

The Tokyo Emissions Trading Scheme: Lessons from a Pioneering Jurisdiction

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I. Introduction and Summary

In 2010, Tokyo launched a pioneering cap-and-trade program for its buildings known as the Tokyo Metropolitan Government Emissions Trading System (ETS).ⁱ The Tokyo ETS was innovative both for the scope of sources covered – industrial factories, large public buildings, educational institutions, and large commercial buildingsⁱⁱ – and for being the first local-level ETS in the world to target carbon emissions. Given the innovative nature of the program, this issue brief examines the workings of the Tokyo ETS and seeks to identify lessons that it holds for other cities, such as New York, that are contemplating adopting their own cap-and-trade program for buildings.

The Tokyo ETS has generally been deemed a success in so far as participating buildings have largely met or exceeded their reduction goals.ⁱⁱⁱ As such, the program set an important precedent that commercial buildings, in addition to industrial buildings and factories, can successfully participate in emissions trading regimes. However, Tokyo took some steps in the name of political expediency to achieve its goal that may have caused relatively few emissions permits to change hands. As a result of the anemic trading market, participants in the Tokyo ETS did not take full advantage of the cost efficiencies that cap-and-trade schemes can provide.^{iv}

This issue brief sheds light on the mechanisms of the Tokyo ETS, including its successes and challenges. The brief begins with an overview of the general theory behind cap-and-trade and then examines the particularities of the Tokyo ETS. It concludes with a discussion of

the outcomes in Tokyo and issues that other jurisdictions interested in reducing building emissions through an ETS should consider in setting up such a program.

II. Overview of Cap-and-Trade

Before delving into the specifics of Tokyo's program, it is helpful to review the basic workings and ideas behind cap-and-trade systems. The first step in setting up a cap-and-trade program is typically for a regulatory authority, like a state, regional or national government, to establish a limit representing the maximum amount that all regulated facilities in an industry can together emit.^v This limit is then subdivided into shares of emissions for which permits are issued and distributed to facilities. The number of permits a facility holds represents the maximum amount it is allowed to emit.^{vi} Facilities then have three choices: to reduce their emissions and sell the extra permits, to keep their permits and use them to comply with their obligations, or to buy permits from other facilities and thereby increase their emissions quota.^{vii} Over the years, cap-and-trade programs have regulated substances from mercury to sulfur dioxide^{viii} and have become a popular method of reducing emissions of greenhouse gases too. Jurisdictions at many different governance levels, including California, the U.S. Northeast, New Zealand, South Korea, China and the European Union, have used cap-and-trade programs to curb greenhouse gas emissions.

III. Mechanics of the Tokyo ETS

The Tokyo ETS has many of the typical elements of a cap-and-trade program, but is unique with respect to the type of sources covered and the means of setting the emissions cap. The program has also adopted a somewhat distinctive approach to calculating the baseline

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against which emissions reductions are measured, and involves some unusual enforcement mechanisms, which may reflect particularities of Japanese culture. These elements of the program are reviewed below.

One last particularity of the Tokyo ETS that should be noted is that the program is linked with the ETS of another province - Saitama.² Tokyo and Saitama developed their ETSs in tandem with each other and the programs are virtually identical.^{ix} As such, references to the Tokyo-Saitama ETS, the Tokyo ETS and the joint ETS all refer to the linked program in both cities (unless noted otherwise). It is noteworthy that the two programs were linked from the outset, as it increased their compatibility and eased trades between facilities across the two jurisdictions.

Covered Sources

As indicated above, to establish an ETS, the controlling authority must first define covered facilities, establish a reporting scheme, and either set an aggregate cap on the total amount of emissions that can be released throughout the regulated sector or establish a baseline against which to compare future reductions. In Tokyo, covered buildings are non-residential buildings that consume more than 1,500 kiloliters³ a year of crude oil equivalent (COE) through their fuel,

² As a large urban area, with different economic characteristics than its rural counterparts, Tokyo is generally more supportive of environmental projects than other parts of the country. Of particular importance, manufacturing is not a dominant employer and there are no power generators in Tokyo, which may lower political opposition to major environmental initiatives. Naturally, this is not the case throughout Japan. Perhaps as a result, when Tokyo asked neighboring prefectures to set up their own ETS linked with Tokyo's to create a bigger market for trading, only one, Saitama, wanted to be involved.

³ One kiloliter of COE is equivalent to about 6.3 barrels of COE. One barrel of COE produces about 1700 kilowatt hours (kWh) of energy and the average US household uses 867 kWh per month meaning the Tokyo-Saitama ETS only covers very large buildings. See BP, *Approximate conversion factors-Statistical Review of*

heat, and electricity needs.^x If a building meets this threshold, the building owner must self-report to the Tokyo Metropolitan Government (TMG) Governor who will classify the building as a "Facility with GHG Reporting Obligations" commonly known as a Reporting Facility.^{xi} If a building is a Reporting Facility for the following three years, the Governor will designate that facility as a Facility with CO2 Reduction Obligations also known as a Compliance Facility.^{xii}

Tokyo does not liberally employ the "bubble theory," which defines a covered facility with reporting requirements as all buildings owned by the same company and permits such owners to demonstrate compliance so long as the average amount of emissions released across the group of buildings does not exceed the regulatory cap.⁴ However, the Tokyo ETS does provide some flexibility to owners of multiple properties. Examples of building combinations that are "bubbled" or treated as a single reporting facility include facilities with many sites that have integrated energy management systems, adjacent buildings with a common owner, and closely located buildings with a common owner where at least one building meets the threshold.^{xiii}

World Energy, <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2018-approximate-conversion-factors.pdf>, see also US ENERGY INFORMATION ADMINISTRATION, *Frequently Asked Questions*, <https://www.eia.gov/tools/faqs/faq.php?id=97&t=3>. Only about 1,400 buildings were covered in the first compliance period. TOKYO METRO. GOV'T, BUREAU OF ENV'T, TOKYO CAP-AND-TRADE PROGRAM 11 (March 2010).

⁴ The TMG opted against this because they were worried it would reduce the total number of participating facilities. Interview with Sven Rudolph, *supra* note 2. Professor Rudolph also noted that many of the initial trades were between facilities from the same company. *Id.*

The Emissions Cap

The Tokyo ETS used a somewhat distinctive approach to setting the emissions cap. Specifically, instead of setting a cap on the total amount of pollution that can be emitted in a sector and then dividing this amount among covered sources, the first step towards establishing Tokyo's cap was to set individualized emission limits for each building based on the amount of emissions it had released in the preceding years (more details on the baseline below). These individualized caps were then aggregated to determine the maximum amount that existing covered buildings were allowed to emit.^{xiv} The final cap for the sector consisted of the aggregate cap for existing buildings plus a specified number of allowances for new buildings.^{xv}

The Baseline

The Tokyo ETS aims to reduce energy consumption of covered sources by 30% from 2000 levels by 2030.^{xvi} Defining "2000 levels" within the program is done by setting a baseline. Baseline setting for emissions programs often requires compromise between environmental advocates and the regulated industry; if the baseline is set too high, the program may not generate substantial reductions.

In Tokyo, each regulated facility has a unique initial baseline. Covered sources averaged three consecutive years of their emissions between 2002 and 2007 and that number was set as their pre-ETS baseline.^{xvii} Some scholars have raised the concern that this method of baseline setting contributed to an overestimation of reduction in the first compliance period,^{xviii} because facilities can count reductions made between 2007 and 2010 towards their reduction requirements under

the program. Others, however, argue that the benefits of political expediency and industry support that went hand-in-hand with this baseline method were worth the compromise.^{xix} Moreover, baseline setting is just one of many ways to signal the program's priorities. Opportunities to revise the reduction goals present themselves throughout the program and an industry-friendly baseline can be paired with bold reduction targets.^{xx}

Compliance Periods

Achieving the programmatic goal of 30% emissions reduction in Tokyo by 2030 is measured in five-year compliance periods. In the first compliance period, 2010–2014, covered facilities were required to reduce emissions by 6–8% from their respective baselines and in the second compliance period, 2015–2019, they were required to reduce their emissions by 15–17% from their baseline.^{xxi} The third compliance period runs from 2020–2024, and the reduction goals are expected to be 25–27%.^{xxii}

Facilities are not allowed to borrow credits between compliance periods and were only allowed to bank credits between the first and second compliance periods.^{xxiii} Facilities have banked a large number of credits, which has caused some scholars, as well as the TMG, to worry that sources will lack adequate incentive to reduce emissions in the next period;^{xxiv} indeed, facilities have so many credits that they may be able to reach the 30% reduction target without making substantial new improvements.^{xxv} One creative solution to this problem that has been proposed is for companies to use some of their excess credits to offset travel to Tokyo for the Olympic Games.⁵

⁵ Tokyo has widely promoted its aims of being carbon neutral for the 2020 games both in the actual events themselves and the preparations. TOKYO 2020, *Tokyo 2020 Announces Sustainability Plan and Guiding Principle "Be better, together - for the planet and the*

people, <https://tokyo2020.org/en/news/notice/20180612-02.html> (last visited Apr. 17, 2019), *see also* Interview with Sven Rudolph, *supra*, note 2. Notably, it is unclear that building owners have an incentive to cooperate with this scheme and, at least in the American context, one

The fact that facilities have been able to bank so many credits indicates that there were abundant low-cost emissions reduction opportunities throughout Tokyo's building stock.^{xxvi} The TMG likes to point out that a majority of reductions, up to 90%, made through the first compliance period were achieved through the introduction of LED lights and other minor upgrades.^{xxvii} Cities looking to implement an ETS similar to Tokyo's that have already transitioned to efficient lighting^{xxviii} may find less low-cost opportunities for energy savings and therefore early emissions savings may be more expensive. For example, New York City adopted Local Law 88 in 2009, which requires common areas of residential buildings larger than 25,000 square feet and all areas of non-residential buildings larger than 25,000 square feet to update lighting in accordance with New York City Energy Conservation Code standards by 2025.^{xxix} Thus, many New York City buildings have already started implementing relatively low-cost energy savings and thus have less remaining low-hanging fruit to harvest.

Excess Emission Reduction Credits and Offsets

As is typical of cap-and-trade programs, the Tokyo ETS allows sources to sell emissions permits to other sources. Credits can be sold by facilities that are reducing more than their obligation to facilities that are still emitting above their cap. Facilities reducing more than "Base-year emissions × Compliance factor × Elapsed years of the compliance period" can sell

could anticipate substantial backlash and potential legal consequences if a government were to require permits to be devoted to this purpose.

⁶ For example, if a facility's baseline is 10,000 tons of carbon emissions per year, and their compliance factor is 8%, it must reduce more than 800 tons in the first year to sell excess credits and more than 1,600 tons total by the end of the second year. If the facility reduces 2,000 tons by the end of the second year, it will have 400 tons worth of credits to sell. The facility would not be able to sell or trade credits worth more than 4,200 tons of emissions any

excess credits up to one-half of the facilities baseline emissions.⁶ However, unlike some other emissions trading regimes, there is no centrally administered marketplace in which the permits can be exchanged. Facilities also must apply to the government to make a trade.^{xxx} This means the ETS does not rely on an open market platform to facilitate trades. Scholars noted that these were the least used type of credit or offset,^{xxxi} and even the TMG website claims that only 10% of reduction targets were met through trades in the first compliance period.^{xxxii}

Notably, the TMG anticipated a slow start to the trading market and, starting in the first compliance period, they organized trading fairs several times a year to help facilitate trades between companies.^{xxxiii} Trades eventually picked up steam and 521,000 credits were traded in 2015.^{7,xxxiv} According to at least one scholar, Tokyo was not particularly bothered by the illiquidity of its trading market because the main focus of the ETS was to reduce carbon emissions and they were less concerned with ensuring that such reductions were achieved at least cost; setting up an efficient market that would minimize compliance costs was a secondary objective and since building owners have generally succeeded in reducing emissions without incurring substantial expense, there has been little political pressure to revise this part of the system.^{xxxv}

In addition to the excess emissions reduction credits, the ETS has offset credits that facilities can use to reach their reduction goals. These

given year. *See* TOKYO METRO. GOV'T, BUREAU OF ENVI., "Tokyo Cap-and-Trade Program" for Large Facilities, 38 (Mar. 30, 2012), http://www.kankyo.metro.tokyo.jp/en/about_us/videos_documents/documents_1.files/Tokyo_Cap-and-Trade_Program_detailed_ver.pdf.

⁷ For reference, in Saitama, in the first compliance period a total of 200,000 credits were traded with a majority of companies trading between 100 and 1,000 credits in a trade. Interview with Sven Rudolph, *supra* note 2.

offset credits likely provided an additional reason for why firms did not need to trade excess emissions credits, especially in the first compliance period. The program makes four types of offset credits available.^{xxxvi} The first type of offset is a Renewable Energy credit which is issued through a green certification.^{xxxvii} The second type is Small and Medium Sized credit which encourages reductions by facilities that are too small to be covered (buildings that emit less than 1,500 kL COE) to participate in the ETS.^{xxxviii} The last two type of offsets, the Outside Tokyo credits and the Saitama credits, works similarly to the Small and Medium credits but are between firms outside of the city or with the linked prefecture of Saitama.^{xxxix} The offset credits add more flexibility to the ETS and arguably brings it more in line with the economic theory that undergirds cap-and-trade schemes.

Enforcement

Once covered facilities are familiar with the parameters of participating in the program, they must also understand the consequences of violating the terms of the program. Enforcement is one of a few elements where Saitama and Tokyo differ. In Tokyo, after the first compliance period, non-compliant facilities faced additional reduction obligations. If a firm does not meet its reduction goal through lowering emissions or purchasing credits during the first period, their shortfall is multiplied by 1.3, increasing their total reduction requirement for the period.^{xl} The TMG ordered non-compliant firms to achieve that increased reduction goal—of shortfall \times 1.3 reduction—by a new Order Fulfillment Deadline.^{xli} The TMG defines the Order Fulfillment Deadline as a reasonable deadline after the compliance period ends for the firm to reach their shortfall plus penalty.^{xlii} Subsequent compliance periods impose additional penalties on non-compliant firms. In particular, in addition to the increased reductions outlined above, non-compliant facilities for that period will be

publicly named and ordered to pay the monetary equivalent of the reduction shortage and/or be subject to fines up to JPY 500,000 (USD 4,528).^{xliii} In Saitama, there are no fines or additional reduction mandates for non-compliance, however, there is a risk of being publicly named which has proven to be an effective compliance mechanism.^{xliv}

Notably, the ETS also employs some positive enforcement mechanisms. For instance, some of the top performing buildings have been called out by the government since the beginning of the program, which is believed to be powerful motivator.^{xlv} They are included in lists such as the *Low Emissions Buildings Top30 in Tokyo*, which recognized buildings that reduced more than 20% of emissions in the summer following the 2011 earthquake, and the *Tokyo Green Building Report 2015* which listed the buildings certified as top-level facilities under the program.^{xlvi}

IV. Outcomes and Effectiveness of the ETS

The ETS has been successful in achieving its primary goal of reducing carbon emissions, evidenced by many participating buildings not only meeting but exceeding reduction goals to date. In 2016, over 90% of facilities met or surpassed their targets from the first compliance phase and a majority of them had already met their obligations for the second compliance period ending in 2019.^{xlvii} However, it took quite some time for trading between facilities to become an important component of the program. The pace is partially explained by the fact that the ETS did not establish an open market platform, such as a stock market, on which permits could be traded but opted instead to rely on bilateral trades as detailed above. It is also important to note that a large portion of reductions achieved in Tokyo have been through implementing new technology, like LED lights.^{xlviii} If a city like New York, which has already made meaningful headway towards improving lighting, were to

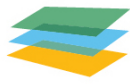
implement an ETS, it may need the cost efficiencies that come from a strong emissions trading market since it could not necessarily rely primarily on the same low-cost options as Tokyo.

Two other factors that contributed to Tokyo's early success were the high baselines discussed above and the 2011 earthquake. The earthquake had an impact on the program in two ways. First, the initial earthquake caused power disruptions throughout the region. Second, once power was restored, the government-imposed power reduction requirements to prevent blackouts in the months following.^{xlix} It should be noted that the ETS was implemented before the Earthquake and the reductions following the earthquake continued even after the government-imposed power reductions were lifted, evidence that it was the ETS that most significantly contributed to the reductions in the first compliance period,¹ and that the earthquake simply accelerated what the ETS had planned.

V. Conclusion

The Tokyo ETS has proven that emissions trading regimes can be successfully adopted to end-users of electricity, including buildings. Municipalities interested in implementing similar systems should thus be heartened by Tokyo's experience. However, Tokyo's experience also suggests areas that other cities can improve upon. Of particular importance, jurisdictions looking to benefit from the savings that market mechanisms can generate may want to encourage more trading between covered facilities from the outset, perhaps through the creation of a public exchange, instead of relying on bilateral trades. Other cities may also want to impose more stringent limits on the number of permits facilities can bank in order to avoid undermining the incentives for reductions in subsequent periods. Finally, countries with industries that are less motivated by public

shaming may want to increase their enforcement mechanisms.



ⁱ Masayo Wakabayashi & Osamu Kimura, *The Impact of the Tokyo Metropolitan Emissions Trading Scheme on reducing greenhouse gas emissions: findings from a facility-based study*, 18 CLIMATE POL'Y 1028 (2018).

ⁱⁱ *Id.*

ⁱⁱⁱ Sven Rudolph & Toru Morotomi, *Acting Local! An Evaluation of the First Compliance Period of Tokyo's Carbon Market*, 10 CARBON & CLIMATE L. REV. 75 (2016).

^{iv} For a review of the cost-efficiencies that emissions trading can provide, see Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law* 37 STAN. L. REV. 1333, 1342-1351 (1985).

^v ENVTL. DEFENSE FUND, *How cap and trade works*, <https://www.edf.org/climate/how-cap-and-trade-works> (last visited Apr. 17, 2019).

^{vi} *Id.*

^{vii} *Id.*

^{viii} EVNTL. PROT. AGENCY, *Acid Rain Program*, <https://www.epa.gov/airmarkets/acid-rain-program> (last visited Apr. 17, 2019).

^{ix} Sven Rudolph & Takeshi Kawakatsu, *The Tokyo-Saitama Emissions Trading Scheme – An Example for Successful Linking*. CARBON AND CLIMATE L. REV. 13(2) (forthcoming) [hereinafter *Tokyo-Saitama ETS*].

^x TOKYO METRO. GOV'T, BUREAU OF ENV'T, "Tokyo Cap-and-Trade Program" for Large Facilities, 13 (Mar. 30, 2012)

http://www.kankyo.metro.tokyo.jp/en/about_us/videos_documents/documents_1.files/Tokyo_Cap-and-Trade_Program_detailed_ver.pdf.

^{xi} *Id.*

^{xii} *Id.*

^{xiii} *Id.* at 14.

^{xiv} Rudolph & Morotomi, *supra* note iii, at 76.

^{xv} Sven Rudolph & Takeshi Kawakatsu, *Tokyo's Greenhouse Gas Emissions Trading Scheme: A Model for Sustainable Megacity Carbon Markets?* MAGKS JOINT DISCUSSION PAPER SERIES IN ECONOMICS, No. 25-2012 (2012) [hereinafter *Tokyo's Greenhouse ETS*].

^{xvi} Wakabayashi, *supra* note i, at 1028.

^{xvii} *Id.*

^{xviii} *Id.* at 1029.

^{xix} Skype interview with Sven Rudolph, Assoc. Prof., Kyoto Univ. (Apr. 10, 2019).

^{xx} *Id.*

^{xxi} INT'L CARBON ACTION P'SHIP, *Japan - Tokyo Cap-and-Trade Program*, [https://icapcarbonaction.com/en/?option=com_etsmap&task=export&format=pdf&layout=list&systems\[\]=51](https://icapcarbonaction.com/en/?option=com_etsmap&task=export&format=pdf&layout=list&systems[]=51) (last visited Apr. 17, 2019).

^{xxii} *Id.*

^{xxiii} Stefano De Clara et al., *The World's Carbon Markets: A Case Study Guide to Emissions Trading*, INT'L EMISSIONS TRADING ASS'N, https://www.ieta.org/resources/Resources/Case_Studies_Worlds_Carbon_Markets/2015/tokyo_case_study_may2015.pdf (last updated May 2015).

^{xxiv} Interview with Sven Rudolph, *supra*, note xix.

^{xxv} *Id.*

^{xxvi} Interview with Sven Rudolph, *supra*, note xix.

^{xxvii} See TOKYO METRO. GOV'T, *Tokyo Cap-and-Trade Program: All covered facilities achieve their CO2 emission reductions for the first compliance period*, Nov. 16, 2016,

<http://www.metro.tokyo.jp/english/topics/2016/161116.html>.

^{xxviii} *Id.*

^{xxix} NYC MAYOR'S OFFICE OF SUSTAINABILITY, *LL88: Lighting Upgrades & Sub-metering*, <https://www1.nyc.gov/html/gbee/html/plan/ll88.shtml> (last visited Apr. 24, 2019).

^{xxx} Wakabayashi, *supra* note i, at 1033.

^{xxxi} Yuko Nishida et al., *Alternative Building Emission-Reduction Measure: Outcomes from the Tokyo Cap-and-Trade Program*, 44 BUILDING RES. & INFO. 644 (2016) (noting that the excess emissions reduction program was supplemental).

^{xxxii} TOKYO METRO. GOV'T, *Tokyo Cap-and-Trade Program: All covered facilities achieve their CO2 emission reductions for the first compliance period*, Nov. 16, 2016, <http://www.metro.tokyo.jp/english/topics/2016/161116.html>.

^{xxxiii} Interview with Sven Rudolph, *supra* note xix.

^{xxxiv} Rudolph & Morotomi, *supra* note iii.

^{xxxv} Interview with Sven Rudolph, *supra* note xix.

^{xxxvi} Wakabayashi, *supra* note i, at 1033.

^{xxxvii} *Id.*

^{xxxviii} *Id.*

^{xxxix} *Id.*, see also INT'L CARBON ACTION P'SHIP, *supra* note xxi.

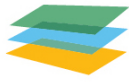
^{xl} INT'L CARBON ACTION P'SHIP, *supra* note xxi.

^{xli} TOKYO METRO. GOV'T, BUREAU OF ENV'T, "Tokyo Cap-and-Trade Program" for Large Facilities, 13 (Mar. 30, 2012)

http://www.kankyo.metro.tokyo.jp/en/about_us/videos_documents/documents_1.files/Tokyo_Cap-and-Trade_Program_detailed_ver.pdf.

^{xlii} *Id.*

^{xliii} INT'L CARBON ACTION P'SHIP, *supra* note xxi; TOKYO METRO. GOV'T, "Tokyo Cap-and-Trade Program" for



Large Facilities, May 2015,
http://www.kankyo.metro.tokyo.jp/en/climate/cap_and_trade/index.files/TokyoCaT_detailed_documents.pdf.

^{xliiv} *Tokyo-Saitama ETS*, *supra*, note viii.

^{xlv} See TOKYO METRO. GOV'T, BUREAU OF ENV'T, *Low Emissions Buildings Top30 in Tokyo*, Sept. 2011, http://www.kankyo.metro.tokyo.jp/en/climate/top30.files/TOP30_English.pdf; see also TOKYO METRO. GOV., *Tokyo Green Building Report 2015*, July 2015, http://www.kankyo.metro.tokyo.jp/en/climate/index.files/Tokyo_GB_eng.pdf.

^{xlvi} *Id.*

^{xlvii} Rudolph & Morotomi, *supra* note iii, at 78.

^{xlviii} TOKYO METRO. GOV'T, BUREAU OF ENV'T, *Tokyo Cap-and-Trade Program: All covered facilities achieve their CO2 emission reductions for the first compliance period*, Nov. 16, 2016, <http://www.metro.tokyo.jp/english/topics/2016/161116.html>

^{xlix} *Id.*, see also Nishida, *supra* note xxviii.

¹ Rudolph & Morotomi, *supra* note iii, at 78.