energy Efficiency Promotion and Infrastructure Development Project (Survey on Energy-Saving Technologies for Industrial Furnaces, etc.)" report.) ④CO_2 Emission Reduction Rate Compared to Existing Industrial Furnaces (FY2041–FY2050): 100% (Estimated based on industrial furnaces capable of 100% exclusive firing of ammonia and hydrogen, or equivalent electric furnaces.) ⑤Annual Installation of Industrial Furnaces for 100% Exclusive Firing of Ammonia and Hydrogen (or Equivalent Electric Furnaces): Approximately 1,300 units per year from FY2041 to FY2050, reaching a penetration rate of about 40% by FY2050. (Estimated based on the annual replacement rate of industrial furnaces from METI's "FY2014 Energy Efficiency Promotion and Infrastructure Development Project (Survey on Energy-Saving Technologies for Industrial Furnaces, etc.)" report.)
Calculation Formula	①×②×③=Approximately 2.6 million metric tons/year (FY2032–FY2040) ①×④×⑤=Approximately 5.2 million metric tons/year (FY2041–FY2050)

This amount of CO_2 emission reduction includes contributions achieved not only through proceeds procured via JCTBs but also through expenditures from research and development entities and other sources. Additionally, the maximum limit of government expenditure for this project may be fully covered by JCTB proceeds.

Output		Impact	
Indicator	Actual Results/ Future Expectations (Unit)	Amount of Energy Reduction or Reduction Rate Actual Results/ Future Expectations (Unit)	Amount of GHG Reduction or Avoided Emissions Actual Results/ Future Expectations (Unit)
Number of Installed Decarbonized Industrial Furnaces	【Future Expectations】 Approximately 1,300 units/year	【Future Expectations】 ・50% (Reduction rate per unit, FY2032–FY2040) ・100% (Reduction rate per unit, FY2041–FY2050)	【Future Expectations】 ・Additional CO_2 reduction of approximately 2.6 million metric tons/year compared to the previous year (FY2032–FY2040) ・Additional CO_2 reduction of approximately 5.2 million metric tons/year compared to the previous year (FY2041–FY2050)

5.3. Support for Strengthening Supply Chain Resilience of Critical Materials in Response to Economic and Environmental Changes: Project for Enhancing the Resilience of the Battery Manufacturing Supply Chain Essential for a Green Society

Significance and Objectives of the Project

Batteries are a key factor in achieving carbon neutrality by 2050 and are essential materials on which public life and economic activities in an electrified and digital society depend. They 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. A disruption in the supply of batteries could affect production activities in numerous manufacturing sectors, including automobiles, energy, and electronics industries. It could also result in suspending various services, business activities, and operations, such as power supply-demand adjustments in power grids and backup power for critical facilities like data centers. Given these potential consequences, the impact on public life and economic activities would be devastating, making batteries equally essential from the perspective of economic security.

This situation is being observed worldwide. Many countries are implementing large-scale, proactive policy support to establish battery supply chains within their own countries and regions, rapidly advancing efforts to establish and secure supply capacity.

Against this backdrop, this project aims to enhance the resilience of the domestic battery manufacturing supply chain by supporting capital investment and technological development related to batteries and their parts and materials.

Project Details

This project implements the following initiatives to strengthen the battery manufacturing supply chain within Japan and to ensure a stable supply.

(1) Support for Capital Investment in Batteries, parts and materials, and Manufacturing Equipment

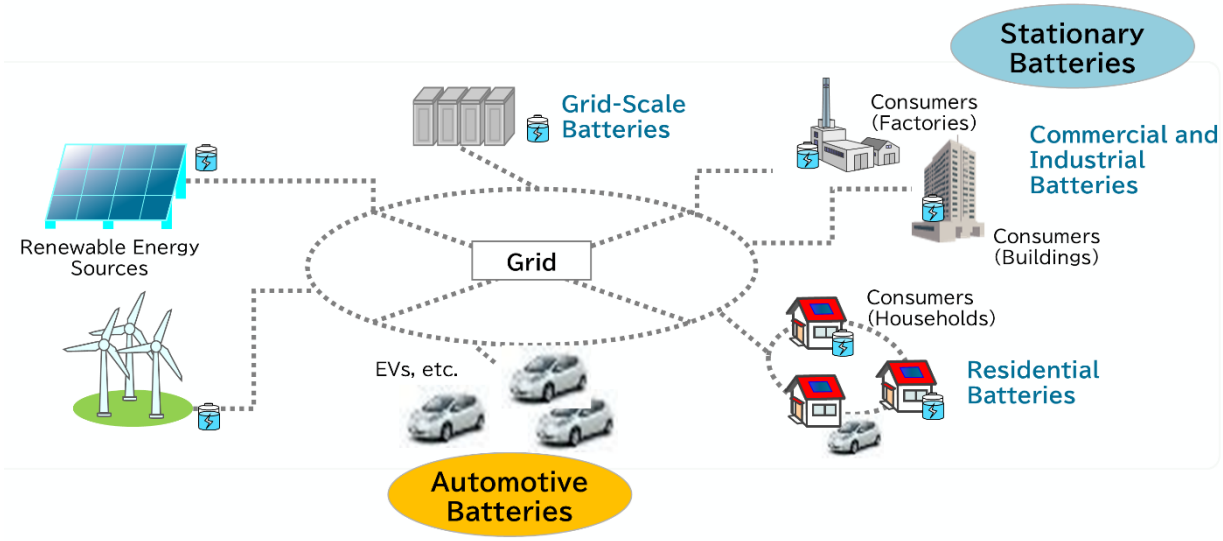
To strengthen the domestic manufacturing base for batteries, parts and materials, and manufacturing equipment, subsidies will be provided to businesses establishing large-scale production facilities, manufacturing bases for parts and materials currently limited in domestic production, or facilities employing unique or proprietary technologies and related facilities.

(2) Support for Technological Development of Batteries, parts and materials, and Manufacturing Equipment

Subsidies will be provided to businesses developing technologies to secure competitive advantages and essentiality in batteries, parts and materials, and manufacturing equipment. This includes technologies aimed at decarbonizing manufacturing processes, and digital technologies for managing production data and enhancing productivity in manufacturing operations.

Note: The subsidy rate is up to one-third for capital investment and up to one-half for technological development, with up to one-half available for capital investment in manufacturing bases for battery manufacturing equipment by small and medium-sized enterprises.

Figure 15: Project Image



Source: Battery Industry Strategy, Public-Private Council for Battery Industry Strategy, 2022

Direct Outcomes (Outputs) and Future Outlook

In FY2023, a total of 15 Ensuring supply plans were approved, including two plans aimed at expanding battery production capacity, such as building factories to manufacture batteries. The production capacity for batteries anticipated from these two plans is estimated at a total of 45 GWh per year. This estimation reflects GHG avoided emissions, specifically associated with the production capacity expansion outlined in the certified projects for FY2023.

This project allocated 265.8 billion yen under the FY2023 supplementary budget and 230 billion yen under the initial budget for the FY2024, including support for battery manufacturing equipment. By September 2024, 12 plans were certified, of which four aimed to expand battery production capacity. Through the efforts to date, a production base for batteries of approximately 120 GWh per year is expected to be secured. To achieve a manufacturing base of 150 GWh per year by 2030, continued encouragement and support for private-sector investment remain essential.

GHG Reduction Impact

Under this project, assuming that the maximum annual production capacity of battery manufacturing facilities supported by subsidies from the FY2022 supplementary budget is fully utilized in domestic EVs, the transition from internal combustion engine vehicles to EVs is expected to avoided emissions

of approximately 13.5 million metric tons of CO_2 over the lifecycle of the vehicles equipped with these batteries.

The methodology for calculating the GHG avoided emissions, including the parameters used and the calculation formula, is as follows.

Method of Estimation	Assuming all batteries produced are used in EVs, the GHG reduction effect is estimated based on replacing internal combustion engine vehicles with EVs.
Parameters Used	①Production Capacity at Full-Scale Production: 45 GWh/year (Annual production volume at subsidized factories) ②Battery Capacity per BEV: Assumed to be 60 kWh per vehicle As adopted in the IEA report ③CO_2 Emissions from Internal Combustion Engine Vehicles: Estimated at 38 metric tons per vehicle Derived from the IEA report ④CO_2 Emissions from EVs: 15–26.6 metric tons per vehicle (Assumed to be 20 metric tons per vehicle for calculation purposes) Based on the IEA report, considering roughly half the impact of grid decarbonization expected over the life cycle.
Calculation Formula	(① ÷ ②) × (③ − ④) = 13.5 million metric tons

Output		Impact	
Indicator	Actual Results/ Future Expectations (Unit)	Amount of Energy Reduction or Reduction Rate	Amount of GHG Reduction or Avoided Emissions
		Actual Results/ Future Expectations (Unit)	Actual Results/ Future Expectations (Unit)
Production Volume at Subsidized Factories	【Future Expectations】 45 GWh/year	【Future Expectations】 –	【Future Expectations】 13.5 million metric tons of CO_2

5.4. Support for Strengthening Supply Chain Resilience of Critical Materials in Response to Economic and Environmental Changes: Project for Enhancing the Resilience of the Semiconductor Supply Chain to Achieve GX through Improved Power Performance

Significance and Objectives of the Project

In response to digitalization and green innovation, the role and functions of semiconductors in enhancing public life and driving economic development are increasing. Among them, power semiconductors—which are responsible for current and voltage control—are indispensable for achieving carbon neutrality because these semiconductors are essential power control components used for a wide range of devices, including EVs and wind power generation. From the perspective of economic security, they are also highly critical. Advancing energy-efficient semiconductor technologies and securing robust manufacturing capabilities are essential prerequisites for building a sustainable digital society. In recognition of the growing importance of semiconductors, many countries and regions are implementing unprecedented support measures covering a broad spectrum of areas, including semiconductors, manufacturing equipment, parts and materials and raw materials.

Around 1990, Japan accounted for about 50% of the global semiconductor market. Subsequently, with intensified international competition, its share has since fallen to around 10%. Meanwhile, the semiconductor market is expected to continue to expand significantly in the future. Japan has been working to establish domestic manufacturing bases for advanced semiconductors and other related initiatives, but it must continue to make efforts to ensure a stable supply of semiconductors. At the same time, there are concerns about the potential hollowing out of Japan' s industry due to intensifying competition to attract semiconductor manufacturing, potentially accelerating the overseas relocation of development bases, for semiconductor manufacturing equipment and parts and materials —areas in which Japan holds a competitive edge.

Against this backdrop, this project aims to prevail in intensifying international competition by leveraging the technical advantages of each company and providing support for efforts to strengthen domestic production capacity for power semiconductors and other critical materials. It also seeks to promote steady investments toward achieving GX while enhancing the resilience of supply chains.

Project Details

Based on the Economic Security Promotion Act, this project supports businesses aiming to secure a stable supply of semiconductors by approving ensuring supply plans for semiconductors created and submitted by these businesses to the METI Minister. Specifically, for “mature-node semiconductors,” including power semiconductors, and “semiconductor parts and materials,” including SiC wafers, grants are provided for capital investment costs and other expenses that meet the specified criteria and qualify as eligible subsidy costs.

The subsidy rate is one-third.

Mature-node Semiconductors (Including Power Semiconductors*)

- ●Capital investment requires a remarkably large scale that private efforts alone cannot accomplish.
- ●For power semiconductors, which have high energy-efficiency and are expected to experience substantial market growth driven by rising demand for EVs and other applications, investments must be at a scale thought to be needed for maintaining global competitiveness in the future (as a rule, projects larger than 200 billion yen), focusing on SiC power semiconductors, which are expected to experience substantial market growth driven by rising demand for EVs and have high energy-efficiency. These investments must take into account measures for securing critical parts and materials.
- ●Equipment and machinery introduced must demonstrate state-of-the-art performance.

Semiconductor Parts and Materials (Including SiC Wafers)

- ●Capital investment requires a remarkably large scale that private efforts alone cannot accomplish.
- ●Project size must exceed 30 billion yen in principle.
- ●Projects under 30 billion yen can be certified if they meet certain requirements.
- ●Equipment and machinery introduced must demonstrate state-of-the-art performance.
- ●For SiC wafers, which have high energy-efficiency and are expected to experience substantial market growth driven by rising demand for EVs and other applications, the project must take into account that it contributes to securing international competitiveness in the power semiconductor industry.

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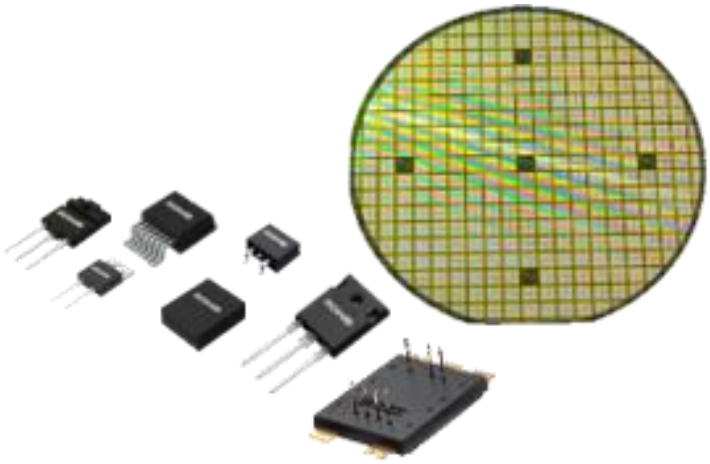
*Overview of Power Semiconductors

Power semiconductors are a type of semiconductor used to control and supply electrical energy, such as reducing voltage or converting AC to DC. It has a wide range of applications, including inverters and power modules for vehicles, batteries, power transmission and distribution systems, railway vehicles, and household appliances such as air conditioner inverters. Power semiconductors have the effect of reducing electrical losses and improving energy efficiency. The switching function of power semiconductors is primarily used for power conversion.

The market size for power semiconductors is expected to steadily expand in the coming years. One of the factors driving this growth is the shift to EVs. Power semiconductors are often used in input and output of electricity in motors and batteries loaded in EVs. They are also essential for data centers, solar power generation, wind power generation, and stationary batteries, which are seeing increasing investment and require a large volume of power semiconductors. In response to this increasing demand, power semiconductor manufacturers are ramping up capital investment and accelerating development efforts.

Power semiconductors, which handle high voltage and high currents, face the challenge of “loss,” where electricity converts into heat within the device. SiC power semiconductors offer a promising solution to address this issue. SiC, or silicon carbide, combines silicon (Si) and carbon in a 1:1 ratio, and is produced by bonding and carbonizing Si and graphite in an electric furnace. Using SiC as a material for next-generation power semiconductors may enable significant reductions in power loss (on-state resistance) compared to traditional Si materials. For example, research findings have demonstrated that prototype SiC-based power semiconductors reduced power loss by approximately 70% compared to conventional Si-based power semiconductors. Reducing power loss in EVs directly translates to longer driving ranges. Manufacturers are therefore expected to transition power semiconductors in electronic components from conventional Si to SiC, tailored to application and performance requirements. As EVs gain widespread use, demand for SiC power semiconductors is projected to expand substantially, which is expected to drive intense competition among power semiconductor manufacturers worldwide.

Figure 16: Image of Power Semiconductors (Provided by an Approved Company)



Direct Outcomes (Outputs) and Future Outlook

In FY2023, METI approved two ensuring supply plans backed by JCTBs, which are designed to expand the production capacity of power semiconductors (SiC and Si) and SiC wafers. Subsidies will be provided to the project implementers: Company A (for SiC wafer production), Company B (for SiC power semiconductor production), and Company C (for Si power semiconductor production). Each plan is expected to enable Company A to produce 288,000 SiC wafers (six-inch diameter) per year, Company B to produce SiC power semiconductors equivalent to 720,000 six-inch wafers per year, and Company C to produce Si power semiconductors equivalent to 1.68 million six-inch wafers per year.

Note that all of the wafers mentioned above are calculated based on a six-inch diameter (hereinafter the same).

GHG Reduction Impact

Power semiconductors are used in a wide range of applications; however, for the purpose of this analysis, it is assumed that all power semiconductors (SiC semiconductors or Si power semiconductors) manufactured through this project will be installed in EVs. This scenario is expected to reduce CO_2 emissions by approximately 1.8 million metric tons per year, resulting from improvements in vehicle energy efficiency.

The methodology for calculating the CO_2 avoided emissions, including the parameters used and the calculation formulas, is as follows.

Method of Estimation	Assuming they are used for EVs, the primary application of power semiconductors: ①Estimate the number of power semiconductor chips per six-inch wafer and the number of chips used per EV to calculate the number of EVs supported by a single wafer. ②Calculate the CO_2 reduction per EV due to power semiconductors by considering: the energy efficiency of EVs, the average annual mileage of private vehicles, the power loss ratio of power semiconductors in EVs, and the expected reduction in power consumption achieved by replacing conventional Si power semiconductors with SiC power semiconductors or next-generation Si power semiconductors. ③Multiply the number of EVs calculated in Step 1 by the CO_2 reduction per EV calculated in Step 2 to determine the total CO_2 reduction.

Parameters Used	①Annual number of wafers (standardized to six-inch diameter) used for power semiconductor production: Company A: 288,000 wafers/year Company B: 720,000 wafers/year Company C: 1,680,000 wafers/year (Source: METI calculations based on individual business plans) ②Estimated number of power semiconductor chips per wafer (standardized to six-inch diameter):513 chips/wafer (Source: METI calculations based on company-provided data) ③Number of power semiconductor chips installed per EV:36 chips/vehicle (Source: METI calculations based on company-provided data) ④Average annual mileage per vehicle:9,360 km/year (Source: METI materials, e.g., R&D and Social Implementation Plans for the Next-Generation Digital Infrastructure Construction Project) ⑤Energy efficiency of EVs: Six km/kWh (Source: METI calculations based on manufacturer catalogs for various models) ⑥Estimated power loss ratio of power semiconductors in EVs:20% (Source: METI materials, e.g., R&D and Social Implementation Plans for the Next-Generation Digital Infrastructure Construction Project) ⑦Estimated energy consumption reduction by replacing conventional Si power semiconductors with SiC power semiconductors:50% (Source: METI calculations based on company-provided data) ⑧Emission factor for electricity (FY2022 national average):0.000438 tCO_2/kWh (Source: METI materials, e.g., Calculation and Publication of Emission Factors by Business Operators under the Act on Promotion of Global Warming Countermeasures — Emission Factors by Electricity Business Operators) ⑨Estimated energy consumption reduction by replacing conventional Si power semiconductors with next-generation Si power semiconductors:25% (Source: METI calculations based on company-provided data)
Calculation Formula	(① [Companies A and B] × ② ÷ ③) × (④ ÷ ⑤ × ⑥ × ⑦ × ⑧) = Approximately 981,000 metric tons/year (① [Company C] × ② ÷ ③) × (④ ÷ ⑤ × ⑥ × ⑧ × ⑨) = Approximately 818,000 metric tons/year Total: 1,799,000 metric tons/year

Output		Impact	
Indicator	Actual Results/ Future Expectations (Unit)	Amount of Energy Reduction or Reduction Rate Actual Results/ Future Expectations (Unit)	Amount of GHG Reduction or Avoided Emissions Actual Results/ Future Expectations (Unit)
Production volume to be achieved under the stable supply assurance plan certified by METI	【Future Expectations】 Company A: SiC wafer production of 288,000 pieces/year Company B: SiC power semiconductor production of 720,000 pieces/year Company C: Si power semiconductor production of 1,680,000 pieces/year Note: Each wafer, for all companies, is standardized to a diameter of six inches.	【Future Expectations】 Company A: Approximately 640.2 GWh/year Company B: Approximately 1,600.6 GWh/year Company C: Approximately 1,867.3 GWh/year	【Future Expectations】 Company A: Approximately 280,000 metric tons/year Company B: Approximately 701,000 metric tons/year Company C: Approximately 818,000 metric tons/year

5.5. The Project to Promote the Installation of Advanced Equipment for Improving Residential Insulation Performance and Related Initiatives

Significance and Objectives of the Project

The Plan for Global Warming Countermeasures sets a target to reduce CO_2 emission by 66% in the residential sector by FY2030 (compared to FY2013 levels). However, around 82% of existing housing do not meet the current energy conservation standard, highlighting the urgent need for energy-saving measures for existing housing. To meet this target, it is necessary to promote energy efficiency improvements of existing housing of about 50 million.

CO_2 emission from heating and cooling is a significant source of emissions in housing in Japan, and much of the heat loss occurs through openings such as windows. Therefore, promoting insulating existing windows is important.

The total number of insulations for the housing in Japan from January 2014 to October 2018 was approximately 720,000 units (an average of about 160,000 units per year), indicating a low level of progress. One reason for this was the high cost of high-performance windows. Therefore, subsidizing renovation costs is efficient to promote it.

The purpose of this project is to reduce CO_2 emission from the residential sector by 66% for achieving a 46% reduction target by FY2030, and to ensure energy performance of the "ZEH" standard on average of the existing housing for achieving carbon neutrality by 2050. Specifically, this project aims to promote rapid improvement of thermal insulation performance of existing housing by providing subsidies for retrofitting windows, which account for a significant portion of heat loss in existing housings.

Project Details

Through this project Japanese Government pays part of the cost for renovating windows (glasses and sashes) to windows with high thermal insulation performance in detached houses and apartment. Windows are required to meet specific standards, such as a thermal transmittance (Uw value) of 1.9 or lower,[24] exceeding the 2030 target set by the Top Runner Program for building materials. The subsidy amount is fixed based on the kind of renovation, with a subsidy rate equivalent to approximately 50% of the cost or similar levels. The maximum amount of subsidy per unit is two million yen.

[24] In the case of replacing outer windows in mid- to high-rise apartment buildings using the cover method, Grade B (Uw value greater than 1.9 and less than or equal to 2.3) is also eligible.

Figure 17: Project Overview

Examples of Subsidy Amounts

Example: Detached Houses and Low-Rise Apartments

	Grade	Size Categories		
		Large (2.8 m² or Larger)	Medium (1.6 m² to 2.8 m²)	Small (Smaller than 1.6 m²)
Installation of Inner Windows	S S	124,000	84,000	53,000
	S	84,000	57,000	36,000
	A	69,000	47,000	30,000
Replacement of Outer Windows	SS	183,000	136,000	91,000
	S	124,000	92,000	62,000
	A	102,000	76,000	51,000

Thermal transmittance (W/m²·K) for each grade
SS: Uw ≤ 1.1, S: Uw > 1.1 and ≤ 1.5, A: Uw > 1.5 and ≤ 1.9

Direct Outcomes (Outputs) and Future Outlook

This project is composed of “the Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses”, which targets detached houses, and “the Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows”, which targets apartments.

The former project provided subsidies for renovating windows of 203,365 detached houses, besides the latter one provided subsidies for 40,301 apartments in FY2022 and FY2023.

GHG Reduction Impact

These two projects contributed to a reduction of approximately 71,000 metric tons of CO_2 emissions per year in FY2022 (about 63,000 metric tons per year from detached houses and about 8,000 metric tons per year from apartment).

The methodology for calculating CO_2 emission reductions, including the parameters used and the calculation formula, is as follows.

Method of Estimation	CO_2 emissions reduction due to decreased energy consumption for air conditioning in housing subject to the programs

Parameters Used	Number of Subsidized Units: detached houses: 203,365 units (the numbers of detached houses subject to “the Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses”), apartments: 40,301 units (the number of apartments subject to “the Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows”.) Electricity emission factors: 0.549 kg-CO_2/kWh (Regions 1–2*), 0.496 kg-CO_2/kWh (Regions 3–4*), 0.457 kg-CO_2/kWh (Regions 5–8*). Kerosene emission factor: 0.0686 kg-CO_2/MJ. (Electric Utility Emission Factor List (FY2023 Submission), MOE, https://ghg-santeikohyo.env.go.jp/files/calc/r05_coefficient_rev4.pdf) *Regional classification: Based on the Energy Conservation Law for Buildings. Areas with higher numbers indicate warmer climates. Regions 1–2 predominantly cover Hokkaido, 3–4 cover Tohoku and mountainous regions, and 5–8 cover urban areas such as Tokyo, Osaka, and Nagoya.
Calculation Formula	The CO_2 reduction effect by renovating windows varies depending on the type of housing (detached houses or apartments), the thermal insulation performance of windows after renovation, the number of renovated windows (e.g., all windows in the living-dining-kitchen area or just window in living area), and the climatic characteristics of the region where the house is located. Specific simulation software was used to determine energy savings for both of detached houses and apartment, and the CO_2 reduction amounts were derived by multiplying fuel-specific conversion factors to the sum of calculated energy savings. Note: For apartments, the CO_2 reduction effect by renovating windows varies depending on the unit type, such as middle units (units located between other units) or end units (units located at the edge or corner of the building). Note: Sometimes some windows with several thermal insulation performance and several sizes are introduced to a single house, however, for simplification, it is assumed that all windows have same thermal insulation performance (highest level in that house) and largest size in calculation. Example: In the case of renovation of windows in Regions 1-2, detached houses, and LDKs Total amount of CO_2 reduction: Reduction in units renovated to Grade S + Reduction in units renovated to Grade A Reduction in units renovated to Grade S {[(electricity reduction 5kWh/unit × electricity emission factor 0.549kg-CO_2/kWh) + (kerosene reduction 2,793MJ/unit × kerosene emission factor 0.0686kg-CO_2/MJ)] × number of units 4,787 units} Reduction in units renovated to Grade A {[(electricity reduction 5kWh/unit × electricity emission factor 0.549kg-CO_2/kWh) + (kerosene reduction 2,147MJ/unit × kerosene emission factor 0.0686kg-CO_2/MJ)] × number of units upgraded 904 units}

Output		Impact	
Indicator	Actual Results/ Future Expectations (Unit)	Amount of Energy Reduction or Reduction Rate	Amount of GHG Reduction or Avoided Emissions
		Actual Results/ Future Expectations (Unit)	Actual Results/ Future Expectations (Unit)
Number of Subsidized Units (Single-Family Housing)	【Actual Results】 203,365 (units)	【Actual Results】 Electricity: Approximately 90 GWh/year Kerosene: Approximately 314 TJ/year	【Actual Results】 Approximately 63,000 t-CO_2/year
Number of Subsidized Units (Multi-Family Housing)	【Actual Results】 40,301 (units)	【Actual Results】 Electricity: Approximately 90 GWh/year Kerosene: Approximately 314 TJ/year	【Actual Results】 Approximately 63,000 t-CO_2/year

chapter 6

External Review

This report summarizes the allocation status of proceeds and case studies regarding the JCTBs issued in FY2023, based on the Framework established by the Government of Japan in November 2023. Limited assurance on the results of the allocation of proceeds, as well as a second party opinion confirming compliance with the ICMA's Green Bond Principles 2021, the ICMA's Climate Transition Finance Handbook 2023, and the Basic Guidelines on Climate Transition Finance (May 2021 version) issued by FSA, METI, and MOE, has been obtained from JCR, an independent external reviewer.

Disclaimer

■This document aims to explain the issuance and the allocation status of proceeds from the JCTBs and does not constitute an offer or solicitation to sell or subscribe to specific bonds.

■This document has been compiled based on data deemed reliable. However, its accuracy and completeness are not guaranteed. Furthermore, the future outlooks or forecasts presented in this document reflect what the Government of Japan considers reasonable at this time, but does not guarantee their realization.

■ The CO_2 reduction impacts presented in this document are estimates derived from assumptions based on currently available and reasonable data and methodologies. These estimates may be revised as new data or methodologies become available. Furthermore, depending on the nature of the projects, the impacts may include benefits achieved through expenditures other than those funded by JCTBs.

■The decision to use this document is left to the reader's judgment.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