

Tokyo's Emissions Trading System: A Case Study

The Tokyo Metropolitan Government (TMG) has developed the world's first cap and trade program at the city level targeting energy-related CO₂. Called the Emissions Trading System (ETS), the program took effect in April 2010 and covers 1,340 large facilities including industrial factories, public buildings, educational institutions and commercial buildings.

Targeting the city level for the reduction of greenhouse gas (GHG) emissions is of vital importance for climate change mitigation goals. Although there are several ETSs targeting GHGs around the world, none have operated at the city level until Tokyo's.

City-based ETS systems have been largely aimed at enhancing local air quality by targeting local pollutants that may also happen to be GHGs. There are three particularly relevant cases of ETSs covering local pollutants at the city level (see Table 1). Tokyo's ETS is unique because it is the only one targeting GHGs, with the primary objective of mitigating climate change.¹

Emissions Trading Systems

Emissions trading is a market-based approach for addressing air pollution problems. If designed and implemented well, emissions trading systems can be economically efficient, providing incentives for participants to reduce their emissions of specified pollutants.

Also known as "cap and trade", the basic principle of any emissions trading scheme is to set a limit on the total quantity of pollutants for a given time period (the "cap"). Each participant in the scheme receives an individual cap or allowance. Within the overall cap, individual allowances may be determined in a number of ways, for example from historical baselines, or by auctioning allowances to participants.

Trading can then take place: for the specified time period for which allowances are set, a participant who emits less than their allowance may then sell the unused balance to another participant who has exceeded their allowance. The price for allowance units is determined by the market. Those who are able to reduce emissions cheaply, for instance by investing in more efficient technology, have the incentive to do so, in order to benefit from selling their unused allowances. Likewise, those who find it difficult or expensive to reduce emissions may find it cheaper to purchase allowances from others.

An ETS, when functioning well, results in overall emissions remaining within the cap, while individual participants have the flexibility of a market-based mechanism within which to operate.



Photo: Alexander Chechekin

Laying the Groundwork

TMG began efforts to curtail Tokyo's CO₂ emissions in 2000 by developing a program called the "Tokyo CO₂ Emissions Reduction Program" under the "Tokyo Metropolitan Environmental Security Ordinance."² This program included a voluntary emissions reduction plan with a mandatory reporting scheme for targeted facilities.

TMG prioritized CO₂ emissions reductions from large-scale businesses and buildings in the industrial and commercial sectors, which represent less than 1% of all businesses in Tokyo, but account for 40% of all CO₂ emissions. The initial target facilities – those using over 1,500 kL of crude oil equivalent annually – were identified using surveys under the national Energy Efficiency Law for No. 2 Type Specified Energy Conservation Facilities³ and through inquiries carried out independently by TMG. It has been estimated that one of these facilities emits the same amount of GHGs as 3,300 households (Miyazawa, 2010).

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Table 1: Other ETSs in Operation Worldwide

Governmental Unit	Name of ETS	Target Pollutant	GHG	Target Organization
International ETSs				
European Union	EU-ETS	CO ₂ , CH ₄ (methane), N ₂ O (nitrous oxide), HFCs (hydrofluorocarbons), PFCs (perfluorocarbons), SF ₆ (sulfurhexafluoride)	Yes	Electricity generation and energy-intensive industries
Country-Based ETSs				
United Kingdom	CRC ⁴ Energy Efficiency Scheme	Energy-based CO ₂	Yes	Large organizations with high energy consumption (although exempts those covered by Climate Change Agreements or the EU-ETS)
Sub-National ETSs				
Northeastern & Mid-Atlantic region, United States	Regional Greenhouse Gas Initiative (RGGI)	Energy-based CO ₂ from power plants	Yes	Electricity generators
New South Wales, Australia	Greenhouse Gas Reduction Scheme (GGAS)	GHGs from electricity production	Yes	Energy producers and highly energy-intensive users
City-Based ETSs				
Los Angeles, United States	Regional Clean Air Incentives Market (RECLAIM)	nitrogen oxides (NO _x), sulfur oxides (SO _x)	No	Facilities emitting more than 4 tons a year of either gas.
Chicago, United States	Emissions Reduction Market System (ERMS)	Volatile organic materials (VOMs) (particularly tropospheric ozone)	No ⁵	Stationary sources emitting more than 10/tons per season (2 seasons per year)
Santiago, Chile	Emission Offset Program of Supreme Decree No. 4	Total suspended particles (TSP)	No	Stationary combustion sources with a rated exhaust gas flow rate greater than 1,000 m ³ /hour

Source: Environment Canada (2010), Kamal-Chaoui, L. and Robert, A. (eds.) (2009), Illinois EPA (2010), Schreifels (2010), SCAQMD (2010), GGAS (2010), RGGI (2010), UK Department of Energy and Climate Change (2010), and EUR-Lex (2010)

Facilities participating in the voluntary program were required to set a target based on average emissions in a consecutive three-year period, and to devise a plan to implement the basic reduction measures set by TMG. TMG provided guidance at both planning and implementation stages to help participants set and achieve reasonable targets, assess their achievements, and publicize the results.

Starting in 2005, plans received a rating based on a five-tier scale:

- AA** (more than 5% reduction planned through additional measures);
- A+** (more than 2% reduction planned through additional measures);
- A** (basic measures planned);
- B** (only no-cost operational improvements planned);
- C** (no basic measures or no-cost operational improvements planned).

The average target levels remained around 3% to 4% among participating facilities; only about a quarter achieved emissions reductions greater than 5%. TMG ascribes this to the fact that the emissions reductions were not mandatory (Miyazawa, 2010).

Large emitters identified for the mandatory reporting scheme were required to submit a five-year GHG emissions reduction strategy (ERS) that was made public in an effort to incentivize them to perform in-depth analyses of their emissions profiles (Tokyo Metropolitan Government, 2010; Miyazawa, 2010).

The Process of Developing the ETS

It took many years and a considerable amount of work to establish Tokyo's ETS. The idea originated with the planning division of the Department of General Affairs, Bureau of Environment (BOE) of TMG in 2002, when TMG launched a project titled "Creating an Emission Trading Market" and began discussing possible emissions trading designs (Sakamoto, 2009).

Governance and Operative Context

The National Government of Japan has taken important steps to implement policies to reduce GHG emissions, but takes a relatively hands-off approach and expects—instead of directs—lower tiers of government to work to achieve general emissions reductions (Sugiyama and Takeuchi, 2008). The exact targets for reductions are left up to the lower tiers of government, although the national guidelines give suggestions for sectoral targets and the exact GHGs to cover.

The Bureau of Environment (BOE) of the Tokyo Metropolitan Government (TMG), in coordination with other bureaus, is responsible for the planning and administration of environmental issues in Tokyo. This includes the development of climate change strategies, plans, and programs as well as preparation of emissions inventories. The BOE is also the focal point for Tokyo's membership in the International Carbon Action Partnership (ICAP), which aims to increase the number of cap and trade carbon markets worldwide.

TMG first developed the outline for the ETS through an expert panel and next consulted with other stakeholders to gain their acceptance. TMG collected opinions from communities, industries, municipalities, NGOs, scholars, research institutes and energy suppliers through public opinion surveys, internet-based monitoring questionnaires, and stakeholder meetings. A series of internet workshops were held to discuss (i) methods of calculating emissions, (ii) methods of categorizing emissions, and (iii) trading methodologies.

Despite this participatory approach, it was still not easy to build consensus with stakeholders. Many objections were raised by stakeholders, such as the Keidanren (Japan's larg-

"Tokyo aims to reduce emissions by 25% below 2000 levels by 2020."

est business lobby), during the planning process, including after the launch of Tokyo's Climate Change Strategy in 2007. Some constituencies argued that the ETS has the potential to restrict economic activities in Tokyo, and some facilities considered the proposed caps to be excessive.

Discussions concerning the emissions cap revolved around whether to make the cap mandatory or voluntary. In the end, the TMG-supported absolute cap on emissions prevailed.

The "Tokyo Metropolitan Environmental Security Ordinance" was amended by the Tokyo Metropolitan Assembly in July 2008 to include clauses for the establishment of emissions caps on large emitters, with effect from April 1, 2010. This amendment formed the legal basis for implementation of the ETS, and ETS implementation became a regulatory design issue.

Key Features of Tokyo's ETS

Energy-based CO₂

Although companies are encouraged to report their total GHG emissions profiles, energy-based CO₂ is the only gas included in the ETS. CO₂ was singled out for five main reasons.

1. *Breadth* – 95% of Tokyo's emissions are from energy-based CO₂.
2. *Simplicity* – Tokyo's emissions are dominated by commercial buildings, which in turn have an energy consumption profile

made up almost exclusively of distributed electricity. Most of these emissions are therefore easy to report and audit.

3. *Precision* – Electricity meters are already installed in all commercial, residential and industrial buildings on a subdivided basis. Total emissions can be calculated by multiplying the billed monthly electricity consumption by a crude oil CO₂ emissions factor. The same precision is achieved in using fuel bills for other energy-based CO₂ emissions.

4. *Minimal burden* – Reporting on only one gas is less burdensome for a company from a technical standpoint. TMG requires companies that use fuels other than CO₂ to simply calculate their usage.

5. *Confidence* – Since the ETS is fundamentally a market-based system, it relies on confidence in the traded good among market participants. As CO₂ emissions are relatively easy to calculate and audit, participants trading in the ETS would have greater confidence that CO₂ credits traded are correctly measured and certified.

Categories of Facilities

At present, 1,340 facilities fall under the ETS provisions. These facilities are categorized as large-scale facilities, or small and medium-sized facilities.

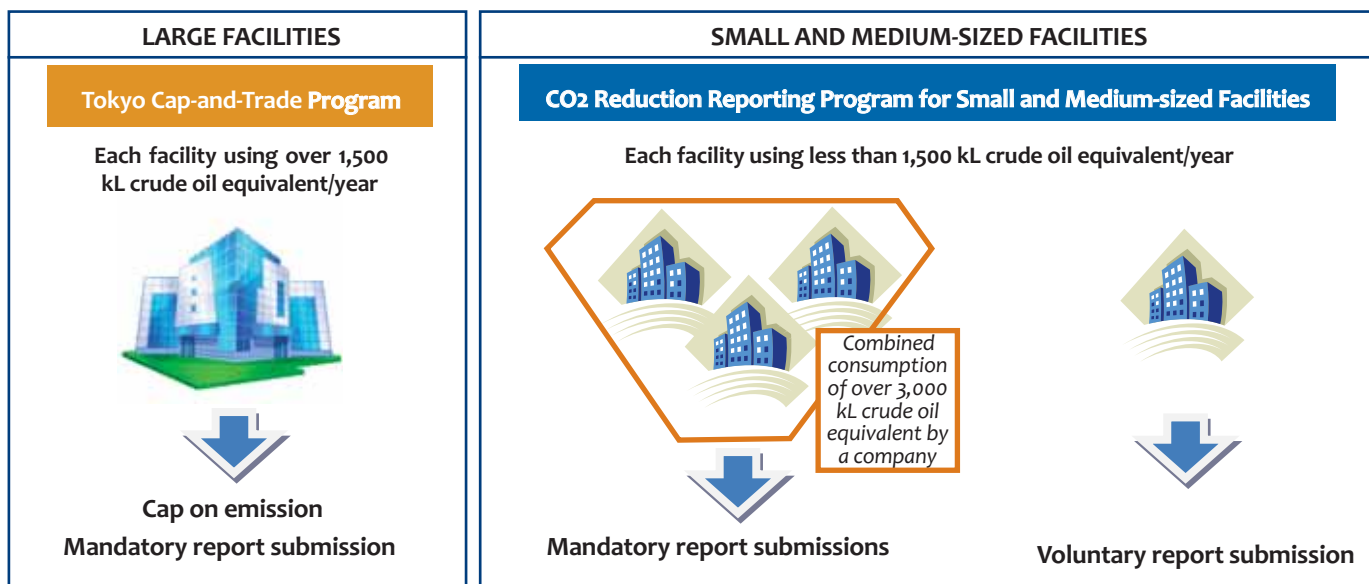
Large facilities:

- Single buildings or facilities that consume more than 1,500 kL crude oil-equivalent.
- If no individual tenant in a given building exceeds the energy consumption limits, while the building does as a whole, the tenants are required by law to cooperate with the building owner to report emissions; the final

Figure 1: History of National Policy and City Level Action on Climate Change Mitigation in Japan

	National Level	Tokyo ETS Development
1990's	1990: Action Plan to Arrest Global Warming	
	1998: Adoption of Kyoto Protocol in Japan -Promotion of Nuclear Power -Energy Conservation Law -Law Concerning the Promotion of Measures to Cope with Global Warming	
2000 - 2005	2002: Ratification of Kyoto Protocol and revision of Article 20 of Global Warming Law →decentralized climate change planning under "Target Achievement Plan"	2000: Ordinance amendment for mandatory emissions reporting
	2005: Enforcement of Kyoto Protocol →lower levels of government draw up plans	ETS Planning 2002: Deliberations begin 2002-2004: Phase 1 of Voluntary Scheme -Emissions reporting -Voluntary emissions reduction setting -Three-year emissions reduction plan
2005 - 2010	2008: Complete revision of Target Achievement Plan →focus on Kyoto Mechanisms (60-80% cuts in emissions from 2008 levels by 2050 and 14% by 2020)	June 2007: Launch of Tokyo Climate Change Strategy
	2009: Prime Minister Yukio Hatoyama announces cuts of 25% from 1990 levels	June 2008: Ordinance Amendment for ETS Implementation 2005-2009: Phase 2 of Voluntary Scheme Public announcements and evaluations of reduction plans begin
		2010: April 1 st , start of ETS

Figure 2: Obligations Under the Tokyo Metropolitan Environmental Security Ordinance



Note: A company may have multiple obligations since emissions are measured on a facility basis.
Source: Adapted from Tokyo Metropolitan Government, 2010.

report for the whole building is then submitted by the building owner.

- These facilities must set a reduction target and submit a five-year reduction plan and an annual emissions reduction progress report.

Small/Medium Facilities:

- For companies with multiple buildings, factories, etc. located throughout Tokyo: if the combined crude oil-equivalent consumption is over 3,000 kL per annum but no single building or facility is over 1,500 kL per annum, the headquarters of the company must submit an annual energy efficiency plan report, which is made publicly available.
- Although these facilities are not required to cap their emissions, TMG aims to help them understand both their energy consumption profiles and available methods to reduce emissions.
- If the consumption of any one facility is less than 30 kL per annum, there is no obligation to report the emissions from that facility.

CO₂ reduction obligations apply only to individual facilities in the large-scale segment. So for example, a company may have one large factory in the large-scale segment, and several smaller factories. In this case, the large factory itself has a CO₂ reduction obligation, which does not apply to the rest of the company.

Setting Reduction Targets

TMG aims to reduce CO₂ emissions by 25% below 2000 levels by 2020. A 6% to 8% reduction is targeted during the first compliance period (2010-2014), with a further 17% reduction by the end of the second compliance period (2015-2019).

The baseline for emissions reductions is the average emissions from any three consecutive years in the period 2002–2007. Some facilities have pre-existing data from the mandatory reporting program. Facilities were free to choose any

period of three consecutive years to use. In some cases, the average of two consecutive years was allowed (e.g. shut down of a factory in one year that significantly altered emissions).

Three categories of emissions reductions targets were set for the first compliance period (2010-2015):

- Category 1-A: an 8% reduction for office buildings, public institutions, commercial buildings, lodging, educational facilities, medical facilities, etc. that do not fall under Category 1-B;
- Category 1-B: a 6% reduction for buildings in which air conditioning/heating from district cooling/heating plants make up more than 20% of energy consumption; and
- Category 2: a 6% reduction for factories that do not come under Category 1.

Fines are imposed on those who do not meet their targets and fail to purchase credits through the ETS to cover the shortfall. The amount of each fine is JPY500,000 (about USD5,500), coupled with an additional emissions reduction obligation beyond the shortfall itself. The names of offenders are made public in a “name and shame” scheme to further incentivize reductions.⁶

Calculation of Allowances⁷

Allowances are grandfathered⁸ based on historical emissions and are calculated by compliance period. The total emissions allowance for the compliance period is calculated as follows:

$$[\text{Base Year Emissions} - \text{Required Reduction (6\% or 8\%)}] \times \text{Compliance Period (5 years)}$$

To provide an incentive to participants, “top-level” facilities – those assessed as having achieved outstanding progress in reducing emissions – may have their compliance factor reduced by half. “Quasi top-level” facilities may have their compliance factor reduced by one-quarter. This reduction is implemented for a three-year period and performance of each facility is regularly monitored.⁹

Emissions Auditing

TMG requires audits to verify emissions under the ETS. The cost of auditing is borne by the respective facility. Currently, there are several dozen private audit firms within Tokyo that are licensed to undertake this verification. These audit firms must be registered with TMG for a particular segment.¹⁰

Arrangements for Trading and Offsets

If a facility exceeds its emissions reduction requirements under the ETS' cap, it is allowed to sell the excess reductions as credits. Banking of accumulated credits is permitted, but borrowing is not. This is illustrated in Figure 3 based on the assumptions provided in the previous allowance calculation.¹¹

While TMG asks that participants in the ETS principally trade emissions credits with one another, the ETS also provides for three other methods for acquiring credits:

- *Credits from small/medium facilities:* credits may be purchased from those facilities that have voluntarily reduced their emissions.
- *Credits from outside Tokyo:* applying credits from large facilities outside Tokyo (purchase restricted to a maximum of one-third of base year emissions).
- *Renewable energy credits:*
 - *Green Electricity Certification:* certificates for emissions reductions can be obtained (i) if a facility changes power source and uses green electricity (certified by TMG) or (ii) if the power company serving the target facility either installs increased renewable energy as a percentage of delivered end-user power or installs additional substations that bring in additional renewable energy from outside the Tokyo area.
 - *City Solar Energy Bank:* Run by Cool-Net Tokyo, this is a bank for residential renewable energy credits. When TMG gives out subsidies for facilities with renewable energy in residences (solar power, solar water heating, etc.), the user—i.e. the household purchasing renewable energy—is required to relinquish 10 year's worth of carbon credits to TMG. These credits may then be purchased by businesses and individuals on a voluntary basis to offset their emissions. (Tokyo Metropolitan Government, 2008).

"Interacting with stakeholders was repeatedly identified as the most important lesson learned in Tokyo."

Beginning in April 2011, one year after implementation of the ETS, TMG will offer an online platform for companies to trade emissions reduction credits. The platform will match buyers with sellers and facilitate the transfer of credits between participants' accounts. Actual transfers of cash will take place directly between transacting parties without involving TMG. To ensure greater transparency in the prices of credits, a private joint venture between CoalinQ.com and Smart Energy broker carbon credit trades; the joint venture will charge a 5% fee on the transaction value of each transaction.

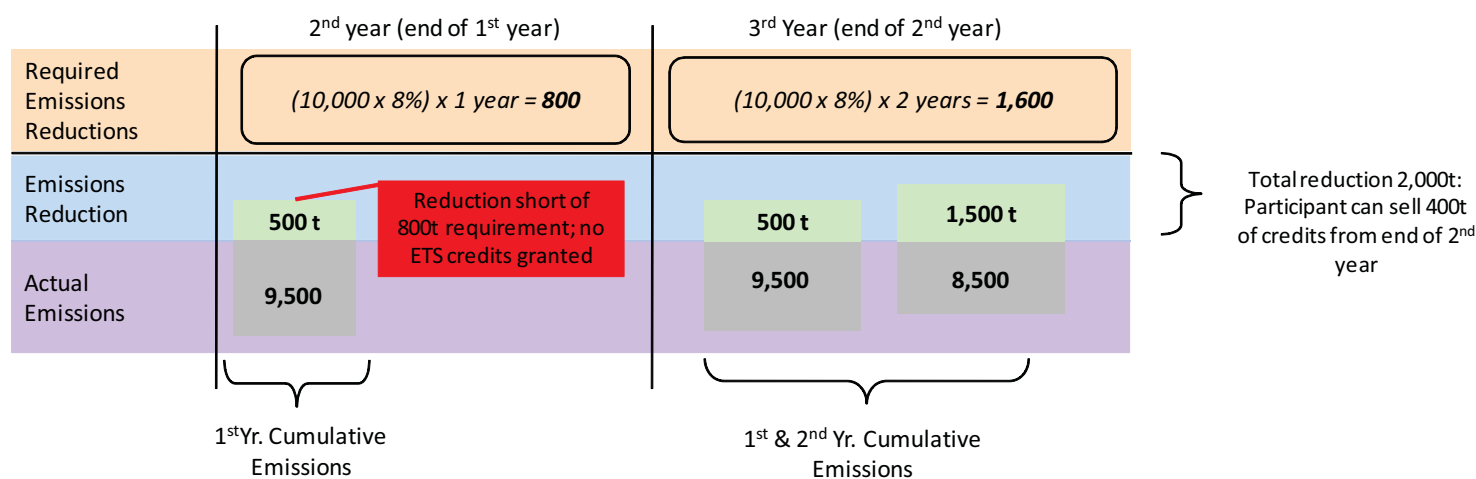
Key Lessons Learned

Tokyo's success in implementing the ETS can be attributed to a generally cooperative environment and the high level of technical and financial management capacity both within the government and in the private sector. Some notable features from this experience include:

Mandatory Reporting: The critical first step by TMG to establish a multi-year mandatory emissions reporting ordinance for the largest emitters in the city yielded a large database of information on GHG emissions by facility. The detailed breakdown of sources for individual energy consumption including reports on specific machinery and infrastructure allowed TMG to calculate GHG emissions and identify best practices for energy efficiency. During stakeholder consultations, the mandatory reporting gave TMG a data-based argument to assert that energy efficiency targets were indeed possible.

Simplicity: Many companies complained that they did not have the technical capacity to develop an emissions report each year. The development of a simple reporting system that relied on existing data from electricity and fuel bills, and equipment inventory lists, was one of the most important elements for gaining acceptance for the ETS. That said, reporting in this way limits the target gases to energy-based CO₂.

Figure 3: Calculating Reductions Exceeding Obligations



Source: Adapted from Tokyo Metropolitan Government, 2009.

Incentive Development: While the voluntary emissions reduction program yielded only minimal success in achieving actual reductions, it also afforded Tokyo the opportunity to learn about creating incentives. TMG introduced guidelines for target setting and reduction measures, evaluation and public announcement of results of mitigation efforts, and submission of progress reports. These elicited a more serious commitment to the program, raising the average target level among the 1,255 participating facilities to 4.8%.

Stakeholder Consultation: Interacting with stakeholders was repeatedly identified as a very important lesson learned in Tokyo. Including stakeholders from the beginning afforded TMG the chance to tailor the ETS to individual companies' needs, while meeting TMG's ambitious reduction goals. The stakeholder meetings identified areas for improvement in the ETS design. More importantly, these meetings helped TMG to build confidence among ETS participants.

Legal Framework: Tokyo's experience indicates that it is difficult to achieve ambitious reduction targets solely through voluntary efforts. Instead, voluntary efforts should be thought of as a proof-of-concept to gain support within the government apparatus and among stakeholders for binding measures. From this perspective, it is very important to institutionalize relevant instruments through legal mandates.

Implementation Timing: Appropriately timing each step in the development of the ETS increased both private and public sector support. Through consultations with global and local experts, TMG developed the core proposal, with inputs from public discussions. In mid-2008, the proposal was submitted to the Tokyo Metropolitan Assembly, which approved the implementation of the ETS.

Appropriate ETS Design: Lastly, designing an ETS both appropriate to the conditions in Tokyo and responsive to the goals of TMG was essential. First, while an intensity-based cap can lead to energy efficiency, an absolute cap was considered the only way to reach the goal of reducing total emissions. Second, TMG focused on those facilities that would have the greatest impact on reducing total emissions. It thus avoided having to manage thousands of facilities that would have had only a marginal effect on emissions reductions.

The contents of this paper are the views of the authors and do not necessarily reflect the views of the Tokyo Metropolitan Government.

End Notes

¹From the climate change planning documents of London, United Kingdom; Paris, France; and Austin, Texas, United States; there are intentions to reduce GHGs through carbon credit systems, but it is not clear the exact form such systems would take.

²Tomin no Kenkou to Anzen wo Kakuho suru Kankyou ni Kansuru Jourei

³Shouenehou no dainishu enerugii shitei kanrikoujou

⁴CRC was formerly known as the Carbon Reduction Commitment, but is now simply known as the CRC.

⁵While CC mitigation was not an objective of ERMS, tropospheric ozone is a GHG, so to a limited extent there are co-benefits from this ETS for climate change mitigation.

⁶Tokyo Metropolitan Government (2010)

⁷Tokyo Metropolitan Government (2009)

⁸There is currently consideration of a gradual transition to auctioning of allowances, but this is still at an inchoate stage (Tokyo Metropolitan Government 2010a).

⁹See also (in Japanese): [http://www2.kankyo.metro.tokyo.jp/sgw/daikibo/data090629/shiryou2_3\(16\)_090629.pdf](http://www2.kankyo.metro.tokyo.jp/sgw/daikibo/data090629/shiryou2_3(16)_090629.pdf)

¹⁰Tokyo Metropolitan Government (2009)

¹¹Ibid.

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