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ARIMURA, Toshi H.
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Overview of the Japanese GX-ETS and Prospects for Phase II *

Toshi H. ARIMURA

Research Institute of Economy, Trade and Industry Faculty Fellow, Waseda University

Abstract

Japan introduced the GX Emissions Trading Scheme (GX-ETS) as a central component of its “growth-oriented carbon pricing” strategy for achieving carbon neutrality. Following a three-year voluntary phase beginning in fiscal year 2023, participation became mandatory in April 2026. This paper provides an overview of the institutional design of the GX-ETS, with a focus on Phase II, and examines its distinctive features and future development. Unlike many existing emissions trading systems, the GX-ETS regulates emissions at the company level rather than the facility level and covers a broad range of sectors. Free allowances are allocated primarily through sector-specific benchmarks, which cover approximately 90% of regulated emissions, while grandfathering applies to the remainder. Benchmark stringency gradually increases from the emissions intensity threshold of the top 50% of firms to that of the top 32.5% by fiscal year 2030. This bottom-up approach emphasizes technological feasibility. The GX-ETS also incorporates measures that address carbon leakage and changes in activity levels, additional allocations linked to GX-related R&D, limited use of carbon credits, and a price corridor with upper and lower bounds. These mechanisms seek to reconcile emissions reductions with international competitiveness and innovation.

Nevertheless, important challenges remain. Phase II allocation levels are not derived directly from Japan’s Nationally Determined Contribution, while the initial carbon price corridor is unlikely to support large-scale deployment of emerging technologies such as hydrogen or CCS. Future reforms will therefore need to strengthen alignment with Japan’s climate targets, gradually strengthen carbon price signals, develop a liquid allowance market, and manage the transition to auctioning in the power sector beginning in 2033.

Keywords: Emissions Trading; GX-ETS; free allocation; benchmarking; grandfathering; price corridor

JEL classification: H2, Q48, Q54, Q58

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1. The Road to the Institutional Design of the GX-ETS

Japan has long lagged behind Europe in adopting comprehensive carbon pricing. Although a Tax for Climate Change Mitigation was introduced in 2012, its rate was only JPY 289 per ton of CO₂, far below the carbon prices observed in European carbon pricing systems. For gasoline, this tax amounted to only about JPY 0.76 per liter. Following the adoption of the Paris Agreement in 2015 and the release of the IPCC Special Report on Global Warming of 1.5°C in 2018, limiting global warming to 1.5°C above pre-industrial levels became a central objective of international climate policy. As governments worldwide announced carbon neutrality targets, Japan's existing climate tax came to be viewed as far too low to support these increasingly ambitious policy goals.

Japan's emissions trading policy was initially led by subnational governments. In 2010, the Tokyo Metropolitan Government introduced the Tokyo Emissions Trading Scheme (Tokyo ETS), the first mandatory cap-and-trade program for CO₂ emissions in Asia. Unlike earlier emissions trading programs elsewhere, the Tokyo ETS was designed primarily to reduce emissions from commercial and service-sector facilities in an urban setting. Because large power plants are rarely located within Tokyo, the scheme covers approximately 1,300 large commercial and institutional facilities, most of which are office buildings, other commercial buildings, and hotels. In 2011, Saitama Prefecture, located north of Tokyo, launched another subnational ETS covering approximately 600 facilities. Although linked to the Tokyo ETS, the Saitama ETS resembles a more conventional cap-and-trade program, because most covered facilities are in the manufacturing sector (Arimura, 2024).

At the national level, discussions of carbon pricing intensified following the Paris Agreement, particularly within advisory councils of the Ministry of the Environment. However, substantial momentum toward a nationwide carbon pricing system emerged after then-Prime Minister Yoshihide Suga announced Japan's commitment to carbon neutrality in 2020. Under its Green Transformation (GX) framework, the government began promoting what it called "*growth-oriented carbon pricing*." Subsequently, Keidanren (the Japan Business Federation) also identified emissions trading as a key policy instrument for achieving carbon neutrality. The enactment of the GX Promotion Act in May 2023 marked a major step in Japan's transition toward comprehensive carbon pricing.

The GX Promotion Act provides the legal basis for two forms of carbon pricing. The first is a fossil fuel levy on imported fossil fuels that will be implemented in 2028. Economically, this levy is equivalent to a carbon tax. The second is a specified operator contribution system, which effectively entails auctioning emission allowances to the power sector within an emissions trading framework. Although fossil-fuel levies and carbon taxes are economically equivalent, their institutional arrangements differ. In particular, introducing or revising a carbon tax requires approval by the Diet, whereas a levy can be established and adjusted under a different legal framework without following the same legislative process required for a tax.

At the same time, a further form of carbon pricing—the GX Emissions Trading Scheme (GX-ETS)—was introduced voluntarily beginning in fiscal year 2023, although its legal basis had not yet been fully established. Under the leadership of the Ministry of Economy, Trade and Industry (METI), the GX League was created as a platform for companies seeking to pursue both carbon neutrality and economic growth. One of the League's central initiatives was the voluntary GX-ETS, under which participating companies agreed to set emissions reduction targets and participate in emissions trading.

Although participation in the GX-ETS was voluntary, the scheme quickly attracted participation from many of Japan's largest emitters and ultimately covered more than half of the country's greenhouse gas emissions. Several factors helped explain this high participation rate. First, companies expected participation to give them a voice in the design of future mandatory emissions trading rules. For firms anticipating the eventual introduction of a mandatory national ETS, early participation gave them an opportunity to help shape a system better suited to their operational circumstances.

A second incentive was access to financial support through GX Economy Transition Bonds. Participation in the GX League—and therefore in the voluntary GX-ETS—effectively became a

prerequisite for receiving this support. Japan's GX strategy thus combines financial incentives with regulatory discipline. Notably, the government chose first to provide incentives by issuing GX Economy Transition Bonds before introducing mandatory carbon pricing. The government estimates that achieving carbon neutrality will require approximately JPY 150 trillion in investment, of which JPY 20 trillion will be financed by government-issued GX Economy Transition Bonds to catalyze private sector investment in decarbonization technologies. In practice, companies seeking access to these funds were required to join the GX League, making participation in Phase I of the GX-ETS nominally voluntary but strongly encouraged in practice.

Despite the policy importance of the GX-ETS, few studies provide a comprehensive account of its institutional design, particularly Phase II, which marks the transition from a voluntary to a mandatory emissions trading system. This paper addresses this gap by providing an overview of the GX-ETS, with particular emphasis on Phase II, under which participation is mandatory. The discussion is based on the institutional proposal released in December 2025, which was subsequently incorporated into the ministerial ordinances and public notices promulgated in March 2026.

2. Phase I of the GX-ETS

Phase I of the GX-ETS, covering fiscal years 2023–2025, had several distinctive design features. Most importantly, participation in the GX League was organized at the company level rather than through industry associations, unlike Keidanren's Voluntary Action Plan on the Environment (1997–2012) and its subsequent Commitment to a Low Carbon Society (from fiscal year 2013). This marked a significant departure from Japan's earlier voluntary environmental initiatives, which had generally been coordinated through industry associations (Arimura *et al.*, 2019). Accordingly, the GX-ETS itself was also implemented at the company level. Throughout this paper, the term *company* is used for readability as broadly equivalent to the term *operator*, while recognizing that many companies own and operate multiple facilities.

Participating companies were required to set emissions reduction targets covering both Scope 1 and Scope 2 greenhouse gas emissions. However, only Scope 1 CO₂ emissions were subject to emissions trading. Thus, the trading system covered direct CO₂ emissions from regulated facilities, including emissions from fossil-fuel combustion and industrial processes, such as those from cement production.

In Phase I, the GX-ETS adopted a **reduction credit** approach similar to those used in the Tokyo and Saitama ETSs. Unlike allowance-based systems such as the EU ETS, in which emission allowances are allocated *ex ante*, a reduction credit system issues tradable credits *ex post* to participants whose emissions fall below their established targets. This design partly reflects earlier criticism in Japan that emissions trading could become little more than a “money game” (Roppongi *et al.*, 2017).

Because Phase I was voluntary, participating companies could determine their own emissions reduction targets. However, tradable reduction credits were issued only for emissions reductions exceeding the trajectory implied by Japan's Nationally Determined Contribution (NDC). Using fiscal year 2013 as the reference year, companies could receive reduction credits only if their emission reductions exceeded 27.0% in fiscal year 2023, 29.7% in fiscal year 2024, and 32.4% in fiscal year 2025.

Companies could also use eligible carbon credits to meet their reduction targets. These included **J-Credits**, the Japanese government's domestic crediting mechanism, and credits generated through the **Joint Crediting Mechanism (JCM)**, Japan's international bilateral crediting program (Arimura, 2024). In addition, Phase I permitted the limited use of certain removal-based credits, an option unavailable under Phase II.

To enhance market liquidity, a carbon credit market was established on the Tokyo Stock Exchange (TSE). Following a pilot program supported by METI in fiscal year 2022, full-scale J-Credit trading began in October 2023. By contrast, neither the Tokyo ETS nor the Saitama ETS established a dedicated exchange, largely because of concerns about speculation. The launch of the TSE carbon credit market therefore marked an important milestone in the development of emissions trading in Japan.

3. Phase II of the GX-ETS

Although Phase I of the GX-ETS was voluntary, the system underwent a major institutional transition toward mandatory participation during this period. In May 2025, the GX Promotion Act was amended, and the Diet approved mandatory implementation of the GX-ETS beginning in April 2026. Between July and December 2025, alongside meetings of the ETS Subcommittee, three benchmark working groups were established for the power, manufacturing, and transport sectors. These working groups developed the main institutional framework for Phase II of the GX-ETS. The following sections outline the key features of Phase II, which marks the transition from a voluntary to a mandatory emissions trading system.

3.1. Regulated Entities and Coverage

As in Phase I, the GX-ETS regulates emissions at the company level. This approach differs from the EU ETS and the Tokyo and Saitama ETSs, which regulate emissions at the facility level. One reason for adopting a company-based approach was likely administrative feasibility. Regulating individual facilities would require monitoring far more emission sources, substantially increasing the administrative burden on both the government and third-party verification bodies. Accordingly, regulating companies rather than individual facilities can reduce monitoring and verification costs. Moreover, the company-based approach also gives firms greater compliance flexibility by allowing them to reallocate abatement efforts across multiple facilities, thereby potentially reducing overall compliance costs.

As in Phase I, Phase II covers only **Scope 1 CO₂ emissions**. The scheme regulates direct CO₂ emissions from fossil-fuel combustion and industrial processes, such as those arising from cement production. As under the EU ETS, Scope 2 emissions associated with electricity consumption are excluded. Moreover, the GX-ETS covers only CO₂ emissions. Because the GX-ETS is nationwide, emissions from electricity generation are regulated directly as Scope 1 emissions of power producers. Consequently, unlike the Tokyo ETS, there is no need to include Scope 2 emissions to create incentives to reduce emissions from electricity generation.

One notable feature of the GX-ETS is that, unlike many other emissions trading systems, it covers a broad range of sectors from the outset of mandatory participation. For example, the EU ETS initially covered only the power and manufacturing sectors, while the Regional Greenhouse Gas Initiative (RGGI) in the United States is limited to the power sector. By contrast, the GX-ETS applies to companies emitting at least 100,000 tons of CO₂ annually. Consequently, it covers not only power generation and manufacturing but also transport, real estate, and several other sectors from the outset. In terms of sectoral coverage, the GX-ETS is among the broadest emissions trading systems introduced to date.

Because the regulated entity is the company rather than the individual facility, all Scope 1 emissions generated by covered companies are subject to the system. This includes emission sources that would typically fall outside facility-based emissions trading systems, including fuel consumed by company-owned vehicles. This is another important distinction between the GX-ETS and facility-based systems such as the EU ETS.

For both regulatory efficiency and fairness, overlapping national and subnational regulation of the same emissions should be avoided. This issue is particularly important in Saitama, where many manufacturing facilities are already covered by the prefectural ETS. Without coordination, companies could otherwise face overlapping compliance obligations under both the national GX-ETS and the Saitama ETS for the same emissions. During the policy design process, some stakeholders therefore argued for exempting facilities covered by the Tokyo and Saitama ETSs from the national GX-ETS. However, because the GX-ETS is established under national legislation, whereas the Tokyo ETS is based on a metropolitan ordinance and the Saitama ETS is administered under a prefectural framework, national legislation takes legal precedence over these subnational frameworks. Consequently, facilities covered by the Tokyo and Saitama ETSs were not exempt from the GX-ETS. Instead, the Tokyo and Saitama ETSs now exclude Scope 1 emissions that are already regulated under

the national GX-ETS.²

3.2. Allocation of Allowances

In Phase II, all covered companies receive allowances free of charge. Energy-intensive industries receive benchmark-based allocations, while allowances for other sectors are allocated through grandfathering.³ Under both methods, the amount of free allocation declines over time. The two allocation methods are described below.

3.2.1. Benchmarking

Under **benchmark-based allocation**, the initial allocation equals the benchmark value for each sector multiplied by the reference activity level, defined as the average activity level over fiscal years 2023–2025.

$$\text{Initial allocation} = \text{Benchmark} \times \text{Reference activity level}$$

Under **grandfathering**, companies that invested in energy efficiency before the ETS was introduced may receive fewer free allowances because their historical emissions are lower. This can raise fairness concerns by disadvantaging early adopters of decarbonization measures. Benchmark-based allocation avoids this problem because allocations depend on emissions intensity rather than historical emissions. As a result, it preserves incentives for early investments in decarbonization and is generally regarded as superior to grandfathering on both efficiency and equity grounds.

Under benchmarking, the benchmark value expresses CO₂ emissions per unit of output. For example, in the power sector it is expressed as grams of CO₂ per kilowatt-hour of electricity generated (g-CO₂/kWh), whereas in the steel industry it is expressed as tons of CO₂ per ton of crude steel produced.

For the first compliance year (fiscal year 2026), the benchmark is set at the emissions intensity of the **least carbon-intensive 50%** of firms within each industry. The benchmark then tightens progressively each year, reaching the emissions intensity of the **top 32.5%** of firms by fiscal year 2030. Applying a common methodology across sectors improves transparency and facilitates rapid implementation of the system.

Benchmark stringency was determined with reference to Japan's experience under the **Top Runner Programme** established under the Energy Conservation Act. Experience with that program suggests that firms can improve energy efficiency from the industry average to approximately the top-15% level over a 10-year period. Accordingly, the GX-ETS adopts the halfway point—the **top 32.5% level**—as the benchmark for the initial five-year compliance period. This gradual tightening of the benchmark gives firms sufficient time to adapt while maintaining ongoing incentives for technological improvement and emissions reduction.

Under this approach, firms with emissions intensity at or above the industry average (such as Firms A and B in Figure 1) need not undertake additional abatement in the first compliance year. By contrast, less efficient firms (such as Firms E and F) must either cut emissions or purchase additional allowances. Because the benchmark becomes progressively more stringent over time, even firms with average emissions intensity will eventually need to achieve further emissions reductions.

² The emissions reduction targets for the manufacturing sector in Phase IV (2025–2029) are 33% under the Tokyo ETS and 27% under the Saitama ETS. Both targets are considerably more stringent than the benchmark stringency applied to manufacturing under Phase II of the GX-ETS.

³ Under benchmarking, free allowances are allocated according to sector-specific performance benchmarks, so firms with lower emissions intensity receive relatively larger allocations. Under grandfathering, allowances are allocated primarily based on historical emissions or activity levels, subject to a declining allocation factor over time.

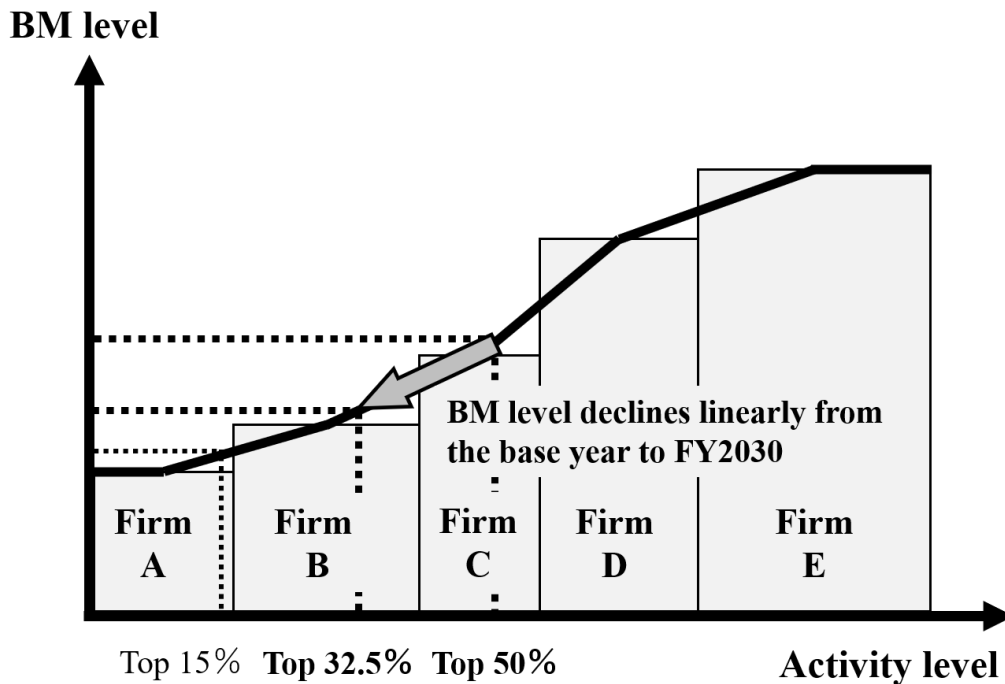


Figure 1 Benchmark and Allowance Allocation Framework

Source: author's illustration based on materials from METI's Emissions Trading Committee

The underlying premise is that efficiency levels already achieved by domestic top performers are technically feasible and can therefore be attained by other firms with existing technologies. In other words, the benchmark requires firms to attain energy efficiency levels already demonstrated in Japan. As an initial ETS benchmark, it does not impose technically unrealistic requirements on firms. At the same time, unlike earlier energy conservation policies, the GX-ETS introduces explicit economic incentives through emissions trading. It can therefore be viewed as a mandatory regulatory system that relies on market-based incentives rather than conventional command-and-control measures. In this respect, the benchmark serves both as an allocation rule and as a technology-diffusion mechanism, encouraging firms to converge toward the performance of domestic best-practice firms.

To develop these benchmarks, METI established benchmark working groups for the power, manufacturing, and transport sectors. The working groups held a series of technical discussions and consulted industry associations to determine appropriate benchmark methodologies. Their main conclusions are summarized below.

In the power sector, the benchmark is defined as CO₂ emissions per unit of electricity generated (g-CO₂/kWh). A key design question was whether to establish separate benchmarks for each fuel type, such as coal and natural gas, or to apply a single benchmark to all thermal power generation. Under an all-thermal benchmark, electricity generated from lower-emission natural gas is included in the benchmark calculation, thereby making the benchmark more stringent for coal-fired power plants. While an all-thermal benchmark creates stronger incentives for fuel switching from coal to natural gas, fuel-specific benchmarks provide weaker incentives to alter the existing generation mix.

During the first three years of Phase II, free allowances are allocated entirely using fuel-specific benchmarks. From the fourth year onward, however, allocation gradually shifts toward the all-thermal benchmark. The benchmark is calculated as a weighted average of the all-thermal benchmark and the fuel-specific benchmark with the weighting parameter α . Initially, α is set equal to zero, so allocation is based entirely on fuel-specific benchmarks. It then increases to 0.2 in fiscal year 2029 and to 0.4 in fiscal year 2030. By fiscal year 2030, therefore, 40% of free allocation is determined using the all-thermal benchmark.

$$\text{Power-sector benchmark level} = \text{all-thermal benchmark level} \times \alpha + \text{fuel-specific benchmark level} \times (1 - \alpha)$$

This gradual change in the weighting parameter is expected to materially affect power utilities. Companies with a relatively large share of coal-fired generation will face increasingly large allowance shortfalls relative to their actual emissions. To meet their compliance obligations, these firms will need to reduce emissions by switching to natural gas, increasing biomass co-firing, or purchasing carbon credits. This phased transition balances the stability of existing power generation assets against stronger long-term incentives for decarbonization through fuel switching.

Benchmarks for the Power Sector

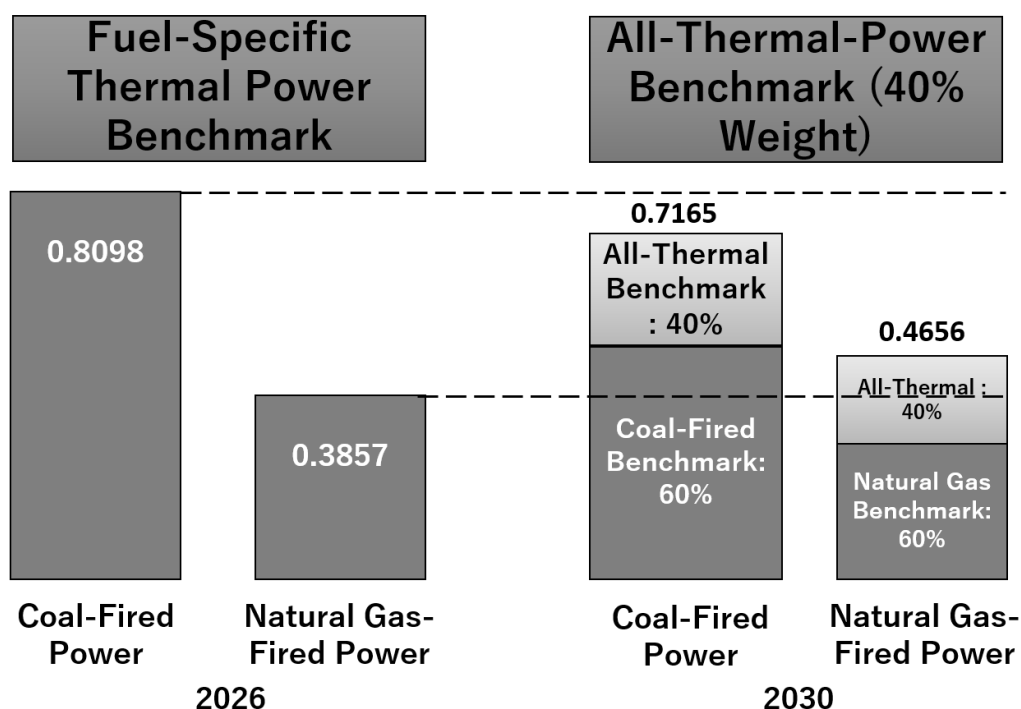


Figure 2. Power-Sector Benchmark Levels (kg-CO₂/kWh)

Source: author's illustration.

In the manufacturing sector, benchmark values are generally established at the product level, and free allowances are calculated by multiplying the benchmark emissions intensity by the corresponding production level. However, defining the relevant product is not always straightforward in practice. For integrated blast-furnace steel production, crude steel provides a relatively straightforward benchmark unit. By contrast, specialty steel produced using electric arc furnaces covers a wide range of products, ranging from ordinary structural steel to high-alloy steel, which makes it difficult to define a single representative product. Similar challenges arise for ordinary electric arc furnace steel production. In sectors where a common product cannot be identified readily,

energy input (heat consumption) serves as a proxy for production activity when establishing the benchmark.

Another important issue in manufacturing benchmark design is on-site electricity generation. Many firms in electricity-intensive industries, such as steel and chemicals, generate some of their electricity on site. For electricity purchased from the grid, the associated CO₂ emissions are regulated upstream as Scope 1 emissions of the electricity producer rather than as Scope 1 emissions of the manufacturing firm. By contrast, electricity generated on site creates Scope 1 emissions for the manufacturing company itself. Without adjustment, firms with self-generation could therefore receive fewer allowances than otherwise comparable firms purchasing electricity from the grid, even if their production processes are equally efficient. To correct this asymmetry, the benchmark incorporates an adjustment for the share of self-generated electricity. Specifically, the benchmark is first calculated using both direct and indirect emissions associated with electricity use, and the final allocation is then adjusted according to the firm's share of direct emissions.

In sectors with complex production processes, benchmarking is applied only to processes that are common across firms, while the remaining processes are covered by grandfathering. Automobile manufacturing provides a typical example. Vehicle production involves pressing, body assembly, painting, and final assembly, but the extent to which these processes are performed in-house differs across manufacturers. Consequently, only painting, a process common to all manufacturers, is subject to benchmarking, whereas the remaining processes are covered by grandfathering. Additional adjustments are made to account for differences in emissions intensity across vehicle classes.

In the transport sector, benchmarks are established for airlines, road freight transport, and domestic coastal shipping. Unlike manufacturing, transport services are comparatively homogeneous, and activity is measured in ton-kilometers. In aviation, only two airlines—which together account for the vast majority of domestic passenger traffic—are covered by the GX-ETS. Nevertheless, benchmark data are collected from operators outside the regulated scope, allowing the benchmark to draw on a broader industry dataset. A similar approach is used in manufacturing sectors where only a limited number of firms are covered by the GX-ETS.

The development of such a comprehensive set of sector-specific benchmarks within a relatively short period is notable. This was made possible by the extensive experience accumulated under the Energy Conservation Act, together with the technical expertise of METI's sectoral divisions, and close consultation with industry associations. More generally, the benchmark design process demonstrates the institutional capacity required to implement a technically sophisticated emissions trading system.

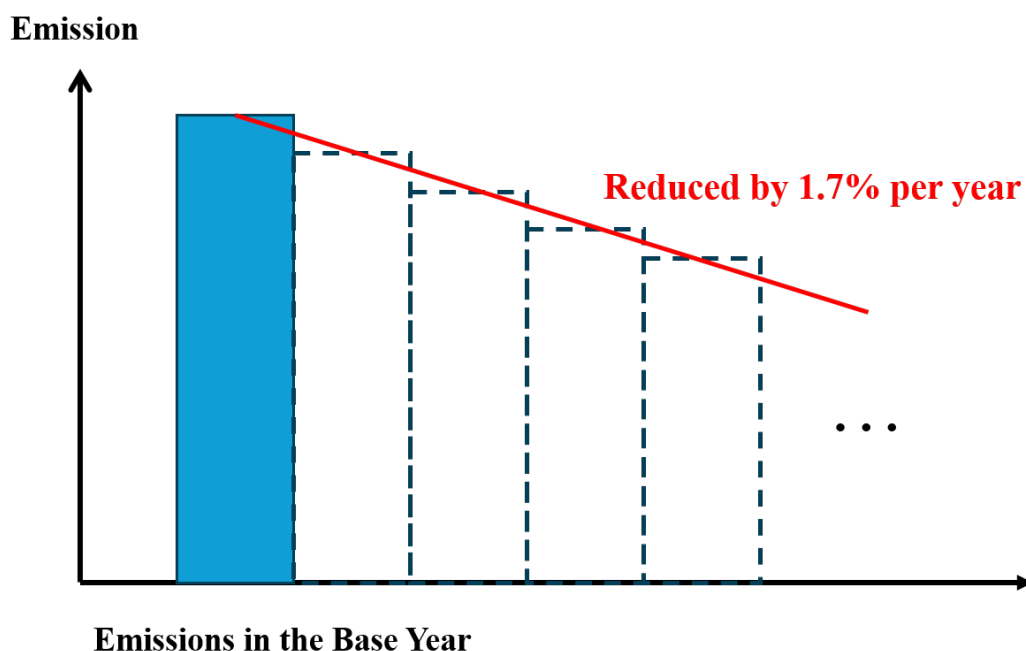
This flexible approach permits benchmarking even in sectors where product heterogeneity would otherwise make product-based benchmarks impractical.

3.2.2. Grandfathering

Sectors and companies not covered by benchmarking receive free allowances based on historical emissions during fiscal years 2023–2025. Under grandfathering, the annual reduction factor is set at **1.7%**. This rate reflects the assumption that firms in these sectors can reduce emissions by about **8.5%** over the five-year compliance period through comparatively straightforward measures, such as switching from heavy oil to natural gas.

A well-known limitation of grandfathering is that it can disadvantage firms that reduced emissions early before the ETS was introduced. For example, a company that invested in low-carbon technologies in 2021 would have lower historical emissions and consequently receive fewer free allowances than an otherwise similar company that delayed investment. To mitigate this disadvantage, the GX-ETS provides additional allowances to firms that made qualifying early investments, thereby improving fairness while preserving incentives for early action⁴.

⁴ Eligibility for additional allocation is determined through METI's review of evidence showing that the investment was undertaken before the GX-ETS was introduced and meets the criteria specified in the ministerial guidelines.



Source: author's illustration based on materials from METI's Emissions Trading Committee

Figure 3. Grandfathering-Based Allowance Allocation Framework

The annual reduction factor under grandfathering also affects benchmarked sectors. To maintain consistency across the two allocation methods, the annual tightening of benchmark-based allocation is capped at the same **1.7%**. This cap prevents benchmarked sectors from facing substantially steeper annual reductions than sectors covered by grandfathering, particularly where moving from the **top 50%** benchmark to the **top 32.5%** benchmark would otherwise imply a larger annual reduction. By applying the same annual reduction factor to both allocation methods, the GX-ETS seeks to maintain broadly comparable compliance burdens across sectors, despite employing different allocation approaches.

Table 1. Allocation Methods and Representative Sectors under Phase II of the GX-ETS

Allocation method	Representative sectors
Benchmarking	Power generation, steel, cement, chemicals, paper, transport, etc
Grandfathering	Real estate, retail, services, sectors where product benchmarks cannot yet be established

According to METI, approximately **90%** of emissions covered by the GX-ETS are expected to receive benchmark-based allocation, whereas only about **10%** will remain under grandfathering. Table 1 summarizes the allocation methods and representative sectors. At the first scheduled review, five years after implementation, one issue will be whether benchmarking should be extended to sectors that are currently allocated allowances through grandfathering.

3.3. Compliance-Related Rules

3.3.1. Banking

As in many other emissions trading systems, the GX-ETS allows firms to bank allowances for future compliance periods. Banking provides firms with intertemporal flexibility and can reduce compliance costs. However, substantial accumulations of banked allowances have occurred in both the Tokyo ETS and the Korean ETS, contributing to limited market liquidity. In response, the GX-ETS is considering limits on the volume of allowances that firms may bank. Specific limits are expected to be determined in fiscal year 2026 as part of the development of market trading rules. The policy challenge is to preserve the cost saving benefits of intertemporal flexibility without allowing excessive banking to undermine market liquidity.

3.3.2. Offsets

In Phase II, covered companies may use government-certified domestic J-Credits and credits generated through the Joint Crediting Mechanism (JCM) for compliance. The use of these credits is limited to **10% of a company's emissions**. Because some major emissions trading systems, including the EU ETS and the UK ETS, do not permit the use of offsets, the GX-ETS therefore offers covered companies a relatively flexible compliance option.

J-Credits predated exchange-based trading, but most transactions occurred bilaterally and market liquidity remained limited. Exchange-based trading of J-Credits commenced on the Tokyo Stock Exchange (TSE) in October 2023. J-Credits fall broadly into three categories: energy efficiency credits generated through investments in energy-saving measures, renewable energy credits generated through renewable energy projects, and forest credits generated through forest management and conservation activities. When exchange-based trading began, forest credits traded at the highest prices, followed by renewable energy and energy efficiency credits. In 2023, for example, energy efficiency credits traded at approximately JPY 1,700 per ton of CO₂, compared with around JPY 5,000 for renewable energy credits and approximately JPY 8,000 for forest credits.

Differences in demand across credit categories have been observed in Japan since the early stages of the J-Credit program. When credits are purchased for voluntary purposes, such as corporate social responsibility, buyers may assign additional value to the environmental and social attributes associated with forest credits. However, as the introduction of the mandatory GX-ETS approached, energy efficiency credit prices rose from approximately JPY 1,700 to more than JPY 5,000 per ton of CO₂. This pattern suggests that price differentials across J-Credit categories may be narrowing.

From a compliance perspective, one ton of verified emissions reductions has the same value for compliance regardless of whether it is generated through energy efficiency improvements, renewable energy projects, or forest-related activities. The transition from predominantly voluntary demand to compliance-driven demand may therefore promote price convergence across credit categories. However, whether the recent increase in the price of energy efficiency credits reflects rising marginal abatement costs, expectations of greater compliance demand under the mandatory GX-ETS, or a combination of both remains an important topic for future research.

3.3.3. Alternative Compliance and Penalties

Under mandatory Phase II of the GX-ETS, companies generally must surrender allowances equal to their emissions. However, when the allowance price reaches the upper price bound, companies may satisfy their compliance obligations by paying to the government at the upper price bound instead of purchasing and surrendering allowances. In such cases, companies are deemed compliant for the corresponding emissions and are not required to purchase allowances in the market.

If a company nevertheless fails to fulfill its compliance obligation, it must pay a penalty termed the “nonretirement equivalent contribution,” which is set at 1.1 times the upper price bound. Thus, the upper price bound effectively caps regulated companies’ compliance costs, while the higher noncompliance payment preserves an incentive to comply with the system.

In practice, this mechanism also functions as a cost-containment mechanism: when emissions reductions are especially costly and sufficient allowances are unavailable in the market, the

contribution limits the financial exposure associated with an allowance shortfall.

3.4. Measures Addressing International Competitiveness

Carbon leakage and the potential loss of international competitiveness are important design considerations for emissions trading systems. Like many other ETSs, the GX-ETS incorporates measures to address carbon leakage and includes provisions addressing changes in firms' activity levels.

3.4.1. Carbon Leakage Measures

The first step in addressing carbon leakage is identifying sectors exposed to leakage risk. In Phase II, drawing on the Australian Safeguard Mechanism, the GX-ETS applies a trade share threshold of 0.1. Sectors satisfying the following condition are eligible for carbon leakage measures:

$$\text{Trade share} = (\text{imports} + \text{exports}) / \text{domestic production} > 0.1$$

For eligible sectors, additional allowances may be allocated in the subsequent year if the cost of purchasing allowances exceeds a specified share of operating profit. In designing this rule, METI considered financial indicators such as the ratio of cash and deposits to operating profit and changes in current liabilities, to limit the risk that allowance procurement costs could cause serious liquidity constraints. Using financial data from the past 20 years, METI set the threshold at **4% of operating profit**. When procurement costs exceed this threshold, firms become eligible for additional allocation.

Specifically, additional allowances may be allocated to companies in carbon leakage-exposed sectors to mitigate excessive procurement costs. However, the additional allocation is limited to **50% of the allowance shortfall**. Thus, even firms that receive additional allocation bear part of the compliance cost, which preserves incentives to reduce emissions. The measure therefore seeks to balance reduced carbon leakage risk against continued abatement incentives. According to METI estimates, even under relatively high cost scenarios, additional allocation under this mechanism would account for only 2–3% of total emissions covered by the GX-ETS, suggesting only a limited overall effect on system stringency.

Takeda *et al.* (2014) proposed **output-based allocation (OBA)** to address carbon leakage in the Japanese economy. Under OBA, free allowance allocation varies with output, thereby limiting the increase in average production costs caused by carbon pricing. The GX-ETS leakage measure for benchmarked sectors shares features with OBA, although the two mechanisms are not identical. Under the GX-ETS, when allowance procurement costs exceed the 4% threshold, additional allowances covering up to 50% of the allowance shortfall may be provided. When an allowance shortfall results from increased production, the mechanism partly resembles OBA because additional allocation rises in response to higher activity and associated emissions. It can therefore be interpreted as incorporating elements of an output-responsive allocation mechanism while retaining incentives for emissions reduction.

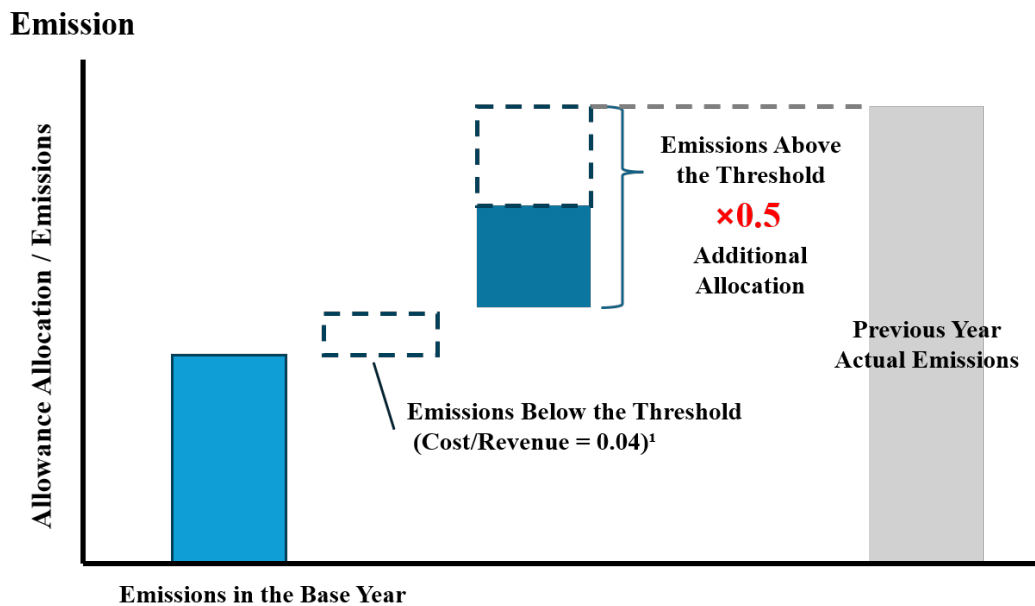


Figure 4. Measures to Mitigate Carbon Leakage Risk

Source: author's illustration based on materials from the Ministry of Economy, Trade and Industry

Measures to address carbon leakage in emissions trading systems generally aim both to reduce the risk of relocating production and emissions abroad and to mitigate adverse effects on the international competitiveness of domestic industries. The GX-ETS leakage measures likewise seek to reconcile domestic decarbonization incentives with concerns about the international competitiveness of Japanese firms.

3.4.2. Measures for Changes in Activity Levels

Phase II of the GX-ETS also includes provisions for changes in activity levels. If a firm's activity level increases or decreases by more than **7.5% for two consecutive years**, its allocation is adjusted using a newly established reference activity level.

This mechanism helps prevent the creation of “hot air”—that is, free allowances received without corresponding mitigation—when activity levels decline substantially. Conversely, when firms expand production, the mechanism reduces the risk of the allocation system unduly constraining growth. In this respect, the measure resembles **OBA**, under which allowance allocation varies with output, and may therefore help limit adverse effects on international competitiveness. Because the 7.5% threshold must be exceeded for two consecutive years, the adjustment mechanism is likely to apply only after relatively substantial and persistent changes in activity.

3.4.3. Promoting Innovation

Another distinctive feature of the GX-ETS is its explicit objective of promoting innovation through “*growth-oriented carbon pricing*.” One reason Japan delayed introducing emissions trading was concern that the cost of purchasing allowances could divert financial resources away from corporate research and development (R&D), and thereby discourage innovation. The GX-ETS includes measures intended to address this concern. Specifically, in Phase II, additional allowances may be allocated to firms engaged in GX-related R&D activities.

A key challenge is identifying firms conducting GX-related R&D. The GX-ETS uses two methods. First, additional allocation is available to firms that hold patents related to GX technologies, identified through the GX technology classification developed by the Japan Patent Office. Second,

firms participating in government-supported GX-related R&D projects may also qualify. In particular, companies participating in projects financed by the Green Innovation Fund may qualify for additional allocation even when their R&D activities have not yet resulted in patents. These projects include technologies such as hydrogen, ammonia, and perovskite solar cells.

Additional allocation is provided to firms whose GX-related R&D expenditure exceeds the corresponding sectoral average. The amount of additional allocation is calculated by dividing eligible R&D spending above the sectoral average by the allowance price. Explicitly incorporating R&D investment into allowance allocation is highly distinctive to the GX-ETS and, to the best of our knowledge, does not appear in other major emissions trading systems.

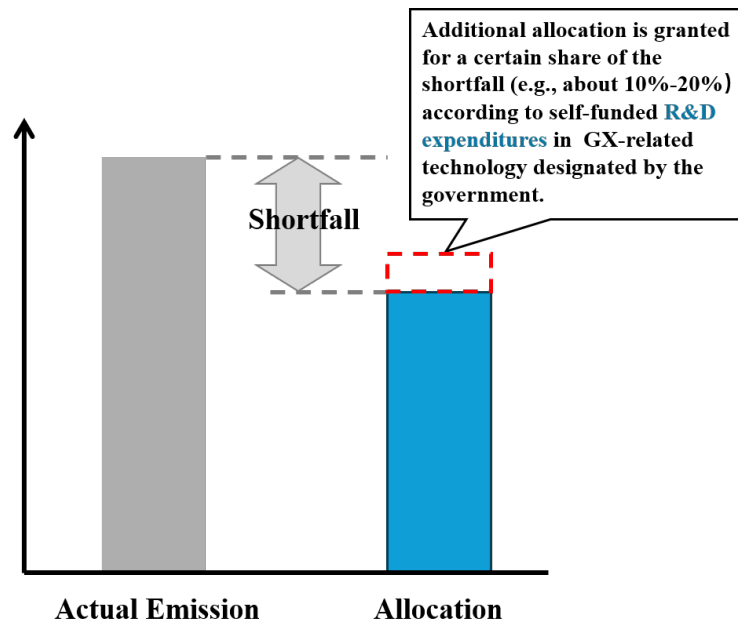


Figure 5. Illustration of Measures Based on R&D Investment in GX-Related Fields

Source: author's illustration based on materials from METI's Emissions Trading Committee

The R&D-related allocation may be combined with additional allocation provided under the carbon leakage measures. The mechanism is intended to support firms' investment in low-carbon innovation while maintaining incentives for emissions reduction. To limit any weakening of these incentives, R&D-related additional allocation is capped at **10% of the allowance shortfall**.

3.5. Prices and Markets

Unlike under a carbon tax, the government does not directly determine the carbon price in an emissions trading system. Higher allowance prices strengthen incentives for low-carbon investment and decarbonization but can also heighten concerns about international competitiveness and carbon leakage for firms that must purchase allowances. Conversely, when allowance prices are too low, incentives for such investment become weaker. Regulators have therefore explored mechanisms for keeping allowance prices within appropriate ranges.

The EU ETS, for example, experienced a prolonged period of depressed allowance prices during the 2010s. Following the global financial crisis, economic activity slowed, while renewable electricity generation expanded as Member States adopted policies such as feed-in tariffs. These developments reduced allowance demand and contributed to a substantial market surplus. Allowance prices, which had exceeded EUR 20 at the beginning of Phase II in 2008, later fell to around EUR 5. Persistently low prices weakened decarbonization incentives, particularly in the manufacturing sector. In response, the EU introduced the Market Stability Reserve (MSR), a quantity-based mechanism

that adjusts the supply of allowances entering the market. Together with later reforms and increasingly stringent climate targets, these measures contributed to a recovery in allowance prices. In 2019, the European Green Deal set the objective of achieving climate neutrality by 2050. This was followed by the Fit for 55 package in 2021, which set a target to reduce net greenhouse gas emissions by at least 55% by 2030 relative to 1990 levels and further strengthened the EU ETS. Against this policy backdrop, allowance prices eventually rose above EUR 100.

An alternative to quantity-based intervention is to establish upper and lower bounds on allowance prices. When emissions trading systems are introduced, industry often raises concerns about the possibility of sharp increases in allowance prices. Economists therefore proposed a “safety valve,” which caps compliance costs (Pizer, 2002). Conversely, when allowance prices fall too low, investment incentives weaken, creating a rationale for a price floor. The literature has also examined arrangements that combine upper and lower price bounds to create a **price corridor** (Burtraw *et al.*, 2012). In practice, RGGI in the northeastern United States applies an auction reserve price that functions as a price floor, while California’s cap-and-trade program also incorporates mechanisms that constrain allowance prices at both the lower and upper ends.

The relative merits of price-based and quantity-based market stabilization remain an important issue in ETS design. Drawing on the extensive literature on the EU ETS, Borghesi *et al.* (2023) compare the two approaches. They argue that the MSR may reduce short-term market liquidity and may amplify price volatility, and suggest that a price corridor with upper and lower bounds may offer a preferable approach to market stabilization.

Drawing on this experience, the GX-ETS adopts a price-based approach with both upper and lower bounds. For fiscal year 2026, the lower bound is set at **JPY 1,700 per ton of CO₂**, while the upper bound is **JPY 4,300 per ton**. The lower bound was set with reference to the market price of energy efficiency J-Credits at the launch of exchange-based trading on the TSE in October 2023, whereas the upper bound was proposed with reference to the estimated cost of switching from coal to natural gas in sectors such as power generation.

Under Phase II, METI determines the upper and lower price bounds annually, following deliberations by the relevant committee, in the year preceding their application. METI may also indicate reference price levels for future years. When discussing the future trajectory of the price corridor, the committee considered both inflation and real increases in carbon prices, with real increases intended to provide a predictable signal for corporate investment decisions. A **3% annual real increase** in the price bounds was proposed with reference to the weighted average cost of capital commonly used in investment decisions. From an economic perspective, bankable allowances can be viewed as intertemporal assets analogous to exhaustible resources (Rubin, 1996). Under an ETS that permits banking, the Hotelling condition implies that, in an efficient intertemporal equilibrium, allowance prices tend to rise at a rate linked to the relevant interest rate, reflecting the opportunity cost of holding allowances for future use. A predictable increase in the price corridor is broadly consistent with this intertemporal relationship.

The price corridor requires different implementation mechanisms for the upper and lower bounds. If the allowance price reaches the upper bound, firms may pay the government an amount corresponding to the upper bound price and are then deemed to have satisfied their compliance obligations for the corresponding emissions; they need not purchase allowances for those emissions. Implementing the lower bound is less straightforward. In systems such as RGGI, price floors can be implemented through allowance auctions. Because the GX-ETS initially relies on free allocation, a different mechanism is required. The government therefore plans to use **reverse auctions** to support the lower price bound. If allowance prices fall below the intended level, the government would purchase allowances in the market, thereby supporting the carbon price and maintaining incentives for corporate decarbonization. Important implementation details remain unresolved, including the conditions that would trigger such reverse auctions. The GX-ETS thus uses asymmetric mechanisms to implement its price corridor: an alternative compliance payment at the upper bound and government purchases through reverse auctions at the lower bound.

The venue and rules for allowance trading are another important element of market design. In Phase I, as in the Tokyo and Saitama ETSS, no public exchange was established for trading GX-

ETS reduction credits. This arrangement is expected to change substantially in Phase II. The **GX Acceleration Agency** is expected to establish and operate a market where GX-ETS allowances can be traded and market prices formed.

Another significant change is the possible participation of certain nonregulated entities in allowance trading. Under the Tokyo and Saitama ETSs, transactions have been primarily bilateral, and entities not covered by the schemes generally have not been able to purchase allowances. Allowing nonregulated traders to participate would therefore mark a significant departure from previous Japanese ETS practice. Their participation could improve market liquidity and facilitate allowance procurement by regulated companies. At the same time, eligibility is expected to be limited to entities with relevant market experience, such as firms with experience trading carbon credits or similar environmental instruments.

4. Next Steps for the GX-ETS

This section discusses the next steps in the development of the GX-ETS, including the transition to Phase III, scheduled to begin in 2033.

4.1. Consistency with the NDC

Emissions trading is an important policy instrument for decarbonization, making alignment with Japan's long-term climate targets an important consideration. As discussed above, however, Phase II of the GX-ETS does not explicitly link allocation levels to Japan's NDC under the Paris Agreement. Benchmark-based allocation, which is expected to cover approximately 90% of emissions from companies subject to the GX-ETS, initially uses the emissions intensity threshold of the top 50% of performers in each sector and gradually tightens it to the top 32.5% level over five years. Sectors subject to grandfathering face an annual reduction rate of 1.7%. These levels are not derived directly from Japan's NDC trajectory. Instead, they are based primarily on existing technological conditions and the expected potential for technological improvement. In this respect, Phase II of the GX-ETS can be characterized as a **bottom-up system**, in which the stringency of the system is determined largely by sector-specific technological feasibility. This differs markedly from Phase I, in which the eligibility thresholds for generating reduction credits were explicitly linked to Japan's NDC.

However, a supplementary resolution accompanying the 2025 amendment to the GX Promotion Act calls on the government to assess whether emissions reductions under the GX-ETS are consistent with Japan's NDC. The relationship between the stringency of the GX-ETS and Japan's NDC is therefore expected to be reviewed, potentially resulting in tighter emissions reduction requirements.

4.2. Auctioning of Allowances

Although the GX-ETS initially relies on free allocation, allowance auctions for the power sector will **begin in Phase III in 2033**, under the specified operator contribution system. Introducing auctions first in the power sector, where carbon leakage concerns are relatively limited, broadly follows the historical development of the EU ETS. Because both mechanisms impose a carbon price on power sector emissions, the GX-ETS allowance price and the auction price under the specified operator contribution system are therefore likely to be closely linked.

Revenues from the specified operator contribution system, together with revenues from the fossil fuel levy to be introduced in 2028, will finance redemption of the GX Economy Transition Bonds. Because the government plans to issue approximately JPY 20 trillion in these bonds, securing sufficient future revenue from these carbon pricing mechanisms will therefore be important. This financing structure may create pressure for carbon prices to increase over time, suggesting that GX-

ETS allowance prices may eventually rise substantially above those prevailing during the initial years of Phase II.

4.3. The GX-ETS as Industrial Policy

The GX-ETS is designed primarily to achieve cost-effective greenhouse gas emissions reductions, but it also has an important industrial policy dimension. First, by encouraging investment in energy efficiency and fuel switching, the system creates business opportunities for suppliers of relevant technologies and services. The Tokyo ETS has already supported the diffusion of energy-saving technologies, particularly in commercial buildings. Given its nationwide coverage and broader sectoral scope, the GX-ETS could generate substantially larger effects.

Second, carbon prices are expected to rise over the medium to long term, potentially widening differences in competitiveness between more and less carbon-efficient firms. Less efficient firms may eventually exit the market, reduce production, or consolidate with other firms. Some Japanese industries have long been characterized by a relatively large number of firms and low rates of firm exit. By increasing the cost of carbon-intensive production, the GX-ETS could therefore promote industrial restructuring toward more energy- and carbon-efficient production.

Third, higher carbon prices could accelerate the diffusion of innovative technologies involving hydrogen, ammonia, carbon capture, utilization and storage (CCUS), and other low-carbon technologies. It remains uncertain which of these technologies will ultimately become commercially viable. However, technologies that become competitive under increasingly stringent carbon pricing could underpin new industries in which Japanese firms develop international competitiveness. In this sense, the GX-ETS may serve both as an environmental policy instrument and as a mechanism for promoting technological innovation and longer-term industrial transformation.

4.4. Remaining Issues

Although the broad institutional framework of the GX-ETS was established in fiscal year 2025, several important implementation issues remain. While the allocation rules have largely been determined, calculating and distributing allowances to individual companies will require substantial administrative effort during fiscal year 2026.

Detailed rules governing allowance trading also remain to be finalized. Key issues include determining which entities beyond regulated companies will be permitted to participate in the market and which entities may act as market makers. Another issue is whether a futures market will develop. Even without an explicit government decision to establish one, futures trading may emerge as the allowance market matures and the necessary institutional conditions emerge.

Ensuring sufficient market liquidity may also be challenging, as experience with the Korean ETS illustrates. Extensive banking has contributed to limited market liquidity in both the Tokyo ETS and the Korean ETS. An important policy question is whether banking should be restricted and, if so, how such restrictions should be designed. The goal is to preserve the intertemporal flexibility and cost-saving benefits of banking without allowing excessive accumulation of allowances to undermine market liquidity.

4.5. Comparison of the GX-ETS with Other Major ETSS

Japan's GX-ETS was developed using lessons from emissions trading systems in other countries and jurisdictions. Some features are drawn from the EU ETS, while others draw on Korea's K-ETS or Australia's Safeguard Mechanism. At the same time, the GX-ETS has several distinctive features. For example, the GX-ETS provides additional allowance allocations linked to GX-related R&D and patent activity. Its sectoral coverage is broader from the outset because it includes freight carriers. Table A.1 summarizes these features and compares the GX-ETS with other major systems.

5. Conclusion

The GX-ETS has become one of Japan's key policy instruments for achieving carbon neutrality. Although the system initially operated voluntarily, mandatory participation began in April 2026. About two decades after the launch of the EU ETS, Japan has therefore begun implementing a full-scale, market-based climate policy at the national level.

In its initial stages, the GX-ETS is likely to encourage wider adoption of energy efficiency technologies and fuel switching from oil to natural gas across a range of sectors. The initial price floor and ceiling appear designed around relatively mature and readily available mitigation options. Moreover, the benchmark-based allocation system is largely based on technologies and efficiency levels that have already been achieved by leading firms in Japan. In this respect, Phase II adopts a relatively pragmatic, bottom-up approach that emphasizes technological feasibility. As a result, the GX-ETS may not drive major structural changes during its first few years. Nevertheless, the system has considerable potential to become a stronger driver of decarbonization over time.

Achieving carbon neutrality, however, will ultimately require more fundamental technological changes, including deployment of hydrogen and ammonia, as well as widespread adoption of carbon capture, utilization, and storage (CCUS). The initial price ceiling under Phase II is unlikely to be high enough to support the large-scale deployment of these emerging technologies and energy sources. A central challenge for the GX-ETS will therefore be facilitating a gradual and predictable transition toward carbon price levels that provide strong enough incentives for their development and deployment, while also addressing concerns about international competitiveness and carbon leakage.

The GX-ETS should therefore be viewed as an evolving policy framework rather than a fully developed emissions trading system. Its effectiveness will depend not only on its initial design but also on the way its stringency, price corridor, allocation rules, and market institutions are adjusted over time. In particular, closer alignment with Japan's NDC, the transition toward auctioning in Phase III, and the development of a liquid allowance market will be important to its evolution. If these adjustments are implemented successfully, the GX-ETS could evolve from a relatively cautious initial system into a central policy instrument for both decarbonization and industrial transformation in Japan.

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Appendix

Table A.1 Comparison of Major Emissions Trading Systems

Japan GX-ETS, EU ETS, Korea K-ETS, and Australian Safeguard Mechanism (as of August 2026)

Item	Japan: GX-ETS	EU ETS	Korea: K-ETS	Australia: Safeguard Mechanism
Start date	2023: voluntary Phase I 2026: mandatory Phase II	2005; Phase IV: 2021–2030	2015; Phase IV: 2026–2030	2016; substantially reformed in July 2023
Sectoral coverage	Companies emitting $\geq 100,000$ t-CO ₂ /year. Power, manufacturing, aviation, freight carrier, real estate, etc. Company-level regulation of Scope 1 CO ₂ .	Power and heat, energy-intensive manufacturing, aviation, maritime transport, etc.	Power, industry, buildings, waste, transport, domestic aviation, maritime transport, etc.	Facilities emitting $>100,000$ t-CO ₂ /year. Mining, oil and gas, manufacturing, transport, waste, etc.
Allowance allocation / baseline setting	Primarily free allocation. Approximately 90% based on benchmarking (BM) and 10% on grandfathering (GF). Power generation initially receives BM-based free allocation. Auctions for the power sector are scheduled from FY2033. Additional Allowances for GX related R&D	Power generation: auctioning in principle. Industry: Gradual shift from free allocation based mainly on product benchmarks to auctioning. Benchmarks generally reflect the average performance of the most efficient 10% of installations.	BM + GF + auctioning. In Phase IV, the auctioning share for the power sector rises from 15% to 50% by 2030. Leakage-exposed industries continue to receive 100% free allocation.	No conventional ex-ante allowance allocation. Baselines are generally based on output $\times$ emissions intensity. Facilities below their baselines generate Safeguard Mechanism Credits (SMCs); facilities above them must surrender SMCs, ACCUs, etc.
Price regulation / market stabilization	Explicit Price Corridor. FY2026: floor of JPY 1,700/t and ceiling of JPY 4,300/t. The floor is supported through measures including reverse auctions; government intervention applies at the ceiling.	No explicit price floor or ceiling. Market stabilization relies primarily on quantitative adjustment through the Market Stability Reserve (MSR).	Market stabilization measures apply. Phase IV strengthens supply-demand and price stabilization mechanisms, including the K-MSR.	A cost-containment mechanism allows eligible facilities to purchase ACCUs from the government at a specified price, effectively providing a ceiling-type mechanism.
Emissions reduction target	BM tightened from the top-50% performance level in FY2026 to the top-32.5% level in FY2030. GF allocation declines by 1.7% annually. Direct consistency with Japan's NDC remains an issue for further consideration.	EU ETS sectors: 62% reduction by 2030 relative to 2005.	Korea's NDC: 40% reduction by 2030 relative to 2018; the Phase IV cap is tightened accordingly.	Baselines generally decline by 4.9% annually from 2023–24 through 2029–30, consistent with the 2030 target for covered facilities.
Carbon leakage measures	Sectors with a trade share above 0.1 may qualify. Additional free allocation is available when allowance procurement costs impose an excessive burden, including when they exceed 4% of operating profit; additional allocation is capped at 50% of the shortfall. Activity-level adjustments also apply.	Benchmark-based free allocation for sectors exposed to carbon leakage. For CBAM sectors, free allocation is being gradually phased out as CBAM is introduced.	Leakage-exposed sectors such as steel, petrochemicals, cement, and semiconductors continue to receive 100% free allocation.	TEBA (Trade-Exposed Baseline-Adjusted) arrangements reduce the rate of baseline decline for facilities facing significant trade-exposure and leakage risks.

Key Characteristics of the GX-ETS in Comparative Perspective

Treatment of the power sector. Since 2013, power generators under the EU ETS have generally been required to obtain allowances through auctions. By contrast, the GX-ETS initially provides even power generators with benchmark-based free allocation, with auctioning for the power sector scheduled to begin in FY2033.

Benchmark stringency. Whereas EU ETS industrial benchmarks generally reflect the average emissions performance of the most efficient 10% of installations, the GX-ETS begins at the top-50% level in FY2026 and gradually tightens this to the top-32.5% level by FY2030. The GX-ETS therefore follows a gradual tightening path for benchmark-based allocation.

Market stabilization. The EU ETS does not employ an explicit price floor or ceiling, instead relying primarily on the MSR to adjust allowance supply. The GX-ETS, by contrast, explicitly establishes a price corridor, with both a floor and a ceiling. This is a price-based rather than a quantity-based approach to market stabilization.

Carbon leakage and competitiveness. Japan's approach shares features with Australia's Safeguard Mechanism. Rather than relying solely on sectoral classification, the GX-ETS considers trade exposure and the financial burden of allowance procurement when determining eligibility for additional allocation. The Australian system similarly adjusts baseline requirements for trade-exposed facilities.

Overall assessment. The GX-ETS should not be viewed simply as Japan's delayed adoption of the EU ETS model. Rather, it is a hybrid system that incorporates elements found in the EU, Korean, and Australian systems while adding distinctive Japanese features, particularly its explicit price corridor, gradual tightening of benchmarks, and additional allocation linked to innovation activities.