

Chapter 3 Response to Critical Issues Facing Japan

Section 1 Promotion of Measures Taken to Solve Critical Issues

1 Realization of a Safe, Comfortable and High-quality Life for the Japanese Public

The Fourth Basic Plan lists "a safe, comfortable and high-quality life for the Japanese public" as one of the goals which Japan should aim at. It is important to promote efforts to increase experiences that will enrich people's minds and spirits, in addition to protecting them from large-scale natural disasters, grave accidents, and terrorism. It is also important to improve people's safety by securing food and water resources in a stable manner, so that the Japanese public can live a safe and comfortable life, both now and in the future.

(1) Enhancement of safety and convenience in life

Concerned authorities make efforts described below in order to secure the safety of people's daily lives from natural disasters, accidents and crimes and to preserve human health and the ecosystem, and also to balance improvements in safety, convenience and comfort.

1) Promotion of the survey and observation of earthquakes, volcanos, tsunamis, high wave/high tides, storm and flood damages, and landslide disasters, as well as research and development to improve prediction, disaster prevention, disaster mitigation and capabilities to respond to such disasters.

In FY 2011, an earthquake off the Pacific coast of Tohoku caused many aftershocks and induced earthquakes. Other various natural disasters also occurred in various regions such as "the 2011 July Rain Storm in Niigata and Fukushima," heavy rain disasters caused by the 2011 Typhoon No. 12 (Tropical Storm Talas) and No.15 (Typhoon Roke), and a heavy snow disaster that occurred in the second half of December, 2011. Furthermore, Mt. Kirishima (Mt. Shinmoe) became active in January 2011 and still maintains eruption activity. In regard to countries overseas, there were severe damages caused by natural disasters all over the world, for example, the Thailand floods that lasted from July 2011 through January 2012, and the earthquake in Turkey in October 2011. It is extremely important to promote the survey and research of earthquakes and volcanoes and the research and development of disaster preventions in order to mitigate damages caused by future natural disasters based on the lessons we have learned from those disasters.

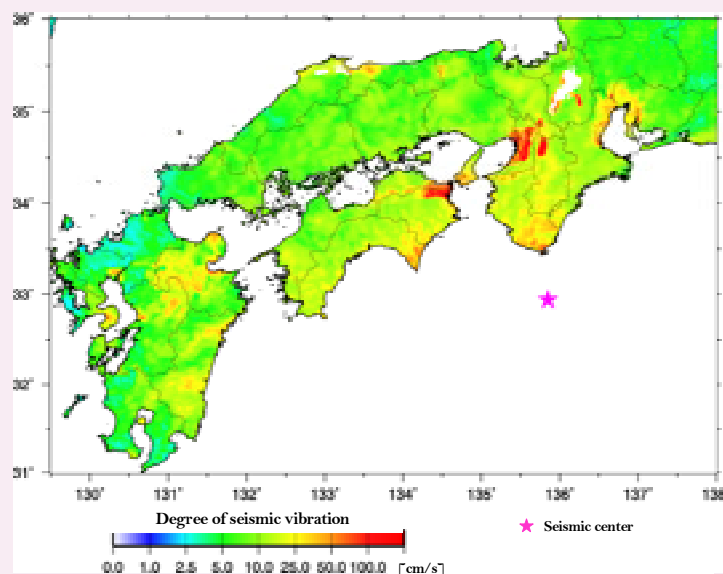
(i) Promotion of research and development in the seismic field (MEXT)

The survey and research of earthquakes in Japan are conducted in close collaboration and cooperation with related administrative offices under the management of the Headquarters for Earthquake Research Promotion (Administrative Chief: Minister of Education, Culture, Sports, Science and Technology). In response to the occurrence of the GEJE, the Headquarters for Earthquake Research Promotion reviews and discusses possible revisions to the "Promotion of a New Survey and Research of Earthquakes" that

was established in April 2009, in order to summarize basic policies in regard to surveys and the research of earthquakes in Japan.

The Headquarters for Earthquake Research Promotion has conducted long-term evaluation of the probability and scales of earthquakes but could not evaluate a massive earthquake caused by multiple areas linking together such as the 2011 Earthquake which occurred off the Pacific coast of Tohoku. Therefore, in June 2011, it was determined they review the evaluation method and consider a way of evaluation that can be practically used for disaster prevention, and so the investigation of a new evaluation method is in progress. In addition, the headquarters published a "Prediction Map of Long-period Ground Motion" that illustrates the distribution of long-period ground motion as predicted in earthquake areas near and far, such as in the case of an earthquake similar to the 1946 Nankai Earthquake (Figure 2-3-1).

Figure 2-3-1/ Prediction Map of Long-period Ground Motion



Courtesy of Headquarters for Earthquake Research Promotion

In regard to the "Promotion of Observation and Research Program for Seismic and Volcanic Eruption Prediction (Proposal)" (Council for Science and Technology (CST), July 2008) that summarizes research plans of earthquakes and volcanic eruptions, predictions are performed by related organizations such as universities and CST, which is making progress on a review to revise the plan in response to the 2011 off the Pacific coast of Tohoku Earthquake, since surveys and research on such an extremely powerful earthquake was not in the scope.

MEXT drives surveys and research required for evaluation by the Headquarters for Earthquake Research Promotion, as well as conducting surveys and research focusing on areas where social and economic damage can be significant when an expected earthquake hits. These include "Special Project for Earthquake Disaster Mitigation in Tokyo Metropolitan Area", "Focused Survey and Research in the Area Where the Strain is Concentrated", and "Research on Evaluation of Linkage between Tokai/Tonankai/Nakai Earthquakes." In particular, the results from "Disaster Prevention and Mitigation against Epicentral Earthquakes beneath the Capital Special Project (project term: FY 2007 through FY

2011)" are 1) understanding of the plate structure and the possibility of a potential earthquake under the metropolitan area, based on observation results provided by the enhanced Metropolitan Seismic Observation network (MeSO-net) and 2) a concrete proposal of measures for the safety of medical facilities and the building of skyscrapers based on the experimental results of E-Defense. Furthermore, comprehensive research, including emergency measures taken right after the earthquake up through the measures taken when recovery and reconstruction was conducted. In Tokyo, in particular, the registers of disaster victims were converted into electric files to drive the social implementation of a system to help disaster victims promptly resettle into their normal lives.

Regarding enhancement of the earthquake monitoring network, after the Great Hanshin-Awaji Earthquake, dense coverage was established on land by cooperation among related organizations. On the contrary, far fewer monitoring points were available on the seabed as compared to the number of those on land, although some monitoring networks were built, such as the offshore Tokai/Tonankai 24 hours Underwater Cable Earthquake Monitoring System built by the Japan Meteorological Agency.

To solve the situation, MEXT started the full-scale operation of a high-density underwater network system that was equipped with a seismograph and a water-pressure gauge at the expected hypocentral region of a predicted Tonankai earthquake, and MEXT continues the development of technology in order to build a similar system for the expected hypocentral region of a predicted Nankai earthquake. MEXT also started the enhancement of an underwater cable earthquake and tsunami monitoring network around the hypocentral region of the 2011 off the Pacific coast of Tohoku Earthquake where larger aftershocks and tsunami could occur in the near future (refer to 1 (3) of Part 2 Chapter 2 Section 1).

(ii) Promotion of S&T for disaster prevention (National Research Institute for Earth Science and Disaster Prevention (NIED))

The National Research Institute for Earth Science and Disaster Prevention (NIED) conducts seismic engineering research with the practical use of E-defense, research on the precise prediction of rainfall and the prediction of landslides/storms/food disasters through the use of next-generation, high-performance radar, and research of damages caused by natural disasters, such as volcanic disasters or snow hazards. The institute also promotes research to develop a system to integrate, and use practically, information from various disasters. In FY 2011, the institute made progress in the recovery of earthquake monitoring facilities that were damaged by the GEJE, provided related organizations with earthquake monitoring data to contribute to their research and development, and conducted research and development to understand the occurrence mechanism of ocean-trench earthquakes, such as the 2011 Earthquake off the Pacific Coast of Tohoku.

(iii) Research on earthquake monitoring/forecast, tsunami forecast, and Earthquake Early Warning technology (Japan Meteorological Agency)

The Japan Meteorological Agency processes and analyzes the monitoring data collected through their own earthquake monitoring facilities combined with monitoring data from other related institutions in order to provide other organizations with the results. In March 2011, the agency started the service of forecast information about earthquake activities in the area of eastern Izu, and is making efforts to develop methods for earthquake activity forecast for other regions.

The Meteorological Research Institute of the Japan Meteorological Agency conducts 1) research and development on tsunami forecast with the practical use of instantaneous estimations of massive earthquake scale and offshore tsunami-monitoring data to mitigate disaster by tsunami, 2) research on seismic-intensity estimation methods, in order to increase the accuracy of the Earthquake Early Warning technology, and 3) research on monitor/analysis technology of diastrophism, in order to improve the accuracy of Tokai earthquake prediction.

(iv) Improved monitoring and analysis of diastrophism, (The Geospatial Information Authority of Japan)

The Geospatial Information Authority of Japan conducts research and development for the monitoring and analysis of diastrophism and plate motion as well as advancement of them by using continuous GPS monitoring with Electronic Reference Stations¹, Very Long Baseline Interferometry (VLBI²), and Synthetic Aperture Radar (SAR³) interferometry. Furthermore, since FY 2010, the Japan Meteorological Agency and the National Research Institute for Earth Science and Disaster Prevention (NIED) have conducted comprehensive analysis of volcano GPS including data at GPS monitoring points around a volcano and they plan to continue a more detailed monitoring of diastrophism around a volcano.

(v) Enhancement of geodetic and topographic surveys of the seafloor for earthquake research (Japan Coast Guard (JCG))

The Japan Coast Guard has been carrying out GPS/acoustic seafloor geodetic observation and topographic survey of submarine active faults around Japan. Based on the experience of the 2011 off the Pacific coast of Tohoku Earthquake, the JCG has installed additional seafloor reference points in the Nankai Trough region to detect spatial variation of intraplate deformation.

(vi) Geological surveys of volcanoes, active faults and tsunami deposits (The National Institute of Advanced Industrial Science and Technology (AIST))

AIST performs geological surveys of active volcanoes, active faults and tsunami deposits, and publishes results of these surveys. The institute carried out urgent surveys after the eruption of Mt. Shinmoe (Kirishima volcano), and the 2011 off the Pacific coast of Tohoku Earthquake (Figure 2-3-2, Figure 2-3-3). Survey results of the 2011 earthquake were compared with the tsunami inundation history and the active fault information, which had also been clarified by AIST, and were published through the website of AIST and interview. AIST has also maintained and operated the integrated ground water observatories and built a system for the real-time exchange of data collected in the observatories with the National Research Institute for Earth Science and Disaster Prevention (NIED). These efforts allow the comprehensive determination of the deep seismic slip distribution based on data collected by AIST and NIED, which greatly contributes to the prediction of the Tonankai/Nankai earthquake.

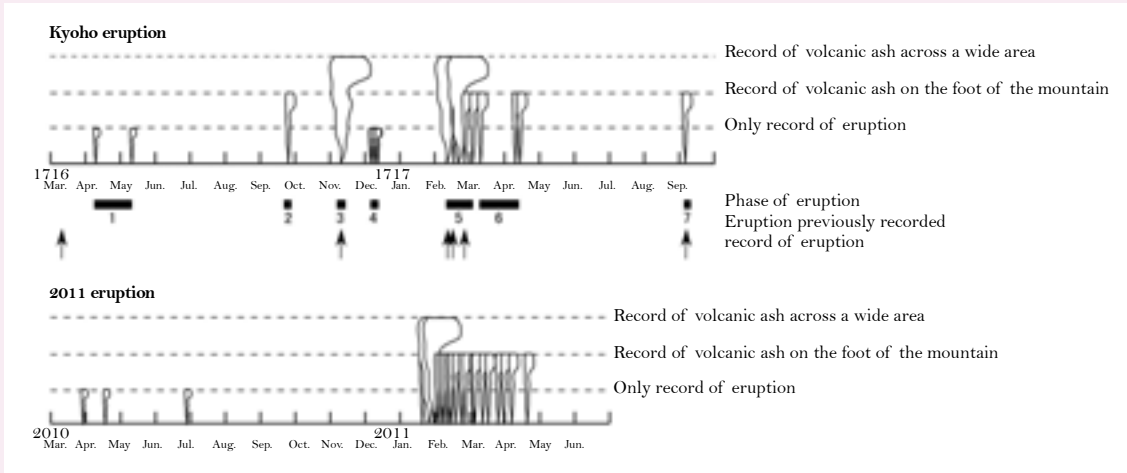
¹ Total of 1,240 stations nationwide as of the end of March 2012.

² Technology used to measure the distance of several thousand kilometers within accuracy of a few mm by using radio waves that reach the earth from a far distance.

³ Technique to monitor changes in earth surface from a satellite (Advanced Land Observing Satellite "DAICHI" (ALOS) stopped its service in May 2011)

Figure 2-3-2/ Comparison of the Kyoho and 2011 eruptions at Mt. Sinmoe (Kirishima volcano)

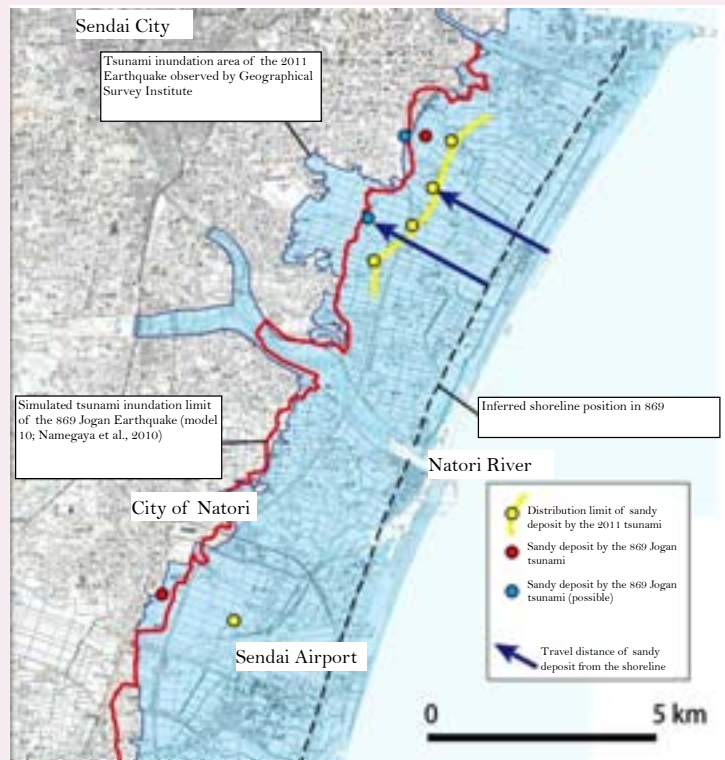
In January 2011, the eruption at Mt. Shinmoe was associated with a great pumice eruption. This eruption had showed no remarkable precursor since the small scale eruption occurred seven-month before; these processes are similar to those of the Kyoho eruption in November 1716.



Source: "The 120th Volcano Eruption Prediction Liaison Committee Material (June 7, 2011), The National Institute of Advanced Industrial Science and Technology (AIST)

Figure 2-3-3/ Comparison of tsunami inundation areas between the 869 Jogan Earthquake (red line) and 2011 off the Pacific coast of Tohoku Earthquake (painted in blue)

The tsunami inundation area of the 2011 Tohoku Earthquake was found to be almost the same as that of the 869 Jogan Earthquake. The grain size distribution, which shows tsunami inundation, of the 2011 tsunami deposit will contribute to the prediction of potential tsunami inundations.



Source: The National Institute of Advanced Industrial Science and Technology (AIST)

(vii) Research and development on the monitoring of waves and tide levels and on disaster prevention to mitigate damages caused by natural disasters (Ministry of Land, Infrastructure, Transport and Tourism (MLIT))

The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) establishes and operates the Nationwide Ocean Wave Information Network for Ports and Harbors (NOWPHAS) under mutual cooperation with the Port and Airport Research Institute, collects wave and tide level monitoring data acquired throughout the nation and discloses it to the public in real time through the Website. In FY 2011, MLIT improved the real-time monitoring information process system of wave monitoring.

Under cooperation with related MLIT departments, the National Institute for Land and Infrastructure Management (NILIM) of MLIT conducts research to contribute to the planning and proposal of disaster prevention policies and research related to the development of technical standards, in order to secure safety against disasters from the perspectives of housing and social capital infrastructure such as roads, rivers, and ports. This includes the disaster prediction and disaster prevention plan to prevent or mitigate natural disasters such as earthquakes, tsunamis, floods and landslides. In FY 2011, taking the GEJE into account, NILIM performed research on the structure of coastal dike that would continuously work even if, for example, a tsunami higher than the tsunami hypothesized for the design flooded over the dike.

(viii) Research to prevent, mitigate and promptly recover from greater and diversifying natural disasters (Public Works Research Institute)

The Public Works Research Institute conducts research and development to contribute to preventing, mitigating and recovering from damages caused by earthquakes, tsunamis, eruptions, storm and flood disasters, landslide disasters and snow and ice disasters. For example, the Typhoon No. 12 (Tropical Storm Talas) that landed on the Kii Peninsula in early September, 2011, and caused large-scale debris flows and slope failures that blocked rivers, resulting in natural dams. In response to a request by the government, the Public Works Research Institute then sent sediment-control experts who measured water levels in the natural dam with the PWRI's aerially placeable floating water gauge and provided technical support on analysis of the floodplain in case there might be a collapse of the dam.

Column

2-2

Emergency technique used at disaster site of natural dams caused by the Typhoon No. 12 (Tropical Storm Talas)

■ Introduction

The Typhoon No. 12 (Tropical Storm Talas) that hit on the Kii Peninsula in early September 2011, caused large-scaled debris flows and slope failures, some of which were found blocking the river. This is what was reported as a "landslide dam." This is called a natural dam in the fields of sediment disaster research. The natural dam keeps a tremendous amount of water in its upstream side, and once the overflow starts, it can be a large-scale debris flow to downstream in a moment's notice. This is a very dangerous situation.

Therefore, it is necessary to quickly estimate the time it would take and the area that could be damaged in order to prevent damage. Here, we will describe the emergency technique used against the disaster caused by natural dams collapse. This is what was actually applied to the natural dam in the Kii Mountains when Typhoon No. 12 (Tropical Storm Talas) hit.



Example of a natural dam formed by Typhoon No. 12 (Tropical Storm Talas)

Courtesy of the Ministry of Land, Infrastructure, Transport and Tourism, Kinki Regional Development Bureau

■ The emergency technique used against the disaster caused by a natural dam collapse.

1. Technique to estimate debris flow inundation area in the case of a natural dam collapse.

The Public Works Research Institute developed a method to estimate the area of debris flow inundation area in considering the case of natural dam collapse and causing debris flow to flood downstream. The estimation method enables a prompt estimation of the downstream area that can be damaged by debris flow by using two-dimensional flood calculation as well as a hydrograph estimation of debris flow with one-dimensional calculation of riverbed deformation used to estimate erosion of the natural dam. This method requires minimum parameters for the measurement in order to allow quick calculations under emergency situations. It is designed to get results under any situation, for example, by using data on the Digital Japan Web System of the Geospatial Information Authority of Japan for terrain data used for simulation. Due to these features, it could estimate the debris flow inundation area in just two days to enable prompt disaster prevention measures against debris flow caused by the natural dam collapse, such as when they found natural dams formed by Typhoon No. 12 (Tropical Storm Talas).



An example of estimation results of debris flow inundation area
 Courtesy of Ministry of Land, Infrastructure, Transport and Tourism, Kinki Regional Development Bureau

2. The PWRI's aerielly placeable floating water gauge

A natural dam collapse depends on whether the water level in the natural dam rises to overflow the dam. Therefore the water level must be observed immediately after finding a natural dam. If a natural dam is formed in a mountain area, however, it is impossible to measure the water logging level unless the following issues are solved: 1) terrain around is precipitous and no road is available (some roads may be blocked by slope failures, 2) difficulty in land transportation of materials and equipment and 3) no availability of data transfer facility.

Then when the Iwate-Miyagi Nairiku Earthquake occurred in 2008, the Public Works Research Institute developed a water level gauge (the PWRI's aerielly placeable floating water gauge) that can be carried by a helicopter in order to measure the water logging level in the natural dam. This typhoon formed many natural dams and MLIT monitored the most critical five dams by themselves. The PWRI's aerielly placeable floating water gauge was used at four of the five dams.



Appearance and setting condition of PWRI's aerielly placeable floating water gauge
 Courtesy of Ministry of Land, Infrastructure, Transport and Tourism, Kinki Regional Development Bureau

(ix) Collection and analysis of disaster information, development of a training system to prepare for disaster (FDMA (Fire and Disaster Management Agency))

Considering the issues around information gathering at the GEJE, the Fire and Disaster Management Agency (FDMA) started research and development of a system that can support the judgment of those who work on emergency support, such as sending emergency fire response teams to the damaged area with techniques to collect and analyze disaster information that is accessible outside of the damaged area immediately after an earthquake. The agency also started to develop a training system in regard to team operation and instructed how to issue evacuation orders when a massive disaster occurs, which was learned by leveraging empirical knowledge on emergency support from the GEJE and using it for future emergency support during a disaster.

2) Promotion of research and development in measures against fires, grave accidents and crimes

The National Research Institute of Police Science conducts various research in supporting criminal investigation and root-cause analysis of accidents. In FY 2011, the institute promoted 1) research in individual identification of biological data using haplotype analysis² to support criminal investigation, 2)

¹ Time series data of flow rate at rivers or mountain streams
² A DNA type analysis method that categorize multiple types as single type.

research in quick screening techniques of multicomponents in medicinal toxicants and behavioral science research on the techniques used to interview suspects and victims, and 3) research in simulation techniques used in the fire judgment for root cause analysis of fire accidents and as proof in arson cases.

As a part of the "Project on Science and Technology for a Safe and Secure Society," MEXT promotes the research and development of antiterrorism technology as well as the sharing of knowledge and technology, by accumulating and organizing knowledge and personal connections gained through individual R&D projects, and uses it to provide feedback to researchers at government offices in each field that requires them. Since FY2010 MEXT has also started "R&D Program for Implementation of Anti-Crime and Anti-Terrorism Technologies for Safe and Secured Society" by cooperating with related ministries and agencies funded by Special Coordination Funds for Promoting Science and Technology (from FY 2011: Strategic Funds for the Promotion of Science and Technology). Regarding international cooperation on the safety and security of S&T, MEXT aggressively promotes cooperation activities, such as holding a Japan-U.S. biosecurity symposium, based on a cooperation framework of the "U.S.-Japan Framework Initiative for a Safe and Secure Society" under the S&T cooperation agreement.

3) Promotion of research and development aimed at human health protection and ecosystem preservation

The Public Works Research Institute performs research on evaluating, managing and controlling the risk of environmental contaminants in water in order to protect human health and preserve ecosystems.

The National Maritime Research Institute performs research on fundamental technologies that contribute to the realization of environmental regulations that significantly reduce environmental impact and that possess social rationality aimed at zero-emission, in order to preserve marine environments.

4) Promotion of research and development to balance improvements in safety, convenience and comfort

(i) Research and development on the upgrading and safety evaluation of traffic/transportation systems

Rebuilding the safety and reliability of traffic/transportation systems as a daily commuting tool for the Japanese public is an urgent issue, and it is necessary to focus on and promote the practical use of new technologies in order to completely ensure preventive safety, while considering future increases in air traffic needs, the human factor of operators in traffic organization, and the discovery, judgment and operation of vehicle drivers.

The National Police Agency, the Ministry of Internal Affairs and Communications, and the Ministry of Land, Infrastructure, Transport and Tourism promote efforts aiming at the practical application of a Driving Safety Support System by using vehicle-to-infrastructure cooperation and vehicle-to-vehicle communication.

The Ministry of Land, Infrastructure, Transport and Tourism implemented ITS spots¹ in approximately 1,600 locations, mainly on highways, and started ITS spot service nationwide in 2011. The ministry also promotes technological development that contributes to further safety in the railway field,

¹ An area where Dynamic Route Guidance (Service to distribute traffic jam data of wide area so that a car navigation system to select a route wisely), Driving Safety Support System and ETC are available with radio device installed at a roadside.

such as platform doors. This can support various train cars whose doors are placed in different positions.

The National Maritime Research Institute conducts research that contributes to the realization of a "safe and secured society" by establishing safety regulations that can significantly reduce marine accidents and yet possess social rationality in order to secure the safety of marine transportation. The institute also conducts research on efficiency measures of maritime logistics and transportation system that supports the promotion of modal shift¹ and the smooth transfer.

The Electronic Navigation Research Institute is selectively implementing R&D on the effective utilization of airspace and capacity expansion of flight routes, R&D on capacity expansion of congested airports, R&D of improved safety and efficiency achieved by preventative safety, and technologies for ensuring the security and smoothness of air traffic.

In FY 2011, the National Research Institute of Police Science promoted development of the advanced traffic-accident analysis technology, in order to analyze the root cause of traffic accidents, and promoted research on the medical/ psychological judgment methods applied to drunk drivers, in order to prevent driving under influence.

(ii) Promotion of research and development on advanced and more durable housing and on social infrastructure, in order to counteract the aging and wear of such infrastructure.

The Ministry of Land, Infrastructure, Transport and Tourism conducts the development of technologies that can contribute to the management of prevention and preservation efforts by taking measures prior to the occurrence of fatal damage in order to prevent accidents and disasters caused by the aging and wear of housing and other social infrastructure, and so as to reduce life cycle cost.

The Public Works Research Institute conducts 1) development of technologies that can contribute to efficient maintenance and management which support prevention of aging in social infrastructure, and 2) development of technologies that can contribute to the improvement and longer life of social capital functions based on progress of material technologies.

(2) Stable securement of food, water, resources and energy

Related organizations make the efforts described below to improve the safety of food, water, resources and energy that are essential to daily life and that must be provided in a stable and sustainable manner.

The Ministry of Agriculture, Forestry and Fisheries attempts to accelerate gene function elucidation to solve food, water, resources, and energy problems and conducts research on the generation of super high-yielding grain, defective environment-resistant crops, environmental purification plants, and high quantity biomass plants, in order to contribute to solving issues in these fields. In addition, the Ministry makes efforts on 1) the development of domestic agricultural products, including foodstuff that possesses breakthrough characteristics in quality and processing suitability, and 2) the development of livestock-products technology such as high quality meat using domestic foodstuff.

The Ministry also makes efforts to develop technology that supports more precise and more efficient epidemic-prevention measures, in order to reduce potential risks to humans and to reduce the economic loss to livestock farmers due to critical domestic animal diseases, such as avian flu and foot-and-mouth disease.

¹ To replace freight transportation with railroad and marine transportation whose impact to the environment is lower.

Furthermore, the ministry makes efforts to develop technologies that reduce risks in the production, distribution and manufacturing process of agricultural products by targeting hazardous chemicals and hazardous microorganisms.

In addition, the ministry makes efforts to develop methods to capture scientific evidence on the functions of disease prevention in agricultural, forest and fishery products and food ingredients, and to develop breeds that are rich in functional ingredients and which can be cultivated in a way that results in a healthy and long-living society.

MEXT promotes research and development to advance exploration techniques for marine mineral resources and preservation techniques for living marine resources, in order to stably secure marine resources (refer to Part 2 Chapter 3 Section 1, 4(2)). MEXT also promotes the research and development of breakthrough technologies for renewable energy and for distributed-energy systems that would significantly contribute to the creation of green innovation and toward a low-carbon society (refer to Part 2 Chapter 2 Section 2, 1 (1) and (2)).

The National Maritime Research Institute conducts research on the development and improvement of safety evaluation methods for offshore structure and environmental load mitigation methods that are the foundation of basic technologies related to marine resources and energy development.

METI attempted to promote the material recycle of plastics by supporting private businesses with development and system verification technology that can quickly and automatically identify waste plastics in used products by material type. This was done in order to establish a recycle system of used products and is aimed at the conquest of resource restrictions and the formation of a sustainable recycling-based society that lives in harmony with the natural environment.

(3) Enhancing the comfort level of the Japanese lifestyle

Related organizations continue the efforts described below in order to contribute to enhancement in the quality and comfort of life and to experiences that will enrich people's minds and spirits via S&T.

1) Efforts aiming at the enhancement in quality and comfort of daily life

The Ministry of Internal Affairs and Communications built a network environment using ICT devices such as tablet PCs and interactive whiteboards at 20 schools nationwide (10 elementary schools, 8 junior high schools, and 2 special-needs education schools), and conducted a "Future School Promotion Project," empirical research to extract and analyze issues around information and communication technology at school sites in collaboration with MEXT and in order to promote the practical use of ICT in education fields. In the area of welfare, subsidies to cover part of research and development costs are provided to those who perform research and development of communication and broadcasting technologies for the development of a communication/broadcasting service that will contribute to improvements in convenience to elderly/disabled people. In medical and long term care areas, verifications for experimental proof were performed on the function, technology and effects of Ubiquitous Net Technology¹ and on medical information linking infrastructure which allowed for the secure and smooth circulations of medical

¹ Technology to automatically identify acts of healthcare workers and patient's status by practical use of electric tags and sensors that are attached to patients, medical supplies and medical equipment.

information owned by local communities. In the administrative field, the ministry promotes efforts to enhance services in the public sector in each community with information and communication technology. The ministry also conducts the investigation and verification of link data items and link function/methods that enable smooth operation of data links between organizations using a data cloud environment.

The Research Institute of Science and Technology for Society promotes research and development with a problem solving style to apply new fruits that are useful to solve problems on-site in cooperation with researchers at universities and public research institutions and with "concerned people (stakeholders)" who have various backgrounds and are familiar with the situation/issues at the working site, such as local residents, NPO and local government. These research and development are driven in four areas and by two programs. The four areas are: "Design of new aged society created with community", "Anti global warming and environmental friendly society rooted in community", "Protecting Children from Crime", and "Science, Technology and Humanity". The two programs are: "Problem-Solving Based Service Science Research and Development Program" and "Science Research and Development Program for Science and Technology Innovation Policies."

Column
2-3

Aiming for global warming prevention and building an attractive town – efforts made at Kiryu

"Global warming prevention through power of community and future town – establishment at Kiryu" conducted in Kiryu City, Gunma Prefecture, is one of the efforts that The Research Institute of Science and Technology for Society of the Japan Science and Technology Agency made for an "Anti global warming and environmentally friendly society rooted on community" in the research and development area. A suburb-like city structure where commercial facilities and housing estates are located, results in the deterioration of public transportation, commerce and industries in the downtown area. To solve issues that cities face, such as the above-mentioned deterioration and associated car dependent society, efforts are being made to realize an anti global warming town that is energetic and easy to live in. This comprehensive research and development includes 1) a methodology of building the town by leveraging local characteristics, such as existing transportation infrastructures, like railroads, various remaining industrial heritage sites and culture, and rich forest and water resources, and 2) an investigation of quantification techniques for the purpose of reducing CO₂ emissions, thus aiming at a lower carbon city that contributes to reducing CO₂ emissions by 80% from 1990 to 2050.



Introducing of a newly developed electrically-powered low-speed community bus to citizens.

Courtesy of the Research Institute of Science and Technology for Society, Japan Science and Technology Agency

Aiming at a balance between lower carbon-traffic infrastructure and stimulation and improved attractiveness in the downtown area, some of the trials to be conducted include 1) establishment of a traffic system that comprises bicycles, busses and trains and is sustainable, from both energy and city environment perspectives, and 2) the introduction of IT to shopping streets.

In concrete terms, the following activities are in progress: 1) development of operation regulations and field tests in regard to electric rent-a-bicycles and bicycles that can be carried onto trains, 2) development of an electrically-powered low-speed community bus that is harmonized with town and uses electric power generated by small hydraulic power generators in the mountains, and 3) trial of an information system that allows its users to access the information of shops nearby bus stops through the use of a portable terminal.

In conjunction with the above, there are other efforts in progress to establish a system, where citizens can be proactively involved. These are 1) establishment of a network between stakeholders such as citizens, public administration, NPOs and local companies, being lead by Gunma University (a local university), 2) efforts to directly ask local elementary/junior-high school students who belong to Gunma University's Engineering Club (targeting approximately 10,000 students) to take action to reduce carbon dioxide, and 3) information publishing in cooperation with the local media.

These above-mentioned efforts are in steady progress to balance the drastic reduction of carbon dioxide and the establishment of a local city that is energetic and convenient to live in. Other regions can follow these efforts through television and newspaper reports, and similar efforts are expected to be conducted nationwide.

2) Efforts for developing experiences that will enrich people's minds and spirits

In order to promote the production and circulation of digital contents, MIC investigates economic revitalization by sending out Japan-made contents, by the enhancement of production and circulation of contents, and by the creation of a new platform to circulate contents.

MEXT tries to contribute to creation of a new culture by combining culture, S&T, so MEXT conducts research and development for the realization of a digital museum where the audience can experience the tangibles and intangibles of cultural heritage interactively through all five senses.

Table 2-3-4/ Measures taken to realize a safe, comfortable and high-quality life for the Japanese public (FY 2011)

Ministries and agencies	Conducting organization	Measures
National Police Agency	National Research Institute of Police Science	Research on the individual identification of biological data with haplotype analysis
		Behavioral science research on techniques to interview suspects and victims
		Research on quick-screening techniques of multicomponent in medicinal toxicants
		Development of advanced traffic accident analysis
		Research on the practical application of simulation techniques in fire judgment
		Research on medical/ psychological judgment method applied to drunk drivers
Ministry of Internal Affairs and Communications (FDMA(Fire and Disaster Management Agency))	National Research Institute of Fire and Disaster	Research and development of IT to strengthen fire-control services at large-scale disasters
MEXT	MEXT	Enhancement of the observation network for Japan trench submarines and for earthquakes/tsunamis
		Earthquake/tsunami monitoring system
		Research on Evaluation of Linkage between Tokai/Tonankai/Nakai Earthquakes
		Development of submarine GPS technology
		Disaster Prevention and Mitigation against Epicentral Earthquakes beneath the Capital Special Project
		Focused Survey and Research in Areas Where the Strain is Concentrated
		Active fault survey
	National Research Institute for Earth Science and Disaster Prevention (NIED)	Surveying and monitoring of earthquakes/tsunamis that occurred in the earthquake off the Pacific coast of Tohoku
		Area of monitoring/prediction research
		Area of disaster mitigation research
		Area of disaster social prevention research

Ministry of Agriculture, Forestry and Fisheries (MAFF)	MAFF	New agricultural business development genome project
		Development of technology to efficiently reduce risks of avian flu, BSE and foot-and-mouth disease
		Research for Production of Valuable Livestock by Feeding Self-sufficient Forage Crops
		Development of fundamental technology for analysis and evaluation of functional agricultural products and functional foods
		Practical Technology Development Project for Promoting New Policy in Agriculture, Forestry and Fisheries [literal translation] Practical Technology Development Program for the Promotion of New Agricultural, Forestry and Fishery Policies
National Agriculture and Food Research Organization Bio-oriented Technology Research Advancement Institution	Basic Research Promotion Program for the Creation of Innovation	
METI	National Institute of Advanced Industrial Science and Technology (AIST)	Geological survey and research in urban areas and coastal zones, and enhancement of geological information and environment information
		Improvement of precision earthquake prediction with active fault surveys and earthquake observations
		Improvement of the precision prediction of changes of volcano eruption
Ministry of Land, Infrastructure, Transport and Tourism (MLIT)	MLIT	Technology on provisions in wide-area traffic information, provisions for driving-safety support information, and the gathering of information for vehicle routing
		Realization of improvement in safety and convenience by strategic maintenance and renovation of housing and social capitals – development of inspection/monitoring techniques for management of prevention and preservation -
	National Institute for Land and Infrastructure Management	Research on enhancement and management standard of social capital facilities by considering aging variation of functionality and performance
		Research on measures for seamless international ferry transport in response to the expanding network in Asia

2 Strengthening Japan's Competitiveness in Industries

(1) Strengthening common infrastructure in order to strengthen competitiveness in industry

Since manufacturing (MONODZUKURI) is Japan's most competitive industry, and since it greatly influences other industries and can be a fundamental driver for economic growth, measures to strengthen manufacturing technology were aggressively taken in the past. Due to the occurrence of the GEJE, however, research and development, as well as production activities in the private sector, slowed down, and thus, the supply chain of products/parts/materials was badly effected. Because of the drastic rise of the yen in recent years and because of procurement limitations on materials such as rare-earths, in addition to the impacts caused by the earthquake, people became concerned with the hollowing out of industry due to the manufacturing base being shifted abroad and due to reduction in research and development investment caused by a tougher business conditions. In response to these situations, necessary measures were taken to rebuild a more powerful system and an infrastructure that will support manufacturing in order to achieve sustainable economic growth by improving the competitiveness of the Japanese industry.

MIC conducts research and development of technology that enables efficient use of radio frequencies

and the use of higher frequencies to precisely support new communication demands and in order to create new industry using radio.

MEXT promotes the development of one-and-only, leading-edge measurement and analysis technology/equipment that supports the needs of the world's cutting-edge researchers and manufacturing sites (refer to Part 2 Chapter 3 Section 1, 5(1)).

METI aims at strengthening competitiveness in industries and promotes the following research and developments to build common infrastructure in manufacturing areas that support the creation and growth of new industry.

1) R&D of higher functionalities of steel materials and Steel structures

In order to respond to global warming issues and the increased price of materials, to accelerate green innovation in the industrial sector, and to significantly reduce energy consumption in the manufacturing process, METI conducted research and development on the higher functionalities of steel materials and steel structures. This will innovatively contribute to higher efficiency, decreased energy consumption, longer life, and the safety and security of plants, structures and automobiles that use steel materials.

2) Development of fundamental technology in the manufacturing process

Carbon fiber is expected to be in great demand as it is used in structural materials for aircrafts and automobiles because of its lightness and tremendous strength. In cooperation with universities and carbon fiber manufactures, METI was involved in development of fundamental technology in the manufacturing process that can reduce environmental burden, such as carbon dioxide emission, and that can significantly increase the efficiency of production by taking a completely different approach from previous methods.

3) Development of semiconductor technology

Regarding semiconductor technology, METI conducted the following research: 1) fundamental technology for evaluation necessary for next generation EUV (extreme ultraviolet radiation¹) exposure systems that realize a 10 nm range semiconductor micro fabrication/manufacturing technology, 2) super lower-power technology with new material/structure, 3) Normally off computing “Normally OFF—instantly ON computing,” a fundamental technology that consumes electric power only when data processing is required, by embedding nonvolatile elements into the semiconductor, and 4) three-dimensional integration technology for semiconductors.

4) Development of embedded systems

In order to secure the reliability and safety of embedded systems that are the source of Japan's industrial competitiveness, METI supports 1) development of guidelines that support the functional safety standard that is being discussed for standardization in Europe and 2) development and evaluation of development/evaluation/verification tools of basic-control software.

¹ Ultraviolet rays with 13.5 nm of wavelength. The goal is short - wavelength light for next generation semiconductor optical lithography .

5) Development of energy-saving technology at data centers

In order to promote the development of energy-saving technology at data centers that form the axis of the cloud computing era¹, METI conducts the development of green cloud-computing technology and next-generation power devices, in addition to the research and development of individual devices and equipment, such as the "Green IT Project."

6) Support of activities for the reduction and possible elimination of rare earth elements

Regarding rare earth elements that are essential for the next-generation environment, adaptable products such as hybrid and electric car motors and air conditioner compressors, there are emerging problems such as shrinking the export ceiling in China, soaring prices, and the issue of the significant disparity between domestic and foreign prices. In response to these problems, and following the rare earth elements general measures taken in the FY 2010 supplementary budget, METI uses practically the third supplementary budget of FY 2011 to support the development of technology that considerably reduces the use of dysprosium,² a rare earth with a high supply risk. METI also supports activities to find alternatives for magnets used in the making of motors. As a medium- to long-term effort, METI has been conducting a rare-metal-substitution material development project since FY 2007 and supports the development of technologies that realize rare earth functions by using richer materials and to significantly reduce the use of rare earths.

7) Support of an innovation center

MITI conducts an "Innovation-center location promotion project" to support the enhancement and development of facilities necessary for empirical research, prototype manufacturing and performance/safety evaluations aimed at the practical application of the fruits of research and developments that have been accomplished in the past by various companies.

8) Efforts to promote research and development by small businesses

In order to promote research and development by small businesses, authorized pursuant to the "Act on Technology Advancement of SMEs" (2006 law No.33), METI conducted the "Project for Strategic Promotion of Advanced Basic Technologies" to encourage research and development, and low-interest loans by the Japan Finance Corporation. METI also supported upgrading basic techniques in small-business manufacturing, such as casting, forging, and cutting.

(2) Creation of new industrial infrastructure by leveraging Japan's strength

Desiring to improve international competition in end-product markets, such as machinery, automobiles and electronics, the government promotes the establishment and export of comprehensive systems, such as next-generation transportation systems and smart grids aimed at the creation of a new, added value. To be successful, the government promotes the research and development of combined services, including even maintenance and operation through synchronization with field tests and international standardization. The

¹ The system that a service operator provides IT resource through network

² Rare earth added to high-performance neodymium magnets as an ingredient to improve heat-resistance. The high-performance neodymium magnet is used for motors in hybrid car/electric cars and air-conditioner compressors.

government also promotes efforts in research and development for the efficient and practical use of S&T in order to increase productivity in the service industry. Furthermore, the government promotes research and development in information and communication technology in order to build a next-generation network and to realize a highly reliable cloud computing system. Such efforts are aimed at improving the efficiency of the economic and social system as a whole, as well as at the creation of new industries, and the government promotes the practical use of them in a wide range of fields.

The Ministry of Internal Affairs and Communications conducts research and development on upgrading automotive radar using radio to protect pedestrians, develops technical standards for intelligent transport systems, and for vehicle-to-vehicle/roadside-to-vehicle communication with 700 MHz radio band, all of which are aimed at the practical application of a driving safety support system. In regard to smart grids, MIC conducts an ICT field test related to realization of the Building and Energy Management System (BEMS) and the Home Energy Management System (HEMS). MIC also verifies the actual effect of their introduction to communities, supports the introduction of communication interface standards required to realize the efficient use of energy at the community level, and promotes standardization activities. Furthermore, with a new-generation communication network test bed, **Japan Gigabit Network-eXtreme (JGN-X)** run by the National Institute of Information and Communications Technology (NICT) since April 2011, the Ministry promotes the research and development as well as the field testing of new-generation network technology and new applications aimed at industrial vitalization, the improvement of Japan's international competitiveness, and the strengthening of international cooperation.

METI promotes research and development aimed at the improvement in efficiency of the whole economic/social system. Aiming at the establishment of a smart community, MITI conducts the development of smart-grid related technologies by starting large-scaled field tests in four regions nationwide and by community-oriented field tests in seven areas nationwide by using local resources with the purpose of complementing those large-scale field tests (refer to Part 2 Chapter 2 Section 2, 1(1)). Furthermore, aiming at enhancement of reliability of cloud computing and creation of new services, the Ministry operated verification projects to realize the upgrade of industries in medical, transportation, social infrastructure and contents areas, and has conducted development of reliability/productivity improvement techniques, development of a reliability evaluation index, and high-volume data process/analysis technology, and data anonymity technology.

Table 2-3-5/ Major measures to strengthen Japan's industrial competitiveness (FY 2011)

Ministries and agencies	Conducting organization	Conducting organization
MIC, Ministry of Internal Affairs and Communications	MIC	Research and development of elemental technologies aimed at the advanced usage of frequencies for mobile communication systems
		Research and development of platform technology to promote the shifting of radio systems to unused frequency bands
Research and development of the advanced use of frequency to realize new broadband access in white space		
Research and development of a next-generation space communication system to contribute to the efficient use of frequencies		
Cost required to conduct technical examination for measures against frequency stringency		
	National Institute of Information and Communications Technology (NICT)	Research and development of network platform technology
MEXT	Japan Science and Technology Agency	(Leading-edge measurement and analysis technology/instrument development program)
METI	METI	Innovation and commercialization support program
		International research and development/demonstration project in environment/medical fields
		Innovation-center location promotion project
		Embedded systems and basic technology development project
		Next-generation, high reliability, energy-saving IT platform for technology development/demonstration projects
		Super light/high-strength, innovative, integrated material project to realize a low carbon society (except those funded by NEDO)
		International lead to secure the safety and security of nano materials
		Development of a world-leading noxious examination method required for new regulation of chemical substances, such as oil refining materials
	Institute of Advanced Industrial Science and Technology (AIST)	Project for Strategic Promotion of Advanced Basic Technologies
		Material that is functional at the nano level, multi-functional materials
		Measurement standards that support global business industries
		Promotion of open innovation in the nano-electronics field
	New Energy and Industrial Technology Development Organization	Technology to add more functionalities and higher value to devices
		Advanced industry-technology creation project, advanced energy-saving industry creation project, advanced non-fossil energy industry creation project
		Next generation device manufacturing technology development project, achieved by combining different fields
		High-power, complex, multi-wavelength laser process platform technology development project

3 Contribution to Solution of Global Issues

(1) Promotion of responses to global issues

Japan's S&T has reached a high level in the world due to the promotion of measures taken in the past. Measures for research and development are promoted, focusing on the response to various global level issues, and in cooperation with universities, public research institutions, industrial sectors, other nations and international organizations.