STUDY ON NEW SMART CITY STANDPOINT FROM BUSINESS CONTINUITY MANAGEMENT IN JAPAN

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ABSTRACT

The concept of BCM, the definition of a smart city and the necessity of SBCM were discussed in conjunction with the concept of "making smart." If efforts made by relevant major companies toward SBCM are verified by further demonstration and consequently come to be utilized in many households, it is expected that a large number of people can live securely and safely. Studies were conducted to find measures for maintaining utilities necessary for business operations, such as electricity, telecommunication, gas, water supply and sewage, during the time of disaster occurrence. Particularly, it is necessary to examine DHC (District Heating and Cooling) still more. DHC is the system by supply cold and hot water, this equipment is set in one place, it can use the energy efficiently and save more space. By the collaboration of BEMS and DHC, the smarter center works more efficiency. And SBCM that is a basic concept of a smart city has been put together and the process for its implementation in the Shinagawa/Tamachi Station area in Minato City, Tokyo has been examined. It is hoped that the steady SBCM project will make the 2020 Olympic/Paralympic Games result in success and at the same time take the initiative among the nations of the world in actualizing the creation of a smart city.

Keywords: Smart city, Business management, The 2020 Olympic and Paralympic Games, Smart Business Continuity Management (SBCM)

INTRODUCTION

The growth of smart cities has been remarkable throughout the world. The concept of a smart city as a new type of urban lifestyle has been receiving much attention worldwide. This research study investigated smart city & district cooling and heating in Japan, it will introduce the smart city projects implemented in Japan and discuss their future prospects.

NECESSARY OF SBCM

Business continuity plan (BCP) and business continuity management (BCM). Many organizations and companies are preparing a business continuity plan (BCP) so that they can continue or resume the business operation even though it is affected by the outbreak of such incidents as natural disasters, accidents, and infectious diseases. In the process of BCP formulation, a business impact analysis (BIA) is conducted in the first place, where targets, activities and impacts related to business continuity are clarified and subsequent risks are identified. Then, systems and facilities on which priorities of restoration should be placed are selected and restoration procedures are designed. Since the occurrence of the Great East Japan Earthquake in March, 2011, the importance of BCP has been reconfirmed, encouraging a large number of companies to draw up their own BCP. Previous to the disaster, the Cabinet Office, Government of Japan, issued the 1st edition of Business Continuity Guidelines in August, 2005, urging Japanese companies including small and medium businesses to formulate their own business continuity plans, which is considered to be the origin of Japanese BCP.

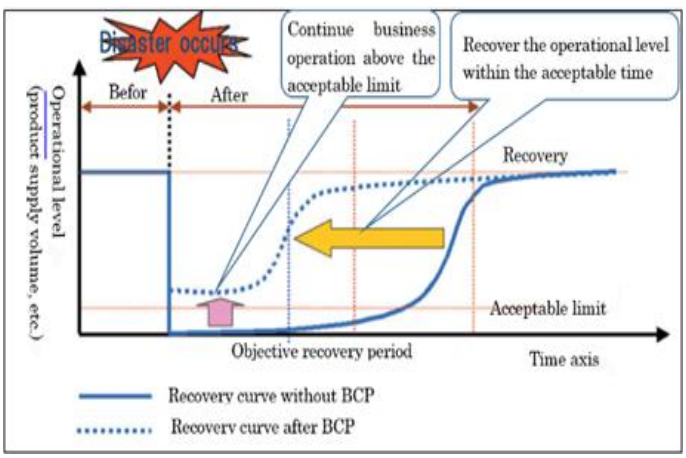

Figure 1. BCP concept

Figure 1 illustrates the concept of BCP. These guidelines explains that a long business suspension not only puts a company's trade connection to trouble but incurs the risk of losing its confidence and that the preparation of plans for such occasions is a strategic issue for the business protection. The guidelines were revised to the 2nd edition of Business Continuity Guidelines in November, 2009, and the 3rd edition of Business Continuity Guidelines in August, 2013. In the 3rd edition of Business Continuity Guidelines, attention is called to the preparation for a wide range of potential risks to deal with unforeseen incidents by thinking back on such disasters as the Great East Japan Earthquake and the Thai flood. Based on the experience of supply chain interruption, the guidelines mentions alternative strategies and counter measures, accentuating the importance of various linkages between business partners, trade organizations and local interested parties.

Smart Business Continuity Management (SBCM)

BCM that is made smarter is SBCM. "Making a system smart" generally means that information processing technologies and management functions are integrated into the system by taking advantage of IT.

Currently, BCM is reinforced for individual structures or organizations separately, and holistic plans or operations to enhance the functionality of an entire city have yet to be established. Nevertheless, if the business continuity function is managed under SBCM, business continuity can be further optimized; information can be sorted out effectively; damage in case of emergency can be minimized; and restoration time can be shortened. When SBCM is implemented throughout a city, its safety will be more secured. In addition, practical convenience of the city will be improved. As a result, the value will be added to the city. Since the occurrence of the Great East Japan Earthquake in March, 2011, the implementation of SBCM has been being propelled more actively.

ADVANTAGES IN INTRODUCING SBCM

The introduction of SBCM will bring substantial advantages to the society. Some examples are as follows:

(1) The optimal supply of energies including electricity, gas and water is realized.
(2) The development of IT infrastructure offers easy access to cloud computing and big data, ensuring a steady supply of information in case of emergency.
(3) The system of low-carbon societies is established, which is expected to lead to the environmental betterment.

These improvements will bring immeasurable benefits to the 2020 Tokyo Olympic and Paralympic Games as well. The Tokyo Games will be built on the following three foundations: Delivery, with guaranteed quality and maximum benefits; Celebration, with the city hosting a dynamic and welcoming party that will inspire the youth of the world; and Innovation, using Japan's renowned creativity and technology to benefit sport and the Games.

The integration of SBCM will successfully carry through compact venue planning, efficient transportation planning, and accommodation planning. With emphasis on the Japanese spirit of harmony, we can inform the world that Japan is one of the safest nations, where the crime rate is considerably low.

As in the case of the 2012 London Olympics, the 2020 Tokyo Olympics will be able to focus on additional elements by making refinements on infrastructure for this sporting extravaganza during the early stages in this major global city. The goal is that "the global sporting family will 'Discover Tomorrow' through Tokyo 2020." The introduction of SBCM is essential to carry out these plans. In the next section, the process of introducing SBCM to the area around Shinagawa Station and Tamachi Station in Minato City, Tokyo, will be examined.

SMART CITY

Efforts are exerted in various fields to make their systems smarter. To facilitate the successful implementation of SBCM, the concept of the smart city can be specially referred to. Generally, the smart city is considered to be a city which develops, by efficiently using energy and infrastructure while pursuing environmentally-friendly solutions with the help of the information and communication technology (ICT).

As for regional exemplifications in Japan, a number of projects for realizing the efficient use of local energies are carried out in four cities of Yokohama, Toyota, Keihanna, and Kitakyushu. Also on a world scale, more than 400 projects are currently under way. Infrastructure that will be made smart consists not only of tangible basic utilities such as electricity, gas, transportation, water supply and sewage, but also of intangible social services which are closely associated with people's daily life such as medical and nursing cares.

Table 1. Different Interpretations of the Smart City

Japan Smart City Portal (JSCP)	A new style of city providing sustainable growth and designed to encourage healthy economic activities that reduce the burden on the environment while improving quality of life (QOL).
Ministry of Economy, Trade and Industry	A system that uses local energies effectively through the network between households, buildings and transportation systems.
Hitachi, Ltd.	An environmentally conscious city that uses information technology (IT) to manage energy and other resources efficiently.

Table 2. BCM measures for office buildings

Tangible measures		Intangible measures
(1) Improvement of seismic resisting and damping properties of buildings [Examples] -Old bldg.: installing a new type of vibration damping device in an existing building. -New bldg.: designing an office building at a seismic resisting level equivalent to that for data centers and administrative facilities.	**BCM measures by real-estate**	(5) Saving for emergency [Examples] - Storage of blankets, medicines, equipment /materials, and portable toilets in addition to food provisions. - Free distribution of one-day provisions among office building tenants.
(2) Establishment of energy and domestic water supply systems [Examples] -A triple-structured blackout prevention system, consisting of a primary substation, a secondary substation and a private power generation facility. - Construction of an emergency water well. - Introduction of a wastewater treatment and recycling system which makes the office lavatory usable for two weeks despite suspension of water supply.		(6) Acceptance of stranded commuters [Examples] - Provisions prepared by office buildings near a railroad station or in the urban regeneration special areas for stranded commuters in addition to office workers of the buildings. - Drills in accepting stranded commuters (jointly with administrative offices.)
(3) Establishment of an emergency information system [Examples] - Centrally controlled "emergency portal site" for information regarding damage to any properties, safety of a building custodian, any person confined in an elevator, and stocked items. - Development of an emergency information distribution system to provide stranded commuters with well-timed information by making use of a local broadcasting station. - Development of a "damage evaluation system" to automatically monitor the degree of structural damage by using an accelerometer. - Preparation of a multiplex communication system for an emergency (e.g. building up an original radio system using a general service unit.) - Development of websites reserved only for tenant companies to provide out-of-office employees and families with information about damage to the companies.		(7) Disaster prevention agreement between real-estate companies and local governments [Example] - Disaster arrangement to prepare temporal refuges and provisions for stranded commuters.
		(8) Organization of disaster prevention teams and education for the disaster prevention personnel [Examples] - A large-scale emergency drill given to employees of real-estate companies several times a year. - Construction of company-run houses for the disaster prevention personnel. - A drill conducted under an undisclosed scenario to take such measures as the occasion demands.

		(9) Completion and reexamination of disaster prevention manuals [Examples] - Formulation of rules on which the company staff can judge the degree of risk immediately after disaster. - Reexamination of emergency manuals based on the experience of the Great East Japan Earthquake.
(4) Development of an efficient energy supply system [Example] - Development of a zero-energy building (ZEB) which makes the most of natural energies (e.g. sunlight, wind, and geothermal heat) and unused energies (e.g. cogeneration), integrated with energy-saving techniques.		(10) Development of awareness of disaster prevention measures in office tenants [Examples] - Distribution of pamphlets on disaster prevention measures among office tenants. - An earthquake-specific emergency drill.

SMART ENERGY CITY PROJECTS FOR CEMS

The strategic local lifestyle in a low-carbon society is described here as a smart community. In the smart community, a community/cluster energy management system (CEMS) that exercises the optimal energy management with various mechanisms has been being developed. CEMS is expected as its goal to be a new information and communication applied technology that connects BEMS, HEMS, electric vehicles (EV), dispersed power sources including renewable energy and smart cities.

EFFORTS FOR SBCM

Properties taken care of by real-estate companies include office buildings, commercial facilities, collective houses and accommodations. In this study, a main focus is placed on office buildings. As Table 2 indicates, office buildings need to be treated with BCM measures from the both tangible (e.g. structural strengthening and ICT) and intangible (e.g. organization of office staff and stock) aspects.

DISTRICT HEATING AND COOLING IN JAPAN

Number of Service Districts

District Heating and Cooling（DHC）is the system by supply cold and hot water, this equipment is set in one place, it can use the energy efficiently and save more space. By the collaboration of BEMS and DHC, the smarter center works more efficiency; by supplying reliable energy, the service range is also enlarged. It can be realized that the energy of the area will be efficiency used, and the function of BCP can be expected, too.

The construction of the first district heating and cooling system is in 1970 at the Senri Chuo Area in Osaka. The history of district heating and cooling in Japan comes from Senri of Osaka, 1970, in the current heat is being supplied to 154 districts of the whole country. The following figure shows the development history of DHC.

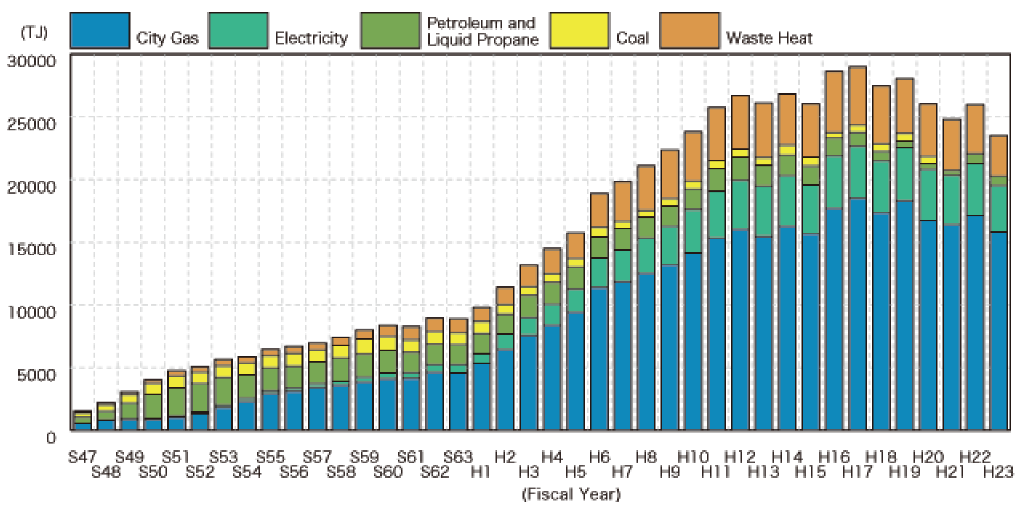

Figure 2. Changed in Energy Supply System

STANDARD SYSTEM

Design Considerations

The following items must be considered when devising a district heating and cooling system. The selection of a heat production system appropriate for the heat medium and energy source. The selection of a heat supply system appropriate for the heat medium, demand and the geographical conditions. Selection of the optimum heat medium, taking into consideration the type of demand for thermal energy within the district and the geographical conditions. Selection of an energy source suitable for supplying heat.

TYPES OF SYSTEMS

- Steam boiler plus steam absorption chiller
- Steam boiler plus steam turbine-driven turbo chiller
- Heat-collecting heat pump plus heat storage tank
- Air-cooled heat pump plus heat storage tank
- Electric turbo chiller (heat storage tank) plus steam boiler
- System utilizing river water or seawater plus absorption heat pump
- System utilizing waste heat from waste plus hot water boiler
- Heat pump utilizing seawater plus heat storage tank and steam absorption chiller
- Cogeneration plus waste heat driven absorption water heater and water heater
- Cogeneration plus steam boiler, steam absorption chiller and turbo chiller

EFFECTIVE USAGE OF UNUTILIZED ENERGY

By recovering urban waste heat and using it to heat and cool buildings throughout the district, for example, DHC systems can utilize untapped energy sources to help decrease our dependence on fossil fuels. For this reason district heating and cooling has been identified as a key component of the urban infrastructure for the new century, one that is both effective and friendly to the global environment. District heating and cooling systems make use of the following unutilized energy resources: cogeneration systems, energy generated from wastewater temperature differential, energy derived from solid waste, energy derived from waste (refuse derived fuel, or RDF), heat energy from seawater.

ANNUAL COST COMPOSITION OF AIR SOURCE HEAT PUMPS AND DHC

Europe, as the birthplace of DHC, household penetration rate of District Heating (below referred to as DH) in Iceland is 92%, Finland is 50%, Denmark 61%. Sales volume of district cooling (below referred to as DC) (3TWh) is to occupy 1% of the cooling market (300TWh). Japan's housing sector to Europe is 0.1% of the total market in 2009[2]. I will try to estimate the annual fee of household air-cooled heat pump and gas facilities.

The configuration of the air-cooled heat pump charges, air conditioning costs, part of the public interest costs and rents. District heating fee is composed of pay-as-you-go and the basic charge.

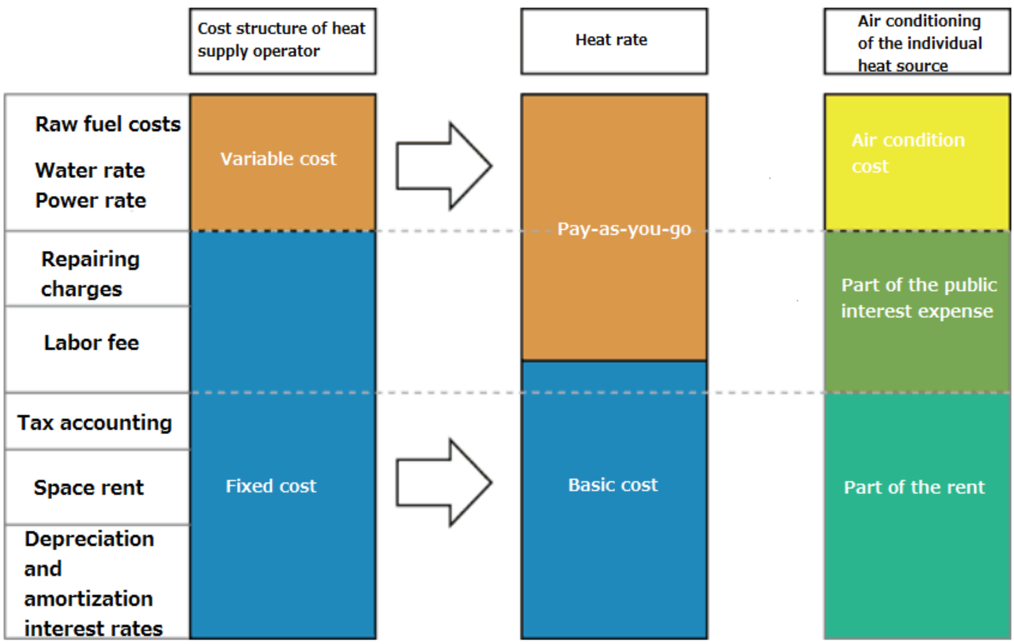

Figure 3. Annual Cost Composition of Air Source Heat Pumps and DHC

INTRODUCTION OF SBCM TO MINATO MIRAI 21

Although the Minato Mirai 21 (MM21) district suffered the 2011 Great East Japan Earthquake, the area has been highly expected as a future city not only serving various conveniences but also holding the value of urban functionality in such fields as disaster prevention and energy-saving. For this reason, MM21 was judged to be an ideal model case for this study.

The development of MM21 started in 1983 on the general theme of creating a secure city according to the Minato Mirai 21 Urban Disaster Prevention Master Plan. Table 3 shows requirements of a secure city suggested in the plan. Even today almost 30 years after the initial planning, the requirements of a secure city have not changed.

Table 3. Requirements of a secure city

[At ordinary times] (1) Easy to comprehend the city layout. (2) Great awareness of disaster prevention.	[During the emergency relief period] (for three days or so) (6) Emergency relief activities taken without any trouble. (7) Necessary information gathered properly. (8) Speedy evacuation of residents.
[Immediately after disaster] (- several tens of minutes) (3) No human injuries. (4) No damage in crease. (5) No panic.	[During the restoration period] (for one or two months) (9) Living function and social order maintained. (10) Placement of a relief operation base. (11) Quick recovery of urban activities.

Even today almost 30 years after the initial planning, the requirements of a secure city have not changed. They are universal and unvarying elements. By 2050, nearly 30 years from now, however, social conditions would have considerably changed, where more secure and safer environments would be sought for due to such factors as a super-aging population, an increasing number of foreign residents and the construction of more skyscrapers.

Hence, smart measures which would possibly be implemented to satisfy these security and safety requirements were investigated to see whether they effectively work or not. Table 4 summarizes the result. A mark representing a circle in the table indicates that a particular measure is effective to meet a particular requirement.

CHANGES IN JAPAN BY 2020

Tokyo is proud of its world-leading public transportation systems and facilities in terms of high accessibility. The Olympic and Paralympic Games that Tokyo will host in 2020 will furnish an excellent opportunity for this cosmopolitan metropolis to show the world how to make the most of the latest technology and innovative architecture in order to secure better access throughout the urban community.

Accordingly, The Olympic and Paralympic Games will leave various legacies not only to Tokyo but to Japan and to the Olympic Movement, most of which will possibly enlarge various opportunities including employment of handicapped people, thus bringing hopes to many people.

Among all districts in Tokyo, three cities, namely Chiyoda, Chuo and Minato, constitute one of Japan's major economic centers, where about 30% of all companies listed in the first section of the Tokyo Stock Exchange and the number of companies operated there and ranked among "Fortune Global 500" is more than twice the number for New York, London or Paris. Besides, this area has developed as a base not only for economic activities but for culture and social exchanges, containing many cultural facilities, historical properties and highly advanced and convenient transport infrastructures including Tokyo Station, a chief terminal station in the metropolitan area.

The total floor space of large-scale office buildings to be developed within Tokyo's 23 cities by 2018 is approximately 5 million square meters. Moreover, nearly 80% of these development projects are concentrated in the three cities, presenting a principal center of Tokyo's redevelopment project. The further accumulation of those urban functions into the three cities will substantially increase their dominance in Tokyo.

PROPOSAL FOR SBCM

The 2014 Urban Development Guideline in the Shinagawa/Tamachi Station District drawn up by the Tokyo Metropolitan Government makes mention of energy and disaster prevention as a policy of city planning. According to the policy, energy conservation will be practiced, and at the same time BCP will be reinforced as its measure. The implementation of SBCM would be difficult to achieve only by efforts of an individual building or community. It has been clarified that facilities for electricity, gas, water supply and sewage need to be improved in order to promote SBCM. The implementation of SBCM should not be confined to a project of an individual building but be applied to that of a district, a town or a city as a unit. In developing the new station area, it is considered to be essential that SBCM is conducted comprehensively in the entire district. Table 5 shows the improvements expected in the fields of energy and disaster prevention under SBCM.

Table 4. Smart measures and requirements of a secure city in the time of disaster

	Categories	No	Measures	Requirements of a secure city										
				1	2	3	4	5	6	7	8	9	10	11
				Easy to comprehend the city layout.	Great awareness of disaster prevention.	No human injuries.	No damage increase.	No panic.	Emergency relief activities taken without any trouble.	Necessary information gathered properly.	Speedy evacuation of residents.	Living function and social order maintained.	Placement of a relief operation base.	Quick recovery of urban activities.
Smart measures	ICT	I1	Provision of information and communication without interruption via a satellite channel.						○	○		○	○	○
		I2	Risk avoidance and panic prevention based on real-time information of people tracking with use of seamless GPS.	○	○	○	○	○	○					
		I3	Availability of speedy recovery process based on big data and AI real-time data.							○		○	○	○
		I4	Placement of a base facility equipped with a cloud system for sorting out real-time nationwide data about disaster prevention measures.						○	○			○	○
	Robot	R1	Fire extinguishment and automatic recovery of disabled facilities/devices aided by AI and robots.				○					○		○
		R2	Smooth transportation under the automatic operation system during a recovery period.				○	○		○	○	○		○
	Energy	E1	Continuous energy supply through an independent facility using renewable energies and fuel cells.									○	○	○
		E2	Open space well-lighted around the clock by solar power generation.	○	○	○		○			○		○	
	Monitoring	M1	Monitoring and AR display of well-timed city information based on various sensors and virtual city 3D models.	○	○	○	○	○	○	○				○
		M2	Low-cost emergency monitoring by regular use of sensors including smart meters, surveillance cameras and unmanned helicopters.		○	○	○	○	○					○
	Forecast/ Prediction	F1	Provision of risk information by the earthquake early warning system according to an immediate damage estimate.		○	○	○	○	○					
		F2	Estimation of damage under the prediction technology based on big data and provision of real-time information about risk avoidance and safety.		○	○	○	○	○	○			○	○
	Structure	S1	Securement of higher earthquake resistance using the latest seismic technologies (structure and secondary members.)			○	○			○	○	○	○	○
		S2	Reduction of strong vibrations in high-rise buildings with a damping technique.			○	○	○				○		

Table 5. Improvements expected in the fields of energy and disaster prevention under SBCM

Establishment of autonomous energy distribution systems that can withstand disasters	Introduction of autonomous energy distribution systems including co-generation systems, which contribute to power saving during peak summer hours.
	Contribution to energy saving by the effective use of waste heat in the community.
	Implementation of advanced business support functions and self-sustaining energy generations by taking advantage of various urban development systems.
Attainment of a higher level in environmental achievement by establishing an energy/information network	Optimal energy utilization under central management by making the most of an information network.
	Implementation of such mechanisms that cope with social trends, including ICT-based demand response to reduce the peak power consumption.
	Adjustment of operating rates for future facilities and securement of energy efficiency for renewed facility.
Heat/energy supply by making the most of unused energies and renewable energies	Introduction of heat supply systems by making use of unused energies such as sewage heat to the area, where planar heat supply systems including community air-conditioning are effective.
	Examination as to utilization of unused energies including waste heat from waste incineration plants.
	Introduction of renewable energies including photovoltaic generation.
Reinforcement of disaster prevention functions	Allotment for evacuation areas including green zones in development planning.
	Construction of a road network to enhance the efficiency of emergency transportation.
Formulation of disaster prevention measures by each community/district through cooperation of residents, businesses and administrators	Development of organizational frameworks (e.g. the council for promoting the protection of the stranded around Shinagawa Station) in close cooperation among members of an entire community including railway companies, administrators and residents.
	Guidance to private enterprises regarding measures to promptly resume business operations after disaster by preparing fire protection water tanks, a sufficient amount of stockpiles and multiple communication lines.
	Establishment of disaster prevention organization in each district to observe emergency rules and to promote DCP.
	Formation of support systems for foreigners in case of emergency.
	Coordination of emergency activities through cooperation and linkage between companies: relief of disaster victims; operation of power/communication systems; preparation for food, drinking water and toilets; and information provision.
Promotion of BCP/DCP	Implementation of co-generation systems.

CONCLUSIONS

The concept of a smart city as a new type of urban lifestyle has been receiving much attention worldwide. The vision for the future society would be committed to the construction of a society which is able to cope with both reduced environmental burden and sustainable economic growth based on the 3E policy.

The process of SBCM implementation project applicable to the Shinagawa/Tamachi Stations area in Minato City, Tokyo, is examined. SBCM that is a basic concept of a smart city has been put together and the process for its implementation has been examined. These systems will surely provide comfortable livability and convenience even after the 2020 Olympic/Paralympic Games.

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