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Tokyo's Emissions Trading System

A Review of its Operation Since 2010

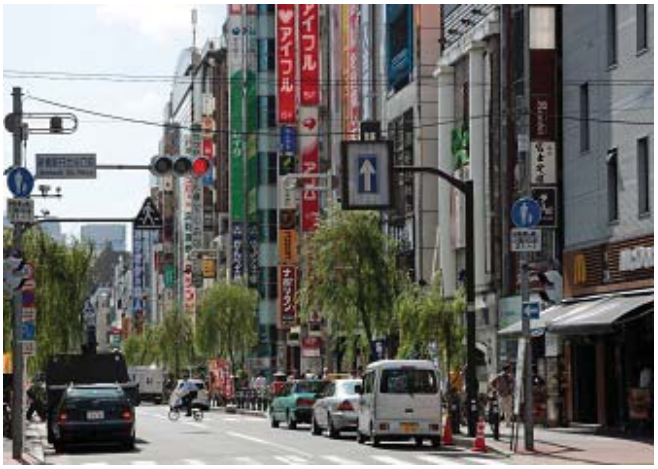
This note reviews the operations and experience of Tokyo's emissions trading system since its launch in 2010 and follows on from an earlier issue of Directions in Urban Development that described the design and development process of the system.

An Introduction to Tokyo's ETS System

Tokyo's emissions trading system (ETS) began operating in April 2010, and was the world's first city-level cap-and-trade program targeting energy-related carbon dioxide (CO_2). Among city-based ETSs, Tokyo's was the first to target a greenhouse gas (GHG) with the primary objective of mitigating climate change. Of the several ETSs targeting GHGs around the world, such as the European Union's, none operated at the city level before Tokyo's. Table 1 summarizes the key features of Tokyo's ETS.

Results from the First Two Years of ETS Operation

In January 2013, the Tokyo Metropolitan Government (TMG) announced that FY2011 – the second full year of ETS operation from April 2011 to March 2012 – saw a 23 percent reduction in the emissions from participating facilities covered by the ETS, compared with the base year. Total emissions from these facilities in FY2011 were 7.22 million tons of CO_2, which was some 2.16 million tons less than the base year. Notably, 93 percent of these facilities achieved reductions in excess of their obligations for the first compliance period in FY2011.



Tokyo, Japan — Simone D. McCourtie / World Bank

This surpassed the first year performance recorded in FY2010, where emissions were 13 percent below the base year, with 64 percent of facilities achieving reductions in excess of obligations for the first compliance period (TMG 2013a).

TMG identified the main factor for this reduction as the "significant electricity savings promoted by covered facilities after the power crisis" that followed the Great East Japan Earthquake of March 2011 (TMG 2013a). With the shutdown of nuclear reactors and enforced power cuts, Japan's total energy supply in November 2011 was 9.8 percent lower than in November 2010, and total supply over the period April to November 2011 was down 6.7 percent on the same period in 2010 (Caine and Jenkins 2012). A simple view of the earthquake's impact,

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Table 1: Key Features of Tokyo's ETS

Coverage	Over 1,300 large facilities that consume fuels, heat, and electricity totaling more than 1,500 kiloliters of crude oil-equivalent per year.
Base year emissions	Average annual emissions from any three consecutive fiscal years (FYs) between FY2002 and FY2007.
Compliance periods	1st compliance period: FY2010 – FY2014 2nd compliance period: FY2015 – FY2019
Targets / reduction obligations[1]	6 to 8 percent reductions for the 1st compliance period: • Category I-A: 8 percent for office buildings, public institutions, commercial buildings, lodging, educational and medical institutions; • Category I-B: 6 percent for buildings where air conditioning/heating from district cooling/heating plants accounts for more than 20 percent of energy consumption; • Category II: 6 percent for factories that do not fall under Category I. 17 percent for the 2nd compliance period (planned).
Allocation of allowances	Grandfathered based on historical emissions, and calculated by compliance period: [Base year emissions – Reduction obligation (6 or 8%)] x Compliance period (5 years)
Trading	• From the second year of each compliance period, reductions in excess of annual obligations may be traded as credits, subject to a limit of one-half of base year emissions. • Banking of accumulated credits is allowed, including across compliance periods, but borrowing is not.
Offsets	• Credits from small and medium-sized (SME) facilities within Tokyo. • Credits from large facilities outside Tokyo (for up to one-third of reduction obligations). • Renewable energy credits. • Credits from Saitama prefecture's ETS.
Penalties for non-compliance	• Surcharge on reduction obligation of 1.3 times the shortfall. • Fines of up to JPY500,000 (~USD5,500).

Source: Adapted from TMG 2010

therefore, is that it provided an additional, unexpected exogenous factor that reduced electricity consumption and the corresponding CO_2 emissions.

At the same time, Tokyo's ETS can be seen to have contributed to increasing the resilience of participating facilities in coping with the impact of the earthquake. Such facilities were better able to cope with reduced electricity consumption precisely because they had already been planning to undertake energy conservation measures in response to the ETS. For example, a survey conducted by TMG found that owners and tenants of a leased building already had a system to work cooperatively on electricity savings, from twice-yearly tenant meetings that had started two years before the earthquake (TMG 2013a).

In order to reduce their emissions, facilities covered by Tokyo's ETS pursued a wide range of measures. The most common measures were related to the management of air-conditioning and lighting. Some 50 percent of facilities reduced office illumination from around 750 lux to 500 lux, in FY2011 (TMG 2013a). Table 2 summarizes the types and numbers of measures taken, and provides selected examples of these.

A further analysis of emissions reductions from FY2010 reveals that the level of reductions varied across facility types. Factories and waste management facilities achieved the highest reductions in FY2010, of over 20 percent (compared to the average of 13 percent across all facilities that year). Switching to alternative fuels, and energy efficiency measures, were common factors. It should also be noted, however, that 'leakage' occurred from some factories that shifted production activities (and thus emissions) to locations outside Tokyo. On the other hand, facilities in the information-communication and education categories registered more limited reductions of 1 percent and 5 percent, respectively. These facilities cited increasing business activities as the main challenge they faced in reducing emissions

Special Post-Earthquake Provisions

To ensure that no facility was unduly penalized as a result of the earthquake, TMG also introduced special provisions applicable to situations where facilities used off-grid or co-generation power systems, or otherwise switched from electricity to other energy sources. Under these provisions, facilities that had at least partly

Table 2: Summary of Measures Taken by Participating Facilities

Category	Number of Measures Taken	Examples of Measures Taken
Management of air-conditioning and ventilation	1,602	• Upgrade of air conditioning equipment • Review of adequate temperature-humidity • Review of air-conditioner operating hours • Review of operation schedule of fans in parking lot
Management of lighting, incoming and transformer equipment	1,436	• Introduction of LED or high luminance guide lights • Introduction of control devices such as motion sensors • Lights-off when not using rooms during lunchtime • Upgrade to high-efficiency transformer devices
Management of heat sources	897	• Upgrade of freezers • Temperature management of hot and cold water at return points • Introduction of inverter to hot and cold water pump/cooling water pump • Strengthening of insulation at vapor bulb
Management of hot water supply, water supply and drainage, freezing and cooling equipment	302	• Stop supply of hot water to washroom except in winter • Upgrade to water-saving toilets or automatic shut-off faucets • Stop heating supply to toilet seats • Upgrade to energy-saving vending machines
General management	275	• Development of a framework for energy saving • Offer of energy consumption data to tenants • Energy-saving education for employees

Source: Adapted from TMG 2012a

switched from electricity to direct fuels were allowed to calculate their emissions based on the more favorable ratio of fuel to electricity that they had registered in any one year out of FY2009, 2010 or the base year. (Further information on these special provisions is given in the longer technical paper.)

Trading Under Tokyo's ETS

Under Tokyo's ETS, facilities that reduce emissions below the target may sell the excess reductions as credits. Conversely, if actual emissions reductions fall short of the target, they may purchase credits to make up the difference. Apart from excess emissions reductions, eligible credits include offsets from small and medium-sized facilities, large facilities outside Tokyo, renewable energy credits, and credits from Saitama prefecture's ETS. (Further information on these offsets is given in the longer technical paper.) TMG has issued guidelines for the calculation of offset credits, as well as for the verification of such credits by a third-party auditor. In all cases, credits will only be issued by TMG upon application.

TMG has established an electronic registry and accounting system to record the issuance, transfer and surrender of credits. TMG manages and maintains this registry, including all data input. The registry system includes three types of accounts with different functions:

1. *Designated holding account (for compliance)*: Each facility must open this account, which records transactions at the facility level. Excess emissions reductions approved by TMG will be recorded in this account, but credits as a tradable property right are recognized only when transferred to the general holding account.
2. *General holding account (for trading)*: Credits can only be transferred to other parties through this account. Each facility may have multiple general holding accounts, where multiple participants exist.
3. *Governor's holding account (for retirement/surrender of credits)*: Credits to be utilized for compliance must be transferred to this retirement account. Once credits are transferred to this account, no further transfers will be allowed.

As of the end of calendar year 2012, credits in the amount of 82,909 tons of CO_2 had been issued, with the bulk of this supply – 75,708 tons or 91 percent – originating in renewable energy credits. Table 3 summarizes the issuance of these credits. Over this same period, the

volume of trades has been relatively modest. In FY2011, 29,341 tons of CO_2 were traded in eight transactions, with a further 36,190 tons traded in 28 transactions during FY2012 (through December 2012) (TMG2012b, TMG2013b).

Information on market prices has been quite limited. The first trade was announced in August 2010, when 22 tons were traded at JPY12,000 per ton (approximately USD142 at the time) (Reuters 2010). More recently, in October 2012, TMG sold 600 tons of offsets from green electricity certificates, at JPY10,000 per ton. More generally, TMG has estimated two reference prices: JPY15,000 per ton based on the price of solar energy under the Renewable Portfolio Standard law, and between JPY8,000 and 26,000 per ton based on the price of Green Energy Certificates as surveyed by Japan's Ministry of the Environment (TMG 2011a, Nishida 2013).

The relatively limited trading activities under Tokyo's ETS should be understood in light of the fact that TMG does not intend for trading to be a primary option. Instead, trading is intended as the last option for facilities that are unable to meet their reduction obligations by other means. Accordingly, the ex-post issuance of credits only upon application hardly creates enough liquidity during the early stages of an emerging market like the Tokyo ETS. It also makes it difficult for facilities or other market players to gauge the potential demand and supply of credits. Moreover, the facilities themselves do not seem to consider using offset credits as a priority in achieving their reduction targets. Seventy-three percent of facilities surveyed by TMG indicated that they would not need to purchase offset credits (TMG 2012c). The survey also found that facilities tend to prefer to bank excess reductions now, in anticipation of deeper emissions reduction targets during the second compliance period.

A degree of uncertainty persists with respect to the overall demand and supply of credits for the whole of the first compliance period. The results reported for FY2010 and 2011 indicate a potential situation of over-supply: potential annual demand is estimated at less than 300,000 tons, while the potential annual supply of credits could range from 400,000 to 900,000 tons (see the technical paper for more details of this estimate). TMG's own estimates for the whole of the first compliance period, based on prior application as of September 2012, are for a supply of offset credits (from SMEs, renewable energy, and outside Tokyo) of approximately 250,000 tons, coupled with other emissions reductions (for compliance, but not trading) of around 400,000 tons (TMG 2012d, Nishida 2013).

Expansion to Saitama Prefecture

Saitama prefecture's efforts to reduce GHG emissions began as early as 2002 with its Environmental Damage Reduction Program, under the prefecture's Community Environmental Preservation Ordinance. This program included a voluntary emissions reduction plan with mandatory reporting requirements, for targeted facilities. As in Tokyo, targeted facilities were those with annual energy consumption of over 1,500 kiloliters of crude oil-equivalent, or with a size of over 10,000 square meters. Most of these facilities are in the commercial and industrial sectors.

Saitama prefecture decided to adopt a city-based ETS in 2009. The reasons for doing so included the finding that emissions from commercial facilities had increased continuously since 1990, and the realization that the earlier program did not contribute to continuous GHG reductions. Saitama prefecture's ETS has the same basic design as Tokyo's, with the exception that no fines are imposed for non-compliance in Saitama. Table 4 provides a comparison of the two ETSs.

Table 3: Issuance of Credits by TMG, as of December 2012

FY	Excess Reductions		SME Credits		Renewable Energy Credits (environmental value equivalent)		Renewable Energy Credits (others)		Total
	Cases	tCO_2	Cases	tCO_2	Cases	tCO_2	Cases	tCO_2	tCO_2
2011	0	0	3	117	1	7,285	22	39,244	46,646
2012	10	6,739	5	345	1	7,423	10	21,756	36,263
Total	10	6,739	8	462	2	14,708	32	61,000	82,909

Source: Nishida 2013

Table 4: Comparison of Tokyo and Saitama ETSs

	Tokyo	Saitama
Total GHG emissions, tons of CO_2 (FY2009)	56.6 million	38.8 million
Target Facilities	Large facilities with annual energy consumption of over 1,500 kiloliters of crude oil-equivalent (about 1,300 facilities – mostly commercial)	Same as Tokyo (about 600 facilities – two-thirds industrial)
Compliance Periods	1st compliance period: FY2010 – FY2014 2nd compliance period: FY2015 – FY2019	1st compliance period: FY2011 – FY2014 2nd compliance period: FY2015 – FY2019
Reduction Targets	• 8 percent reduction for office building, public institutions, commercial buildings, etc. • 6 percent reduction for factories, water supply and sewerage facilities, solid waste management facilities, etc.	Same as Tokyo
Tradable Credits	• Excess reductions as credits • Credits from small/medium facilities in Tokyo • Renewable energy credits • Credits from outside Tokyo	• Excess reductions as credits • Credits from small/medium facilities in Saitama • Renewable energy credits • Credits from outside Saitama • Forest absorption credits
Penalties for non-compliance	• Surcharge on reduction obligation of 1.3 times the shortfall. • Fines of up to JPY500,000 (~USD5,500).	None.

Source: TMG 2011b, Saitama Prefecture 2012

Cooperation between TMG and Saitama prefecture on cap-and-trade is based on an agreement made in September 2010. Under this agreement, participating facilities in each ETS can trade credits across the boundary between Tokyo and Saitama. Specifically, excess reductions from a large facility in either jurisdiction can be utilized by a facility in the other jurisdiction to fulfill reduction obligations, from the end of the first compliance period in 2015. Credits from small/medium-sized facilities in either jurisdiction can also be utilized by a large facility in the other jurisdiction to fulfill reduction obligations, from 2012. The agreement also simplified the registration process for audit firms that verify emissions under the ETS, if these firms work for both Tokyo and Saitama. Both governments also agreed to organize joint training for these auditors.

In May 2013, Saitama prefecture announced that its ETS achieved a 21.5 percent reduction in emissions below base year emissions, from participating facilities for FY 2011 (Saitama Prefecture 2013). This percentage reduction is close to that registered by Tokyo's ETS for the same fiscal year. A key difference is that the while around 85 percent of facilities in Tokyo are commercial, 70 percent of facilities in Saitama are industrial/factories. Given the experience of Tokyo, where industrial facilities seemed better able to register large emissions reductions compared to commercial facilities, this strong first-year performance of Saitama's ETS is not unexpected.

Lessons Learned So Far

The experience of Tokyo's ETS since 2010 clearly demonstrates how it has been very effective as an instrument to promote reductions in GHG emissions among the largest facilities in the city. Moreover, by encouraging facilities to plan for energy savings and efficiency, the ETS catalyzed the important co-benefit of increasing these facilities' resilience in the face of power shortages following the 2011 earthquake. The introduction of a very similar ETS in Saitama prefecture also demonstrates the relevance and attractiveness of ETS as an option for climate change mitigation at the city level.

A number of lessons can be drawn that would be of relevance to any city considering an ETS of its own:

- *Data and reporting*: The rich data available in Tokyo (and Saitama) began with the mandatory reporting program in the years prior to the design and implementation of the ETS. Such data is essential to designing an ETS, and to ensure robust monitoring, reporting and verification (MRV) throughout.

- *Flexibility*: Tokyo's ETS provided participating facilities with some degree of flexibility, such as with the selection of the base year for emissions. The special provisions for calculating emissions following the earthquake also provided facilities the opportunity to avoid being penalized by the consequences of that unexpected natural disaster. Such flexibility is important for ensuring stakeholder buy-in for continued smooth implementation of the ETS.

Predictability: Flexibility notwithstanding, Tokyo's ETS operates within a clear and predictable rules-based framework. TMG has provided a framework for long-term goal setting by indicating the estimated emissions reductions that would be required in the second compliance period. This in turn enables participating facilities to plan and execute their emissions reduction activities well in advance, taking the long-term view and planning for investment as necessary.

End Notes

[1] For more information on the design features of Tokyo's ETS, please refer to the earlier *Directions in Urban Development* note from 2010, "Tokyo's Emissions Trading System: A Case Study".

[2] "Top-level" facilities that are highly energy efficient may have their compliance factor reduced by one-half or one-quarter. Further information is available at: http://www.kankyo.metro.tokyo.jp/climate/large_scale/cap_and_trade/toplevel.html (in Japanese).

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