

**Air Pollution Control in Japanese Urban Transport
Systems
Effectiveness and Challenges in Metropolitan Tokyo**

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Abstract

This paper deals with the different approaches to implementation of air-pollution control policy measures for the operation of transport vehicles in Tokyo; the metropolitan city has a modern transport system co-ordinated by public and private vehicle sectors. In practice, the access to traffic vehicles' environmental safety is difficult in such a populous and travel-intensive area. In the course of continuous socio-economic development, the atmosphere and health of residents in cities like Tokyo are still affected although since long Japan has paid much attention to environmental issues. Several measures have been introduced for air protection by the central government, the Tokyo metropolitan government and transport-related enterprises.

The paper focuses on voluntary approaches, which are variously implemented by government agencies and industries. Implementing environmental policy measures in an environmentally multi-strategic country like Japan requires taking into consideration different opinions, options and other aspects of the transport sector. This paper will explore the co-existence of a system of public and private environmental policies and actions, and their effects on Japanese urban transportation, particularly the transport system of Tokyo. By analysing the application of environmental policy measures to the management of transport, it is shown that the government's policy measures and private industries' strategies have differing impacts.

1. INTRODUCTION

1.1. Background

From the late 1990s, new environmental measures against air pollution in transport sector were introduced on top of the existing policies maintained since the 1960s. Traditional environmental problems such as air and water pollution had been addressed through extensive measures and they were no longer the chief policy issues in Japan. Instead, global environmental issues such as climatic change, ozone layer depletion and diminishing tropical rain forests attract increasing attention among the government, industries and citizens. Today, while there are still some sectors, which favour regulation and government control, there is a strong opinion to move away from interventionist industry policy whereby Japan should minimise the government role and rely more on market mechanisms. In this context, the vehicle production industries, like many other Japanese industries, adopted the “voluntary action plans” approach promulgated by *Keidanren*, the Federation of Economic Organisations. Almost all corporations, particularly leading ones, are making efforts to improve environmental performance in accordance with this approach. Concurrently, the government intensified its policy efforts. Local governments are responsible for regional development, the regional transport network and maintaining transport services for the citizens; the central government is responsible over the provision of national framework of transportation.

Indeed, the degradation of the urban environment in Japan is alarming. Air quality in the greater Tokyo area remains poor, far below the level required by environmental standards on nitrogen dioxide and suspended particulate matter (SPM). “Is your vehicle ok?” is the title of leaflet on Emission Regulations for diesel vehicles introduced on October 1, 2003 and handed out by the Tokyo prefectural and municipal governments. Current facts show that air pollution in major Asian cities, particularly Tokyo, is a matter of serious concern, and special attention should be paid to vehicle emissions, which is the main cause of air pollution and thus require regulation. Air pollution caused by sulfur dioxide decreased dramatically because of regulations on emissions from stationary sources and on sulfur content of fossil fuels. Today, however, air pollution caused by nitrogen dioxide has not declined and air it is slow to be brought under controlled because of the increase in emission of pollutants resulting from the continuing and rapid growth of automobile use. Traffic congestion and atmospheric pollution in Japanese city centers seriously affect the environment.

Today's air pollution (and global warming as well) is being addressed through various methods, including regulatory measures, voluntary efforts of private enterprises and citizens, economic instruments, and even the building of infrastructure. The Japanese government promotes the Transportation Demand Management policy (focusing on Traffic Oriented Development in recent years) and other environmental policies.

In the area of automobile traffic, for instance, drastic changes are considered necessary to coordinate and to reduce the demand for automobile use in large cities in order to tackle problems of traffic congestion and traffic accidents. Furthermore, it is necessary to plan for voluntary activities among private firms, mobilized by the Keidanren (Japan Federation of Economic Organizations). In this respect, enterprises independently implement their own measures with the hope of promoting their business without much government intervention. Meanwhile, economic instruments are considered to be one of the fundamental measures for reducing environmental load and contributing to the efficient distribution of resources (as stated in the Basic Environment Law enacted in 1993). Current situation is that, in considering environment and trade, undertakings by private sector actors are as important as those by the state. Eco-labeling programs for the popularization of environmentally friendly products and the introduction of environment management systems by private firms contribute greatly to the general environmental efforts.

1.2. Research motivation and objective

There have been many discussions about environment and approaches to environmental policy in advanced industrial countries. For sometime now, industrialized countries have formulated and implemented environmental protection norms, policies and practices to cope with the effects of industrial pollution and other environmental problems (Schreurs, 1997: 1). The developed countries learn from one another's experiences as part of "an ongoing process that continues to challenge the advanced industrialized states" (Schreurs, 1997: 26). The discussions also indicate that measures introduced in some countries are now being discussed in other countries and the different approaches seem to converge (Visser, Binsbergen and Nemoto, 1999: 30). Accordingly, Japan more or less follows similar measures applied in some European countries although the Japanese approach has its own unique aspects. Early in the emergence of conservation groups in the post-WWII world and then modern environmental movements in high-growth states during the 1960s and 1970s, the "economic miracle states" like Germany and Japan and other European powers had similar

pollution control policies (Schreurs, 1997: 6-7). Pollution control legislation in Japan was influenced by developments in the West. In the early 1970s, the European national governments started to address pollution problems through the enforcement of pollution control regulations and legislation. In that context, Japan developed new laws and established administrative bodies for environmental protection, just as the governments in the west did. The Japanese government does, however, prefer voluntary approaches to air pollution control and use regulations and incentives to guide industrial change only when necessary. The precautionary principle has gained somewhat greater acceptance in Japan than in the United States but is not as fully embraced as the case in Germany and some other European countries. A discussion of the environmental policies in Japan, which is famous for modern means of transport, raises many questions, especially since the government's actions and industries' activities related to environment take place rather separately in Japan.

Considering Japanese means of transport, it is questionable if the government's measures to operate transportation system are implemented together with private industries' adoption of voluntary action plans in which industries themselves consider and reduce their total environmental load without government interventions. On the one hand, national and local governments formulate and implement public policies for environmentally friendly road transportation. On the other, the voluntary actions are carried out in the private sector. Combined effects of policies and actions in public authorities and those in private companies on the state of Japanese urban environment, particularly the air in Tokyo are particularly interesting. Thus, it is important to understand how these two styles of policy work, how they converge or diverge so as to understand how and why Tokyo has gained stable atmospheric quality in operating a network of dense transport and various vehicle-supplying actors.

This paper aims to study the current situation in Japan where there are two air-protection policy trends in transport-related public and private sectors. The objective is therefore to answer the following questions:

- How are the public and private policy measures implemented?
- What do these policies have in common? How do they differ? How do their effects relate to each other?

1.3. Methodological issues

This thesis is mainly based on my field trip to Japan for four weeks in July and August 2004. During my fieldwork I collected information in the overall transportation industry and the government's policies in reducing air pollution. Simultaneously, I tried to obtain the

access to relevant data concerning specific companies/associations' environmental strategies for environmental vehicle-operation in metropolitan Tokyo. It is possible to consider my choice of research question and study measures as a descriptive single case study with some exploratory tendencies attached, as Yin stated: "Even a single-case study can often be used to pursue an explanatory, not merely exploratory (or descriptive) purpose" (Yin 1984: 15-16).

The study will have two parallel approaches. One is analyzing collected secondary data and the other is assessing the data gathered from interviews in the field.

During the fieldwork, I searched for relevant information from existing sources of literature, documents, surveys and other reports by the government, public authorities, and relevant sections and enterprises operating in Tokyo. This method has two parts. One is generating data for a descriptive analysis of air pollution reduction policy applied in traffic operation generally and in measures formulated by transport-concerned manufacturing industries or service associations from a commercial perspective. The other part is to generate data for an explorative discussion of the relation between the strategies of the government and those by transportation industries or transport-related manufacturers' associations. In order to find answers to the research questions posted earlier, the following "propositions" (Yin 1984: 30) will be tested in the paper:

- The management of transport system for air quality protection is taking place in the public and private sector, bringing about positive impacts on the environment.

In the light of this, I explored literature, articles, and reports on environmental laws, regulations, logistic works, etc. by public authorities and private enterprises that I could approach during my stay in Tokyo.

- Difference and convergence between the public policy measures and the private ones that result in limited effects and reciprocal effects on a low-air-pollution transportation system in Tokyo.

Accordingly, I made efforts to investigate information of the implementation of macro policy such as laws and regulations at local governments and enterprises from sources of prior research.

The second approach for my study is the interview. In a case study, it is important to maximize the types of informants and the number of research instruments used in the course of inquiry. According to Berg, the interview is identified to include three major categories: the

standardized interview (formal), the un-standardized interview (informal), and the semi-standardized interview (guided-semi-structured) (Berg 2001: 15-19). The most important problem that arises in the interviewing process is to choose in which way and based on which sample an interview is conducted. I have utilized an informal way of interviewing whereby my knowledge of relevant facts in the study area was made use of. A short list of questions was prepared before holding an interview rather than a formal questionnaire. I have made efforts to conduct interviews with a sample of reliable informants such as organizations' representatives (one governmental organization), enterprises' member staff (two private companies) to capture various viewpoints in policy-making relevant to my exploratory interests. Although the number of interviews is just a few, I am trying to make certain generalizations from the information gathered during the interviews. In practice, information that comes from the people I interviewed in Japan is partly of generality in terms of oral response and partly concrete in literature they provided. Several ordinary people were also interviewed, providing further understanding of their perceptions and viewpoints towards the government's traffic management as well as companies' actions taking places. This paper will be based on an analysis of the gathered data, which comprise of actual experiences, attitudes and assessments about the actual situation.

1.4. Problems and limitations

The field study was restricted to just four weeks because of limited local supervision time and other practical constraints, thus limiting the amount of data that could be gathered. The work focused on collecting written material from the local university's libraries, state and private enterprises, collecting written and oral information from the government and public transport companies, and conducting interviews with representatives of companies.

Another limitation has been obtaining literature in English in Japan. As regards material in Japanese, it was hard to look for and collect relevant books in such a short time. Of course a longer field stay would have also enabled me to obtain more qualitative data and perhaps even better access to relevant enterprises and their internal documents.

Yet another difficulty was the fact that Japanese are traditionally not very open and responsive toward foreign fieldworkers. Another fact limiting the study is that the fieldwork was supplemented with e-mail contacts or interviews conducted in a mixture of English and Japanese because the interviewer did not speak enough good Japanese in the field and the interviewees spoke little English.

1.5. Outline of the thesis

The paper begins with an introduction providing the fundamental statements of the study. Chapter Two gives a general background of the environmental transportation policy in Japan. Chapter Three describes the system of Tokyo metropolitan transport policy measures implemented by the Tokyo Metropolitan Government and their impact on the state of transport networks of Tokyo. Chapter Four discusses the outcome of public policy measures, trying to highlight their effectiveness in the Japanese context. Chapter Five looks at policy measures implemented by private-sector companies, in particular at Odakyu Railways Company, Toyota Motor Corporation and Bus and Truck Companies. Chapter Six gives an assessment of actions taking place in the private sector, their strong points and deficiencies in affecting the quality of means of transport operating in metropolitan areas. Chapter Seven attempts to give a constructive conclusion.

2. POLICIES OF THE PUBLIC AUTHORITIES

2.1. Macro policy - The national government's approach

In order to cope with air pollution caused by particulates coming from automobiles such as nitrogen dioxide (NO_x) and particulate matter (PM), there is necessity for Road Transport Demand Management policies. These are based on measures of development and dissemination of low pollution car and traffic countermeasures such as modal shift, distribution promotion and encouragement to the use of public transport facilities in line with reduction of exhaust from each car. In this context, the Ministry of Land, Infrastructure and Transport enforces policies to improve the atmospheric environment as follows.

Strengthening of the Exhaust Regulation

A. Steady enforcement of new long-term regulation:

Regarding Exhaust Regulation on new cars, Japan enacted in October 2003 the new short-term Regulation decreasing both NO_x and PM by 30% in comparison with the existing regulation. Moreover, the new long-term Regulation, which decreases NO_x by 41% and PM by 85% compared to the current regulation being the strictest one in the world, will be enforced in 2005, two years earlier than supposed initially. (Transport Ecology Mobility Foundation, 2004: 41)

B. Enforcement of the revised automotive NOx/ PM Law:

Due to the increase of road transport, it is a difficult problem to attain an air standard for nitrogen dioxide. On the other hand, an atmosphere seriously polluted with PM, which includes potentially cancer-causing substances and harms inhabitants' health, poses a great concern. As a result, in line with the strengthening of traditional measures for NO_x, a bill of revised Automobile NO_x Law was formed in August 2001 to reduce PM emission in road transport. Revised Laws for NO_x and PM emitted from automobiles such as the expansion of policy area (enforced in December 2001) and the strengthening of car-specific regulations (in October 2002) are gradually being executed. (Transport Ecology Mobility Foundation, 2004: 41-42)

Action plans for reducing exhaust emission from diesel automobiles

A. Support measures to bus and truck enterprises:

In view of the urgency of automobile pollution problem in large city areas, the Japanese government is paying increasing attention to subsidising bus and truck companies with low-pollution buses, trucks and diesel particulate-removing devices such as DPF (Diesel Particulate Filter) and oxidation catalyst (using platinum or other catalyst to reduce particulate matter through oxidation) since 2002 (Transport Ecology Mobility Foundation, 2004: 45-46). As a result, there is increased usage of low-pollution automobiles and air pollution is alleviated. Starting from 2004, Japan further expanded and strengthened the system through providing subsidies to automobiles controlled by new long-term regulation (stated earlier).

B. Project for the promotion of next generation low-polluting automobile development:

The Japanese government, industries and universities are cooperating in a joint effort to encourage the early development and introduction of next generation low-polluting vehicles as substitutes for large-sized diesel automobiles. This project is the core of the self-administering Research Institute of Environment and Transport Safety (Transport Ecology Mobility Foundation, 2004: 47). Furthermore, with the purpose of practically applying and disseminating the next generation low-polluting vehicles, actions are undertaken to formulate and establish security standards on safety and environmental preservation, which will be necessary for the introduction of next generation low-polluting vehicles' form as needed environmental adjustment.

In addition, regarding Environmentally Friendly Vehicles (EFVs), the Japanese government provides tax incentives, subsidies, and preferential parking privileges for these vehicles and promotes planned introduction of EFVs in the public and private sector, aiming

to introduce over 10 million EFVs by 2010 (Ono, 2003: 15-16). For promotion of the development and practical use of next-generation EFVs, the government has initiated a project to develop prototype heavy-duty EFVs in cooperation with several automobile manufacturers.

Supply of low-sulfur light oil

A. Car fuel purification:

Automobiles' mileage and exhaust emission capacities technically have an inverse relationship; however, improving the fuel quality will enhance the compatibility of these two factors at high level.

Furthermore, the usage of diesel particulate-removing devices does not entirely preclude instances where low-sulfur fuels are not used or there is inadequate action. Thus, purifying car fuels is indispensable to the betterment of road transport environment.

With consideration to the above issues, the regulation governing oil's sulfur content is lowered by 50ppm from the original 500ppm by the end of 2004 (Transport Ecology Mobility Foundation, 2004: 48). Moreover, this target was already achieved among the Petroleum Association that had begun to supply low-sulfur light oil throughout Japan since April 2003. Besides, improvement of gasoline such as sulfur lowering is also promoted.

Henceforth, in addition to the development of low-polluting vehicles for the purpose of further ameliorating mileage/exhaust standard, there is also great need for increased promotion of fuel sulfur reduction.

B. Promoting of appropriate use of fuel:

The fuel condition of vehicles influences their safety and environmental performances. Although automobiles supposed to use low-sulfur light oil such as low-PM emission cars are henceforth sold, it is necessary to appropriately use low-sulfur light oil. The reason is that refueling this kind of vehicle with gasoline of traditional sulfur content level will decrease the durability of devices helping to drastically lower exhaust capacity and reduce emission. Furthermore, the increase of particulate matter emission as a result of using illegal light oil that is adulterated with heavy oil with the aim of evading tax has severe impacts on the environment. As a result, the Government aggressively promotes appropriate utility of low-sulfur fuels.

Removal of poorly equipped vehicles

In the course of reducing environmental load of automobiles, it is necessary to sufficiently equip cars and maintain exhaust emission capacity as usual in the process of operation. A number of poorly equipped automobiles, which emit much more NO_x/PM than ordinary, result in a serious environmental problem.

Thus, automotive adjustment need effective examination in order to limit exhaust emitted from these poorly equipped vehicles. According to results of diesel car inspection implemented by repair companies, about half of all the vehicles black smoke from which is controlled is acknowledged to have the effect of lowering black smoke density by over 10 per cent (Transport Ecology Mobility Foundation, 2004: 49).

Hereafter, in line with the promotion of inspections on stocked cars at repair companies and voluntary inspections on holding automobiles done by transport enterprises, comprehensive measures such as strengthening of supervision by the street-corner tests are of much concern to the Government.

Auto-related environment tax

Japan is taking measures for the greening on automobile tax and the reduction of automobile acquisition tax in order to make current low-polluting vehicles widespread. The greening of automobile taxation means that automobiles tax rate on low-polluting cars is reduced; on the other hand, much attention is paid to automobiles of one standard age above on the assumption of the neutrality of automobile tax revenues.

Furthermore, in line with the enforcement of automobile acquisition tax, the government's policy measures also include the partial deduction of acquisition value on vehicles with low mileage and low emission acknowledged, and the reduction of tax rates on CNG (compressed natural gas), methanol, electric and hybrid automobiles.

As a result, the number of types of vehicles available for tax rate reduction under this system rapidly increased from 79 types at the end of 2000 to 312 types at March-end 2003. The number of low-pollution vehicles newly registered in 2002 has also increased by 2,420,000 units, a significant factor in steadying effects of the Greening of Automobile Tax and the measures for the reduction of Automobile Acquisition Tax. (Transport Ecology Mobility Foundation, 2004: 49-50).

The national government has undertaken a number of special taxation measures including expansion of types of vehicles subject to tax cuts and reduction of tax rates. Such measures were intended to promote environmental conservation in relation to automobiles.

Some of the special measures concerning taxation adopted are as follows. (Transport Ecology Mobility Foundation, 2004: 49-51):

- Incentive for Introduction of Low-Emission Vehicles: When a low-emission vehicle is purchased, the rate of automobile acquisition tax is reduced.
- Incentive for Introduction of Fuel-Efficient Vehicles: For fuel-efficient vehicles meeting the requirements of the fuel-efficiency standards set forth in the Energy Conservation Law, the automobile acquisition tax is computed after deducting 300 thousand yen from the actual purchase price.
- Incentive for Introduction of Vehicles Conforming to the Automobile NO_x Law: When vehicles such as trucks and buses in specified areas that do not conform to the standards stipulated in the Automobile NO_x Law are replaced with new vehicles that do meet the requirements of those standards, the automobile acquisition tax rate are reduced by 1.2%.

Moreover, there are some other taxes such as Motor Vehicle Weight Tax, which is fixed according to vehicle weight for each type of automobiles at the time of inspection. This goes to the national government's funds earmarked for roads. And Gasoline Tax is levied primarily according to the amount of gasoline removed from or received by a given area.

2.2. Micro policy - The local governments' approaches

In co-operation with the central environmental organisations, city governments enforce measures for the reduction of the amount of automobile emissions by improving inspection systems, the exchange of related inspection techniques, and the adoption of more energy-efficient means of public transportation. Taking comprehensive measures regarding traffic pollution, governments are responsible for establishing targets for fuel consumption efficiency for gasoline-fuelled vehicles and promoting improved efficiency of freight transportation. Public transportation is also being promoted to commuters in cities as an alternative means of transport. Extensive efforts are made towards prevention of traffic pollution and securing safe and smooth transportation, while giving due consideration to the improvement of the environments in local areas. Concrete actions include regulating the amount of exhaust from vehicles, the quality of automobile fuel, the level of fuel efficiency and vehicle categories in specified areas, using subsidies and taxation to encourage purchases of low-emission vehicles, promoting various technological developments. These measures are based on Air Pollution Control Law, Automobile NO_x Law, and such, formulated by the central Government. In addition, the promotion of a shift in modes of transport through

improving railways, access routes for public transportation, pedestrian walkways, bicycle roads, and promotion of their use are also carried out. Concurrently, traffic of large-sized vehicles is reduced by properly situating distribution facilities. City governments also provide guidance and information concerning transportation patterns and facilities. Moreover, city governments have recently been studying on the development of an Intelligent Transport Systems (ITS) for more efficient traffic flow.

Stipulated in the Automobile NO_x Law, prefectural governors of the specified areas have formulated plans regarding measures to reduce the total volume of nitrogen oxides in automobile exhaust. Based on the Automobile NO_x Reduction Law of May 1992 regarding nitrogen oxides, local authorities are continuing to tighten already existing regulations on individual automobiles. These actions have been executed systematically to improve air quality. The governors of the prefectures, for instance, measure the density of motor vehicle exhausts in the air, on the road or in places surrounding the road where serious air pollution by motor vehicle exhausts occurs or is likely to occur on account of auto traffic congestion occurring at traffic intersections and other factors.

In line with the national government's environmental policies on vehicles, local governments promulgate positive measures including noticeable kinds of taxes implemented as follows (Sugiyama, Kuniyama, Asano and Kuse, 2003: 115-117).

- Automobile Acquisition Tax: levied based on the acquisition price of the vehicle at the time of purchase. The revenue generated from this tax goes into prefectural and municipal governments' funds earmarked for roads.
- Local Road Tax: levied primarily according to the amount of gasoline distributed from or to a specific area. The revenue of this tax is allotted to local governments' funds earmarked for roads.
- Automobile Tax, Light Vehicle Tax: levied each year according to total engine displacement and type of vehicle. Revenues from automobile tax are allotted to prefectural governments' general funds and revenues from light vehicle tax go into municipal governments' general funds.
- Light Oil Delivery Tax: basically levied on the volume of light oil received. Revenues from this tax go into prefectural governments' funds earmarked for roads.

The above taxes are aimed to improve traffic infrastructure and to reduce congestion and exhaust density in local areas.

Plans and actions taken by prefectural and municipal governments will be discussed in details through the instance of the Tokyo Metropolitan Government's policy measures and instruments in the following part of this paper.

3. MEASURES IMPLEMENTED BY THE TOKYO METROPOLITAN GOVERNMENT

Of Japan's top ten severely polluted locations, Tokyo accounts for 7 in terms of NO₂ and 5 in terms of suspended particulate matter (Transport Ecology Mobility Foundation, 2004: 5). However, in response to this alarming fact, The Tokyo Metropolitan Government (TMG) has led the nation in tackling environmental problems. Today, it continues to take the initiative in many ways. The first local authority of Tokyo introduces controls on emissions to safeguard the lives and health of residents. In the social and institutional context of countermeasures in environmentally experienced Japan, the TMG not only relied on national policy measures but also advanced its own original plan tailored to the regional characteristics of Tokyo. Considering the threat of health damage by air pollution aggravated by the increase in the number of automobiles, the TMG has established a basic policy that "Tokyo starts the reform to create a healthy and safe environment and to build a sustainable society" (Sugiyama, Kunihisa, Asano and Kuse, 2003: 109). On this basis, it formulated a new "TMG Master plan for Environment" in January 2002.

Regarding the automobile tax, the Local Tax Law authorises local governments to fix tax rates depending on vehicle specifications and based on the standard tax rates, provided that the variance does not exceed 20% of the standard rates. Utilising this provision, the TMG enacted an ordinance on the automobile tax in March 1999 such that vehicles used more than 10 years are subject to tax rates higher than the standard rates while the rates for environmentally friendly vehicles are lower than the standard rates. This variable taxation in Tokyo was in effect for the period from FY 2001 to FY 2004. (<http://www.env.go.jp/air/car/n-jigyou/index.html>)

Tokyo Metropolitan Government has air pollution measuring stations in various parts of the Metropolis. In fact, the concentration levels for substances such as nitrogen dioxide and suspended particulate matter remain high in big cities, especially Tokyo. In related air-pollution investigations implemented by the Ministry of the Environment, the yearly pollutant concentration measured by automobile emission measuring stations in the Metropolis was higher than the national average and often exceed standards. In response, Tokyo government has installed devices for monitoring air pollution conditions at different locations within

Tokyo. These monitoring stations measure air pollutants continuously everyday to provide information for the Tokyo Bureau of Environment. The information includes data from the general atmospheric measuring stations, which are set up to monitor the condition of pollution in general areas such as residential areas, and data from the automobile exhaust emission measuring stations located along major trunk routes and intersections.

At the same time, the Tokyo government also asks large truck companies to voluntarily reduce nitrogen oxide exhaust output by certain percentages over limited periods. In addition, the city prohibits engine idling except for buses, emergency vehicles and refrigerated vehicles. This law is similar to the Environment Agency's the Idling-stop campaign in co-operation with truck and taxi associations and other organisations (Transport Ecology Mobility Foundation, 2004: 64-65).

The number of diesel vehicles in Tokyo has increased with the increase in vehicle traffic in Tokyo. It is important to note that vehicles are the major source of nitrogen oxides and SPM, of which diesel vehicles are responsible for almost all nitrogen oxides and SPM emitted. The TMG is taking aggressive measures to achieve reduction of emissions from diesel vehicles. These measures include stringent emission control regulations, improvements to the quality of light oil as diesel fuel, technological support for the development of diesel particulate-matter reduction systems, promotion of low-emission vehicles, and supervising systems for reducing vehicle traffic volumes in the centre of the Metropolis. There is a real need to conserve clean air and to mitigate polluted atmosphere's harmful health effects. Thus, greater efforts are made to ameliorate vehicle pollution by imposing regulations on diesel vehicle emissions, spurring the supply of low-sulphur diesel fuel, promoting the introduction and development of low-pollution vehicles and such. To control of diesel engine exhaust emissions, which contain harmful substances threatening the health of Tokyo citizens, the TMG enforces a diesel vehicle emissions control regulation effective from October 2003 (Sugiyama, Kuniyama, Asano and Kuse, 2003: 117). This regulation applies to diesel vehicles such as buses, trucks, and other special category vehicles such as garbage collection trucks and refrigeration vehicles. Diesel vehicles failing to meet the PM emissions regulation are banned from travelling through Metropolitan Tokyo and must be replaced with a low-pollution vehicle or be equipped with a diesel particulate matter reduction system certified by the relevant public authorities.

In order to expedite regulation enforcement, the TMG is co-ordinating action with motor vehicle maintenance and repair businesses in Tokyo to promote understanding of the emission control regulations and installation of PM control devices for automobile owners

having vehicles maintained. For automobile makers and PM control device manufacturers, the TMG is asking for an increase in the supply of PM control devices and motor vehicles that comply with emission regulations (<http://www.env.go.jp/air/car/vehicles2003/htm/liq002>). However, in order to put PM control devices into practice, the need of supply of low-sulphur light oil has to be adequately addressed. Thus, in view of the national government's regulation related to oil's sulphur content (stated above), the TMG asked the Petroleum Association of Japan to supply of low-sulphur light oil as early as possible. Subsidies were also granted to cover the price difference between low-sulphur light oil and ordinarily used light oil. As a result, low-sulphur light oil became available to bus and truck operators refuelling vehicles at their business operation centre. The supply of new light oil gradually became popular at most of gasoline pumping stations in Tokyo and available throughout Japan. The Japanese government's plan for car fuel purification is beginning to show effects now. At the same time, in order to facilitate enforcement of the diesel vehicle regulation smoothly and effectively in October 2003, a campaign to "eliminate all illegal diesel vehicles" was organised (<http://www.env.go.jp/air/car/n-jigyoku/index.html>). In addition, the TMG solicited co-operation of diesel vehicle makers for promotion of diesel vehicle replacement purchases and increase in the supply of oxidation catalysts in 2003, one year after Japanese government started the promotion of low-pollution motorised vehicles spread and DPFs (diesel particulate filters) and oxidation catalysts application. Concurrently, in view of the central government's subsidy programs for bus and truck companies with diesel particulate-removing devices (mentioned above), the TMG established guidelines and has designated certified particulate matter (PM) reduction systems. In association, Tokyo government has actively co-ordinated with manufacturers of DPFs and oxidation catalysts as well as diesel vehicle manufacturers.

In line with the national government's strategy of the removal of poorly equipped vehicles and various regulations governing automobiles, the TMG organises operation of vehicle pollution inspection. The vehicle pollution inspectors actively examine, monitor, and give advices on operations performed in enterprises, factories and on the road. Since 2002, guidance for idling-stop practices on parking lots and roads has been provided by these inspectors and on-the-spot inspections are now made to eliminate use of unlawful diesel fuels in parallel with street-corner tests run by the central government and on-site inspections of enterprises. Tokyo government carried out the affixing of stickers certifying PM reduction compliance to vehicles equipped with diesel PM reduction systems with the dual purpose of disseminating diesel PM reduction systems and supporting vehicle-pollution inspectors in their supervisory and advisory activities (http://www.ecomo.or.jp/gaiyo_syokai_2003.10).

To promote PM emissions standard compliance, the TMG runs a support program under the Diesel Vehicle Regulation targeting operators who own diesel vehicles that do not comply with PM emissions standards and with the aim of encouraging these operators to replace or equip their vehicles with the PM reduction systems. This program includes loans, funds and subsidies covering expenses relating to the purchase and maintenance of low-emission vehicles and PM control devices.

In addition to the promotion of the PM reduction systems, it is also necessary to promote the spread of low-pollution vehicles so as to increase the effectiveness of exhaust emission control regulations. Thus, the TMG actively promotes the use of electric cars, compressed natural gas or liquefied petroleum gas automobiles and hybrid cars that are appointed as low-pollution vehicles. Preferential car tax for low-pollution vehicles and a discount parking fee system for certified low-emission cars attached with certification stickers are also established. Subsidies for widespread use of compressed natural gas buses and for the installation of compressed natural gas fuelling stations in Tokyo are provided. Further, the TMG also promotes the development of fuel cell-powered automobiles, the promising next-generation vehicle. (Transport Ecology Mobility Foundation, 2004: 17-23)

Measures for Transportation Demand Management (or Traffic Oriented Development) have been paid much attention and there is comprehensive study for its practical development. There is an urgency to tackle traffic congestion that has severe impacts on urban atmosphere. To deal with this problem, the implementation of joint transport operations and a shift to public transportation are needed to realise an environmentally effective traffic system. A number of comprehensive and systematic measures have been established by the TMG for the improvement of traffic conditions in Tokyo. Of those measures, the Tokyo Bureau of the Environment is now considering the introduction of road pricing systems. Acting as a toll system on vehicles entering or travelling through Tokyo central areas, road pricing will help to spread the use of public means of transportation and reduce vehicle traffic volume and exhaust emissions caused by congestion and low vehicle speed in the metropolis of Tokyo. The TMG has set up its professional committee that carries out extensive studies of such road pricing systems (Transport Ecology Mobility Foundation, 2004: 29).

4. ASSESSING EFFECTS OF THE PUBLIC POLICY MEASURES

Japan and especially Tokyo have long been beset with pollution problems. These environmental issues have afforded Japan a wealth of experiences and achievements. The

"Action Plan for the Creation of an Eco-society" formulated in 1998 (Inoguchi, Newman and Paoletto, 1999: XXI) by the TMG brought about better-operated transportation demand management systems and road networks with more effective traffic congestion control. Air pollution is one of the environmental problems arising from daily economic activities and its solution requires central and local governments' regulations and incentives. In other words, to a certain extent, governmental contribution is essential to supplement the efforts of the private sector. Indeed, facts show that Japan achieved its remarkable results in controlling pollution thanks to such public air-protection policies.

With the Automobile NO_x Law, Tokyo took concrete steps to gradually rationalise the use of automobile and comparatively succeeded in reducing the high concentration of air pollution in the Metropolis. This law further promotes measures to help ensure an efficient traffic system including the establishment of bypasses and the constructive and appropriate use of railways and other transportation means. Regarding the spread of low pollution vehicles, such vehicles are increasingly used as official vehicles for government work. Furthermore, the Pollution-related Health Damage Compensation Law (Environment Agency, 2000: 346) provides subsidies for use of low emission buses by public or private bus companies.

It is very important for vehicle pollution reduction to ensure a safe and smooth traffic flow. Measures in traffic management are shown to be effective. Specifically, heavy vehicles are diverted away from the centre through designated routes. The switch from private vehicles to mass public transportation and the elimination of illegal parking that obstructs the smooth flow of traffic was aggressively realised. In addition, public measures such as increased supply of parking spaces and intersection movements play an essential role in relieving traffic congestion and thereby reducing the burden on the environment.

In the area of distribution, the multi-modal transportation is being increasingly encouraged by a favourable taxation system, a form of governmental financial support. That helps bringing about more effective rail freight transport and truck transportation in which there was a shift from own-transport by private companies towards transport by professional carriers, and thereby a more efficient distribution system including effective joint transport and delivery of goods.

Since the active implementation of regulations and policy measures, the amount of air pollutants emitted from vehicles has greatly reduced. Furthermore, governmental support of emission control technology development through financial support and automobile acquisition tax reduction for low pollution vehicles has encouraged efforts and investment to

the research and development of this technology type. For instance, electric cars and compressed natural gas vehicles attract an unprecedented level of interest among public authorities and business circles.

However, beside the above positive effects, deficiencies still remain to some extent. First, the standards for NOx emissions formulated in Japan seem too strict for automobile manufacturers to develop appropriate techniques to meet in short term. Especially when regarding Japan's experiences as possible lessons for measures to counter urban problems in developing countries, these seem less feasible. In addition, Japan emphasises technological solutions more than social solutions. For instance, sulphur dioxide emissions have been effectively controlled through the development of fuel gas de-sulphurization devices, but a decrease in NOx emissions that requires a decrease in automobile use has been more difficult. The main reason is that Japan has some of the biggest automobile manufacturers in the world and thus finds it difficult to focus on changing social attitudes to limit the use of automobiles.

5. CURRENT ACTIONS BY THE PRIVATE SECTOR

An overview of transport and environment trends in Japan showed that although railway accounts for 27.9% of passenger transport in Japan – which is exceptionally high – it accounts for only 4.3% of freight transport (Moriguchi, 2003: 8). Other means of transportation, which are less environmentally efficient such as automobiles account for the rest. Companies, enterprise associations and even individual entrepreneurs also play important roles in the entire environmental preservation system. In fact, an action plan called "the Basic Environment Plan" was introduced under the Basic Environment Law (Transport Ecology Mobility Foundation, 2004: 2), clarifying the measures taken by the national and local governments, as well as actions carried out by citizens, businesses and private organizations in pursuit of cleaner environment. In addition, when motorized vehicle exhaust from industries is regulated, they suppose that voluntary reduction of emissions is more effective than enforced compliance because with their reputations at stake, companies must continually improve anti-pollution measures. On the other hand, a newspaper reported of a group of Tokyo residents living near highways who sued auto makers such as Toyota, Nissan Motor, etc. for exceeding the current diesel-exhaust standard (The Daily Yomiuri magazine, June 1st, 1996).

5.1. Odakyu Electric Railways Company

In the Tokyo metropolitan area, the Teito Rapid Transit Authority, which is run by the city of Tokyo and the national government, and the Transportation Bureau of Tokyo Metropolitan Government jointly outline the plans for expansion of the subway network. Simultaneously, private railway companies undertake various measures to increase the transport capacity. Accordingly, the aims of attracting more commuters to this environmentally effective means of transportation and reducing the emissions of air pollutants emitted from motorised vehicles are reached. Odakyu Electric Railway Company is a private railway company doing its business dominantly in Japan, especially in the Metropolis of Tokyo.

Odakyu aggressively pursues activities to preserve the environment through efforts to reduce the environmental impact of its activities. In 1999, the Company formulated environmental policies and in 2000 established an environmental management system company-wide based on the global standard ISO14001. Odakyu contributes to the provision of public transportation services and the expansion of usage of railways as a means of environmentally friendly transportation. Facts show that nationwide in Japan, the railway's energy consumption is only 8 percent of the entire amount in the transportation sector, which results in the emission of pollutants such as CO₂ and NO_x, in comparison with the 65 percent by automobiles (Golany, Hanaki and Koide, 1998: 245). Consequently, Odakyu electric railway is one of the most effective transportation service companies in terms of pollution and energy consumption. In its business activities, Odakyu necessarily consumes large amounts of electricity, thus in observance of environmental laws and regulations, it is important for Odakyu to strive for curtailment of CO₂ emission through electric saving measures. Accordingly, Odakyu formulates and solicitously improves its environmental management system and also promotes “coexistence with nature” for its railways lines and other operations (Odakyu Corporate Brochure, 2004: 15).

Interviews conducted at Odakyu Electric Railway Company reveal that Odakyu's environmental action incorporate new technologies and modern devices that are mostly regarding CO₂ emission reduction. Information obtained also demonstrate the comprehensiveness of Odakyu's air pollution preventive measures such as measures for the reduction of exhaust gas emitted by company cars and exhaust gas curtailment for taking-out vehicles in a commercial institution. In this way, the control of pollutant emission from Odakyu's cars is thoroughly carried out. Accordingly, they execute plans for appropriate

vehicle operation and the introduction of low-pollution car equipped with particulate reducing devices. Moreover, the elimination of wasteful car-operating time is also emphasised.

Regarding measures for electric energy saving or the curtailment of CO₂ emissions, Odakyu puts 3000 type trains into practice in pursuit of high comfort and environmental consideration as the energy saving vehicles. As compared with the former vehicle series (the previous 5000 type vehicles), the amount of consumed electricity was cut down by 37.4% (Odakyu's Environmental Report, 2003: 13). Instead of using heat from electricity in operating a resistor to transforming the electric current at former type operation, these 3000 type vehicles are equipped with the VVVF controlling device (Variable Voltage Variable Frequency) that is used in converting direct current into alternating one without wasting electric energy. The rate of vehicles equipped with the VVVF controlling device is 36.9% (Odakyu's Environmental Report, 2003: 13) of overall Odakyu's possessed vehicles. Regenerative brakes are also one of the main features to help generate and transfer electricity through cables to the next train by using regenerating motors as braking. The percentage of vehicles equipped with this device is 65.2% (Odakyu's Environmental Report, 2003: 13). Furthermore, a 3000-type vehicle weighs less than a former type one does, helping reduce electricity amount needed whilst running. Other measures for electricity energy saving are also taken such as the scheduled running of substations that helps activate regenerative electricity and reduce electricity consumption through operation partly paused during leisure time (excluding rush hours), and the installation of electricity-consumption reduction devices at train stations.

In addition to the above activities at Odakyu Electric Railway Company, companies belonging to Odakyu group also actively contribute to air pollution control. In particular, in Odakyu's transport business, there is a focus on measures for an environmentally efficient traffic operation. One of those measures is promoting the introduction of low-pollution buses including idling-stop buses, compressed natural gas buses and diesel particulate filters that are already used by Odakyu Bus Company. Concurrently, the environmental commutation ticket system, which encourages commuters to travel outside, covered area on weekend or fiestas (government holidays) in order to reduce traffic congestion in these rush time, is established and applied in Odakyu group's bus companies. In order to mitigate environmental load and air pollution, transport demand management programs are also carried out such as "park and ride" system organized stations' surroundings, "public vehicle priority system" and "bus location system" aiding fixed operation, and "community bus" serving commuters at residence areas (Odakyu's Environmental Report, 2003: 21).

5.2. Toyota Motor Corporation

Toyota Motor Corporation is one of the biggest automobile manufacturers of Japan, making a considerable contribution to the Japanese automobile industry's achievements. On one hand, the automobile provides people with the convenience of free mobility, but on the other, it also harms the environment and atmosphere through the use of limited fossil fuel resources and the emission of pollutants. In the course, Toyota has been investing time, funds as well as mental power in environmental actions to reduce the road traffic-related air pollution. Since it officially introduced environmental actions through its first Environmental Report in 1998, Toyota has made significant contributions, including expansion of the hybrid and ultra-low emission vehicle line-up and fuel cell hybrid vehicles. It is not easy to balance social and economic benefits. Nevertheless, extensive environmental management for motorized vehicles is being implemented at Toyota.

Toyota's efforts in favor of the environment embodied the pursuit of environmental technologies and the development of a voluntary plan through preventive measures and compliance to environment-related laws. Currently, the Third Toyota Environmental Action Plan for a term of 2001-2005 is under implementation, containing the promotion of specific company-wide activities for the consideration of air-related issues such as fuel efficiency, exhaust emissions, clean-energy vehicles and transportation systems (Toyota, Environmental and Social Report 2003, 2003: 12). The latest report shows the state of Toyota's actions as of July 2003 in view of the FY2003 action policy set in accordance with the Third Toyota Environmental Action Plan. The report is as follows:

In the area of development and design, Toyota researches and installs new devices that improve fuel efficiency and produces cleaner exhaust emissions for gasoline-powered and diesel-powered vehicles in order to develop Fuel Efficient Engines. The Toyota Intelligent Idling Stop System using hybrid technologies is also installed, allowing the car engine to automatically be turned off without idling as stopping and be smoothly restarted.

Furthermore, so as to reduce exhaust emissions, increased efforts are made to develop more vehicles meeting the Ministry of Land, Infrastructure and Transport's Approval System for Low-Emission Vehicles and the emission control devices. It is interesting to note that the ultra-low emission vehicles, which had lower exhaust emission level three fourths than the 2000 exhaust emission standards, accounted for nearly half of total product in the year. Since March 2002, a monitoring program of the diesel particulate NOx reduction system, a new

catalytic converter system for diesel vehicles that uses the NOx storage reduction three-way catalyst technology, has been realized. As a result, the emissions of hydrocarbons, sulfur dioxide and PM have been reduced to the levels specified in the Ordinance on Environmental Preservation by the Tokyo Metropolitan Government.

Regarding clean-energy vehicles, Toyota's first achievement is the Toyota fuel cell hybrid vehicle (FCHV), four of which were firstly leased as official cars for governmental use by the end of 2002 (<http://www.env.go.jp/air/car/vehicles2003/htm/liq002.htm>). This FCHV achieved highly efficient operations through sophisticated energy management, leading among vehicular fuel cell technologies worldwide. In addition, a voluntary cooperation program between Toyota and Nissan Motor Co., Ltd. in which Toyota supply basic hybrid system components to Nissan was enforced in 2002 so as to aggressively promote the popularization of hybrid vehicles. The CNG-Powered Century is an ultra low-emission car, which is also a high-technology achievement created by Toyota in January 2003 and obtains an exhaust emission level that is 75% lower than the 2000 standards formulated by the Ministry of Land, Infrastructure and Transport. Toyota is trying to sell as many clean-energy vehicles as possible although in 2002 the number of such vehicles sold accounted for only 0.9% of all domestic vehicle sales by Toyota.

For information systems regarding new technology development, the active promotion of environmental management and provision of information is executed through Toyota's life cycle assessment (LCA). The purpose of this action program includes analyzing the emission volume of air pollutants, identifying areas requiring improvements and evaluating technologies so as to provide a more complete life cycle environmental information system.

5.3. Transport-related enterprise associations

A. Truck enterprise association:

So as to reduce environmental loads, enterprises set up content of action plans for environmental preservation ("Fundamental Environmental Action Plan") and promote the positioning of "Green Business" as a tour of inspection of the plan implementation (Transport Ecology Mobility Foundation, 2004: 60).

Proposed action plans include the following:

(a) Dissemination of Eco-drive:

To promote Eco-drive, the "Eco-drive promotion Manual" for enterprises and the "Energy-saving auto operation Manual" and the "Eco-drive promotion Handbook" for truck

drivers are issued. In addition, the opening of Eco-driving training courses and the promotion of attendance to these courses through tuition fee subsidies are carried out (Transport Ecology Mobility Foundation, 2004: 61).

(b) Thorough execution of "idling stop":

Companies are operating voluntary patrol in service areas to eliminate motor idling. "Idling stop statement" car stickers, subsidies for the installation of idling-stop promoting systems such as regenerating systems, combustion air, heating systems or freezing air coolers are provided.

(c) Promotion of low-pollution vehicle introduction:

Lobbying the subsidy system jointly granted by the Ministry of Land, Infrastructure and Transport, the Ministry of Economy, Trade and Industry and regional public organisations, truck companies themselves aid the new introduction fees of low-emission vehicles such as natural gas, hybrid and certified low-PM trucks, in co-operation with the regional Truck Association.

(d) Concerning measures for issues of black smoke and particulate matter, aggressive support is executed for equipping vehicles with PM-reducing devices like DPFs and oxidation catalysts.

B. Bus enterprise association:

Bus companies aggressively develop voluntary action plans and actively promote green business program jointly run by the association. In a voluntary program to promote the introduction of low-pollution vehicles, the association had targeted a 10% increase in the spread ratio of designated low-pollution vehicles by 2010. This program was so successful that the target was reached by the end of 2002.

The promotion of Eco-drive is also carried out through organising Focus Eco-drive Month every year with goals such as thorough idling stop, prevention of velocity acceleration, stringent inspection and adjustment of vehicles, and promotion of the appropriate use of fuel, staff training, affixing of stickers for drivers, in-car campaign guidance.

6. ASSESSING EFFECTS OF THE PRIVATE POLICY MEASURES

A study by Wong on the state of environmental policies in Japanese businesses and industries shows that they have little interest in environmental issues except where stability in the supply and prices of energy and natural resources are concerned (Wong, 2001: 65). Facts of the implementation of the private policy measures as described above shows an emphasis

on technology development in order to meet governments' control regulations without worsening business and service activities. When appraising the situation, it is obvious that the private policy measures play an important role in regular consultation and insight consideration alongside the public policy actors.

First, in public transportation, commuter railway networks, a railway and subway transit system implemented by the railway industry including private companies, continued to be located predominantly in city centre areas. Odakyu contributed to the environmentally effective running of railways through technology development and convenience improvement, thus drawing commuters towards trains and away from individual vehicles. This also contributes greatly to the reduction of road traffic congestion and pollution mitigation. Moreover, thanks to voluntary active cooperation among Odakyu and other private railway firms, the traffic on rails are smoothly coordinated for greatest efficiency and convenience for the commuters. The target of business and brand expansion continuously spurs large corporations like Odakyu to pursue environmental policies such that even bus, trucking and other service operations are equipped with efficient facilities.

Japanese big businesses are influential in government policy making because they are concurrently a constituent and patron of powerful ministries. As a result, environmental policy at a big private firm like Toyota Motor Corporation is greatly influenced by regulations and standards established by the Ministry of Land, Infrastructure and Transport whereby regulation compliance is urged upon the firm, creating the firm's growing voluntary investment in and development of environmental technology. The principle purpose is to preserve its reputation for quality and market share through consistently meeting regulations. It is indeed good timing for Japan to develop an advance environment technology industry, especially in clean air, which is a result of urban pollution clean-up process with active contributions from the private industries, in addition to the public sector's efforts through governmental incentives.

Besides, it is impossible to miss the effects originating in enterprises and enterprise associations' activities contributing to the assurance of smooth traffic flow execution, the strengthening of automobile exhaust emission standards, and the dissemination of low-pollution vehicles through various self-governing plans and voluntary co-operation.

7. CONCLUSION

The aim of this paper was to analyse the formulation and implementation of Japanese urban transportation policy concerning air protection in Tokyo, and its effects including those in the public and private sector on traffic networks of the Tokyo metropolis. The major conclusion that follows this research is the emphasis on reciprocal effects of the public policy measures and the private policy ones in respect to the further preservation of low-air-polluted urban transportation. The results show that the complex-strategy-mechanism society of modern Japan divide the responsibility for environmentally sound actions rather fairly between various actors that contribute to make up the Japanese urban transportation. In accordance, effects of these actions on the state of transportation can be different or separate in some respects and converged or similar in other respects.

Under the control by public authorities, which covers the entire transport system, private-sector companies are more or less forced to comply. In this respect, there remain difficulties and hindrances for companies to conduct business while trying to fit governments' regulating such as the nomination of specific routes, park-and-ride regulations, operating time restrictions, permits for entering certain areas, road pricing or charges, and vehicle control regulations, etc. These regulating actions by governments contribute to an efficient solution system for environmental problems, yielding much more effective outcomes at macro level than private policy measures. Of course, there is much necessity for the jointly co-operative actions from the private sector in compliance with these regulations. Prevalent situation is the occurrence of efforts in following public measure guidelines to access compliance rather than taking countermeasures against them even for business purposes at private enterprises. For instance, private railway companies' co-ordination, the voluntary co-operation between private freight transport actors, co-operation between automobile manufacturers and governmental authorities for the official use of low-pollution vehicle, and so on, can be part of environmental transport policy. That means public policy measures differ but provoke voluntary active strategies of enterprises. Table 1 shows a comparison of the two policies whereby the differences and similarities in terms of policies' affecting can be understood.

Technology improvement and the establishment of information systems are the convergence points of the two policy styles. In my view, these policy similarities create striking improvements in Japanese environmental technology in the pursuit of a more mature environmentally oriented society. Mass transportation in the metropolitan areas is based primarily on the extensive networks of the national railways and private commuter railways

that are increasingly technologically advanced. Efficient and convenient bus and trucking industries are also paid great attention by both the government and private firms. Most important of all, Japanese automobile industry, which makes the major contribution to vehicle exhaust emission, has been environmentally upgrading its products through significant technological achievements in the field. These facts lead to the creation of a high-tech vision for Japan promoted by developers and entrepreneurs, and enthusiastically adopted by the government such as a network of well-known *Shinkansen* lines, the high-speed train, the environmentally friendly means of public transport, and low-emission automobiles.

Table 1. Comparison of public and private policy measures

Policy measures	Public			Private	Public and Private	
Items applied on	Regulations	Pricing	Financial support	Voluntary business operations	Technology improvement	Information systems
Land use	Zoning for traffic management activities	Land use pricing in goods transport	Subsidies for land use prices in goods transport	-	-	-
Logistic operation	Traffic demand management	-	Subsidizing inter-modal transportation	Environmental management auditing systems	-	-
Networks	Vehicle and time restrictions	Road pricing	Bypasses, new highways	-	-	Roadside environmental information
Operation / Stopping	Specified vehicle operating area and time	Toll charges	Subsidizing park-and-ride systems	Idling-stop implementation	Idling-stop unit system development	Real time traffic information
Vehicles	Emission standards	Fuel taxes, emission taxes, automobile acquisition tax	Subsidies for low-pollution vehicles	Emission control technology development	Low-emission vehicle line-up development	Information on pollution-reducing devices and low-emission vehicles

Furthermore, the government and industries aggressively construct and improve information systems. From the examination and assessment of policy measures' effects, it is clear that the interaction between the two policy-styles' affecting Tokyo's transportation had a reciprocal nature. This provides a comparatively comprehensive coverage of the effectiveness of Japanese transport policies in terms of atmospheric sustainability.

Under Japan's situation of limited land availability for expansion in dense urban areas, it is not easy to improve people's mobility in terms of safety and comfort in harmony with the environment, whilst competing with the increased ownership and the growing supplying market of private motored vehicles. Individuals and companies belonging to both private and public sector carry out urban transport operation. Hence, the enforcement of public policy and planning regarding the management of urban transport makes regulating and facilitating indispensable. In this process, the more support from public policy measures is provided towards private strategies such as voluntary actions, the stronger reciprocal effects are created. The convergence of the two policy styles brings about comfortable urban traffic conditions and the mobility with high quality transport service for Tokyo and other cities.

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