

Equilibrium carbon price
for future carbon pricing in Japan

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Executive Summary



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Japan is preparing to adopt carbon pricing from FY2026 in pursuit of net-zero emissions by 2050. Developing an equilibrium price of carbon would offer several key advantages in terms of achieving the Japanese government's decarbonization targets via energy transition and leveraging market mechanisms to drive sustained economic growth. One such advantage is maintaining accountability to the Japanese public and international community. Others include that an equilibrium price that balances carbon emissions market demand with supply would encourage constructive behavioral change among stakeholders.

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Carbon pricing as a lever to achieve net-zero emissions

The Japanese government has set a target of reducing greenhouse gas emissions by 46% relative to FY2013 by FY2030 and achieving net-zero emissions by FY2050. This green transformation (GX) will require ¥150tn of combined public and private investment spread over a decade. To jump-start such investment, the government plans to issue some ¥20tn of so-called GX economic transition bonds, ¥1.6tn of which were issued in FY2023 with another ¥1.4tn of issuance on tap in FY2024.

The government intends to use carbon pricing as a source of funding to redeem the GX bonds. It aims to spearhead the transition to a low-carbon society by both promoting investment and imposing mandates. In FY2026, it will launch an emissions trading scheme and start publishing a carbon reference price to improve carbon price predictability and boost GX investment's expected returns. The scheme will allow companies to voluntarily trade emission credits in pursuit of their decarbonization targets. In FY2028, the government will start taxing fossil fuel importers, among others, based on the amount of emissions generated by each fossil fuel. In FY2033, it will start requiring electric utilities to purchase emission rights at auction to fully offset their respective emissions.

Carbon prices in Japan

Carbon pricing incentivizes changes in carbon emitters' behavior by putting a price on carbon emissions. The key benchmark is the price of carbon, which often

refers to a carbon tax or emissions trading prices. In Japan, where there is no government-run emissions trading market, the most commonly cited carbon price is the government's carbon tax (global warming mitigation tax) rate of ¥289/tCO₂.

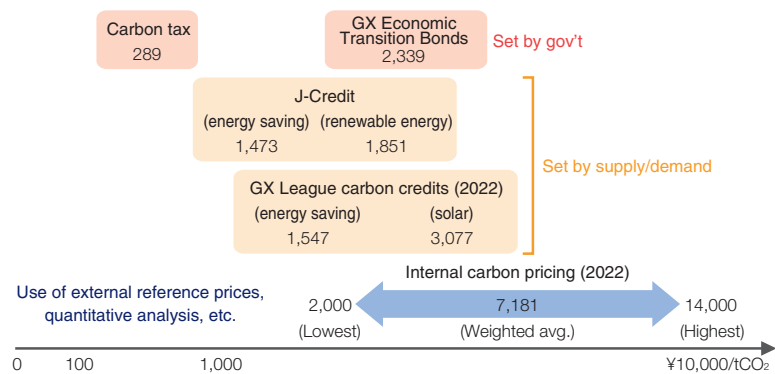
In addition to the Japan carbon tax rate, alternative carbon prices have emerged in connection with various net-zero initiatives undertaken in recent years (Figure 1). The carbon prices used in Japan range from ¥289/tCO₂ (Japan carbon tax) all the way up to ¥14,000/tCO₂, the highest internal carbon price set by a Japanese company as of 2022. This wide price range stems from differences in how carbon prices are calculated and used and by whom they are set. I see such broad price dispersion as a source of macroeconomic inefficiency and an impediment to government decarbonization targets' attainment. Another concern is that forward visibility of carbon prices is currently poor. Such opacity may result in potential investment opportunities being missed. It may also make it impossible to determine the present value of companies and products that contribute to decarbonization.

The core principle of a market economy is that prices are set at the intersection of supply and demand curves (equilibrium prices). I believe carbon prices likewise should be set at a level that equilibrates supply and demand but must also factor in two other considerations. The first is national and global decarbonization targets at the relevant point in time. The second is the carbon budget¹—i.e., the cumulative amount of CO₂ that can be emitted through 2050 while keeping global warming within tolerable limits. While the Japanese government has not explicitly set a carbon budget, its aforementioned 2030 and 2050 decarbonization targets imply a carbon budget of 8.55bn tCO₂.

NOTE

1) According to the Global Carbon Project's *Global Carbon Budget 2023*, the global carbon budget associated with a 50% probability of limiting global warming to +1.5°C is 75bn tCO₂.

Figure 1: Japanese carbon price levels



Source: NRI, based on data from various sources

Using elasticity to estimate equilibrium carbon prices in Japan

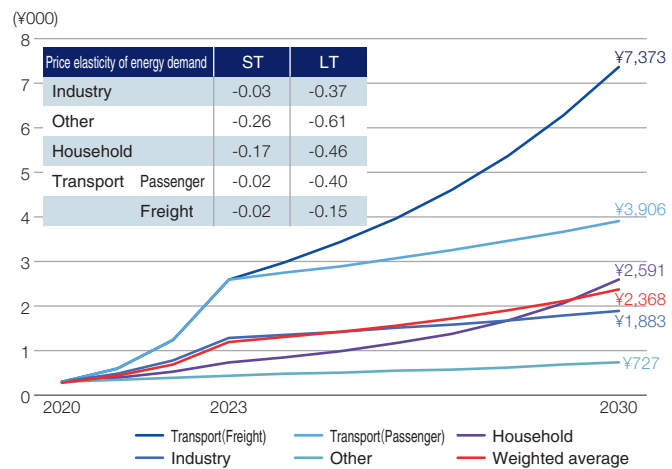
The most efficient way for Japan to allocate its limited carbon budget would be to adopt equilibrium carbon prices that equalize demand with the remaining supply of emittable CO₂ across all points in time given the Japanese government’s targets and implicit carbon budget. I estimated the equilibrium carbon price from 2020 through 2030 using the Japanese government’s carbon emissions targets and the (short- and long-term) price elasticity² of the corporate and household sectors’ carbon emissions (Figure 2).

Assuming an initial price of ¥289/tCO₂ in 2020, I estimated the 2030 equilibrium carbon price per tonne at ¥727 for the non-industrial/non-transport corporate sector, where demand is most elastic, and ¥7,373 for the (freight) transport sector, where demand is least elastic³. The overall equilibrium (i.e., all-sector weighted average) price I arrived at was ¥2,368/tCO₂.

2) My estimation model was informed by Mizuho Information & Research Institute’s 2016 estimates of the price elasticity of energy demand that were presented in a Japanese Ministry of the Environment analysis of the environmental impact of a tax to fund policies to mitigate global warming. I applied short-term elasticities to 2020-22 and long-term elasticities to 2023-30.

3) Assuming (1) carbon price increases are 100% passed through to energy prices and (2) changes in sectoral energy consumption in response to a one unit increase in energy prices result in equivalent percentage changes in CO₂ emissions, I modeled equilibrium carbon prices’ path using the percentage carbon-price change that would equilibrate demand with supply. To calculate the weighted average price, I used CO₂ emissions at each point in time as the weighting factor, which I applied to the sectoral carbon price paths derived from the price elasticity of demand in each sector.

Figure 2: Equilibrium carbon price paths estimated using elasticities



Note: ST: short-term; LT: long-term
 Source: NRI, based largely on Mizuho Information & Research Institute’s 2016 estimates of price elasticity of energy demand that were included in a Japanese Ministry of the Environment analysis of the environmental impact of a tax to fund policies to mitigate global warming

Although a rough estimate, ¥2,368/tCO₂ is in line with the carbon price that appears to be factored into the GX economic transition bond issuance plan. When the planned GX bond issuance’s aggregate par value of ¥20tn is divided by the 8.55bn tonne carbon budget implied by the government’s decarbonization targets, the par value per tonne is ¥2,339.

However, Japan’s carbon price should reflect not only such domestic factors but also international carbon prices. For example, the EU, which was an early adopter

of carbon pricing, is now phasing in a Carbon Border Adjustment Mechanism (CBAM). From FY2026, importers of carbon-intensive goods into the EU will be required to pay to the EU the difference between the EU-ETS (Emissions Trading System) carbon price and the carbon price paid in the imported goods' country of origin. The yen-equivalent price at which carbon traded on the EU-ETS in the first half of 2023 ranged from about ¥12,000 to ¥15,400/tCO₂⁴. One private research firm is forecasting an EU-ETS carbon price of €167 (over ¥26,000) per tonne in 2030⁵. With the EU carbon price so much higher than the Japan's carbon tax rate and my estimated equilibrium carbon price, the EU's CBAM could impose additional costs on Japanese exporters to Europe. In utilizing carbon pricing or setting carbon prices, the Japanese government should perhaps address unevenly distributed cost burdens that arise from such international differences in carbon pricing schemes by sharing the costs across industries and/or generations.

4) Converted to yen at an exchange rate of ¥160/€

5) GMK Center, *Carbon price in the EU in 2030* (2023). Euros converted to yen at ¥160/€

Even in Japan, emissions trading prices and a government-published reference price are expected to play an important role as a Japan carbon price and bellwether of future prices from FY2026 onward. The price estimation model presented above is merely one example, but the Japanese government should pursue a carbon price that is set by supply and demand and accountable to both the Japanese public and international community.

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