



Japan Climate Transition Bonds

Allocation and Impact Report for FY2023 Issuance
Allocation Report for FY2024 Issuance

January 2026

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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Executive Summary

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The Government of Japan is issuing GX Economy Transition Bonds in order to provide upfront investment support of approximately 20 trillion yen over a ten-year period, with the aim of realizing over 150 trillion yen in GX investment by the public and private sectors to simultaneously achieve economic growth, decarbonization, and stable energy supply. In February 2024, the government began issuing Japan Climate Transition Bonds (hereinafter referred to as JCTBs), an individual securities of the GX Economy Transition Bonds, as the world's first sovereign transition bonds. JCTBs are issued based on a framework that was revised in June 2025 and is consistent with the Green Bond Principles, Climate Transition Bond Guidelines,[1] and other relevant international standards established by the International Capital Market Association (ICMA). Under this framework, allocation status of proceeds and environmental improvement effects are reported annually. This fiscal year (FY)' s report covers the allocation status of proceeds and impact for the allocated projects for FY2023 issuance, as well as the allocation status of proceeds for the allocated project for FY2024 issuance. The contents of this report have received third-party evaluation from the Japan Credit Rating Agency (JCR).

Outline of FY2023 Allocation and Impact Report

(1) Allocation Report

The cash proceeds of the JCTBs[2] issued in FY2023 were approximately 1,594.7 billion yen, which was allocated[3] to a variety of projects that contribute to the promotion of GX. The Allocation Report for the JCTBs issued in FY2023 had been already published in December 2024, and there was an unallocated balance of approximately 30 billion yen at the time of the prior announcement in November 2024. The entire amount was allocated by the end of FY2024. Based on the final allocation amounts, this report presents an updated summary of the allocation status. The specific allocated projects are as follows.

- Green Innovation Fund
- Innovative GX Technology Creation Project (GteX)
- Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure
- Demonstration Reactor Development Project for High-Temperature Gas Reactor
- Demonstration Reactor Development Project for Fast Reactor
- Support Project for Strengthening the Manufacturing Supply Chain of Batteries
- Support Project for Strengthening the Semiconductor Manufacturing Supply Chain for Achieving GX
- Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation
- Grant for Decarbonization Transition Acceleration for Specific Regions
- Subsidy for Promoting the Introduction of Clean Energy Vehicles
- Promotion Project for the Electrification of Commercial Vehicles
- Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses
- Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows

(2) Impact Report

Given that GX simultaneously pursues the three goals of stable energy supply, economic growth, and decarbonization, the impact report shows, to the extent possible, not only the environmental improvement effects

[1] Obtained second party opinions from an external reviewer in January 2026.
[2] Funds procured from the market by the government through issuance of JCTB.
[3] Funds for which the government has decided to issue or contract with the government, and for which the government has decided to spend.

of the above allocated projects, but also the economic effects such as the expected market size and the amount of investment by the public and private sectors. (See pages .** to .** for details)

❶ **Environmental Impacts** are calculated differently depending on the nature of the allocated projects. The basic concepts are as follows:

① Research and Development Projects: Estimated CO_2 emission reduction effects based on the assumption of future technological diffusion

② Capital Investment Support Projects: Estimated CO_2 emission reduction effects based on the assumption of a certain amount of production using the relevant facilities

③ Demand-side Measures Projects: Estimated CO_2 emission reduction effects based on the actual number of subsidies

❷ **Economic Impacts** are primarily calculated based on the following concepts.

① Research and Development Projects: Future market size, etc.

② Capital Investment Support Projects: Amount of public and private investment based on the actual amount of grants provided for the relevant capital investment, etc.

③ Demand-side Measures Projects: Amount of public and private investment based on the actual amount of subsidies disbursed, etc.

The scope of calculation for each indicator includes both projects that show effects in Japan and worldwide.

Overview of Allocation Report in FY2024

The cash proceeds from the JCTBs issued in FY2024 were approximately 1,392 billion yen, and the following projects were newly included in this fiscal year. (See pages.** to .** for details.)

●Deep Tech Startup Support Program in the Green Transformation field
●Support for energy/manufacturing process conversion for hard-to-abate industries
●Support for establishing production and supply system of sustainable aviation fuel (SAF)
●Support for enhancing the resilience and autonomy of circular economy systems through industry-government-academia collaboration
●Support for building GX supply chains
●Investment promotion for advanced resource circulation
●Promotion of the construction of zero-emission ships etc.
●Support for strengthening domestic production capacity of power semiconductors contributing to energy savings
●Installation support for electricity storage systems such as grid-scale batteries to expand renewable energy usage
●Subsidy for promoting energy savings in households through installing high-efficiency water heaters
●Accelerating decarbonizing renovations for buildings
●Support focused on the price gap to build supply chains for hydrogen and its derivatives
●Capital for GX Acceleration Agency

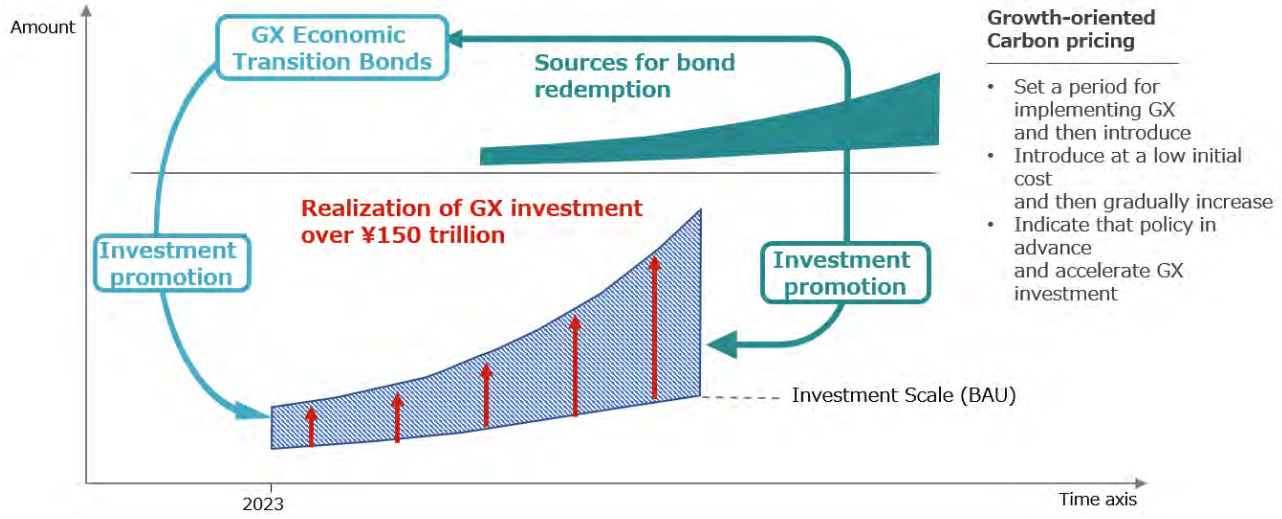
chapter 2

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 government of Japan has introduced the concept of Green Transformation (GX). This initiative seeks to transform 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,[4] 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. Subsequently, in February 2025, the government revised the Plan for Global Warming Countermeasures and formulated the 7th Strategic Energy Plan, and formulated the GX2040 Vision as a revision of the GX Promotion Strategy. These policy documents set ambitious greenhouse gas emissions reduction targets that Japan aims to reduce by 60% in FY2035 and by 73% in FY2040.

The key to realizing GX policies is the Pro-Growth Carbon Pricing Initiative. Under the initiative, in addition to providing up-front investment support of around 20 trillion yen over 10 years by issuing GX Economy Transition Bonds, carbon pricing will be introduced in stages after a period of focused efforts on GX. For example, the emissions trading system will be put into full operation in FY2026, a fossil fuel levy will be introduced in FY2028, and a paid auction will be introduced to power generation companies in FY2033. Through these efforts, the government and private sector will invest more than 150 trillion yen in GX over the 10 years from FY2023, aiming to achieve carbon neutrality and other emission reductions by 2050, as well as economic growth and industrial competitiveness (Figure 1).

Figure 1: Pro-Growth Carbon Pricing Initiative



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 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 it was revised in June 2025 (see the column on p. 8). Based on the Framework, the issuance of JCTBs started in February 2024. The Framework is aligned with the ICMA's Green Bond Principles, the Climate Transition Finance Handbook (CTFH), [5] and the Climate Transition Bond

[4] Cabinet Decision on the Basic Policy for the Realization of GX METI News Release; February 10, 2023
[5] ICMA, Climate Transition Finance Handbook, November 2025

Guidelines (CTBG), [6] 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), [7] and MOE, and is certified by independent external reviewers.[8]

In December 2024, the government released the Allocation Report for FY2023 Issuance as the reporting required under the Framework, which reports the proceeds allocated and the use of proceeds from the JCTBs issued in FY2023. In the present report, we provide an update on the allocation status previously reported for the FY2023 issuance and report the impact of JCTBs (environmental improvement effects such as CO_2 emission reduction, etc.). In addition, this report covers the allocation status of proceeds for FY2024 issuance.

[6] ICMA, Climate Transition Bond Guidelines, November 2025
[7] FSA, METI, and MOE, Basic Guidelines on Climate Transition Finance, March 2025
[8] The Framework and its second-party opinions are available on Ministry of Finance's website.

Column

Progress of the GX Strategy and Revision of the Framework

Japan has made steady progress toward the implementation of its GX strategy since the enactment of the GX Promotion Act in 2023.

In December 2023, the government formulated Sector-Specific Investment Strategies for investment promotion measures utilizing GX Economy Transition Bonds, presenting basic concepts such as basic principles and policies toward realization, the concept of commitment required from businesses subject to support measures, and execution principles. In addition, the government summarized the direction of the GX and investment promotion measures for priority areas.

In February 2025, to clarify the medium- to long-term direction toward 2040, the government adopted the GX2040 Vision and 7th Strategic Energy Plan, and revised the Plan for Global Warming Countermeasures.

In May 2025, the government amended the GX Promotion Act to clarify target businesses and the concept of system design in preparation for the launch of emissions trading in FY2026. This amendment imposes a series of obligations on businesses with direct CO_2 emissions exceeding a certain threshold (100,000 tons), from calculating emissions to holding emission allowances equal to their actual emissions, and requires them to formulate and publish a transition plan that includes medium- to long-term emission reduction targets and the GX investment plans through FY2030.

In light of these policy developments, the Framework was revised in June 2025 to reflect the latest policies and targets. The main points of the revision are as follows:

Reflection of policy developments

- Clarification of the fossil fuel levy and redemption of government bonds through emissions allowance auctions following the amendment of the GX Promotion Act
- Positioning of the Plan for Global Warming Countermeasures, 7th Strategic Energy Plan, and GX2040 Vision as Climate Transition Strategy
- Clarification of cooperation with Asia through AZEC and other means to promote transition

Use of Proceeds, etc.

- Positioning of the Sector-Specific Investment Strategies as roadmaps to be referred to.
- Clarification that projects to which proceeds will be allocated each fiscal year shall be reviewed by an independent external reviewer.
- In addition to subsidies, equity investments, and debt guarantees, allocation to financial resources for tax credits is also stated.
- Addition of DX-related descriptions (e.g., development of data centers) in response to the GX2040 Vision.
- Addition of descriptions regarding support for investment in decarbonized power sources by electric power companies in light of the 7th Strategic Energy Plan.

In addition, based on the projects scheduled for allocation in FY2024 and FY2025, project examples have been added, such as support for the establishment of a sustainable aviation fuel (SAF) production and supply system, and support projects focusing on price differentials to develop supply chains for hydrogen and other resources.

Starting in FY2026, the issuance of JCTBs based on the revised Framework will commence. By linking issuance to policy progress and ensuring stable issuance, the government will further contribute to Japan's transition to a Decarbonized Growth-Oriented Industrial Structure.

Column

Global Transition Finance Trends and Development of International Frameworks

The CTFH formulated by ICMA in 2021 (revised in 2025) has become an international standard for transition finance. While the CTFH was intended to supplement the Green Bond Principles, the Sustainability Bond Guidelines, and the Sustainability-Linked Bond Principles, the government of Japan formulated the Basic Guidelines for Climate Transition Finance based on the CTFH in 2021 (revised in 2025), and has been working to develop a sector-specific technology roadmap centering on hard-to-abate sectors, promoting model projects and subsidy projects, formulating guidelines on financed emissions and follow-up and other related initiatives, thereby improving the transition finance environment in Japan and communicating the importance of transition finance internationally.

In 2025, there was a movement to position transition bonds and loans as independent of green bonds and loans. In October 2025, the Loan Market Association (LMA) published a draft of its Guide to Transition Loans (hereinafter referred to as the GTL), which provides definitions and practical guidelines for labeled transition finance in the loan market.[9] In the CTBG released by ICMA in November 2025, ICMA proposed the Climate Transition Bond (CTB) as a label independent of the green label, with a particular focus on decarbonization in high-emission and hard-to-abate sectors. These are important moves toward further expansion of transition finance. Regarding JCTBs issued in FY2025, a Second Party Opinion (SPO) was obtained from an independent external reviewer in January 2026 to confirm alignment with the CTBG.

These new guidelines position the roadmap approach adopted in Japan as a reliable reference tool for assessing eligibility for transition finance, along with the taxonomy approach. In the CTBG, consistency with national and regional taxonomies and roadmaps is required as a safeguard when assessing eligibility for CTB-eligible projects. The annex provides reference information to Sector-Specific Technology Roadmaps. The GTL also states that consistency with national and regional technology roadmaps and taxonomies should be confirmed when assessing the transition eligibility of borrowers.

In the policy trends of various countries, the promotion of transition finance and the formulation of roadmaps are spreading. For example, the UK Transition Finance Council released Sector Transition Plans: The Finance Playbook in August 2025,[10] which provides a practical framework for integrating finance into sectoral transition plans and technology roadmaps. In addition, the Transition Finance Guidelines[11] released in November 2025 cited region- and country-specific roadmaps aligned with the Paris Agreement targets as one basis for the "Credible Pathway." In September 2024, the Australian government announced technology transitions and emission reduction pathways for 6 sectors, including electricity, to achieve net zero emissions by 2050. Furthermore, in June 2025, it established its own taxonomy and created a "transition" category.[12]

In addition, for transition finance to expand further around the world, it is important not only to provide "transition finance" as labeled financial products but also to provide funds to contribute to the transition of society as a whole, targeting countries, regions, and industries. The government of Japan has been discussing the role of transition finance in Asia since March 2025. In its interim report released in July 2025, it proposed an "Inclusive Approach"[13] as a broader concept of transition finance to meet the enormous financing needs of countries to achieve their NDCs and long-term targets. This approach is also explained in the GTL as "financing the transition" which is distinct from labeled finance. In the future, it is expected that the role of transition finance, including finance for the transition of society as a whole in addition to labeled finance, will further expand to support a realistic transition to decarbonization in the world.

[9] LMA, Guide to Transition Loans, October 2025
[10] UK Transition Finance Council "Sector Transition Plans: The Finance Playbook," August 2025
[11] UK The Global City, Transition Finance Guidelines, November 2025
[12] The Climate Change Authority, Sector Pathways Review, September 2024
[13] This approach is based on the concept that "the provision of funds is not based on the reliability of individual companies' transition strategies, but rather on the overall funding needs required when viewed in aggregate at the level of countries, regions, and industries." See FRTF: Fundamental Review of Transition Finance — Japan Public-Private Working Group's Report on Scaling "Inclusive" Transition Finance in the ASEAN Region (July 2025).

chapter 3

Selection of Eligible Projects for Japan Climate Transition Bonds

3.1 Eligibility Criteria for Use of Proceeds

3.1.1 Eligibility Criteria for Use of Proceeds under the Framework

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 2: 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 Promoting 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 Promoting 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 3—informed by the fundamental principles of upfront investment support for GX Economy Transition Bonds will be selected from the eligibility criteria shown in Figure 2.

Figure 3: GX Economy Transition Bonds "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 changes corporate investment and demand-side behavior
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 4).

Figure 4: 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 Use of Proceeds for JCTBs based on the Green Bond Principles

Figure 5 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 5: JCTBs: 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 Selection of Eligible Projects and Assessment of Eligibility for JCTBs

3.1.3 of the Framework 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,[14] established under 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 (revised in December 2024 and December 2025).[15] 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 derivatives (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, 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. In addition, discussions are conducted within the Expert Working Group for Realizing GX, and the projects are incorporated into the government' s budget proposal. Furthermore, for each fiscal year, the projects expected to be financed by the bonds to be issued in that year are identified, taking into account the corresponding budget, and their eligibility is reviewed by an independent external evaluation institution. At this time, confirmation shall be made, as necessary, by the Government-Related Ministries and Agencies Liaison Conference on GX Economy Transition Bonds Issuance (hereinafter referred to as the "Liaison Conference"[16]), composed of Director General-level officials, and shall be reported to the GX Implementation Council after consultation with other relevant Ministries and Agencies and organizations. Additionally, each project is determined as part of the government budget and approved annually by the National Diet.

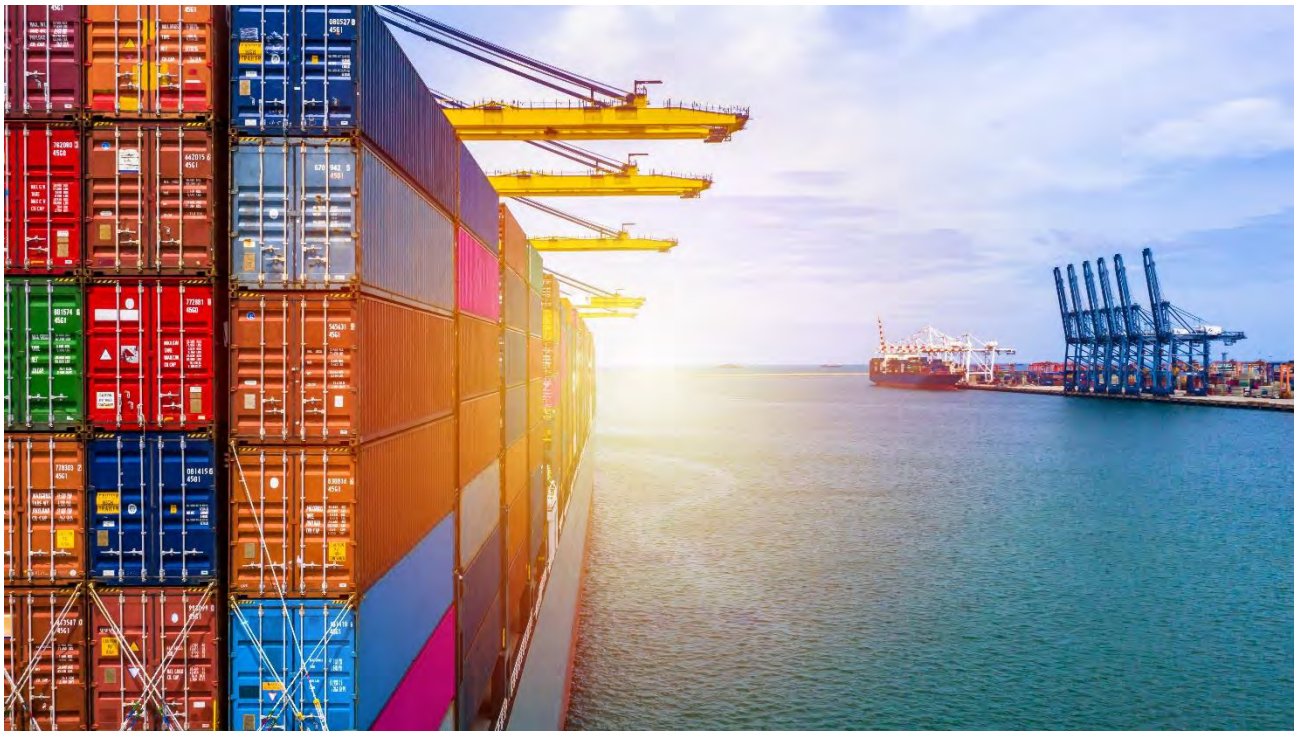
The proceeds can be allocated to the eligible projects that commence operations or are executed during the fiscal

[14] 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.
[15] "Sector-Specific Investment Strategies" Compiled as Effort for Specifying Investment Promotion Measures for the Realization of GX; METI News Release; December 22, 2023
[16] Members of the Liaison Conference include the Cabinet Secretariat, FSA, MOF, METI, and MOE.

year (FY)[17] 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 tracks and monitors 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 allocation status of proceeds is reviewed and evaluated through Allocation Report and Impact Report by the aforementioned Liaison Conference, and reported to the GX Implementation Council if necessary.

For the JCTBs issued in FY2023 and FY2024, the use of proceeds was reported at the GX Implementation Council and the Liaison Conference, and a Second Party Opinion has been obtained from JCR. [18] In addition, for those issued in FY2023, certification[19] was acquired from the Climate Bonds Initiative (CBI) prior to the issuance. The proceeds raised have been managed according to the management methods stipulated in the Framework.



[17] 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.
[18] JCR, Japan Climate Transition Bonds (1st) Evaluation Results, January 2024
[19] Climate Bonds Initiative(Climate Bond Certified), Certification: 5 & 10-year Japan Climate Transition Bonds (1st), Issued by the Government of Japan, February 2024

chapter 4

Allocation and Impact Report for FY2023 Issuance

4.1 FY2023 Issuance

Figure 6 presents the auction results for ten-year bonds on February 14, 2024, and five-year bonds on February 27, 2024.

Figure 6: 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	Approx. 800 billion yen	Approx. 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 were intended for allocation to the designated projects, as outlined in Figure 7.

Figure 7: Projects to be Funded by JCTBs (FY2023 Issuance)[20]

Classification	Fiscal year	Projects to be funded	Ministries with jurisdiction
(A) Research and development of innovative technologies aimed at market deployment	FY2022 Supp.	Green Innovation Fund	METI
	FY2023 Initial		
	FY2022 Supp.	Innovative GX Technology Creation Project (GteX)	the Ministry of Education, Culture, Sports, Science and Technology(MEXT)
	FY2022 Supp.	Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure	METI
	FY2023 Initial	Demonstration Reactor Development Project for High-Temperature Gas Reactor	METI
	FY2023 Initial	Demonstration Reactor Development Project for Fast Reactor	METI
(B) Capital investment that contributes to both economic growth and greenhouse gas reduction	FY2022 Supp.	Support Project for Strengthening the Manufacturing Supply Chain of Batteries	METI
	FY2022 Supp.	Support Project for Strengthening the Semiconductor Manufacturing Supply Chain for Achieving GX	METI
	FY2022 Supp.	Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation	METI
	FY2023 Initial	Grant for Decarbonization Transition Acceleration for Specific Regions	MOE
(C) Nationwide demand-side measures that support economic growth	FY2022 Supp.	Subsidy for Promoting the Introduction of Clean Energy Vehicles	METI
	FY2023 Initial		
	FY2023 Initial	Promotion Project for the Electrification of Commercial Vehicles	MOE (Joint with METI and the Ministry of Land, Infrastructure, Transport and Tourism(MILT))

[20] In addition, it has been disclosed that proceeds may be allocated to future continuing projects.

	FY2022 Supp.	Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses	METI
	FY2022 Supp.	Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows	MOE (Joint with METI and MILT)

4.2 Allocation Status of Proceeds for FY2023 Issuance

The proceeds from the JCTBs issued in FY2023 were allocated to projects under the FY2022 Supplementary Budget, FY2023 Initial Budget, and FY2023 Supplementary Budget of the government of Japan, which were deemed eligible uses of proceeds under the Framework as of November 2023.

The total issuance amount (proceeds from issuance) of the JCTBs (FY2023 issuance) was 1,594.7 billion yen. The proceeds were allocated as shown in Figure 8. Among these, 908.7 billion yen was allocated to the projects under the FY2022 Supplementary Budget during FY2022 which ended before the FY2023 issuance of the JCTBs .[21]

In the Allocation Report for FY2023 Issuance published in December 2024, which reported the allocation status as of November 2024, there was an unallocated balance of approximately 30 billion yen; however, full allocation was completed by the end of FY2024. The following page summarizes the allocation status based on the final allocation amounts.

Specifically, additional allocations were made as follows: approximately 200 million yen for the Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses (FY2022 Supplementary Budget); approximately 2.5 billion yen for the Development Project for High-Temperature Gas Reactor Demonstration Plant (FY2023 Initial Budget); and approximately 200 million yen for the Grant for Decarbonization Transition Acceleration for Specific Regions (FY2023 Initial Budget). Furthermore, regarding the approximately 27.3 billion yen that could not be fully allocated to projects under the FY2022 Supplementary Budget and FY2023 Initial Budget, allocations were made to the Subsidy for Promoting the Introduction of Clean Energy Vehicles, which is a continuing project under the FY2023 Supplementary Budget.

[21] 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 JCTBs Proceeds (by Project and Green Category)

As of the end of November 2025

Category	Budget year	Project name	Overview	Allocated (billion yen)	Green Category
(A) Research and development of innovative technologies aimed at market deployment	FY2022 Supp.	Green Innovation Fund	Support will be provided to elicit the acceleration and expansion of R&D and capital investment by private companies as a catalyst for the need to further accelerate the development and social implementation of innovative technologies essential for achieving carbon neutrality by 2050.	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	
	FY2022 Supp.	Innovative GX Technology Creation Project (GteX)	Support for the promotion of basic research at universities and other institutions to create innovative GX technologies toward carbon neutrality by 2050	49.6	● Clean transportation/ ● Energy efficiency/ ● Renewable energy/ ● Circular economy adapted products, production technologies and processes
	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, with the aim of strengthening our country's development and manufacturing infrastructure for post-5G information and communications systems	75.0	●Energy efficiency
	FY2023 Initial	Demonstration Reactor Development Project for High-Temperature Gas Reactor	Demonstration that hydrogen production is possible by establishing a technology for connecting a high-temperature heat source and a hydrogen production plant by 2030. Project to obtain prospects for the technical feasibility of a carbon-free hydrogen production method	4.7	●Low-carbon and decarbonized energy
	FY2023 Initial	Demonstration Reactor Development Project for Fast Reactor	Expansion of the development of elemental technologies related to infrastructure development and safety improvement toward common issues of fast reactors, establishment of key technologies that will be important for future fast reactor development, and support for the development of test and research facilities that support the development of private companies	7.4	●Low-carbon and decarbonized energy
(B) Capital investment that contributes to both economic growth and greenhouse gas reduction	FY2022 Supp.	Support Project for Strengthening the Manufacturing Supply Chain of Batteries	Support for securing stable supplies of important materials such as semiconductors and storage batteries, including those that contribute to resolving social issues such as decarbonization, by developing production bases, diversifying supply sources, stockpiling, introducing, developing, and improving production technologies, and developing alternative materials	331.6	●Energy efficiency
	FY2022 Supp.	Support Project for Strengthening the Semiconductor Manufacturing Supply Chain for Achieving GX		152.3	●Clean transportation/ ●Renewable energy
	FY2022 Supp.	Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation	Support for the introduction of advanced energy-saving facilities and equipment that contribute to the replacement of plants and workplaces with facilities and equipment with high energy-saving performance, collaboration among multiple businesses, and conversion to non-fossil energy	2.4	●Energy efficiency
	FY2023 Initial	Grant for Decarbonization Transition Acceleration for Specific Regions	Support for local governments that promote decarbonization in their communities and lifestyles by creating new demand and expanding investment in decarbonized products and technologies such as renewable energy, energy conservation, and energy storage across the region	0.2	●Renewable energy
(C) Nationwide demand-side measures that support economic growth	FY2022 Supp.	Subsidy for Promoting the Introduction of Clean Energy Vehicles	Support for the creation of initial demand for electric vehicles and fuel cell vehicles in the early stages of introduction, promotion of price reductions through mass production effects, and investment in production facilities and research and development by companies in anticipation of growing demand through partial subsidies for purchase costs.	68.9	●Clean transportation
	FY2023 Initial			17.8	
	FY2023 Supp.			27.3	
	FY2023 Initial	Promotion Project for the Electrification of Commercial Vehicles	Intensive support for vehicle installation costs for companies that have set ambitious installation targets for BEVs and FCVs, those affected by the transition to non-fossil energy, etc.	10.8	●Clean transportation
	FY2022 Supp.	Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses	To improve the insulation performance of windows with large heat loss in existing houses, to contribute to a 70% reduction in CO_2 emissions from the residential sector in FY2030 (compared to FY2013), and to support the securing of energy-saving performance at the level of ZEH standards on the 2050 stock average *the Ministry of Economy, Trade and Industry project for detached houses	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 Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses *the Ministry of the Environment project targeting apartment buildings	9.7	●Energy efficiency
Total				**1,594.7**	
Total issuance amount of the JCTBs issued in FY2023 (cash proceeds)				**1,594.7**	
Amount of unallocated proceeds (cash proceeds - amount of proceeds allocated)				**0**	

4.3 Impact of Allocated Projects for FY2023 Issuance

4.3.1 Approach to Impact Calculation

This chapter explains the outline of the projects financed by the JCTBs issued in FY2023, as well as the impacts generated by those projects. Regarding the impact indicators, given that the GX policy aims to achieve decarbonization and economic growth simultaneously, the report presents the environmental improvement effects of the financed projects and, where possible, also presents their economic effects.

For environmental improvement effects, calculation methods differ depending on the nature of each financed project. The basic approach is as follows:

(1) For Research and Development Projects, we estimate CO_2 emission reduction effects on the assumption of future diffusion of the relevant technologies.

(2) For Capital Investment Support Projects, we estimate CO_2 emission reduction effects based on certain assumed production volumes using the supported facilities.

(3) For Demand-Side Measures Projects, we calculate realized CO_2 emission reduction effects based on the actual number of subsidized cases.

For economic effects, we calculate:

(1) For Research and Development Projects, the future market size;

(2) For Capital Investment Support Projects, the scale of capital investment induced; and

(3) For Demand-Side Measures Projects, the size of demand created.

Depending on the project, the scope of the impact assessment covers either effects within Japan or effects at the global level. Details of the impact calculation methods and the indicators used for each project are provided in the Annex.[22]

The impact reporting in this report has been prepared in line with the core principles and recommended practices set out in the ICMA guidance document "Harmonised Framework for Impact Reporting.[23]"

[22] It should be noted that some projects include financial resources from outside JCTBs, but since it is difficult to distinguish the recipients of funds, this report shows the impact of all projects covered by funds.

[23] ICMA「Harmonised Framework for Impact Reporting」(June 2024)

Figure 9: Impacts of Allocated Projects for FY2023 Issuance (Green Innovation Fund Project)

Project Name	Key Achievement		Environmental Improvement Effects			Economic Effects	
	Indicator	Results	Indicator	Results	Approach to calculation	Indicator	Results
Development of Next-Generation Solar Cells	Number of Supported R&D Projects	7	Global CO_2 emission reduction effect from the introduction of next-generation solar cells manufactured by Japanese companies	Approx. 1.5 million t-CO_2/year (2030) Approx. 100 million t-CO_2/year (2050)	Estimated CO_2 emission reduction effect assuming that Japanese companies have a 25% share of the global next-generation solar cell market	Next-generation solar cells by Japanese companies in the global solar cell market	Approx. 31.1 billion yen/year (2030) Approx. 1.25 trillion yen/year (2050)
Cost Reductions for Offshore Wind Power Generation		20	Domestic CO_2 emission reduction effect from offshore wind power introduced in Japan's territorial waters, replacing thermal power generation	Approx. 3-7 million t-CO_2/year (2030) Approx. 90 million t-CO_2/year (2050)	Estimation of the effect of reducing domestic CO_2 emission by replacing thermal power with offshore wind power	Market size in Japan and parts of Asia (25%)	Approx. 1 trillion yen/year (2030) Approx. 2 trillion yen/year (2050)
Large-Scale Hydrogen Supply Chain Establishment		8	Global CO_2 emission reduction effect expected from the international hydrogen market and the expansion of hydrogen demand	Approx. 7 million t-CO_2/year (2030) Approx. 400 million t-CO_2/year (2050)	Based on an estimate of the amount of hydrogen supplied by the international hydrogen supply chain, the CO_2 emission reduction effect from natural gas is estimated assuming that the supplied hydrogen replaces natural gas as a fuel for power generation.	Global market size for hydrogen trading (2030 and 2050) Global market size for hydrogen power generation turbines (cumulative to 2050)	Approx. 300 billion yen (2030) Approx. 5.5 trillion yen (2050) Up to: approx. 23 trillion yen (cumulative to 2050)
Development of Next-Generation Aircraft		7	Global CO_2 emission reduction effect from the introduction of next-generation aircraft	Approx. 640 million t-CO_2/year (2050)	Estimation of the CO_2 emission reduction effect by improving fuel efficiency and lowering the basic unit when aircraft are replaced with next-generation aircraft worldwide	Global market size of aircraft equipped with technologies established by this project	Approx. 2.1 trillion yen/year (2050)
Development of Next-generation Ships		6	CO_2 emission reduction effect from the introduction and deployment of zero-emission ships with support from Green Innovation Fund (2030) Global CO_2 emission reduction effect from introduction of new zero-emission ships (2050)	Approx. 0.33million t-CO_2/year (2030) Approx. 560 million t-CO_2/year (2050)	Estimation of CO_2 emission reduction effect of the zero-emission ship to be launched under the Green Innovation Fund project	Global economic effect generated by the new zero-emission ship operation	Approx. 170 billion yen (2030) Approx. 6.8 trillion yen (2050)
Hydrogen Utilization in Iron and Steelmaking Processes		5	CO_2 emission reduction effect introducing the Blast Furnace equipped with COURSE50 technology (by 2030) CO_2 emission reduction effect inroducing innovative hydrogen reduction steelmaking and CCUS technology worldwide (2050)	Approx. 2 million t-CO_2/year (by 2030) Approx. 1.3 billion t-CO_2/year (by 2050)	Estimate of CO_2 emission reduction effect if COURSE50 technology is introduced to domestic steelworks (by 2030) Estimate of CO_2 emission reduction effect if hydrogen reduction steelmaking and CCUS technology Estimation of CO_2 emission reduction effect when the system is used worldwide (2050)	Commercial size steel production from 1 large blast furnace equipped with COURSE50 technology (by 2030) Global green steel production market size (by 2050)	Approx. 320 billion yen/year (by 2030) Approx. 40 trillion yen/year (by 2050)
Decarbonization of Thermal Processes in Manufacturing		1	2032~:domestic industrial furnaces replaced with 50% ammonia/hydrogen co-combustion furnaces 2041~:replaced with 100% ammonia/hydrogen mono-fuel combustion furnaces	Approx. 20 million t-CO_2/year (2040) Approx. 80 million t-CO_2/year (2050)	Estimation of CO_2 emission reduction effect compared with existing industrial furnaces, assuming that 50% co-firing combustion furnaces and exclusive combustion furnaces become widespread to a certain extent, assuming that supply of ammonia and hydrogen progresses as planned	Economic effect of replacing industrial furnaces with ammonia and hydrogen co-firing furnaces in Japan and overseas	Approx. 4.2 trillion yen (Cumulative total up to 2040) Approx. 10 trillion yen (Cumulative total up to 2050)
Hydrogen Production through Water Electrolysis Using Power from Renewables		3	Global CO_2 emission reduction effect from substituting natural gas heat demand with hydrogen produced by water electrolysis	Approx. 40 million t-CO_2/year (2030) Approx. 1.52 billion t-CO_2/year (2050)	Assuming that hydrogen produced by water electrolysis is mainly used for heat, and assuming that hydrogen can replace the heat demand of imported natural gas by heat equivalent, the CO_2 emission reduction effect is estimated.	Global market size due to introduction of water electrolysis equipment	Approx. 400 billion yen (Cumulative total up to 2030) Approx. 4.4 trillion yen/year (2050)
Achieving Carbon Neutrality in Waste and Resource Circulation Systems		4	Global CO_2 emission reduction effect from the implementation of CN-type carbon-circulation plants	Approx. 10.5 million t-CO_2/year (2030) Approx. 1.24 billion t-CO_2/year (2050)	Estimation of the total value of the difference between the reduction in methane emissions due to the reduction in landfill waste and the increase in CO_2 emissions due to the increase in incineration, the reduction in methane emissions due to the increase in intermediate treatment, the CO_2 yield from CCUS, and the reduction in CO_2 emissions due to the substitution of city gas	Global economic impact effect from the deployment of incineration and pyrolysis treatment facilities equipped with CC	Approx. 500 billion yen/year (2030) Approx. 5.2 trillion yen/year (2050)
Development of Technology for Producing Raw Materials for Plastic Using CO_2 and Other Sources		11	Global CO_2 emission reduction effect from introducing plastic raw materials produced using CO_2 generated in supported projects	Approx. 40 million t-CO_2/year (2030) Approx. 1.5 billion t-CO_2/year (2050)	Estimation of CO_2 emission reduction effect by adding the reduction amount by olefin, green hydrogen, methanol, ethanol, CB, and naphtha cracking furnace (2050 only)	Global market size of plastic raw materials using CO_2 and other inputs	Approx. 10 trillion yen (2030) Approx. 363 trillion yen (2050)

Figure 10: Impacts of Allocated Projects for FY2023 Issuance

Project name	Key Achievement		Environmental Improvement Effects			Economic Effects	
	Indicator	Results	Indicator	Results	Approach to calculation	Indicator	Results
Innovative GX Technology Creation Project (GteX)	Number of selected R&D themes	16 team-based research and 16 innovative elemental technology research	【Batteries】Establishment of fundamental technologies for next-generation batteries 【Hydrogen】Establishment of advanced technologies related to hydrogen production, storage, and utilization 【Bio-manufacturing】Establishment of technologies that enhance CO_2 fixation and enable the development of innovative microorganisms		Since the main purpose of this project is to support the establishment of a research and development management system, the progress and contributions of the support are explained qualitatively at present.	-	-
Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure	Number of supported organizations	8 organizations	CO_2 emission reduction effect from the deployment of optical and electrical fusion technologies at data centers in Japan	Approx. 3.54 million t-CO_2/year (2032 – 2041)	Calculated the effect of reducing power consumption by introducing photoelectric fusion technology on the power consumption of data center (DC) infrastructure	-	-
Demonstration Reactor Development Project for High-Temperature Gas Reactor	Total number of JAEA, MHI, and partner companies	19 companies	CO_2 emission reduction effect per ton of decarbonized hydrogen produced utilizing high temperature heat from high temperature gas-cooled reactors	Approx. 7.22t-CO_2/t (after establishment of HTGR)	Based on the concept that the amount of decarbonized hydrogen produced at the point when high-temperature gas-cooled reactors are established directly corresponds to the reduction in CO_2 emissions that would have been generated by conventional methods, the CO_2 emission reduction effect from establishing hydrogen production methods using high-temperature gas-cooled reactors (e.g., high-temperature steam electrolysis) is calculated.	-	-
Demonstration Reactor Development Project for Fast Reactor	Total number of JAEA, MHI, MFBR, and partner companies	45 companies	Reduction ratio of high-level radioactive waste	Volume reduced to 1/7 (after fast reactor operation starts)	While there is an effect of reducing emissions as a decarbonized power source for fast reactors, the management of radioactive waste is also very important in the utilization of nuclear power. Therefore, this project is described with the impact of the amount and half-life of high-level radioactive waste.	-	-
			Half-life of high-level radioactive waste	Reduced from 100,000 to 300 years (after fast reactor operation starts)		-	-
Support Project for Strengthening the Manufacturing Supply Chain of Batteries	Number of certified supply-security plans approved in FY2023 among the currently certified supply-security plans	14 plans	CO_2 emission reduction effect assuming that all storage batteries manufactured at supported plants are installed in BEVs	Approx. 13.5 million t-CO_2/year (after operation of supported plants)	Assuming that the maximum number of storage batteries manufactured in 1 year is installed in domestic BEVs, the CO_2 emission reduction effect assumed during the life cycle of vehicles equipped with BEVs by switching from internal combustion engine vehicles is calculated as an impact.	Total project cost under the certified supply-security plans	Approx. 852.3 billion yen
Support Project for Strengthening the Semiconductor Manufacturing Supply Chain for Achieving GX	Number of companies subsidized in FY2023	3 companies	CO_2 emission reduction effect assuming that all power semiconductors manufactured at supported plants are installed in EVs	Approx. 1.74 million t-CO_2/year (after operation of supported plants)	Assuming that all power semiconductors manufactured through this project are installed in EVs, the annual CO_2 emission reduction effect expected by improving the energy efficiency of automobiles is calculated.	Total project cost under the certified supply-security plans	Approx. 419.2 billion yen
Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation	Number of subsidized projects	16 projects	Expected annual CO_2 emission reduction effect of upgrading to energy-saving facilities and equipment	Approx. 3,300 t-CO_2/year (from FY2025)	Calculated the expected annual energy savings from upgrading to energy-saving facilities and equipment for 16 projects that utilized JCTBs in FY2023, and calculated the resulting CO_2 emission reduction effect	Total investment amount by supported businesses	Approx. 2.7 billion yen
Grant for Decarbonization Transition Acceleration for Specific Regions	Number of supported local governments	4 local governments	CO_2 emission reduction effect over the five-year project plan period for supported Decarbonization Leading Areas.	Approx. 342,000 t-CO_2/year (5-year project period)	Calculation of CO_2 emission reduction effect based on business plans of 4 local governments implementing microgrid-related projects utilizing privately-owned distribution lines	Total project cost for initiatives in leading decarbonization areas	Approx. 3.5 billion yen
Subsidy for Promoting the Introduction of Clean Energy Vehicles	Number of subsidized Vehicles under the FY2022 supp. and FY2023 initial	153,882 vehicles	Emission reduction effect of subsidized electric vehicles	Approx. 95,000 t-CO_2/year (FY2023)	For the number of units introduced under the FY2022 supp. and FY2023 initial projects, it is assumed that EVs and PHEVs were introduced in place of gasoline-powered passenger vehicles at the time of new vehicle purchase, and the CO_2 emission reduction effect in the year of introduction is calculated accordingly.	Public-private investment amount based on the number of units actually subsidized under the FY2022 supp. and FY2023 initial	Approx. 589 billion yen
Promotion Project for the Electrification of Commercial Vehicles	Number of subsidized vehicles	3,698 vehicles	Annual CO_2 emission reduction effect achieved by replacing gasoline vehicles and other vehicles with eligible commercial vehicles supported under the program	Approx. 14,000 t-CO_2/year (from FY2025)	Based on the assumption that electric light trucks replace gasoline-powered light trucks, electric pickup and standard trucks replace diesel-powered pickup and standard trucks, and electric taxis replace average gasoline-powered taxis, the emission reduction effect for each type of vehicle is estimated and calculated as a total.	Public–private investment based on the number of units actually subsidized	Approx. 24.5 billion yen
Promotion Projects for the Installation of Advanced Equipment to Improve the Insulation Performance	Number of units subsidized (detached houses) Number of units subsidized (apartments)	203,365 detached houses 40,301 apartments	CO_2 emission reduction effect due to improvement of air conditioning efficiency by retrofitting windows in supported houses	Approx. 63,000 t-CO_2/year (detached houses) Approx. 8,000 t-CO_2/year (apartments) (from FY2024)	Calculated the effect of CO_2 emissions reduction by reducing energy consumption for air conditioning in homes where the insulation windows were retrofitted.	Public–private investment amount based on actual performance in insulating window retrofits	Approx. 167.6 billion yen

Column

The Green Innovation Fund Projects

The "Green Innovation Fund (GI Fund)," established by METI and operated by the New Energy and Industrial Technology Development Organization (NEDO), provides continuous support to companies and organizations committed to taking on the challenge of ambitious targets for 2030 shared by the public and private sectors for up to 10 years, from R&D to demonstration and social implementation, particularly in policy areas that require long-term efforts and have a significant impact.

The Green Innovation Project Committee is established under the Industrial Structure Council.[24] METI, NEDO, and related organizations implement GI Fund projects in line with the Basic Policies for the Green Innovation Fund, approved by the committee. To ensure proper and efficient execution of the GI Fund projects, the committee formulates the "Policy for Allocation of Funds for each Field." Based on this policy, Field-Specific Working Groups (WGs), which are established under the committee, evaluate the project prioritization and the appropriateness of funding levels for each project.

Subsequently, the relevant ministries' project divisions formulate each project's details as the "R&D and Social Implementation Plan" and initiate public calls for applications in sequence.

This plan sets ambitious 2030 output targets, including performance, cost, productivity, deployment scale and CO_2 emission reduction. It also defines outcome targets, such as emission reduction effects and wider economic ripple effects.

For ongoing projects, WGs periodically review the implementation status and the degree of executive involvement through dialogue with the managers of the companies and organizations implementing the projects. Several times a year, NEDO's Technology and Social Implementation Promotion Committee hears reports on progress and issues and provides expert advice. The committee also reviews the progress toward the KPIs set for each project and the overall project progress. If the project is judged to be difficult to achieve the KPIs at the stage-gate review, it will be discontinued. If the project is deemed unlikely to achieve market uptake in the future, the committee will discuss the appropriateness of continuing the project and report the results to WGs as reference information for their review of project progress.

As of December 2025, the total size of the GI Fund was 2,756.4 billion yen, 756.4 billion yen of which had been additionally contributed by JCTBs in FY2023. JCTBs are expected to contribute to the following 12 projects and have already disclosed the information on the progress and impacts of each project on its website (https://green-innovation.nedo.go.jp/).

Figure 11: Details of Green Innovation Fund

Business Type	Allocated projects (including some candidate projects)	Target areas
R&D	Development of Next-Generation Solar Cells	Electricity
	Cost Reductions for Offshore Wind Power Generation	Electricity
	Large-Scale Hydrogen Supply Chain Establishment	Electricity and Heat/Manufacturing
	Development of Next-Generation Aircraft	Transportation
	Development of Next-Generation Ships	Transportation
	Development of Technologies for Producing Fuel Using CO_2 and Other Sources	Transportation
	Hydrogen Utilization in Iron and Steelmaking Processes	Heat and Manufacturing
	Decarbonization of Thermal Processes in Manufacturing	Heat and Manufacturing
	Hydrogen Production through Water Electrolysis Using Power from Renewables	Electricity and Heat/Manufacturing
	Achieving Carbon Neutrality in Waste and Resource Circulation Systems	Waste
	Development of Technology for Producing Raw Materials for Plastic Using CO_2 and Other Sources	Waste and manufacturing (Chemistry)
	Promotion of Carbon Recycling Using CO_2 from Biomanufacturing Technology as a Direct Raw Material	Manufacturing (Chemistry)

*The following sections present excerpts and reports for 10 selected projects from those shown in Figure 11, for which expenditures from JCTBs have been approved to date.

[24] 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.

4.3.2 Impact of Each Project

1 GI Fund project: Development of Next-Generation Solar Cells

Progress and Results of the Project

Key Achievement

Number of Supported R&D Projects

7

Environmental Improvement Effects

Global CO_2 emission reduction effect from the introduction of next-generation solar cells manufactured by Japanese companies

Approx. 1.5 million t-CO_2/year (2030)
Approx. 100 million t-CO_2/year (2050)

Economic Effects

Next-generation solar cells by Japanese companies in the global solar cell market

Approx. 31.1 billion yen/year (2030)
Approx. 1.25 trillion yen/year (2050)

Objectives and Details of the Project

To achieve carbon neutrality by 2050, renewable energy is required as the main power source. In Japan, where there is little flat land, it is important to introduce photovoltaic power generation to places where installation was difficult until now, such as roof of industrial plants and building walls. To this end, it is essential to develop next-generation solar cells that are lightweight and flexible, with conversion efficiency and durability comparable to conventional silicon solar cells. This project aims to: (1) develop technologies to improve the basic performance of solar cells (small laboratory-scale cells), (2) develop technologies to scale up and integrate solar cells into modules, including product-size fabrication and manufacturing processes (coating process, electrode formation, sealing process, etc.), while maintaining performance, (3) develop technologies to maintain performance in actual outdoor environments after passing indoor tests such as durability evaluations, and (4) develop tandem technologies to dramatically improve conversion efficiency by stacking solar cells with different absorption wavelength bands.[25]

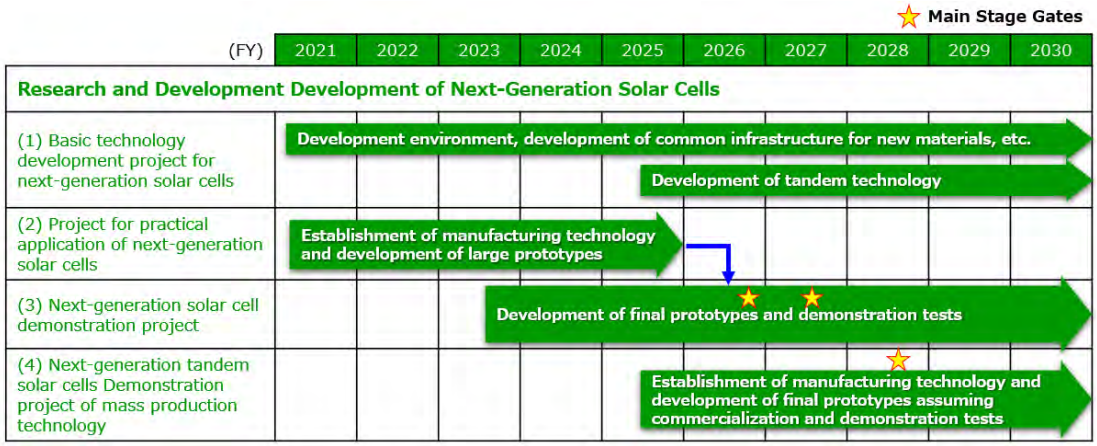
Current Progress and Future Outlook

At the NEDO's Technology and Social Implementation Promotion Committee in May 2024, it was confirmed that the entire project is progressing as planned.[26] The current Technology Readiness Level (TRL) of perovskite and other next-generation solar cells is 4. In September 2025, the "R & D and Social Implementation Plan" was revised to include the development of next-generation tandem solar cells.[27] From FY2026, we plan to work on specific measures to promote the introduction of next-generation solar cells and develop related rules to create demand. We aim to achieve a power generation cost of 14 yen/kWh or less, equivalent to that of conventional silicon solar cells, by 2030. The single-junction solar cells aim to achieve a power generation cost of 14 yen/kWh or less under certain conditions (such as solar radiation). The tandem solar cells aim to achieve a power generation cost of 12 yen/kWh or less for residential applications under certain conditions (such as solar radiation) and a conversion efficiency of 30% or more. We envision achieving TRL 5 in R & D (2) and TRL 6-7 in (3) and (4).

The next-generation solar cell demonstration project (R & D (3)) will last for a maximum of 7 years from FY2024 to FY2030. However, the implementation period for each theme will be 5 years in principle, and a stage-gate review will be conducted in the third year. The next-generation tandem solar cell mass-production technology demonstration project (R & D (4)) will last for a maximum of 6 years from FY2025 to FY2030. The initial contract will last until the end of the 4th fiscal year (including the month in which 3 years have elapsed) from the fiscal year in which the grant decision was made, and a stage-gate review will be conducted in the fourth year.[28]

[25] NEDO website, "Green Innovation Fund Project: Development of Next-Generation Solar Cells"
[26] "Green Innovation Fund Project: Development of Next-Generation Solar Cells 2024 WG Report," NEDO (May 2024)
[27] "R&D and Social Implementation Plan" for the "Green Innovation Fund Project: Development of Next-Generation Solar Cells," Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry (September 2025)
[28] Compiled based on selected R&D themes from the "R&D and Social Implementation Plan."

Figure 12: Expected Schedule for R&D and Social Implementation



Concept of Impact Calculation

Based on objective data such as the global market size and growth pace of solar power generation, the market share of next-generation solar cells, and the share of Japanese companies, the CO_2 emission reduction effect and market size of single-junction and tandem solar cells as of 2030 and 2050 are calculated. The economic effect of this project is estimated to be 12.5 billion yen in 2030, assuming that the cumulative installed capacity of photovoltaic power generation worldwide reaches 2 TW by 2030, the total market size is approximately 5 trillion yen, and single-junction next-generation solar cells account for 1%, with Japanese companies holding a 25% global share. Similarly, assuming that the installed capacity of tandem solar cells reaches approximately 1.3 GW, the economic effect is 18.6 billion yen, resulting in a total projected economic effect of 31.1 billion yen. By 2050, the cumulative global installed capacity is expected to reach 4.4 TW. Assuming that next-generation solar cells account for 50% of the total market and that Japanese companies hold a 25% share, the economic effect is estimated to reach approximately 1.25 trillion yen.

2 GI Fund Project: Cost Reductions for Offshore Wind Power Generation

Progress and Results of the Project

Key Achievement

Number of Supported R&D Projects

20

Environmental Improvement Effects

Domestic CO_2 emission reduction effect from offshore wind power introduced in Japan's territorial waters, replacing thermal power generation

Approx. 3-7 million t-CO_2/year (2030)
Approx. 90 million t-CO_2/year (2050)

Economic Effects

Market size in Japan and parts of Asia (25%)

Approx. 1 trillion yen/year (2030)
Approx. 2 trillion yen /year (2050)

Objectives and Details of the Project

To achieve carbon neutrality by 2050, it is necessary to maximize the introduction of renewable energy as a primary power source. In particular, offshore wind power generation is a key driver for the mainstreaming of renewables as a primary power source, as it enables large-scale deployment and cost reduction, and is expected to have economic effects. In Japan and across Asia—regions characterized by steep bathymetry and extensive deep-water areas—there is a growing need to optimize offshore wind systems for meteorological and ocean conditions such as low wind speeds, typhoons, and lightning strikes, as well as ocean conditions.

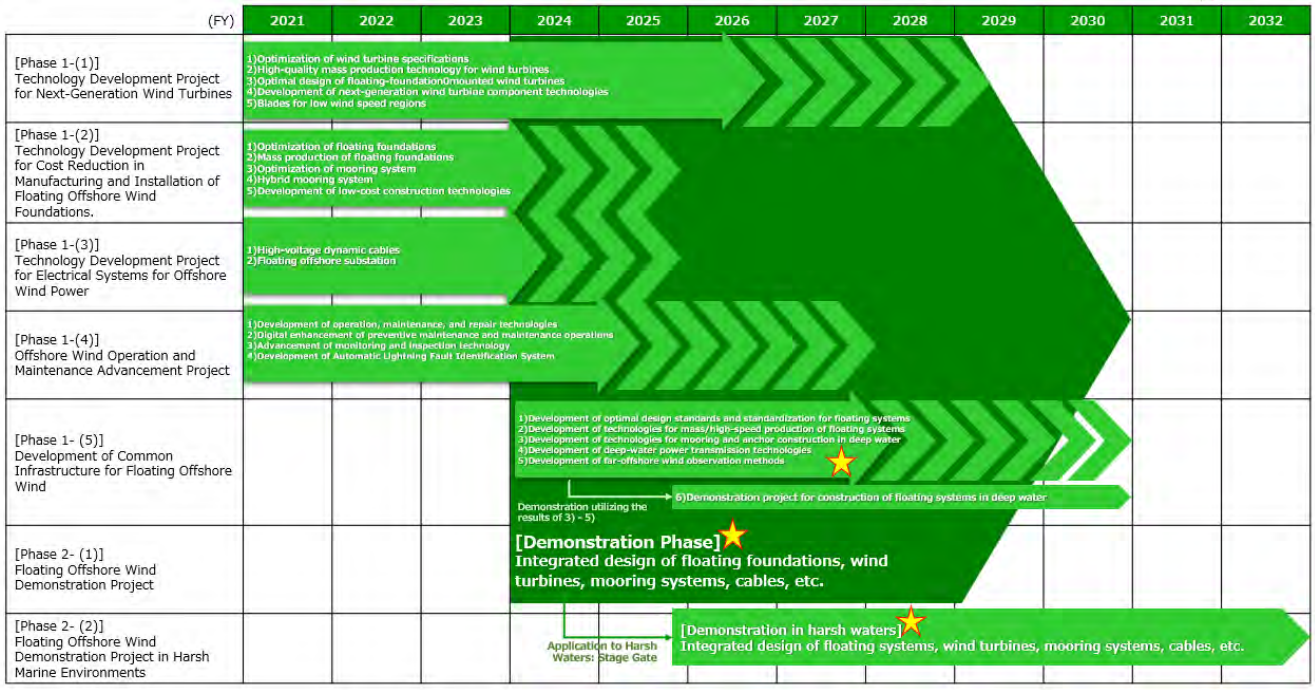
In order to achieve a virtuous cycle of expanding the introduction of offshore wind power and strengthening industrial competitiveness in Japan, this project aims to achieve early cost reductions in offshore wind power generation, focusing on floating offshore wind systems, which offer substantial potential for deployment even in

deep-water areas, and to accelerate deployment not only in Japan but also overseas, especially in Asia.[29]

Current Progress and Future Outlook

Projects of TRL 4 or higher are basically targeted for support. As of December 2024, although some project plans needed to be revised, progress was generally smooth. At the WG held in September 2025, it was reported that Phase 1 projects on (2) floating-structure manufacturing and installation, (3) electrical systems, and (4) maintenance (advanced operation and maintenance), which were initiated in FY2021, were completed, and their results were carried over to Phase 2.[30] For Phase 2, research and environmental assessment are being prepared for demonstration. The R&D objectives are to establish technologies that can deliver an estimated LCOE of 8-9 yen/kWh for fixed-bottom systems under specified conditions and to enable the commercialization of floating systems at internationally competitive cost levels by 2030.[31] [32]

Figure 13: Expected Schedule for R&D and Social Implementation



Concept of Impact Calculation

Assuming that electricity generated by offshore wind displaces thermal power generation, the resulting domestic CO_2 reduction is counted as an environmental benefit. The economic effect is estimated at 1 trillion in 2030 and 2 trillion in 2050, based on the portion of global offshore wind investment corresponding to the entire Japanese market plus 25% of the Asian market.

[29] NEDO website, "Green Innovation Fund Project: Cost Reduction for Offshore Wind Power Generation"
[30] "Green Innovation Fund Project: Cost Reduction for Offshore Wind Power Generation 2025 WG Report," NEDO (September 2025)
[31] "R&D and Social Implementation Plan" for the "Green Innovation Fund Project: Cost Reduction for Offshore Wind Power Generation," Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry (November 2025)
[32] Compiled based on selected R&D themes from the "R&D and Social Implementation Plan"

3 GI Fund Project: Large-Scale Hydrogen Supply Chain Establishment

Progress and Results of the Project

Key Achievement

Number of Supported R&D Projects

8

Environmental Improvement Effects

Global CO_2 emission reduction effect expected from the international hydrogen market and the expansion of hydrogen demand

Approx. 7 million t-CO_2/year (2030)
Approx. 400 million t-CO_2/year (2050)

Economic Effects

Global market size for hydrogen trading
Approx. 300 billion yen /year (as of 2030)
Approx. 5.5 trillion yen /year (as of 2050)

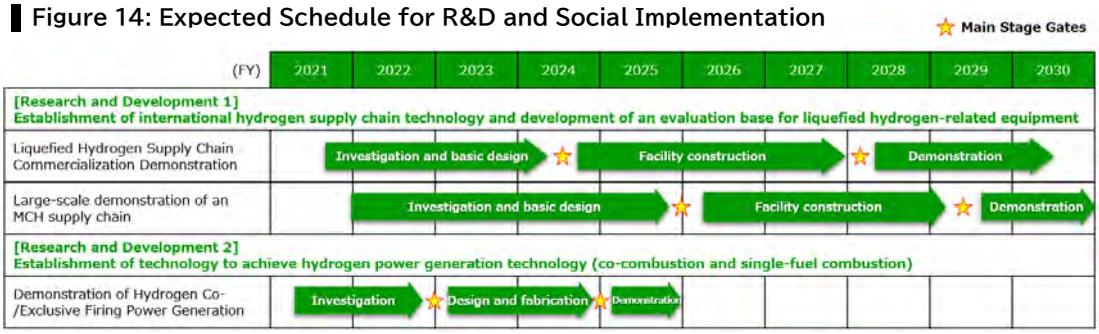
Global market size for hydrogen power generation turbines
Up to approx. 23 trillion yen (cumulative to 2050)

Objectives and Details of the Project

Hydrogen is a secondary energy essential for decarbonization of the electric power sector and effective use of renewable energy. Hydrogen is also expected to contribute to decarbonization of industrial sectors (Raw material utilization, heat demand, etc.) where electrification is difficult. However, in the early days of hydrogen, uncertainty over long-term demand has become a barrier to private investment in infrastructure. Therefore, this project aims to establish technologies that can create large-scale demand for hydrogen and reduce supply costs through (1) establishment of international hydrogen supply chain technologies and enlargement of transportation facilities, and (2) demonstration of hydrogen power generation by co-firing and single-firing. As a result, we aim to achieve a hydrogen supply cost of 30 yen/Nm3 by 2030 and 20 yen/Nm3 or less by 2050 (equivalent to that of fossil fuel), and promote the construction of a sustainable large-scale hydrogen supply chain.[33][34]

Current Progress and Future Outlook

Figure 14: Expected Schedule for R&D and Social Implementation



① As for the liquefied hydrogen supply chain, within R&D for the international hydrogen supply chain, we have started the construction of a liquefied hydrogen base and liquefied hydrogen carrier ships necessary for commercialization demonstration. As initially planned, R&D and technology demonstrations are progressing and will be steadily promoted. Regarding R&D for dehydrogenation technology from ammonia for large-scale hydrogen transportation, we are considering the implementation of public solicitations while monitoring the development status of each technology.[35] ② Regarding hydrogen power generation technology, we conducted a technology demonstration of hydrogen co-firing power generation in FY2025. We are making steady progress on 10% co-firing (calorific value basis) power generation technology, such as providing part of the electricity generated by the demonstration to the Osaka and Kansai Exposition. Regarding high co-firing power generation technology, we are considering the implementation of public solicitations while monitoring the maturity of technology development.[36]

Concept of Impact Calculation

In 2030, the amount of CO_2 emission reduction from natural gas was calculated based on the estimation of the amount of hydrogen supplied by the international hydrogen supply chain, assuming that the supplied hydrogen replaces natural gas as a fuel for power generation in a calorie-equivalent manner. In 2050, the amount of CO_2 emission reduction from the substitution of hydrogen for natural gas was estimated based on the expansion of international hydrogen trade worldwide. Regarding economic effect, the market size was estimated based on the assumption of the average hydrogen supply cost. In addition, the cumulative market size of the hydrogen power turbine market was estimated by multiplying the maximum installed capacity (approximately 290 million kW) by the turbine price (approximately 80,000 yen/kW).

[33] NEDO website, "Green Innovation Fund Project: Large-Scale Hydrogen Supply Chain Establishment"
[34] "R&D and Social Implementation Plan" for the "Green Innovation Fund Project: Construction of a Large-Scale Hydrogen Supply Chain," Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry (October 2025)
[35] "Green Innovation Fund Project: Large-Scale Hydrogen Supply Chain Establishment 2024 WG Report," NEDO (September 2024)
[36] Compiled based on selected R&D themes from the "R&D and Social Implementation Plan"

4 GI Fund Project: Development of Next-Generation Aircraft

Progress and Results of the Project

Key Achievement

Number of Supported R&D Projects

7

Environmental Improvement Effects

Global CO_2 emission reduction effect from the introduction of next-generation aircraft

Approx. 640 million t-CO_2/year (2050)

Economic Effects

Global market size of aircraft equipped with technologies established by this project

Approx. 2.1 trillion yen (2050)

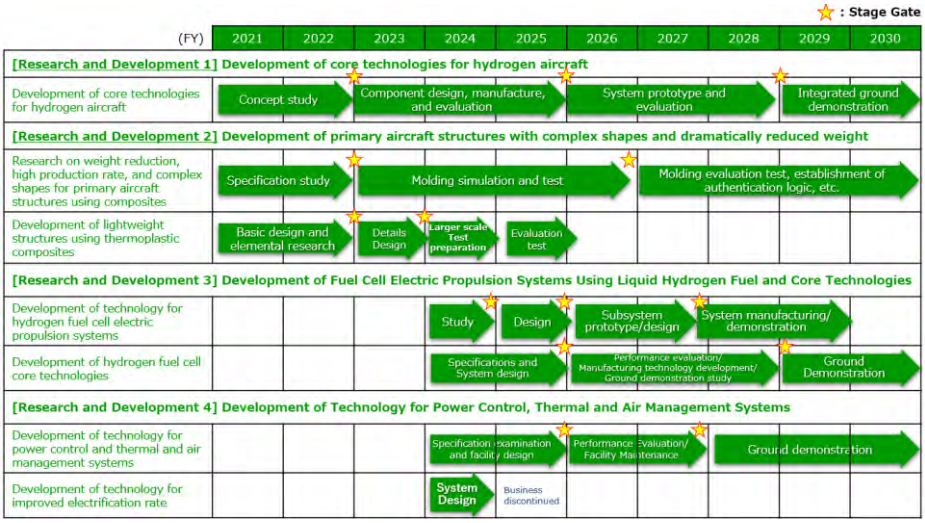
Objectives and Details of the Project

Seizing the shift to green technologies based on the demand for decarbonization in the aviation sector as an opportunity to dramatically strengthen the competitiveness of the Japanese aviation industry, this project will carry out the development of core technologies and systems for hydrogen-powered aircraft (Hydrogen combustion, hydrogen fuel cell), the development of complex shapes and dramatic reductions in the weight of major aircraft structural parts, and the development of technologies to increase the electrification rate.[37]

Current Progress and Future Outlook

Currently, the R&D items are (1) core technology development for hydrogen aircraft, (2) aircraft weight reduction, (3) fuel cell electric propulsion system and core technology development, and (4) power control and thermal air management system technology development. As of May 2025, progress has been made as planned. The project for (3) and (4) started in FY2024. Although progress varies according to each item, the technology development target for R&D items (1) through (4) is set at TRL 6 or higher by the end of the project.[38][39][40]

Figure 15: Expected Schedule for R&D and Social Implementation



Concept of Impact Calculation

Assuming that domestic and international aircraft operated in 2050 will be replaced to a certain extent by aircraft with electrification, weight reduction, hydrogen fuel cells, and hydrogen combustion, the CO_2 emission reduction effect due to improved fuel efficiency and lower emissions per unit are calculated as environmental improvement effect. In addition, regarding the economic effect of this project, we estimated the economic effect of aircraft equipped with the technologies developed under the project by assuming the share of hydrogen aircraft and electric aircraft in new aircraft demand in 2050, and taking into account the technology share in conventional aircraft. The global market size in 2050 for hydrogen and electric aircraft equipped with the technologies established through this project is estimated to be 2.1 trillion yen.

[37] NEDO website, "Green Innovation Project: Development of Next-Generation Aircraft"
[38] "Green Innovation Fund Project: Development of Next-Generation Aircraft 2025 WG Report," NEDO (May 2025)
[39] "R&D and Social Implementation Plan" for the "Green Innovation Fund Project: Development of Next-Generation Aircraft," Manufacturing Industry Bureau, Ministry of Economy, Trade and Industry (June 2025)
[40] Compiled based on selected R&D themes from the "R&D and Social Implementation Plan"

5 GI Fund Project: Development of Next-Generation Ships

Progress and Results of the Project

Key Achievement

Number of Supported R&D Projects

6

Environmental Improvement Effects

CO_2 emission reduction effect from the introduction and deployment of zero-emission ships with support from Green Innovation Fund

Approx. 0.33 million t-CO_2/year (2030)

Global CO_2 emission reduction effect from introduction of new zero-emission ships

Approx. 560 million t-CO_2/year (2050)

Economic Effects

Global economic effect generated by the new zero-emission ship operation

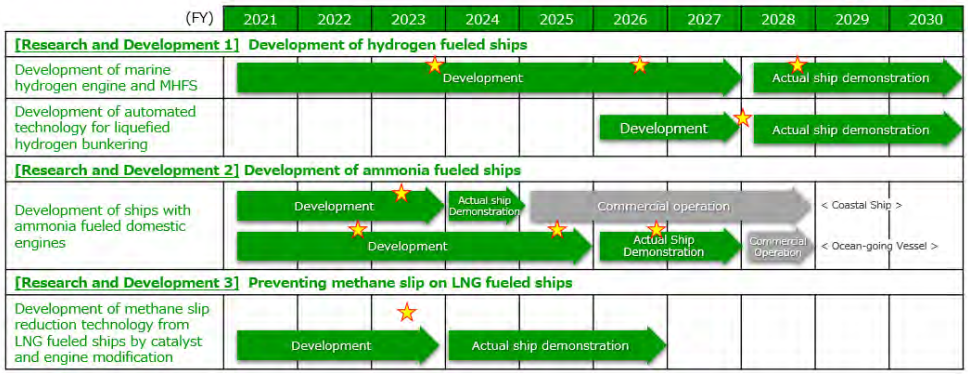
Approx. 170 billion yen (2030)
Approx. 6.8 trillion yen (2050)

Objectives and Details of the Project

CO_2 emission from the international shipping sector account for approximately 2.1% of the global total (as of 2018). To achieve carbon neutrality in marine transportation, it is essential to switch from conventional heavy oil to gaseous fuels such as hydrogen, ammonia, and carbon-recycled methane. Accordingly, it is necessary to develop marine machineries that use hydrogen and ammonia as fuel and to reduce methane slip from ship fuels, including liquefied natural gas (LNG) and carbon-recycled methane. In this project, the engines, fuel tanks, and fuel supply systems for (1) hydrogen-fueled ships and (2) ammonia-fueled ships will be developed and tested on actual ships, with the aim of achieving the widespread adaptation of zero-emission ships by 2050. In parallel with the deployment of zero-emission ships, (3) methane slip countermeasures for LNG-fueled ships will be addressed. These initiatives enhance the international competitiveness of the Japanese shipbuilding and marine industries and promote social implementation in cooperation with the shipping industry.[41]

Current Progress and Future Outlook

Figure 16: Expected Schedule for R&D and Social Implementation ☆: Stage Gate



(*) The commercial operation (social implementation) phase is outside the GI Fund project.

Current TRL is 3-4, and technology development is progressing steadily. In March 2025, NYK Line and IHI Power Systems Co., Ltd., which had received a public invitation to develop an ammonia-fueled ship, reported the successful completion of a demonstration cruise of the ammonia-fueled tugboat "Sakigake." The vessel was completed on August 23, 2024, under an R&D project conducted in cooperation with ClassNK. The goal is to achieve commercial operation (TRL 9 or higher) as soon as possible by 2028. [42] ① Land-based tests of hydrogen-fueled engines have also started, and the goal is to complete demonstration operation (TRL 8 or higher) by 2030. In October 2025, the "R&D and Social Implementation Plan" was updated to expand its scope to cover R&D on bunkering for the realization of hydrogen-fueled ships. ③ Methane oxidation catalysts and exhaust gas recirculation (EGR) systems have been developed for LNG-fueled ships, and demonstration tests of these systems on LNG-fueled ships have been underway since FY2024. The goal is to achieve a methane slip reduction rate of at least 60% (TRL 8 or higher) for LNG-fueled ships by 2026.[43][44]

Concept of Impact Calculation

The CO_2 emission reduction effect in 2030 is calculated based on the number of zero-emission ships that start operation under GI Fund projects. The figure for 2050 is based on the target reduction scenario for GHG emissions from international shipping adopted by the International Maritime Organization (IMO). The economic effect in 2030 is calculated based on the economic effect generated by zero-emission ships that start operation under the GI Fund project. The economic effect in 2050 is calculated based on the market size of the domestic shipbuilding industry in that year. The market size in 2030 is predicted from the market size in 2014, and the market size in 2050 is calculated by applying the predicted growth rate from 2030 to 2050, based on OECD long-term GDP projections.

[41] NEDO website, "Green Innovation Fund Project: Development of Next-Generation Ships"
[42] "The World's First Ammonia-fueled Tugboat "Sakigake" for Commercial Use Completed a Demonstration Voyage — Achieved a Maximum GHG Emission Reduction of 95% through a Demonstration Voyage —," NEDO (March 28, 2025)
[43] "R&D and Social Implementation Plan" for the "Green Innovation Fund Project: Development of Next-Generation Ships," Maritime Bureau, Ministry of Land, Infrastructure, Transport and Tourism (October 8, 2025)
[44] Compiled based on selected R&D themes from the "R&D and Social Implementation Plan"

6 GI Fund Project: Hydrogen Utilization in Iron and Steelmaking Processes

Progress and Results of the Project

Key Achievement

Number of Supported R&D Projects

5

Environmental Improvement Effects

CO_2 emission reduction effect introducing the Blast Furnace equipped with COURSE50 technology

2 million t-CO_2/year (by 2030)

CO_2 emission reduction effect inroducing innovative hydrogen reduction steelmaking and CCUS technology worldwide

1.3 billion t-CO_2/year (by 2050)

Economic Effects

Commercial size steel production from 1 large blast furnace equipped with COURSE50 technology

Approx. 320 billion yen/year (by 2030)

Global green steel production market size

Approx. 40 trillion yen/year (by 2050)

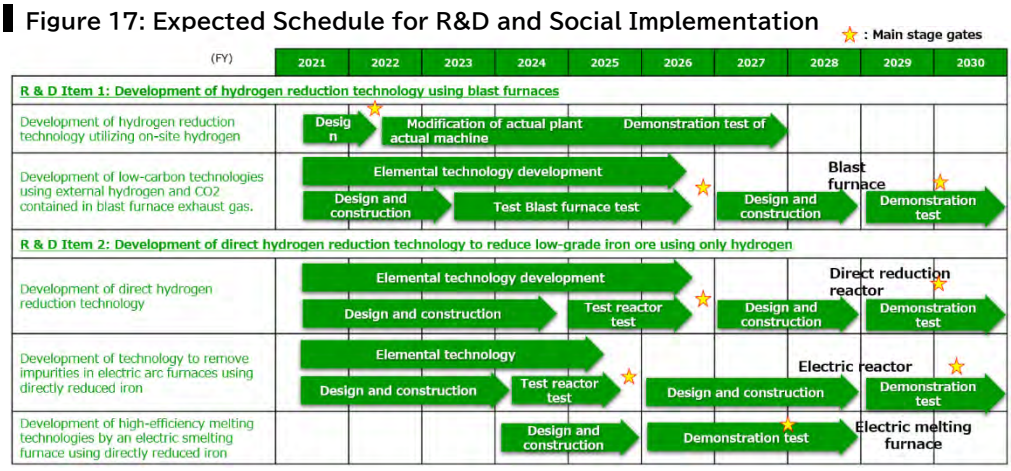
Objectives and Details of the Project

Although the steel industry is the foundation of all industries, it is a problem that a large amount of CO_2 is emitted during production. The emissions of the steel industry in Japan account for about 40% of the total industrial sector. In order to achieve carbon neutrality, it is necessary to establish innovative decarbonization technologies such as hydrogen reduction ironmaking as early as possible and to build a production system for green high grade steel. In this project, development of (1) hydrogen reduction technology using a blast furnace and (2) direct reduction technology for low-grade iron ore with hydrogen (direct hydrogen reduction technology) are carried out in parallel.[45]

Current Progress and Future Outlook

As of April 2025, the whole project has progressed as planned. ① In the hydrogen reduction technology using a blast furnace, a 43% reduction in CO_2 emissions was achieved for the first time in the world through a high-temperature hydrogen injection test into a small test blast furnace. Regarding the direct hydrogen reduction technology in (2), a small test furnace (Shaft furnace, electric furnace) has been constructed and started operation. The current TRL for the development of high-efficiency smelting technology using an electric smelting furnace utilizing directly reduced iron, which started in FY2024, is 4, and the specifications of the test facilities are under consideration. For both projects, the target for 2030 is TRL6-7.[46][47][48]

Figure 17: Expected Schedule for R&D and Social Implementation



Concept of Impact Calculation

The environmental improvement effect by 2030 is estimated as the CO_2 emission reduction effect if COURSE50 (R&D item (1)-(1) Blast furnace equipped with hydrogen reduction technology and CO_2 separation and capture technology) technology is introduced to domestic steelworks by 2030. The environmental improvement effect by 2050 is estimated as the CO_2 emission reduction effect if hydrogen reduction steelmaking and CCUS technology are spread worldwide. The economic effect is estimated as the annual scale of steel production from 1 blast furnace using COURSE50 technology of about 320 billion yen by 2030 and the global green steel market of about 40 trillion yen by 2050.

[45] NEDO website, "Green Innovation Fund Project: Hydrogen Utilization in Iron and Steelmaking Processes"
[46] "R&D and Social Implementation Plan" for the " Green Innovation Fund Project: Hydrogen Utilization in Iron and Steelmaking Processes," Manufacturing Industry Bureau, Ministry of Economy, Trade and Industry (December 2023)
[47] "Green Innovation Fund Project: Utilizing Hydrogen in Iron and Steelmaking Processes 2025 WG Report," NEDO (April 2025)
[48] Compiled based on selected R&D themes from the "R&D and Social Implementation Plan"

7 GI Fund Project: Decarbonization of Thermal Processes in Manufacturing

Progress and Results of the Project

Key Achievement

Number of Supported R&D Projects

1

Environmental Improvement Effects

2032～:domestic industrial furnaces replaced with 50% ammonia/hydrogen co-combustion furnaces
2041～:replaced with 100% ammonia/hydrogen mono-fuel combustion furnaces

Approx. 20 million t-CO_2/year (2040)
Approx. 80 million t-CO_2/year (2050)

Economic Effects

Economic effect of replacing industrial furnaces with ammonia and hydrogen co-firing furnaces in Japan and overseas

Approx. 4.2 trillion yen (cumulative total up to 2040)
Approx. 10 trillion yen (cumulative total up to 2050)

Objectives and Details of the Project

The CO_2 emission from industrial furnaces for metal heating account for more than 40% of CO_2 emissions in Japan's industrial sector, and decarbonization efforts are lagging behind, especially in the shape materials industry, where there are many SMEs. Therefore, R&D for the establishment and social implementation of decarbonization technologies for thermal processes, such as conversion to CO_2-free fuels and electric furnaces, is necessary.

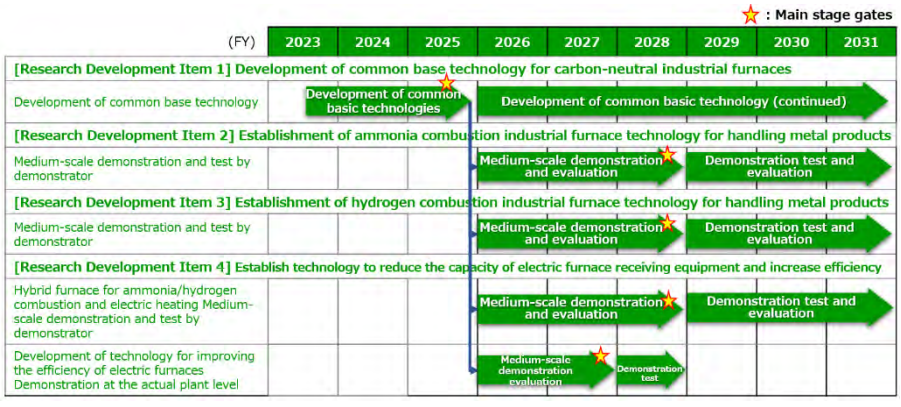
In this project, we will establish technologies to solve the technical issues (Quality of metal products, NOx emissions, combustion stability and control accuracy, long-term operation stability, etc.) of combustion furnaces when ammonia and hydrogen are used as fuels. In addition, in order to enable SMEs, which are the main users of industrial furnaces in our country, to select conversion from combustion furnaces to electric furnaces as an option, we will establish technologies for hybrid operation of ammonia and hydrogen combustion technologies and electric heating, higher output heaters, and technologies to prevent deterioration and extend the life of resistors as technologies to minimize the receiving capacity and to improve the efficiency of the entire electric furnace.[49]

Current Progress and Future Outlook

As of October 2024, the whole project is progressing as planned, and the TRL is 3-4. Regarding the establishment of combustion furnace technology using ammonia and hydrogen, the goal is to establish a 50% mixed combustion furnace using existing fuels such as natural gas and ammonia or hydrogen by FY2031, and to achieve a TRL of 6 or higher for 100% exclusive combustion technology. Regarding the electric furnace, the design study has been completed, and the demonstration will start from FY2026 in a medium-sized furnace. The goal is to achieve a TRL of 6 or higher by FY2031.[505152]

Concept of Impact Calculation

Figure 18: Expected Schedule for R&D and Social Implementation



Assuming that 50% ammonia and hydrogen co-combustion furnaces (or an electric furnace equivalent thereto. Hereinafter referred to as "combustion furnace, etc.".), which are being developed in this project, will be installed in society after FY2032 and spread by a certain number every year, and that 100% ammonia and hydrogen single-combustion furnaces will spread after FY2040, the CO_2 emission reduction effect compared with conventional industrial furnaces is estimated. The economic effect of replacing industrial furnaces with ammonia and hydrogen co-combustion furnaces in Japan and overseas is assumed to be 4.2 trillion yen (cumulative effect until FY2040) and 10 trillion yen (cumulative effect until FY2050).

[49] NEDO website, "Green Innovation Fund Project: Decarbonization of Thermal Processes in Manufacturing"
[50] "R&D and Social Implementation Plan" for the "Green Innovation Fund Project: Decarbonization of Thermal Processes in Manufacturing," Manufacturing Industry Bureau, Ministry of Economy, Trade and Industry (March 2023)
[51] "Green Innovation Fund Project: Decarbonization of Thermal Processes in Manufacturing 2024 Report by Energy Structure Transformation Field WG," NEDO (October 2024)
[52] Compiled based on selected R&D themes from the "R&D and Social Implementation Plan"

8 GI Fund Project: Hydrogen Production through Water Electrolysis Using Power from Renewables

Progress and Results of the Project

Key Achievement

Number of Supported R&D Projects

3

Environmental Improvement Effects

Global CO_2 emission reduction effect from substituting natural gas heat demand with hydrogen produced by water electrolysis

Approx. 40 million t-CO_2/year (2030)
Approx. 1.52 billion t-CO_2/year (2050)

Economic Effects

Global market size due to introduction of water electrolysis equipment

Approx. 400 billion yen (cumulative total up to 2030)

Approx. 4.4 trillion yen/year (2050)

Objectives and Details of the Project

In order to promote the social implementation of hydrogen, it is necessary to simultaneously reduce supply costs by enlarging supply facilities and create large-scale hydrogen demand. However, in the early days of hydrogen, it is difficult for private companies to invest in large-scale infrastructure because long-term hydrogen demand is uncertain. In order to reduce this uncertainty, it is necessary to construct a social implementation model that can increase hydrogen supply and create hydrogen demand while maximizing existing infrastructure. One of the models is self-consumption and utilization of hydrogen in surrounding areas, with the use of water electrolyzers as the core. Under this project, efforts will be made to the (1) development of technology for enlarging water electrolyzers and large-scale demonstration of Power to X, (2) establishment of technology for evaluating the performance of water electrolyzers, and realization of technology that can predict the equipment cost of alkaline water electrolyzers (52000 yen/kW) and polymer electrolyte (PEM) water electrolyzers (65000 yen/kW), which are at a technical level close to commercialization, by 2030, and realization of technology that can predict the equipment cost of solid oxide water electrolyzers (SOEC) to be lower than 68000 yen/kW by 2032.[53]

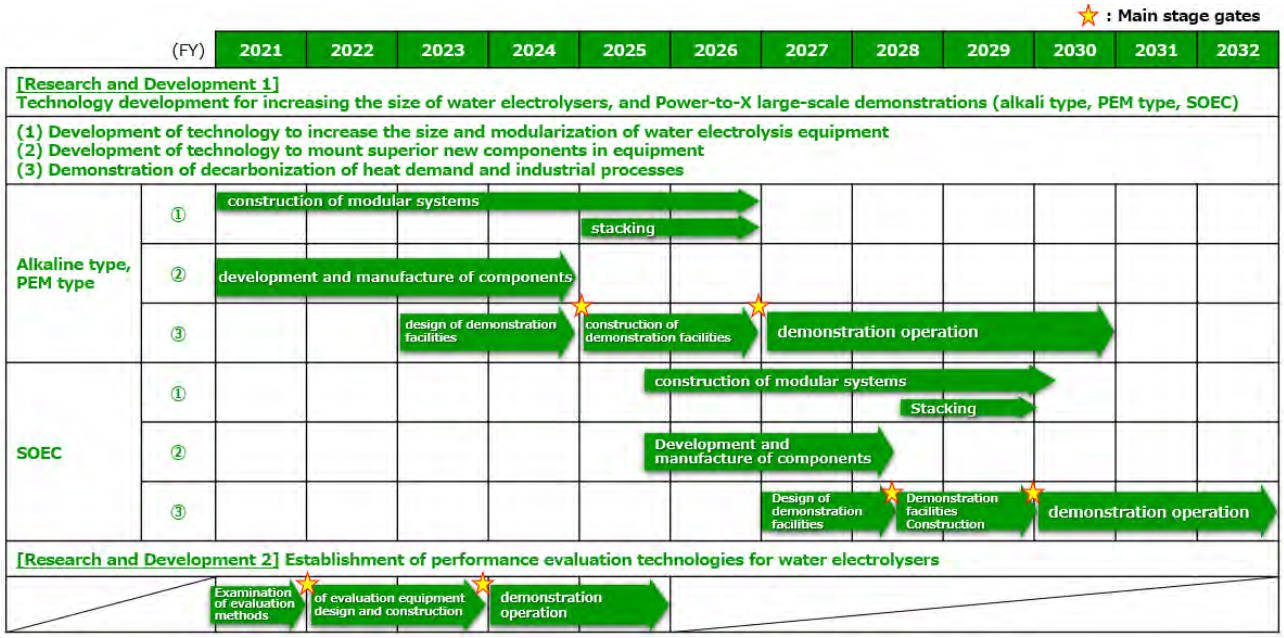
Current Progress and Future Outlook

As of July 2025, elemental technology development is making steady progress. ① Of these, "Development of large-scale alkaline water electrolysis equipment and demonstration of green chemicals" is expected to complete the required demonstration within the project period after careful examination of the operation plan, although there were delays in the delivery of some equipment and a review of overseas demonstration sites. For "Development of large-scale PEM water electrolysis equipment and demonstration of decarbonization of heat demand," although there was a delay in the start of the demonstration due to the long delivery time of the equipment, the developed equipment was confirmed to perform as expected in pre-demonstration tests, and the stage gate was cleared in April 2025.[54] A new SOEC R&D initiative was added in October 2025. Public applications were accepted until December 2025 and are currently under review (planned for adoption in February 2026). Two types of water electrolyzers, alkaline and PEM, are at a technical level close to commercialization (equivalent to TRL 5 at the start of the project), and SOEC is in the R&D stage (equivalent to TRL 5 as of 2025).[55]

② Regarding the performance evaluation of water electrolyzers, the introduction of the required 3 types of equipment was completed by FY2024. Discussions are ongoing in an expert committee, including how to reflect the results in international standards, and the aim is to establish a performance evaluation basis by FY2025. [56]

[53] NEDO website, "Green Innovation Fund Project: Hydrogen Production through Water Electrolysis Using Power from Renewables"
[54] "Green Innovation Fund Project: Hydrogen Production through Water Electrolysis Using Power from Renewables 2025 WG Report," NEDO (July 2025)
[55] "R&D and Social Implementation Plan" for the "Green Innovation Fund Project: Hydrogen Production through Water Electrolysis Using Power from Renewables," Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry (October 2025)
[56] Compiled based on selected R&D themes from the "R&D and Social Implementation Plan"

Figure 19: Expected Schedule for R&D and Social Implementation



Concept of Impact Calculation

The main use of hydrogen produced by water electrolysis is assumed to be heat demand, and hydrogen is assumed to replace the heat demand of imported natural gas by heat equivalent. As for the production volume of hydrogen, the global CO_2 emission reduction effect was estimated assuming that the total volume of hydrogen produced by major countries and regions with a target of introducing water electrolysis equipment by 2030 operated at the operation rate calculated from the German national hydrogen strategy at the start of this project. The CO_2 emission reduction effect by 2050 was calculated assuming that the introduction of water electrolysis equipment progressed further. As for the economic effect, the cumulative total up to 2030 and the global market size in 2050 were calculated by multiplying the installed volume of water electrolyzers by the average unit price, assuming the above assumptions.

9 GI Fund Project: Achieving Carbon Neutrality in Waste and Resource Circulation Systems

Progress and Results of the Project

Key Achievement

Number of Supported R&D Projects

4

Environmental Improvement Effects

Global CO_2 emission reduction effect from the implementation of CN-type carbon-circulation plants

Approx. 10.5 million t-CO_2/year (2030)
Approx. 1.24 billion t-CO_2/year (2050)

Economic Effects

Global economic impact effect from the deployment of incineration and pyrolysis treatment facilities equipped with CC

Approx. 500 billion yen/year (2030)
Approx. 5.2 trillion yen/year (2050)

Objectives and Details of the Project

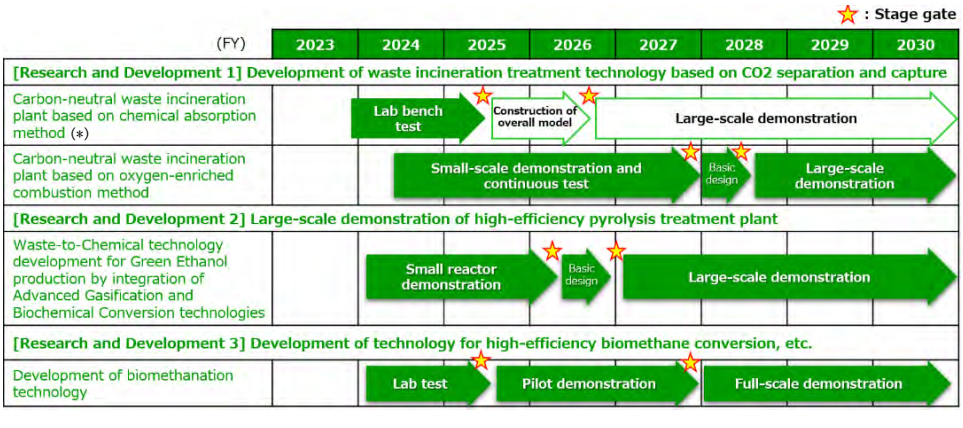
The emissions of CO_2 and methane from waste incineration and landfill have become environmental problems. To achieve carbon neutrality, it is essential to recover carbon from waste and recycle it as raw material or fuel. On the other hand, there is a problem that it is difficult to use technologies such as carbon recovery in other fields in their current state of development because the amount and properties of gas after waste treatment are unstable.

This project aims to realize a carbon-neutral carbon circulation system by (1) developing waste incineration technology assuming CO_2 separation and recovery, (2) large-scale demonstration of high-efficiency pyrolysis treatment facilities, and (3) developing high-efficiency biomethane conversion technology.[57]

Current Progress and Future Outlook

As of June 2025, it has been confirmed that progress has generally been made as planned. For each theme, laboratory tests and simulations have been conducted to obtain the data necessary for the design of demonstration test equipment and to predict the performance of large-scale facilities. Although small-scale demonstration facilities are already under construction for some research themes, large-scale demonstrations will be started for all themes from FY2026. In FY2030, we aim to establish technologies that achieve a CO_2 recovery rate of 90% or more and technologies that realize a regionally distributed treatment system that converts organic waste into biomethane, etc.[58][59]

Figure20: Expected Schedule for R&D and Social Implementation



(*) For elemental technology development and large-scale demonstrations that are deemed to be truly necessary, a new budget will be allocated and will be continued.

Concept of Impact Calculation

The emission reduction effect is calculated as the sum of the difference between the reduction in methane emission due to the reduction in landfill waste and the increase in CO_2 emission due to the increase in incineration, the CO_2 yield from CCUS, and the reduction in CO_2 emission due to the replacement of city gas with biomethane through methane fermentation and biomethanation. The economic effect of this project is estimated to be approximately 500 billion yen in 2030 as the sum of the introduction of incineration/pyrolysis facilities with CC and methane fermentation facilities. (the CO_2 emission reduction effect and the economic effect are calculated in the same way for 2050.)[60]

[57] NEDO website, "Green Innovation Fund Project: Achieving Carbon Neutrality in Waste and Resource Circulation Systems"
[58] "Green Innovation Fund project: Achieving Carbon Neutrality in Waste and Resource Circulation Systems 2025 WG Report," NEDO (June 2025)
[59] Compiled based on selected R&D themes from the "R&D and Social Implementation Plan"
[60] "R&D and Social Implementation Plan" for the "Green Innovation Fund Project: Achieving Carbon Neutrality in Waste and Resource Circulation Systems," Ministry of the Environment (October 6, 2023)

10 GI Fund Project: Development of Technology for Producing Raw Materials for Plastic Using CO_2 and Other Sources

Progress and Results of the Project

Key Achievement

Number of Supported R&D Projects

11

Environmental Improvement Effects

Global CO_2 emission reduction effect from introducing plastic raw materials produced using CO_2 generated in supported projects

Approx. 40 million t-CO_2/year (2030)
Approx. 1.5 billion t-CO_2/year (2050)

Economic Effects

Global market size of plastic raw materials using CO_2 and other inputs

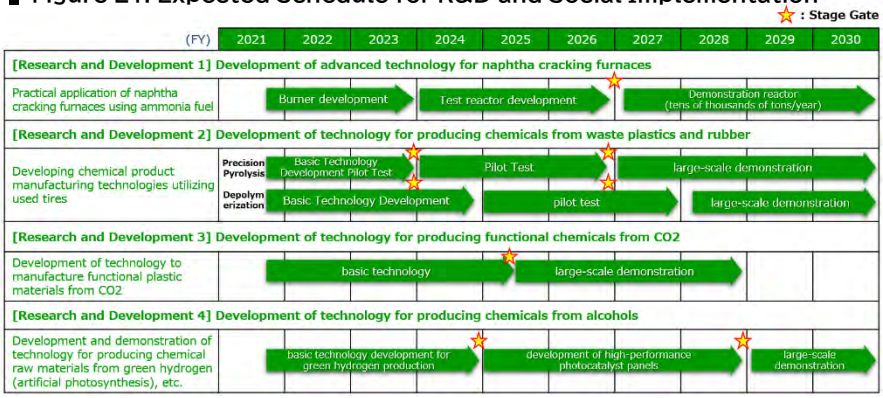
Approx. 10 trillion yen (2030)
Approx. 363 trillion yen (2050)

Objectives and Details of the Project

Carbon recycling is a technology that effectively uses CO_2 as a resource and is a key technology for realizing a carbon-neutral society. Most plastic materials are derived from naphtha, which is obtained from petroleum refining. Approximately half of the CO_2 emitted from the chemical industry comes from the process of decomposing naphtha to produce basic chemicals such as ethylene and propylene. In addition, although about 84% of waste plastics are recycled, about 57% of this is used as a heat source for power generation by incineration of waste (thermal recycling) and is ultimately emitted as CO_2. Therefore, drastic measures are required.

In this project, we will develop four carbon recycling technologies ((1) Technology for upgrading naphtha decomposition furnaces by using carbon-free heat sources, (2) Technology for producing chemicals from waste plastic and rubber, (3) Technology for producing functional chemicals from CO_2, and (4) Technology for producing chemicals from alcohols) related to the production of plastic materials.[61][62]

Figure 21: Expected Schedule for R&D and Social Implementation



Current Progress and Future Outlook

NEDO's Technology and Social Implementation Promotion Committee held meetings in July and December 2024 and January and August 2025. Stage gate reviews were conducted for 5 themes ("Development of chemical recycling technology for alcohols and olefins using CO_2, and other substances as raw materials," "Development of chemical recycling technology using waste plastics," "Development of technology to manufacture functional plastic materials from CO_2," "Development for commercialization of chemical raw material production by artificial photosynthesis,"), and all were continued with some conditions. As of September 2025, changes and course corrections are being made in each item from the initial implementation plan in the category of R&D and social implementation plan based on changes in the surrounding environment and advice from the committee members. As for the advanced technology of the naphtha cracking furnace, the development of the ammonia burner is going well, and the examination for the large-scale demonstration is progressing. The development of the technology for the production of chemicals from waste plastic and waste rubber and the technology for the production of functional chemicals from CO_2 at the laboratory and bench scale is almost finished, and the transition to the pilot test is progressing. In addition, "Development of chemical recycling technology to produce basic chemicals from mixed plastics wastes" and "Development of technology for reusing carbon from polymer products, including used tyres" have started.[63]

[61] "R&D and Social Implementation Plan" for the "Green Innovation Fund Project: Development of Technology for Producing Raw Materials for Plastic Using CO_2 and Other Sources," Manufacturing Industry Bureau, Ministry of Economy, Trade and Industry (November 2024)
[62] NEDO website, " Green Innovation Fund Project: Development of Technology for Producing Raw Materials for Plastic Using CO_2 and Other Sources"
[63] Compiled based on selected R&D themes from the "R&D and Social Implementation Plan"

Concept of Impact Calculation

For 2030, the CO_2 emission reduction effect was calculated based on the estimated production volume of olefin, green hydrogen, methanol, ethanol, carbon black, etc., if the technology is realized according to the R&D target. For 2050, the CO_2 emission reduction effect was estimated by adding the CO_2 emission reduction effect by switching the heat source of the naphtha cracking furnace to carbon-free, in addition to the emission reduction factors assumed in 2030. For the economic effect, the global market size was estimated based on the same assumption.

11 Innovative GX Technology Creation Project (GteX)

Progress and Results of the Project

Key Achievement

Number of selected R&D themes

Team-based Research
16

and Innovative Elemental Technology Research
16

Impact

[Storage batteries]

Establishment of foundational technologies for next-generation batteries

(Reference *)
CO_2 Emission Reduction Effect (Global reduction effect of EV Popularization): Approx. 460 - 570 million t-CO_2/year (2047)

Economic Effect (Global Sales):
Approx. 53 trillion yen (Innovative Storage Battery)
Approx. 47 trillion yen (Stationary Storage Battery)
(2050)

[Hydrogen]

Establishment of advanced technologies related to hydrogen production, storage, and utilization

(Reference *)
CO_2 Emission Reduction Effect (Domestic emission reduction effect from the transition to green hydrogen): Approx. 5 million t-CO_2/year (2030)

Economic Effect
(International hydrogen trading market size):
Approx. 5.5 trillion yen (2050)

[Bio-manufacturing]

Establishment of technologies that enhance CO_2 fixation and enable the development of innovative microorganisms

(Reference *)
CO_2 Emission Reduction Effect (Global emission reduction effects through product practical application and commercialization): Approx. 4.21 billion t-CO_2/year (2050)

Economic Effect (Global market size):
Approx. 199.4 trillion yen (2050)

*Since this project promotes basic research, the effects of reducing CO_2 emissions and economic effects are described from the R & D plan of this project for reference.

Objectives and Details of the Project

In order to realize GX, it is essential not only to introduce existing technologies but also to create new technologies. Therefore, it is important to promote R & D and human resource development through collaboration between industry and academia. This project aims to raise innovative technologies with low TRL to a level at which companies can make full-fledged investment decisions. It supports R & D and human resource development at universities and national research institutes. The aim is not only to produce excellent academic results, but also to strengthen networks and research environments of researchers in academia in Japan and abroad, and to improve TRL for social implementation. Specifically, the project identifies "battery storage," "hydrogen," and "bio manufacturing" as fields in which Japanese academia can make significant contributions in the future, and supports R & D conducted in an all-Japan "team" style that promotes materials development, engineering, evaluation, and analysis in a unified and integrated manner.[64] In addition, the project promotes business collaboration with NEDO in order to seamlessly link basic and fundamental research in academia to technology development, demonstration, and social implementation in companies.[65] This project will be conducted as a commissioned project.

Figure 22: Examples of innovative GX technologies and outline of support for technology creation

[64] The region will be revised as necessary in light of revisions to the Basic Policy for GX Realization, industry trends, R & D trends, and corporate investment intentions.
[65] Japan Science and Technology Agency (JST) "GteX (Innovative GX Technology Creation Project)"

Current Progress and Future Outlook

In FY2023, the Japan Science and Technology Agency (hereinafter referred to as JST) adopted 15 R & D projects for team-based research (7 for storage batteries, 3 for hydrogen, and 5 for bio manufacturing). In FY2024, we adopted 1 additional R & D project for team-based research in the storage battery area, and as of FY2025, we are currently working on a total of 16 R & D projects.

In addition, in FY2023, we adopted 16 R & D projects for innovative elemental technology research (6 for storage batteries, 5 for hydrogen, and 5 for bio manufacturing) in each area to be conducted in a single Fiscal year, and published the R & D project completion reports and post-evaluation (4 rated S, 8 rated A, and 4 rated B) after the projects were completed. Some of the R & D projects that produced excellent results were combined with team-based research after the completion of R & D, and continue to be conducted.

Concept of Impact Calculation

Since this project is mainly intended to support technical research at the basic research stage, the results of R & D projects in each field are described qualitatively. In the storage battery field, we aim to establish basic technologies for next-generation storage batteries by constructing a database to search for new battery systems. In the hydrogen field, we aim to establish advanced technologies related to hydrogen production, storage, and utilization toward the realization of a hydrogen society. In the bio manufacturing field, we aim to improve CO_2 immobilization through DNA synthesis and genome editing technologies, diversify the types of chemicals that can be produced, and establish a foundation for the development of unknown metabolic pathways and innovative microorganisms that lead to improved productivity.

Column

Innovative GX Technology Creation Project (GteX)

GteX aims to contribute to the realization of GX by fully leveraging Japan's strong potential and accumulated capabilities in basic research in academia, and by supporting research and development as well as human resource development at universities and national research and development agencies. Through these efforts, the program seeks to generate innovative technological seeds and foster human resources. It is operated using a fund established at JST through the FY2022 Second Supplementary Budget. While the primary beneficiaries are universities and national research and development agencies, participation by companies and other entities is also allowed when necessary for early social implementation.

As the organization with overall responsibility for the program, JST has established the Innovative GX Technology Promotion Committee, chaired by the Program Director (PD). JST has also appointed Program Officers (POs) responsible for each of the thematic areas of "storage batteries," "hydrogen," and "bio-manufacturing," and is operating the program based on the basic policy formulated by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the R&D policy for each area.

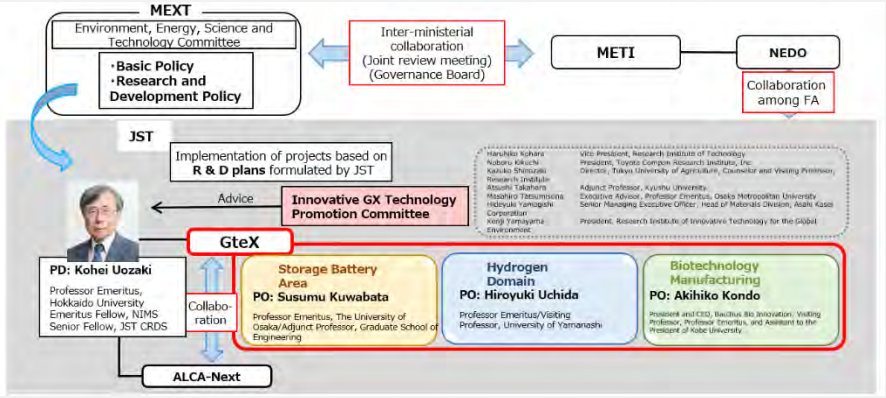
In FY2023, JST selected R&D projects under two schemes: "team-based research," in which a large, all-Japan R&D team integrating elemental technology development carries out research and development; and "innovative elemental technology research," in which individual researchers or very small teams conduct one-year feasibility studies.

The research period for team-based research is, in principle, up to five years. During the research period, stage-gate evaluations are conducted by the PD/PO together with external experts from industry and academia, and strict decisions are made regarding continuation or termination of projects, increases or decreases in R&D funding, and revisions to the R&D structure. As a rule, these stage-gate evaluations are carried out in the third year after the start of the program (FY2025), the fifth year (FY2027), and so on. Depending on the results, the research period may be extended for up to a maximum of ten years. In conducting the evaluations, JST adopts a multifaceted perspective, assessing not only recent research progress but also the potential contribution to GHG emission reductions and the potential for future market development and investment mobilization, and revising team structures within each area as necessary.

In addition, "ALCA-Next (Advanced Low Carbon Technology Research and Development Program)," a complementary project to GteX, targets a broader range of fields and aims to generate game-changing technologies through small teams of researchers. Under the same PD, the two programs work in close coordination to maximize overall outcomes. [66]

GI Fund Projects, which is also supporting technology development aimed at achieving carbon neutrality by 2050, takes into account the needs of industry and provides continuous support to companies and organizations, from R & D to demonstration and social implementation. It is complementary to GteX, which approaches bottlenecks that are expected to be solved mainly through ideas from academia. It holds joint workshops and works together to bridge research issues.

Figure 23: Operating System of Innovative GX Technology Creation Project (GteX)



[66] Japan Science and Technology Agency (JST) "ALCA-Next (Advanced Low Carbon Technology Research and Development Program) "

12 Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure

Progress and Results of the Project

Key Achievement

Number of supported organizations

8 organizations

Environmental Improvement Effects

CO_2 emission reduction effect from the deployment of optical and electrical fusion technologies at data centers in Japan

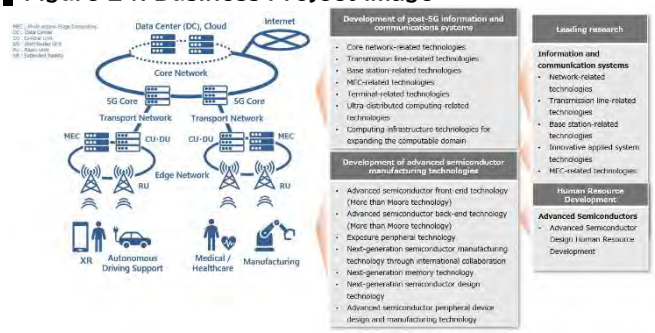
Approx. 3.54 million t-CO_2/year (2032 – 2041)

Objectives and Details of the Project

Post-5G refers to communications technology with enhanced functions, such as ultra-low latency and multiple simultaneous connections, compared to the current fifth-generation mobile communications systems (5G). It is expected to be used in a variety of industrial applications, such as factories and autonomous driving. Improving the energy efficiency of post-5G information and communications systems (post-5G information and communications systems) will have a significant effect on saving energy and reducing power consumption in all fields, including data centers, where power demand is expected to grow significantly.

For this reason, in FY2023, JCTBs commissioned and subsidized some of the themes listed in (2) of the Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure ((1) Development of post-5G information and communications systems, (2) Development of advanced semiconductor manufacturing technologies, (3) Leading research, and (4) Human resource development) as particularly conducive to GX.[67] Specifically, in order to achieve significant energy savings in semiconductors, JCTBs are supporting the development of next-generation technologies such as photoelectric fusion technology, which converts electrical wiring into optical wiring. Incidentally, the maximum amount of subsidy and commission expenses for each theme of this project is shown in the R & D Plan, [68] and the subsidy rates are 2/3, 1/2, and 1/3.

Figure 24: Business Project image



Current Progress and Future Outlook

In FY2023, 3 themes (Optical Chiplet Mounting Technology, Photoelectric Fusion Interface Memory Module Technology, Definite Delay Computing Infrastructure Technology) were adopted based on the Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure established by the Ministry of Economy, Trade and Industry. In principle, the project period is 5 years or less (3 years or less in some cases). The status of R & D achievement for each theme will be ascertained by NEDO and periodically evaluated by a committee composed of external experts, and development goals will be revised as necessary. In addition, a stage-gate review will be conducted approximately at the midpoint between the start and the end of R & D, taking into consideration the status of the implementer's commitment to implementing the research results toward the realization of GX. As a result of a stage-gate review by external experts, the continuation of the defined-delay computing infrastructure technology, which was evaluated 1.5 years after its start, was approved. In this report, the 3 themes adopted in FY2023 whose impact can be examined at present are reported. The status of adoption of additional themes will be announced on the project website as needed.

Concept of Impact Calculation

When the technologies of each research and development theme are introduced into the data center (DC) infrastructure, the emission reduction effect of the power consumption reduction of each technology on the DC power consumption is calculated.

[67] NEDO HP "Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure"
[68] Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure - R & D plans

13 Demonstration Reactor Development Project for High-Temperature Gas Reactor

Progress and Results of the Project

Key Achievement

Total number of JAEA, MHI, and partner companies

19 companies

Environmental Improvement Effects

CO_2 emission reduction effect per ton of decarbonized hydrogen produced using high-temperature heat from high-temperature gas-cooled reactors

Approx. 7.22 t-CO_2/t
(after establishment of HTGR)

Objectives and Details of the Project

To realize a carbon-neutral society by 2050, decarbonization of the industrial sector, which accounts for about 25% of total domestic emissions, is indispensable. To achieve this, it is essential to construct a large-scale and low-cost hydrogen supply infrastructure. The HTGR, which is one of the next-generation advanced reactors, can supply high-temperature heat above 800°C with excellent safety, and is expected to have a wide range of heat applications, including industrial applications such as stable and large-scale carbon-free hydrogen production using high-temperature heat.[69] Aiming at the development of the demonstration reactor, this project (1) examines the entire supply chain, including design and construction of the HTGR, development of elemental technologies, and fuel production. (2) develops connection technologies and evaluation methods between the HTGR and hydrogen production facilities through hydrogen production tests using the HTTR.[70][71] This program is implemented as a commissioned project.

Figure 25: High Temperature Gas-cooled Reactor Demonstration Image

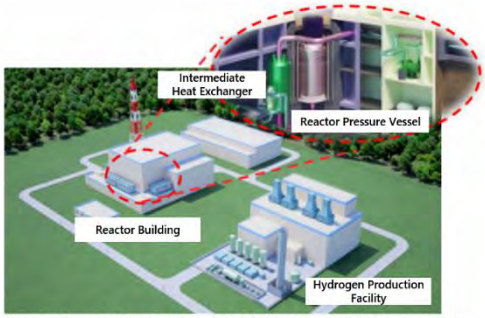


Illustration of a High-Temperature Gas-Cooled Reactor (HTGR) Demonstration
(Plans include carbon-free hydrogen production via methane steam reforming once the technology is established.)

Current Progress and Future Outlook

① In the demonstration reactor project, Mitsubishi Heavy Industries, Ltd. was selected as a core company for the HTGR demonstration reactor development in July 2023. The thermal output of the demonstration reactor will be approximately 6 times that of the HTTR, and design and R & D of the reactor are currently underway.
② With regard to hydrogen production tests using the HTTR, in March 2025, the Japan Atomic Energy Agency (hereinafter referred to as "JAEA") submitted to the Nuclear Regulation Authority an application for permission to change the installation of the reactor in order to modify the reactor facilities in connection with the HTTR and hydrogen production facilities, based on the "Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors" in order to actually produce hydrogen using the heat of the HTTR.

In the future, the design and R & D of the HTGR will be carried out to realize the start of operation in the 2030s, and the hydrogen production test using the HTTR will be started in 2028. The concrete progress and future prospects of each R & D item will be confirmed and announced periodically in the "Innovative Reactor Working Group, Nuclear Power Subcommittee, Power and Gas Business Subcommittee, Advisory Committee on Natural Resources and Energy."

Concept of Impact Calculation

The impact of this project is calculated as the "CO_2 emission reduction effect" resulting from the conversion from the conventional hydrogen production method to the production method using HTGR, which does not emit CO_2 (While conventional hydrogen production methods (e.g., natural gas reforming) emit CO_2, the hydrogen production method using a high-temperature gas-cooled reactor (e.g., high-temperature steam electrolysis) that this project aims to establish does not emit CO_2 during the production process.).

[69] High Temperature Gas-cooled Reactor (HTGR) is a nuclear reactor that uses highly heat-resistant graphite and SiC ceramic materials as the core and fuel components, and helium gas as the coolant. It can extract heat at a much higher temperature (about 900°C) than light water reactors (which can extract heat at about 300°C).
[70] Abbreviation for the High Temperature Engineering Test Reactor.
[71] JAEA, "Progress of the Fast Reactor and High Temperature Gas-cooled Reactor Demonstration Reactor Project" (October 2024)

14 Demonstration Reactor Development Project for Fast Reactor

Progress and Results of the Project

Key Achievement

Total number of JAEA, MHI, MFBR and partner companies

45 companies

Environmental Improvement Effects

Reduction ratio of high-level radioactive waste

Volume reduced to 1/7
(after fast reactor operation starts)

Environmental improvement Effects

Half-life of high-level radioactive waste

Reduced from 100,000 to 300 years
(after fast reactor operation starts)

Objectives and Details of the Project

As the demand for electricity is expected to increase in the future, it is essential to make full use of nuclear power as a decarbonized power source. Fast reactors are expected to contribute to the decarbonization of energy supply as a decarbonized power source, and to enhance the effectiveness of the nuclear fuel cycle by reducing the volume of radioactive waste, reducing the degree of toxicity, and effectively using resources by reacting neutrons with fuel at high speed. Research and development are underway in other countries, and in Japan, the development of fast reactors is being steadily promoted in 7th Strategic Energy Plan.

This project aims to accumulate technical data and knowledge necessary for the design of fast reactors by expanding the development of elemental technologies related to infrastructure improvement and safety improvement for common issues of fast reactors, in order to maintain the technological foundation of fast reactor development in Japan and to obtain the prospect of commercialization including economy. This program is implemented as a commissioned project.

Figure 26: Image of the fast reactor demonstration plant

Current Progress and Future Outlook

In July 2023, a sodium-cooled tank-type fast reactor using liquid sodium was selected as the reactor concept for the demonstration reactor development, and Mitsubishi Heavy Industries, Ltd (MHI). was selected as the core company. In July 2024, the Integrated Research and Development Organization was established in JAEA to complete the whole R&D of the reactor and fuel cycle to a certain level, and to integrate them into the basic design. In addition to the improvement of the large-scale sodium test facility, the demonstration plan of the components and systems of the demonstration reactor has been organized, and the necessary facility improvement plan has been compiled. In addition, a dialogue with the Nuclear Regulation Authority has been started to foster a common understanding on severe accident evaluation methods and seismic isolation technology for fast reactors. In addition, the fuel cycle technology has been studied for the concrete study of fuel technology around FY2026. Based on the strategic roadmap revised in FY2022, the conceptual design and R&D for the transition to the basic design and licensing phase will be carried out around FY2028 toward the realization of the start of operation of the demonstration fast reactor in the 2040s. After the overall system including fuel fabrication facilities and reprocessing facilities has been studied, the concrete study of fuel technology will be carried out around FY2026. The progress and future prospects of each R&D item will be discussed at the "Innovative Reactor Working Group, Nuclear Power Subcommittee, Power and Gas Business Subcommittee, Advisory Committee on Natural Resources and Energy" and the Strategic Working Group of the Japan Fast Reactor Development Council.[72]

Concept of Impact Calculation

The fast reactor being developed in this project contributes to volume reduction and toxicity reduction of radioactive waste and effective use of resources, in addition to the emission reduction effect as a decarbonized power source. The impact on the environment is smaller than that of conventional light water reactors. Therefore, the amount and half-life of high-level radioactive waste are presented as impacts of this project. The outline of each is shown below.

【Volume of high-level radioactive waste】Because uranium and plutonium, which account for the majority of spent fuel, are recovered and used in a fast reactor, the effect of volume reduction is greater than in the case of direct disposal, and the volume is reduced to 1/7 by volume.[73]

【Half-life of high-level radioactive waste】It takes 100,000 years to reduce the radioactivity of high-level radioactive waste to the same level as natural uranium when it is disposed of directly, but it is shortened to 300 years when it is combusted in a fast reactor.[74]

[72] JAEA, "Progress of the Fast Reactor and High Temperature Gas-cooled Reactor Demonstration Reactor Project" (October 2024)
[73] the Ministry of Economy, Trade and Industry, "Initiatives for Establishment of Nuclear Fuel Cycle and Future Considerations" (June 25, 2024)
[74] Same as the above

Column

Renewable energy and nuclear power in Japan's GX policy

Japan's energy self-sufficiency rate is around 10%, which is extremely low by international standards. Because Japan depends almost entirely on overseas sources for fossil fuels, changes in the global energy situation have a major impact on people's daily lives and on industry. In the current context, where economic security concerns are growing—for example, due to Russia's invasion of Ukraine and rising tensions in the Middle East—securing power sources that contribute to a stable energy supply is critically important. Moreover, electricity demand is expected to increase in the future due to DX and GX, and securing decarbonized power sources will become even more important for both achieving decarbonization and supporting Japan's economic growth. From this perspective, the 7th Strategic Energy Plan, approved by the Cabinet in February 2025, and the GX2040 Vision clearly state that it is extremely important not to engage in a binary debate of "renewables versus nuclear," but rather to make maximum use of both renewables and nuclear power.

Regarding renewable energy, the relevant ministries and agencies are to work together to strengthen policy measures to promote its maximum deployment, on the fundamental premise of S+3E, which is the basic principle of energy policy. In addition, to expand the use of domestically produced renewable energy and improve technological self-sufficiency, efforts are being advanced to support the development and social implementation of next-generation renewable energy technologies such as next-generation solar cells and floating offshore wind power.

At the same time, the use of nuclear power, which constitutes the other pillar of decarbonized power, is being reassessed not only in Japan but also internationally. For example, at COP28 held in December 2023, 22 countries including Japan[75] issued a joint declaration to "triple global nuclear power generation capacity by 2050 compared to 2020," and for the first time, nuclear power was explicitly recognized in the outcome document as one of the solutions to climate change. In recent years, the US and the UK have announced large-scale support measures for nuclear power, and there have been moves toward a return to nuclear utilization in countries such as Italy, Spain, Vietnam, and Indonesia, where the governments had previously decided to phase out nuclear power plants, as well as moves in nuclear-newcomer countries toward introducing nuclear power. These developments reflect rising expectations for nuclear energy.

That said, the fundamental precondition for the use of nuclear power is the assurance of safety. The 7th Strategic Energy Plan states that Japan will accelerate the restart of nuclear power plants on the premise of ensuring safety, and will proceed with the replacement of existing reactors with next-generation advanced reactors that incorporate new safety mechanisms to reduce accident risks. For example, as a safety mechanism of next-generation advanced reactors, high-temperature gas-cooled reactors (HTGRs) use natural air circulation and thermal radiation for cooling, allowing the cooling system to continue functioning even in the event of an accident, and are therefore considered to have a high level of safety. Discussions on safety extend not only to the operational phase, but also to back-end measures such as the nuclear fuel cycle, including reprocessing of spent fuel, and the final disposal of high-level radioactive waste. Disposal facilities for high-level radioactive waste are under close international scrutiny; for instance, under the EU Taxonomy, it is required to have a plan that includes concepts and technical solutions for waste management. In Japan, the Strategic Energy Plan clearly states that the government will take the lead, based on the "Basic Policy on the Final Disposal of Specified Radioactive Waste," in working toward the realization of final disposal, and literature surveys and other processes toward site selection for the disposal facility are underway.

Next-generation advanced reactors offer multiple advantages in addition to providing decarbonized electricity and enhancing safety: they can serve as distributed energy sources, help reduce the volume and radiotoxicity of radioactive waste, and supply carbon-free hydrogen and heat. For example, HTGRs can provide high-temperature heat of 800°C or higher, enabling cascade use of heat for hydrogen production and power generation. They are expected to contribute to decarbonizing basic materials industries such as steel and chemicals, where large-scale, economical, and stable supplies of hydrogen are needed. Fast reactors, meanwhile, are characterized by their ability to reduce the volume and radiotoxicity of high-level radioactive waste and to make more efficient use of resources; they can shorten the time required for the potential radiotoxicity of high-level radioactive waste to decline to levels comparable to those in nature from 100,000 years to about 300 years.

In this report, in light of these characteristics, we present as environmental effects, for the HTGR demonstration reactor project, the "CO_2 emission reduction effect through decarbonized hydrogen production using high-temperature heat," and for the fast reactor demonstration project, the "reduction ratio of high-level radioactive waste," among other indicators.

[75] The following day, Armenia also joined, bringing the number of supporting countries to 23.

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

Progress and Results of the Project

Key Achievement

Number of certified supply-security plans approved in FY2023 among the currently certified supply-security plans

14 plans

Environmental Improvement Effects

CO_2 emission reduction effect assuming that all storage batteries manufactured at supported plants are installed in BEVs

Approx. 13.5 million t-CO_2/year
(after operation of supported plants)

Economic Effects

Total project cost under the certified supply-security plans

Approx. 852.3 billion yen

Objectives and Details of the Project

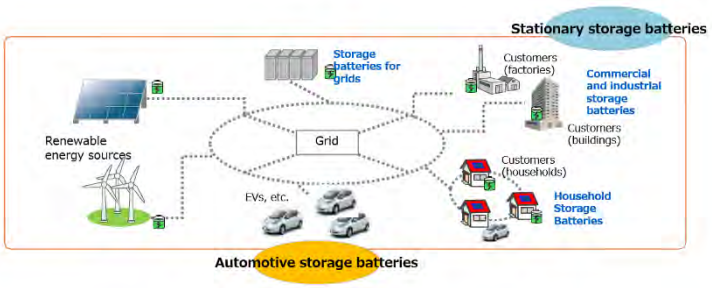
Storage batteries are the key to achieving carbon neutrality by 2050 and are an important commodity on which people's lives and economic activities depend in an electrified and digitalized society. This project aims to strengthen the manufacturing supply chain of storage batteries in our country and ensure stable supply, as well as the following initiatives:

(1) Capital Investment Support for Storage Batteries, Parts and Materials, and Manufacturing Equipment: In order to strengthen the domestic manufacturing infrastructure for storage batteries, parts and materials, and manufacturing equipment, subsidies will be provided to businesses that develop large-scale manufacturing infrastructure, parts and materials whose production is currently limited in Japan, and manufacturing infrastructure using unique technologies.

(2) Support for Technology Development of Storage Batteries, Parts and Materials, and Manufacturing Equipment: The government will provide subsidies to businesses that develop technologies for establishing the superiority and indispensability of storage batteries, parts and materials, and manufacturing equipment, decarbonizing manufacturing processes, managing data in manufacturing processes, and improving productivity.

*The maximum subsidy rate is 1/3 for capital investment and 1/2 for technology development. However, the maximum subsidy rate is 1/2 for capital investment related to the development of manufacturing infrastructure for storage battery manufacturing equipment by SMEs.

Figure 27: Diverse Usage Scenes for Storage Batteries



Current Progress and Future Outlook

Of the current approved supply assurance plans, 14 supply assurance plans were approved in FY2023 as projects eligible for support from the JCTBs in FY2023. There are 2 plans to expand the production capacity of storage batteries through the development of production infrastructure and the introduction, development, and improvement of production technologies. The other plans are mainly to expand the production capacity of parts and materials. The outline of the plan to expand battery production capacity is as follows. The implementation status is checked every fiscal year through regular reports on the approved supply assurance plan by the business operators. In order to secure a manufacturing base of 150 GWh/year by 2030, this project continues to encourage private investment.[76]

[76] the Ministry of Economy, Trade and Industry, "Essential for a Green Society Support Project for Strengthening the Manufacturing Supply Chain of Batteries" June 2025.

Figure 28: Overview of Major Certified Supply Assurance Plans

Business Operator	Item	Type of Initiative
Honda Motor Co., Ltd. GS Yuasa Co., Ltd. Blue Energy Co., Ltd. Honda・ GS Yuasa Co., Ltd. EV Battery R&D	In-vehicle and stationary lithium-ion batteries	・Development of production infrastructure ・Introduction, development, and improvement of production technologies
Toyota Motor Corporation / Prime Planet Energy & Solutions Corporation / Toyota Battery Corporation / Toyota Industries, Ltd.	・Automobile batteries for BEVs ・Automobile batteries for newly structured BEVs ・Next-generation automotive batteries	・Development of production infrastructure ・Introduction, development, and improvement of production technologies

Concept of Impact Calculation

The CO_2 reduction contribution is estimated based on the assumption that the total production capacity of storage batteries provided by 2 of the current certified supply assurance plans, which were certified in FY2023, will be 45GWh/year. Assuming that all of the maximum amount of storage batteries produced in 1 year at the manufacturing facilities established by the above 2 business plans will be installed in domestic BEVs, the CO_2 reduction contribution assumed during the life cycle of vehicles equipped with BEVs due to the replacement of internal combustion engine vehicles with EVs is calculated as the environmental improvement effect. As an economic effect, approximately 852.3 billion yen, which is the total amount of subsidies for the 14 supply assurance plans and the company's own funds, is calculated.

16 Support for Strengthening Supply Chain Resilience of Critical Materials in Response to Economic and Environmental Changes: Project for Strengthening the Semiconductor Manufacturing Supply Chain for Achieving GX through Improved Power Performance

Progress and Results of the Project

Key Achievement

Number of companies subsidized in FY2023

3 companies

Environmental Improvement Effects

CO_2 emission reduction effect assuming that all power semiconductors manufactured at supported plants are installed in EVs

Approx. 1.74 million t-CO_2/year
(after operation of supported plants)

Economic Effects

Total project cost under the certified supply-security plans

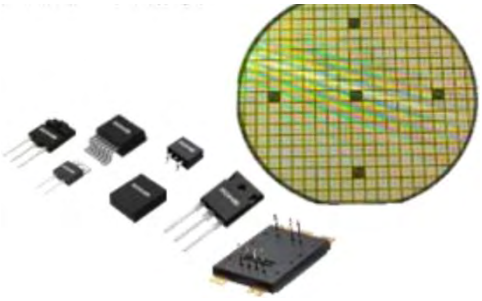
Approx. 419.2 billion yen

Objectives and Details of the Project

Semiconductors are becoming increasingly important due to advances in digitalization and green innovation. In particular, power semiconductors used to control and supply electric energy are essential from the perspective of achieving carbon neutrality and economic security.

This project is based on the Economic Security Promotion Act, and provides support to businesses that intend to secure a stable supply of semiconductors by granting approval to plans for efforts to secure a stable supply of semiconductors, etc. (supply security plans) that are prepared and submitted to the Minister of Economy, Trade and Industry. the Ministry of Economy, Trade and Industry's subsidy program for semiconductor manufacturing supply chains began in FY2020 and continues to provide support. In particular, power semiconductors, SiC wafers, and other semiconductor component materials that are expected to reduce CO_2 emissions when used in EVs are targeted by JCTBs from the perspective of GX. Specifically, if each of the subsidy requirements (Difficult to achieve through independent efforts by the private sector, exceeding a certain scale of projects, etc.) is met, subsidies will be provided at a subsidy rate of 1/3 for capital investment expenses that fall under the subsidy category.

Figure 29: Image of a power semiconductor (provided by the Certified Business Operator)



Current Progress and Future Outlook

In FY2023, from JCTBs, JCTBs appropriated funds for 2 of the semiconductor supply assurance plans approved by the Ministry of Economy, Trade and Industry in FY2023 (One SiC wafer and one power semiconductor) that are expected to reduce CO_2 emissions. Based on these plans, subsidies were provided to 3 companies that produce SiC wafers and power semiconductors.[77]

Concept of Impact Calculation

Power semiconductors are used in various applications. In the 2 projects approved in FY2023 and funded by JCTBs, production capacity of power semiconductors (SiC and Si) and SiC wafers is increased. Although power semiconductors are used in a wide range of applications, for the purpose of impact assessment, the calculation is based on the assumption that all power semiconductors and SiC wafers produced by the implementation of each project are installed in EVs. In this case, the annual contribution of CO_2 reduction expected by energy efficiency improvement of automobiles is shown as the environmental improvement effect. As the economic effect, the total amount of subsidies for the 2 supply assurance projects and the company's own funds, etc., is approximately 419.2 billion yen.

[77] For information on each company's business plans and future prospects, see "Semiconductors (METI/the Ministry of Economy, Trade and Industry)."

17 Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation

Progress and Results of the Project

Key Achievement

Number of subsidized projects

16 projects

Environmental Improvement Effects

Expected annual CO_2 emission reduction effect of upgrading to energy-saving facilities and equipment

Approx. 3,300 t-CO_2/year (from FY 2025)

Economic Effects

Total investment amount by supported businesses

Approx. 2.7 billion yen

Objectives and Details of the Project

This project aims to achieve an energy saving of 21.55 million kl among the energy saving measures taken by the industrial and commercial sectors (approximately 27 million kl) in the energy supply and demand forecast for FY2030 by supporting the introduction of advanced energy saving facilities and equipment that contribute to the replacement of factories and workplaces with facilities and equipment with high energy saving performance, collaboration among multiple businesses, and conversion to non-fossil energy.[78] This project covers the following 3 business areas, and JCTBs used funds for all of these projects in FY2023.[79]

(A)Advanced project: Support for the introduction of advanced equipment that can achieve significant energy saving in factories and workplaces

(B)Custom-made project: Support for energy saving initiatives such as equipment renewal and process improvement, including the introduction of custom-made equipment that requires individual design

(D)Energy demand optimization project: Support for more efficient and effective energy saving initiatives such as the introduction of EMS control and high-efficiency equipment and operational improvement based on plans prepared jointly with energy management companies, etc.[80]

In the case of (A), the subsidy rate is 2/3 for SMEs and 1/2 for large enterprises. (B), the maximum amount of subsidies is 1/2 for SMEs and 1/3 for large enterprises. For both (A) and (B), the maximum amount of subsidies per fiscal year is 1.5 billion yen for energy-saving projects and 2 billion yen for non-fossil fuel projects, and the minimum amount is 1 million yen for both. (D), the maximum amount of subsidies per fiscal year is 100 million yen, and the minimum amount is 1 million yen for the entire project.

In FY2023, 149 projects were selected, of which 16 single-year projects were eligible for funding from JCTBs in FY2023. For multi-year projects, funding will be applied from JCTBs in FY2024.

In this project, it is confirmed that the funds are being used appropriately based on the project plan even after the grant, and the energy-saving effect is verified after the project is completed.

Concept of Impact Calculation

For 16 projects that utilized JCTBs in FY2023, the annual energy saving expected by the renewal of energy-saving facilities and equipment was calculated, and the CO_2 emission reduction effect realized by this was estimated. Regarding the economic effect, the total investment amount of the subsidized enterprises was estimated.

[78] the Ministry of Economy, Trade and Industry, "Outline of FY2022 supplementary budget (PR material)," December 2022.
[79] (C)Subsidy for the installation of designated facilities is provided through separate budget projects.
[80] "FY2022 supplementary budget for energy conservation investment promotion and support for demand structure transformation" from the Environment Creation Initiative HP

18 Grant for Decarbonization Transition Acceleration for Specific Regions (microgrid-related projects utilizing privately-owned distribution lines and other related initiatives)

Progress and results of the project

Key Achievement

Number of supported local governments

4 local governments

Environmental Improvement Effects

CO_2 emissions reduction effect over the five-year project plan period for supported Decarbonization Leading Areas

Approx. 342,000 t-CO_2/year
(5-year project period)

Economic Effects

Total project cost for initiatives in leading decarbonization areas Efforts in decarbonization leading areas
Total project cost

Approx. 3.5 billion yen

Objectives and Details of the Project

This grant is one of the "Regional Decarbonization Promotion Grants" promoted by the Ministry of the Environment. The "Regional Decarbonization Promotion Grants" support local decarbonization initiatives for local governments that are actively working together with the private sector to achieve decarbonization. Among these, regions that are making pioneering efforts toward decarbonization in accordance with regional characteristics are selected as "Decarbonization Leading Areas, [81]" and part of the expenses necessary for the projects is provided (90 proposals from 119 municipalities in 40 prefectures nationwide have been selected as of September 2025). Among these, this grant will support the introduction of major decarbonization products and technologies (renewable energy, energy conservation, and livestock energy) that are highly effective in reducing emissions, targeting "microgrid-related projects utilizing privately-owned distribution lines implemented by local governments" in Decarbonization Leading Areas. In principle, the grant rate is 2/3, but some local governments whose FY strength index is below the national average (0.51) receive 3/4 (maximum grant of 5 billion yen).

Figure 30: Grants for the Promotion of Regional Decarbonization

	(1)Regional decarbonization transition and renewable energy promotion grants		(2)Specific regional decarbonization transition Acceleration grant 【GX】
Business category	Decarbonization leading regional development project	Acceleration project for priority measures	
Grant requirements	• Be selected as a leading decarbonization area.	• Install more than a certain number of renewable energy power generation facilities. • Achieve net zero CO2 emissions from electricity consumption in office operations by FY 2030.	• Be selected as a first decarbonization area.
Target projects	**1)Projects to introduce equipment to reduce CO2 emissions** **2)Projects to promote effectiveness**	①At least two of (1) and (2) must be implemented ① Rooftop and other self-consumption solar power generation ② Location of renewable energy that coexists with and benefits local communities ③ Thorough energy conservation in commercial buildings, etc., and induction of ZEB conversion during renovation, etc. ④ Improvement of energy-saving performance of houses and buildings ⑤ Zero-carbon drive	**Private sector benefit-type self-managed line microgrid, etc.** Support will be provided for the introduction of renewable energy, energy-saving, and energy storage facilities that are highly effective in reducing greenhouse gas emissions in regions where private-public partnerships will be used to construct self-operated microgrids that benefit private businesses.

Current Progress and Future Outlook

In FY2023, JCTBs provided subsidies for microgrid-related projects utilizing privately-owned distribution lines implemented by 4 local governments selected as decarbonization leading areas: Tsukuba City in Ibaraki Prefecture, Hidaka Village in Kochi Prefecture, Ikusaka Village in Nagano Prefecture, and Nagoya City in Aichi Prefecture. The themes of each local government are as follows. In Tsukuba City, high-efficiency lighting equipment has already been installed and put into operation.

Figure 31: Theme for each local government

Tsukuba City, Ibaraki Prefecture	Acceleration of super cities brought about by decarbonization, creation of startups, and invigoration of central urban areas by attracting companies
Hidaka Village, Kochi Prefecture	Decarbonization of specialty agricultural products, improvement of added value of facilities and horticulture, and realization of renewable energy expansion and strengthening of resilience in cooperation with local communities

[81] Decarbonization Leading Areas are regions that achieve net-zero CO_2 emissions from electricity consumption in the consumer sector (household and business and other sectors) toward carbon neutrality by 2050, and achieve reductions in other greenhouse gas emissions, including those from the transportation sector and heat use, that are consistent with our country's FY2030 targets according to regional characteristics.

Ikusaka Village, Nagano Prefecture	Connecting, Maintaining, and Mourning Ikusaka: Aiming to Build a Sustainable Rural Model
Nagoya City, Aichi Prefecture	Decarbonized Compact City Model Realized in Redevelopment Areas

The Ministry of the Environment follows up on the initiatives of the decarbonized leading areas every year, and carries out an interim evaluation about 3 years after the selection, and reviews the plans to ensure the modelability. Furthermore, at the end of the final year of the plan, the results of the initiatives are reported, and the evaluation committee consisting of external experts evaluates and analyzes the initiatives by holding hearings as necessary. The plans for the decarbonized leading areas are generally 5 years, and the necessary costs for the future microgrid-related projects on the privately-owned distribution lines will continue to be covered by the JCTBs issued after FY2024.

Concept of Impact Calculation

In FY2023, JCTBs calculated the CO_2 emission reduction effects based on the plans of the decarbonization leading areas for microgrid-related projects utilizing privately-owned distribution lines implemented by 4 local governments. In addition, the total project costs were shown as economic effects.

As shown in the project description, only the construction of microgrids is covered by the FY2023 JCTBs. However, decarbonization leading areas are expected to promote regional decarbonization and economic growth by combining the entire regional decarbonization promotion subsidy project. For this reason, the impact is not limited to the construction of microgrids.

Efforts in decarbonization leading areas are planned over multiple years to install private lines, storage batteries, renewable energy power generation facilities, high-efficiency air conditioning equipment, and high-efficiency lighting equipment. Of these, the estimated CO_2 emission reduction effect of the facilities introduced and put into operation by FY2024 in these 4 local governments is approximately 1,082t-CO_2/year in total.

19 Subsidy for Promoting the Introduction of Clean Energy Vehicles

Progress and Results of the Project

Key Achievement

Number of subsidized vehicles

153,882 vehicles

*Total number of vehicles subsidized for FY2022 supplementary and FY2023 initial projects.

Environmental Improvement Effects

Emission reduction effect of subsidized electric vehicles

Approx. 95,000 t-CO_2/year (FY2023)

*Total for FY2022 supplementary and FY2023 initial projects

Economic Effects

Public-private investment amount based on the number of units actually subsidized

Approx. 589.4 billion yen

*The amount obtained by multiplying the number of subsidized units under the FY2022 supplementary budget and the FY2023 initial budget projects by the minimum unit cost for each vehicle type

Objectives and Details of the Project

The transport sector accounts for about 20% of Japan's carbon dioxide emissions, and the automobile sector accounts for about 90% of the transport sector. In order to achieve carbon neutrality by 2050, it is important to spread clean energy vehicles with superior environmental performance.

For this reason, the introduction of EVs and other vehicles in Japan is being promoted, and Subsidy for Promoting the Introduction of Clean Energy Vehicles (CEV Subsidy) has been launched. In this project, part of the purchase cost of EV and other passenger vehicles will be subsidized in order to promote price reduction through the creation of demand and mass-production effects, as well as to encourage companies to invest in production facilities and research and development in anticipation of expanding demand. The amount of the subsidy is determined by comprehensively evaluating evaluation items for each type of vehicle newly registered, and the upper limit varies by type. In FY2023, the upper limit of the subsidy is increased for EV and PHEV passenger vehicles that meet the conditions that they have an external power supply function and are subject to the Act on the Rational Use of Energy (Energy Conservation Act) Top Runner System's 2030 fuel efficiency standards (type-designated vehicles).

Figure 32: Example vehicles to support

Vehicle type	FY2022 Supp. / FY2023 Initial	
	Base	Conditional
EV	¥650,000	¥850,000
Light EV (Kei EV)	¥450,000	¥550,000
PHEV	¥450,000	¥550,000
FCV	¥2,300,000	¥2,550,000

In FY2023, JCTBs supported the introduction of a total of 153,882 vehicles in FY2022 supplementary and FY2023 initial projects. In FY2024, JCTBs plan to continue using the funds for ongoing projects. Since FY2024, the evaluation method has been revised, and a mechanism has been introduced to determine the amount of subsidy based on a comprehensive evaluation of manufacturers' efforts, including charging infrastructure development, disaster response, and after-sales service systems, in addition to conventional vehicle performance. In the long term, the government will further promote the spread of clean energy vehicles toward the realization of the target of 100% electric vehicles in new passenger car sales by 2035 set forth in the Green Growth Strategy, etc.

Concept of Impact Calculation

The environmental improvement effect of this project was calculated as the CO_2 emission reduction effect in the year of introduction, assuming that EVs and PHEVs[82] were installed in FY2022 supplementary and FY2023 initial instead of gasoline vehicles when purchasing new vehicles. In addition, the economic impact of this program is calculated as 589.4 billion yen, obtained by multiplying the number of subsidized units awarded under the FY2022 supplementary budget and the FY2023 initial budget programs by the minimum price for each vehicle type.

[82] Other than EVs and PHEVs (FCVs, etc.) are not included because the number of subsidized vehicles is small and emission factors and calculation methods have not been established.

20 Promotion Project for the Electrification of Commercial Vehicles

Progress and Results of the Project

Key Achievement

Number of subsidized vehicles

3,698 vehicles

Environmental Improvement Effects

Annual CO_2 emission reduction effect achieved by replacing gasoline vehicles and other vehicles with eligible commercial vehicles supported under the program

Approx. 14,000 t-CO_2/year
(from FY2025)

Economic Effects

Public–private investment amount based on the number of units actually subsidized
*

Approx. 24.5 billion yen
*Total purchase amount of each model

Objectives and Details of the Project

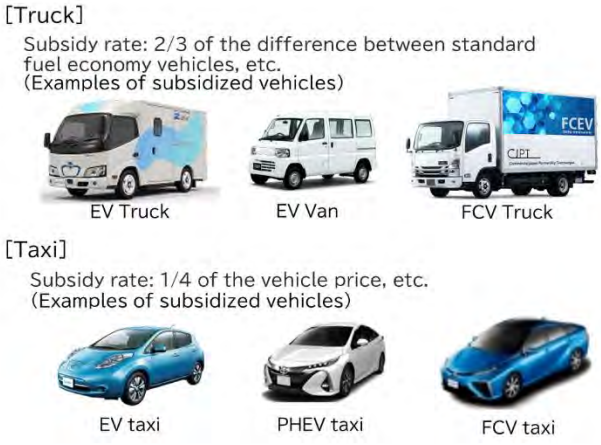
The transport sector accounts for about 20% of Japan's total CO_2 emissions, of which about 40% are from trucks and other commercial vehicles. In order to achieve carbon neutrality by 2050 and the target of reducing greenhouse gas emissions by 46% from 2013 in FY2030, electrification of commercial vehicles (EV, PHEV, FCV) is essential.

This project provides intensive support for the electrification of commercial vehicles (EV, PHEV, FCV). Specifically, following the obligatory preparation of medium- to long-term plans based on "non-fossil energy conversion targets" based on the Act on the Rational Use of Energy (Energy Conservation Act) (Law Concerning the Rational Use of Energy and Conversion to Non-Fossil Energy), the government will provide intensive support for vehicle introduction costs, such as 2/3 of the difference between trucks and standard fuel-efficient vehicles and 1/4 of the vehicle price for taxis, to businesses that have prepared ambitious introduction targets for EVs and FCVs and businesses that will be affected by the conversion to non-fossil energy.

In FY2023, the government supported the introduction of 3262 trucks (EVs), 6 taxis (FCV), 406 taxis (EVs), 5 taxis (PHEV), and 19 taxis (FCV).

In the continuing project after FY2024, for which JCTBs is scheduled to apply in FY2024, buses, charging facilities, and construction equipment are added to the subsidy targets as needed to support the acceleration of introduction in the early stage of popularization. By attracting domestic investment over the next 10 years, we will achieve the 2030 target of 20~30% of new electric vehicles sold (8 tons or less) and the cumulative introduction of 5000 units ahead of schedule (over 8 tons) for commercial vehicles. In addition to supporting the introduction of passenger cars, we will promote decarbonization of the entire transportation sector.

Figure 33: Examples of subsidized vehicles and subsidy rates



Concept of Impact Calculation

Emission reduction effects of commercial vehicles introduced through this project were estimated. Emission reduction effects were calculated based on the average emission factors for each type of vehicle, assuming that gasoline-powered vehicles are substituted for light trucks, diesel-powered vehicles are substituted for light and ordinary trucks, and average gasoline-powered vehicles are substituted for EVs for taxis.[83] As an economic effect of this project, 24.5 billion yen was calculated as the total purchase price of each type of vehicle.

[83] Because PHEVs and FCVs have limited sales to date, we assume they are all replaced by EVs.

21 Promotion Projects for the Installation of Advanced Equipment to Improve the Insulation Performance

Progress and Results of the Project

Key Achievement

Number of units subsidized

203,365
(detached houses)

40,301
(apartments)

Environmental Improvement Effects

CO_2 emission reduction effect due to improvement of air conditioning efficiency by retrofitting windows in supported houses

Approx. 63,000 t-CO_2/year
(detached houses)
Approx. 8,000 t-CO_2/year
(apartments)
(from FY2024)

Economic Effects

Public-private investment amount based on actual performance in insulating window retrofits

Approx. 167.6 billion yen

Objectives and Details of the Project

To reduce CO_2 emissions from the household sector, energy-saving measures for housing are urgently needed. Approximately 90% of existing houses do not meet the current energy-saving standards, and it is necessary to urgently promote insulation retrofitting of windows which cause a large amount of heat loss.

This project subsidizes part of the cost of renovating windows in detached houses and apartments with windows with high insulation performance (Glass, Sash). It aims to respond to rising energy prices (reduce heating and cooling costs), and to contribute to a 70% reduction in CO_2 emissions from the household sector in FY2030 (compared to FY2013) and to ensuring energy-saving performance at the level of the ZEH standard on a 2050 stock average basis. The subsidy targets must meet certain standards, such as heat transfer coefficient (Uw value) of 1.9 or less[84] and exceed the 2030 target level of the Building Materials Top Runner System. The amount of subsidy is a fixed amount according to the type of construction, and the subsidy rate is equivalent to 1/2, with a maximum amount of 2 million yen per 1 house.

In FY2023, JCTBs provided support for (1) the "Promotion Project for the Installation of Advanced Equipment to Improve the Insulation Performance of Detached Houses" for detached houses (FY2022 supplementary project) and (2) the " Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows" for apartments (FY2022 supplementary project). In (1), subsidies were provided for the insulation improvement of windows in 203,365 detached houses, and in (2), subsidies were provided for the insulation improvement of windows in 40,301 apartments.

In the FY2023 supplementary project, the "Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows" was also provided to support the insulation improvement of windows in detached houses and apartments, and the funds will be applied from the FY2024 JCTBs.

Figure 34: Examples of subsidy targets and subsidy amounts

Examples of subsidy amounts

Example:Detached houses and low-rise apartment buildings

	Grade	Size Classification		
		Large (2.8 m2~)	Medium (1.6 ~2.8m2)	Small (less than 1. 6 m2)
Inner windows installed	SS	124,000	84,000	53,000
	S	84,000	57,000	36,000
	A	69,000	47,000	30,000
exterior window replacement	SS	183,000	136,000	91,000
	S	124,000	92,000	62,000
	A	102,000	76,000	51,000

Concept of Impact Calculation

CO_2 emission reduction effect by reducing energy consumption for air conditioning in the houses where the insulation window improvement was estimated. The effect is calculated for each improvement pattern because it depends on the attributes of the house (detached house or apartment), the insulation performance of the windows after the improvement, the scale of the insulation improvement (whether it is the improvement of the LDK or the main living rooms), and the climate characteristics of the area where the house is located. As an economic effect, the total cost of 167.6 billion yen was calculated based on the number of the insulation window retrofits for which subsidies were provided.

[84] In the case of exterior window replacement (cover method) for high-rise apartment buildings, B grade (Uw value greater than 1.9 and less than or equal to 2.3) is also covered.

chapter 5

Allocation Report for FY2024 Issuance

5.1 FY2024 Issuance

Figure 35 presents the auction results for ten-year bonds on May 28, 2024 and October 22, 2024, and five-year bonds on July 18, 2024 and January 29, 2025.

Figure 35: Auction Results for JCTBs (FY2024 Issuance)

Issue	10-Year Japan Climate Transition Bonds (2nd)	5-Year Japan Climate Transition Bonds (2nd)	10-Year Japan Climate Transition Bonds (2nd)	5-Year Japan Climate Transition Bonds (2nd)
Auction date	May 28, 2024	July 18, 2024	October 22, 2024	January 29, 2025
Issue date	May 29, 2024	July 19, 2024	October 23, 2024	January 30, 2025
Maturity date	March 20, 2034	June 20, 2029	March 20, 2034	June 20, 2029
Nominal coupon	1.0%	0.5%	1.0%	0.5%
Offering amount	Approx. 350 billion yen	Approx. 350 billion yen	Approx. 350 billion yen	Approx. 350 billion yen
Amounts of competitive bids	1,100.7 billion yen	1,411.7 billion yen	1,160.0 billion yen	1,116.4 billion yen
Amounts of bids accepted	349.6 billion yen	349.6 billion yen	350.0 billion yen	349.8 billion yen
Yield to maturity	1.040%	0.595%	0.943%	0.888%

The proceeds raised through the auctions are intended for allocation to the designated projects, as outlined in Figure 36.

Figure 36: Projects to be funded by JCTBs (FY2024 Issuance)[85]

Category	Fiscal year	Project to be funded	Ministries and agencies with jurisdiction
(A) Research and development of innovative technologies aimed at market deployment	FY2024 Initial	Development Project for High-Temperature Gas Reactor Demonstration Plant	METI
	FY2024 Initial	Development Project for Fast Reactor Demonstration Plant	METI
	FY2024 Initial	Deep Tech Startup Support Program in the Green Transformation field	METI
	FY2023 Supp.	Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure	METI
(B) Capital investment that contributes to both economic growth and greenhouse gas reduction	FY2024 Initial	Support for energy/manufacturing process conversion for hard-to-abate industries	METI
	FY2023 Supp.	Support Project for Strengthening the Manufacturing Supply Chain of Batteries	METI
	FY2024 Initial		
	FY2024 Initial	Support for establishing production and supply system of sustainable aviation fuel (SAF)	METI
	FY2024 Initial	Support for enhancing the resilience and autonomy of circular economy systems through industry-government-academia collaboration	METI
	FY2024 Initial	Support for building GX supply chains	METI
	FY2024 Initial	Investment promotion for advanced resource circulation	MOE (METI Joint Project)
	FY2024 Initial	Promotion of the construction of zero-emission ships etc.	MOE (MLIT Joint Project)

[85] In addition to the above, this may also be allocated to projects that were previously financed by Climate Transition (CT) Government Bonds and continue to be budgeted for in the FY2023 supplementary budget or the initial FY2024 budget, as well as to projects that are expected to be continued in the future.

	FY2023 Supp.	Support for strengthening domestic production capacity of power semiconductors contributing to energy savings	METI
	FY2023 Supp.	Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation	METI
(C) Nationwide demand-side measures that support economic growth	FY2024 Initial	Installation support for electricity storage systems such as grid-scale batteries to expand renewable energy usage	METI
	FY2024 Initial	Grant for Decarbonization Transition Acceleration for Specific Regions	METI
	FY2023 Supp.	Subsidy for promoting energy savings in households through installing high-efficiency water heaters	METI
	FY2023 Supp.	Subsidy for Promoting the Introduction of Clean Energy Vehicles	METI
	FY2023 Supp.	Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows	MOE (METI and MLIT Joint Project)
	FY2023 Supp.	Accelerating decarbonizing renovations for buildings	MOE (METI and MLIT Joint Project)
	FY2023 Supp.	Promotion Project for the Electrification of Commercial Vehicles	MOE (METI and MLIT Joint Project)
(D) Cross-cutting initiatives for realizing GX	FY2024 Initial	Support focused on the price gap to build supply chains for hydrogen and its derivatives	METI
	FY2024 Initial	Capital for GX Acceleration Agency	METI

5.2| Allocation Status of Proceeds for FY2024 Issuance

Revenues from the JCTBs issued in FY2024 were allocated to projects in the FY2022 Supplementary Budget, FY2023 Supplementary Budget and FY2024 Initial Budget of the government of Japan that fall under eligible uses of funds under the November 2023 Framework.

The total amount of issuance (proceeds from issuance) of the JCTBs issued in FY2024 was 1,392 billion yen. These proceeds from issuance were allocated as of the end of November 2025 as shown in Figure 37.

Figure 37: Allocation of FY2024 Eligible Expenditures and JCTBs Proceeds (by Project and Green Category)

As of the end of November 2025

Category	Fiscal year	Project name	Overview	Allocated (billion yen)	Green Category
(A) Research and development of innovative technologies aimed at market deployment	FY2024 Initial	Development Project for High-Temperature Gas Reactor Demonstration Plant	Demonstration of possible hydrogen production by establishing a technology for connecting a high-temperature heat source and a hydrogen production plant by 2030. Project to obtain prospects for the feasibility of technology for carbon-free hydrogen production	18.3(*1)	●Low-carbon and decarbonized energy
	FY2024 Initial	Development Project for Fast Reactor Demonstration Plant	Support the establishment of key technologies that will be important for future fast reactor development and the development of test and research facilities that will support the development of private companies by expanding the development of elemental technologies related to infrastructure development and safety improvement toward common issues of fast reactors	18.9	●Low-carbon and decarbonized energy
	FY2024 Initial	Deep Tech Startup Support Program in the Green Transformation field	Support necessary for business growth, including R & D and capital investment, for deep-tech and start-up support in the GX field from pre-startup to business expansion over multiple years	41.0	Cross-sectoral (All green categories are covered.)
	FY2023 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 to strengthen our country's infrastructure for the development and manufacture of post-5G information and communications systems	28.1	●Energy efficiency
(B) Capital investment that contributes to both economic growth and greenhouse gas reduction	FY2024 Initial	Support for energy/manufacturing process conversion for hard-to-abate industries	In order to reduce emissions and strengthen industrial competitiveness in industries where it is difficult to reduce emissions, support capital investment that leads to early social implementation	0.4	●Circular economy adapted products, production technologies and processes
	FY2023 Supp.	Support Project for Strengthening the Manufacturing Supply Chain of Batteries	Support for capital investment in storage batteries and components, and support for technological development to strengthen the battery manufacturing supply chain and ensure stable supply	265.8	●Energy efficiency
	FY2024 Initial			230.0	
	FY2024 Initial	Support for establishing production and supply system of sustainable aviation fuel (SAF)	For SAF manufacturing projects, support is provided to companies engaged in large-scale SAF manufacturing in Japan with the aim of establishing a system that can supply SAF stably at internationally competitive prices.	0.1(*2)	●Clean transportation
	FY2024 Initial	Support for enhancing the resilience and autonomy of circular economy systems through industry-government-academia collaboration	Support for technological development, demonstration, and capital investment for commercialization related to resource recycling and enhancing product lifetime of automobiles, batteries, electrical and electronic products, packaging, plastics, and textiles through industry-government-academia collaboration	0.1(*3)	●Environmentally sustainable management of living natural resources and land use, circular economy
	FY2024 Initial	Support for building GX supply chains	To establish a domestic manufacturing supply chain for the GX sector, subsidies are provided to manufacturers of water electrolysis equipment, floating offshore wind power generation, perovskite solar cells, etc., large-scale investment plans for related materials and equipment, and companies with proprietary technologies.	0.5	●Renewable energy/ ●Circular economy adapted products, production technologies and processes
	FY2024 Initial	Investment promotion for advanced resource circulation	Support for investment in resource recycling facilities that significantly contribute to reducing CO_2 emissions in industries that have difficulty reducing CO_2 emissions (hard-to-abate industries) and recycling facilities that supply high-quality recycled products essential for the production of innovative GX products	0.01	●Environmentally sustainable management of living natural resources and land use, circular economy
	FY2024 Initial	Promotion of the construction of zero-emission ships etc.	Support for the development of facilities and reinforcement of the supply base necessary for the construction of Zero-Emission Ships in anticipation of accelerated conversion to new fuel ships	0.8(*4)	●Clean transportation
	FY2023 Supp.	Support for strengthening domestic production capacity of power semiconductors contributing to energy savings	In order to ensure a stable supply of semiconductors in Japan and strengthen the supply chain, in addition to conventional semiconductors, support will be provided for efforts to strengthen production capacity for manufacturing equipment, parts, and raw materials.	280.6	●Energy efficiency
	FY2022 Supp.	Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation	Support for the introduction of advanced energy-saving facilities and equipment that contribute to the replacement of factories and workplaces with facilities and equipment with high energy-saving performance, collaboration among multiple businesses, and conversion to non-fossil energy	34.4	●Energy efficiency
	FY2023 Supp.				
(C) Nationwide demand-side measures that support economic growth	FY2024 Initial	Installation support for electricity storage systems such as grid-scale batteries to expand renewable energy usage	To accelerate the introduction of renewable energy, subsidies are provided for the introduction of power storage systems such as storage batteries and water electrolysers that can be used as regulatory power.	1.8(*5)	●Energy efficiency/ ●Renewable Energy
	FY2024 Initial	Grant for Decarbonization Transition Acceleration for Specific Regions	Support is provided to local governments that promote decarbonization in their communities and lifestyles by creating new demand and expanding investment in decarbonized products and technologies such as renewable energy, energy conservation, and energy storage throughout the region.	0.05(*6)	●Renewable energy
	FY2023 Supp.	Subsidy for promoting energy savings in households through installing high-efficiency water heaters	Subsidy for the introduction of high-efficiency water heaters (Heat pump water heaters, hybrid water heaters, household fuel cells) necessary to reduce household energy consumption	56.0	●Energy efficiency
	FY2023 Supp.	Subsidy for Promoting the Introduction of Clean Energy Vehicles	Creation of initial demand for electric vehicles and fuel cell vehicles through partial subsidy of purchase costs, promotion of price reductions through mass-production effects, and support for companies' investment in production equipment and research and development in anticipation of growing demand	22.2	●Clean transportation
	FY2023 Supp.	Support Project for Accelerating Energy Conservation and CO_2 Reduction in the Household Sector through Insulating Windows	Support for the improvement of the insulation performance of windows with large heat loss in existing houses, which contributes to a 70% reduction in CO_2 emissions from the residential sector in FY2030 (compared to FY2013) and to the securing of energy-saving performance at the level of ZEH standards on the 2050 stock average	98.6	●Energy efficiency
	FY2023 Supp.	Accelerating decarbonizing renovations for buildings	Support for decarbonizing renovations for buildings (enhancement of thermal insulation performance of building envelope and introduction of high-efficiency air conditioning equipment, etc.)	0.6	●Energy efficiency
	FY2023 Supp.	Promotion Project for the Electrification of Commercial Vehicles	Intensive support for vehicle installation costs for companies that have set ambitious installation targets for BEVs and FCVs, those affected by the transition to non-fossil energy, etc.	17.4	●Clean transportation
(D) Cross-cutting initiatives for realizing GX	FY2024 Initial	Support focused on the price gap to build supply chains for hydrogen and its derivatives	Support for all or part of the price differences between low-carbon hydrogen and existing raw materials and fuels to be replaced, with the aim of building a self-sustaining pilot supply chain contributing to the realization of GX by FY2030, for 15 years	0.1	●Circular economy adapted products, production technologies and processes
	FY2024 Initial	Capital for GX Acceleration Agency	The GX Promotion Organization was established in FY2024 to provide financial support services, such as debt guarantees and equity investments, to compensate for risks that private financial institutions are unable to cover, thereby supporting the supply of private funds to GX investment.	120.0	Cross-sectoral (All green categories are covered.)
Total				**1235.8**	
Total issuance amount of the JCTBs issued in FY2024 (cash proceeds)				**1392.0**	
Amount of unallocated proceeds (cash proceeds - amount of proceeds allocated)				**156.2**	

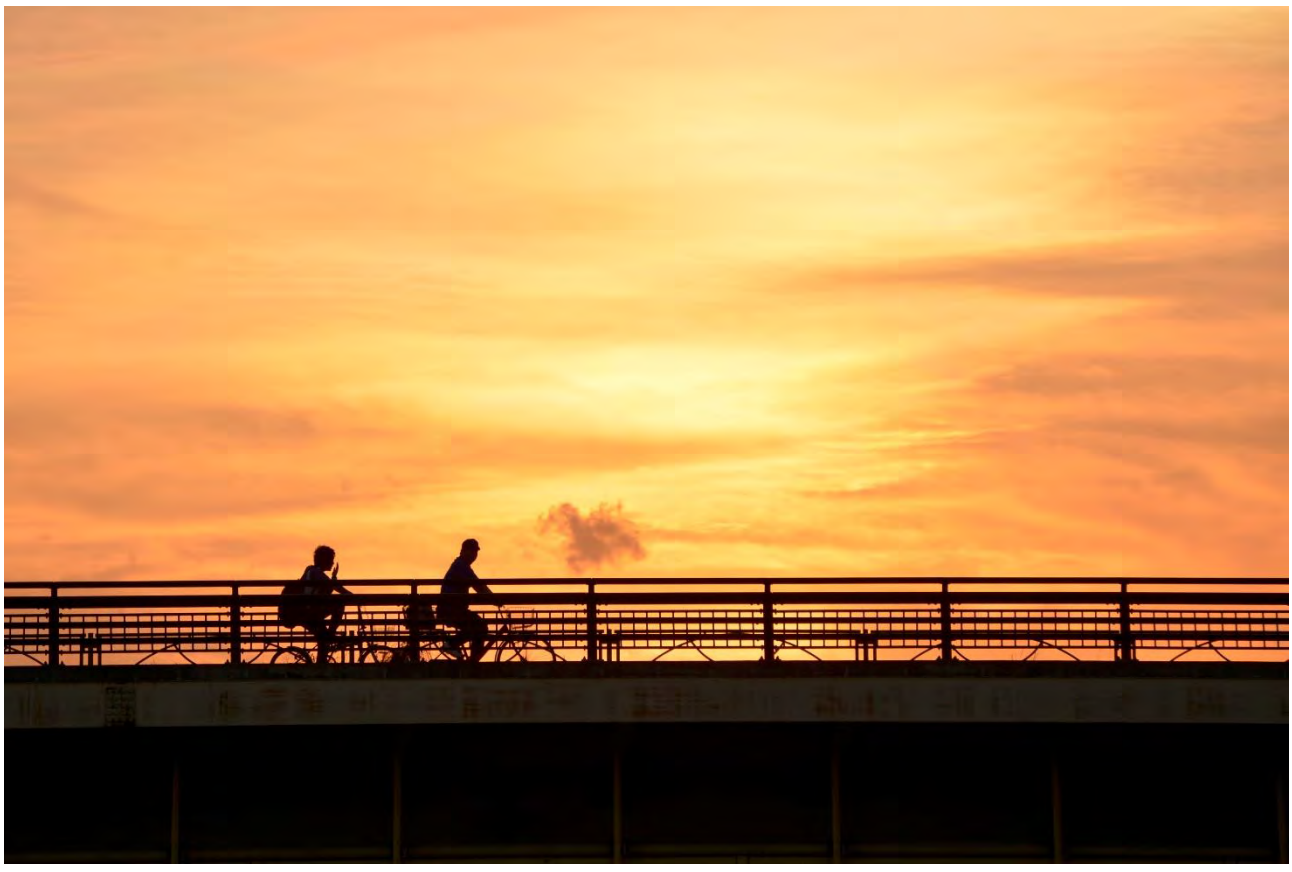
(Note)Of the unallocated balance of 156.2 billion yen, 18.2 billion yen was carried forward from the beginning of FY2024 for Development Project for High-Temperature Gas Reactor Demonstration Plant and Development Project for Fast Reactor Demonstration Plant (＊1), 27.5 billion yen for Support for establishing production and supply system of sustainable aviation fuel (SAF) (＊2), 3.5 billion yen for Support for enhancing the resilience and autonomy of circular economy systems through industry-government-academia collaboration (＊3), 500 million yen for Promotion of the construction of zero-emission ships etc. (＊4), 6.7 billion yen for Installation support for electricity storage systems such as grid-scale batteries to expand renewable energy usage (＊5) and 600 million yen for Grant for Decarbonization Transition Acceleration for Specific Regions (＊6) to FY2025. The amounts that have not been appropriated in the FY2023 amendment and the beginning of FY2024 will be appropriated for the continuation of the FY2024 amendment, Support Project for Support Project for Strengthening the Manufacturing Supply Chain of Batteries, Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation, Support program for promoting energy efficiency in the household sector through the introduction of high efficiency water heaters, and Subsidy for Promoting the Introduction of Clean Energy Vehicles. The unappropriated balance will be fully appropriated by the end of FY2025.
(Note 2) The reason why Amounts of Allocated Proceeds figures for each project do not agree with Amounts of Allocated Proceeds figures is that they are rounded off to the second decimal place.
(Note 3) For projects with an allocated amount of less than 0.05 billion yen, figures are shown to the second decimal place.

chapter 6

External Review

This report summarizes the allocation status and impact of the JCTBs issued in FY2023, as well as the allocation status of the JCTBs issued in FY2024, based on the Framework established by the government of Japan in November 2023.

For each set of allocation and impact results, a Second-Party Opinion confirming alignment with the ICMA Green Bond Principles 2021, the Ministry of the Environment's Green Bond Guidelines 2022, the ICMA 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.

ANNEX

Formula for Calculating the Impact of Each Project

1 GI Fund Project: Development of Next-Generation Solar Cells

Concept of Impact Calculation	<2030, 2050> Based on objective data such as the global solar power market size and growth pace, the market share of next-generation solar cells, and the share of Japanese companies, we calculated the CO_2 emission reduction effect of single-junction and tandem solar cells as of 2030 and 2050.
Used Parameters	<2030> 112 GW of photovoltaic power generation was installed worldwide in 2019 *1. We assumed that the installation will continue at the current pace until 2030, when single-junction next-generation solar cells will account for 1% of the global solar cell market. *2 ① Global installed capacity of single-junction next-generation solar cells by 2030: 3.5 GW ② Estimated installed capacity of tandem next-generation solar cells by 2030: 1.3 GW ③ Share of Japanese companies: 25% ④ Capacity utilization rate: 15% ⑤ CO_2 emission factor: 0.51 Mt-CO_2/TWh <2050> Solar power generation is estimated to be introduced globally at an annual average rate of about 120 GW between 2030 and 2050. The expected market for next-generation solar cells and other technologies in 2050 is assumed to account for 50% of the total solar power generation market. *3 ④ Capacity utilization rate: 15% ⑤ CO_2 emission factor: 0.51 Mt-CO_2/TWh ⑥ Estimated cumulative installed capacity of next-generation solar cells in 2050: 0.15 TW (Source and supplement) *1 IEA PVPS Trends Report 2020 *2 Estimated by Ministry of Economy, Trade and Industry based on various publicly available information *3 Estimated by Ministry of Economy, Trade and Industry based on various publicly available information ① Estimated by NEDO based on various publicly available information ② Results of a hearing survey of Japanese solar cell manufacturers ③ Assumed to be equivalent to the peak market share of 25% since 2010, when the global solar cell market rapidly expanded ④ Estimated by the Ministry of Economy, Trade and Industry based on various publicly available information ⑤ IEA WEO2020 ⑥ NEDO estimates based on various public information.
Calculation Formula	<2030> 【Global CO_2 emission reduction effect of introducing next-generation solar cells manufactured by Japanese companies】 = (①×③+②)×④×⑤×8,760 (time: 24 hours ×365 days) = approx. 1.5 million t-CO_2/year <2050> 【Global CO_2 emission reduction effect of introducing next-generation solar cells manufactured by Japanese companies】 = ⑥×④×⑤×8,760 (time: 24 hours ×365 days) = approx. 100 million t-CO_2/year

2 GI Fund Project: Cost Reductions for Offshore Wind Power Generation

Concept of Impact Calculation	<2030, 2050> Assuming that electricity generated by offshore wind power displaces electricity generated by thermal power, the amount of CO_2 reduction in Japan is calculated as the impact.
Used Parameters	<2030, 2050> Projected Offshore Wind Capacity: 1.68-3.68 million kW (2030)/45 million kW (2050) ① Average Thermal Power Emission Factor in FY2030: 0.66 kg-CO_2/kWh ② Facility Utilization Rate: 33.2% (Source and Supplement) ① The 7th Strategic Energy Plan / Advisory Committee for Natural Resources and Energy: Subcommittee on Energy Conservation and New Energy / Subcommittee on Electricity and Gas Industry, Subcommittee on Large-Scale Introduction of Renewable Energy and Next-Generation Power Networks (31st Meeting), Document 2. ② Ministry of Economy, Trade and Industry calculation based on public information ③ Estimated value based on the supply price cap for Round 1, which was publicly solicited in 2020
Calculation Formula	<2030, 2050> 【CO_2 emission reduction effect in Japan by substituting thermal power generation with offshore wind power introduced to domestic waters】 =①×8,760 (hours: 24 hours ×365 days) ×②×③ = approx. 3-7 million t-CO_2/year (2030), approx. 90 million t-CO_2/year (2050)

3 GI Fund Project: Large-Scale Hydrogen Supply Chain Establishment

Concept of Impact Calculation	<2030, 2050> In 2030, the amount of CO_2 emission reduction from natural gas was calculated based on the estimation of hydrogen supply through the international hydrogen supply chain, assuming that the supplied hydrogen could replace natural gas as a fuel for power generation in a calorific equivalent manner. In 2050, the amount of CO_2 emission reduced by substituting hydrogen for natural gas was estimated based on the expansion of international hydrogen trade. In both cases, the CO_2 emission reduction effect on a global scale was calculated by converting carbon to CO_2 using the calorific value of hydrogen and the carbon emission coefficient of natural gas.
Used Parameters	<2030 and 2050> ① Hydrogen Supply from International Hydrogen Supply Chain 1 million tons/year【2030】, 55 million tons/year【2050】 ② Hydrogen standard calorific value: 142 MJ/kg (HHV) ③ Imported natural gas carbon emission factor: 13.87 g-C/MJ ④ Coefficient for converting carbon to CO_2: 44/12 ⑤ Coefficient for converting grams to tons: 10^{-6} (Source and supplement) ① Set based on implementation targets in the Green Growth Strategy ② Source: IEA The Future of Hydrogen, etc. ③ Source: Ministry of Economy, Trade and Industry, Agency for Natural Resources and Energy, Standard Calorific Value and Carbon Emission Coefficient
Calculation Formula	<2030 and 2050> 【Expected global CO_2 reduction effect from expansion of the international hydrogen market and hydrogen power generation market】 =①×②×③×④×⑤= approx. 7 million t-CO_2/year (2030), approx. 400 million t-CO_2/year (2050)

4 GI Fund Project: Development of Next-Generation Aircraft

Concept of Impact Calculation	<2050> It is assumed that electrified (including hybrid electric), hydrogen fuel cell, and hydrogen combustion propulsion aircraft will replace 1/3 of domestic and small aircraft, which account for 40% of the global fleet as of 2050. In addition, it is assumed that lightweight and electrified (including hybrid electric) technologies will be introduced to aircraft, including international flights. and large aircraft, and the CO_2 emission reduction effect due to these improvements in fuel efficiency and reductions in emissions per unit are calculated. (The effects of alternative fuels are not considered.)
Used Parameters	<2050> ① Fuel efficiency benefits from hydrogen aircraft: 100% ② CO_2 emissions from jet fuel (international + domestic) in 2050: 2 billion tCO_2-eq./year ③ Use of hydrogen-powered aircraft: 1/3 of domestic flights (40% of total) ④ Use of hydrogen fuel cells: 1/3 of domestic flights (40% of total) ⑤ Increase in fuel efficiency through weight reduction: 2% ⑥ Increase in fuel efficiency through electrification: 5% (Source and supplement) ① Hydrogen Emission intensity of aircraft assumed to be 0gCO_2/kwh ② Air Transport Action Group Waypoint2050 2nd Edition (September 2021) ③ IATA Air Passenger Market Analysis (June 2025) ④ IATA Air Passenger Market Analysis (June 2025) ⑤ GI Fund Project Summary Data ⑥ GI Fund Project Summary Data
Calculation Formula	<2050> 【Global CO_2 emission reduction effect of introducing next-generation aircraft】 =①×②×③+①×②×④+②×(1-③-④)×⑤+②×(1-③-④)×⑥ = approx. 640 million t-CO_2/year (2050)

5 GI Fund Project: Development of Next-generation Ships

Concept of Impact Calculation	<2030> The CO_2 emission reduction effect in 2030 is based on the number of zero-emission ships that start operation under the GI Fund project. The CO_2 emissions per ship are calculated from the 2019 aggregate data for oceangoing ships with a gross tonnage of 5,000 tons or more, based on the fuel oil consumption performance reporting system of the International Maritime Organization (IMO). The total CO_2 emission reduction in 2030 is then calculated by applying the number of zero-emission ships operating under the GI Fund project. <2050> The figure for 2050 represents the amount of CO_2 emission reduction achieved through the use of next-generation fuels, based on a scenario for achieving the 2050 targets adopted by the International Maritime Organization (IMO) for international shipping.
Used Parameters	<2030> ① Number of zero-emission ships in operation in 2030: 10 ② CO_2 emissions per 1 ship: 33000 tons/year (Source and supplement) ① The value is calculated by summing the number of zero-emission ships that will begin operation under the GI Fund project, based on the business strategy vision of the project-implementing companies. ② The value is calculated based on the 2019 aggregate data for oceangoing ships with a gross tonnage of 5,000 tons or more, based on the IMO's fuel oil consumption performance reporting system.
Calculation Formula	<2030> 【Global CO_2 emission reduction effect through the operation of zero-emission ships】 = ①×②= approx. 0.33 million t-CO_2/year <2050> 【Global CO_2 emission reduction effect through the operation of new zero-emission ships】 = approx. 560 million t-CO_2/year

6 GI Fund Project: Hydrogen Utilization in Iron and Steelmaking Processes

Concept of Impact Calculation	<2030> Estimated CO_2 emission reduction effect if COURSE50 (R & D item (1)-(1) Blast furnace equipped with hydrogen reduction technology and CO_2 separation and capture technology) technology, which has been set as a target of this project, is introduced to domestic steelworks by 2030. <2050> Estimated CO_2 emission reduction effect if hydrogen reduction steelmaking and CCUS technology and other innovative steelmaking technologies are widely used worldwide by 2050 based on the steel technology roadmap published by the International Energy Agency (IEA) in 2020.
Used Parameters	<2030> ① Crude steel production by 1 blast furnace: approx. 4 million t/year ② CO_2 emissions per 1 ton of crude steel (current status): approx. 1.5-2 t-CO_2/ ton ③ CO_2 emission reduction rate by COURSE50 technology: 30% ④ Number of units to be installed with COURSE50 technology by 2030: 1 <2050> ① CO_2 emissions from the steel industry in 2019 (worldwide): 2.6 billion tons ② CO_2 emissions reduction effect by introducing innovative steelmaking technology: 50% (compared to 2019) (Source and supplement) <2030> ① Approximate value for typical size (5,000m3 class) of domestic blast furnaces ② Set based on the CO_2 emission intensity as of 2015 described in the Japan Iron and Steel Federation "JISF Long-term vision for climate change mitigation: A challenge towards zero carbon steel" ③ "R&D and Social Implementation Plan" for the " Green Innovation Fund Project: Hydrogen Utilization in Iron and Steelmaking Processes," Manufacturing Industry Bureau, Ministry of Economy, Trade and Industry (December 2023) ④ "R&D and Social Implementation Plan" for the " Green Innovation Fund Project: Hydrogen Utilization in Iron and Steelmaking Processes," Manufacturing Industry Bureau, Ministry of Economy, Trade and Industry (December 2023) <2050> ① IEA Steel Technology Roadmap (2020) ② IEA Steel Technology Roadmap (2020)
Calculation Formula	<2030> 【CO_2 emission reduction effect in Japan by introducing blast furnaces equipped with COURSE50 technology】 = ①×②×③×④= approx. 2 million t-CO_2/year <2050> 【CO_2 emission reduction effect if hydrogen reduction steelmaking and CCUS technology become widespread worldwide】 =①×②= 1.3 billion t-CO_2/year

7 GI Fund Project: Decarbonization of Thermal Processes in Manufacturing

Concept of Impact Calculation	<2040, 2050> The CO_2 emission reduction effect compared with existing industrial furnaces is estimated on the assumption that 50% ammonia and hydrogen co-combustion furnaces (or equivalent electric furnaces), which are being developed in this project, will be installed in society after FY2032 and spread by a certain number every year, and that 100% ammonia and hydrogen single-combustion furnaces (or equivalent electric furnaces) will spread after FY2041. The estimation is based on the assumption that the supply of ammonia and hydrogen, which is the government target, will progress as planned and that the number of 37000 industrial furnaces in Japan will not change.
Used Parameters	<2040> ① CO_2 emissions per industrial furnace (current status): approx. 4000 t-CO_2/year ② Reduction rate of CO_2 emissions compared with existing industrial furnaces (FY2032-2040): 50% ③ Number of industrial furnaces (or equivalent electric furnaces) with 50% ammonia and hydrogen : approx. 1,300 per year from FY2032-2040 (penetration rate as of 2040: approx. 30%) <2050> ① CO_2 emissions per industrial furnace (current status): approx. 4000 t-CO_2/year ④ CO_2 emission reduction rate compared with existing industrial furnaces (FY2041-2050): 100% ⑤ Use of 100% ammonia/hydrogen exclusively firing industrial furnaces (or equivalent electric furnaces) : Approximately 1,300 furnaces per year from FY2041-2050 (penetration rate as of 2050: approximately 40%) (Source and supplement) ① Calculated based on the Ministry of Economy, Trade and Industry (METI), FY2014 Project for Developing the Foundation to Promote the Rational Use of Energy (Survey on the Actual Status of Energy-Saving Technologies for Industrial Furnaces, etc.) Report. ② Assumed an industrial furnace co-firing 50% ammonia/hydrogen (or an equivalent electric furnace). ③ Annual number of industrial furnaces replaced, based on METI, FY2014 Project for Developing the Foundation to Promote the Rational Use of Energy (Survey on the Actual Status of Energy-Saving Technologies for Industrial Furnaces, etc.) Report. ④ Assumed an industrial furnace dedicated to 100% ammonia/hydrogen firing (or an equivalent electric furnace). ⑤ Annual number of industrial furnaces replaced, based on METI, FY2014 Project for Developing the Foundation to Promote the Rational Use of Energy (Survey on the Actual Status of Energy-Saving Technologies for Industrial Furnaces, etc.) Report.
Calculation Formula	<2040> 【Calculation formula for the number of domestic industrial furnaces that have been replaced with ammonia/hydrogen co-firing furnaces, etc. after 2032) CO_2 emission reduction effect) = ①×②×③×9 years (FY2032-2040) = approx. 20 million t-CO_2/year <2050> 【CO_2 emission reduction effect when domestic industrial furnaces are replaced by ammonia/hydrogen co-firing furnaces after 2032 and by dedicated furnaces using the same fuel after 2041】 =【CO_2 emission reduction effect】(as of 2040) +①×④×⑤×10 (FY2041-2050) = approx. 80 million t-CO_2/year

8 GI Fund Project: Hydrogen Production through Water Electrolysis Using Power from Renewables

Concept of Impact Calculation	<2030, 2050> The main use of hydrogen produced by water electrolysis is assumed to be heat demand, and hydrogen is assumed to replace heat demand from imported natural gas by heat equivalent. The volume of hydrogen produced was estimated assuming that the total volume of major countries and regions that set a target for introducing water electrolysis equipment by 2030 operated at the operation rate calculated from the German national hydrogen strategy at the start of this project. The CO_2 emission reduction effect by 2050 was calculated assuming further progress in the introduction of water electrolysis equipment.
Used Parameters	<2030, 2050> ① Imported natural gas Carbon emission factor: 13.87 g-C/MJ ② Hydrogen standard calorific value: 142 MJ/kg (HHV) ③ Water electrolyzer installed capacity: 70 GW (2030)/2640 GW (2050) ④ Water electrolyzer operation rate: 30% ⑤ Electricity required to produce 1 kg of hydrogen: 33 kwh/kg (Source and supplement) ① Ministry of Economy, Trade and Industry Agency for Natural Resources and Energy "Comprehensive Energy Statistics (Standard Calorific Value and Carbon Emission Coefficient)" ② Ministry of Economy, Trade and Industry Agency for Natural Resources and Energy, Integrated Energy Statistics, Standard Calorific Value and Carbon Emission Factor ③ (2030) Total installed capacity in EU, Chile and UK (2050) With reference to the Faster Innovation Case in IEA's Energy Technology Perspectives 2020 (2020), it was assumed that water electrolysis capacity would be deployed at an average rate of 88 GW per year. ④ Estimated from the German federal government's National Hydrogen Strategy (formulated in June 2020) ⑤ Low heating value of hydrogen (approx. 120 MJ/kg) expressed in kWh
Calculation Formula	<2030, 2050> 【Replacing the heat demand of natural gas with hydrogen produced by water electrolysis equipment CO_2 emission reduction effect】 = ③×8760 hours (=365 days) ×④÷⑤×②×①×44/12 (CO_2 equivalent) = approx. 40 million t-CO_2/year (2030), approx. 1.52 billion t-CO_2/year (2050)

9 GI Fund Project: Achieving Carbon Neutrality in Waste and Resource Circulation Systems

Concept of Impact Calculation	<2030, 2050> Estimated CO_2 emission reduction effect is the sum of the difference between the reduction in the methane emission due to a reduction in the amount of landfill waste and the increase in CO_2 emission due to an increase in the amount of incineration, the reduction in methane emissions due to an increase in intermediate treatment, the CO_2 yield from CCUS, and the reduction in CO_2 emission due to the replacement of city gas with biomethane through methane fermentation and biomethanation.
Used Parameters (2030)	<2030> ① Volume of waste processed by CC incinerators in 2030: 3.5 Mt/year ② Volume of waste processed by pyrolysis facilities in 2030: 0.084 Mt/year ③ Composition of municipal solid waste in 2030: 47.1% (food), 15.8% (paper), 11.3% (plastics), 1.7% (rubber/leather), 1.9% (wood), 22.1% (glass, metal, other) ④ CH4 emission unit by landfill composition: 0.9 t-CO_2/t (CO_2 equivalent, dry weight), 2.7t-CO_2/t (waste paper), 3.0 t-CO_2/t (waste fiber), 2.1 t-CO_2/t (waste wood) ⑤ Amount of plastics processed at incineration and pyrolysis facilities with CC technology: 0.41 Mt/year ⑥ CO_2 emission factor of municipal solid waste by composition (unit: t-CO_2/t): 0.27 (food), 1.07 (paper), 2.31 (plastics), 2.17 (rubber, leather), 0.66 (wood) ⑦ Global municipal solid waste generation in 2030: 2,586 Mt/year ⑧ Methane fermentation ratio of municipal solid waste in 2030: 8.0% ⑨ Prevalence of biomethanation facilities in 2030 (Ratio of biogas produced by methane fermentation to methanation): 1.6% ⑩ CO_2 recovery ratio: 90% ⑪ Effective carbon utilization rate at pyrolysis facilities: 27% (gasification), 48% (oil production) ⑫ Biogas generated per 1 ton of food waste: 131.6 Nm^3/t ⑬ CO_2 emission factor for city gas: 2.23 t-CO_2/1000Nm^3 (Source and supplement) ① Ministry of Economy, Trade and Industry calculation based on the assumption that projects planned and in operation at the time of the social implementation plan (2023) are in operation as of 2030. ② A 280 day operation rate of 150 t/day is assumed for gasification and oil production. ③ Estimated from the World Bank's "What a Waste 2.0" ④ Estimated from the Ministry of the Environment's "Manual for Formulation and Implementation of Local Government Action Plans (Clerical Work) (Calculation Methods)" ⑤ Estimated from (1), (2), and (3) ⑥ Estimated from the National Urban Cleanup Council's "Guidelines for Planning and Design of Waste Disposal Facilities (2017 Revision)" ⑦ Estimated from the World Bank's "What a Waste 2.0" ⑧ Based on the World Bank report "What a Waste 2.0" (2021), it is assumed that 50% of food waste in 2050 (818 Mt/year) will be directed to methane fermentation facilities. Starting from 2020, when the share is assumed to be 0%, the share is assumed to increase linearly. Under these assumptions, the amount of methane-fermented food waste in 2030 is estimated to be 207 Mt/year. ⑨ Estimated from IEA's "Net Zero by 2050" (2021) ⑩ R & D targets described in R & D and social implementation plans ⑪ R & D targets described in R & D and social implementation plans ⑫ Estimated from the Ministry of the Environment "Energy Recovery Waste Treatment Facility Development Manual (revised April 2020)" ⑬ Ministry of the Environment "List of calculation methods and emission factors under the calculation, reporting, and publication system (for calculation of emissions after FY2009)"
Calculation Formula (2030)	<2030> 【 Global CO_2 emission reduction effect by installing CN-type carbon cycle plants】 =(①+②)×③×④ : Reduction in methane emissions due to reduction in landfill -⑤×⑥ : Increase in emissions due to waste treatment at incineration facilities +⑦×⑧×⑨×④ : Methane reduction through methane fermentation (biomethanation) +①×③×⑥×⑩ : CO_2 yield by CCUS +②×③×⑥ ×⑪ : CO_2 reduction by effective use of carbon in pyrolysis facilities +⑦×⑧×⑨×⑫×⑬ : CO_2 reduction by using biomethane instead of city gas = 10.5 million t-CO_2/year

Used Parameters (2050)	<2050> ① Global volume of municipal solid waste generated in 2050: 3,399 Mt/year ② Ratio of municipal solid waste incinerated in 2050: 28% ③ Current ratio of municipal solid waste incinerated: 11% ④ CH4 emission unit by landfill composition (CO_2 equivalent): 0.9 t-CO_2/t (food waste), 2.7 t-CO_2/t (paper waste), 3.0 t-CO_2/t (fiber waste), 2.1 t-CO_2/t (wood waste) ⑤ Global plastic (municipal waste) generation in 2050: 378 Mt/year ⑥ CO_2 emission factor by municipal waste composition (unit: t-CO_2/t): 0.27 (food), 1.07 (paper), 2.31 (plastics), 2.17 (rubber/leather), 0.66 (wood) ⑦ Methane fermentation ratio of municipal waste in 2050: 24% ⑧ Prevalence of incineration facilities with CC in 2050: 24% ⑨ Composition of municipal waste in 2050: 48.1% (food), 15.1% (paper), 11.1% (plastics), 1.5% (rubber, leather), 1.7% (wood), 22.4% (glass, metal, other) ⑩ CO_2 recovery rate: 90% ⑪ Biogas generation per 1 ton of food waste: 131.6 Nm^3/t ⑫ CH4 ratio in biogas in 2050: 57.8% ⑬ Biomethanation facility penetration rate (proportion of methane fermentation biogas used for methanation): 6.1% ⑭ CO_2 emission factor for city gas: 2.23 t-CO_2/1000Nm^3 (Source and supplement) ① Estimated from the World Bank's "What a Waste 2.0" (2021) ② Estimated from the World Bank's "What a Waste 2.0" (2021) ③ Estimated from the World Bank's "What a Waste 2.0" (2021) ④ Ministry of the Environment "Manual for Formulation and Implementation of Local Government Action Plans (Clerical Services) (Calculation Methods)" ⑤ Estimated from the World Bank's "What a Waste 2.0" (2021) ⑥ Estimated from the National Urban Cleanup Council "Guidelines for Plan and Design of Waste Disposal Facilities (2017 Revision)" ⑦ Estimated from the World Bank's What a Waste 2.0 (2021), estimates were made assuming that by 2050, 50% of food waste (818 Mt/year) will be directed to anaerobic digestion facilities.⑧ It is assumed that the ratio of CC facilities to newly constructed incinerators will increase year by year after 2030, reaching 100% in 2050 ⑨ Estimated from the World Bank's "What a Waste 2.0" (2021) ⑩ R & D targets stated in the R & D and Social Implementation Plan ⑪ Estimated from the Ministry of the Environment's "Manual for Development of Energy Recovery Type Waste Treatment Facilities (revised April 2020)" ⑫ National Urban Cleanup Council's "Guidelines for Planning and Design of Waste Treatment Facilities" ⑬ Estimated from IEA "Net Zero by 2050" ⑭ Ministry of the Environment "List of calculation methods and emission factors under the calculation, reporting, and publication system (for calculation of emissions after 2009)"
Calculation Formula (2050)	<2050> 【Global CO_2 emission reduction effect by installing CN-type carbon cycle plants】 =①×(②-③)×④ : Reduction in methane emissions due to reduction in landfill volume -⑤×(②-③)×⑥ : Increase in emissions due to waste treatment at incineration facilities +①×⑦×④ : Methane reduction effect due to methane fermentation (biomethanation) +①×②×⑧×⑨×⑥×⑩ : CO_2 yield from CCUS +①×⑦×⑪×{⑫+⑬×(1-⑫)}×⑭ : Reduction by using biomethane instead of city gas = 1.24 billion t-CO_2/year

10 GI Fund Project: Development of Technology for Producing Raw Materials for Plastic Using CO_2 and Other Sources

Concept of Impact Calculation	<2030 and 2050> For 2030, CO_2 emission reduction effect was calculated based on the estimated production volumes of olefins, green hydrogen, methanol, ethanol, and CB, etc., if these technologies were realized according to the R & D targets. For 2050, the emission reduction effects were estimated by taking into account the technology implementation plan and adding the CO_2 reduction by converting the heat source of the naphtha cracking furnace to carbon-free in addition to the emission reduction factors assumed as of 2030.
Used Parameters	<2030 and 2050> ① Production volume of basic chemicals from waste plastics : 50,000 tons/year【2030】, 2 million tons/year【2050】 ② Production volume of basic chemicals from waste rubber 102,000 tons/year【2030】, 1 million tons/year【2050】 ③ Production volume of carbon black (CB) from waste tires 5,000 tons/year【2030】, 300,000 tons/year【2050】 ④ Production volume of functional chemicals from CO_2 (DRC) 3,000 tons/year【2030】, 500,000 tons/year【2050】 ⑤ Production volume of functional chemicals from CO_2 (MDI) 100,000 tons/year【2030】, 500,000 tons/year【2050】 ⑥ Production volume of green hydrogen: 4,160 tons/year【2030】, 1.5 million tons/year【2050】 ⑦ Production volume of basic chemicals from methanol 200,000 tons/year【2030】, 2.2 million tons/year【2050】 ⑧ Production volume of basic chemicals from ethanol : 100,000 tons/year【2030】, 1 million tons/year【2050】 ⑨ Production volume of basic chemicals from advanced naphtha cracking furnaces : 6.8 million tons/year【2050】* Used for the 2050 calculations only) ⑩ CO_2 emission factor for waste plastics: 1.6-0.8+2.5=3.3 kg-CO_2/kg ⑪ CO_2 emission factor for waste rubber: 2.1-1.2+2.4=3.3 kg-CO_2/kg ⑫ CO_2 emission factor for CB from waste tires: 2.1-1.0+3.7=4.8 kg-CO_2/kg ⑬ CO_2 emission reduction factor for DRC: 1.0+0.3=1.3 kg-CO_2/kg ⑭ CO_2 emission reduction factor for MDI: 1.0+0.3=1.3 kg-CO_2/kg ⑮ CO_2 emission reduction factor for green hydrogen: 8.9 kg-CO_2/kg ⑯ CO_2 emission reduction factor for methanol: 1.6 kg-CO_2/kg ⑰ CO_2 emission reduction factor for ethanol: 1.6 kg-CO_2/kg ⑱ CO_2 emission reduction factor for advanced naphtha cracking furnaces: 1.15-0.35=0.8 kg-CO_2/kg ⑲ Japan's share of the world's current ethylene plant production capacity: 2.8% ⑳ Japan's share of carbon black: 5% (Source and supplement) ①②③Based on the Ministry of the Environment's "GI Fund Project: Development of Technology for Producing Raw Materials for Plastic Using CO_2 and Other Sources" R&D and Social Implementation Plan. Assuming the 2050 market size is at a similar level to that assumed at the time the Social Implementation Plan was formulated, the production volume parameters were calculated by setting the 2030 demonstration scale at roughly a few percent of the 2050 deployment scale. ④⑤Using a CO_2 emissions reduction effect from CO_2 uptake (0.3 kg-CO_2/kg), calculated from company interviews with reference to AIST-IEDA data, the annual production volumes of DRC and MDI were estimated. ⑥Cited from IEA, The Future of Hydrogen ⑦⑧⑨Based on the Ministry of the Environment's "GI Fund Project: Development of Technology for Producing Raw Materials for Plastic Using CO_2 and Other Sources" R&D and Social Implementation Plan. Assuming the 2050 market size is at a similar level to that assumed at the time the Social Implementation Plan was formulated, the production volume parameters were calculated by setting the 2030 demonstration scale at roughly a few percent of the 2050 deployment scale. ⑩⑪ Calculated based on the Ministry of the Environment's "Emission Factors under the Calculation, Reporting, and Publication System 'Emission Factor List by Electric Utility Industry'" ⑫ Based on information from the Carbon Black Association: Calculated by targeting a CO_2 emissions reduction of about half of the conventional unit emission factor (2.1 kg-CO_2/kg), and adding the CO_2 emission factor at disposal (i.e., incineration) for CB (3.7 kg-CO_2/kg; i.e., CO_2 emissions of material origin). ⑬⑭Using a CO_2 emissions reduction effect from CO_2 uptake (0.3 kg-CO_2/kg), calculated from company interviews with reference to AIST-IEDA data, the annual production volumes of DRC and MDI were estimated. ⑮⑯⑰⑱Cited from IDEA v. 2.3 ⑲ Ministry of Economy, Trade and Industry, "Future supply and demand trends of global petrochemicals (October 2019) " ⑳ Carbon Black Association * Estimated based on production volume in Japan (600,000 tons/year) and world production volume (12 million tons/year)
Calculation Formula	<2030, 2050> 【Global effects of introducing plastic materials using CO_2 produced by the support project CO_2 emission reduction effect】 ={(①×⑩) + (②×⑪) + (④×⑬) + (⑤×⑭) + (⑥×⑮) + (⑦×⑯) + (⑧×⑰) + (⑨×⑱) }÷⑲+(③×⑫)÷⑳ = approx. 40 million t-CO_2/year (2030), approx. 1.5 billion t-CO_2/year (2050) World: Reverse calculation of domestic values using Japan's share (Ethylene related: 2.8%, CB related: 5%) *Underlined values are added only for 2050 calculations

12 Research and Development Project for Enhancing the Post-5G Information and Communication System Infrastructure

Concept of Impact Calculation	<2032–2041> The effect of reducing power consumption through the introduction of photoelectric fusion technologies on the power consumption of data center (DC) infrastructure is calculated. The amount of CO_2 reduction is calculated using the national average emission factor by multiplying the percentage of the power consumption of DC infrastructure accounted for by the elements targeted by each theme, the share of the results, and the power consumption reduction ratio. Calculated by converting the cumulative reduction over 10 years into an annual average, taking into account the share of companies in the initial stage of commercialization.
Used Parameters	<2032–2041> ① Global power consumption of DC infrastructure (cumulative 2032 – 2041): 3,414 TWh ② Percentage of power consumption of DC infrastructure covered by each theme: ・Optical chiplet implementation technology: 3% ・Opto-electric fusion interface memory module technology: 2% ・Fixed delay computing infrastructure technology: 1% ③ Power consumption reduction ratio: ・Optical chiplet Mounting Technology: 40% ・Opto-electric Fusion Interface Memory Module Technology: 30% ・Fixed Delay Computing Infrastructure Technology: 40% ④ Unit Conversion: 1TWh = 1 billion kWh ⑤ Electric Power (Average of All Power Sources) Emission Factor: 0.423 kg-CO_2/kWh ⑥ Unit Conversion: 10,000 t = 10 million kg ⑦ Annual Conversion: 10→1 year (Source and supplement) ① Calculated from IEA Report "Electricity 2024" ②③ Calculated by the Ministry of Economy, Trade and Industry based on the research and development plan for this project and information provided by each company. ④ Based on the national average coefficient for FY2023 results in the "List of Emission Factors by Electricity Utilities" for emission factors under the disclosure system.
Calculation Formula	<2032 to 2041> 【CO_2 Emissions Reduction Effects by Utilizing Photoelectric Fusion Technology at Data Centers in Japan】 = ①×②×③×④×⑤×⑥×⑦ = approx. 194 (Reduction by Optical Chiplet Mounting Technology) + approx. 86 (Reduction by Photoelectric Fusion Interface Memory Module Technology) +approx. 74 (Reduction by Fixed Delay Computing Infrastructure Technology) = approx. 3.54 million t-CO_2/year

13 Demonstration Reactor Development Project for High-Temperature Gas Reactor

Concept of Impact Calculation	This project aims to establish a hydrogen production method that does not emit CO_2, such as high-temperature steam electrolysis (SOEC) using the high-temperature heat of a high-temperature gas-cooled reactor. The impact of this project is calculated as the "CO_2 emission reduction effect" by switching from a conventional hydrogen production method to a production method using a high-temperature gas-cooled reactor that does not emit CO_2. While conventional hydrogen production methods (e.g., natural gas reforming) emit CO_2, the hydrogen production method using a high-temperature gas-cooled reactor (e.g., high-temperature steam electrolysis) that this project aims to establish does not emit CO_2 during the production process. Each time decarbonized hydrogen is produced using this technology, CO_2 emitted by the conventional method is reduced. Therefore, the amount of decarbonized hydrogen produced by this project is directly linked to the amount of CO_2 emitted by the conventional method.
Used Parameters	① Imported natural gas carbon emission factor (amount of carbon emitted by using natural gas in the conventional method) :0.01387 t-C/GJ ② Hydrogen standard calorific value (heat energy per 1 ton of hydrogen burned): 142 GJ/t (HHV) ③ CO_2 conversion factor: 44/12 (Source and supplement) ① Agency for Natural Resources and Energy, Standard Calorific Value and Carbon Emission Coefficient (Comprehensive Energy Statistics) ② Standard value of the Higher Heating Value (HHV) of hydrogen
Calculation Formula	< After the establishment of the High Temperature Gas-cooled Reactor > 【CO_2 emissions reduction effect in Japan through the production of decarbonized hydrogen production using high-temperature heat at the time of the establishment of the High Temperature Gas-cooled Reactor】 =①×②×③ = approx. 7.22 t-CO_2/year (＊per 1 ton of hydrogen produced)

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

Concept of Impact Calculation	In this project, assuming that all of the maximum annual production volume of storage batteries at manufacturing facilities developed according to the Supply Assurance Plan approved in FY2023 among the current Certified Supply Assurance Plan are installed in domestic BEVs, the impact is calculated as the amount of CO_2 reduction expected during the life cycle of vehicles equipped with BEVs due to the replacement of internal combustion engine vehicles with BEVs.
Used Parameters	① Production capacity in the year of starting full production: 45GWh/year (annual production at subsidized plants) ② Load capacity per 1 BEV: Assume 60kWh/unit ③ CO_2 emissions from internal combustion engines: Assume 38 tons/unit ④ CO_2 emissions from BEVs: 20 tons per vehicle *This project assumes emissions over the entire BEV manufacturing life cycle. (Source and supplement) ① The Ministry of Economy, Trade and Industry calculations with reference to each business plan ② IEA Global EV Outlook 2024 ③ IEA Global EV Outlook 2024 ④ Calculated by the Ministry of Economy, Trade and Industry reference to IEA Global EV Outlook 2024
Calculation Formula	< After operation of the supported plants > 【Assuming that all of the storage batteries manufactured in the supported plants are installed in BEVs, CO_2 reduction contribution when BEVs replace internal combustion engine vehicles】 =(①÷②)×(③-④) = approx. 13.5 million t-CO_2/year

16 Support for Strengthening Supply Chain Resilience of Critical Materials in Response to Economic and Environmental Changes: Project for Strengthening the Semiconductor Manufacturing Supply Chain for Achieving GX through Improved Power Performance

Concept of Impact Calculation	Power semiconductors are used in a variety of applications. In this study, we made a calculation assuming that all power semiconductors (SiC semiconductors or Si power semiconductors) manufactured through this project are installed in EVs. In this case, the expected annual contribution to CO_2 reduction by improving the energy efficiency of automobiles is presented as the impact.
Used Parameters	① Number of wafers (6 inch diameter equivalent) used to produce power semiconductors: Company A: 288000 wafers/year, Company B: 720,000 wafers/year, Company C: 1.68 million wafers/year ② Number of power semiconductor chips (estimated) per 1 wafer (6 inch diameter equivalent): 513 chips/wafer ③ Number of power semiconductor chips installed per 1 EV: 36 chips/vehicle ④ Average mileage per 1 vehicle: 9,360 km/year ⑤ Electric cost of EV: 6 km/kWh ⑥ Power loss ratio of power semiconductors in EVs (expected): 20% ⑦ Estimated reduction in electricity consumption by replacing older-generation si power semiconductors with sic power semiconductors: 50% ⑧ Power emission factor: 0.423 kg-CO_2/kWh ⑨ Estimated reduction in electricity consumption by replacing older-generation si power semiconductors with next-generation si power semiconductors: 25% (Source and supplement) ① Calculated by the Ministry of Economy, Trade and Industry with reference to each business plan ② Calculated by the Ministry of Economy, Trade and Industry with reference to information provided by each company ③ Calculated by the Ministry of Economy, Trade and Industry with reference to information provided by each company ④ R & D and social implementation plan for the "Next Generation Digital Infrastructure" project ⑤ Calculated by the Ministry of Economy, Trade and Industry based on manufacturer catalogs for multiple models ⑥ R & D and social implementation plan for the "Next Generation Digital Infrastructure" project ⑦ Calculated by the Ministry of Economy, Trade and Industry based on information provided by each company ⑧ Refer to the FY2023 national average coefficient based on the Ministry of the Environment's "Emission Factors under the Calculation, Reporting, and Publication System 'Emission Factor List by Electric Utility Industry'" ⑨ Calculated by the Ministry of Economy, Trade and Industry based on information provided by each company
Calculation Formula	< After operation of supported plants > 【CO_2 emissions reduction effect assuming that all power semiconductors manufactured at supported plants are installed in EVs】= approx. 1.74 million t-CO_2/year (Breakdown) Company A, B =(①×②÷③)×(④÷⑤×⑥×⑦×⑧) = approx. 270,000 t-CO_2/year (Company A), 680,000 t-CO_2/year (Company B) Company C =(①×②÷③)×(④÷⑤×⑥×⑧×⑨) = approx. 790,000 t-CO_2/year

17 Support Project Costs for Promoting Energy Efficiency Investment and Demand Structure Transformation

Concept of Impact Calculation	Estimation of CO_2 emission reduction effect based on the expected annual energy savings from 16 energy-saving facilities and equipment replacement projects supported by energy-saving subsidies in the FY2022 2nd supplementary budget.
Used Parameters	(A) Advanced projects ① Annual energy conservation: 327.3 kl/year ② CO_2 emission factor: 2.67 t-CO_2/kl (B) Custom-made projects ① Annual energy conservation: 915.7 kl/year ② CO_2 emission factor: 2.67 t-CO_2/kl (D) EMS project ① Annual energy conservation: 26.5 kl/year ② CO_2 emission factor: 2.67 t-CO_2/kl (Source and supplement) ① Refer to each business plan, calculated by the Ministry of Economy, Trade and Industry (METI). ② Refer to the FY2023 national average coefficient based on the Ministry of the Environment's "Emission Factors under the Calculation, Reporting, and Publication System 'Emission Factor List by Electric Utility Industry'"
Calculation Formula	(from FY2025) 【Expected annual CO_2 emission reduction effect of upgrading to energy-saving facilities and equipment subject to support】 = ①【Annual energy estimation of (A) + (B) + (D)】× ② = 3,300 t-CO_2

18 Grant for Decarbonization Transition Acceleration for Specific Regions (microgrid-related projects utilizing privately-owned distribution lines and other related initiatives)

Concept of Impact Calculation	CO_2 emission reduction effect over a five-year business plan period as a decarbonization leading area for the four local governments that provided the subsidy for the microgrid-related project is presented as impact.
Used Parameters	< CO_2 Emissions Reduction Effect over the Five-Year Project Planning Period > ・Tsukuba, Ibaraki Prefecture ①Project for Accelerating Specific Regional Decarbonization Transition (Private Sector Benefit Private Line Microgrid, etc.) 169,274 t-CO_2 ②Project for Promoting Regional Decarbonization Transition and Renewable Energy (Decarbonization Leading Area Development Project) 14,434 t-CO_2 ・Hidaka Village, Kochi Prefecture ①Project for Accelerated Regional Decarbonization Transition (Private Sector Benefit Line Microgrid, etc.) 9,805 t-CO_2 ②Project for Regional Decarbonization Transition and Renewable Energy Promotion (Decarbonization Leading Area Development Project) 23,671 t-CO_2 ・Ikusaka Village, Nagano Prefecture ①Project for Accelerated Regional Decarbonization Transition (Private Sector Benefit Line Microgrid, etc.) 4,601 t-CO_2 ②Project for Regional Decarbonization Transition and Renewable Energy Promotion (Decarbonization Leading Area Development Project) 64,391 t-CO_2 ・Nagoya City, Aichi Prefecture ①Project for Accelerated Regional Decarbonization Transition (Private Sector Benefit Line Microgrid, etc.) 38,185 t-CO_2 ②Project for Regional Decarbonization Transition and Renewable Energy Promotion (Decarbonization Leading Area Development Project) 17,760 t-CO_2 < Projected CO_2 Emissions Reduction Effect from Facilities Introduced and Operational by FY2024 > ③Tsukuba, Ibaraki Prefecture: 131 t-CO_2 Renewable energy generation facilities, high-efficiency air conditioners, and high-efficiency lighting equipment were installed. ③Hidaka, Kochi Prefecture: 339 t-CO_2 Renewable energy generation facilities, high-efficiency water heaters, high-efficiency air conditioners, groundwater heat utilization equipment, and heat storage equipment were installed. Introduction of storage batteries and EMS, and construction of a microgrid on a private line started. ③Ikusaka, Nagano Prefecture: 612 t-CO_2 Renewable energy generation facilities, high-efficiency lighting equipment, EVs, etc. were installed. Introduction of EMS and construction of a microgrid on a private line started. ③Nagoya City, Aichi Prefecture: Construction of ZEH-M and construction of microgrids on private lines has begun. (Source and supplement) ①Project Plan for Accelerating Decarbonization Transition in Specific Regions (Project for Microgrids on Private Lines Benefiting the Private Sector) ②Project Plan for Promoting Decarbonization Transition and Renewable Energy (Project for Developing Decarbonized Areas) ③Calculated based on reports submitted by each local government *CO_2 emission reduction effects are calculated by each local government using the "Global Warming Countermeasures Project Effectiveness Calculation Guidebook (for subsidized project applicants)" etc.
Calculation Formula	【CO_2 Emissions Reduction Effect over the Five-Year Project Planning Period】 = (① + ②) × four municipalities = approx. 342,000 t-CO_2/year 【Projected CO_2 Emissions Reduction Effect from Facilities Introduced and Operational by FY2024】 = ③ ((131 + 339 + 612) t-CO_2) = approx. 1,082 t-CO_2/year

19 Subsidy for Promoting the Introduction of Clean Energy Vehicles

Concept of Impact Calculation	The impact of this project is calculated as the reduction in CO_2 emissions resulting from the replacement of gasoline-powered vehicles with EVs and PHEVs. (FCV is not included because the number of auxiliary vehicles is small and emission factors and calculation methods have not been established.) The difference in emissions between EVs and PHEVs and gasoline-powered vehicles is regarded as the substantial reduction resulting from the introduction of EVs and PHEVs through this subsidy. Based on the Ministry of the Environment statistics, we first calculated the annual CO_2 emissions per vehicle for each powertrain by dividing the total emissions of each powertrain in Japan in FY2023 by the number of vehicles. We then multiplied the difference in emissions between EVs and PHEVs and gasoline-powered vehicles by the actual subsidy for EVs and PHEVs introduced through this project.
Used Parameters	① Population: 124,885,175 ② Ownership (gasoline) per population: 0.3682 units/1 person ③ Ownership (EV) per population: 0.0022 units/1 person ④ Ownership (PHEV) per population: 0.002 units/1 person ⑤ Annual emissions (gasoline): 64,152,071 t-CO_2 ⑥ Annual emissions (EV): 143,344 t-CO_2 ⑦ Annual emissions (PHEV): 266,924 t-CO_2 ⑧ Number of EVs introduced (Reiwa 4 correction, initial period of Reiwa 5): 90,346 ⑨ Number of PHEVs introduced (Reiwa 4 correction, initial period of Reiwa 6): 50,725 (Source and Supplement) ①-⑦ The Ministry of the Environment estimates based on the Ministry of Land, Infrastructure, Transport and Tourism's "National Road and Street Traffic Situation Survey Vehicle Origin and Destination Survey" (2023) ⑧⑨ Number of vehicles supported by this project
Calculation Formula	【Annual emissions per vehicle for each powertrain】 Gasoline vehicles: ⑤÷(①×②)　EV: ⑥÷(①×③) PHEV:⑦÷(①×④) 【Annual emissions reduction by EV introduction】 ={(⑤÷(①×②))-(⑥÷(①×③))}×⑧= approx. 79,000 t-CO_2/year 【Annual emissions reduction by PHEV introduction】 ={(⑤÷(①×②))- (⑦÷(①×④))}×⑨= approx. 17,000 t-CO_2/year 【Annual emission reductions due to the introduction of EVs and PHEVs (total)】 = approx. 79,000 t-CO_2/year + approx. 17,000 t-CO_2/year = approx. 95,000 t-CO_2/year

20 Promotion Project for the Electrification of Commercial Vehicles

Concept of Impact Calculation	Emission reduction effects of commercial vehicles introduced through this project were estimated. Emission reduction effects were calculated for each type of vehicle and totaled based on the assumption that gasoline-powered light trucks, diesel-powered pickup and standard trucks, and average gasoline-powered taxis would be replaced with electric vehicles.
Used Parameters	【Trucks】 Light trucks ① Average fuel consumption of gasoline-powered light trucks: 13.2 km/l ②Emissions per liter of gasoline: 2.32 kg-CO_2/l ③Electric power cost of EVs: 8.06 km/kWh ④Power source emission factor: 0.423 kg-CO_2/kWh ⑤Average annual mileage: 7,571 km ⑥Number of vehicles subsidized: 1,645 Pickup trucks ① Average fuel consumption of diesel pickup trucks: 8.8 km/l ② Emissions per liter of diesel oil: 2.58 kg-CO_2/l ③ Electric power cost of EVs: 1.92 km/kWh ④ Power source emission factor: 0.423 kg-CO_2/kWh ⑤ Average annual mileage: 10,832 km ④ Power source emission factor (kgCO_2/kWh): 0.423 kg-CO_2/kWh ⑥ Number of vehicles subsidized: 635 Standard trucks ① Average fuel consumption of diesel vehicles: 4.0 km/l ② Emissions per liter of diesel fuel: 2.58 kg-CO_2/l ③ Electric power cost of EVs: 1.92 km/kWh ④ Power source emission factor: 0.423 kg-CO_2/kWh ⑤ Average annual mileage: 25,826 km ⑥ Number of vehicles subsidized: 988 【Taxis】 ① Average fuel consumption of gasoline vehicles: 10.5 km/l ② Emissions per liter of gasoline: 2.32 kg-CO_2/l ③ Electric power cost of EVs: 5.88 km/kWh ④ Power source emission factor: 0.423 kg-CO_2/kWh ⑤ Average annual mileage: 14,412 km ⑥ Number of vehicles subsidized: 430 (Source and supplement) ① Values are based on the Ministry of Land, Infrastructure, Transport and Tourism “Vehicle Fuel Consumption Survey.” ② Values are based on the Ministry of the Environment ”List of calculation methods and emission factors under the greenhouse gas emission calculation and reporting system (for calculation of emissions after FY2009).” ③ Average model values are used. ④ Refer to the FY2023 national average coefficient based on the Ministry of the Environment’s ”Emission Factors under the Calculation, Reporting, and Publication System ’Emission Factor List by Electric Utility Industry’” ⑤ (Trucks) the Ministry of Land, Infrastructure, Transport and Tourism, ”Vehicle Fuel Consumption Survey.” (Taxi) Calculated by referring to the actual mileage based on the Ministry of Land, Infrastructure, Transport and Tourism, ”Vehicle Transport Statistics Survey,” and the total number of taxis based on the ”Trends in the Number of Operators and Vehicles Nationwide” by the Japan Federation of Car Hire and Taxi Associations. ⑥ Number of vehicles subsidized by this project
Calculation Formula	【Annual CO_2 emission reduction effect by replacing gasoline-powered vehicles, etc. with subsidized commercial vehicles】 Emission reductions for light trucks, pickup trucks, standard trucks, and taxis are calculated as follows: CO_2 emission reduction effect for each vehicle type = (②/① − ④/③)×⑤×⑥ Total CO_2 emission reduction effect = approx. 14,000 t-CO_2/year

21 Promotion Projects for the Installation of Advanced Equipment to Improve the Insulation Performance

Concept of Impact Calculation	The amount of CO_2 emission reduction resulting from the reduction in energy consumption for air conditioning in the retrofitted housing due to subsidized insulation window retrofits. The CO_2 emission reduction effect is calculated for each retrofit pattern, as it differs depending on the attributes of the housing (detached or apartment building*1), the insulation performance of the windows after retrofitting, the scale of the retrofit (whether the retrofit is for the LDK or the main living rooms), and the climate characteristics of the area where the housing is located. Specifically, the amount of energy reduction, such as electricity, is calculated using a program that complies with the Energy Conservation Standards for Housing*2, which allows users to evaluate the energy consumption performance and exterior performance of the housing by selecting and inputting conditions for buildings and equipment, and the reduction is multiplied by the conversion factor for each fuel type.*3 *1 Since the CO_2 emission reduction effect of the renovation of apartment building differs depending on the difference between the middle dwelling unit and the gable dwelling unit (a dwelling unit located at the end of a dwelling unit/corner room), the calculation was carried out separately. *2 A program based on technical information compiled by the Ministry of Land, Infrastructure, Transport and Tourism National Institute for Land and Infrastructure Management, the Building Research Institute, and the Japan Sustainable Architecture Association in cooperation with academic experts and practitioners from universities. *3 In reality, there are cases in which multiple grades of windows are renovated per application. In such cases, it is assumed that all windows with the highest grade and largest size are renovated, and calculations are made based on a single grade.
Used Parameters	① Electricity Reduction ② Electricity Emission Factor: 0.549kg-CO_2/kWh (1-2 regions) 0.496kg-CO_2/kWh (3-4 regions) 0.457kg-CO_2/kWh (5-8 regions) ③ Kerosene reduction ④ Kerosene emission factor: 0.0686kg-CO_2/MJ ⑤ Number of refurbished units in the retrofit pattern (Source and supplement) ① As the amount of electricity reduction varies depending on the retrofit pattern, it is calculated by a special program. ② Climate zone classification: Categories defined under Japan's Building Energy Efficiency Act. Higher numbers indicate warmer climates. Zones 1–2 are mainly Hokkaido; zones 3–4 are mainly Tohoku and mountainous areas; zones 5–8 include Tokyo, Osaka, Nagoya, etc. ③ The amount of kerosene reduced differs depending on the renovation pattern, and is calculated using a special program. ④ The Ministry of the Environment's Emission Factor List by Electric Utility Industry (for submission in FY2023) ⑤ Calculated based on information on the number of subsidized homes
Calculation Formula	【CO_2 emission reduction effect by improving air conditioning efficiency through window retrofits in supported houses】 Calculated by (①×②+③×④)×⑤ for each retrofit pattern and added together. = approx. 63,000 t-CO_2/year (detached houses), approx. 8,000 t-CO_2/year (apartments)


2050 CARBON NEUTRAL