

Climate Resilient Cities

A Primer on Reducing Vulnerabilities to Disasters

I/ CITY DESCRIPTION

Tokyo, the capital of Japan, is the most populous urban agglomeration in the world, with a population of over 35 million (consisting of the Tokyo metropolitan region and adjoining urban areas). The Tokyo Metropolis, located in the southern Kanto Region, positioned in approximately the center of the Japanese archipelago, has a population of 12.54 million (September 2005 data). The Greater Tokyo Area is made up of Tokyo and the three neighboring prefectures of Saitama, Kanagawa, and Chiba. This area is home to around 26 percent of Japan's total population. The National Capital Region is made up of Tokyo and the seven surrounding prefectures of Saitama, Kanagawa, Chiba, Gunma, Tochigi, Ibaraki, and Yamanashi.

Tokyo is a metropolitan prefecture comprising smaller administrative bodies, special wards, and municipalities. The central area is divided into 23 special wards, and the western Tama area is made up of 26 cities, three towns, and one village. The 23 special-ward area and the Tama area together form a long, narrow stretch of land, running about 90 kilometers from east to west and 25 kilometers north to south. The Izu Islands and the Ogasawara Islands, two island groups in the Pacific Ocean, are also administratively part of Tokyo, despite being geographically separated from the metropolis. The islands have between them two towns and seven villages. The total area of the Tokyo Metropolitan Region is about 2,187 square kilometers.

The 23 special wards are local public entities not found in other urban regions of Japan. The ward areas function as a single administrative area and are, in principle, subject to the same regulations that apply to cities. However, the wards come under a special system designed to meet the needs of the large metropolis. The Tokyo Metropolitan Government (TMG), as a regional government, carries out some of the administrative work that would usually be carried out by cities, such as managing waterworks and levying and collecting a portion of municipal taxes. The services that touch closely on the residents' lives, such as garbage collection, are the responsibility of ward governments.



The Promotional Plan for a Disaster-Resistant City was formulated in March 1997 to overcome the fragilities in Tokyo's disaster readiness.



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International Strategy for
Disaster Reduction

Protecting people's lives and property from disasters and keeping social assets safe are the basic issues for development of the metropolitan area of Tokyo.

II/ PRIORITY HAZARDS/VULNERABILITIES

Due to the concentration of population in Tokyo, as well as its political, economic, and other functions, disasters have very high impact on the affected people as well as the region and the world. Therefore, protecting people's lives and property from disasters and keeping social assets safe are the basic issues for development of the metropolis. Disaster prevention and risk management are accorded very high priority.

In December 1923, Tokyo was severely damaged from the Great Kanto earthquake. The earthquake had a magnitude of 7.9 and left over 141,000 dead and destroyed over 128,000 houses. The safety of Tokyo has gradually been improved with increased fireproofing of buildings and other preventive measures. However, much remains to be done. Densely built wooden houses and a shortage of open spaces, combined with diversifying household energy uses and weakening actions taken in the event of disasters resulting from the aging population, have been the major causes of the spread of fire, a secondary disaster of earthquakes.

III/ ADAPTATION MEASURES: ENHANCING RESILIENCE TO CLIMATE CHANGE IMPACTS

Lessons were learned from the Great Kanto earthquake, and subsequently the Great Hanshin-Awaji earthquake. Moreover, considering the fact that an earthquake eruption directly under Tokyo is expected in the near future, the Promotional Plan for a Disaster-Resistant City was formulated in March 1997 to overcome the fragilities

in Tokyo's disaster readiness. Based on this Plan, the bolstering of buildings' earthquake resistance will be pursued and the multi-layered and comprehensive advancement of projects for development of a disaster-resistant city will be pursued in areas of densely packed wooden housing.

The most important aspects of the Plan include the following:

Creation of a Fire-Resistant City

Fireproof Buildings

The Tokyo Metropolitan Government has designated key disaster prevention areas as fireproof districts. This includes all districts inside Loop Road No. 6. The city also makes effective use of a Fireproof Promotion Program, and has improved the subsidy system to make buildings fireproof and encourage joint civic/business reconstruction of old buildings.

Urban Redevelopment for Disaster Prevention

In accordance with the Urban Redevelopment Master Plan, a comprehensive plan has been prepared to incorporate construction of a fire-resistant city that will promote urban redevelopment for disaster prevention to eliminate districts where firefighting activities are difficult, making use of a method suited to each district. The system of redeveloping an area into a disaster-resistant area has been given legal backing. As a result, it has become possible to take such measures under joint or coordinated planning and extend financial assistance for the reconstruction of old, wooden, leased apartments into fireproof buildings.

The urban redevelopment projects for disaster prevention in the Koto area are stressing disaster prevention. Efforts are being encouraged to create a town that is comfortable and safe to live in, utilizing the vitality of the private sector.

Securing Open Spaces

Parks, green tracts, roads, and other open spaces in urban areas have important functions in disaster management. Top priority needs to be given to secure open spaces in

TABLE 1. Intended Uses of Open Spaces in the Disaster Management Plan

Type of open spaces	Roles in disaster prevention	Direction of improvement
Large-scale parks (metropolitan)	<ul style="list-style-type: none"> • Refuge base • Disaster recovery base, etc. 	• Improvement and construction of metropolitan parks
Small parks (ward, city, town)	<ul style="list-style-type: none"> • Disaster-resistant activity bases • Rendezvous sites 	• To secure a park for every town block
Roads (city planning roads)	<ul style="list-style-type: none"> • Firebreaks • Refuge roads 	• Improvement of roads in high-risk areas

Source: Tokyo Disaster Management Plan, 2007.

areas where they are lacking. The disaster management policy has categorized three categories of open spaces and their relation to postdisaster uses (Table 1).

Improvement of Earthquake Safety of Districts

Development of a Disaster-Proof Living Zone

Many improvement projects are planned in urban areas to reduce earthquake risk. These include:

- Creation of firebreaks, which make up disaster-resistant urban areas; improvement of roads, parks, rivers, etc.; and promotion of fireproof measures for areas along roads;
- Creation of disaster-resistant living zones to be carried out first in those areas where the risk is greatest. These should be roughly the size of an elementary or junior high school district, which are surrounded by firebreaks. Any necessary guidance and subsidies should be provided; and
- Within each disaster-proof living zone, making use of the district planning system to improve public squares, minor roads, and the living environment and its capacity to fend off disasters.

Identification of Seismically Weak Buildings

Based on the Tokyo Metropolitan Earthquake Disaster Countermeasure Ordinance and the Tokyo Metropolitan Earthquake Disaster Prevention Plan, the earthquake resistance of public buildings constructed before 1981 is being diagnosed. This process will ascertain the resistance of fire stations, police stations, schools, and hospitals that will serve as bases for information, rescue, and relief in the event of a major earthquake. In addition, a consultation system for private buildings has been established and information to technical organiza-

tions is being provided through a Building Earthquake-Resistance Diagnosis System.

Securing Safety of Relief Camps and Affected People

The following steps have been planned for ensuring safety and security of the affected people and that of the various relief camps that will be set up after an earthquake:

- Improvement of refuge bases, roads, and bridges to secure the safety of victims. Replace distant refuge bases with nearer ones and promote fireproof and safety measures for areas near refuge bases and along refuge roads;
- In principle, a refuge base should be designated with an area of at least 10 hectares. A secure, effective area of at least one square meter per each refugee should be provided. After taking appropriate safety measures, the government may permit people to remain in areas where fire-resistant buildings are concentrated and free from danger of a major fire in the city;
- In improving the refuge system, measures should be taken for cooperation with citizens, with consideration of the aged and handicapped. Consideration should also be given to foreign residents and visitors through provision of public relations activities and bulletin boards in foreign languages; and

Creation of disaster-resistant living zones should be carried out first in those areas where the risk is greatest.

The Government has made effective use of the Comprehensive Flood Prevention Information System.

- Owners should be instructed to take safety measures and tighten regulations on building standards to prevent the danger of broken and falling concrete block walls, precipices, and retaining walls. In particular, regulations and guidelines should be tightened for building structures. These regulations and guidelines would include the design of the building with minimum open spaces that provide security from falling objects and other potential dangers during earthquakes.

Determination of Vulnerable Districts

For the purpose of introducing an indicator for the development of disaster-resistant cities, the Tokyo Metropolitan Government assesses the vulnerability of each district for earthquakes and announces the results to Tokyo citizens.

Disaster Management Strategy for Floods Hazard

Tokyo experiences problems with floods mainly along the small and medium-sized rivers in the Yamanote area (Tokyo's hilly region) and the Tama area. Flood problems are also experienced in basins where the water-retaining capacity has declined due to increasing residential developments in the existing urban areas and surrounding areas that has resulted in the reduction of water runoff. Flash floods are also recurring with higher frequency, resulting in needed preventive measures. Flash floods are a result of the high incidence of local torrential rains and the increase in underground spaces in recent years. In the lowland area east of the Sumida River, there is a danger of floods due to high tides and earthquakes.

The following measures have been initiated for flood control in Tokyo:

Increased Safety against Floods

The Tokyo Metropolitan Government's planned measures include repair of embankments to make rivers capable of disposing of rainfall up to 50 millimeters per hour. The Government has also planned to improve and expand adjustment reservoirs, diversion channels, and sewerages to quickly eliminate the danger of floods. For prompt and accurate response to local changes in precipitation and danger of high tides, the Government has made effective use of the Comprehensive Flood Prevention Information System.

Stronger Measures to Improve River Basins

Concurrent with the expansion and improvement of rivers and sewerages, the Tokyo Metropolitan Government is constructing facilities to store rainwater and make it permeate the ground, particularly in such public spaces as roads and parks and large-scale private facilities. This action reduces the flood load on river basins. There is also a subsidy system to help individuals improve the drainage of their home lots.

Promotion of Facilities that Harmonize with Regional Characteristics

Measures have been devised to encourage the design of facilities to harmonize with regional characteristics and not alter the architectural characteristics of the area.

Protection of Eastern Lowlands

To protect the eastern lowlands and waterfront areas from water damage due to high tides and earthquakes, the construction of tide dikes, coastal embankments, water gates, and wastewater treatment facilities will be promoted.

Flood Control Measures Using Underground Rivers

In the western part of the wards area, underground rivers will be constructed (for example, under Loop No. 7) based on a comprehensive flood control measure plan that includes measures for each river basin. In addition, the installation of adjustment reservoirs along rivers will be promoted to improve flood safety.

Construction of Protective Embankments

In the Tama area, the construction of protective embankments will be promoted with emphasis on areas

with frequent water damage. In addition, measures to improve food safety have been carried out in conjunction with measures for sewerage and watershed control.

Promotion of Super Dike Construction

Along the Tamagawa, Arakawa, Sumidagawa, and other large rivers, the construction of super dikes, having superior earthquake resistance and flood control ability, will be promoted as a part of overall urban renewal.

Development of Plans to Improve Waterside Environment

In promoting flood control projects, efforts will be made to create an attractive waterside environment by planting greenery on dikes and constructing walking paths, with a good balance between economic water utilization and the use of waterside areas for rest and recreation.

IV/ MITIGATION MEASURES

The Tokyo Climate Change Strategy defines a basic policy for the 10-Year Project for a Carbon-Minus Tokyo, an ambitious undertaking launched by Tokyo Metropolitan Government at the end of January 2007. It spells out a basic framework of climate change mitigation strategies that the Tokyo Metropolitan Government intends to carry out over the next 10 years.

Representative measures designed to cope with climate change are identified in this strategy. This policy specifies the direction in which TMG climate change mitigation strategies should be pushed forward. The policy is based on the details of a TMG-initiated study, as well as on an interim report submitted by the TMG in preparation for a revision to the Tokyo Metropolitan Environmental Master Plan.

In the absence of a national strategy on climate change mitigation, the Tokyo Metropolitan Government has advanced the world's highest-level strategies and has taken the lead in Japan's climate change mitigation measures. It may be noted that the Tokyo Climate Change Strategy is far more ambitious in its objectives and scope than Japan's commitment under the Kyoto Protocol. This strategy is an outcome from the TMG commitment to a

more sustainable future and its objective to improve the city for future generations.

With this commitment, Tokyo aims to achieve the following:

- A new look at how energy should be used in cities results in a shift toward a low-CO₂ society—a low-energy society—that allows people to lead an affluent, comfortable urban life while spending the minimum required amount of energy. Low-CO₂ social systems and technologies that make this society possible become widespread throughout Tokyo's urban society, thus minimizing the greenhouse gas (GHG) emissions from the Metropolis;
- While the optimum use of energy in a manner befitting the characteristics of demand progresses, renewable energies such as solar energy and unutilized energy from urban waste heat are increasingly put to effective use, thereby enhancing Tokyoites' independence in terms of energy;
- Progress is made in the passive use of energy that uses light, wind, and heat naturally, particularly in homes. The city architecture not only reflects the performance of a building but also cares about the dynamics among buildings, the relationship between structures and surrounding greenery, and the effective utilization of the local microclimate;
- The development and subsequent spread of low-CO₂ social systems and technologies are creating a new urban-style business. These social systems, technologies, and lifestyles that minimize environmental burden enhance the charm of Tokyo. Tokyo dominates as a trailblazing city model that continues to be chosen by people and business enterprises in competition among cities across the world; and

The Tokyo Climate Change Strategy defines a basic policy for the 10-Year Project for a Carbon-Minus Tokyo.

- In an effort to realize such a city model as soon as possible, Tokyo Metropolitan Government focuses its efforts on achieving its targets under the 10-Year Project for a Carbon-Minus Tokyo: Reduce Tokyo's 2000 GHG emissions 25 percent by 2020.

Basic Policy for Climate Change Mitigation Strategy

The basic philosophy of the mitigation strategy is based on the following pillars:

Create a mechanism to bring Japan's environmental technologies into full play to achieve CO₂ reduction.

Japan has traditionally prided itself on its ability and its leadership in technological development. In the past, several technological innovations have contributed to reduction of CO₂. These technologies include highly efficient energy systems and equipment, LED and other lighting technologies, fuel-efficient vehicles, hybrid vehicles, and photovoltaic power generation systems. These technologies and others under development can be used to reduce the CO₂ emissions in the city through appropriate policy instruments.

Create a mechanism whereby large businesses, smaller businesses, and households achieve CO₂ reduction in their own capacities and on their own responsibility.

It is recognized that there is no panacea for climate change mitigation, and all sectors contributing to emissions need to take steps to reduce the CO₂ emissions. While large businesses have the financial capacity to undertake CO₂ reduction, the smaller ones require knowledge and technology. Suitable policy instruments can be used to encourage emissions reduction in all segments of the city to achieve the 10-year plan targets.

Carry out measures strategically and intensively during the first three to four years as the initial period of a shift to a low CO₂ society.

The lifestyles of residents will need to be changed in order to achieve the 2020 reduction target. Meeting the target will also require changes in economic and urban activities such as application of the latest energy-saving technologies and extensive use of renewable energy. This

will require large-scale public awareness campaigns to engage the various stakeholders. During the first three to four years, drastic measures to reduce emissions may not be feasible.

Utilize private and public funds and tax incentives and carry out necessary investment boldly.

The switch to alternate technologies for energy reduction requires huge initial investments. The Tokyo Metropolitan Government intends to create a mechanism that enables it to acquire necessary initial funds and make necessary investments through diverse measures, such as collaborating with financial institutions, utilizing the Fund to Promote Measures against Climate Change, and using tax incentives. Through these and other measures, the shift to low-CO₂ society can be achieved.

Five Initiatives and Main Activities for Climate Change Mitigation

One of the most important considerations in formulating the climate change strategies in Tokyo has been to define the direction of policy measures to be carried out in order to realize a new city model that enables remarkable achievements in GHG reductions. This requires a fresh look at the existing energy demand, transformation of existing social systems (i.e., lifestyles), and urban architecture and building. The goal of the city is to allow its citizens to lead a comfortable life with as little energy as possible.

As a first step, efforts must be made to promote the full utilization of energy-saving technologies and renewable energies, and by reducing the total emissions of CO₂ and other greenhouse gases produced by urban activities.

The five main initiatives promoted through the plan follow.

Initiative 1 Promote private enterprises' efforts to achieve CO₂ reduction.

CO₂ emissions resulting from corporate activities in the business and industrial sectors in Tokyo account for more than 40 percent of the city's total emissions. Stepping up measures in these sectors is crucial in achieving reductions in the total emissions of greenhouse gases in Tokyo.

- Introduce cap and trade, targeting large CO₂-emitting businesses;
- Promote smaller businesses' energy conservation measures through the introduction of the Environmental Collateralized Bond Obligation Program;
- Call upon financial institutions to expand environmental investment and loan options and disclose information about investments;
- Achieve widespread use of renewable energies by promoting the Green Power Purchasing Program; and
- Collaborate in conjunction with smoke, soot, and air-pollution control measures.

Initiative 2

Achieve CO₂ reductions in households by low-CO₂ lifestyles.

Lighting accounts for a little less than 20 percent of the electricity consumed by households in Tokyo. Electricity need for lighting can be reduced substantially simply by changing incandescent lamps with electric bulb-type fluorescent lamps. A changeover to fluorescent lamps achieves a maximum of 80 percent reduction in energy per lamp.

Tokyo plans to eliminate incandescent lamps from households as soon as possible by starting a large-scale replacement promotion campaign in cooperation with electrical appliance manufacturers, trade organizations, and consumer organizations.

This initiative will also be used to promote other programs, such as encouraging use of energy-efficient home electric appliances and stepping up other measures to ensure that the movement to reduce CO₂ by cutting down on electricity charges spreads among all households. Steps include the following:

- Wage the campaign for elimination of incandescent lamps from households;
- Build a comfortable house using natural light, heat, and wind—regenerate the solar thermal market;
- Improve the energy-saving performance of houses; and
- Facilitate the spread of renewable energies and

energy-saving equipment such as photovoltaic power generation systems and high-efficiency water heaters in houses.

Initiative 3

Lay down rules for CO₂ reduction in urban development.

- Formulate the world's highest-level energy conservation specifications for buildings and apply them to facilities of Tokyo Metropolitan Government;
- Require large new buildings to have energy conservation performance;
- Introduce energy conservation performance certificate program for large new buildings; and
- Promote effective utilization of energy and use of renewable energy in local areas.

Initiative 4

Accelerate effort to reduce CO₂ from vehicle traffic.

- Formulate rules for the use of fuel-efficient vehicles to facilitate widespread diffusion of hybrid vehicles;
- Implement a project to encourage introduction of green vehicle fuel conducive to CO₂ reductions;
- Create a mechanism of support for voluntary activities such as an eco-drive campaign; and
- Carry out traffic volume measures by taking advantage of the world's most refined public transportation facilities.

Initiative 5

Create a TMG mechanism to support activities in respective sectors.

- Introduce CO₂ emission trading system;
- Create a program to encourage and support small

CO₂ emissions resulting from corporate activities in the business and industrial sectors in Tokyo account for more than 40 percent of the city's total emissions.

- business and household energy-saving efforts; and
- Commence a study to introduce TMG energy conservation tax incentive both in terms of tax reduction and taxation.

Initiatives of Tokyo Metropolitan Government

The Tokyo Metropolitan Government is the largest emitter of CO₂ in Tokyo. It is therefore very important that the Tokyo Metropolitan Government begin immediate steps to implement the five initiatives described above. Some major initiatives that the Tokyo Metropolitan Government is taking are:

- Applying the Tokyo Energy Conservation Design Specifications 2007 to all TMG facilities starting 2007;
- Formulating the Guidelines for Energy Conservation and Introduction of Renewable Energies in TMG facilities in 2007;
- Creating the National Network of Green Power Purchasing in collaboration with local governments across Japan;

- Replacing all vehicle traffic signals and pedestrian traffic signals in Tokyo with LED signals;
- Formulating measures designed to reduce CO₂ emissions produced in procurement of goods (including public works projects); and
- Revising the Global Warming Prevention Tokyo Metropolitan Government Plan.

Note

This “City Profile” is part of *Climate Resilient Cities: A Primer on Reducing Vulnerabilities to Disasters*, published by the World Bank. The analysis presented here is based on data available at the time of writing. For the latest information related to the Primer and associated materials, including the City Profiles, please visit www.worldbank.org/eap/climatecities. Suggestions for updating these profiles may be sent to climatecities@worldbank.org.

¹ Tokyo Metropolitan Region is the domain of Tokyo Metropolitan Government. The Tokyo Megalopolis also includes Yokohoma and other cities that have a different government. The total Megalopolis population is around 35 million.



THE WORLD BANK

Sustainable Development East Asia and Pacific Region

1818 H Street, N.W.
Washington, D.C. 20433, USA

Telephone: 202 473 1000
Facsimile: 202 477 6391
Web Site: www.worldbank.org/eapsd and
www.worldbank.org/eapurban

