City of Sendai

# Restoration and Challenge of Sendai

## Towards a Disaster-Resilient and Environmentally-Friendly City



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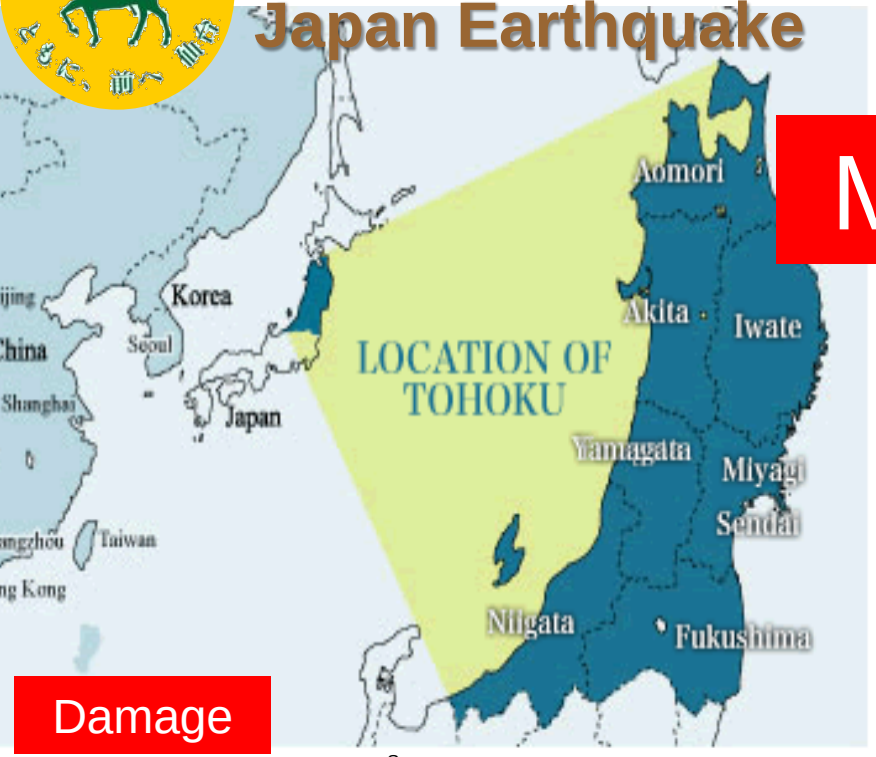
# Overview of Damage from The Great East Japan Earthquake




**M9.0**

Epicenter

(Miyako City , Iwate)

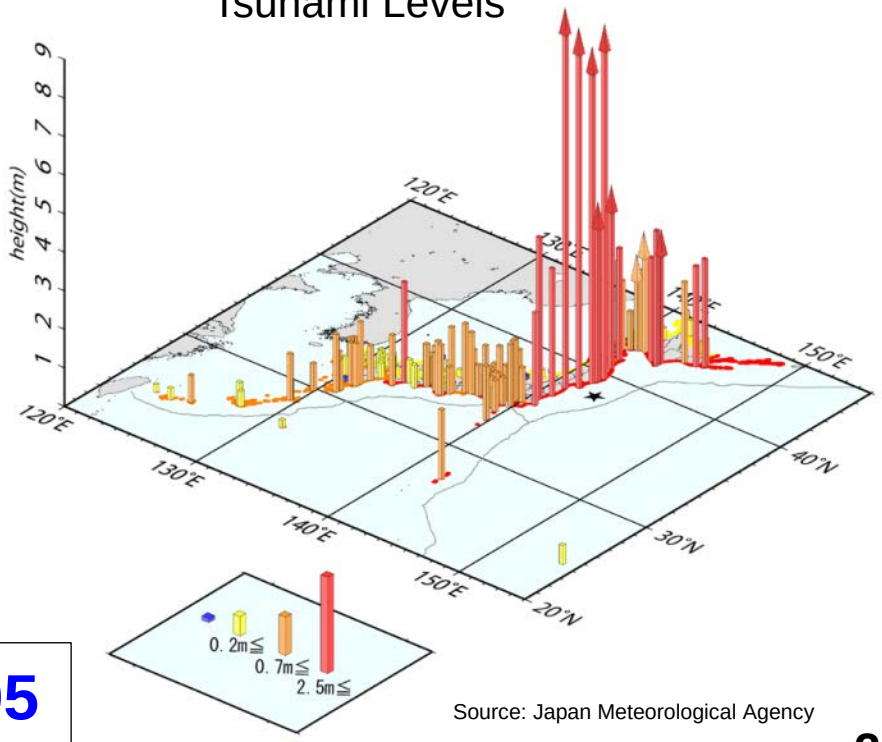
Source: Fire and Disaster Management Agency

## Damage

Source:
National Police Agency (death toll and building damage as of Mar. 10, 2016)
Reconstruction Agency (Quake-related deaths as of Sep. 30, 2015)

| | Death Toll | Completely Collapsed Homes |
|---|---|---|
| Iwate | 5,128 | 19,597 |
| Miyagi | 10,459 | 82,999 |
| Fukushima | 3,592 | 15,171 |
| Aomori | 3 | 308 |
| Yamagata | 4 | |
| **Nationwide** | **19,301** | **121,805** |

## Tsunami Levels




Source: Japan Meteorological Agency

# Damage in Sendai City

## Casualties

| | Within Sendai City | |
|---|---|---|
| | | Sendai Citizens |
| Deaths | 904 | 809 |
| Missing | 26 | |
| Injured | 2,275 | |

(as of Mar. 31, 2016)

* The number of deaths includes those related to the disaster.
* 1,002 Sendai residents lost their lives. (191 Sendai residents confirmed dead outside of Sendai)

## Buildings

| | Sendai City |
|---|---|
| Completely Collapsed | 30,034 |
| Severely Damaged | 27,016 |
| Partially Damaged | 82,593 |
| Minor Damage | 116,046 |

(as of Sep. 22, 2013)

## Estimated Cost of Damage

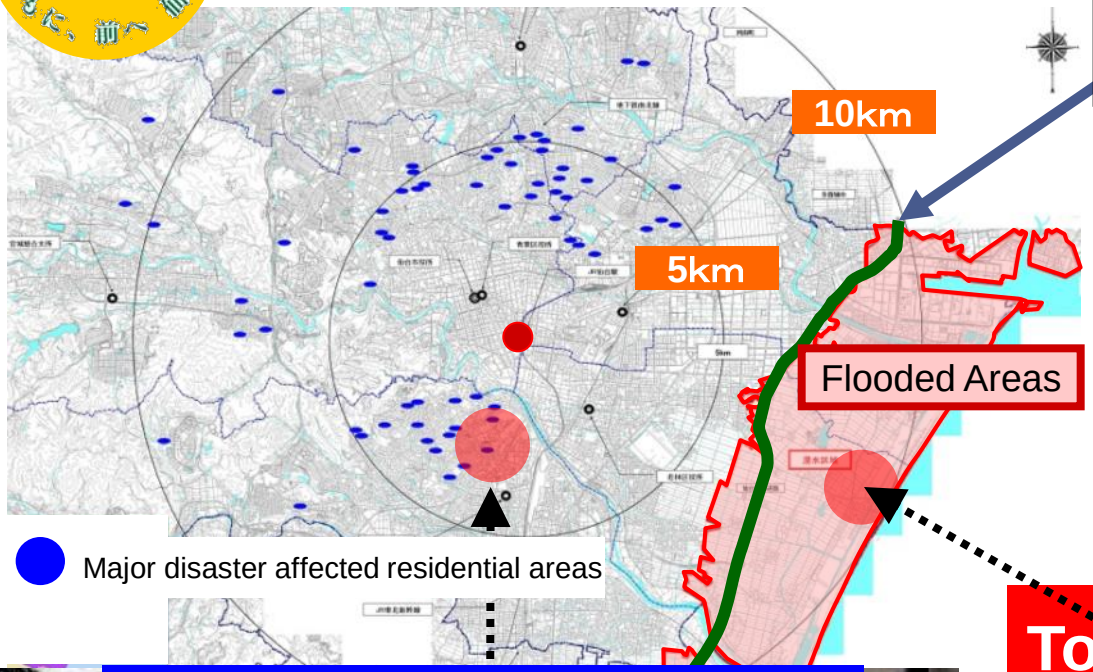
**Approx. ¥1,382.9 billion**

**( $12.6 billion $1=¥110 )**

| | |
|---|---|
| City-owned facilities | Approx. ¥340.9 billion |
| Other public facilities | Approx. ¥145.2 billion |
| Housing/residential Land | Approx. ¥608.6 billion |
| Commercial | Approx. ¥214.7 billion |
| Agricultural/marine | Approx. ¥73.5 billion |

(as of Sep. 30, 2015)

# Areas Flooded Due to the Tsunami & Major Disaster-affected Residential Areas




Sendai Tobu Road served as an Embankment

**Total area flooded: 4,523ha**

**Damage to residential land: 5,728 locations**

Midorigaoka, Taihaku Ward

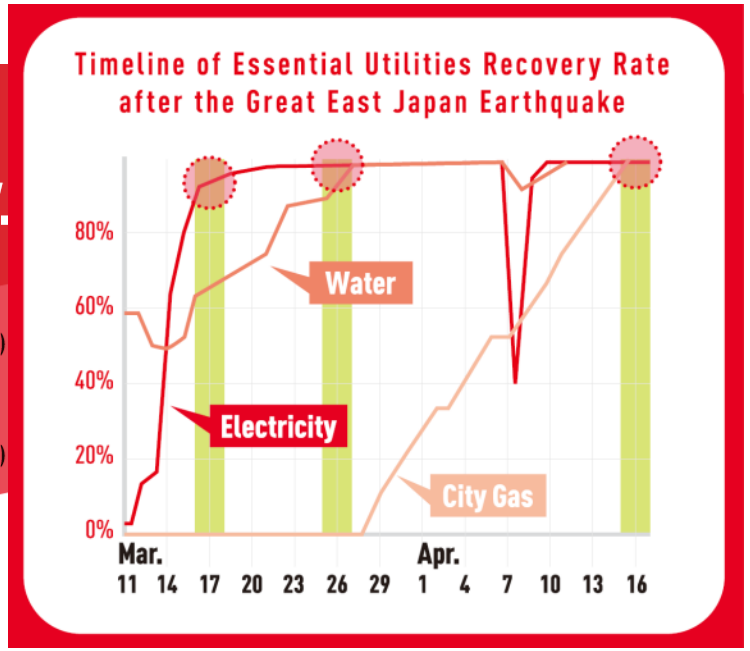
Arahama, Wakabayashi Ward (Arahama Elementary School)

# Restoration of Essential Utilities and the Evacuee Count

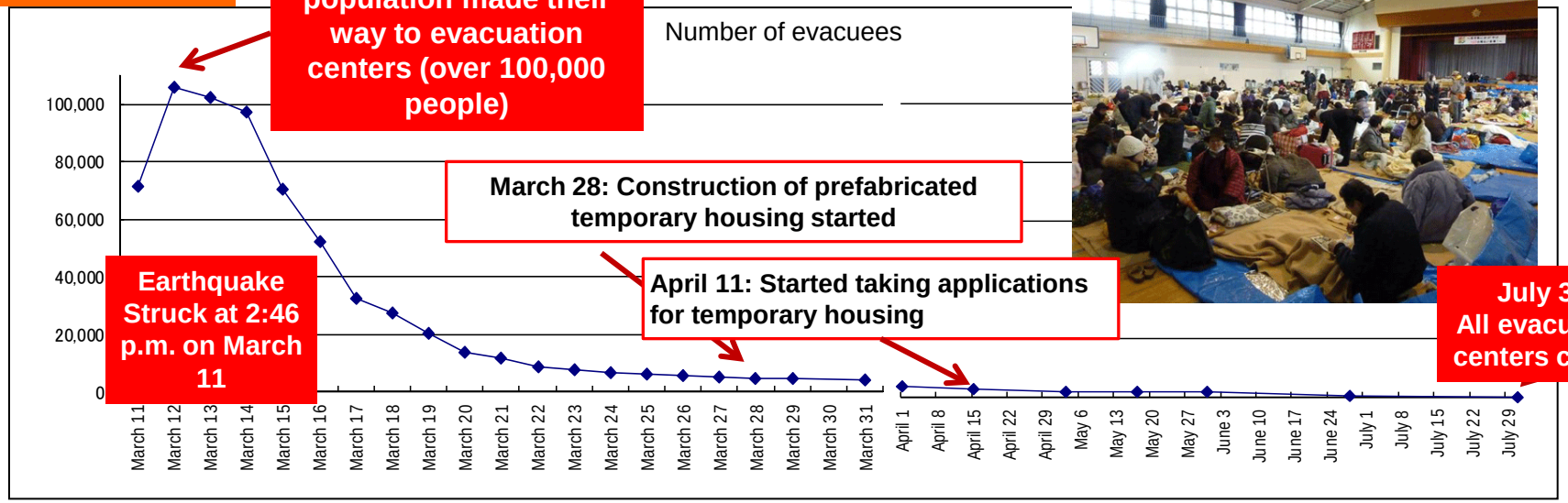
## The high rate of earthquake-resistant infrastructure contributed to a faster recovery.

| | | |
|---|---|---|
| Percentage of water pipes made earthquake-resistant* | 84.5% | Restored 18 days after the earthquake (Except in areas affected by the tsunami/landslides) |
| Percentage of gas pipes made earthquake-resistant* | 80.9% | Restored 36 days after the earthquake (Except in areas affected by the tsunami/landslides) |
| Percentage of educational facilities made earthquake-resistant* | 99.6% | There were no deaths of students under the supervisions of schools |

* All percentages are pre-disaster figures




## Evacuee Count




# Disposal of Debris

***2.72 million tons of disaster waste was treated***

Equivalent of **7 years** worth of waste generated in Sendai

(A temporary incinerator)

**The Sendai Method (self-containment)**

Waste collection sites (total area: 100ha) and temporary incinerators were set up in three locations in the eastern coastal area. Waste disposed of at the sites was then sorted into more than 10 different categories, such as concrete, home appliances, and wood.

Treatment of all disaster waste completed in December 2013

**Volume of disaster waste treated**

| Category | Amount disposed | Percentage of waste recycled |
|---|---|---|
| Debris | 1.37 million tons | 72% |
| Tsunami Sediment | 1.35 million tons | 96% |
| Total | 2.72 million tons | 84% |

Reused as embankment material for roads and other facilities

*Recycling goal of 50% achieved*

Waste collection sites restored to their original state in Mar. 2014

# Rebuilding Homes

## [After the Earthquake]

**Homes were washed away by the tsunami**

## [Today]

Collective relocation:
13 districts, 733 areas rezoned

Relocated to safe inland areas

Construction of 3,206 lots of disaster reconstruction municipal housing

# Restoration of Disaster-affected Residential Land

## [After the Earthquake]

## [Today]

169 districts were restored as part of a public project

Land restoration after landslides

# Restoration of Farmland

## [Today]

## [After the Earthquake]

**Rice paddies covered in debris from the tsunami**
Roughly 1,860 ha of farmland was flooded

Removal of debris and desalinization ⇒ Resumed farming in the eastern part of Sendai from FY2015

Zoned into large areas to improve agricultural productivity and stabilize agricultural management (farmland reclamation)

# Basic Concept for Preventing Tsunami Damage

## Multiple Defenses

**■Minimize tsunami damage by elevating prefectural roads**

Disaster mitigation through multiple defenses to such as the reconstruction of tide embankments, regrowth of disaster prevention forests and elevation of roads.

## Evacuation

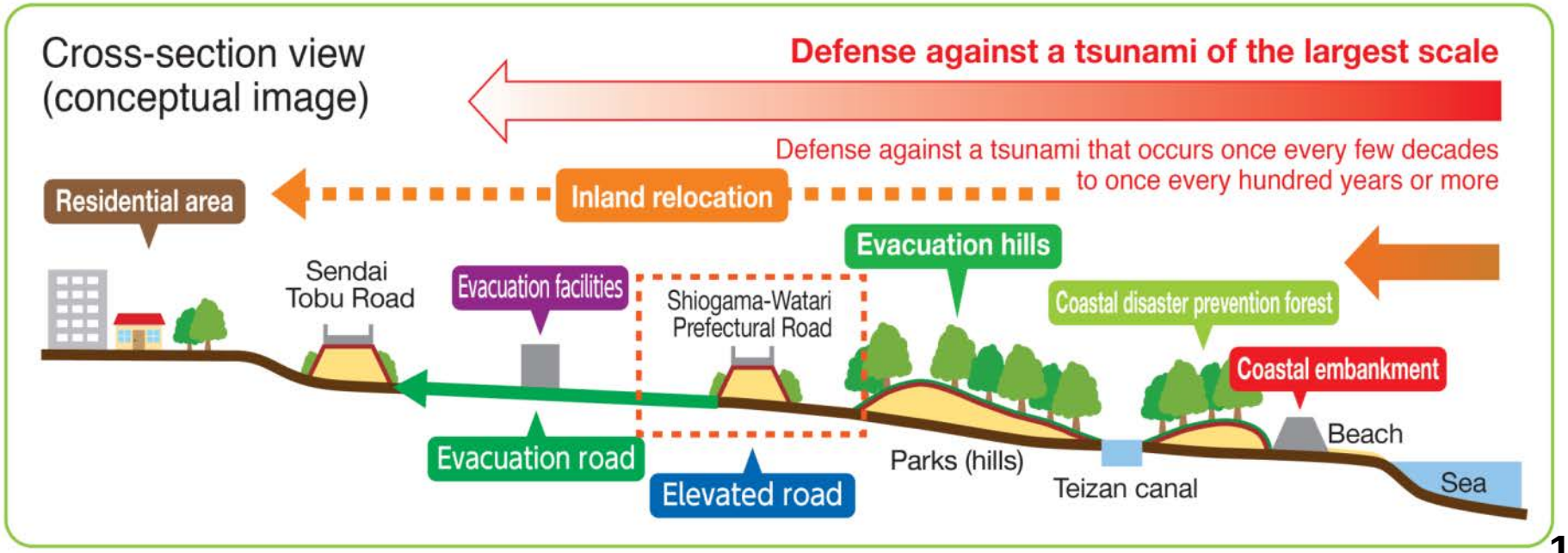
**◆Secure evacuation facilities**

Focus on evacuating, including moving to high ground, evacuation facilities, and evacuation roads.

## Relocation

**■Relocate to safe inland areas**

Comprehensive disaster prevention measures: collective relocation to safe inland areas



# Tsunami Prevention Measures
## [Today]

Sea/river embankments and other redevelopments
Regrowth of coastal forests (scheduled area)
Elevated roads

Evacuation road development
Development of tsunami evacuation facilities
Stairs along Sendai Tobu Road for evacuating to higher ground

Disaster hazard areas (relocate inland)
Inland relocation sites
Collective relocation movements

Tsunami evacuation facility

Tozai Subway Line

Nanakita River

Sendai Tobu Road

Natori River

Evacuation stairs

Coastal embankment

Elevated roads

# Strengthening Disaster Prevention Measures

Strengthening both services and infrastructure based on lessons learned from the earthquake in order to help prevent disasters.

| | [Before the Earthquake] | | [Today] |
|---|---|---|---|
| Community Disaster Prevention Leaders | 0 | → | 584 |
| Community-based Evacuation Center Operation Manuals | 0 | → | 171 |
| Introduction of disaster prevention photovoltaic systems to designated evacuation centers | 0 | → | 194 |
| Temporary lodgings for stranded commuters | 0 | → | 12 |
| Agreements for aid to prevent disasters | 116 | → | 175 |
| Percentage of water pipes made earthquake-resistant | 84. 5% | → | 86. 5% |
| Percentage of gas pipes made earthquake-resistant | 80. 9% | → | 84. 9% |

# Passing on Experiences and Lessons of the Disaster

## —Sendai aims to become a disaster-resilient and environmentally-friendly city that can contribute to the world—

Certified as a Role Model City for Disaster Risk Reduction (2012)

Recognition of civic cooperation initiatives and citizen power

The Third UN World Conference on Disaster Risk Reduction (2015)


The Sendai Framework for Disaster Risk Reduction was adopted

2016 Sendai Symposium

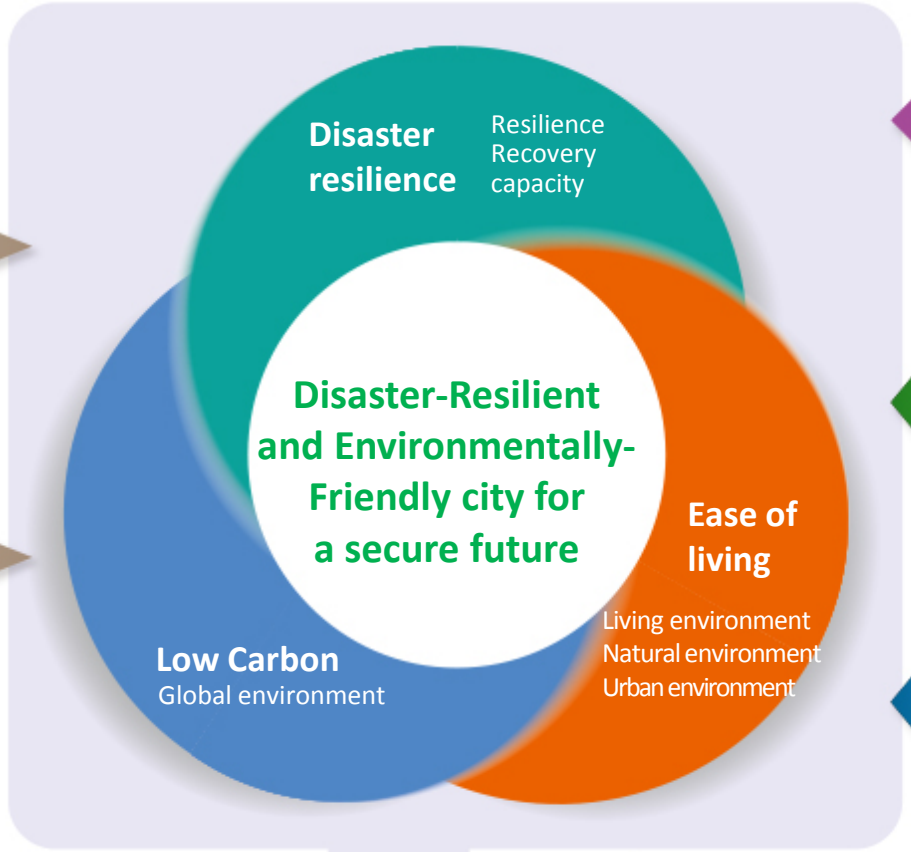

As a leader in disaster prevention, Sendai contributes to the prevention and reduction of disasters around the world

**Sendai 3/11 Memorial Community Center**

This memorial site and the disaster remains it houses pass on lessons from the earthquake

**Arahama Elementary School**

# Aiming to Make Sendai a ‘Disaster-Resilient and Environmentally-Friendly City’




**Experiences and lessons learned from post-disaster recovery**

**History of building an environmental city of Sendai –the City of Trees**

**Disaster recovery efforts**
- Restoring the livelihood of people affected by the disaster
- Multiple defenses against tsunamis
- Agricultural rehabilitation and green regeneration

**Disaster prevention and environment-focused urban development**
- Developing resilient infrastructure
- A city with self-sustaining energy
- Building a low carbon city

**Disaster prevention and environment-focused ‘human capacity building’**
- Educating people on disaster prevention
- Improving community resilience
- Disaster recovery memorial

**Sharing information throughout Japan and the world**

**Promotion of exchange activities and economic investments**

**Contributing to world’s disaster prevention culture and establishing a city brand**

# Aiming to Make Sendai a ‘Disaster-Resilient and Environmentally-Friendly City’

## Urban Development

- Improving of disaster resilience of lifeline and infrastructure, and reducing of degradation risk
- Construction of multiple defenses to minimize tsunami damage, such as coastal embankment and elevated road
- Promoting of strengthening of disaster resilience in economic activities
- Developing of low-carbon and resource-circulating city
- Creating of disaster-resistant decentralized energy sources, research and development next-generation energy

Replanting coastal disaster-prevention forests in order to dampen the momentum of tsunamis

Restoration work on the Minami-gamo Wastewater Treatment Plant is proceeding at full speed

Solar panels on the roof of a junior high school building
(Installed at all designated evacuation centers and used as emergency power source during power outages)

## Human Capacity Building

- Promoting Sendai’s disaster preparedness education
- Disaster risk reduction measures including the perspectives of women, children & youth, people with disabilities
- Operating community-based evacuation center
- Support system for people requiring assistance during a disaster
- Cultivating Sendai City Community Disaster Preparedness Leaders
- Partnering with business on measures to help those stranded during a disaster

Training “Sendai City Community Disaster Preparedness Leaders”

Agreement reached with companies on support for those unable to return home

Children taking part in disaster drills

## Sending Out Information and Establishing City Brand

- Global contribution thorough passing on our experiences and lessoned learned form the disaster and reconstruction by multi-stakeholder, such as citizens, local communities and research institutions
- Preservation of disaster remains
- Compilation of reconstruction records
- Establishing of disaster memorial facilities and local monument

Preservation of disaster remains
(Arahama Elementary School)

Established the Global Centre for Disaster Statistics


Study tour by JICA trainees to the Arahama Elementary School

# The Third UN World Conference on Disaster Risk Reduction

## March 14-18, 2015 Sendai



# Community Initiatives for Disaster Prevention and Disaster Risk Reduction

## 2016 Sendai Symposium for Disaster Risk Reduction and the Future

## March 12, 2016  Sendai



# Thank You



Disaster-Resilient and Environmentally-Friendly City Promotion Office, City Planning Policy Bureau, Sendai City
http://www.city.sendai.jp/en