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Innovating in sub-national climate policy: the mandatory emissions reduction scheme in Tokyo

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This study analyses the drivers behind the policy-making and implementation of the recently developed climate policies in the Tokyo Metropolitan Government (TMG). In 2010, the TMG introduced a mandatory CO_2 emission reduction and a cap-and-trade scheme; the world's first such scheme that sets binding targets for buildings. The research was carried out through reviews of the published and unpublished literature, surveys and face-to-face interviews with various stakeholders involved in the policy process. The essential components that enabled successful policy-making and implementation of the scheme in Tokyo are revealed, such as the administrative leadership and the capacity of the TMG administration, the availability of historical data supporting the policy discussions and the gradual and flexible implementation mechanisms. The article concludes with recommendations for future improvements in the TMG and beyond.

Policy relevance

This article presents the lessons from the recent advancements in climate policy in Tokyo, particularly the world's first mandatory city-scale emission reduction and cap-and-trade scheme that includes buildings. The scheme was relatively effective as the total GHG emissions were reduced by 23% on average from the base years and 10% below the average of other parts of the country before the end of the first compliance period of five years (2010–2014). The policy innovations from the world's largest city and the capital of Japan can inform sub-national governments about the potential barriers and opportunities for introducing mandatory GHG emissions reductions.

Keywords: city; emission trading scheme; governance; Japan; sub-national; Tokyo

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1. Introduction

While national governments are cautious about setting audacious targets to reduce emissions of GHGs, sub-national governments[1], especially the mega-cities[2], are developing their own innovative initiatives to tackle climate change. For example, the cities of New York City and Paris aim to reduce GHG emissions well below the national targets (City of New York, 2015; Mairie de Paris, 2007) through a series of city-led actions. In Japan, the TMG introduced a mandatory CO_2 emission control linked to a cap-and-trade system: the first such scheme that sets binding targets for buildings. By the end of the 2013 fiscal year, total emission in Tokyo was reduced by 23% on average from the base years, 90% of the 1281 regulated facilities achieved the first reduction target and 69% of them already met 2019 targets (TMG, 2015a).

This article analyses the recent advancements in Tokyo's low-carbon policy to understand the main drivers of institutional innovations in sub-national climate policy. The research examines how and why Tokyo was able to establish this pioneering mandatory emission cap-and-trade system. It also explores the unique design features that can be considered for the future development of climate policy frameworks elsewhere. Additionally, it identifies the factors that enabled the programme to have such successful outcomes, as Tokyo was able to significantly reduce its emissions in a short period of time. Overall, this article aims to demonstrate the importance of sub-national governments for placing climate change in the mainstream development agenda with the engagement of stakeholders to overcome the obstacles at the policy formulation and implementation stages.

2. Climate governance and cap-and-trade systems in sub-national governments

2.1. Sub-national climate governance

It is no longer unusual to see sub-national governments leading climate policy ahead of their central governments (Bedsworth & Hanak, 2013; Betsill & Bulkeley, 2007). Sub-national governments have a key opprtunity to move forward with climate policies as many of them have control over several sources of GHG emissions, from land-use decisions, local transport, energy management and building regulations to solid waste management (Bulkeley & Betsill, 2003; Kousky & Schneider, 2003; Sullivan, Gouldson, & Webber, 2012). This highlights the fundamental role of cities in the global climate regime; many problems of climate change stem from local activities and the national profiles are largely influenced by decisions made at the sub-national level (Collier, 1997).

The form and extent of sub-national climate activities depend on a number of governance factors (Goldsmith, 1996; Puppim de Oliveira, 2009; Silvestrini et al., 2010), which often enable (or disable) sub-national policy emergence and implementation. The enabling conditions require broad and sustained engagement of local stakeholders, including local officials from different departments, communities, civil society and businesses. The involvement of stakeholders at an early stage of policy-making enables the exploration of policy problems, which also helps speed up policy implementation (Gerrits & Elelenbos, 2004). Tokyo has made a significant contribution in this regard by legislating a successful compulsory CO_2 reduction scheme involving stakeholders, given its distinctive position in political and regulatory geography.

2.2. Cap-and-trade programmes around the world

Tokyo's cap-and-trade programme needs to be understood as part of both the growing trend of city-based climate action and the global development of cap-and-trade systems. Emission trading is one of the concepts popularized by Article 17 of the Kyoto Protocol, and cap-and-trade has become the mainstream design of emission trading schemes (ETS) around the world. Cap-and-trade involves setting an absolute cap against a baseline emission for covered entities. It has been introduced at several different levels: supranational implementation, as exemplified by the EU ETS; national-level schemes, such as the New Zealand and Swiss ETSs; regional cases, including the Regional Greenhouse Gas Initiative (RGGI) by eight states in the US; and sub-national implementation, pioneered by California and followed by other sub-national authorities like Tokyo, Quebec and seven pilot schemes in China (International Carbon Action Partnership, 2015).

The TMG scheme has several remarkable features. It is a cap-and-trade scheme that regulates energy consumers (called large building facilities) rather than regulating entities within specific sectors. Electricity generation and large energy combustion sources are not the main target of the regulations, as a large part of the electricity comes from outside; a geophysical rather than sectoral approach is used to define capped entities. Market participants within the Tokyo ETS are also limited to the capped building facilities subject to mandatory reduction, and hence no brokering is permitted. In addition, emission allowances alone cannot be traded in the market, as tradable carbon credits subject to offset are only credited based on actual reductions verified by the designated authority. As a result, short-selling is not possible in the TMG scheme, which prevents speculation and market manipulation.

These features have certainly attracted research attention in the existing literature, which mainly explains the policy design and effects of the Tokyo cap-and-trade scheme (Nishida & Hua, 2011; Rudolph & Kawakatsu, 2012; Satou & Yamamoto, 2012). As analysis of policy process, capacity building and the stakeholder engagement is limited (Niederhafner, 2013), this article focuses on understanding the TMG's policy development using the framework below.

3. Analytical framework and research methodology

Development of climate policy has widely been studied at different levels of governance (Betsill & Bulkeley, 2007; Cloutier et al., 2014; OECD, 2009). Several policy-oriented studies examine the factors that influence policy-making and implementation processes in climate policies and how governments build the capacity to undertake those policies (OECD, 2010a; Puppim de Oliveira, 2009; Rusche, 2010). OECD, for example, is active to examine processes of sub-national climate policies, and illustrated that effective involvement of stakeholders at different levels is crucial to build capacity and generate benefits for sub-national climate governance at all stages of the policy process (OECD, 2009, 2010a, 2010b). Thus, in line with the literature on the development of climate policies, our analytical framework seeks to collect evidence from various primary and secondary data in order to identify the key factors that were crucial to explain the effectiveness in the formulation and implementation stages of the TMG climate policy. Initially, an analysis of the policy design and process in Tokyo is presented (section 4) using the data collected, followed by the identification of the key factors for policy effectiveness, which includes policy design, local-national relations and stakeholder involvement (section 5).

The research relied on the case study method (Ragin & Becker, 1992), which is the best fit to understand complex decision processes where data may be available but the decisions and their implementation cannot be explained only with quantitative data. The policy process analysis supported by the specific technical information from the TMG provides grounds for in-depth understanding of the scheme within Tokyo and the potential for its expansion and replication elsewhere in the world. The paper uses published and unpublished literatures, surveys and face-to-face interviews for collecting primary and secondary information done between 2013 and 2015. An extensive desk research was done in all available official documents in Japanese and English, such as reports and legislations. For the purpose of examining policy achievements, emission data of 1281 compliance facilities (TMG, 2015b) was used to analyse the sectoral distribution[3]. In addition to the data from the 2013 survey for industries conducted by the TMG and semi-structured in-depth interviews[4] to capped entities and stakeholders involved in the policy process were carried out[5]. Thus the coverage of the stakeholders is of representative nature, rather than exhaustive. However, the inclusion of autonomous NGOs and non-official experts in the data collection and the lack of any commercial and institutional relations of the authors with the TMG provide an independent assessment of the situation in Tokyo.

4. Policy design and process of the Tokyo's cap-and-trade scheme

This section explores what policy context made the emergence of the TMG scheme possible by filling in the background of the successful policy-making and implementation of the cap-and-trade in Tokyo.

4.1. Putting Tokyo into context

Under the Japanese legal system, Tokyo is designated as a metropolis with an administrative structure similar to that of Japan's other prefectures. Tokyo's 23 special wards, which until 1943 constituted the city of Tokyo, are now separate, self-governing municipalities, each having a mayor, a council, and the status of a city. The TMG is headed by a publicly elected governor and metropolitan assembly (Council of Local Authorities for International Relations, 2012). The TMG has over 165,000 employees and governs about 10% (13.2 million in 2012) of the country's population and over 30% of its economic activities (TMG Bureau of Industrial and Labor Affairs, 2013; TMG Statistics Division Bureau of General Affairs, 2014). Tokyo's daytime population is multiplied by 1.2 times due to the influx of commuting workers and students from the neighbouring prefectures of Saitama, Kanagawa and Chiba. The Tokyo Metropolitan Area (TMA), which consists of Tokyo and neighbouring prefectures, is known to be the world's largest metropolitan area with a population of over 38 million (Department of Economic and Social Affairs of the United Nations Secretariat, 2014).

Tokyo has long been pioneering environmental regulations in Japan, which its cap-and-trade scheme fits into. Pollution control in Japan started from local ordinances, from as early as Tokyo's factory pollution control in 1949 prior to the national Air Pollution Control Act of 1968 (World Bank, 2011). On top of legislation, informal communication and voluntary agreements between the local governments and industries played a significant role in effective pollution reduction (Schreurs, 2008; Tsutsumi, 2001; Welch & Hibiki, 2003).

4.2. Cap-and-trade design

Energy-related CO_2 emission accounts for 95% of the entire GHG emissions in Tokyo and is the only GHG subject to control under the current scheme. Regulated entities under the Tokyo Metropolitan Environmental Security Ordinance (hereafter 'the Ordinance') are the large business facilities that consume more than 1500 kl of oil equivalent in energy annually for electricity and heat consumption. Approximately 1300[6] regulated large business facilities, which only account for 0.2% of the total number of business establishments, are responsible for 40% of the CO_2 emitted from all industrial and commercial facilities in Tokyo (TMG Bureau of Environment, 2015).

An emission cap is applied as an absolute limit of emission volume over five years depending on the category of the facility (Table 1). Office buildings are divided into those that are (I-2) and are not (I-1) connected to district heating and cooling. Factories are classified as category II. The compliance factor for the first compliance period (2010–2014) was further tightened in the second compliance period (2015–2019). TMG-accredited efficient facilities have less stringent caps in order to recognize their previous efforts[7].

Base emission is calculated by a grandfathering method, where each specified facility takes an average of three consecutive past emission years of choice. Thus, base year and base emissions are both decided according to the individual facility, rather than setting a uniform baseline applicable to the entire system. The compliance assessment is carried out over five-year periods rather than each calendar year. This allows the specified facilities to make plans in the short, medium and long term to achieve reduction goals by 2020 (TMG Bureau of Environment, 2015). The emission amount that exceeds the cap can be offset by the five types of credits[8] under the scheme (Table 2).

The Governor of Tokyo is able to warn facility owners to improve compliance performance when they fail in reporting, disclosure, planning and maintenance obligations. If mandatory reduction obligations cannot be achieved by the end of the sixth fiscal year, the Governor of Tokyo orders the facility to reduce its emissions by a volume 1.3 times the allowance shortfall. If the ordered reduction is breached, the final result is a nominal fine of up to 500,000 JP¥, official announcement of the violation to the public and a fee to purchase the exceeding amount in the market. Reports have to be verified by third-party organizations registered with the TMG (TMG Bureau of Environment, 2015).

A common dilemma of any climate policy is 'leakage'; mandatory carbon reduction needs to be implemented in other prefectures, otherwise large facilities would always have an option to move their operations out of Tokyo. This can discredit the scheme in the long term. Credit exchanges

Table 1 Compliance factors according to category in the first and second compliance periods

			Compliance factor	
Category		Regional heating and cooling	Period 1 (2010–2014) (%)	Period 2 (2015–2019) (%)
Office buildings (I)	I-1	No	8	17
	I-2	Yes	6	15
Factories (II)		N/A	6	15

Adapted from TMG Bureau of Environment (2012).

Table 2 A list of tradable credits under Tokyo's ETS

Type of credit	Description
1 Exceeding credit	Emission reduction amount that exceeds the yearly obligation can be traded from the second year of the compliance period.
2 Small and mid-sized installation credits within the Tokyo area	Emission reduced by small and mid-sized facilities in Tokyo through energy-saving measures can be purchased by specialized facilities without limit.
3 Renewable energy certificates	Credits issued through the state-led green certifications and the TMG-certified environmental value calculation can be used for offset.
4 Outside Tokyo credits	Emission reduced through energy-saving measures by large facilities with base year emission of less than 150,000 tonnes outside of Tokyo can be purchased by specialized facilities, up to a third of the base year emission amount.
5 Saitama credits	Credits certified by the Saitama prefectural government (neighbouring the TMG) for emission reductions by small and mid-sized facilities in Saitama and large facilities with a base year emission of less than 150,000 tonnes in Saitama. Abovementioned credits in Tokyo are also tradable in Saitama.

Adapted from TMG Bureau of Environment (2012).

agreed with the Saitama prefecture in 2011 illustrate a step forward in cross-prefectural actions, yet further development is needed to expand mandatory reductions to other prefectures in the TMA to avoid leakages. Moreover, horizontal collaboration by not only linking the different prefectural systems, but also sharing lessons of climate governance would generate chances for incubating other innovative practices in different sub-national governments.

4.3. Phases of the climate policy in Tokyo

Climate policy in Tokyo emerged alongside the recognition that the prominent national climate legislations in Japan, known as the Energy Conservation Law and the Global Warming Law, were too weak to bring significant emission reductions (Kuramochi, 2015). While the Global Warming Law sets no numerical reduction target, it established two schemes overseen by the Ministry of the Environment (MOEJ): the national offset credit scheme (JVER) in 2008 (MOEJ, 2014); and the national-level ETS (JVETS) in 2005, which ended in 2013 despite years of pilot study and discussions at the committee level (MOEJ, 2013). Both laws mandate regulated facilities to submit reduction plans and reports on energy use and carbon emission, but these requirements are not legally binding. In fact, during the late 1990s and early 2000s, Japan's total emissions of GHGs exceeded 1990 base levels, and showed no signs of reduction (National Institute for Environmental Studies, 2015).

Tokyo's cap-and-trade was first debated in the TMG ministerial sub-committee in 2000, and the idea was discussed with the Governor in May 2007[9]. Climate policy is mainly within the jurisdiction of the TMG Bureau of Environment and was gradually developed in three phases (Figure 1).

In 2002, the Tokyo Carbon Reduction Reporting Programme (a mandatory reporting scheme) was introduced, as a part of the enactment of the Ordinance in 2000. The reporting paved the way for

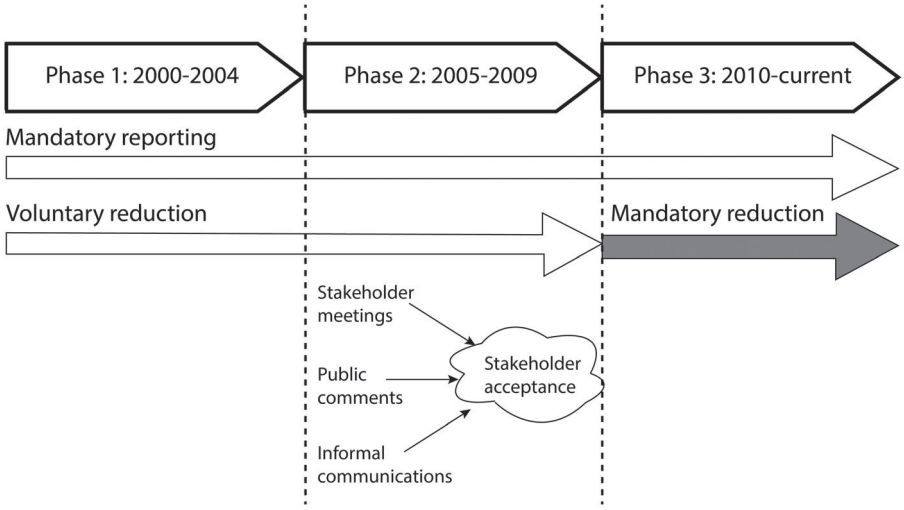

Figure 1 Three phases leading to the implementation of Tokyo cap-and-trade

further policy development by allowing participating facilities to recognize their emission patterns, which could induce changes that ultimately reduced carbon emissions. Although the revision of the Ordinance in 2005 introduced a mechanism to provide guidance for reduction plans and an evaluation system to reward outstanding facilities, voluntary reduction by the majority of the facilities lacked significant progress (Ohno, 2013)[10]. Once the mandatory cap-and-trade was proposed in the Tokyo Climate Change Strategy of 2007, a series of meetings were held with a wide range of stakeholders from both industrial sectors and civil society organizations and ministerial officials in attendance as observers. Public comments and informal communication also contributed to the information exchange and subsequent consideration of stakeholder voices. Rounds of active discussions ultimately led to the agreement of the amendment of the Ordinance in 2008, which paved the way to Tokyo's new mandatory climate scheme starting in 2010 (TMG Bureau of Environment, 2008, 2015). Building tenants were not included in the reporting system initially, but from the third phase, specified tenants using over 5,000 m^2 of floor and six million kWh/year of electricity were required to submit reduction plans through the building owners (TMG Bureau of Environment, 2015).

4.4. Policy achievements

In the face of the policy weakness at the national level, these new initiatives attracted much international attention, not only because of the novelty in the establishment of the cap-and-trade scheme but also the emission reduction beyond the annual average goals of the Ordinance (TMG, 2014). The TMG was internationally awarded for its climate leadership (City Climate Leadership Awards, 2014) and was also invited to the technical expert meeting at the United Nations Framework Convention on Climate Change (UNFCCC) to share its experience (UNFCCC, 2014). The fact that only two auctions have taken place for credit purchase so far (as of June 2015) reflects the successful emission

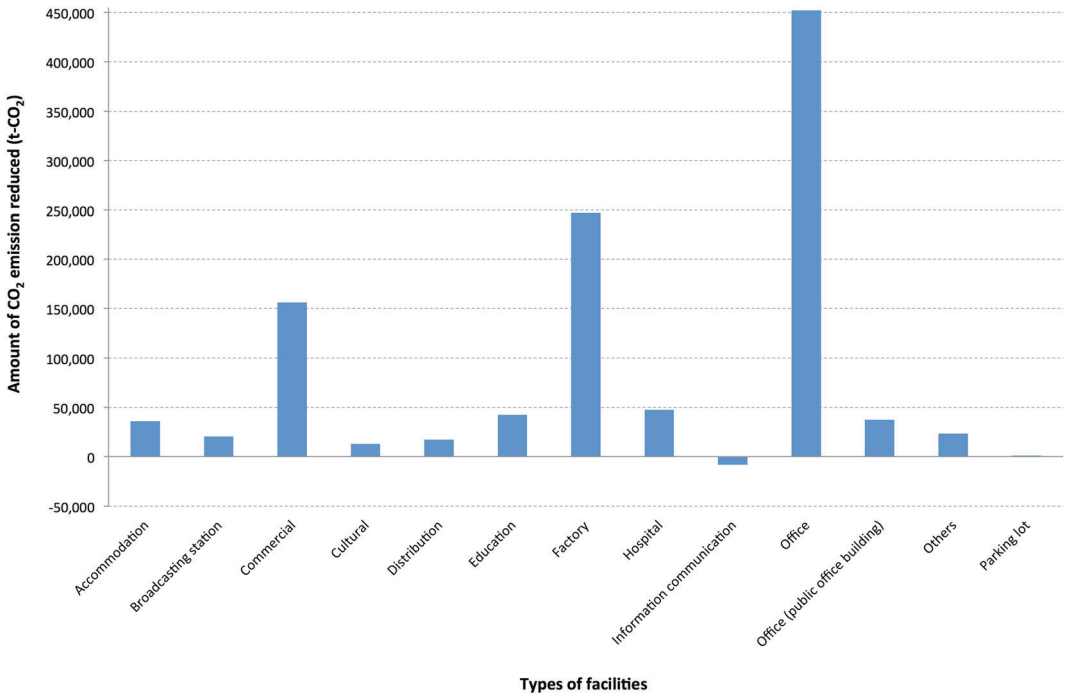

Figure 2 Sum of CO_2 emission reduced between 2010 and 2013
Adapted from TMG, 2015a.

reductions in almost all the facilities. Most of issued credits are exceeding credits (73%) and renewable energy certificates (22%), which have been banked (TMG, 2015b).

As shown in Figure 2 and Table 3, the emission reductions came mostly from business offices and factories, followed by commercial buildings and hospitals. The broadcasting station category has the highest mean reductions, as its proportion is comparatively small. An exception is the information communication buildings that saw an overall increase in emissions.

The latest TMG report shows that technological improvements, such as the use of LEDs and other energy efficient equipment, largely contributed to the reductions in the 2013 fiscal year. The TMG-led survey of 2014 also revealed that business management's awareness of reduction (72%) and employees' cooperation to reduce energy use (73%) have increased 16% and 12% from the previous survey respectively (TMG, 2015a). The impact of the Great Eastern Triple Disasters of March 2011 undeniably forced Japan to reduce energy consumption. Nevertheless, industrial and commercial emissions from the capped facilities decreased by nearly 10% in Tokyo between 2010 and 2011, which is more than that of the national emission which only decreased by less than 3% (TMG, 2014). Additionally, most of the electricity used in Tokyo is produced outside Tokyo. The problem of leakage also extends to a potential geographical shift of facilities or certain parts of business operation to outside

Table 3 Break down of CO_2 emission reduced between 2010 and 2013.

	Amount of CO_2 emission reduced					
Types of facility	Sum	Maximum	Minimum	Mean	% of total	Percentage of facilities (*N* %)
Accommodation	35,811	7888	− 3767	796	3.3	3.5
Broadcasting station	20,533	7104	385	2281	1.9	0.7
Commercial	156,080	6441	− 3530	882	14.4	13.8
Cultural	13,055	2053	− 610	522	1.2	2.0
Distribution	17,115	3266	− 1455	685	1.6	2.0
Education	42,581	7529	− 2663	539	3.9	6.2
Factory	246,914	16,644	− 15,097	939	22.8	20.5
Hospital	47,345	7513	− 1718	649	4.4	5.7
Information communication	− 8300	10,803	− 21,518	− 104	− 0.8	6.2
Office	452,264	9455	− 6957	1016	41.7	34.7
Office (public office building)	37,457	4712	− 627	1070	3.5	2.7
Others	23,340	7010	− 4022	1015	2.2	1.8
Parking lot	221	221	0	111	<0.1	0.2

Adapted from TMG, 2015a.

Tokyo – although this cannot be determined from the currently published data set, concerns have been expressed by stakeholders[11].

5. Discussion: key factors in explaining the policy development

Section 4 explained how the TMG's mandatory cap-and-trade scheme entered into force in 2010. Based on the analysis of the collected information, several factors were identified as key drivers of the policy-making process and implementation. Among those are policy design, the involvement of stakeholders in the process and national-local relations. Enriching the understanding of those factors is of academic and practical interest, to draw lessons for future climate policy innovations in other contexts.

5.1. Key factors for the policy-making process

Control of environmental pollutants like GHGs tends to face stiff opposition due to differences in priority and interest among stakeholders at the local level (Bartle, 2009; Mathur, Afionis, Paavola, Dougill, & Stringer, 2013). Businesses often argue that they would become uncompetitive compared with other places in the country or elsewhere, and threaten to move or close facilities. This is even more accentuated in a country like Japan that has faced a severe economic slowdown since 1990s and high business costs. How Tokyo was able to move ahead with such innovative, yet potentially costly, policy can be explained by the factors listed below.

5.1.1. Leadership and capacity of local administration

The determination of the TMG's administrative leadership is one of the key factors behind the introduction of the mandatory schemes according to the interviewees[12]. The high degree of technical competency and experience of Tokyo's bureaucracy also helped to establish the scheme during a lengthy period of discussions with politicians and stakeholders. The former head of the TMG Bureau of Environment seems to have played a pivotal role in developing the framework from the onset to the second compliance period (Niederhafner, 2013)[13].

Design and implementation of Tokyo's mandatory carbon scheme stands on the historic accumulation of administrative and technical capacity in the city's bureaucracy to lead pollution control without previous national laws, which dates back to the enactment of the Tokyo Industrial Pollution Control Ordinance in 1949. Although achievements in pollution control at the sub-national level have not always led to effectiveness in sub-national climate policy (Puppim de Oliveira, 2011), the TMG leadership, instead of trying to apply simple command-and-control approaches for GHGs, initiated a new period of searching for consensus among stakeholders following the discussions to revise the diesel pollution control in 2000.

5.1.2. Centre-local political and administrative competition

The centre-local rivalry between the national government and the TMG has contributed to strong motivation and capacity building within the TMG since the early environmental policies. The national government has long struggled to set a coherent approach to climate policy (Suwa, 2009); in the TMG-led official stakeholder meetings, though invited as observers, representatives from national ministries were not active stakeholders. On the other hand, institutional learning was explored in Tokyo and the TMG officials' aspiration to be 'ahead of the game' has become an important driver behind innovative environmental policies (Ohno, 2013). Tokyo officials claim that not only knowledge and experience, but also Tokyo's so-called 'DNA' to be the most progressive on environmental issues in Japan, were passed on to the current generation of bureaucrats as a legacy from previous generations (Ohno, 2013)[14].

5.1.3. In-depth involvement of stakeholders in policy design

Interactions between administrators and society are known to have played increasingly vital roles in communicating knowledge within the policy issues, and Tokyo's case also addresses the significance of the involvement and support from stakeholders. A range of stakeholders participated in the discussions to design the Tokyo's cap-and-trade scheme since its early stages, which helped to obtain legitimacy and support for the policy (Nishida & Hua, 2011). Participants to the formal TMG-led stakeholder meetings include the following sectors: manufacturing, transport, energy, education, services, consumers' cooperatives, and environmental NGOs (TMG Bureau of Environment, 2008). By involving both opposing and supporting members in the formal stakeholder meetings, the TMG was able to present critical issues and respond to concerns of the business stakeholders, while supporting arguments were also presented through the voices of civil society organizations[15]. Environmental NGOs were generally in support of the TMG initiative, and by having strong supporting members in the stakeholder meeting, especially as representatives of citizens, eased the polarized conflict between the TMG and business opponents.

Policy adjustment as a result of in-depth stakeholder involvement in creating and modifying operational rules left little rationale for capped facilities to object or oppose the mandatory cap-and-trade scheme. The TMG's facilitation of stakeholder involvement, in the eyes of the meeting participants, is a key factor behind the acceptance of the policy and subsequent compliance[16].

5.1.4. Availability of historical data to support the discussions

The TMG had a decade-long dataset to analyse industrial activities and existing reduction plans, which helped to create a detailed policy design that matched local conditions. The concerns and criticisms of stakeholders were addressed by factual data, which had been collected through informal communication and historical data prior to the stakeholder meetings. Acceptance of the mandatory scheme by industrial sectors was also possible because of constructive discussions with stakeholders that were supported by objective data[17]. The case of Tokyo illustrates that acquiring such data was one of the fundamental elements to induce collective action, rather than a common 'command and control' approach using penalties and sanctions.

5.2. Key factors for the implementation

The implementation of the new climate measures in Tokyo is regarded effective as they significantly reduced CO_2 emission. The scheme evolved in response to the demands of the stakeholders and became a combination of regulating and market/information approaches. In fact, the key to the CO_2 reduction seems to be the compulsory cap and the voluntary, but closely monitored, actions that helped to build capacity both in the government and regulated facilities. This sub-section provides an analysis of the factors for implementation, deduced from the TMG experience.

5.2.1. Regulated market: avoiding financial speculation by tightly regulating cap-and-trade

Different stakeholders were initially concerned that the cap-and-trade scheme would lead to a 'casino' through speculative trading. Thus, the TMG guaranteed that the main trading players had to be the companies who are the key emitters (TMG Bureau of Environment, 2008). Under the Tokyo scheme, tradable credits could only be earned by an emitter reducing its emission within the compliance period; there is no free allocation of tradable credits without making efforts to reduce actual emission. Credits are issued and recorded in the Tokyo Registry System after the TMG certifies the facility reduced a certain amount of emissions. The five types of carbon credits (Table 2) are available for trading with other parties, only if the owners of the credits have fulfilled their own emission reduction obligations. Credits could also be stored in the facility's saving account, which could be used to offset one's own exceeding emissions in the future (TMG Bureau of Environment, 2012, 2015).

Thus, even though the climate scheme in Tokyo is often portrayed as a market-based instrument due to the systemic nature of capping and trading, it is indeed a mixture of regulated market and information sharing mechanism.

5.2.2. Responsive relations and flexible targets

Regulators were responsive during the policy design after listening to the stakeholders and adapted to their needs. All the invited stakeholders were asked to present their opinions, and pros and cons were

discussed (Nishida & Hua, 2011). Suggestions for the mandatory measures and reiterative arrangements, such as differentiation of compliance factors among facilities and categories with different compliance requirements, were included due to the concerns raised by stakeholders (TMG Bureau of Environment, 2008).

This responsiveness of the regulators is also reflected in the choice of the base year and performance certification. Base year is any three consecutive fiscal years chosen by each compliance facility from 2002 to 2007 (TMG Bureau of Environment, 2012, 2015). The freedom to choose base years engaged participants in the reduction effort. Moreover, accredited efficient facilities based on a point system had their compliance factors relaxed up to a half.

5.2.3. The role of information and transparent monitoring

Effective monitoring and enforcement mechanisms, and their transparency, were fundamental to the high compliance. Even though detailed data that may contain business strategic information are not released to the public, the emission reports, reduction calculations and associated trading processes of each large facility are monitored by the TMG and verifying organizations. For the facilities that have difficulty fulfilling requirements, simple diagnostic and advisory service for energy use are provided for free by the TMG. There is also a close cooperation between the TMG and facility operators under the advisory system (Niederhafner, 2013). Strict but transparent monitoring seemed to have functioned as an enforcement mechanism in this context, rather than the nominal penalties.

The availability of historical data and the expertise to monitor one's own emission activities helped many regulated agents to better understand the functioning of their own facilities and identify the areas of improvement related to CO_2 emissions. 90% of the currently regulated facilities plan to continue emission reduction measures even after reaching their targets, of which 80% say changes in everyday business environment were stimulated by the Tokyo's climate policy (TMG, 2015a). Moreover, the low carbon plans and energy information were particularly useful when the TMG was in the position to introduce the contingent energy efficiency strategy after the electricity shortfall caused by the Great Eastern Earthquake in March 2011. Although some facilities feel the new scheme has brought more burdensome tasks due to overlaps with national-level schemes, most of the facilities were better prepared for the rationing as they were involved and had learnt from the process in TMG, which helped them to save more than facilities in other parts of Japan[18]. A key to the CO_2 reduction, therefore, appears to be the compulsory monitored cap supported by information sharing between regulated agents and regulators.

5.2.4. Gradual implementation

Obligatory reduction did not come out of the blue for regulated facilities; the eight years of prior reporting prepared them to set their own realistic goals. The solid monitoring scheme is a result of historical learning since the voluntary reporting started in 2002, and mandating reduction was put on the discussion table from the second phase. The preparatory phases provided training opportunities to understand energy use patterns, which ultimately assisted the linkage of energy consumption and emission reduction mandates. The remarkable level of compliance in the third phase would not have been possible without the gradual learning and changes in the previous phases.

The gradual implementation of the policy in the three main phases also led to a learning process for both the TMG and regulated agents. The policy was adjusted as it moved ahead. For example, mandatory reporting that preceded binding reduction helped visualize one's own energy use patterns and areas for potential improvements. The process also raised awareness and habituated emission reduction as part of the regular business activities. According to the survey conducted by the TMG, 72% of the responding facilities agreed that awareness towards emission reduction by the business leadership have risen after the implementation of the Tokyo's new climate measures in 2010 (TMG, 2015a).

6. Conclusion

This study analysed the policy development and enabling factors that made Tokyo's cap-and-trade scheme effective. It demonstrated a high degree of success, offering lessons to overcome the common challenges sub-national governments face in climate policy including lack of leadership, capacity, information, relations with national governments and stakeholder involvement. The research also highlights the effectiveness in policy formulation and implementation stages of Tokyo's cap-and-trade scheme that would not have been possible without administrative capacity and a wide range of stakeholder participation from businesses to environmental groups. Tokyo's policies with sustained support and engagement of stakeholders were particularly paid off when the country as a whole required the radical reduction in energy use after the Fukushima meltdown in 2011.

Nevertheless, sustainability of the scheme depends on improvements over time and gradual adaptation to the changing policy context. An inevitable issue is to strengthen the collaboration between the sub-national and the national governments. Stakeholders raised concerns over coordination between the reporting requirements under the Global Warming Law, Energy Conservation Law and the Ordinance.

The TMG has been proposing plans for coordination and change in national climate policy, yet this has not been responded positively by the national government. Whether it being reporting, credit exchange or cap-and-trade as a whole, the dearth of collaboration between Tokyo and the central government poses another challenge. National-level cap-and-trade has long been debated without a political consensus, in spite of calls for ETS development by Tokyo (MOEJ, 2010). The Bills of Act on Promotion of Global Warming Countermeasures that included clauses on JVETS was drafted in 2010[19], but the Bill was abolished in 2012 and the pilot JVETS came to an end in 2013 (MOEJ, 2013). The political turmoil, uncertainty associated with the international carbon market and the post-Fukushima energy fiasco all go against the nation-wide ETS, which may become a major obstacle to further dissemination of the TMG scheme in Japan.

In applying the research framework to understand policy process, this study illustrated that various factors were key to explain the policy effectiveness, which include leadership and capacity of the administration, centre-local healthy institutional competition, stakeholder involvement in policy formulation, flexible policy design and responsive relations between the TMG and the stakeholders, availability of data, transparent monitoring and gradual implementation. For any city willing to learn from Tokyo, this research pointed that the innovativeness of policy culture in Tokyo is rooted in decades of

experience in environmental control ahead of national policies and gradual implementation backed by more than a decade-long preparation of the climate scheme. This built leadership, administrative, information and communication capacities that brought trust from the different stakeholders and facilitated the policy process.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. Sub-national governments are any administrative or/and political layers of government below the national level. In the case of Japan, prefectures define the second-tier sub-national governments above municipal units like cities, towns, villages and wards. Local, sub-national and cities are used interchangeably sometimes.
2. Mega-cities are urban conglomerations with a population greater than 10 million.
3. Facilities were codified according to the use classification as per the Guideline for Monitoring and Reporting Energy-Related CO_2 Emissions (TMG, 2015c).
4. A telephone interview was used with one individual. Face-to-face interviews were conducted with eight individuals on one or multiple occasions. We asked questions about stakeholder involvement, details of the policy process and key drivers of policy-making and implementation.
5. Consulted parties are current and former employees of entities including the TMG Bureau of Environment, the Japan Renewable Energy Foundation, WWF Japan, Friends of the Earth Japan, the PV Owner Network Japan, the Institute for Sustainable Energy Policies, the University of Tokyo and the Japan Rail East Building.
6. Some facilities were re-classified as non-regulated facilities during the first compliance period due to their extensive effort in reducing their energy consumption to below 1500 kl equivalent of oil. The number of compliance facilities as of June 2015 is 1281 (TMG Bureau of Environment, 2015).
7. Facilities that meet the Standards for Certifying Top-Level Facilities enjoy reductions of their compliance factor by half for top-level and a quarter for near-top-level. The certification standard assesses general management and operation, the energy performance of buildings and equipment, and energy management on mandatory, general and additional items based on a scoring system. Facilities that 'make great progress against global warming', especially including those who implemented measures prior to the TMG scheme, are recognized (TMG Bureau of Environment, 2012).
8. Carbon price is decided based on negotiations by market participants. As a reference, the selling price of TMG-offered offset credits and the declared price listed in the application of transfer credits to the TMG are released.
9. Interview with a former TMG official on 19 December 2013.
10. The initial introduction of mandatory reporting led to a reduction of 3.5% from the base year of choice, but only 1% of facilities were rated as AAA for taking 'exceptionally excellent measures', as opposed to 79% ranked average and 4% insufficient (TMG Bureau of Environment, 2012).
11. Interviews with large business facilities and NGOs from 27 November to 18 December 2013.
12. Interviews with TMG officials, large business facilities and NGOs from 27 November to 19 December 2013.
13. Interviews with large business facilities and NGOs from 27 November to 18 December 2013.
14. Interviews with former and current TMG officials between 17–19 December 2013.
15. Interviews with NGOs from 27 November to 18 December 2013.
16. Interviews with NGOs from 27 November to 18 December 2013.
17. Interviews with NGOs from 27 November to 18 December 2013.
18. Interviews with TMG officials, large business facilities and NGOs from 27 November to 19 December 2013.

19. JVER is one of the most robust offset credit systems already in place, but JVER credits are not subject to credit offset under the Tokyo ETS (MOEJ, 2014).

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