

SENDAI

Towards a Disaster-Resilient and
Environmentally-Friendly City





Aiming to Make Sendai a 'Disaster-Resilient and Environmentally-Friendly City'

Having experienced the Great East Japan Earthquake, we once again realized that cities are exposed to a variety of disaster threats. Based on the lessons learned from this disaster, Sendai City is proceeding to build a 'Disaster-Resilient and Environmentally-Friendly City,' which will be prepared for threats from future disasters and climate change.

With the affluent environment of Sendai, the City of Trees, as our base, we are promoting 'urban development' by improving the resilience of infrastructure and energy supplies as well as promoting 'human capacity building' that will help support disaster prevention activities in local communities. We focus on 'mainstreaming disaster risk reduction', while incorporating both this and environmental considerations into every policy, and maintaining a high level of security and safety in the lives of our residents and in our economic activities, in addition to maintaining the city's comfortable living environment.

While passing on our experiences and lessons learned from the Great East Japan Earthquake to future generations and nurturing our residents' disaster risk reduction culture, we will continue to share information on our various efforts. We will communicate efforts carried out by local communities, NPOs, businesses and research institutions by making use of the domestic and international networks that were created through hosting the Third United Nations World Conference on Disaster Risk Reduction in Sendai in March 2015.

We will focus on contributing to the world's disaster risk reduction culture and establishing a city brand for a comfortable living environment and a high level of disaster preparedness.

Outline of the Great East Japan Earthquake and the Damage Sustained

On March 11, 2011, Sendai City was struck by a tremendous earthquake of magnitude of 9.0 that occurred off the Sanriku coast of northern Japan. The earthquake recorded a maximum of 6 upper (on the Japan Meteorological Agency seismic intensity scale) in Sendai. The tsunami devastated the coastal areas of eastern Sendai. The city's hilly northwestern areas and their surroundings suffered significant landslides that damaged residential areas.

On the other hand, central Sendai did not suffer major damage such as that from the collapse of buildings or widespread fires; however, within the total municipal area, about 140,000 houses were either severely or partially damaged, or totally collapsed.

The disaster led us to face re-emerging challenges specific to urban areas, which include the operation of the evacuation centers where, at its peak, more than 100,000 people accounting for 10% of the city population stayed after the earthquake, providing short-term accommodation for stranded commuters who could not return home after the disaster, and responding to the needs of the elderly and people with disabilities.

Casualties : 904 deceased, 27 missing, 2,275 injured (as of March 1, 2017)
Damage to buildings : 30,034 totally destroyed, 27,016 severely damaged, 82,593 partially damaged, 116,046 minor damage (as of September 22, 2013)
Tsunami flooding : 8,110 households affected (including 1,160 farming households)

Experiences and lessons learned from post-disaster recovery

History of building Sendai as an environmental city - the City of Trees

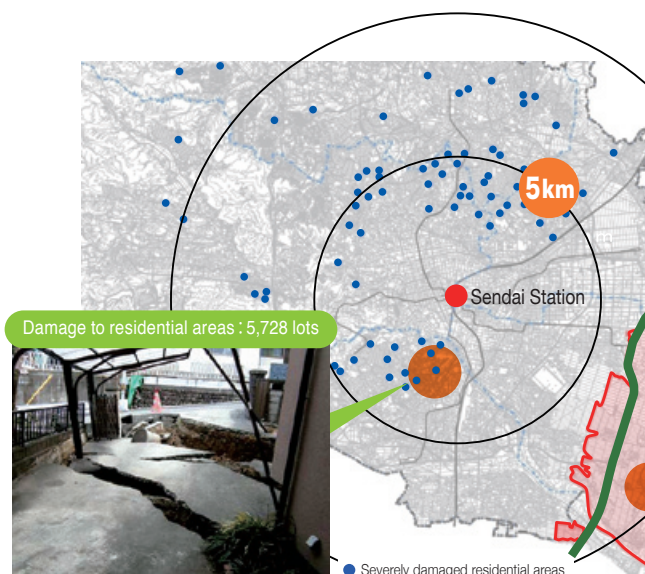
Disaster resiliency
Resilience
Recovery cap

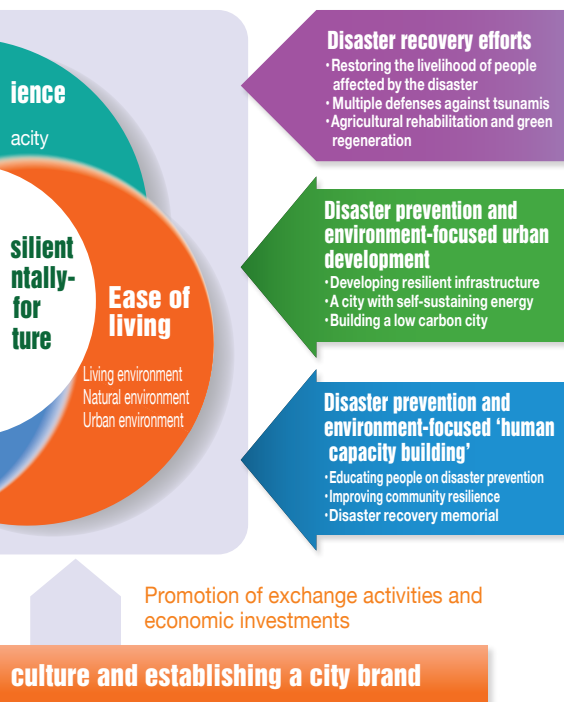
Disaster-Resilient and Environmentally-Friendly City
a secure future

Low carbon
Global environment

Sharing information throughout Japan and the world

Contributing to the world's disaster prevention





The Third United Nations World Conference on Disaster Risk Reduction (WCDRR)

In May 2011, two months after the disaster, Sendai City announced their hope to host the United Nations World Conference on Disaster Risk Reduction to convey their experiences of the disaster and the recovery of the disaster-affected areas. In December 2013, the United Nations General Assembly passed a resolution to hold the conference in Sendai, and it was held from 14 to 18 March 2015.

The main conference of the WCDRR was attended by over 6,500 participants, including 25 heads of state, over 100 ministerial-level delegates and the Secretary-General of the United Nations, representing government delegations from 185 countries, 49 intergovernmental organizations, 188 non-governmental organizations, and 38 international organizations. The public forum events, such as symposiums and exhibitions, were attended by a total of over 150,000 participants. The WCDRR in Sendai was one of the largest international conferences held by the United Nations in Japan.

Other events were held including study tours of the disaster-affected areas, excursions and receptions in cooperation with the six prefectures of the Tohoku Region.



Visitors at the Tohoku Reconstruction and DRR Pavilion (Sendai Mediatheque)



Study tour (Soma City, Fukushima Prefecture)



Closing ceremony (Sendai International Center)

The Sendai Framework for Disaster Risk Reduction 2015-2030

The Sendai Framework is the outcome document of the WCDRR and a successor to the Hyogo Framework for Action 2005-2015 that was adopted at the Second United Nations World Conference on Disaster Risk Reduction held in Hyogo Prefecture in 2005. Many countries have started to implement measures for disaster risk reduction based on the Sendai Framework for Disaster Risk Reduction, an international guideline up to 2030.

As the city where this framework was adopted, we are improving tangibles such as essential utilities and other infrastructure as well as promoting disaster risk reduction on the community level where a variety of residents, including children, elderly people, women and those with disabilities, play a main role in the efforts.

Features of the Sendai Framework

- Global targets such as reducing the mortality rate from global disasters were agreed upon for the first time
- New ideas, such as mainstreaming disaster prevention, pre-disaster investment to be used in measures for disaster prevention and disaster risk reduction, and the concept of 'Build Back Better' were presented
- Emphasis on roles of various relevant stakeholders (refer to page 12), including women, children and the private sector to take a preventive approach to prevent disaster and reduce disaster risk

Addressing 'Build Back Better' in Urban Infrastructure that Supports Everyday Life

Sendai City is implementing disaster risk reduction measures for a variety of urban utility systems, both in terms of knowledge and know-how, and in terms of equipment and facilities. These projects include restoration of the wastewater treatment facilities that suffered damage from the Great East Japan Earthquake and providing support for improving the earthquake resilience of houses and apartment buildings.

In addition, along with making urban utilities resilient, we are promoting programs for energy-saving measures and the wider use of renewable energy. From both the aspects of disaster risk reduction and environment protection, we aim to contribute to advancing the establishment of a sustainable society.

1 Restoration of Minami-Gamo Wastewater Treatment Plant

Before the disaster, the Minami-Gamo Wastewater Treatment Plant had been treating about 70% of Sendai's sewage. On March 11, 2011, a tsunami of over 10 meters in height hit the plant and caused catastrophic damage with building structures broken, its machinery and electrical facilities submerged or swept away, and transmission towers collapsed, resulting in the shutdown of sewage treatment functions. It was imperative to restore the plant promptly, since it was indispensable to the everyday lives of the residents in Sendai. Along with removing debris from the tsunami and restoring the facilities and equipment at the plant, we held discussions on how to implement quick recovery. In September 2011, a restoration policy was decided to restore the plant with better functions than it had previously. It took one year to complete the design of a new plant. The plant was constructed in around three years while successfully reducing construction time from the average of ten years that are usually required to complete such projects.

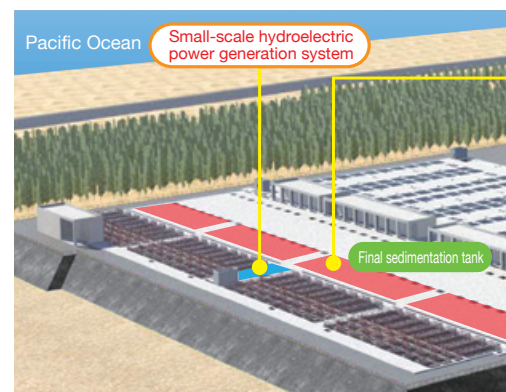


Minami-Gamo Wastewater Treatment Plant flooded by the tsunami on March 11, 2011

A new plant with energy saving features and low environmental impact

The primary and final sedimentation tanks are a two-tray system and the compact reactor tanks are installed underground. The plant is elevated to handle tsunamis of Tokyo Peil* (T. P.) plus 10.4 meters in height and the building doors are water-tight so that the plant is able to resist a tsunami the size of the one that hit Sendai after the Great East Japan Earthquake.

In the event of a blackout, a wastewater treatment and discharge line is secured to allow the minimum treatment and discharging of wastewater without using a pump. A solar power generation system has been installed, as well as a small



hydroelectric power generation system to reduce dependence on commercial power supply.

An approach of 'Build Back Better' is brought to the Sendai Framework. With this approach, recovery from the disaster does not simply involve rebuilding the damaged facilities and equipment to pre-disaster standards, but includes both restoration and improvements to them to cope with future disasters.

The Minami-Gamo Wastewater Treatment Plant has been reconstructed based on this approach.

*Tokyo Peil (T. P.) refers to the average sea level of Tokyo Bay, which sets the standard for sea level height in Japan.

Efforts to improve earthquake resilience

- Improving the earthquake resilience of sewage pipelines in the combined sewer system area.
- Construction of the Third Minami-Gamo Main Line
- Improving the earthquake resilience of wastewater treatment plants and pumping stations

Sewage pipeline



Pre-improvement



Post-improvement

Inquiries

Minami-Gamo Wastewater Treatment Plant, Construction Bureau kos011170@city.sendai.jp

2 Improvements in Earthquake Resilience of Underground Sewage Facilities

With the aging and deterioration of the sewer facilities, road collapses have occurred due to faulty sewage pipes in addition to equipment failures occurring at wastewater treatment plants and pumping stations. The total length of the sewage pipelines in Sendai are 4,684km, and about 200km of the pipeline has exceeded its service life, and such cases are expected to increase in the future.

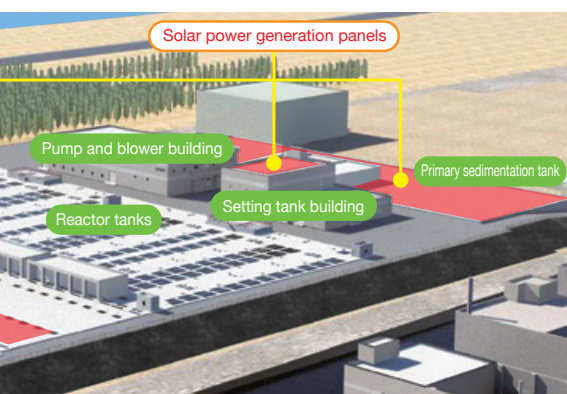
Inquiries

Sewerage Planning Section, Construction Bureau ges011210@city.sendai.jp

Improving the earthquake resilience of the sewage pipeline is an effective way to delay deterioration due to aging. Also, improving the earthquake resilience of the wastewater treatment plants and pumping stations together with their renewal, contributes to reducing costs. In this way, scheduled improvements to the earthquake resilience of facilities have been progressing.



Minami-Gamo Wastewater Treatment Plant after restoration



Layout of the Wastewater Treatment Plant



Technical cooperation with the City of Izmir in Turkey

3 Sewerage Business Continuity Plan

This business continuity plan consists of two parts, namely 'Earthquakes and Tsunamis' and 'Heavy Rainstorms.' The plan was formulated to mitigate the damage and recover quickly from such disasters. It predetermines responses and actions that staff members should take when a disaster occurs.

When the 2011 disaster occurred, quick initial responses were available. This was due to the fact that the sewerage disaster response manual had been created in FY 2006 and development of a sewerage business continuity plan began in 2010.

Inquiries Sewerage and Pipeline Coordination Section, Construction Bureau ges011120@city.sendai.jp

4 Asset Management of Sewerage Business

What is asset management?

Asset management is the process of planning, managing and implementing construction and maintenance operations to gain the maximum effect from assets (facilities) that are owned by organizations. When creating this scheme, an understanding of the present status of service and an estimate of potential operational risks are required. This is then followed by determining the standards for establishing the target objective and priorities of operations. The final step is implementation of continued improvements.

Japan's first ISO 55001 asset management system certification

The pipeline division of Sendai City's sewerage department received Japan's first international standard ISO 55001 Asset Management System Certification in FY 2013. Improvement of most of the sewage facilities in Sendai had been completed by FY 2008. In future, it will be necessary to promote measures against disasters such as earthquakes and inundation in addition to facility maintenance and renovation. In spite of limitations to budgets and personnel resources, by utilizing asset management we prioritize the most

important projects and estimate cost over the long term. By doing this we run projects steadily and efficiently, and ensure the safety of the facilities.

Investigations so far indicate that sewage pipes can be used for about 1.5 times their standard service life and sewage facilities for about 1.5-2 times theirs. We predict that reducing the number of renewals will lead to a reduction in costs. Immediately after the disaster, we were able to efficiently survey the damage using the asset management system.

Conveying experiences and lessons learned to the world

With the cooperation of the Ministry of Land, Infrastructure, Transport and Tourism and the Japan International Cooperation Agency (JICA), Sendai City is conveying valuable experiences and lessons learned from the disaster to the

world through technical cooperation with the City of Izmir in Turkey and to Latin American countries by accepting trainees and implementing other programs relating to disaster risk reduction and asset management.

Inquiries Business Planning Section, Construction Bureau ken010020@city.sendai.jp

Improvements in the Earthquake Resilience of Wooden Houses and Apartment Buildings

At the time of the Great Hanshin Earthquake in 1995, wooden houses built before the earthquake resilient building codes were introduced in 1981 were seriously damaged and many people were killed as a result. Learning from this disaster, Sendai City has been improving the earthquake resilience of city-owned buildings (about 99% completed as of the end of 2016), as

well as subsidizing the fee for earthquake resilience inspection and the renovation of wooden houses and apartment buildings. In addition, the City is providing advice based on the results of the inspection. This program has improved the earthquake resilience of 2,206 wooden houses and two apartment buildings in total over 13 years from 2004 to 2016.

Improvements in the disaster preparedness of apartment buildings

In 2013, Sendai City set up a 'Certification program for apartment buildings with improved disaster preparedness in Sendai - the City of Trees.' The City also formulated 'Guidelines for creating a disaster preparedness manual for apartment buildings,' which is used as reference when a apartment building association of owners make rules for disaster preparedness and prevention.



'Apartment Building with Improved Disaster Preparedness in Sendai - the City of Trees Certificate'

Inquiries Improvements in the earthquake resilience of wooden houses: Construction Guidance Section, Urban Planning Bureau tos009420@city.sendai.jp
Improvements in the earthquake resilience and disaster preparedness of apartment buildings: Housing Policies Section, Urban Planning Bureau tos009430@city.sendai.jp

Multiple Defenses to Minimize Tsunami Damage

Sendai City suffered tremendous damage from the tsunami during the Great East Japan Earthquake. Based on our experiences, we are making efforts to support the recovery of the eastern coastal areas from the tsunami damage and build more resilient communities.

To achieve this goal, we are developing measures to ensure safety and security in case of a 'once-in-several-hundred-years' tsunami by combining three approaches.

Said approaches involve creating multiple defenses at a number of facilities to prevent tsunami damage, evacuation from a tsunami, and the relocation of residents to safer areas.

1 Elevated Road

Construction to elevate a prefectural road running approximately 10km north-south through the coastal areas is progressing on schedule with completion expected by the end of FY 2018. The road will be elevated by 6m using, in part, tsunami sand and mud deposits, and debris from the earthquake and tsunami disaster. In this way, if a tsunami as devastating as that which occurred during the Great East Japan Earthquake were to occur, the elevated road would act as a coastal levee together with the coastal disaster prevention forests to considerably mitigate flood damage.



Inquiries

Southern Road Construction Section, Construction Bureau ken010180@city.sendai.jp

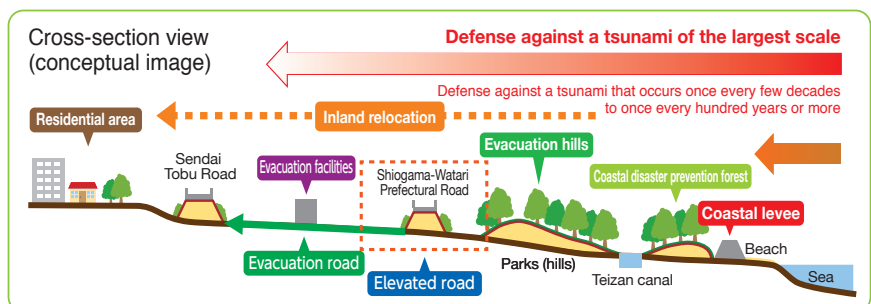
2 Coastal Levee

First, to prepare for a tsunami that may occur frequently (once every several decades to once every hundred years or so), we launched a project to construct a coastal levee of about 9km in length and a height of T. P. plus 7.2m, jointly with the national government and the Miyagi Prefectural government. The levee was completed in March 2017. The levee is designed so that, in the event of a tsunami that exceeds our expectations, the breakdown or collapse time of the levee can be extended or the possibility of its total collapse can be reduced.



Inquiries

Agricultural Administration Planning Section, Economic Affairs Bureau kei008110@city.sendai.jp



Bird's-eye view map



- Coastal levee, river levee, etc. — Elevated road ● Evacuation hills ▲ Evacuation facilities
- Coastal disaster prevention forest ■ Disaster risk area (Inland relocation) □ Inland relocated residential area
- Evacuation roads → Disaster prevention collective relocation movements 🚪 Tobu Road evacuation stairs

3

Coastal Disaster Prevention Forest and Evacuation Hills

We are rebuilding coastal disaster prevention forests and improving Kaigan Park to restore the natural environment and landscape around the coastal areas, in addition to revitalizing the coastal areas to make them new and attractive spots for social interactions.

The development of Kaigan Park includes construction of various sections, with the Gamo development area as a 'sports zone', the Arahama development area as a 'recreation zone', the Ido development area as a 'play zone', and the Fujitsuka development area as a 'nature zone'.

A hill 10-15m in height designed for temporary evacuation has been built in each of these zones, allowing for the evacuation of nearby residents and visitors up to the hills when a tsunami strikes. In FY 2016, the Fujitsuka development area of Kaigan Park, was completely opened, and the Gamo and Arahama development areas in July 2017. The Ido development area is undergoing improvements toward its scheduled opening in FY 2018.

Inquiries Park Management Section, Construction Bureau ken010220@city.sendai.jp



Evacuation hill (Fujitsuka area)



Evacuation hill (upper) and Kaigan Park (lower) (Arahama area)

4

Evacuation Roads

Construction of the three main roads on the evacuation route from the elevated road to the Sendai Tobu Road will be completed by the end of FY 2018, allowing people and cars to smoothly evacuate from a

tsunami. Other city roads will be improved to function as evacuation routes by installing evacuation guide signposts, partially widening roads at crossing points, and implementing other measures.

Inquiries Southern Road Construction Section, Construction Bureau ken010180@city.sendai.jp

5

Evacuation Facilities

In areas which may experience flooding from a tsunami, we constructed a total of 13 evacuation facilities, including six towers, five buildings with fire corps' stations, and two sets of outdoor tsunami evacuation stairs for existing elementary and junior high schools. The evacuation tower in Nakano 5-chome is a two-story steel-framed structure that stands over 6m above the ground, allowing 300 people to evacuate at any given time.

evacuees from cold weather and hypothermia as well as installing slopes for wheelchairs and strollers to provide easy access for the elderly and those with walking disabilities. We have stockpiled electric generators, blankets, water, foodstuffs, portable toilets, etc. with the expectation that evacuees would stay at the evacuation centers for around 24 hours.

Cooperation with the private sector

Sendai City has concluded an "Agreement for use of temporary tsunami evacuation shelters" with the private sector. East Nippon Expressway Company Limited constructed evacuation stairs at five locations that provide access to Sendai Tobu Road.

Inquiries Disaster Prevention Planning Section, Crisis Management Department kks000120@city.sendai.jp



Tsunami evacuation tower at Nakano 5-chome



Outdoor tsunami evacuation stairs at Okada Elementary School



Sendai Tobu Road evacuation stairs

Inland Relocation

(Disaster Prevention Collective Relocation Promotion Project)

In addition to constructing or improving a variety of facilities to prevent damage from tsunamis, we implemented a relocation promotion project for 1,540 households to move from the designated disaster risk areas where tsunamis are expected to flood the

land up to a height of 2m. Sendai City is promoting effective utilization of land purchased from residents who moved out to relocated sites in order to create new value and attractiveness for the land.



Rokugo area



Near the Tago-nishi area

Inquiries Post-disaster Reconstruction and City Planning Section, Urban Planning Bureau tos009140@city.sendai.jp

Aiming to Produce Energy Locally for Local Consumption

Conventional large, centralized energy systems were shown to be vulnerable during the Great East Japan Earthquake.

Sendai City is actively creating a base for disaster-resistant, energy-efficient decentralized energy sources and introducing renewable energy sources, as well as promoting cutting-edge research and development of next-generation energy sources with low environmental impact.

1 Disaster Prevention Solar Energy System

Introduction of the system to designated refuge areas



Immediately after the disaster, electricity, gas and gasoline supplies were suspended, causing various problems during the initial disaster response such as the operation of evacuation centers.

By the end of FY 2017, based on our experiences of the disaster, we will have introduced a solar power generation system combined with a storage battery to 196 facilities, including elementary and junior high school buildings, which are used as designated refuge areas during a

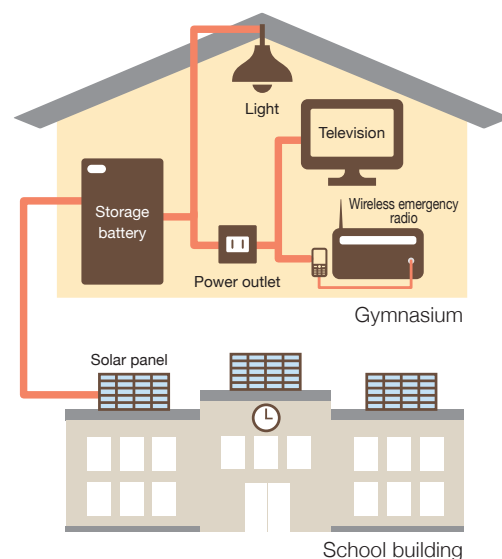
disaster. With this system, a stand-alone power supply is secured when a disaster occurs while reducing CO₂ emissions in regular circumstances.

During power outages, electricity is supplied from the system during the day and from the storage battery during the night. This allows operation of information communications equipment such as disaster prevention radios and televisions as well as lamps.

System features

	 Daytime	 Night-time
Regular circumstances	Electricity generated by solar power is supplied and contributes to the reduction of CO ₂ emissions.	When the storage battery is in a state of discharge, it is charged overnight.
During power outages	Electricity generated by solar power is supplied while concurrently storing it in a storage battery.	Electricity charged during the day is supplied.

Conceptual image of the system

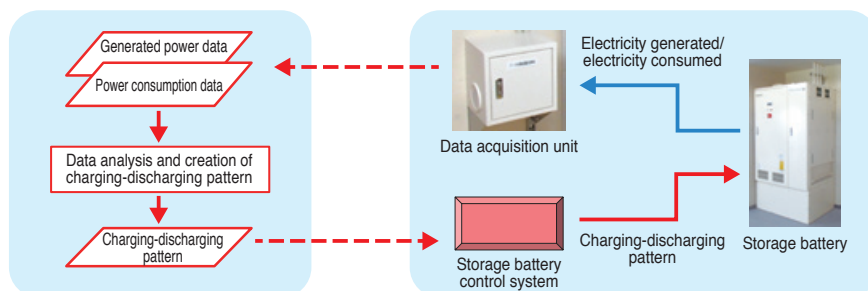


Storage battery with a longer use-life

There was concern that, due to the features of the storage battery, its use-life would be shortened by keeping it fully charged for a long period of time in preparation for power outages.

To address this problem, we intend to make the storage battery use-life longer by paying close attention to control battery operation as well as shaving peak power consumption and effectively using solar power generation.

Conceptual image of storage battery control



Introduction to private facilities

Sendai City subsidizes half of the cost required (up to 10 million Yen) to install renewable energy systems at private facilities which are designated as regional disaster response centers in the event of

a disaster in accordance with the Sendai City Regional Disaster Prevention Plan. Sendai City subsidized seven such facilities between FY 2013 and FY 2016.



Solar panels (Asuto-Nagamachi Kobuta-no-Shiro Nursery School)



Tago-nishi Eco Model Town

2 Eco Model Town Project

The 'Eco Model Town Project' addresses the issue of developing a town where necessary energy is self-produced in an efficient manner without excessively depending on specific energy sources. An energy management system has been introduced to efficiently supply electricity generated through a variety of methods combining solar panels, storage batteries,

and gas co-generation systems* (producing electricity and hot water from city gas). The system is now operating at the disaster reconstruction municipal housing units and detached houses in the Tago-nishi area and the disaster reconstruction municipal housing units in the Arai-higashi area. *The gas co-generation system is used only in Tago-nishi.

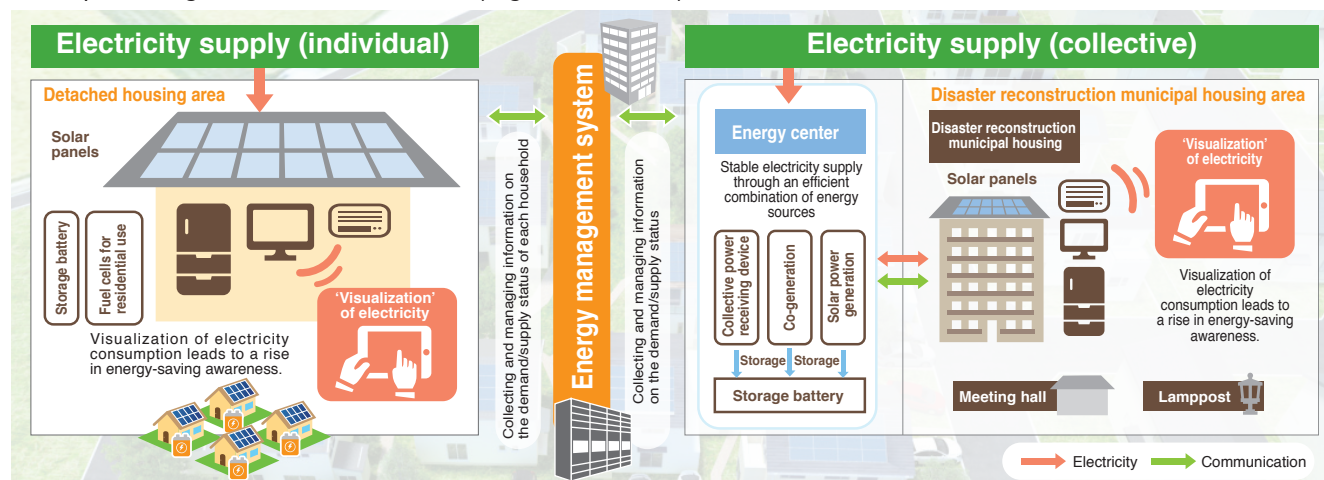
Features

- 1 A private business is implementing a ten-year town management project which supplies electricity and water* and also provides a service to visualize the amounts of electricity generated and consumed.
*Water supply is only in Tago-nishi
- 2 Even in the event of a blackout, electricity is supplied to a meeting hall for residents located on the premises. The meeting hall is used as a place for residents to gather and also as a short-term evacuation area during disasters.

Advantages for residents

- Putting a model of energy-saving activity into practice through visualization
→ **Reducing utility costs**
- Supplying electricity to the meeting hall during a disaster
→ **Securing a disaster response center**
- Raising disaster prevention awareness on the local community level
→ **Mutual support between members of the local community**

Conceptual image of the Eco Model Town (Tago-nishi district)



3 Next-generation Energy Creation Research and Development Program

Subsidy program for projects promoting the creation of new energy

Sendai City subsidizes facilities that produce/supply clean and stable energy or those that conduct research and development and/or conduct demonstration tests on next-generation energy sources. The subsidy

corresponds to the amount of their fixed asset taxes for a maximum of up to 5 years. In addition, if five or more new, full-time employees are employed, the subsidy is increased by 600,000 yen per new employee.

Research on a groundbreaking, next-generation energy source produced from algae

With the joint collaboration of the University of Tsukuba and Tohoku University, Sendai City is promoting a research project on "algal biomass" that aims to produce petroleum from household wastewater. We constructed the "Sendai Minami-Gamo Biomass Technological Development Laboratory" and an outdoor pilot plant on the premises of the Minami-Gamo

Wastewater Treatment Plant, and have conducted research on culturing algae using wastewater and oil extraction and purification. In collaboration with private businesses, Sendai City is advancing its research and development projects based on results obtained thus far.



A combined electricity and heat supply system project using wood biomass for electricity sales and heat utilization (FY 2016 Keiwa Kogyo Corporation)



Outdoor algae biomass pilot plant

Tackling Community Disaster Prevention through Self-Help, Mutual Aid, and Public Assistance

Damages from disasters cannot be reduced only by tangible measures such as the construction and improvement of facilities. Individual residents' preparations for disasters in their daily lives as well as mutual support between members of the community played an important role in reducing damage from the Great East Japan Earthquake.

'Self-help' by individuals to secure safety for themselves and their families, 'mutual aid' by members of the local communities to support one another, and 'public assistance' from the government are integrated in a coordinated way to support disaster prevention and disaster risk reduction.

1 Sendai City Disaster Prevention Plan

In 2013, two years after the disaster, this plan was revised by incorporating additional policies, including 'disaster risk reduction' to minimize damage from a disaster, focusing attention on the needs of people requiring assistance during a disaster, and the promotion of gender equality, into the basic policy.

To promote 'mutual aid' activities undertaken

in local communities, the plan was divided into 'Self-help and Mutual Aid' and 'Public Assistance' to specifically envisage what kind of activity is required for each party. In this plan, 'Self-help and Mutual Aid' describes activities by individual residents and neighborhood associations, and 'Public Assistance' describes Sendai City programs.

Inquiries Disaster Prevention Planning Section, Crisis Management Department kks000120@city.sendai.jp

2 Community Initiatives for Prior Preparations

Community-based evacuation center operation manual

The disaster brought to light various problems in the evacuation center operation system. Thus, when reviewing the Sendai City Disaster Prevention Plan, we created an Evacuation Center Operation Manual based on feedback from local residents, who participated in the operation of evacuation centers at the time of the disaster, and from facility operators.

Using this manual, three parties, namely, community organizations, Sendai City and facility operators, are working together to create a tailored manual for each community. Out of 193 designated refuge areas, 191 areas created their own operation manual as of the end of August 2017, which led to enhanced awareness of disaster prevention in each community.

Inquiries Disaster Prevention Planning Section, Crisis Management Department kks000120@city.sendai.jp

Comprehensive disaster preparedness drills to improve the capacity of residents and communities to deal with disasters

Sendai City aims to realize 'disaster prevention' with the collective strength of its residents in order to protect their lives from large-scale earthquakes and tsunamis. This is allowed by carrying out disaster prevention drills based on 'self-help' 'mutual aid' and 'public assistance' in a well-balanced manner throughout the year.

From FY 2017, as a citizen-oriented disaster preparedness drill, Sendai City has started conducting the Shake Out drill on 'Residents Disaster Prevention Day' on June 12 every year. Taking shelter under a desk at the workplace or school all at once in the event of an earthquake is part

of one of the drills to help you to protect yourself. At business establishments and at home, emergency items for disasters are checked to see if they are in sufficient supply. During the 'Disaster Prevention Week' in early September, we carry out disaster preparedness drills to prepare for the possibility of stranded commuters based on a scenario of interruption of all public transportation.

In addition, the comprehensive disaster prevention drills in each area aim at further improving disaster prevention capabilities through fostering new leaders for the drills, and members of local communities play a central role in these efforts.

Inquiries Disaster Risk Reduction Promotion Section, Crisis Management Department kks000130@city.sendai.jp

Self-Help

Individual residents will take action to secure safety for themselves and their families during a disaster.

Mutual Aid

Local organizations such as neighborhood associations will take action to secure the safety of their local communities during a disaster.

Public Assistance

The government will work to improve tangible aspects of disaster prevention such as infrastructure and facilities as well as intangible aspects such as 'self-help,' 'mutual aid.'



Junior high school students serving hot meals



Confirmation of evacuation routes



3 Development of Sendai City Community Disaster Preparedness Leaders

In order to improve voluntary disaster prevention organizations and the disaster prevention capacity of the entire Sendai area, Sendai City started an independent training program in FY 2012 to develop Sendai City Community Disaster Preparedness Leaders (SBL)*. About five SBLs will take a central role in each 'Alliance of Neighborhood Associations' in the city. 638 participants (including 154 women) have attended the training during the five years up to FY 2016. In the future, we will raise the awareness of SBL, involving more women and youth in this program, and enhance mutual cooperation between SBLs in addition to

developing new leaders and holding 'back-up' training sessions.

*The abbreviation is for Sendai Bosai (disaster prevention) Leader



Drill to rescue people from a collapsed building



Disaster imagination training



Lecture on the basics of evacuation center operation

Inquiries Disaster Risk Reduction Promotion Section, Crisis Management Department kks000130@city.sendai.jp

4 The Local Community Helps Residents in Need

Registration system for people requiring assistance during a disaster

This registration system provides local community organizations with information on people who require assistance such as confirmation of their safety or the need for help in evacuating. It allows each community to create their own evacuation support system. People who require assistance during a disaster must apply for registration. 12,283 persons were registered as of June 2017.

Inquiries Social Affairs Section, Public Health and Welfare Bureau fuk005320@city.sendai.jp

Help card

A 'help card' is available for people with disabilities to make it easier for them to ask

for attention or help when a disaster or problem occurs or in an emergency. It is the size of a business card with information on their emergency contacts, names of hospitals/clinics they are consulting with, and the support they require. We encourage people requiring assistance during a disaster to use the help card and to apply for the registration system.



Help card

Inquiries Disabled Planning Section, Public Health and Welfare Bureau fuk005330@city.sendai.jp

Welfare evacuation center

To cope with the difficulty of living in designated refuge areas, the welfare evacuation center is a secondary evacuation center made available for the elderly, people with disabilities or other people who require assistance during a disaster.

Sendai City is developing a system to respond to the individual needs of people requiring assistance. This is being done by increasing the number of welfare facilities that have agreements with the City to allow their facility to be used as welfare evacuation centers, as well as providing necessary materials and equipment, and emergency supplies. There were 115 welfare evacuation centers in Sendai as of the end of September 2017.

Inquiries General Affairs Section, Public Health and Welfare Bureau fuk005010@city.sendai.jp

5 Substantial Stockpiling of Emergency Supplies

Sendai City encourages each household to stock a minimum of a weeks' worth of food items, drinking water, and daily commodities as well as medical supplies. We are also stockpiling supplies for the public as part of our disaster preparedness policy. Sendai City has stockpiled food (six meals) and drinking water (2L) for two days for a maximum of 106,000 evacuees. The City also has items used by women, elderly people, and babies and infants

such as powdered milk, disposable diapers, and tent-style private rooms stored in evacuation centers and ward offices. Also, we have 101 community disaster prevention centers with warehouses of disaster prevention materials and equipment. Simplified disaster prevention materials and equipment are provided for areas without centers. When a disaster occurs, people can use the stockpile of various types of equipment for voluntary disaster prevention activities.



Community disaster prevention center's warehouse

Use of emergency supplies

In 2010, Sendai City introduced a 'running stock system' to stockpile goods for disasters- the first case that this system was introduced in an ordinance-designated city. Under this system, the goods that the city has purchased, such

as disposable diapers, sanitary items, and toilet paper are put in the distribution route of sales companies and stored in their warehouses as part of emergency supplies, and, in times of disaster, the goods are sent to evacuation centers. This system

has the advantages of saving costs and not needing a warehouse to store goods. Immediately after the Great East Japan Earthquake, these stockpiled goods were provided to each evacuation center according to this system.

Inquiries Disaster Prevention Planning Section, Crisis Management Department kks000120@city.sendai.jp

Disaster Risk Reduction Initiatives by Various Stakeholders*

To effectively promote disaster risk reduction measures, it is necessary for all concerned persons and agencies such as governments, businesses, community-based organizations, and research institutes, to actively work together. We are promoting disaster risk reduction measures by ‘stakeholders’* that include all residents from children to the elderly, irrespective of gender or nationality, the presence or absence of disabilities, so that they can live in safety and security.

*Stakeholders refer to concerned parties that cover a wide range of individuals and groups such as civil society, local communities, academic organizations, and businesses. The Sendai Framework adopted at the WCDRR, newly indicates the importance of empowering women, youth, and having them take a leading role in disaster risk reduction.



1 Promotion of Sendai's Disaster Prevention Education

In order to convey lessons learned from the Great East Japan Earthquake to children in present and future generations, Sendai has striven, since soon after the disaster, to nurture children's capacity to think, judge, and act in times of disaster so that they will have the capacity to take action to help themselves and others.



Creating a disaster prevention map

Inquiries Educational Supervision Section, Educational Bureau kyo019120@city.sendai.jp

2 Sendai Workshop on Disaster Risk Reduction, 'Shelters for Everyone'

The various problems women faced in evacuation centers at the time of the disaster were often due to the fact that there were only a small number of women participating in the decision making process with regard to the operation of evacuation centers. Thus, in collaboration with residents, the Sendai Gender Equal Opportunity Foundation created a workshop program called 'Shelters for Everyone' that employs the female viewpoint in the operations of evacuation centers. This

program has been implemented at civic centers and adult education classes so that various persons, especially women, can take part in local disaster prevention activities on a routine basis.

In the program, participants discuss solutions using actual problems that occurred in the evacuation centers. They realize that others have viewpoints and thoughts that would not occur to them. As a result, they will realize that solutions that suit everybody can be produced by sharing each other's knowledge.

Inquiries Gender Equal Opportunity Section, Community Affairs Bureau sim004180@city.sendai.jp

3 Measures for Stranded Commuters with Cooperation from Businesses

At the time of the Great East Japan Earthquake, public transportation was suspended and many people could not return to their homes. Confusion resulted from non-residents who rushed to nearby evacuation centers, making it impossible for local residents to get into their designated centers.

Using this as a lesson, Sendai City plans to collaborate with organizations and businesses to use train stations, hotels, commercial facilities, and university campuses as temporary lodgings when a disaster occurs. It is expected that, around transport hubs such as JR Sendai Station,

about 14,000 people will be unable to return home during a major disaster in the future. The city will cater for these people at these sites.

A 'liaison council' was established by concerned parties located around JR Sendai Station. In May 2014, they drew up policies to cope with stranded commuters. They include stopping commuters from going home all at once and specifying the measures that people must take, and roles and responsibilities during a disaster, as well as holding disaster drills on a regular basis.

Inquiries Disaster Risk Reduction Promotion Section, Crisis Management Department kks000130@city.sendai.jp

Supplementary Readers for Disaster Prevention Education

This reading material was created to raise children's awareness about disaster risk reduction and develop their ability to judge and act. The material contains stories of children who experienced the disaster as well as questions about what to do in an emergency that will lead children to develop their independence. It consists of three separate volumes, one for 1st to 3rd year elementary school students, one for 4th to 6th year elementary school students, and the third for junior high school students, so as to deepen their understanding according to their developmental stage.



Disaster prevention workshop



Drills for stranded commuters



4

Investigation and Research Conducted by the International Research Institute of Disaster Science (IRiDeS), Tohoku University



Field survey on the 2016 Kumamoto Earthquake



Giving a class in the Philippines

The International Research Institute of Disaster Science (IRiDeS) was established at Tohoku University in April 2012, one year after the disaster. It is involved in a new field of interdisciplinary research to study responses to low-probability 'mega disasters' that cannot be handled effectively with a traditional disaster prevention or disaster risk reduction system. IRiDeS is made up of researchers working in various fields that include literature, science, engineering, informatics, and medicine. IRiDeS conducts a wide range of activities such as explaining the outbreak mechanisms of massive earthquakes and tsunamis,

constructing an archive of the disaster, and handing out the 'Disaster Prevention Handbook for Everyone.' IRiDeS are also carrying out emergency surveys in Japan and overseas so that this knowledge can contribute to the restoration of Tohoku and the mitigation of damage from disasters throughout the world.

Based on an agreement with Sendai City, IRiDeS has drawn up a disaster prevention plan for the Sendai area. They have also developed tsunami evacuation measures such as the creation of hazard maps, made improvements to evacuation centers, and continues to hold workshops to help residents make evacuation maps.

Establishment of the Global Centre for Disaster Statistics

Tohoku University established the Global Centre for Disaster Statistics in March 2015 in collaboration with the United Nations Development Programme (UNDP). By accumulating and analyzing disaster statistics on fatalities and economic losses caused by disasters. The center aims to contribute to the planning of disaster risk reduction and development policies for countries and regions as well as implementing the Sendai Framework. A project to collect disaster damage and loss data is in progress in seven countries including Indonesia and Myanmar.

Inquiries

Public Relations Office, IRiDeS koho-office@irides.tohoku.ac.jp

5

Assistance to Foreign Residents and Visitors during a Disaster

Setting up the Sendai Disaster Multilingual Support Center and foreign language volunteers for disaster response

When a large scale disaster occurs, Sendai City sets up the Disaster Multilingual Support Center to support foreign residents and visitors who may be unable to obtain sufficient information due to language difficulties or differences in customs. Its operation is managed by the Sendai Tourism, Convention and

International Association.

Also, the center has a registry of foreign language volunteers who provide assistance during a disaster. As part of their training, volunteers participate in community disaster drills and play the role of an interpreter for foreign residents.

Disaster prevention education for foreign residents

In order to raise foreign residents' awareness of disaster preparedness and to provide smooth support to them during a disaster, Sendai City sends out disaster prevention information through the distribution of disaster prevention pamphlets and DVDs in different languages, and provides disaster preparedness drills and training for newly arrived foreign residents. In addition, we broadcast programs of disaster preparedness talks featuring foreign residents and bite sized disaster prevention advice in different languages through collaboration with an FM radio station.



Disaster prevention video in 12 languages (produced by Sendai Tourism, Convention and International Association)



Sendai Disaster Multilingual Support Center immediately after the disaster (March 2011)



Volunteers interpreting how to perform CPR at a community disaster prevention drill

Inquiries

International Relations and Planning Section, Culture and Tourism Bureau kik002040@city.sendai.jp

Disaster Preparedness Course in Japanese-language Classes

Since FY 2017, Sendai City has been providing a disaster preparedness course targeting foreign residents who are studying Japanese-language classes at shimin centers. With an interpreter's assistance, they are able to learn about Japanese disaster terms, how to use a storm

and flood hazard map and understand the content of disaster information such as disaster advisories released from the city.

As of September 2017, this course has been held five times thus far, with a total of 117 foreign residents having attended the course.



Conveying Our Experiences and Memories of the Great East Japan Earthquake to the Future and the World

As the number of Sendai residents who have not experienced the Great East Japan Earthquake increases, we need to remember our experiences and the lessons learned from the disaster so that we can prepare ourselves for future disasters.

Therefore, we must keep our memories, knowledge, and the grief we felt in a form that can be handed down to future generations.

Sendai City aims to pass on memories of the disaster through the management of memorial facilities and the archiving of videos and photographs in collaboration with residents and community groups. As a city where the Sendai Framework was adapted at the Third UN World Conference on Disaster Risk Reduction, we are committed to passing on our experiences and lessons learned from the disaster, thus contributing to disaster prevention and disaster risk reduction in the world.

1 Ruins of the Great East Japan Earthquake : Sendai Arahama Elementary School

Sendai City is preserving the Arahama Elementary School building as a tsunami memorial, so as to pass on the lessons learned from this disaster to future generations while striving to reduce the impact of the damage and casualties that may occur in the event of a tsunami. The memorial has been open to the public since April 2017.

Located about 700m inland from the coastline, Arahama Elementary School was attended by 91 students before the 2011 disaster. Although the tsunami flooded the school building with water up to the second floor, 320 persons, including students, teachers and staff of the school and nearby residents who had evacuated to the building, were all safely rescued.

Inside the school building, visitors learn about the tremendous damage that can occur during a tsunami through photos of destroyed classrooms and photos taken immediately after the tsunami struck the school in 2011. There are also DVDs on the history of the Arahama area and materials that recall the elementary school before the disaster so that these memories can be conveyed to future generations.



Exterior of Arahama Elementary School



Exhibition room, 4th floor:
Memories of Arahama from March 11, 2011



Exhibition room, 4th floor: History and Culture of Arahama, and Memories of Arahama Elementary School

Inquiries

Disaster-Resilient and Environmentally-Friendly City Promotion Office, City Planning Policy Bureau mac001605@city.sendai.jp



Exhibition room, 2nd floor

2 Sendai 3/11 Memorial Community Center

At the eastern terminus of the Tozai Subway Line, located inside Arai Station, is the Sendai 3/11 Memorial Community Center. The center opened in February 2016 as a place to archive items so they can be used to pass on the experiences and lessons learned from the 2011 disaster. The 1st floor is a 'communication space' that provides information on the eastern coastal areas affected by the tsunami using maps and slides. On the 2nd floor, there is an exhibition room where visitors can see and learn about the destruction wrought by the tsunami and

earthquake, the progress made thus far in our restoration and reconstruction efforts, and scenes of the eastern coastal areas before the disaster. There is also a studio used for holding workshops or other civic activities on the same floor. The rooftop is utilized as a space to rest.

The Memorial Community Center is not only a facility for displaying exhibits but also a place where people from all walks of life, including residents, residents' groups and NPOs, are able to gather and take part in various activities and build new relationships.

Inquiries

Sendai 3/11 Memorial Community Center office@sendai311-memorial.jp



3 Remember 3/11 Center



Hallway, 1st floor

In May 2011, the 'Remember 3/11 Center' (also known as 'Wasuren!') was established at Sendai Mediatheque as a base for recording information about the disaster and the recovery and reconstruction process from it, with the collaboration of residents, experts, artists, and center staff.

Videos, photos, and sound clips of what was seen and heard by people in various disaster situations are organized and kept as 'Chronicles of the Disaster: Residents' Collaborative Archive' after properly managing the information rights. The records can be viewed on the center website or borrowed from libraries, and are sometimes exhibited or screened. In addition, meetings to discuss the disaster using videos, photos, and sound clips are held. By the end of July 2017, a total of 495 videos, 2,840 photos, and 54 sound clips have been released on the website, some of which have been translated into English.

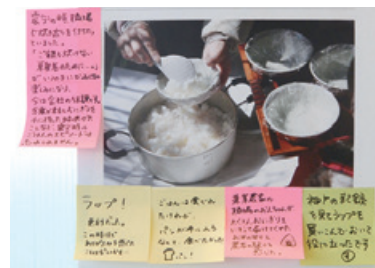


Photo exhibition 'March 12: Hajimari no Gohan (Meals that mark a new start)' (in collaboration with the Remember 3/11 Archive)



Exhibition - Life Post Disaster (Jointly hosted with the executive committee for the Fukushima Disaster Ruins Preservation Project)

Inquiries Activity Support Department, Sendai Mediatheque office@smt.city.sendai.jp

4 Publication of Chronicles of the Post-Disaster Period

We published the 'Sendai City's Five-year Recovery Records from the Disaster' which compiles our efforts for post-disaster reconstruction and disaster risk reduction over five years from the outbreak of the disaster until the completion of the reconstruction plan as scheduled. We hope that this report will be of help for disaster preparedness in the future by passing down the challenges we encountered during the disaster, the lessons we learned from this

experience, and the responses we took to future generations. The report was sent to municipalities throughout Japan. 'Road to Recovery SENDAI' includes interviews on reconstruction efforts by various people and groups, such as Sendai residents, local community groups, NPOs, private companies and volunteers, who played a driving role in reconstruction. Both reports have been released on the official website of Sendai City.



'Sendai City's Five-year Recovery Records from the Disaster' (upper) and 'Road to Recovery SENDAI' (lower)

Inquiries Post-Disaster Reconstruction Department, City Planning Policy Bureau som000300@city.sendai.jp

5 Sendai Symposium for Disaster Risk Reduction and the Future

In March Sendai City annually holds the 'Sendai Symposium for Disaster Risk Reduction and the Future' so that Sendai residents' strong awareness of disaster preparedness will continue after the Third UN World Conference on Disaster Risk Reduction. The symposium also acts as a platform for people working on disaster reconstruction and in disaster risk reduction in the Tohoku region to gather in Sendai and make presentations on their efforts and work to further exchanges. Challenges of disaster preparedness in local communities and future directions for disaster risk reduction are addressed through theme sessions such as: 'passing on the disaster experience,' and 'raising

next-generation leaders to work for disaster preparedness for local communities in future.' This forum also includes exhibitions and mini-presentations.



Activity report by junior high school students

Inquiries Disaster-Resilient and Environmentally-Friendly City Promotion Office, City Planning Policy Bureau mac001605@city.sendai.jp

Sending Out Information through Presentations at International Conferences and Hosting Study Tours

To contribute to disaster risk reduction, Sendai City makes presentations at domestic and international conferences, and actively hosts study tours for people involved in disaster prevention from domestic and international organizations and companies. They include training programs for JICA and other municipalities' staff.



The Fifth Session of the Global Platform for Disaster Risk Reduction (Cancun, Mexico)



City of Sendai
Disaster-Resilient and
Environmentally-Friendly City
Promotion Office

3-7-1 Kokubuncho, Aoba-ku, Sendai 980-8671 Japan

Tel: +81-(0)22-214-8098

Fax: +81-(0)22-214-8497

E-mail: mac001605@city.sendai.jp

<http://sendai-resilience.jp/en/>

Issued in November 2017

