

# CSR Report 2012



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## Editorial Policy

### About this Report

The aim of this publication is to help as many stakeholders as possible to gain a deeper understanding of the activities of the NSK Group. In editing this report, priority is placed on presenting information that is considered of most interest to stakeholders or that is deeply connected to the NSK Group's business.

An effort has been made to present a clear picture of each activity and the Group's progress in those activities by presenting content including policies, goals, and performance on initiatives, examples of activities in fiscal 2011, and data that show progress in activities for each item.

### Reference Data Published on NSK's Website

More information and reference data are published on NSK's website. For more information and reference data related to topics on pages with a  icon in this report, please visit the following site: [www.nsk.com](http://www.nsk.com) > Sustainability > CSR Reports.

### Period of Coverage

April 2011 to March 2012. Activities conducted outside this period are indicated with the inclusion of a date.

### Referenced Guidelines

*Sustainability Reporting Guidelines* (third edition) by the Global Reporting Initiative (GRI)  
 ISO 26000:2010 Guidance on social responsibility by International Organization for Standardization (ISO)  
*Environmental Reporting Guidelines* (2012 edition) by the Ministry of the Environment of Japan

### Scope of Coverage

The report covers all NSK Group sites and plants, both in and outside Japan. For data and information that differs from the scope of coverage above, the scope is separately defined.



**P.10**

## Special Feature NSK's Efforts to Improve Automotive Fuel Economy

Automobiles incorporate many NSK products. In recent years automobiles have become more fuel efficient with the growing interest in environmental responsibility, and the NSK Group has developed a variety of products that help to improve fuel economy. This special feature looks at the Group's efforts across development and design, production, and sales.

**P.2**

## Message from the President

The NSK Group aims to grow together with all the communities in which we do business. The president explains this vision and describes NSK's commitment to increasing management transparency and meeting broader social expectations.

**P.55**

## Third-Party Opinion

In fiscal 2012, NSK asked Professor Yoshinao Kozuma of Sophia University's Faculty of Economics to provide his opinion of the Group's CSR activities.



**P.42**

## Creating Environmentally Friendly Products Close-Up Contributing to the Creation of Highly Efficient Air Conditioning Systems with Lower Environmental Impact

The NSK products incorporated into centrifugal chillers used in building air conditioning systems are contributing to greater energy efficiency. This feature shows how NSK leverages its core technologies to develop groundbreaking new products.

**P.56**

## NSK in Daily Life

This illustration shows where and how NSK products are used everywhere in everyday life—in computers, washing machines, automobiles, trains, and more.

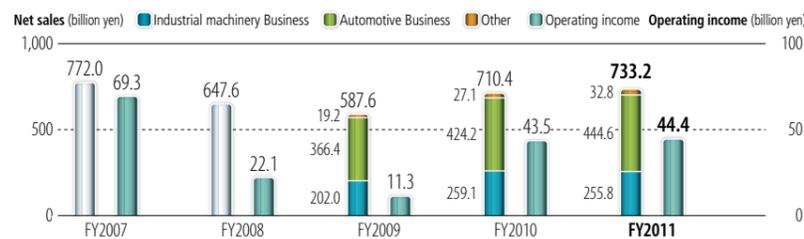
## Corporate Information (as of March 31, 2012)

<b>Company name</b>	NSK Ltd.
<b>Head office</b>	Nissei Bldg., 1-6-3 Ohsaki, Shinagawa-ku, Tokyo 141-8560, Japan
<b>Established</b>	November 8, 1916
<b>Capital</b>	67.1 billion yen
<b>Group companies</b>	Within Japan: 22 Outside Japan: 70
<b>Shareholders</b>	25,302

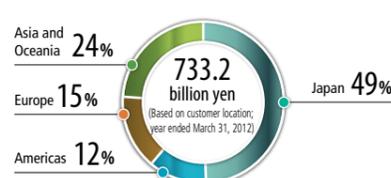
## Financial Data

### Net Sales / Operating Income (Consolidated)

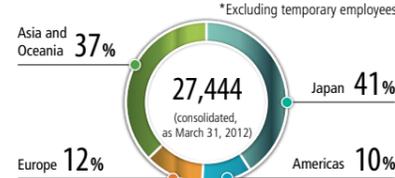
\*The figures for FY2008 and earlier are total. The change to accounting segments was made in FY2009.



### Breakdown of Net Sales, by Region



### Breakdown of Employees, by Region



## NSK Group Sites Worldwide (as of March 31, 2012)





**Norio Otsuka**  
President and Chief Executive Officer,  
NSK Ltd.



## Redoubling Our Efforts to Ensure Management Transparency and Meet Social Expectations

### Working to Regain Trust

In June 2012, the Company, two of its former officers, and a former employee were prosecuted for a violation of the Antimonopoly Act of Japan by the Tokyo District Public Prosecutors Office. I offer the most sincere apologies for the great deal of concern this matter has caused our customers and other stakeholders. To regain the trust of all of our stakeholders, we are making every conceivable effort to strengthen our compliance system and enhance employee education.

### Learning from Massive Natural Disasters

In 2011, both the Great East Japan Earthquake and the massive flooding that occurred in Thailand had a major impact, both directly and indirectly, on our business activities. We emerged from these trying experiences determined never to forget how much the NSK Group's business depends upon our many valued stakeholders—not only customers and suppliers, but also employees and their families. With this awareness, as a manufacturer of parts we are working hard to strengthen our business continuity planning with our top priority on safety and security.

We have articulated clear rules of conduct in the event of another large-scale disaster and reinforced our system for confirming the safety of employees and their families.

As part of efforts to bolster our business continuity plan (BCP\*), we have launched three new initiatives to ensure reliable supply of products to customers: earthquake proofing manufacturing plants across the NSK Group, ascertaining risks and fortifying backup systems across the entire supply chain, and adopting a balanced approach that secures stable electricity supply to NSK's business activities while reducing CO<sub>2</sub> emissions.

\*BCP: A plan that arranges in advance responses in the event of a disaster, accident, or other emergency situation to avoid important work from being interrupted or to restart it in a short period if it is interrupted.

First, we took urgent action at all sites in Japan to prevent all machines, equipment and fixtures from falling over in order to ensure the safety of employees in the event of future earthquakes. We also worked to enhance our BCP by assessing the risk of earthquakes, tsunamis, flooding, and other risks across the supply chain for primary, secondary, and tertiary suppliers. To do our part to ease Japan's ongoing tight electricity supply due to the shutdown of the country's nuclear power plants, we are installing cogeneration systems at manufacturing plants and stepping up energy-saving measures across all NSK sites, while aiming for no increase in CO<sub>2</sub> emissions.

### Growing Together with Local Communities

Today's economic climate, including slowing economic growth in emerging countries and the fiscal and financial crises in Europe, not to mention the prolonged extreme strength of the yen, presents a serious challenge for Japanese companies. The interdependence of the global economy entails various risks caused by unemployment, disparities, and conflicts. It is also challenged by resource shortages and environmental problems such as global warming, and complicated by diverse business trends in each region. Factors of instability like these are now intricately intertwined, and with their effects felt worldwide, it is difficult to foresee the future.

At the NSK Group, we are striving to make our global business structure even more efficient and resilient in the face of exchange rate fluctuations. We are steadily moving ahead with local production and local procurement, while providing products and services that are optimally suited to local customers. As a good corporate citizen, the NSK Group seeks to grow together with local communities by creating employment that supports community development, protecting the environment and providing educational assistance that meets local needs.

### Contributing to Economically and Environmentally Balanced Social Development

Floods, droughts, and other abnormal weather that has occurred around the world have given cause for concern that the progress of global warming may lead to intensification of climate change and cause serious damage. It is also making us rethink the importance of seeking balance between economic growth and protection of the global environment.

Automakers, which are customers of the NSK Group, are focusing attention on the environment. They are making lighter vehicles, creating more efficient engines, and accelerating development of hybrid and electric technology. The NSK Group is strengthening its initiatives in these fields, as meeting the needs of these technical innovations is an important issue for the Group's growth. Our business in electric power steering (EPS) systems, an environmentally friendly product that contributes to improved fuel economy, has achieved growth exceeding that initially envisioned, which I believe is one of our achievements from these initiatives.

Furthermore, the NSK Group established the Future Technology Development Center in order to better meet the needs of our customers. The center aims to create new and innovative technologies that go beyond previous concepts. At present our dedicated technology innovation team is communicating closely with our customers' advanced development departments to determine the solutions needed.

In addition to offering environmentally friendly products, we are also working to improve the environmental performance of our manufacturing operations group-wide. Regarding parts for an automotive hub unit bearing that NSK developed in 2010, the R&D and production departments cooperated closely to develop a new processing method that made it possible to apply a method called cold forging. This method simultaneously saves resources by using less steel and energy by eliminating heating during machining. It won an

Automotive Parts Award in the 'CHO' MONODZUKURI Innovative Parts and Components Award 2011 sponsored by the Nikkan Kogyo Shimbun Ltd. The product also has the advantage of being lighter, and we expect sales to grow.

### Targeting Further Growth as a Global Company

A priority issue for NSK is to build a more robust foundation for fulfilling our social responsibilities by strengthening governance and compliance and increasing management transparency. We will go back to the basics, working to strengthen education and training for officers and employees in and outside Japan in order to foster a corporate culture of total commitment to legal compliance and adherence to corporate ethics.

In fiscal 2011, we opened the Global Management College, inviting select members from our sites in different regions to participate. This is part of our effort to foster the next generation of global leaders and increase the capability of Group companies worldwide to drive their own growth. Going forward, we will build a more dynamic work environment where employees can feel the satisfaction of their career developing along with the Company. We will enhance our educational programs to better meet the needs of local markets and ensure that all employees worldwide understand and embrace NSK's principles and culture.

### Working Together with You

In this report, we have aimed for transparency. We describe how we see the expectations of customers and other stakeholders, the goals we are working toward, and our performance against those goals. I hope that this report will serve as a useful tool for improving communication with all of our diverse stakeholders. Finally, I would like to invite you to share with us your opinions about this report and your expectations of the NSK Group's business activities.

# Important Report

## Antimonopoly Charges

In July 2011, the Japan Fair Trade Commission conducted an on-site investigation against NSK regarding a potential violation of the Antimonopoly Act of Japan in transactions involving bearing products. Then, in April 2012, the Special Investigation Department of the Tokyo District Public Prosecutors Office and the Japan Fair Trade Commission raided NSK facilities regarding a potential violation of the Antimonopoly Act of Japan. In June 2012, the Tokyo District Public Prosecutors Office prosecuted NSK, two former officers and a former employee under criminal charges pressed by the Japan Fair Trade Commission.

In November 2011, the European Commission conducted an on-site investigation against NSK's German sales subsidiary regarding a potential violation of EU competition law in transactions involving bearing products. Further, the United States Department of Justice sent a subpoena to NSK's U.S. subsidiary seeking the provision of information pertaining to transactions involving bearing products.

Additionally, in July 2012 the Korea Fair Trade Commission conducted an on-site investigation against NSK's Korean subsidiary regarding a potential violation of the Monopoly Regulations and Fair Trade Act of Korea in transactions involving bearing products.

The NSK Group apologizes for the great concern caused to shareholders, investors, and other stakeholders.

This CSR report includes information as of December 2012. Please check NSK's website for the most up-to-date information.

## NSK's Response

The NSK Group takes these matters with the utmost gravity and is cooperating fully in the investigations by the authorities

in and outside Japan. Moreover, the NSK Group is investigating the causes and making a range of efforts to further strengthen compliance. The NSK Group is determined to work even harder to conduct its business operations in line with the expectations of stakeholders in the future.

## Main Efforts to Strengthen Compliance

### (1) Establishment of the Compliance Committee and Compliance Enhancement Office

In March 2012, NSK established the Compliance Committee. The committee formulates policies aimed at strengthening compliance, promotes measures to strengthen compliance, verifies progress, and periodically reports on the progress thereof to the Board of Directors.

Additionally, in July 2012 NSK established the Compliance Enhancement Office in the Legal Department. The new office is in charge of overseeing the practical work related to compliance across the entire NSK Group based on the decisions of the Compliance Committee. The office heightens awareness of compliance throughout the NSK Group in cooperation with the Legal Department and departments in charge of compliance in and outside Japan.

### (2) Strengthening the Global Compliance System

To strengthen its compliance system globally, the NSK Group has appointed persons responsible for compliance at headquarters outside Japan, including in the Americas, Europe, China, ASEAN, India, and South Korea. In August 2012, it held a global compliance meeting. Persons responsible for compliance in the Americas, Europe, and China gathered at the head office of NSK to report compliance-related issues in

their respective regions and to discuss measures to strengthen compliance globally in the future.

Moreover, the NSK Group has appointed persons responsible for compliance at each department, site, and group company of NSK in Japan. These persons communicate information related to compliance and conduct risk management in cooperation with the Compliance Division Headquarters. The NSK Group also holds compliance conferences attended by persons responsible for compliance.



Photo 1: Global compliance meeting

### (3) Improving Internal Rules

NSK has revised the NSK Code of Corporate Ethics and its Compliance Rules to ensure thorough compliance. It also improved other necessary rules including its Rules for Compliance with the Competition Law.

### (4) Guidebook on Antimonopoly Act (Competition Law) Distributed to All Officers and Employees

NSK produced a new guidebook that clearly describes the details of competition law and cautionary points. It distributed copies to all officers and employees in the NSK Group in Japan to ensure thorough compliance with competition law throughout the NSK Group. After reading and understanding the content of the



Guidebook on the Antimonopoly Act (competition law)

guidebook, each and every officer and employee in the NSK Group in Japan submitted a written oath declaring that they will act in compliance with competition law and other laws.

The NSK Group will use this guidebook to conduct continuing training and e-learning in an effort to firmly establish understanding of competition law and raise awareness of legal compliance.

### (5) Compliance Education

The NSK Group continually provides training through e-learning and lecture-based training at sites in and outside Japan on topics such as CSR, compliance, information security, and internal controls.

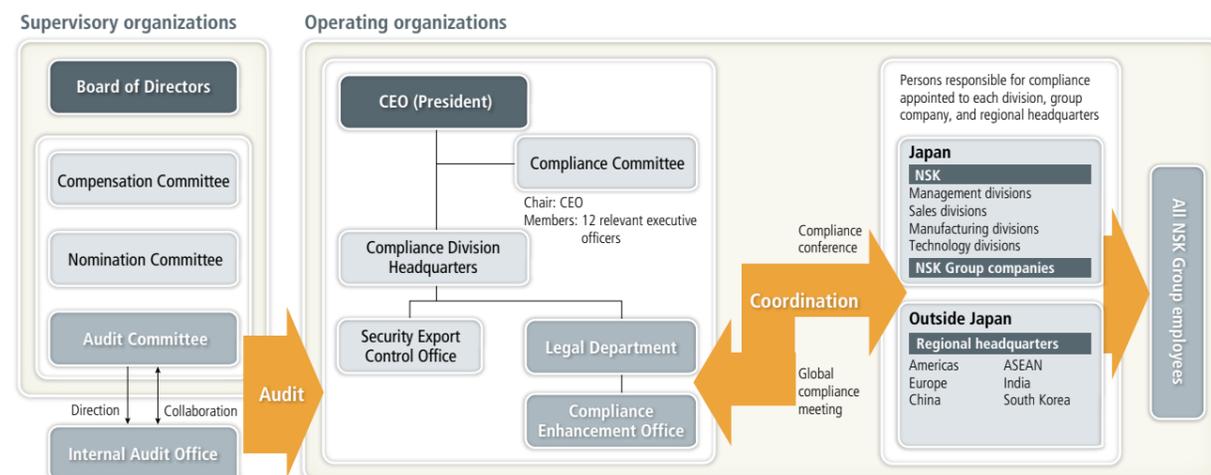
Starting in fiscal 2011, the NSK Group began lecture-based compliance training in greater detail in order to raise awareness of compliance throughout the NSK Group. The training was provided a total of 134 times to about 4,300 people—all officers and all employees working in sales departments across Japan—by the end of December 2012. The Compliance Enhancement Office conducted compliance training in the Americas, Europe, China, ASEAN, India, and South Korea in cooperation with the legal departments of local corporations.

The NSK Group also posted contents to its intranet clearly explaining internal rules and laws that are closely related to the NSK Group's work.



Photo 2: Training session in India on competition law

## Compliance System



See page 20 for a diagram of the corporate governance structure.

## NSK Group's Initiatives

Date	Action taken	Date	Action taken
August 2011	President issues message calling on officers and employees to ensure thorough compliance and to cooperate with the Japan Fair Trade Commission's investigation	May 2012	Revised the Compliance Rules in the NSK Group Rules
January 2012	Started an internal system to consider and decide in advance on the advisability of whether employees should participate in meetings at which competitors will be present	July	Revised the Rules of Employment, clarifying employees' obligation to comply with the law and the disciplinary action for illegal acts
February	Started e-learning program on the topic of compliance, including compliance with the Antimonopoly Act (competition law)	July	Established Compliance Enhancement Office in the Legal Department to promote measures aimed at strengthening compliance
March	Started lecture-based training on the topic of compliance, including compliance with the Antimonopoly Act (competition law)	August	Distributed guidebook on the Antimonopoly Act (competition law) to officers and employees and received submissions of written oaths regarding compliance with competition law and other laws
March	Established Compliance Committee (chaired by CEO with 12 officers as members) for management to deliberate policies to strengthen compliance	August	Assembled persons responsible for compliance outside Japan at a global compliance meeting to discuss measures for strengthening compliance
April	Revised the item relating to compliance with competition law in the NSK Code of Corporate Ethics	December	Assembled persons responsible for compliance in Japan at a compliance conference to discuss measures for strengthening compliance
April	Established the Rules for Compliance with the Competition Law in the NSK Group Rules		
	Held first Compliance Committee meeting (later held in May, August, and November)		

## Mission Statement

NSK aims to contribute to the well-being and safety of society and to protect the global environment through its innovative technology integrating MOTION & CONTROL. We are guided by our vision of NSK as a truly international enterprise and are working across national boundaries to improve relationships between people throughout the world.

## Management Principles

1. To serve our customers through innovative and responsive solutions, taking advantage of our world-leading technologies.
2. To provide challenges and opportunities to our employees, channeling their skills and fostering their creativity and individuality.
3. To identify the needs of the times and of the future and to use all of NSK's resources to meet those needs by being versatile, responsive and dynamic.
4. To work together with our employees and contribute to the communities in which we operate.
5. To manage our business from an international perspective and to develop a strong presence throughout the world.

## Corporate Message

**Responsive and Creative  
MOTION & CONTROL™**

## Corporate Slogan

**Beyond Limits, Beyond Today**

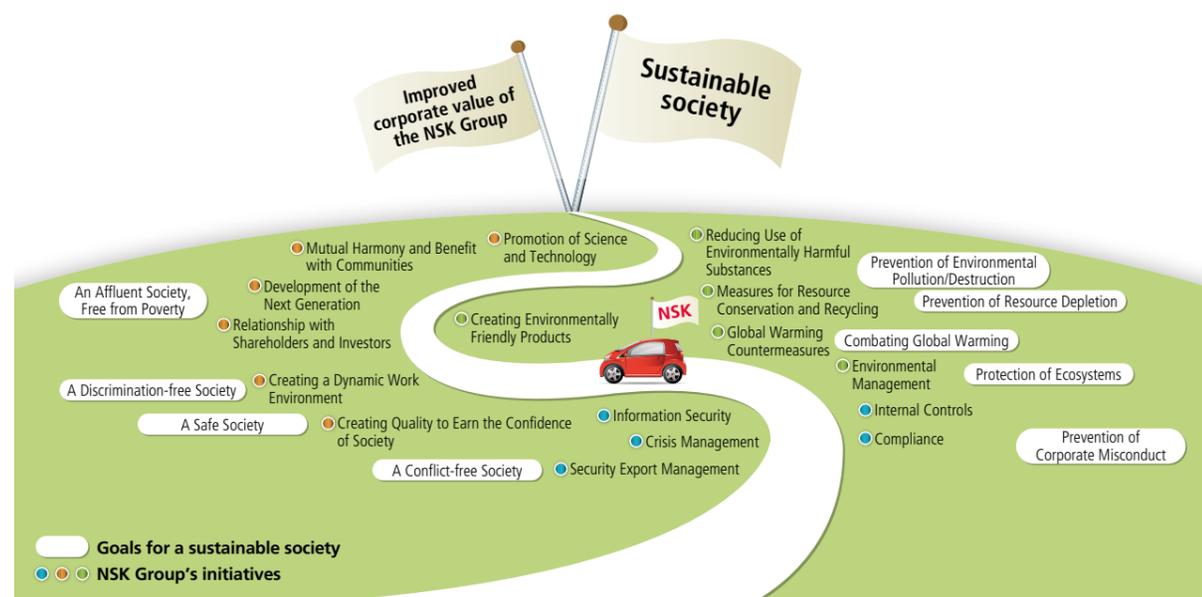
Beyond Frontiers  
Beyond Individuals  
Beyond Imagination  
Beyond Perceptions  
Challenging the Future

## The NSK Group's View of CSR

NSK's Mission Statement makes clear the Group's commitment to contributing to the development of society and to the protection of the global environment, and its Management Principles set the course to realizing these goals.

The NSK Group's products have the special characteristic of aiding the smooth functioning of a wide range of machinery, and they support the reliability, safety, and energy efficiency of the machines into which they are incorporated. The NSK Group regards its fundamental corporate activity as

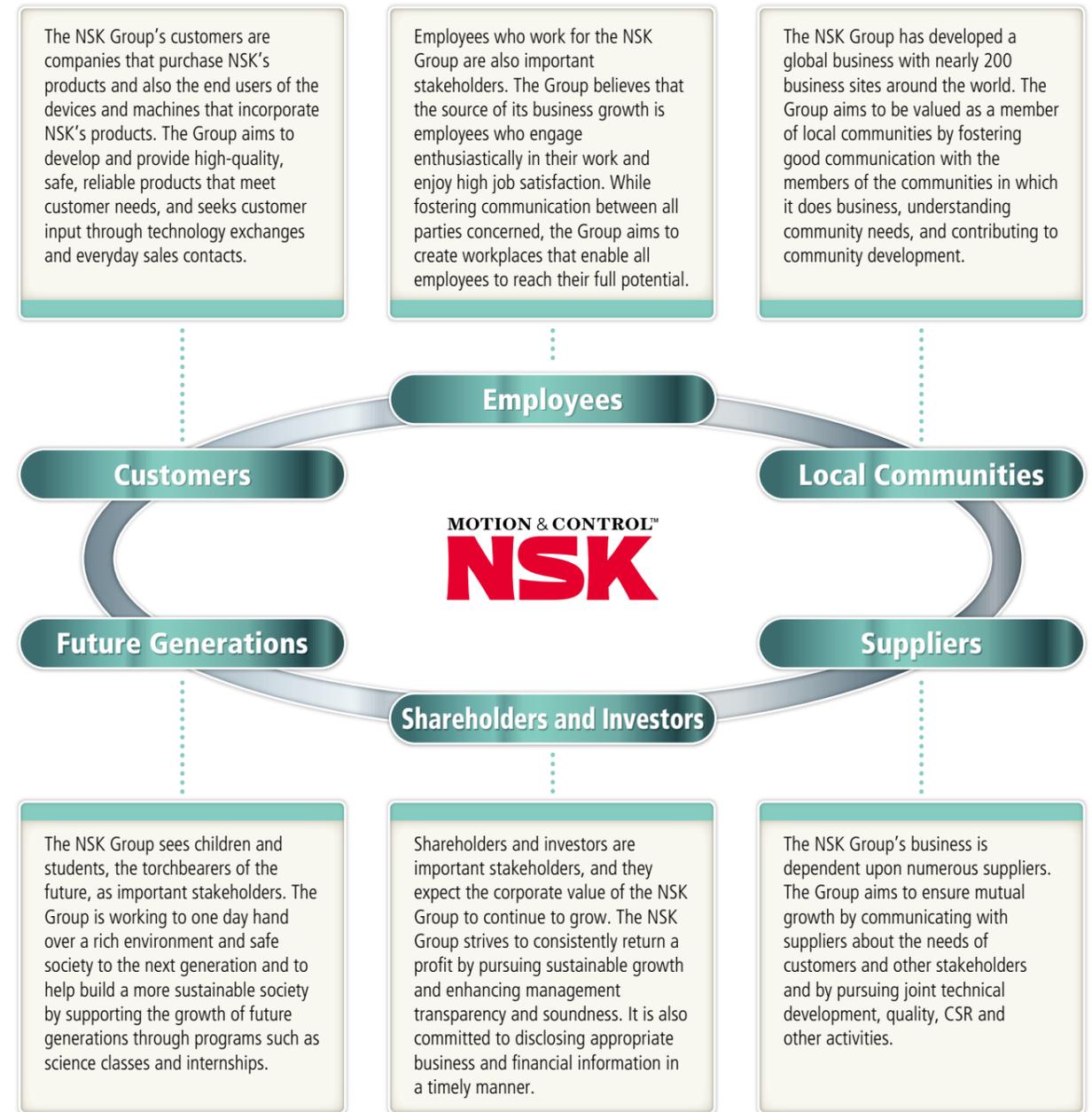
contributing to smoothly running, safe societies, protection of the global environment, and the realization of sustainable societies through the supply of those products—that is, through the Group's main business. The NSK Group aims to achieve greater corporate value and sustainable growth by ensuring that all directors and employees are firmly aware of the Group's roles and by making sincere efforts to contribute to business growth and society by taking the perspective of customers and other stakeholders.

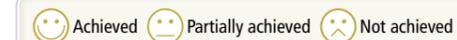


## The NSK Group's Stakeholders

The NSK Group's business is built on the trust of a variety of stakeholders. The NSK Group believes that active communication is the key to building better relationships with its stakeholders. The Group is also striving to build a corporate culture

in which each site, each department, and each and every officer and employee recognizes the needs of stakeholders and the broader society and can reflect those needs in their own everyday work.





FY2011 target	Performance in FY2011	Evaluation	FY2012 target	Page
<b>Management Structure Supporting Sustainable Growth</b>				
Continue to revise the NSK Group Business Standards	Carried out in line with improvement plan	☺	Continue to revise and to accelerate the dissemination of rules, including the NSK Group Business Standards	P. 20 - P. 23
Strengthen internal control implementation structure in Asia and expand scope of evaluation	Established a structure under which regional headquarters in China, ASEAN, and India evaluate the design and operation of internal controls at subsidiaries within their respective regions evaluating J-SOX status and conducting fraud prevention self-assessment	☹	Enhance the internal audit structure at regional headquarters outside Japan and make and implement internal audit plans in each region Standardize and streamline evaluation of internal control over financial reporting	
Expand training on topics such as CSR and compliance to general employees of companies outside Japan	General employees whose superiors deemed such training necessary for them took the training	☹	Continue to provide training on topics such as CSR and compliance for all employees	
Roll out NSK Supplier CSR Guidelines to suppliers in Americas and ASEAN	Started preparations to roll out NSK Supplier CSR Guidelines to suppliers in Americas Provided explanations to suppliers in Japan and collected Self-Assessment Check-Sheets	☹	Roll out NSK Supplier CSR Guidelines to suppliers in Americas Provide feedback on the results of Self-Assessment Check-Sheets	
Reexamine and strengthen BCP, focusing on lessons learned from Great East Japan Earthquake	Fixed production equipment to the floor at all sites Started ascertaining suppliers' earthquake and tsunami risks	☺	Take measures to prevent objects such as ducts from falling Ascertain suppliers' earthquake risks and reflect in BCP	
Strengthen management structure for preventing export of products that could be used in development or manufacture of weapons	Strengthened transaction screenings for indirect exports	☺	Strengthen screening structure for transfer of technology	
<b>Creating Quality to Earn the Confidence of Society</b>				
Certify special process auditors outside Japan	Certified special process auditors in Americas, Europe, and South Korea	☹	Continue certifying special process auditors outside Japan	P. 24 -
Create educational tools for users	Created product cutaway models as educational presentation tools and started using them outside Japan	☺	Continue enhancing educational tools for users	P. 27
<b>Creating a Dynamic Work Environment</b>				
Establish model line and introduce risk management in concrete way	Introduced as planned	☺	Expand to other lines	P. 28 - P. 33
Develop common worldwide basic training	Started Global Management College	☹	Continue Global Management College	
Expand training sessions on human rights	Implemented training on preventing harassment	☺	Expand human rights training sessions	
<b>Working with Local Communities and Supporting Education for the Next Generation</b>				
Create system for giving momentum to each business site's efforts	Specified priority areas for social contribution and emphasized the need for employee involvement	☹	Continue to involve employees in social contribution activities	P. 34 -
Continue to share information on initiatives among business sites	Distributed <i>NSK Group Social Action Program</i> intranet booklet (Japanese/English) to all business sites	☹	Continue to share information on initiatives among business sites	P. 37
<b>Relationship with Shareholders and Investors</b>				
Enhance services for individual investors	Planned and prepared briefings for individual investors	☹	Hold briefings for individual investors	P. 54
<b>Environmental Voluntary Action Plan</b>				
<b>Environmental Management</b>				
Obtain ISO 14001 certification at three new applicable sites (to reach 59 sites in all) (obtain certification within three years of starting full-scale operations)	Obtained certification at two sites (total of 58 sites)	☹	Obtain certification at all applicable sites (total of 59 sites in all)	P. 38 - P. 39
Observe laws and regulations	Seven cases in which the limits for permissible air and water quality standards were slightly exceeded occurred (two in Japan and five outside Japan)	☹	Observe laws and regulations	
Zero oil-leak accidents outside company premises	One oil-leak accident occurred in Japan	☹	Zero oil-leak accidents outside company premises	

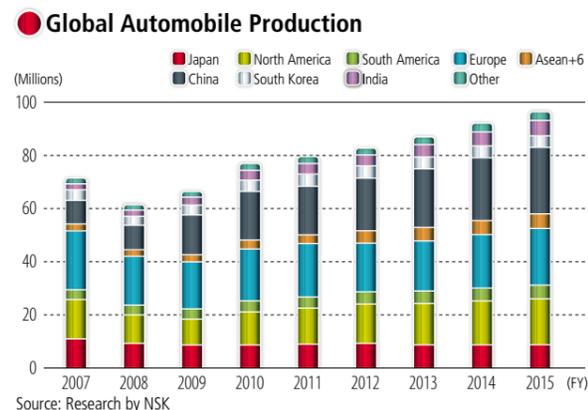
FY2011 target	Performance in FY2011	Evaluation	FY2012 target	Page
<b>Manufacturing</b> In Japan: Conduct environmental audits by Global Environment Department	In Japan: 21 internal audits on environmental risk and the management of environmentally harmful substances conducted	☺	In Japan: Conduct environmental audits by Global Environment Department	P. 38 - P. 39
<b>Creating Environmentally Friendly Products</b>				
Create environmentally friendly products and technologies Calculate and evaluate LCAs (expand subject product scope)	Created 17 environmentally friendly products and technologies Calculated and evaluated LCAs for electric power steering (EPS) systems and automatic transmission parts (one-way clutch)	☹	Continue to create environmentally friendly products and technologies Calculate contribution to CO <sub>2</sub> emissions reduction	P. 40 - P. 43
<b>Global Warming Countermeasures</b>				
<b>Manufacturing</b> In Japan: Reduce CO <sub>2</sub> emissions per production unit by 11.4% (base year: FY1999) Outside Japan: Reduce CO <sub>2</sub> emissions per production unit by 3% (base year: FY2008)	In Japan: Reduced CO <sub>2</sub> emissions per production unit by 11.8% (base year: FY1999) Outside Japan: Reduced CO <sub>2</sub> emissions per production unit by 13.5% (base year: FY2008)	☹	In Japan: Reduce CO <sub>2</sub> emissions per production unit by 12.2% (base year: FY1999) Outside Japan: Reduce CO <sub>2</sub> emissions per production unit by 4% (base year: FY2008)	P. 44 - P. 47
<b>Manufacturing</b> In Japan: Reduce CO <sub>2</sub> emissions to no more than FY2006 level	In Japan: Increased CO <sub>2</sub> emissions by 0.4% (base year: FY2006) (electricity conversion coefficient: variable) Reduced CO <sub>2</sub> emissions by 8.7% (base year: FY2006) (electricity conversion coefficient: fixed)	☹	In Japan: Reduce CO <sub>2</sub> emissions to no more than FY2006 level	
<b>Distribution</b> In Japan: Reduce energy consumed per ton-kilometer by 13% (base year: FY2006)	In Japan: Reduced energy consumed per ton-kilometer by 14.5% (base year: FY2006)	☺	In Japan: Reduce energy consumed per ton-kilometer by 14% (base year: FY2006)	
<b>Measures for Resource Conservation and Recycling</b>				
<b>Development / Design / Manufacturing</b> In Japan: Reduce waste of resources by changing machining processes	In Japan: Reduced material waste for relevant parts	☹	In Japan: Continue to reduce waste of resources by changing machining processes	P. 48 - P. 49
<b>Manufacturing</b> In Japan: Maintain zero emissions (landfill disposal rate no more than 0.5%)	In Japan: Landfill disposal rate was 0.02%	☺	In Japan: Maintain zero emissions (landfill disposal rate no more than 0.05%)	
<b>Manufacturing</b> In Japan: Maintain waste recycling rate of 99% or more Outside Japan: Maintain waste recycling rate of 91% or more	In Japan: Recycling rate was 99.2% Outside Japan: Recycling rate was 91.9%	☺	In Japan: Achieve a waste recycling rate of 99.5% or more Outside Japan: Achieve a waste recycling rate 92% or more	
<b>Distribution</b> In Japan: Reduce packaging material waste per production unit by 4% (base year: FY2007)	In Japan: Packaging material waste per production unit increased by 10.7% (base year: FY2007)	☹	In Japan: Reduce packaging material waste per production unit by 5% (base year: FY2007)	
<b>Reducing Use of Environmentally Harmful Substances</b>				
<b>Procurement</b> In Japan: • Revise NSK Green Procurement Standards (6th edition) • Hold green procurement briefing sessions • Conduct on-site audits at key suppliers • Investigate status of NSK Environmentally Harmful Substances at suppliers Outside Japan: • Hold green procurement briefing sessions (China) • Conduct self-audits at key suppliers • Investigate status of NSK Environmentally Harmful Substances at key suppliers	In Japan: • Finished revising NSK Green Procurement Standards (6th edition) • Held six green procurement briefing sessions • Conducted on-site audits at 56 key suppliers Outside Japan: • Held two green procurement briefing sessions in China • Ascertained key suppliers for self-audits	☹	In Japan: • Conduct on-site audits at key suppliers • Investigate status of NSK Environmentally Harmful Substances at suppliers Outside Japan: • Hold green procurement briefings for key suppliers (ASEAN, India, and South Korea) • Investigate status of NSK Environmentally Harmful Substances at key suppliers (ASEAN, India, and South Korea)	P. 50 - P. 52
<b>Manufacturing</b> In Japan: Reduce amount of PRTR-designated substances (under 2008 law revision) handled by 3% (base year: FY2010)	In Japan: Reduced amount of PRTR-designated substances handled by 3.4% (base year: FY2010)	☺	In Japan: Reduce amount of PRTR-designated substances handled by 3% (base year: FY2011)	
<b>Manufacturing</b> Completely phase out use of machining fluids containing chlorine additives	In Japan: Replaced one fluid; four fluids remaining Outside Japan: Replaced three fluids; three fluids remaining	☹	Completely phase out use of machining fluids containing chlorine additives	

# NSK's Efforts to Improve Automotive Fuel Economy

Modern lifestyles have been changing at a faster pace in recent years than ever before. As new technologies and products are created to support more comfortable and affluent living, their production and use drives up emissions of CO<sub>2</sub> and other greenhouse gases. This in turn contributes to global warming, increasing concern about climate change. The reduction of CO<sub>2</sub> emitted by automobiles, which are so vital to how people live today, is a major challenge.

Although global automobile production fell temporarily with the world economic downturn in 2008, it returned to its previous level by 2010 and has been increasing ever since, backed by growth of the automobile market in emerging countries and the success of the eco car in developed countries. More cars mean an even greater need to reduce CO<sub>2</sub> emissions per vehicle. It also explains why automobile emissions regulations are getting stricter every year around the world.

This special feature introduces NSK's efforts to support automakers' attempts to improve fuel economy.



### CO<sub>2</sub> Emissions Regulations

	2010	2011	2012	2013	2014	2015
Japan						<b>140 g/km</b> 16.8 km/ℓ
USA	27.5 mpg 11.7 km/ℓ					<b>156 g/km</b> 35.5 mpg; 15.1 km/ℓ
EU	<b>140 g/km</b> 16.9 km/ℓ					<b>130 g/km</b> 18.2 km/ℓ
China						<b>165 g/km</b> 14.3 km/ℓ

\*Based on 1 ℓ gasoline = 2,360 grams CO<sub>2</sub>

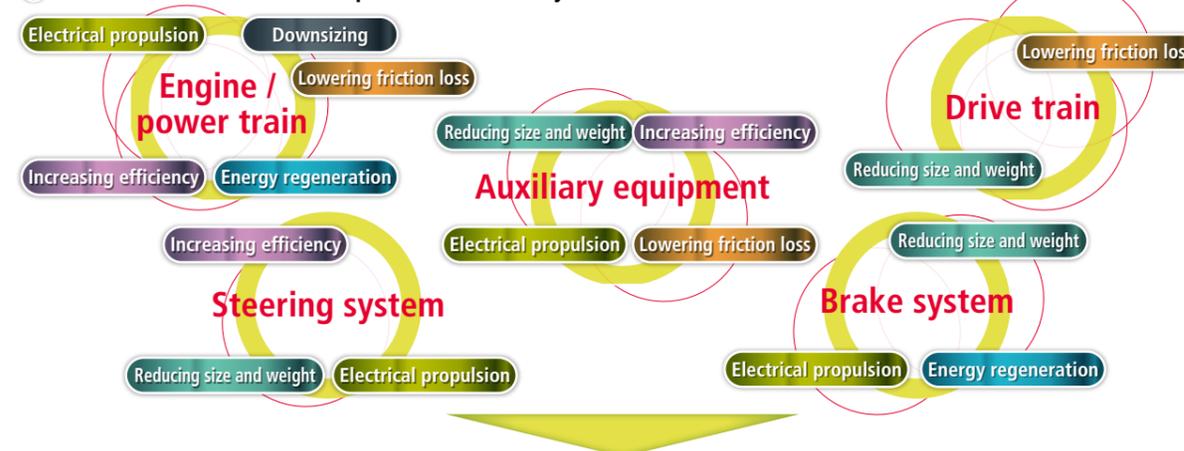
## Automaker Initiatives and NSK's Four Core Technologies

While the level of CO<sub>2</sub> emissions regulation differs from country to country, automakers that fail to achieve the targets can face penalties. Automakers are therefore developing various technologies to improve fuel efficiency and reduce CO<sub>2</sub> emissions. They are working to make engines more efficient, smaller and lighter, and making more use of electrical propulsion.

Automotive fuel economy cannot be significantly improved unless vehicle parts are improved. A single

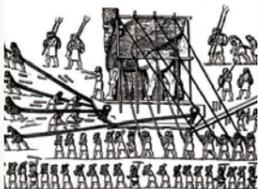
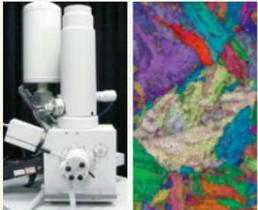
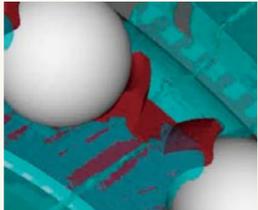
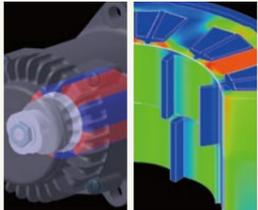
vehicle normally uses 100 to 150 bearings. NSK provides those bearings as well as a wide range of other products such as automatic transmission parts, steering column joints, and power steering systems. NSK skillfully applies the four core technologies it has developed over many years—tribology, material engineering, analysis technology, and mechatronics—to develop new products that enable automakers to offer greater fuel economy.

### Automakers' Initiatives to Improve Fuel Economy



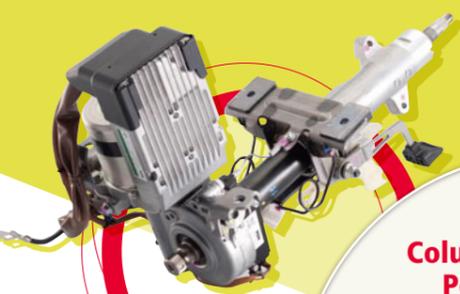
NSK helps improve fuel economy by skillfully applying its four core technologies to product development.

### NSK's Four Core Technologies

Tribology	Material Engineering	Analysis Technology	Mechatronics
<p>Tribology is a technology that controls friction and wear of sliding surfaces in relative motion. This is one of the key technologies for bearings that support rotational or linear motion applications. The principle of bearings traces its origin to ancient Mesopotamia, where gigantic stones were transported with relative ease by placing logs underneath them.</p> 	<p>Materials play a key role in heightening the performance and durability of bearings subjected to extreme usage conditions. Aiming to develop products with even greater durability and reliability, NSK uses a wide variety of performance assessments and analytical technologies to develop new materials with optimal compositions and new heat treatment processes with optimal conditions. Moreover, the Company develops technologies that use new materials, such as ceramics and high polymeric materials.</p> 	<p>NSK uses computer simulations to test and assess the performance of bearings in virtual environments. Taking advantage of advanced analysis technology enables the Company to assess performance in extreme conditions, under which testing in actual machinery is difficult. This helps to speed up the creation of optimal designs and product development for bearings.</p> 	<p>NSK has highly sophisticated mechatronics, which combines electronics with mechanical technologies the Company has fostered through product development and at production sites. In a broad spectrum of areas—including motors, control, and sensors—mechatronics creates new products exemplifying NSK's initiatives to integrate MOTION &amp; CONTROL.</p> 

# NSK Products That Improve Fuel Economy

The improvement of each and every NSK product used in an automobile leads to better fuel economy for the entire vehicle. Every day NSK continues to embrace the challenge of making products smaller and lighter and reducing friction loss to a minimum. Each advance helps to improve fuel economy.



## 1 Column Type Electric Power Steering

Reducing size and weight  
Increasing efficiency  
Electrical propulsion

Electric power steering (EPS) systems are reported to improve fuel economy by 3–5% compared to conventional hydraulic power steering and also provide excellent steering control functions. These advantages are making them increasingly popular around the world. As demand for smaller cars expands with rising environmental awareness, lightweight and compact column type EPS systems, a product that NSK excels in, are helping to improve fuel economy and contributing to the downsizing of automobiles.



## 3 Silent Needle Roller Bearings for Automotive Electrical Components

Reducing size and weight  
Electrical propulsion

Automobiles like electric vehicles (EVs) and hybrid vehicles (HEVs) are generally quiet thanks to their electric motors. This means all the parts used in these vehicles also have to be very quiet. NSK has reduced the noise generated by bearings to less than a third of the conventional level with high-precision machining of rollers. These products help to improve the comfort of EVs and HEVs, which are expected to enjoy a rapidly expanding market in the years to come.



## 4 Grease-lubricated Ball Bearings for High-speed Motors for Next-Generation EVs and HEVs

Electrical propulsion  
Energy regeneration  
Increasing efficiency  
Lowering friction loss

In recent years, automakers have been downsizing and lightening drive motors and power generators to extend the running distance and improve energy efficiency in EVs and HEVs. On the other hand, there is a greater need for high-speed rotation to ensure output. NSK has achieved world-class high-speed rotation in bearings that support electric motors by improving the cage and optimizing the grease.

## 2 Ball Bearings for Turbochargers

Downsizing  
Increasing efficiency

Turbochargers enable better fuel economy by increasing engine output to allow large vehicles to be driven by a small engine. Since turbochargers directly receive high-temperature exhaust gas, the bearings also have to be able to withstand high temperatures. Compared to conventional sliding-type bearings, NSK's bearings reduce mechanical loss by approximately 50%.

## Translating Customer Hopes into Reality: NSK's Technical Collaboration and Responsive, Attentive Service

At NSK, development, design, production, and sales departments work together in pursuit of technical innovations that improve product value for customers.



Development and design departments strive to develop products that meet customer needs by considering specifications, designing products, and testing durability based on technologies refined over many years.

In cooperation with development and design departments, production departments consider production processes, assemble production lines, and manage the progress of daily production. The NSK Group delivers quality products in a timely manner thanks to its global production system.

Sales departments ascertain customer needs and feed that information back to other departments. They build close partnerships with customers through detail-focused service in cooperation with both development and design and production departments.

## 7 Ultra-long-life Ball Bearings for Transmissions

Reducing size and weight  
Lowering friction loss

Bearings for transmissions, which are subject to harsh environmental conditions, must be sufficiently durable. NSK drew on its material engineering capabilities to apply a special heat treatment to the balls, thereby enabling a service life that is two to three times longer than usual. This ensured durability in bearings that are smaller than usual, which is in turn contributing to the pursuit of more compact and lightweight transmissions with less friction.

See pages 14–15 for details.

## 5 High Seal Performance Ball Bearings for Automotive Electric Motors

Electrical propulsion

The number of electric motors in automobiles has increased with the electrification of vehicles. Some bearings in automotive electric motors are exposed to oil for a long time. Under such conditions, oil or other extraneous material can penetrate into the motor through the bearing, causing the motor to malfunction. NSK has developed a high-performance seal to prevent the infiltration of extraneous material, thereby contributing to motor life and reliability.

## 6 Low-friction Ball Screws for Regenerative Braking System Applications

Energy regeneration  
Reducing size and weight

Motor-controlled brakes used in EVs and HEVs make maximum use of regenerative brakes that utilize power generators, ensuring braking power and improving the rate of energy recovery by operating in synchronization with normal brakes. NSK brought together the production technology it has cultivated over many years to enable the production of hollow and smaller ball screws for motor-controlled brakes and also improved performance for low-friction transmissions.

See pages 16–17 for details.

## 8 Low-torque Tappet Roller Bearings for Automobile Engines

Reducing size and weight  
Increasing efficiency  
Lowering friction loss

Tappet roller bearings are used in the opening and closing of engine valves. While there is a need to make bearings smaller along with the downsizing of engines, the requirement of a long service life must also be fulfilled. NSK used a special heat treatment on the tappet roller bearing's roller and shaft, delivering twice the life of the conventional product and enabling the weight to be reduced by about 20%. Additionally, weight and size reductions with the application of life-extending technology resulted in 30–40% lower torque than the conventional product.

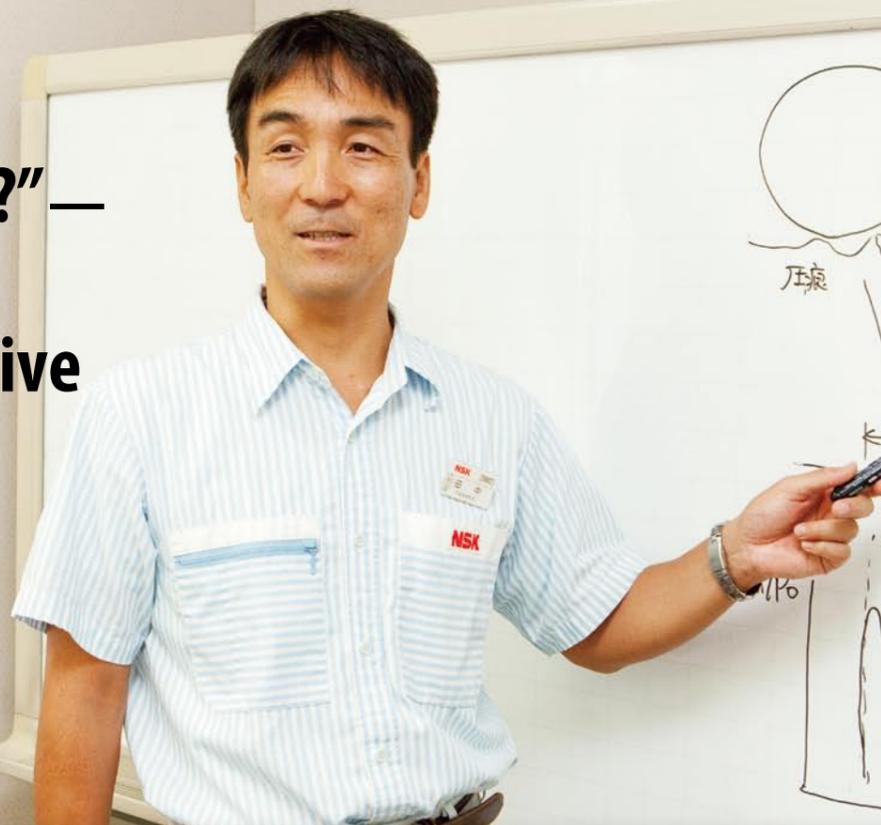
See pages 18–19 for details.

Development and Design

## Always Asking "Why?" — Finding New Ways to Improve Automotive Fuel Economy

**Susumu Tanaka**

Group Manager,  
Drive Train Bearing Technology Department,  
Automotive Bearing Technology Center, NSK Ltd.



### What Our Job Involves

Our department's main work is the design and development of bearings used in transmissions, which are devices that shift engine rotation and transmit power to the tires according to conditions such as the speed of the vehicle. In particular I am involved in the development of bearings for continuously variable transmissions (CVT), hybrid vehicles, and electric vehicles.

As fuel economy regulations become tighter around the world, the development race for greater fuel efficiency has become more intense. Our job in development and design is to create bearings that meet detailed specifications including placement and size, sophistication, smaller sizes, and lighter weights in response to a variety of requests from customers.

### Improved Fuel Economy and Long-life Bearings

Bearings used in transmissions help improve automotive fuel economy by transmitting the engine's power without energy loss and allowing gears to operate more smoothly.

Since there are many gear teeth around transmission bearings, metallic wear dust produced from friction when gears mesh may infiltrate the bearings. This can cause nicks in the bearing, which may lead to flaking.\*1 Flaking in the bearings can cause strange noises in the transmission and, if the damage progresses, in the worst-case scenario may make it impossible to drive the vehicle. To prevent this, NSK has been working for many years to increase bearing service life. There are two conventional ways of increasing bearing life that have been established based on durability testing and analysis technology: preventing the infiltration of foreign matter by attaching a seal to the bearing or strengthening the bearing's outer and inner rings themselves through special heat treatment.

### The Clue Leading to New Technology Development

During durability testing, generally either the outer or inner ring will break, but sometimes the balls will break. One time I noticed that the life of the outer and inner rings was longer than usual when the balls were replaced with new ones and the testing continued. Until then it was common to strengthen either the outer or inner ring in order to lengthen bearing life, but when various durability tests were conducted based on this result, it was found that the life of the bearing itself could be increased by making the balls more impervious to nicks even if they develop in the outer and inner races. The Basic Technology Research Center spent nearly 10 years to derive a new theory of how to improve service life and succeeded in developing a new product. The ultra-long-life ball bearing was the outcome of combining conventional technology with NSK's strengths—namely, material engineering and special heat treatment technology. Through the combination with NSK's proprietary long-life technology (TF technology),\*2 the service life of this

product was lengthened by up to 10 times the conventional standard.

Group company AKS East Japan Co., Ltd. cooperated considerably in the heat treatment process for strengthening the balls and the grinding and inspection processes for satisfying the desired precision. We had difficulty with the design review for mass production, roll out to manufacturing sites, and evaluation tests, but I think that sharing a vision with everyone involved—the needs of customers, the significance of the product, the contribution to improving automotive fuel economy—and working toward that achievement led to our success.

### Products That Can Contribute to the Global Environment and Help Drivers

Automakers' development staff always approach development with the driver's perspective in mind. The general public does not usually see NSK's products, and it may be difficult for drivers to notice how NSK's products are contributing to the global environment. However, we can feel that significance

and mission in direct conversations with staff at automakers. I think that one of my important roles is to communicate to production sites and suppliers how our products contribute, and get them to understand this mission and pursue a high level of craftsmanship.

In addition, we also emphasize repeatedly asking "why? why?" when thinking over issues at work, seeking to understand the reasons behind what customers want and what they expect of NSK. Without this, we cannot provide products with a high level of customer satisfaction and work smoothly with production and suppliers. At present I am working on the development of bearings for continuously variable transmissions (CVT), hybrid vehicles, and electric vehicles, and I will utilize NSK's all-round strength to provide products that can contribute to the continuously evolving demand for greater fuel economy.

\*1 Flaking: A phenomenon in which scales flake off the surface where the ball rolls along the inner and outer races of the bearing, causing the bearing to reach the end of its life.

\*2 TF technology: Technology that lengthens bearing life despite the presence of metallic powder through the use of materials and heat-treatment technology developed by NSK.

## Product Feature

### Ultra-long-life Ball Bearings for Transmissions

In an automobile transmission, metallic wear dust generated as gears wear down can get into the lubrication oil and can damage the bearings. When a bearing rotates, dents develop as the metallic powder is squeezed between the balls and the outer and inner races. As the balls roll over these dents again and again, metal fatigue progresses gradually from those points, causing flaking,\*1 where scales of metal flake off from the surface, resulting in the bearing reaching the end of its life.

Conventionally, development concentrated on materials in which service life did not drop easily and on heat treatment, focusing on the outer and inner rings, where flaking occurs. With the ultra-long-life ball bearing, development started when it was noticed during durability tests repeated by engineers on a routine basis that nicks on the balls might be a cause of the shortening of service life. After conducting a theoretical analysis, a long service life that was previously thought impossible was achieved by applying special heat treatment technology to the balls.

This product helps reduce the size and weight of transmissions and reduce friction loss by making it possible to ensure durability in bearings that are smaller than usual.



### Stakeholder's Voice—Group Company Employee's Voice

#### Contributing through Higher Quality and Environmentally Efficient Production

AKS East Japan produces the balls for ultra-long-life ball bearings. During development, we worked at building up special heat-treatment technology to increase the strength of the balls in a long process that took more than 10 years from basic research through prototyping to mass production.

In mass production, we had difficulties with heat treatment, which differed from the usual method, and in the process of lapping material that is harder than usual into spheres. However, everyone, including those involved in the prototyping, was ecstatic when mass production started, precisely because we had experienced so many challenges along the way. Today, the need for ultra-long-life ball bearings has increased, and we have upped our production.

Since we are making a product that contributes to improving automotive fuel economy, naturally it is important to carry out efficient production that minimizes energy use during production. What I find interesting about manufacturing is that the more you try, the more areas you can find to improve.



**Yoshiyuki Kawato**  
Administration Manager,  
AKS East Japan Co., Ltd.

Production



# Manufacturing That Improves Automobiles As They Continue Evolving

**Toshihiko Satou**

Group Manager,  
Processing Technology Development Department,  
Manufacturing Engineering Center, NSK Ltd.

**Mitsuo Kumagae**

Assistant Manager,  
Automotive Products Team,  
Saitama Plant, NSK Ltd.

## What Our Job Involves

It is our job to take the blueprints drawn by the development and design department and assemble a production line, positioning the most suitable processes for the manufacturing of that product while giving consideration to quality, productivity, and environmental protection. We see to it that daily production on that line is managed and moves ahead smoothly.

Of course, this was also the case with the ball screw for regenerative braking system applications. On the production floor, we understand how customers will use our products and strive to make highly reliable products by communicating closely with the design department and always staying aware of the importance of our work.

## Product Feature

### Low-friction Ball Screws for Regenerative Braking System Applications

Electric and hybrid vehicles use regenerative brakes together with usual brakes when decelerating to charge the battery by running a power generator, thereby recovering kinetic energy as electrical energy, which results in more efficient transportation.

Using the characteristic of ball screws to change rotational motion into smooth linear motion, the low-friction ball screw for regenerative braking systems developed by NSK is used in general brake parts that create hydraulic pressure to drive brakes with the rotation of the motor. The smooth movement of the ball screw also helps coordinate the two brakes in a way that feels natural to the driver.

Moreover, with this product there was the challenge of making the shaft hollow while maintaining the high precision of the ball screw in order to fit many parts into a limited space and enable parts to be smaller and lighter. The development and production departments cooperated to optimize the product shape and overcome challenges by reconsidering the production process, thereby achieving manufacturing that met customer needs.



### Energy Efficiency and Ball Screws

In a normal automobile, the force of the driver stepping on the brake pedal generates hydraulic pressure, and the force of the hydraulic pressure applied to the brakes causes the vehicle to slow down. In this situation, the automobile's kinetic energy is lost as frictional heat. Hybrid and electric vehicles, on the other hand, use regenerative brakes that slow the vehicle while recharging electricity made by running a generator with the rotation of the tires when the brake pedal is pushed down. However, the braking power of regenerative brakes alone is insufficient to allow the driver to stop the vehicle as intended. This is why the braking system is designed to make effective use of energy by working in synchrony with a normal brake while making optimal use of the regenerative brakes. The device that makes this possible is the regenerative braking system.

One of the reasons why ball screws ended up being used as parts in the regenerative braking system was the need to devise a way to fit the system

into the same space as a conventional braking system. Also, the characteristic smooth movement of ball screws allows operability that feels natural to the driver.

### Process Leading to the Mass Production of Low-friction Ball Screws

These ball screws had to be hollow and smaller than usual. The inside of a regenerative braking system has a complex structure packed with numerous parts. Even the ball screws are made so that other parts fit inside the hole in the shaft, giving it a shape with thin walls that adversely affects strength. At the same time, there is a need for sufficient strength so that the shaft does not deform during machining and throw the precision off. These hurdles were cleared by creating a design that envisioned distortions during machining and using special heat treatments, allowing us to invent hollow, smaller ball screws.

It goes without saying that brakes are a part requiring a high degree of reliability, as they are vital for

automotive safety. Quality controls were made even more thorough for the mass production of these ball screws. It was anticipated at the prototyping stage that creating stable quality would be a challenge because of the product's hollow body with thin walls. The solution was reached by building in quality via thorough processes to curtail variability in part precision. Moreover, through the NSK Product Development System (NPDS; see page 25), the parties involved deliberated the issues numerous times from every perspective, including engineering and production, going through a cycle of resolving challenges at every stage from prototyping to mass production. Even now more effort is put into traceability\*<sup>1</sup> than for other products and a system has been adopted for keeping records of everything including materials and the heat treatment process.

### Potential and Future of Ball Screws

These ball screws are used in vehicles such as electric and hybrid cars that store a lot of recovered energy in

high-capacity batteries. However, cars with conventional gasoline engines also have batteries, and so it is possible that fuel economy could be further improved in those vehicles by generating electricity using the power of braking. At present, there are not many instances of the application of ball screws in automobiles. However, they are extremely well suited to the trend toward electrification, and we would like to create products that will be widely adopted in the future.

However, no matter how good products are, it is pointless if lots of oil and energy are used to produce them. Accordingly, the manufacturing divisions work at energy-saving production that makes skillful use of production technology. Products made by the NSK Group are inherently designed to reduce energy loss, so our production methods should, too. We will continue to carry out manufacturing that meets the expectations of society.

\*<sup>1</sup> Traceability: Making it possible to trace the records of manufacturing and shipments such as the raw materials and parts used in a product. Ensuring traceability makes it possible to respond quickly should a problem occur with a product.

### Stakeholder's Voice—Employee's Voice

#### New Product Development through Teamwork between the Production and Design Departments

Different from typical ball screws, our low-friction ball screws for regenerative braking systems have a hollow shaft so that springs and other parts can fit inside in order to make the entire system compact. Because the screw shaft has thin walls, it is possible that the walls could deform during machining, causing a drop in precision. That is why the production and design departments cooperated so closely, working to ensure accuracy in terms of both design and machining.

Ball screws are suited to smoothly transmitting power without loss by changing the rotational motion of the motor to linear motion, and are therefore a part that assists in the electrical propulsion of automobiles. Going forward, we will work at the development and design of products that will expand the application of ball screws in the future.



Mechatronics Products  
Technology Department 2,  
Mechatronics Technology  
Development Center, NSK Ltd.

From left:  
**Toroshi Sakai**,  
**Toru Harada**  
(Assistant Manager),  
**Hiroyuki Itou** (Manager),  
**Koji Hashimoto**  
(Group Manager)

Sales



**Akio Niikura**  
Assistant Manager,  
Mid-Japan Technology Center,  
Automotive Bearing  
Technology Center, NSK Ltd.

**Motoyuki Nakajima**  
Manager, Sales Department 3,  
Mid-Japan Automotive  
Department, NSK Ltd.

**Minoru Tabuchi**  
Sales Department 3,  
Mid-Japan Automotive  
Department, NSK Ltd.

## Driven by the Voice of the Customer— NSK's Interdisciplinary Teamwork Delivers Comprehensive Strength

### What Our Job Involves

At NSK, sales departments have to adequately figure out customer needs through in-depth communication, then convey these needs to developers and production departments, and keep the project moving until it succeeds. Sales people play a vital role—taking the initiative to work with each department to meet customer requests. Sales people at NSK constantly ask themselves, “How can we meet the demands of society and customers while taking into account product features, delivery time, cost, and so many other factors? It takes skill and vision to lead projects that involve several different departments.

In the development of a low-torque tappet roller bearing, sales and engineering staff members met with customers many times. Project members carefully considered everything from specifications to the mass production process and ultimately pushed the project through trial and error to success.

## Product Feature

### Low-torque Tappet Roller Bearings for Automobile Engines

Automakers are developing technology to control the opening and closing timing of intake and exhaust valves and valve lift according to speed of rotation and other factors in order to improve engine performance and fuel consumption. This development has made the mechanism of the part that moves the valves more complex and necessitated the creation of more compact parts for use in the devices.

The durability of NSK's low-torque tappet roller bearing was increased by applying special heat-treatment technology to the rollers and shaft. The new product helps to improve engine efficiency by reducing friction loss by cutting size, weight, and torque. Creating this product required the application of material and heat-treatment technologies developed by NSK over many years. We also had to create production techniques for precise hardening of just the rolling parts of the roller using stable application of the heat treatment, so that both ends of the shaft fixed to the companion parts stay soft.

The sales, production, and development and design departments had to exchange information constantly to solve the challenges of this project. Working as one, they were able to achieve mass production of a high-value-added product that meets customer needs.



### Product Development Aimed at Increasing Engine Efficiency

Inside the cylinders of an engine, the force of exploding fuel pushes the pistons down. That force is transformed into rotational force to propel the vehicle. At the top of each cylinder are valves for the intake of air mixed with gasoline and valves to release gas after combustion. The tappet roller bearing is one part used to operate the constant opening and closing of these valves.

The movement to increase engine efficiency in recent years has led to the need to change the parts used in engines. NSK received a request from a customer to develop a tappet roller bearing in conjunction with the customer's development of a new engine. Thus began our attempt to develop a smaller, low-torque bearing that could withstand a great deal of power—that is, a product that could help improve fuel economy even more.

### NSK's Heat Treatment Technology Helps Achieve the Development Goal

There are two types of tappet roller bearings: a sliding type and a rolling type. The sliding type can withstand more load. On the other hand, the rolling type is more suitable for realizing the low torque that leads to improved fuel economy, since it can reduce friction further. We pursued development of a rolling type bearing, but we faced a challenge: the rolling type cannot withstand a large load, shortening the bearing's life and requiring it to be larger. This would not fulfill the customer's requirements. So we found a way to increase the durability by applying a special induction heat treatment to the surface where the shaft contacts the rollers. This would not have been possible without the advanced heat-treatment technology NSK had developed over many years. This unique induction heat treatment enabled us to succeed with the development of a product

combining durability, low torque, and long life without increasing the size of the bearing.

### NSK's Comprehensive Strength Enables Development for Tight Deadlines

The vehicle mass production schedule set by an automaker absolutely has to be met. There were many technical and production concerns in the development of this product. All hurdles had to be cleared by considering the specifications, producing prototypes for testing, and taking other needed steps within a limited period of time. Everything had to be finished by the launch of mass production. This took cooperation from many people at NSK. The team frequently drew on the NSK Product Development System (NPDS) (see page 25), and countless discussions were held among development and design, manufacturing, and sales departments. Additionally, since the product was to be manufactured with work shared by plants in and outside Japan, we

had to deal with time loss from parts transportation, which required close coordination with local sites.

We believe that the regular sharing of customer feedback among the development and design, production, and sales departments laid the groundwork for the intensive collaboration it took to meet the tight deadline on this project. Being aware of customer conditions enabled employees involved to have a sense of mission and to respond to requests quickly. Moreover, we brought together many technologies that we had accumulated over many years, enabling us to make a proposal that fulfilled the requirements of a variety of customers. Customers have told us that they can count on NSK when they are stuck, and we believe this is due to NSK's comprehensive strength.

We will continue striving to provide high-value-added products while keeping in mind the need to contribute to the global environment and staying closely attuned to customer trends.

### Stakeholder's Voice—Employee's Voice

#### Tackling Customers' Challenges with Pioneering Product Development

In this project, we had to establish production techniques starting with no experience in mass production of this kind of product within a limited period of time before mass production was to begin. The key point was whether we could mass produce on schedule a product that met the customer requirements. The part that was the most difficult was the induction hardening of the shaft. We had to strengthen the shaft, which would be the first part to get damaged, to withstand the power of the valve springs, which exceeds 150 kg. Accordingly, we decided to harden the shaft surface that the rollers contact using special induction hardening. But it was extremely difficult to get the induction hardening just right to achieve even quality in the precise location, since the portion of the shaft being treated is a mere 8.5 mm. I went to the plant numerous times and worked with the people on the production floor in pursuit of the advanced techniques needed to make a product that would meet the customer's needs. What makes NSK strong is our pioneering approach to product development and the technologies we have that differentiate our company from competitors. Going forward, we will continue product development that leverages NSK's strengths, aiming for even better fuel economy.

**Shigenori Murata**  
Group Manager,  
Needle Roller Bearing Technology Department,  
Automotive Bearing Technology Center, NSK Ltd.





# Corporate Governance

Management Structure Supporting Sustainable Growth

- Related stakeholders: Customers, Employees, Suppliers, Local Communities, Future Generations, Shareholders and Investors

The international community must cooperate to overcome a range of challenges including environmental problems in order to realize a sustainable world. As corporate activities expand globally, companies are expected to do their part to help solve the challenges of their respective countries and regions. They are called upon to contribute to the global community by providing helpful products and services through ethical business activities and by respect for local cultures and customs.

## NSK's Approach

### Achieving Sustainable Growth by Increasing Management Transparency and Soundness

The NSK Group has established a corporate governance framework and follows a policy of transparent and sound management in order to achieve sustainable growth as a company while meeting the expectations of society.

NSK defines corporate governance as "a system in which operational organizations can carry out efficient and fair management under the supervision of the board of directors." NSK endeavors to strengthen corporate governance based on the following principles:

- (1) Improve management efficiency and mobility by delegating authority from the board of directors to operational organizations;
- (2) Ensure that supervisory organizations provide proper oversight of operational organizations by separating supervisory organizations and operational organizations;
- (3) Strengthen supervisory organizations' oversight of operational organizations through coordination between supervisory organizations and operational organizations; and

- (4) Improve the fairness of management by strengthening the compliance system.

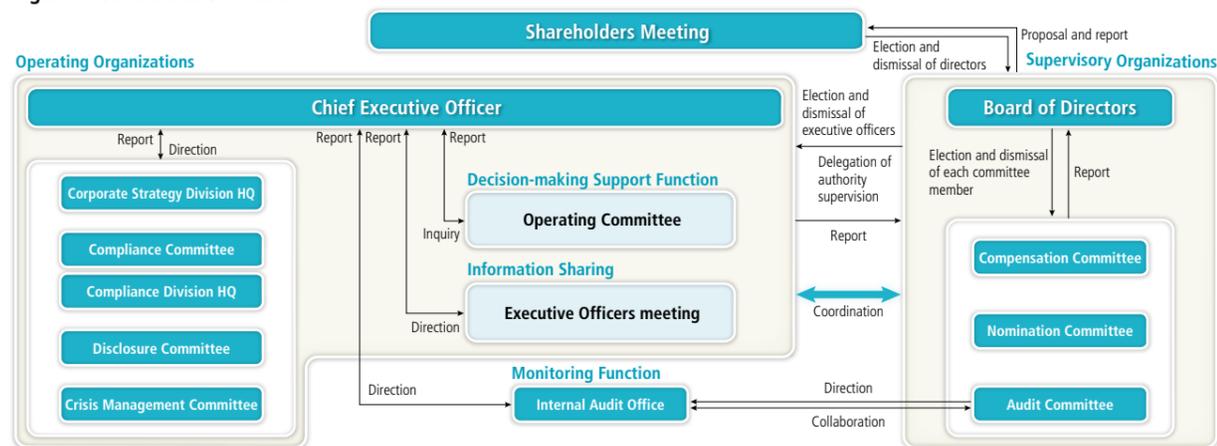
## Corporate Governance System

NSK has strengthened its governance structure by adopting a "Company with Committees" structure. It is increasing management transparency and soundness through a system in which the following types of operational and supervisory functions are clearly defined (see Figure 1).

**Operating functions:** The CEO makes final management decisions, making reference to discussion in the Operating Committee and other bodies. The executive officers in charge see that these operations are carried out.

**Supervisory functions:** The Company has a board of directors that determines basic management policies and supervises executive officers, as well as an audit committee, a compensation committee, and a nomination committee (each committee is composed of one in-house director and two independent directors).

Figure 1: Governance Structure



## Goals and Performance

### Goals

The NSK Group carries out activities aimed at achieving its vision of becoming "No. 1 in Total Quality." This means increasing the quality of not only products but also information and services, and the quality of work performed in each department, in order to strengthen the foundation that supports sustainable growth.

## Compliance

### Basic Approach

The NSK Group specifies the universal philosophy that all officers and employees should adhere to in the NSK Code of Corporate Ethics. The Group aims to continue growing as a company that earns the trust of the international and local communities by following relevant laws and regulations in all of its corporate activities and acting with high ethical standards as a good corporate citizen (see Figure 2).

### FY2011 Highlight 1 Resolving Issues While Safeguarding Users of the Whistle Blower System

The NSK Group operates a whistle blower "Hotline" system, available to officers and employees, to quickly identify and correct acts that may violate compliance. One hotline is in-house at the Compliance Division Headquarters and another is staffed by an outside lawyer. The system allows users to remain anonymous and ensures they suffer no unreasonable loss from using the Hotline. Harassment consultation services for employees have also been established at each business site to provide closer assistance. In fiscal 2011, the hotlines were used twice in Japan.

Figure 2: NSK Code of Corporate Ethics (extract)

Established: February, 2002 Revised: April 2012

NSK Code of Conduct Concerning Compliance (main chapter headings)	
1) Compliance with Competition Laws	8) Prohibition of Illegal and Anti-social Conduct
2) Compliance with Export-related Laws and Regulations	9) Protection of Corporate Assets
3) Prohibition of Commercial Bribery	10) Handling of Confidential Information
4) Transactions with Public Institutions and Handling of Political Donations	11) Relations with Customers
5) Accurate Recording and Processing	12) Relations with Suppliers
6) Prohibition of Insider Trading	13) Relations with Competitors
7) Handling of Intellectual Property	14) Prohibition of Discrimination and Cultivation of a Sound Workplace
	15) Respect of Fundamental Rights at Work
	16) Global Environmental Protection

Note: The NSK Code of Corporate Ethics applies to NSK Ltd., its consolidated subsidiaries (unless they have established their own code independently), and NSK-Warner K.K.

### FY2011 Activities

Pages 20–23 of this report describe initiatives for increasing management transparency and soundness. Pages 24–52 cover the status of initiatives aimed at ensuring the sustainable growth of the NSK Group.

NSK's initiatives to strengthen compliance in fiscal 2011 included establishing the Compliance Committee, revising the NSK Code of Corporate Ethics and enhancing e-learning and lecture-based training programs. It also carried out efforts such as strengthening its business continuity plan (BCP) based on the experience of large-scale disasters such as the Great East Japan Earthquake of March 2011.

### FY2011 Highlight 2 CSR Procurement

NSK believes that sharing recognition of the expectations of society throughout the supply chain, instead of only within the Group, and implementing the initiatives required will translate into growth for the entire supply chain.

In fiscal 2011, explanations of the *NSK Supplier CSR Guidelines* were given to 464 suppliers in Japan at briefing sessions. NSK sought to explain its procurement and green procurement policies in order to ensure the entire supply chain fully embraces the objectives of the CSR Guidelines. Replies on supplier status were also obtained via Self-Assessment Check-Sheets in order to encourage the spread of initiatives.

In fiscal 2012, NSK is supporting suppliers' activities by giving them feedback on the questionnaire results. It is also preparing to respond to the supply chain survey in conjunction with enforcement of the Conflict Minerals Disclosure Rule under the U.S. Dodd-Frank Wall Street Reform and Consumer Protection Act.\*1



Photo 1: Explaining the CSR Guidelines at a meeting on green procurement

### \*1 Conflict Minerals Disclosure Rule under the U.S. Dodd-Frank Wall Street Reform and Consumer Protection Act

Rules requiring companies listed on a U.S. stock exchange to disclose information on the status of use of four minerals (tin, tantalum, tungsten, and gold) originating in the Democratic Republic of the Congo and surrounding countries in order to limit the source of funding for human rights infringements and other conflicts in this region. The rules require the disclosure of information for the previous year's performance, beginning in 2014.



Reference data is available on NSK's website.

[www.nsk.com](http://www.nsk.com) > Sustainability > CSR Reports

- NSK Code of Corporate Ethics (full text)
- In House Education (compliance)
- NSK Supplier CSR Guidelines

**FY2011 Highlight 3** Strengthening Information Security to Prevent Information Leaks

NSK is strengthening its information security to prevent information leaks.

In fiscal 2011, the Company amended the NSK Group Information Security Guidelines, revising the important classified areas in internal R&D departments, and strengthening entry and exit controls. NSK prohibited photography inside company premises, and strengthened controls on the carrying of information-related devices on or off premises in order to prevent the leakage of information outside the Company.

**FY2011 Highlight 4** Export Management

The NSK Group has strengthened its export management system, not only for exports from Japan but also for exports from sites in other countries. These moves are intended to secure peace and security in the global community by preventing the export of products and technology that could be used to develop and manufacture weapons.

In fiscal 2011, the Group strengthened transaction screenings regarding indirect exports through customers in Japan, increasing the accuracy of determinations over whether or not products and technology could be used to manufacture weapons. At the same time, it adopted a system to improve the efficiency of issuing classification sheets, aiming to quickly issue sheets requested by customers.

**FY2011 Highlight 2** Supporting Suppliers' Disaster Prevention Efforts

Disaster prevention is vital to maintaining stable production. As a measure to support suppliers, NSK Group staff members visit suppliers and conduct disaster prevention audits. In fiscal 2011, NSK conducted 80 audits and also considered providing

guidance on earthquake countermeasures based on the experience of the Great East Japan Earthquake that struck in March 2011. The NSK Group aims to raise the level of disaster prevention capabilities throughout the supply chain by sharing best practices and collaborating with suppliers.

**Risk Management**

**Basic Approach**

The NSK Group classifies and organizes potential risks into operating risks, hazard risks, compliance risks, and financial reporting risks. It designates responsible departments that supervise the prevention of risks and countermeasures in the event a risk event unfolds. Additionally, each site and group company carries out activities aimed at reducing risk under the supervision of responsible departments.

**Risk Management System**

The Internal Audit Office gathers risk reports from around the world each month, identifying and assessing important risks, conducting daily monitoring, routinely validating the risk assessment and management system, and striving to reduce risk throughout the Group. The permanent Crisis Management Committee acts to prevent risks and minimize damage in the case of a risk event by developing and strengthening management systems for natural disasters, outbreaks of infectious disease, and major accidents. It also works at establishing and implementing BCPs.

In the event of a crisis or disaster, a disaster response task force is set up at the head office and a local response headquarters established at the site of the crisis or disaster, and relevant departments cooperate to handle the situation quickly and accurately according to the circumstances.

**FY2011 Highlight 1** Strengthening the Internal Audit System

The NSK Group monitors the status of business administration and risks through business audits and assessments of internal control over financial reporting, which are conducted by the Internal Audit Office.

In fiscal 2011, the Group continued working on issues it addressed the previous year: (1) the establishment of internal audit systems in regional headquarters outside Japan; (2) the enhancement of basic internal control audits; and (3) strengthening risk identification and monthly monitoring activities. It also confirmed the effectiveness of internal control over financial reporting and obtained an audit certification (unqualified opinion) from Ernst & Young ShinNihon LLC.

**NSK Action**

**Establishing J-SOX Compliance and Internal Auditing in European Operations**

The European Internal Audit Office was established in 2009 from the 2008 project to gain J-SOX compliance. Since then we have focused on establishing J-SOX internal controls evaluation at 11 group companies across 12 sites. As Europe is a diverse region with many languages and cultures, the team frequently travels to visit the companies, both to evaluate the effectiveness of their internal controls and to provide them with advice on how to improve their control environments. This is how the team helps improve the quality of local initiatives while deepening mutual understanding across the differences in language and culture. Currently, we are conducting a project to provide more internal controls coverage by implementing an internal audit function for Europe.

European Internal Audit Office, NSK Europe Ltd.  
From left: **Eddie Dilnot, Heidi Harris, Shaun Hodson, Laura Martin and Michael Green**



**Strengthening Disaster Resilience Based on the Experience of the Great East Japan Earthquake**

Learning from the Great East Japan Earthquake, NSK has launched initiatives including strengthening disaster prevention activities at sites and ascertaining effects back up through the supply chain in order to mitigate the impact of a potential large-scale earthquake causing widespread damage.

**Earthquake Proofing of Plants**

Aiming to ensure the safety of employees and minimize effects on production, the manufacturing divisions implemented emergency measures at all sites in Japan in 2011. This included steps to prevent production equipment from falling over or moving, prevent parts and instrument storage racks from falling over, and prevent drawers in instrument storage cabinets from flying open. Moreover, employees responsible for disaster prevention and safety at each site visited other sites to hold disaster prevention meetings and began efforts to carry out earthquake proofing in order to quickly roll out these initiatives.

**Efforts at the Saitama Plant**

The Saitama Plant, where many pieces of machinery were shaken out of position during the Great East Japan Earthquake, reconsidered methods of securing all production equipment to the floor, in preparation for an earthquake of intensity 7 on the Japanese scale. It also strove to ensure the safety of employees and keep evacuation paths open by firmly securing cabinets in offices to the floor to prevent them from falling over.



**Photo 2:** Secured production equipment



**Photo 3:** Secured office equipment

**Coping With Electricity Shortages**

Each site strengthened efforts to save energy, such as reconsidering air conditioning temperature and dimming lighting, to cope with the tight supply of electricity in the summer and winter caused by the shutdown of nuclear power plants after the earthquake. Energy-saving measures that can be taken in the home were also highlighted on the Company intranet to encourage energy-saving initiatives at home.

**Ascertaining Risks Throughout the Supply Chain**

The Company looked at the effects of a tsunami and trouble at nuclear power plants on parts and materials procurement. It also examined the effects of an earthquake on sites, not only those of direct suppliers but also back through the supply chain. NSK is also encouraging partners to enhance their BCPs in order to reduce the risk of the supply chain coming to a halt due to a large earthquake.

**Supporting Employment in Areas Affected by the Earthquake**

As part of efforts to support employment in the disaster-affected areas, the Fukushima Plant provided dormitories and company houses as residences for 14 employees of companies that suffered significant damage in the Great East Japan Earthquake and employed them at the Fukushima Plant for about six months starting in June 2011.

**Future Measures**

In fiscal 2012, the Company will aim to make plants safer by carrying out measures to prevent objects from falling from the ceiling (e.g., air conditioning ducts, florescent lights, glass). It will also start efforts to support earthquake proofing as it continues to conduct disaster prevention audits at suppliers' sites. Moreover, given the likelihood that electricity shortages in the summer and winter will continue in the future, the Company plans to install energy-efficient cogeneration systems, starting with plants with high energy use located in areas expected to have especially tight electricity supplies. This should also help to limit increases in CO<sub>2</sub> emissions.

**NSK Action**

**Assisting Reconstruction and Offering Emotional Support to People Afflicted by the Disaster**

In the Great East Japan Earthquake of March 2011, the Tohoku Branch was hit by major shaking of a "6 upper" intensity on the Japanese scale. It suffered severe damage including buckling of the ceiling and walls and broken furniture and fixtures. In the midst of confusing information and a shortage of materials, food and other relief supplies started to arrive from other sites the following week, giving me a feeling of reassurance about being part of NSK.

Luckily my home did not suffer much damage, but the nearby elementary school that had become an evacuation shelter was full of people who had evacuated with little more than the clothes on their backs. I thought that I had to do something and so helped with providing meals to evacuees, starting the day after the earthquake. Right now I am still volunteering to clear away smaller debris by hand in order to rehabilitate farmland along the Tohoku coast. I feel that NSK's business is built on and reliant upon the local communities that support it. I want to continue helping the reconstruction of my local community while offering emotional support to people affected by the disaster and widening the circle of connections among local people through volunteer efforts.

**Taeko Murakami**

Tohoku Branch, Japan Sales and Marketing Division Headquarters, NSK Ltd.





# Quality Assurance

Creating Quality to Earn the Confidence of Society

Related stakeholders: Customers, Employees, Suppliers, Local Communities, Future Generations, Shareholders and Investors

Industrial products that support today's affluent lifestyles must perform their prescribed functions safely and reliably. As the advance of technology and globalization continues to accelerate, companies are expected to contribute to the growth of the broader society by providing high-quality products and advanced technologies that meet the specific needs of consumers across a range of countries and regions.

## NSK's Approach

### No.1 in Total Quality

The NSK Group aims to become "No. 1 in Total Quality." In other words, the Group is working to achieve the industry's best quality in everything it delivers—not only products and services, but also information. The Group believes that this commitment to quality ensures that its products will satisfy customers all over the world (see Figure 1).

### Organization: Quality Board Meeting

To strengthen Group-wide initiatives NSK Group management checks the status of quality control and directs the needed initiatives in a top-down manner at the Quality Board Meeting, which is chaired by the president and composed of directors in charge of each business division headquarters.

NSK has also established quality committees in the Automotive Business Division Headquarters and the Industrial Machinery Business Division Headquarters and developed a structure for strengthening quality improvement efforts through cooperation among the manufacturing, sales, and design departments (see Figure 2).

Figure 1: Quality-Building Initiatives



## Goals and Performance

### Goals: Quality Creation That Ensures Customer Satisfaction

In order to facilitate the creation of quality levels that are indispensable to meeting the NSK Group's mid-term plan, the Group is carrying out activities under the following three programs.

#### 1. NSK Product Development System (NPDS)

In order to quickly transform new orders into reliable, stable production, the NSK Group is promoting initiatives that build quality into each process.

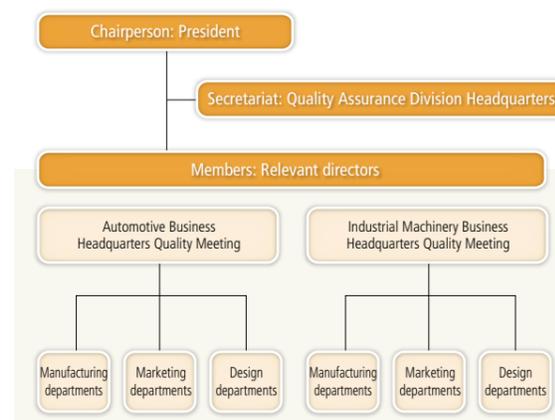
#### 2. NSK Quality No. 1 (NQ1) Program

The NSK Group is promoting initiatives to realize stable production and ensure near-zero defects.

#### 3. Human Resources Development

The Group is promoting human resources development in order to build a stronger foundation for quality creation.

Figure 2: Quality Board Meeting



## FY2011 Activities

In fiscal 2011, the Group enhanced its NPDS activities, adopted new Quick DRs (design reviews), and began providing

training to the technology divisions in order to implement more detailed design reviews. Additionally, it promoted planned initiatives at sites outside Japan, such as approving auditors for special processes.

## FY2011 Highlights

### Obtaining Quality Assurance Management System Certification

The NSK Group has obtained the following quality assurance management system certifications and attempts to maintain and improve its efforts through internal audits and audits by third parties: ISO 9001, the international standard for quality management systems, ISO/TS 16949, the quality system for automotive production and relevant service part organizations, and AS 9100 certification, the quality system for the aerospace industry. Maintaining and improving these quality assurance management systems ensures that the NSK Group's products meet the high quality standards required by customers.

As of March 31, 2012, all 54 product manufacturing sites in the NSK Group had obtained one or more of these certifications.

In fiscal 2011, the Group adopted new Quick DRs and began providing training to engineers in the technology divisions in order to implement more detailed design reviews for small-scale design changes. Quick DRs are a system for conducting effective design reviews in a short time by focusing on alterations and changes with the aim of preventing defects. Three types of training sessions were established from introductory to advanced and attended by 212 people, from design department staff members to section and department managers (see Figure 3).

### NQ1 Program for Stable Production with Zero Defects

The NQ1 program is being implemented with the cooperation of manufacturing, design, production technology, quality assurance, and other departments across the NSK Group. The objectives are to bring defects as close as possible to zero, optimize the flow of both information and physical items through all processes from parts and materials procurement to delivery, and to achieve efficient, stable production.

In fiscal 2011, the Fujisawa Plant, which produces extra large bearings, made efforts to standardize the settings used during machining by quantification techniques in the grinding process cultivated through the long experience of veteran workers, so that anyone can perform them. This enabled the plant to succeed in dramatically reducing the incidence of parts needing reworking and parts discarded as defects.



Photo 2: Explaining the NQ1 program at the Fujisawa Plant

### NPDS: Building Quality into Each Process

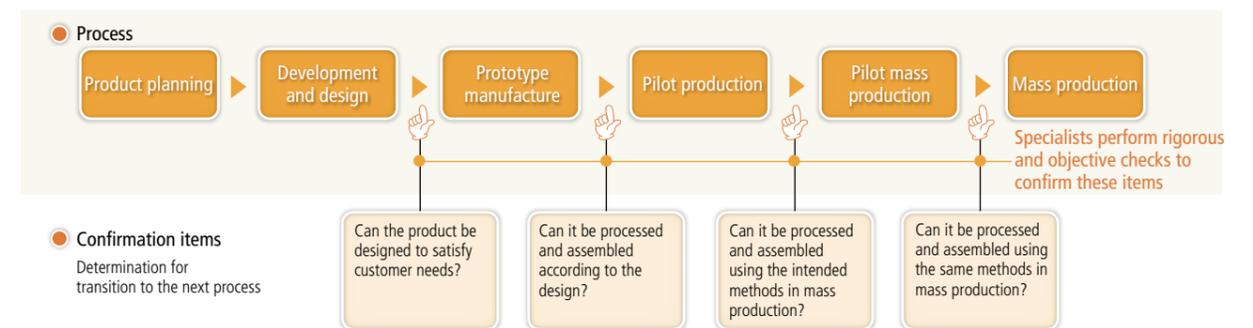
The NSK Group deploys its NSK Product Development System (NPDS) globally. The system enables the Group to respond to new orders with speed and reliability, to steadily develop products that meet customer expectations, and to ensure efficient mass production.

When an order is received, the technical, production, and other issues are first discussed from every angle to determine whether the order can be accepted. If it is accepted, at each process—from product planning to development and design, prototype manufacture, and mass production—confirmation is made that all issues are being resolved, thus building quality into the product.



Photo 1: Quick DR training

Figure 3: Outline of NPDS



Reference data is available on NSK's website.

[www.nsk.com](http://www.nsk.com) > Sustainability > CSR Reports

- Global Quality Assurance Organization
- Certification for Quality Management Systems

### Activities to Raise the Quality of Work in Indirect Divisions

The NSK Group aims to achieve industry-leading quality in everything it delivers—not only products and services, but also the information it provides. Toward that end it carries out efforts to raise the quality of administrative, sales and distribution functions.

In 2008, the NSK head office began efforts to improve the quality of work. In fiscal 2011, the fourth year of this initiative, the International Trade and Relations Department performed activities to improve the work of organizing documents needed in administrative procedures for products exported from Japan. Cooperation was deepened with affiliates outside Japan, departments involved in export work, and sales departments. In addition, disparate processes were organized, and efforts were made to achieve systematization. These efforts made it possible for any member of the International Trade and Relations Department to quickly prepare the needed documents, which has improved the level of work in terms of both the speed and quality of information provided to relevant departments.



Photo 3: Work in the International Trade and Relations Department.

### Efforts to Increase Customer Satisfaction

#### Call Center to Help Resolve Customers' Troubles

At the NSK Call Center, veteran sales engineers who have a thorough knowledge of the many ways in which customers use NSK's products take customer inquiries under the motto "quick, polite, and clear." The content of inquiries covers all manner of fields and ranges widely from technical questions when selecting NSK products to detailed explanations of catalogues. Call center staff strive to meet customer requests accurately by asking about the background that led to the inquiry. Moreover, inquiry information is shared with sales departments in each region through an internal system so that relevant staff members can follow up as needed.

In fiscal 2011, the center handled more than 800 inquiries a month and helped to resolve customers' issues.

### Providing Learning Tools and Conducting Training Sessions around the World to Give Customers a Deeper Understanding of NSK's Products

Bearings, which are the NSK Group's main products, can fulfill their expected function if the optimal shape and size bearings are chosen for the application when designing the machinery into which the bearings will be incorporated. Appropriate maintenance when the machine is in use is also important. For example, when changing bearings that have reached the end of their service life, care must also be taken to avoid excessive impact on the new bearings. To deepen understanding of NSK's products, the NSK Group provides workshops and learning opportunities around the world to engineers engaged in machinery design and technicians who handle equipment management and maintenance.

The Group also provided e-learning programs in seven languages, which have been well received, as they can be taken whenever and wherever one likes. Through fiscal 2011, more than 25,000 people worldwide have taken the Group's e-learning programs.

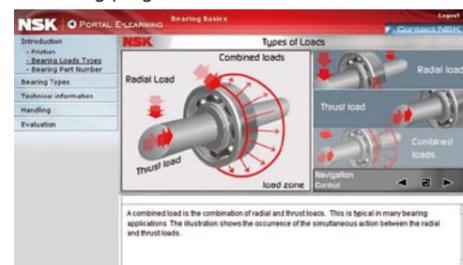


Photo 4: Screen from an e-learning program

### Survey Aimed at Increasing Customer Satisfaction

The NSK Group periodically asks customers to respond to customer service questionnaires. In the surveys, customers evaluate the Group using a five-point scale on matters such as product quality and technical support and also indicate their expectations and opinions of the NSK Group.

Approximately 300 people responded to the survey conducted in June 2012. The survey results, which are provided to relevant departments within the Group such as sales and technology departments, are used to improve activities in each part of the company.

### Human Resources Development That Supports Total Quality No. 1

#### Human Resources Development for Creating Quality

In order to achieve customer satisfaction, it is vital for all employees to understand their own roles, to strengthen their ability to communicate with one another, and to keep

improving the quality of their work. The NSK Group carries out human resources development by providing employees with education and training, and asking them to participate in work improvement activities. In fiscal 2011, the Chinese staff at Suzhou NSK Bearings Co., Ltd. in China planned and implemented their own activities to increase quality awareness. All employees cooperated in the activities, with members of each workplace working together to clarify issues faced in daily work and in the workplace while deepening their understanding of quality. Implementing improvements with their own hands led to increased quality as well as higher employee motivation.



Photo 5: Discussing quality

### Global Development of Quality Guidance and Audits

The NSK Group designates heat treatment and other processes that are important to the stable production of high-quality products as special processes and subjects them to rigorous quality control. Since fiscal 2009, the Group has been strengthening its process management structure, and training and certifying auditors who work out the main elements of initiatives, to enable the same level of rigorous management at plants worldwide. Auditors strive to improve processes throughout the entire supply chain by visiting and auditing suppliers with special processes in addition to their own plants.

In fiscal 2011, the Group continued certifying auditors outside Japan, as it had done in fiscal 2010. In Japan, auditors from different plants conducted mutual audits, increasing quality management and auditor ability.



Photo 6: Special process auditors training at Kunshan NSK Co., Ltd.

### Quality Training for Sales Departments

Since fiscal 2010, the NSK Group has implemented sales quality training sessions intended to raise the level of customer satisfaction by increasing employee awareness of quality in sales departments, which are the point of contact with customers.

In fiscal 2011, the first and second level curricula, which were begun in fiscal 2010, were continued for employees who had not yet taken them. Staff responsible for training at sites outside Japan also participated in this training and prepared to roll out sales quality training globally.

Furthermore, a third level curriculum has been established, and training has started in order to reflect opinions from the sales front and further expand basic knowledge. Aiming to deepen communication with customers, employees in the third level curriculum studied three areas of quality control: process capabilities, reliability prediction and failure analysis, and "why" analysis. Finally, participants conducted group work using the quality control methods studied and shared their results through presentations. In fiscal 2011, this curriculum was divided into two parts, one being held in the first half of the year and the other in the second half of the year, and taken by more than 700 employees who had completed levels one and two.



Photo 7: Group work during sales quality training

### Eliminating Imitation Products

Low-quality imitation products can damage the safety and reliability of customers' products into which the bearings were incorporated.

The NSK Group provides information to customers and cooperates with sales distributors and administrative authorities to prevent the use and distribution of imitation products.

### Working with Suppliers to Improve Quality

The NSK Group works closely with suppliers to improve quality.

In fiscal 2011, the Group shared quality-related issues by attending 58 quality meetings and visiting and auditing suppliers' sites on 26 occasions. Additionally, the Group and suppliers carried out initiatives to deepen their cooperative relationship. These efforts aimed to reduce supplier defects while preventing flaws in the NSK Group's components and materials. Going forward, the Group will strengthen efforts to further improve quality with suppliers.



# Good Work Practices

Creating a Dynamic Work Environment



As globalization advances, there are more and more opportunities for exchange among different peoples and nationalities. It has never been more important to work together to achieve harmony and mutual benefit for all countries and regions, and the basis of this must be deeper mutual understanding. Companies, for their part, must create workplaces where employees respect the diverse cultures and practices of different countries and regions, embrace diversity in the workforce, and can work safely, with vitality, and with sensitivity to the unique characteristics of the local area.

## NSK's Approach

### Creating Workplaces Where Employees Feel Job Satisfaction

The NSK Group's Management Principles clearly state that the Group seeks "to provide challenges and opportunities to our employees, channeling their skills and fostering their creativity and individuality." The Group sees human resources as the foundation of its business. This is why the Group strives to create work environments where employees can work enthusiastically and enjoy ever-increasing job satisfaction. The Group also works constantly to globally develop human resources who will lead the Group in the future (see Figure 1).

- **Creating environments where employees can work with vitality**  
Respect of fundamental rights at work  
Creating safe and healthy workplaces
- **Making the most of diverse human resources**  
Respecting diversity  
Facilitating work-life balance
- **Providing opportunities and workplaces that foster the growth of self-motivated employees**  
Providing opportunities for growth  
Providing workplaces that foster self development

Figure 1: Creating Dynamic Work Environments



## Goals and Performance

### Goal: Develop the Work Environment and Employee Base Needed to Support a Global Management Structure

Global expansion of business activities begins in workplaces where employees with diverse values can play an active role and select from among a variety of working styles.

The NSK Group, aiming to make the most of its diverse human resources, strives to develop globally minded human resources, to foster a professional workforce, and to build a personnel system that embraces diversity.

The Group is also building a worldwide education system to enable continuity when handing over technology and skills within the development and design, production, and other departments.

### FY2011 Activities

The NSK Group holds the Global Human Resources Conference once a year. During the conference, participants strive to globalize human resource functions by discussing issues that are common across regions, such as personnel systems and human resource development programs (see Figure 2).

Beginning in fiscal 2010, regional leaders appointed by the Human Resources Department at NSK's headquarters led

Figure 2: Organization of the Global Human Resources Conference



efforts to share information. Moreover, in fiscal 2011, the Group established the NSK Global Management College, a global version of the NSK Management College that had been

## Respect of Fundamental Rights at Work

### Basic Approach: Prohibiting Discrimination and Respecting Fundamental Rights at Work

As specified in the Group's Management Principles, the NSK Group has committed itself to providing "challenges and opportunities to our employees, channeling their skills and fostering their creativity and individuality." Moreover, the NSK Code of Corporate Ethics clearly states that the NSK Group prohibits discrimination and respects fundamental rights at work. Accordingly, the Group prohibits discrimination on the basis of race, appearance, belief, gender, religion, lineage, ethnicity, nationality, age or physical ability. It also prohibits harassment, forced labor, and child labor. In this way it creates workplaces where diverse human resources can work enthusiastically.

Through awareness-building activities, NSK strives to share the same awareness Group-wide and ensure these principles are adhered to. The Group also works hard to provide equal opportunity in recruitment, job assignment, evaluation, and other employment issues.

## Creating Safe and Healthy Workplaces

### Basic Approach: Creating Workplaces Where Everyone Feels Secure and Helps Build a Culture of Safety

In order to protect the safety and health of each and every employee, NSK undertakes initiatives with the following basic philosophy: "Safety is the first and foremost priority. Workplaces should ensure employees can work safely, no matter the level of output demand."

It is important to raise the awareness of each and every employee in order to ensure safety in the workplace. This is why NSK is fostering a culture of safety awareness where employees watch out for each other and never overlook an unsafe action or condition.

Figure 3: Occupational Safety Structure



Reference data is available on NSK's website.  
[www.nsk.com](http://www.nsk.com) > Sustainability > CSR Reports

- Global Human Resources Strategy
- Workplace Safety & Health and Healthcare Measures

established for employees in Japan, as the start of efforts to develop globally minded management personnel.

### FY2011 Highlight 1 Human Rights Training Provided Worldwide

In January 2009 the NSK Group revised its Code of Corporate Ethics in view of social requests, and promoted awareness of it throughout the Group. In this and other ways the Group has worked to raise awareness of human rights.

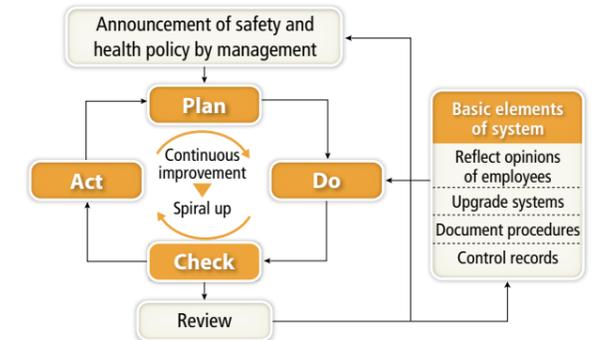
NSK is taking new initiatives to instill the respect of fundamental rights at work (prohibition of discrimination, child labor, forced labor, etc.) as specified in the Code of Corporate Ethics. It expanded the scope of training sessions that had been provided in Japan and made it available to managers of business sites worldwide through e-learning.

In fiscal 2011, more than 8,000 people took those courses. Going forward, NSK will continue providing training sessions and conducting even broader awareness-building activities.

### Management System: Occupational Safety and Health Management System

The NSK Group realizes how important it is to be proactive about safety and health in the workplace, which forms the heart of manufacturing. This is key to providing an environment in which employees can reach their full potential. Based on this belief, NSK regularly convenes the NSK Central Occupational Health and Safety Council, which involves both labor and management. This council sets the course for the entire Group's operation of occupational safety management systems and strives to foster a corporate culture of safety first in which all employees participate. The Group adopted risk assessment\*1 in fiscal 2008 and is moving forward with

Figure 4: Occupational Safety and Health Management System



the creation of safer workplaces by taking reliable safety measures based on objective and quantitative assessments of new equipment (see Figure 3 and 4).

\*1 To ascertain and identify risks, assess them in terms of frequency of occurrence and degree of impact, and then take countermeasures according to the kind of risk.

**FY2011 Highlight 1 Expanding Safety Education and Safety Assessments**

NSK and its main group companies have conducted safety education and worker injury risk assessments since fiscal 2010.

The scope of NSK's safety education is very broad, ranging from basic training and understanding of the direction the Group is headed, to the diverse ways of responding to safety obligations. Thus far, 394 people in plant and technical management positions have undergone education, after which OJT is conducted in the workplace based on the classroom content. In fiscal 2011, education was provided mainly to front-line supervisors. A feature of this training is that identifying actual worksite risks leads to further risk assessment.

Worker injury risk assessment started in 2010, and in fiscal 2011 was expanded to include assessment of full plant premises. Some plants had over 40 indications of potential risks, fulfilling the purpose of the assessment, which was to highlight risks and identify the priority of countermeasures according to risk level. The Group is taking countermeasures and will continue developing these initiatives in the future.



Photo 1: Safety education for supervisors

Table 1: Number of On-the-Job Accidents\*2

	2008	2009	2010	2011
Accidents not resulting in absence from work	33	19	26	12
Accidents resulting in absence from work	4	4	3	1
<b>Total</b>	<b>37</b>	<b>23</b>	<b>29</b>	<b>13</b>

Table 2: Accident Rate\*3 and Lost-Worktime Injury Rate\*4

	2008	2009	2010	2011
Accident rate*3	0.045	0.006	0.001	<b>0.008</b>
Lost-worktime injury rate*4	0.18	0.25	0.17	<b>0.06</b>

\*2 NSK and main group companies in Japan, including the number of accidents involving temporary employees.  
\*3 Accident rate = Total number of days absent from work / Total actual working hours × 1,000.  
\*4 Lost-worktime injury rate = Number of persons absent from work due to occupational accidents / Total actual working hours × 1,000,000.

**FY2011 Highlight 2 Safety and Health Initiatives Outside Japan**

**China: Kunshan NSK Co., Ltd.**

The company designated June as Safety Month and commended workplaces making excellent safety and disaster prevention efforts. It also seeks to raise employee awareness of safety by conducting group activities, fire prevention training, and drills in the operation of firefighting equipment such as fire hydrants, and strives to enable employees to participate in the creation of safe working environments.



Photo 2: Fire hydrant operation drill

**PT. NSK Bearings Manufacturing Indonesia**

In fiscal 2011, the company held talks on the topic of "why unsafe behavior occurs" with employees associated with the relevant tasks in order to increase mutual awareness with the aim of eliminating unsafe behavior, especially during the repair of machinery.



Photo 3: Group activity during safety education.

**NSK Bearings Manufacturing (Thailand) Co., Ltd.**

The company is actively engaged in building safety-awareness through displays during Safety and Health Week in addition to regular health checkups for employees, disaster prevention drills, safe driving education before long vacations, and vehicle safety inspections. The Thai Ministry of Labour, which awarded the company for excellence in safety and health three years running, has praised the firm's everyday efforts. The company will keep making initiatives in the future and hopes to continue winning the award.



Photo 4: Safety and Health Week  
Photo 5: Safety and Occupational Health award

Table 3: Personnel Systems and Human Resources Development for Sustainable Business

Responding to business globalization	Creating personnel systems	Assigning local human resources who know the region well Appoint global human resources, regardless of nationality Fair evaluation system
	Transmission of manufacturing	Developing human resources
	Developing human resources	Develop global human resources Develop professional human resources

**Providing Opportunities and Workplaces That Foster the Growth of Self-motivated Employees**

**Basic Approach: Creating Personnel Systems Suited to Globalization and Developing Human Resources**

The NSK Group believes that as the globalization of business advances, it is difficult for employees to show their abilities without a workplace environment in which they can recognize and solve common challenges, spanning national borders and cultural barriers. That is why the Group designs and uses personnel systems that support business, creates training programs that bring out employees' true ability, and creates fair personnel and evaluation systems.

Assigning human resources at each location who know the local region well and creating personnel systems where employees with the ability to support a global management structure can play an active role are urgent tasks for expanding NSK's business sustainably throughout the world. The Group will also enhance training programs which support the growth of individuals, including not only knowledge required for work, but also problem-solving skills, communication abilities, and leadership. In this way, the Group aims to create workplaces where employees and organizations grow together.

**FY2011 Highlight 1 Global Management College Opened**

The NSK Group provides a Global Management College mainly for executive candidates at bases outside Japan. During fiscal 2011, the college's first year, 10 employees chosen from seven regions—Europe, the Americas, China, ASEAN, India, South Korea, and Japan—spent about six months visiting bases in Japan, China, and India, sharing the Group's mission statement and business strategies and interacting with local NSK employees. The participants, who were split into two teams, considered future business strategies for NSK and made proposals to top management during the final session.



Photo 6: Global Management College

NSK will continue providing the Global Management College as an educational opportunity for diverse, high-potential human resources around the world. The Group plans to select another 11 employees for the second year in fiscal 2012.

**FY2011 Highlight 2 Strengthening Development of Human Resources—the Foundation of Manufacturing**

In 2006, the NSK Group established the NSK Manufacturing Education and Training Center with the aim of passing on plant skills. So far the center has trained a total of 600 people. In fiscal 2011, the center started a new traveling education program that dispatches company instructors. It also began holding conventional training sessions at which attendees assemble. The goal of both programs is to accelerate the education of technicians and respond to the needs of plants flexibly.

As the first step, the Group used the Training Within Industry (TWI) method of Job Instruction (TWI-JI) and Job Relations (TWI-JR) to teach technicians in order to support the training of team leaders being carried out by each plant. In fiscal 2011, 78 people at three plants in Japan undertook the training.

Going forward, the Group will enhance and strengthen the education needed to pass on manufacturing skills according to the needs of each site.

**FY2011 Highlight 3 Promotion of Language Education**

The NSK Group uses English as its common language in order to conduct operations smoothly through active communication between employees around the world. In fiscal 2011, the Group adopted English and Chinese e-learning programs to provide Japanese employees in and outside of Japan with the opportunity to improve their language skills. Five hundred people took the English program and 100 took the Chinese program.

NSK plans to enhance the content of its language education programs to include languages other than English and Chinese (see Table 3 and 4).

Figure 5: NSK Group's Human Resources Development System

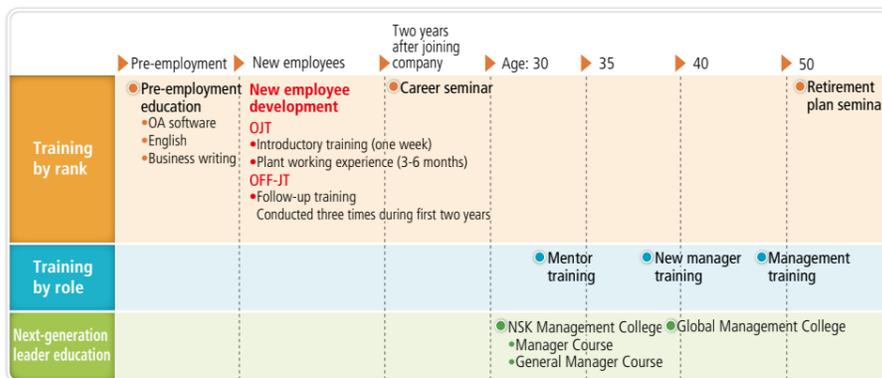


Table 4: Number of Participants in Education and Training Programs in Fiscal 2011\*5

Content	Participants
<b>Headquarters' training</b>	<b>826</b>
• New employee training	
• Language training, etc.	
<b>Technology divisions' training</b>	<b>226</b>
• NIT	
<b>Plant training (conducted by headquarters)</b>	<b>69</b>
• Manufacturing Education and Training Center	
<b>Plant training (conducted by plants)</b>	<b>1954</b>
• Quality education	
• Safety education	
• ISO-related education, etc.	
<b>Other</b>	<b>197</b>
• Retirement plan seminar, etc.	
<b>Total</b>	<b>3272</b>

\*5 The total number of participants who took training programs conducted by the NSK Group.



Reference data is available on NSK's website.  
[www.nsk.com](http://www.nsk.com) > Sustainability > CSR Reports

- Personnel System to Support Career Advancement
- Human Resources Development

## Respecting Diversity

### Basic Policy: Human Resource Diversity that Reflects NSK's Global Business

The NSK Group believes that local communities and the NSK Group can grow together if the Group develops businesses worldwide and creates stable employment. That is why the Group assigns talented human resources with a good understanding of the local region, regardless of nationality, peoples, or gender. By enhancing educational and training programs that encourage understanding of NSK's corporate culture, the Group is also aiming to enable diverse human resources to share NSK's values, work with enthusiasm, and feel that they are growing personally with the NSK Group.

Furthermore, in response to changing social needs in Japan, NSK is creating the systems needed to fully realize the potential of women, older workers, and persons with disabilities.

### Older Workers: Utilization of Human Resources in an Aging Society (Japan)

Japan's population is aging rapidly. In light of changes in the public pension system it has become a social challenge to enable workers to have access to employment opportunities even after mandatory retirement.

NSK recognizes that the knowledge and skills of experienced senior employees are beneficial in growing business. The Company's basic policy is to provide work opportunities to healthy persons willing to work after retirement. The Company has had a reemployment program since April 2001.

Furthermore, the Company will consider revising its reemployment program, including working conditions, to ensure stability in life in addition to the above basic policy in light of the Revised Law Concerning Stabilization of Employment of Older Persons, which will come into effect in April 2013 (see Table 6).

Table 5: Related Employee Data\*6

	2007	2008	2009	2010	2011
Average years of employment	18	17	17	18	18
Average age	40	40	41	41	41
Proportion of female employees	5.5%	5.5%	6.6%	6.5%	6.7%
Rate of childcare leave taken	64%	94%	93%	100%	100%

Table 6: Number of Re-employed Persons (over 60 years of age)\*6

	2007	2008	2009	2010	2011
A Seniors (former union members)	115	156	185	223	271
M Seniors (former managers)	23	35	42	49	54
Others (part-time employees, etc.)	78	77	42	42	34
Total	216	268	269	314	359

Table 7: Rate of Employment of Persons with Disabilities\*6

	2007	2008	2009	2010	2011
Rate of employment of persons with disabilities	1.60%	1.66%	1.83%	1.85%	1.97%

\*6 NSK and main group companies in Japan.

### Persons with Disabilities: Providing Work Opportunities to Persons with Disabilities (Japan)

NSK believes that one role it should perform is providing suitable work opportunities to persons with disabilities who are willing to work. An NSK special subsidiary called NSK Friendly Services Co., Ltd., in particular, provides employment opportunities where persons with intellectual disabilities can work with enthusiasm.

In fiscal 2011, NSK, its main group companies, and NSK Friendly Services together employed a total of 108 persons with disabilities for a rate of employment of persons with disabilities of 1.97% (see Table 7).

#### FY2011 Highlight 1 Overseas Internships

The NSK Group provides internships in Japan to university students from regions outside Japan in order to develop human resources able to sustain manufacturing globally and to create workplaces that respect diversity. In fiscal 2011, the Group accepted students from China, ASEAN, India, and Germany to study NSK's advanced technology.

#### Comments from Interns

I was fortunate to be the first Indian student to attend the internship program at NSK in 2008. During the program I studied NSK's sophisticated, world-leading technologies and R&D and thought it was really worthwhile. I also engaged feverishly in my work in order to meet the expectations of being accepted as a team member. After the internship I joined NSK without hesitation. Today, I tackle my work with the intention of putting my skills and experience to use as much as possible in the development of NSK's global business.



**Sakthivel Kirupasankar**  
Material & Heat Treatment Engineering Laboratory,  
Basic Technology Research Center, NSK Ltd.

Right now I am an intern at the NSK Head Office's Automotive Business Division Headquarters. I chose NSK for my internship because I was very interested in Japanese companies' management style and manufacturing. Everyone at NSK is open minded and full of enthusiasm. Also, especially since the Company has a long history, I feel that the employees engage in their work while supporting each other like one big family. Although I only have a short while left, I would like to continue to learn mutual respect of other people and cultures at work and be of benefit to everyone.



**Christoph Kompalla**  
Automotive Business Division  
Headquarters, NSK Ltd.

## Employment

### Basic Approach: Employment that Preserves the Stability of Both Society and NSK

As a manufacturer that is committed to quality, and as a sustainable company, the NSK Group approaches employment from a long-term perspective. That is why the Group believes

it is essential to continually recruit and develop outstanding human resources who can carry the business forward.

The Group also engages in appropriate employment practices in accordance with the laws and ordinances of each country and region where a business site is located.

## Management-Labor Relations

### Basic Approach: Labor-Management Relations Based on Dialogue

The NSK Group regards sound labor-management relations as critical to the sustainable growth of the Company. One way in which the Group respects fundamental rights at work, as pledged in the NSK Code of Corporate Ethics, is by guaranteeing employees the right to communicate openly and directly with management without fear of retaliation, intimidation, or harassment.

Employees and managers are becoming better partners as they build trust by working to communicate more deeply, share views on the workplace environment and business conditions, and discuss and implement improvement measures. The NSK Group is committed to creating workplaces where employees can work vigorously.

## Facilitating Work-Life Balance

### Basic Approach: Developing a Workplace Environment where Employees Are Enthusiastic and Active

The NSK Group believes that ensuring that employees sincerely enjoy both their work and their private lives, and can be enthusiastic and active, is the key to making its business even more successful.

That is why the Group's basic policy is to develop an ideal working environment for all employees, regardless of gender or age, in terms of both facilities and support programs. The Group always strives to be sensitive to employee needs and social changes.

In Japan, NSK recognizes that it is important to work harder than ever to accelerate support for work-life balance in order

to cope with the social challenges presented by a rapidly aging society with a low birth rate. Such efforts include enhancing programs to support employees' childcare and nursing care obligations and healthy time management.

#### FY2011 Highlight 1 Accelerating Support For Work-Life Balance

In Japan, NSK enhanced its program to support employees' childcare in 2011 as it had also done in 2010 by lengthening the childcare leave period. It also further accelerated efforts to support work-life balance by means such as improving work efficiency through enhanced communication in the workplace and encouraging employees to take annual paid leave (see Table 8).

Table 8: Childcare and Nursing Care Support System at NSK Ltd.

Childcare leave	Japan law	Up to 18 months (non-paid)
	NSK*7	Through the end of April when child is 3 years old (the first five days paid)
Shorter working hours for childcare	Japan law	Up to 3 years old
	NSK	Through the end of April when the child enters elementary school
Nursing care leave	Japan law	Up to 90 days
	NSK	Up to 1 year
Shorter working hours for nursing care	Japan law	Up to 90 days
	NSK	Up to 1 year
Elimination of half-day holiday restriction	Usually, 12 times per year; but when providing nursing care, unlimited.	

\*7 Launched in fiscal 2011

## NSK Action

### Experiencing Childcare Leave

When my family was blessed with our third boy, I took childcare leave for the first time. I was glad to take the leave because on top of relieving the burden on my wife by watching the other kids and doing the housework, I could also spend precious time with my cute little son.

I think that as many people as possible should take childcare leave, as child raising is a precious experience. I hope we can further develop a culture where it is easy for new parents to take leave.

#### Hiroshi Endou

Deputy Operation Chief, Sales Planning Department,  
Japan Sales and Marketing Division Headquarters, NSK Ltd.





# Working with Local Communities

Social Contribution Activities Targeting Community Development



It is widely recognized today that companies—not only government agencies—must play an active role in solving social, environmental, and economic issues to build a sustainable world. Corporations today are expected to contribute to community development not only by providing useful products and services, but also by taking a range of flexible initiatives designed to meet specific local needs.

## NSK's Approach

### Being a Company That Is Needed, Trusted, and Admired by Local Communities

With an understanding of the needs of each country and region, the NSK Group fosters the human resources and technological strengths needed to help the communities where it does business to develop. Aiming to be a company that contributes to sustainable local development and is needed, trusted, and admired by local communities, the NSK Group focuses its efforts on the following three important areas (see Figure 1).

#### Priority Areas for NSK's Social Contribution Initiatives

1. Promoting science and technology that supports the prosperity of society
2. Fostering the development of the next generation
3. Engaging in activities designed to build mutual harmony and benefit with communities

## Goals and Performance

### Goals

The NSK Group is enhancing its efforts to foster the development of local communities by valuing communication with them, ascertaining their needs, and sharing information among business sites in the Group.

### FY2011 Activities

As in fiscal 2010, the *NSK Group Social Action Program* intranet booklet compiled examples of social contribution activities conducted by business sites in the NSK Group in fiscal 2011. It has been distributed to NSK Group sites around the world in an effort to share information within the Group. Additionally, at the Tokyo Motor Show in December 2011, NSK gave children the chance to try their hand at assembling bearings.

Figure 1: Priority Areas for NSK's Social Contribution Initiatives



## FY2011 Highlights

### Taking Social Contribution to a New Level

The United Way is a charitable organization that helps volunteer organizations across North America with funding. Employees of NSK Group companies in the Americas support the United Way's activities through fundraising, cleanups, and other community action programs.

From June to October 2011, employees of NSK Canada Inc. stepped up their efforts, with different departments—sales, distribution, accounting, and others—each hosting a barbecue lunch once a month in order to raise donations. The company matched the funds raised, and the total was donated to the United Way.



Photo 1: United Way Campaign

### Developing the Engineers of the Future

The Peterlee Plant of NSK Bearings Europe Ltd. cooperates with the Seaham School of Technology on a variety of initiatives to support the students who will become the engineers of the future. The plant offers the chance to gain practical engineering skills and runs practice interviews to help students prepare for the job search process. In fiscal 2011, it also held an exhibition of art portraying NSK products. Outstanding works were displayed in the plant's reception area and conference room.

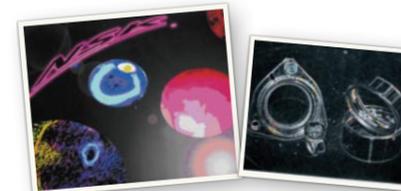


Photo 2: Paintings of bearings by students at the Seaham School of Technology.

### Supporting Flood Recovery in Thailand

Thailand was hit by extensive flooding in October 2011. NSK immediately sent a donation of 5 million baht, while three group companies in Thailand\*1 coordinated with each other and cooperated with local communities to fight the flooding and later to support the recovery effort.

NSK Bearings (Thailand) Co., Ltd. donated money as well as food, beverages, and other needed supplies to people affected by the flooding, and conducted blood drives for the injured.

NSK Bearings Manufacturing (Thailand) Co., Ltd. also cooperated with the Green Roof Project, which recycles paper beverage cartons into roofing material, to help with the repair of damaged housing. During off periods employees participated in volunteer activities to support the disaster-stricken areas. They helped to pile up sandbags around Bangkok International Airport and rescued dogs that had been trapped by the flooding.

Siam NSK Steering Systems Co., Ltd. donated sand bags to prevent the flooding of elementary schools in the Samut Prakan district. It also made donations to and participated in volunteer activities with the Thai Red Cross Society.

\*1 NSK Group in Thailand  
NSK Bearings (Thailand) Co., Ltd.  
Siam NSK Steering Systems Co., Ltd.  
NSK Bearings Manufacturing (Thailand) Co., Ltd.



Photo 3: The president and employees of NSK Bearings (Thailand) visit a disaster area and help with recovery efforts.

Photo 4: NSK Bearings Manufacturing (Thailand) participating in the Green Roof Project.

Photo 5: Siam NSK Steering Systems delivering supplies to the Red Cross.

## NSK Action

### Report from an Instructor of Children's Class on Bearings

At NSK's booth at the 42nd Tokyo Motor Show in 2011, we set up a hands-on section where children could become familiar with NSK's technology by trying their hand at designing and assembling bearings. I was the instructor for the assembly task.

Although the structure of bearings is very simple, it takes some knowledge and ingenuity to assemble the few parts like a puzzle. Some kids cried when it did not go well at first, but they all gave great big smiles when they saw how their bearings spun around when finished. Through the children I was reminded that the bearings which I have grown familiar with are really something special. It was a valuable experience. Nowadays we can get the information we want right away from the Internet. But, I think that the importance for children of knowledge versus experience is completely different. I want children to try many things with curiosity and grow while experiencing the joy of accomplishment. I hope that the bearing assembly experience helped them feel this.



Kimiko Nakai

Automotive Products Development Department, Future Technology Development Center, NSK Ltd.

Feature

UK

Contributing to local community development

- Donating to community
- Supporting technology club at a local school
- Donating to a charity for children



Supporting intractable disease care through cycling

France

Contributing to cultural development

- Supporting France's sports
- Supporting an eco car race team



Supporting activities of Special Olympics France by participating in relays

Germany

Contributing to local community development

- Supporting sports events

- Promotion of science and technology
- Mutual harmony and benefit with communities
- Development of the next generation

Poland

Contributing to public welfare

- Blood donation drives
- Donating to the community

India

Contributing to public welfare and supporting victims of natural disasters

- Blood donation drives
- Supporting community health
- Supporting victims of natural disasters



Blood donation through an NGO

Malaysia

Community environmental efforts

- Blood donation drives
- Community clean-ups
- Tree-planting activities



Conducting cleanups around the plant



Joining coastal cleanups

China

Supporting education of the next generation

- Community clean-ups
- Awarding scholarships
- Plant tours
- Donating to recovery from the Great East Japan Earthquake
- Providing technical training lectures at a university



The 9th academic paper award

Thailand

Actively engaged in contributing to public welfare, community environmental activities, and supporting victims of natural disasters

- Blood donation drives
- Donating to the community
- Tree-planting activities
- Donating to kindergartens
- Supporting victims of natural disasters
- Supporting flood recovery in Thailand



Supporting flood recovery through blood donation

Singapore

Encouraging sound growth of the next generation

- Supporting children's events



Supporting children's future through walking

Japan

Contributing to community development and supporting education of the next generation, working especially to promote hands-on learning at work sites.

- Blood donation drives
- Supporting charity events
- Donating to communities and funds
- Joining traffic safety campaigns and taking first-aid courses
- Community clean-ups
- Supporting and sponsoring community events
- Donating to community festivals
- Donating to students' cultural activities
- Promoting science and technology through NSK-FAM
- Offering internships
- Supporting sports events
- Supporting an eco car race and a robotics competition team
- Supporting recovery from the Great East Japan Earthquake
- Supporting flood recovery in Thailand



Supporting a local marathon



Company tours for local elementary school students

South Korea

Contributing to public welfare and supporting education of the next generation

- Awarding scholarships
- Donating to welfare institutions



Donating to orphanages

Indonesia

Supporting education of the next generation

- Donating to Idul Adha festivals
- Awarding scholarships
- Bearing school
- Supporting recovery from the Great East Japan Earthquake



Giving technical lectures at a university

Australia

Contributing to public welfare and supporting education of the next generation

- Donating to a cancer center
- Supporting mental health in the community
- Participating in community events
- Awarding scholarships



Scholarship recipient graduates

Canada

Contributing to public welfare

- Supporting charity events
- Donating to the community and cooperating in community activities
- Food donation to a local food bank
- Supporting community events
- Awarding scholarships
- Supporting a robotics competition entry
- Providing technical training lectures at a university



Cooperating with United Way

USA

Contributing to public welfare

- Blood donation drives
- Supporting charity events
- Christmas donations
- Donating to the community and cooperating in community activities
- Food donation to local food bank
- Participating in and donating to events such as Relay for Life, which encourages cancer awareness
- Community clean-ups
- Supporting community events
- Supporting a car racing team
- Volunteering at welfare institutions
- Donating to recovery from the Great East Japan Earthquake



Participating in Relay for Life



Mexico

Supporting education of the next generation

- Supporting community events
- Offering internships
- Supporting next-generation interaction events
- Providing technical training lectures at a university



Bearing school

Brazil

Encouraging sound growth of the next generation

- Christmas donations
- Donating to a welfare organization (food, used clothes, etc.)
- Supporting community events
- Plant tours



Providing Christmas presents for children in a facility

Poland Kielce Plant, NSK Bearings Polska S.A.

Blood Donations

The Kielce Plant of NSK Bearings Polska S.A. in Poland has a pool of 150 regular blood donors. The company supports their efforts by awarding a day off for giving blood and commending employees who are consistent blood donors. The Kielce Plant's blood donation efforts have drawn local media coverage.



Blood donation

India Rane NSK Steering Systems Ltd.

Support for Areas Affected by Natural Disaster

Victims of natural disasters such as flooding and earthquakes in the state of Orissa, India were in need of relief goods. At Rane NSK Steering Systems Ltd., about 45 employees gathered supplies such as grain and old clothes and donated them to afflicted areas through an NGO.



Relief supplies for a disaster area

Japan NSK Steering Systems Co., Ltd.

Support for Recovery from the Great East Japan Earthquake

In November 2011, NSK Steering Systems held a charity event to provide ongoing support for recovery in areas affected by the Great East Japan Earthquake of March 2011. Vegetables picked locally and in Fukushima, which was one of the disaster-afflicted areas, were sold and donations collected. A portion of sales was donated to disaster areas.



Disaster support at a plant festival

USA NSK Steering Systems America, Inc.

Relay for Life

Relay for Life is an event held to support cancer patients and transform society's views on cancer. Donations for cancer research are collected and participants walk in a 24-hour relay at the event venue. NSK Steering Systems America, Inc., supported the event by participating in the walk and making a donation.



Participating in Relay for Life



# Environmental Management

System for Promoting Environmental Protection Initiatives



Concern is mounting over global environmental problems caused by human activity conducted in pursuit of affluence. The depletion of resources, the advance of global warming and climate change, and human impact on ecosystems are all very serious issues.

All of humanity shares the challenge of building sustainable societies that can be prosperous without harming the environment. Today, people expect companies to be proactive about meeting this challenge, for instance, by providing eco-friendly products and services and operating in an environmentally responsible manner.

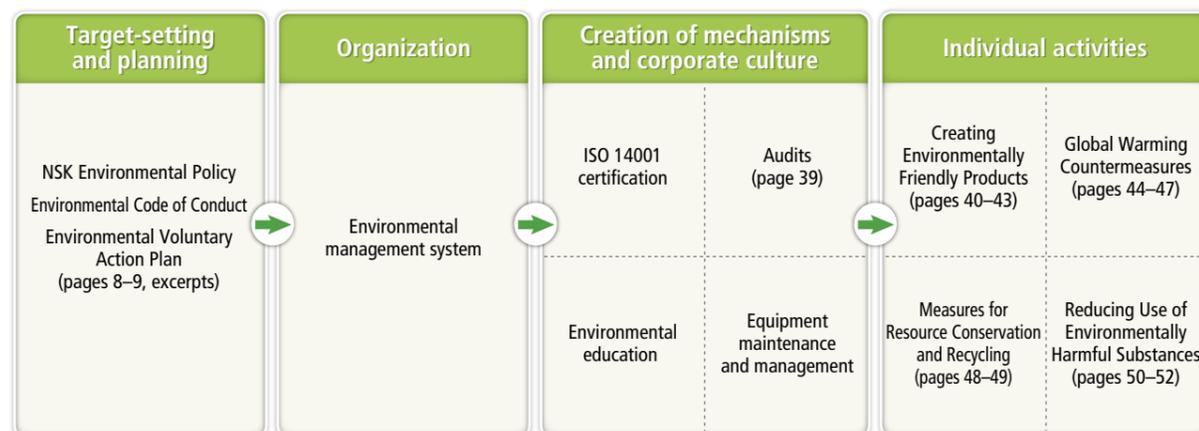
## NSK's Approach

### Developing and Popularizing Environmentally Friendly Products and Reducing Environmental Impact in Business Operations

The NSK Group adheres to the principle that global environmental protection, as outlined in the Group's mission statement, must be an ever-present concern in all business activities. Accordingly, the Group states in its Environmental Policy that environmental management forms the basis of its existence and pursuits. The NSK Group strives to raise the awareness of every single employee while taking action to create environmentally friendly products, implement global warming countermeasures and measures for resource conservation and recycling, and reduce the use of environmentally harmful substances.

The Group believes that responding proactively to the strengthening of laws and regulations in different countries and regions, changes in customer needs, and the risk of storm and flood damage associated with environmental problems such as climate change will help in the building of a sustainable society and increase the NSK Group's growth potential. The Group has established systems to achieve that goal and is working to improve its environmental management efforts.

Figure 1: NSK Group's Environmental Management



## Goals and Performance

### Goals

In fiscal 2011, the NSK Group achieved the majority of its goals, including goals for the creation of environmentally friendly products, the implementation of global warming countermeasures, and the implementation of resource conservation and recycling measures. This progress was made under its Environmental Voluntary Action Plan, which has a target year of fiscal 2012 (see pages 8–9).

### FY2011 Activities

One accident involving oil leakage occurred. However, countermeasures were taken quickly, preventing a major problem. Additionally, there were seven cases in which the limits for permissible air and water quality standards were slightly exceeded.

The NSK Group conducted audits aimed at reducing environmental risk. It also conducted on-site audits and self-audits at each site in order to strengthen the management system for environmentally harmful substances in products.

## FY2011 Highlights

### Systematically Establishing an Environmental Management System

As a system for ascertaining and effectively managing and reducing environmental impact, the following sites are to obtain external certification in ISO 14001—the international standard for environmental management systems—within three years of beginning mass production.

- Plants that manufacture products
- Group manufacturing companies in which NSK has a stake of 50% or more
- Group companies that manufacture NSK brand products
- Group companies that manufacture equipment
- Group companies related to distribution

As of March 31, 2012, 22 sites in Japan and 36 sites outside Japan had acquired certification.

### Reducing Environmental Risk through Environmental Audits

Each site within the NSK Group conducts internal audits, and certification bodies conduct external audits based on ISO 14001 in order to verify that environmental management is being carried out reliably and to ensure continuous improvements are made. Additionally, the NSK head office's environmental management department periodically visits each site to conduct audits and require measures to reduce environmental risks. In fiscal 2011, environmental risk audits were conducted at 14 sites. They focused on checking systems for verifying



Photo 1: Environmental risk audit

compliance, the implementation status of oil leak countermeasures, and the contents of consignment contracts for industrial waste disposal.

Additionally, audits of the control of environmentally harmful substances were conducted at seven sites and issues clarified to improve the level of management.

### Increasing Awareness of the Importance of Protecting Biodiversity

Each site used to carry out its own initiatives on biodiversity, before the NSK Group established the globally uniform NSK Biodiversity Guidelines in October 2010. In fiscal 2011, NSK produced learning materials on topics such as "What is biodiversity?" and "Activities that impact biodiversity," and began educating employees. It also started conducting environmental impact assessments related to biodiversity at company plants. Going forward, the Group will roll out activities to plants of Group companies and promote biodiversity protection.



Photo 2: Biodiversity education at the Saitama Plant

### Report of an Oil Leak and Recurrence Prevention

In April 2011, an accident occurred in which oil leaked into a river outside the premises of Chitose Sangyo Co., Ltd. No effect on the surrounding environment was observed, as an oil fence was set up immediately to prevent the spill from spreading, and the oil was recovered. The cause of the accident was investigated and measures taken to prevent recurrence. In addition, inspections and improvements were carried out at other plants to avoid similar accidents.

Figure 2: Input and Output of Global Business Activities

INPUT		NSK Group	OUTPUT	
<b>Materials and parts</b> Steel 624×10 <sup>3</sup> tons Oils and greases 20×10 <sup>3</sup> tons	<b>Water supply</b> Water 4,102×10 <sup>3</sup> m <sup>3</sup> • Groundwater 1,914×10 <sup>3</sup> m <sup>3</sup> • General water 1,748×10 <sup>3</sup> m <sup>3</sup> • Industrial water 440×10 <sup>3</sup> m <sup>3</sup>		Development ↓ Design ↓ Procurement ↓ Manufacturing ↓ Distribution	<b>Atmospheric gases</b> CO <sub>2</sub> * <sup>2</sup> 876,967 tons NO <sub>x</sub> 135 tons SO <sub>x</sub> 63 tons
<b>Energy</b> Electricity 1,187,699 MWh Fuel 2,224×10 <sup>3</sup> GJ	<b>Materials and parts (Japan)</b> (Environmentally harmful substances) PRTR-designated substances 613 tons* <sup>1</sup>		<b>Water quantity</b> Wastewater 2,639×10 <sup>3</sup> m <sup>3</sup> • Rivers 1,176×10 <sup>3</sup> m <sup>3</sup> • Sewage systems 1,463×10 <sup>3</sup> m <sup>3</sup> BOD* <sup>3</sup> 2.8 tons	<b>Environmentally harmful substances (Japan)</b> Discharge/transfer of PRTR-designated substances 166 tons* <sup>1</sup>

\*<sup>1</sup> Includes new PRTR-designated substances following revision of the PRTR law.  
 \*<sup>2</sup> CO<sub>2</sub> emissions are calculated in conformity with data from Japan's Ministry of the Environment. Also, different coefficients are used for Japan and regions outside Japan.  
 \*<sup>3</sup> River discharge.

Reference data is available on NSK's website. [www.nsk.com](http://www.nsk.com) > Sustainability > CSR Reports

- Environmental Policy
- Environmental Voluntary Action Plan
- Environmental Education
- NSK Group Environmental Structure
- ISO 14001 Certification Status
- NSK Biodiversity Guidelines



# Creating Environmentally Friendly Products

Providing Environmentally Friendly Products and Services



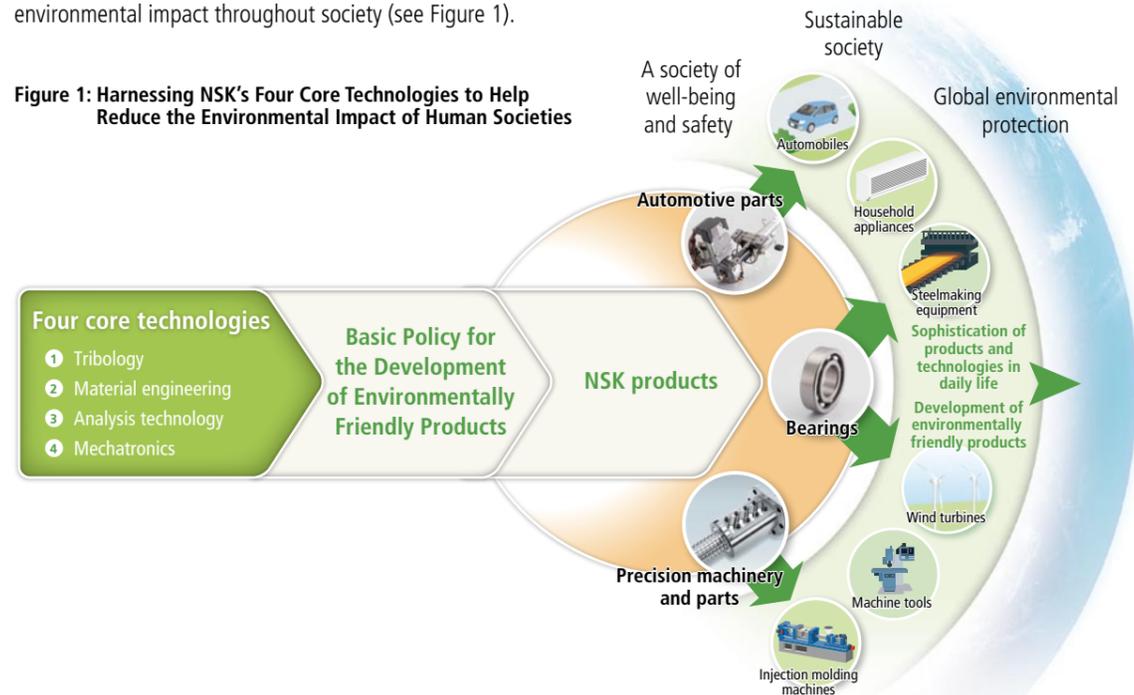
Transforming the structure of society to halt the progress of climate change and the depletion of resources in the future is a common challenge for humanity. Toward that end, companies are expected to make positive contributions through their products and services. This includes the development of new technologies, making those newly developed technologies even more sophisticated to aid in environmental protection, and increasing utilization of renewable energy.

## NSK's Approach

### Harnessing NSK's Four Core Technologies to Help Reduce the Environmental Impact of Human Societies

The products of the future must perform better than today's in order to help reduce the impact human societies have on the natural environment. In an effort to contribute to the well-being and safety of society and to protect the global environment, as spelled out by its corporate philosophy, NSK is working hard to accurately determine the needs of its customers and the broader society, as well as to develop environmentally friendly products and technologies which, in keeping with its basic policy, make the most of the Company's four core technologies (tribology, material engineering, analysis technology, and mechatronics). By delivering these products and technologies to all corners of the globe, the Company aims to contribute to the sophistication of the machinery in which NSK products are incorporated and to the development of environmentally friendly products as well as to the reduction of environmental impact throughout society (see Figure 1).

Figure 1: Harnessing NSK's Four Core Technologies to Help Reduce the Environmental Impact of Human Societies



### Basic Policy for the Development of Environmentally Friendly Products

The NSK Group minimizes the environmental impact of its products at every stage—from R&D and design, to production, usage, and disposal—by upholding the following standards:

1. Each product should contribute toward the energy and resource conservation of the machine in which it is installed.
2. The amount of energy and resources required during product manufacturing should be minimal.
3. Environmentally harmful substances should not be used in products or manufacturing processes.
4. Products should contribute to the health and safety of end users by having low emissions of vibration, noise, and dust.

## Environmentally Friendly Products and NSK Eco-efficiency Indicators

NSK products can be considered environmentally friendly because they reduce friction, which helps to save energy and protect the environment. In an effort to further promote these types of products, the NSK Group formulated the Basic Policy for the Development of Environmentally Friendly Products in fiscal 2001 and started registering new products that meet its standards. Then, in fiscal 2008, the Group introduced the NSK Eco-efficiency Indicators (Neco), a yardstick for quantitatively assessing the degree of environmental friendliness possessed by the products it develops. Currently the Group is working to achieve a Neco score of 1.2 or higher (see Figure 2).

## Goals and Performance

### Goals

The NSK Group is creating even more environmentally friendly products and technologies based on the NSK Environmental Policy and the Basic Policy for the Development of Environmentally Friendly Products. Goals include the following:

- Increase the environmental friendliness of products
- Consider methods for assessing the environmental impact arising from product manufacturing

### FY2011 Activities

#### 17 New Environmentally Friendly Products

In fiscal 2011, the NSK Group developed 17 new environmentally friendly products that help customers conserve energy and resources. The total count for the Company's environmentally friendly products dating back to fiscal 2002 now stands at 157. Some of those are shown here (see Table 1 and Figure 2).

Figure 2: Number of Environmentally Friendly Products Developed (Total)

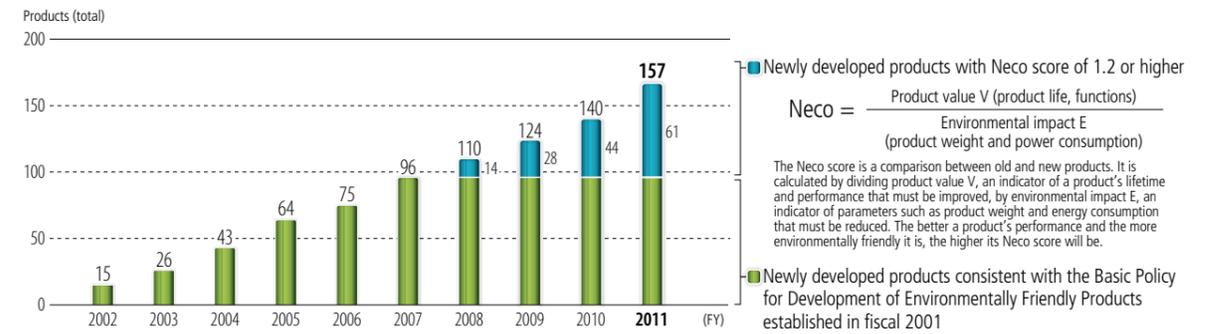


Table 1: Environmentally Friendly Products Developed in Fiscal 2011

NSK products	Environmental benefits for NSK's customers	Technology development at NSK	Neco
<p>Ultra-long-life Ball Bearings for Transmissions</p>	<ul style="list-style-type: none"> <li>• Smaller and lighter transmissions</li> <li>• Improvement of automotive fuel economy</li> </ul>	<ul style="list-style-type: none"> <li>• Extended service life by two to three times</li> <li>• Applied long-life materials and heat treatment technology to rolling element</li> </ul>	2.2
<p>SUSBarrier™ Bearings for Anti-corrosion: SPACE™ Series</p>	<ul style="list-style-type: none"> <li>• Longer maintenance cycle for food machinery</li> <li>• Increased reliability</li> <li>• Resource conservation</li> </ul>	<ul style="list-style-type: none"> <li>• Achieved corrosion resistance 10 times that of the conventional product in antiseptic and sterilization solutions and saltwater conditions</li> <li>• Developed of surface treatment technology with excellent corrosion resistance</li> </ul>	3.7
<p>Single-axis Actuators for Ultra-high Load Applications: Thoughcarrier™ High-thrust Series</p>	<ul style="list-style-type: none"> <li>• Longer life</li> <li>• Space savings</li> </ul>	<ul style="list-style-type: none"> <li>• Increased the endurance time of ball screw by three to eight times</li> <li>• Increased the load capacity by enlarging the shaft and ball diameters of the ball screw within the same space as the conventional product</li> <li>• Adopted a new circulating system</li> </ul>	4.2
<p>Energy-saving Bearings for High-efficiency Motors</p>	<ul style="list-style-type: none"> <li>• Increased motor efficiency and energy savings</li> <li>• Increased reliability</li> </ul>	<ul style="list-style-type: none"> <li>• Achieved 50% lower friction loss</li> <li>• Optimized internal design of the bearing</li> </ul>	1.3
<p>Roller-type One-way Clutch with Low Drag Torque Specifications</p>	<ul style="list-style-type: none"> <li>• Lower operating limit oil temperature</li> <li>• Increased automotive transmission efficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Achieved both lower drag torque and operability under low oil temperature, solving the conventional dilemma</li> <li>• Changed the spring load setting</li> <li>• Reduced automatic transmission fluid (ATF) pooling by optimizing the cage shape</li> </ul>	1.6
<p>Integrated Structure Motor and ECU Column-Type Electric Power Steering</p>	<ul style="list-style-type: none"> <li>• Lighter and smaller vehicles</li> <li>• Improvement of fuel economy</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced the weight and size of EPS systems</li> <li>• Combined the motor, electronic controllers, and the torque sensor</li> <li>• Expanded product variety</li> </ul>	1.3

Reference data is available on NSK's website. [www.nsk.com](http://www.nsk.com) > Sustainability > CSR Reports

Close-Up

# Contributing to the Creation of Highly Efficient Air Conditioning Systems with Lower Environmental Impact

## Example of Mitsubishi Heavy Industries' Centrifugal Chiller

Mitsubishi Heavy Industries' Centrifugal Chiller AART Series reduces energy use by approximately 40% compared to the conventional type. It won the Director-General's Prize from the Agency for Natural Resources and Energy in the Excellent Energy Saving Equipment category at the 28th awards in 2007 sponsored by the Japan Machinery Federation. NSK made a significant contribution to increasing the energy savings by developing bearings that reduce friction in the rotational axis of the compressor, which is the heart of the centrifugal chiller, by making skillful use of the technology it had developed in the fields of machine tools and aircraft jet engines.

### Development Background

#### A Centrifugal Chiller for Delivering Comfort Spaces and Saving Energy

Centrifugal chillers are recommended as air conditioning systems for large facilities due to their large capacity and energy efficiency. However, they have been made even more efficient in response to mounting social needs to fight global warming and conserve energy.

#### Increasing Centrifugal Chiller Efficiency by Allowing Compressor Rotation Speed to Fluctuate

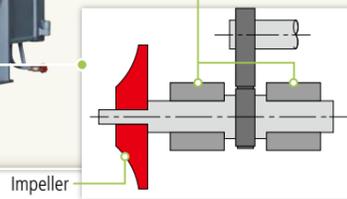
Mitsubishi Heavy Industries' centrifugal chiller achieves highly efficient operation throughout the year by allowing the speed of the compressor's impeller to fluctuate according to the outside temperature. To achieve this, there was a need to develop a highly reliable bearing that is highly rigid, loses little energy through rotation speeds whether low or high, and can withstand external temperature changes during operation.

#### Mitsubishi Heavy Industries' Centrifugal Chiller AART Series

Use of centrifugal chillers as air conditioning systems for large facilities such as office buildings and factories is expanding due to their large capacity and energy efficiency.



NSK applied machine tool bearing technology to optimize the bearing layout.



### Developer's Voice

#### Helping to Develop a Heat Pump with a Plastic Cage

Following its work on the bearing for centrifugal chillers, NSK developed a bearing for heat pumps used in heating and air conditioning equipment for office buildings. In this case, we had to increase the compressor rotation speed in order to achieve higher performance than usual with a new refrigerant. Accordingly, we revised the mechanism for feeding lubricating oil into the bearing and also changed the bearing cage from the usual metal to plastic. This enabled low heat generation even at high-speed rotation.

#### Kazuhiro Hara

Group Manager, Railroad & Aerospace Bearing Technology Department, Aerospace Group, Industrial Machinery Bearing Technology Center, NSK Ltd.



### Core Technology Incorporated into the Low-torque Rolling Bearing for High-Efficiency Centrifugal Chillers

**Neco=1.3**

See page 41 for details about Neco.

#### Tribology

Optimization of lubricating oil to prevent white structure flaking even under harsh conditions such as high load and high-speed rotation

#### Analysis Technology

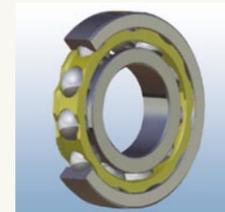
Balancing rigidity and low torque through optimization of bearing placement and design by analyzing the force placed on bearings and temperature changes



### NSK's Solution

#### Leveraging Core Technologies to Develop a Bearing That Withstands Long-term Use

The solution NSK was asked to provide was the development of a bearing with little energy loss that could also withstand high speeds of up to 50,000 revolutions/minute and have a long life enabling the chiller to be run continuously for 50,000 hours (more than four years). Reduction of rotary torque, which is one cause of energy loss, is a trade-off with rigidity and long life. Consequentially, how to optimize both at the same time was the challenge at hand. Moreover, bearings used in the centrifugal chiller have to deliver the required performance under extreme conditions in which they are lubricated with oil mixed with refrigerant.



High durability and low energy loss achieved through sufficient rigidity to withstand high-speed rotation and a petal cage that functions to reduce churning losses by facilitating the discharge of lubricating oil that has gotten inside the bearing

NSK leveraged the technology it had cultivated in the fields of machine tools and aircraft jet engines to analyze the force placed on the bearings in the compressor and temperature changes, enabling it to achieve both rigidity

and long life through the appropriate layout of bearings with the optimum shape.

There was also a need to take measures to prevent white structure flaking caused on bearings' inner and outer races by use under extreme conditions. White structure flaking is a phenomenon that occurs by the penetration into the metal of hydrogen produced through the heat-induced breakdown of a bearing's lubricating oil. Here, NSK increased durability by selecting the most suitable lubricating oil based on the refrigerant.



**White Structure Flaking**  
A phenomenon in which the areas on the inner and outer races along which the balls roll becomes brittle and the surface peels off in flakes, leading to the end of the bearing's life. One cause of this is the hydrogen produced during the thermal decomposition of lubricating oil penetrating into the bearing steel from the surface.

#### Contributing to a 20% Improvement in Cooling Efficiency with Low-torque Rolling Bearings

NSK secured high reliability even under a speed range that was 1.5 times faster than the conventionally used bearings through optimum bearing development consisting of appropriate layout of bearings and optimization of the lubricating oil. It also contributed to a 20% improvement in the centrifugal chiller's energy efficiency by halving friction loss.

### Developer's Voice

#### Embracing the Challenge of Further Increasing Efficiency and Expanding Outside Japan

The need for more efficient air conditioning equipment has increased with the rising need for energy conservation. Furthermore, there is also the need to switch from refrigerants with zero ozone depletion potential to those with a low global warming coefficient. NSK will embrace these challenges and make skillful use of its bearing-related technology and expertise. The fight against global warming is an issue for the entire world, not just Japan. In the future we will work aggressively on expanding outside Japan to meet the global need for energy conservation.

#### Yoshiyuki Tsuruga

Assistant Manager, Railroad & Aerospace Bearing Technology Department, Aerospace Group, Industrial Machinery Bearing Technology Center, NSK Ltd.





# Global Warming Countermeasures

Efforts to Save Energy and Reduce CO<sub>2</sub> Emissions

- Related stakeholders
- Customers
- Employees
- Suppliers
- Local Communities
- Future Generations
- Shareholders and Investors

Concerns are mounting that the advance of global warming will lead to increasingly serious climate change problems and cause tremendous damage including rising sea levels, droughts, localized torrential rain, and the spread of infectious diseases, as well as having harmful effects on ecosystems. At present, the world is debating how to achieve substantial reductions in emissions of CO<sub>2</sub> and other greenhouse gases. To help build a low-carbon world, companies are expected to make aggressive efforts to develop new and more advanced technologies that will lead to energy savings. They are also required to help popularize energy-saving products and reduce the CO<sub>2</sub> emissions generated by their business operations.

## NSK's Approach

### Helping Society Save Energy with Environmentally Friendly Products, and Reducing Energy Use in Operations

The NSK Group is working to develop and promote environmentally friendly products\*<sup>1</sup> in order to help society reduce CO<sub>2</sub> emissions. These products contribute to the fight against global warming by reducing the energy loss that takes place when automobiles, machine tools, and other equipment move. The Group is also carrying out energy-saving measures such as upgrading to high-efficiency equipment and improving production efficiency in order to reduce CO<sub>2</sub> emissions from its own operations (see Figure 1).

\*<sup>1</sup> See pages 40–43 for information about environmentally friendly products.

## Goals and Performance

### Goal

#### Reduce CO<sub>2</sub> Emissions in Operations

The NSK Group is striving to reduce CO<sub>2</sub> emissions generated by its operations through efforts to reduce energy use, switching to

cleaner energies that generate less CO<sub>2</sub> emissions, and improving production and distribution efficiency.

### Fiscal 2012 Targets for Global Warming Countermeasures

#### Manufacturing

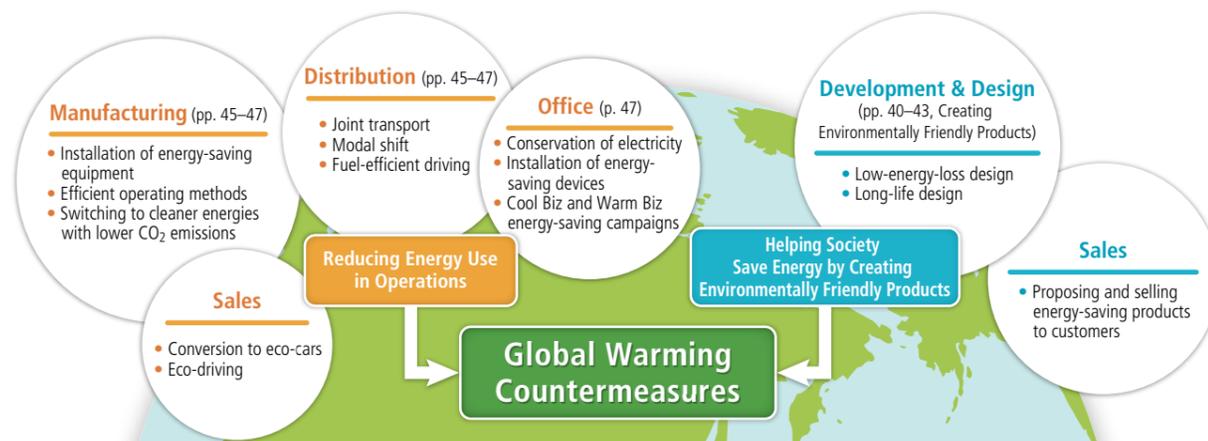
In Japan:  
CO<sub>2</sub> emissions per production unit: 1% annual reduction from FY1999 level (12.2% reduction from FY1999 at fixed electricity conversion factor)  
Total CO<sub>2</sub> emissions: Reduce CO<sub>2</sub> emissions for FY2012 to below FY2006 level (electricity conversion coefficient of variation)  
Outside Japan:  
CO<sub>2</sub> emissions per production unit: 1% annual reduction from FY2008 level (4% reduction from FY2008)

#### Distribution

In Japan:  
Reduce energy consumed per ton-kilometer: 1% annual reduction from FY2006 level (14% reduction from FY2006)

Note: Figures in parentheses include adjustments for targets in each year.

Figure 1: Contributing to the Fight Against Global Warming by Creating Environmentally Friendly Products and Reducing Energy Use in Operations



## FY2011 Activities

### Achieved Goals for CO<sub>2</sub> Emissions per Production Unit

In fiscal 2011, CO<sub>2</sub> emissions from plants in Japan were 8.7% below the fiscal 2006 level when calculated using a fixed electricity conversion factor, due to the effects of the business slowdown caused by the Great East Japan Earthquake, flooding in Thailand, and financial uncertainty in Europe. However, when calculated using a coefficient of variation that includes the effects of the shutdown of nuclear power plants in the conversion factor, CO<sub>2</sub> emissions rose slightly by 0.4% compared to fiscal 2006. For CO<sub>2</sub> emissions per production unit, a reduction of 11.8% compared to fiscal 1999 was achieved, exceeding the goal of an 11.4% reduction, as the result of working groups at each plant steadily pushing ahead with theme-based efforts

(see page 46–47). Additionally, the Company implemented energy-saving measures and generated power with in-house generators in response to requests from power companies to cut power usage at peak times in summer in the aftermath of the Great East Japan Earthquake.

CO<sub>2</sub> emissions from plants outside Japan were up 5.1% compared to fiscal 2010, but for CO<sub>2</sub> emissions per production unit, a reduction of 13.5% compared to fiscal 2008 was achieved, exceeding the goal of a 3.0% reduction.

Meanwhile, distribution divisions in Japan expanded the scope of the modal shift from trucks to ships and improved loading efficiency. These initiatives resulted in CO<sub>2</sub> emissions of 19,400 tons in fiscal 2011, while for energy consumed per ton-kilometer, a reduction of 14.5% compared to fiscal 2006 was achieved, exceeding the goal of a 13.0% reduction (see Figure 2, 3, and 4).

## FY2011 Highlights

### Manufacturing: Overview of Initiatives Saving Energy at Plants Using Issues Matrices for Each Initiative

The NSK Group has created “issues matrices” for its energy-saving initiatives. These cover a wide range of items for each type of equipment, such as production equipment, heat treatment equipment, and compressors. Each plant shares issues and systematically carries out energy-saving activities, such as those described at right.

### Efficient Operation of Equipment

Plants increase the capacity utilization of production lines and promote efficient energy use by improving operation through the consolidation of production lines and equipment maintenance.

### Installation of Energy-Saving Equipment

Plants share information about common issues, such as energy savings for air conditioning equipment and compressors that supply compressed air, and roll out advanced solutions to other plants.

## Electricity Measures Triggered by the Great East Japan Earthquake

The NSK Group made efforts to reduce electricity usage, not only during peak times but also at normal times, in response to the limited electricity supply caused by the shutdown of nuclear power plants after the earthquake.

Plants implemented measures such as operating on weekends, cutting electricity use by using fuel-based compressors, and using in-house generators in order to reduce peak power usage by 15% compared to fiscal 2010, based on the power consumption restriction order issued in the summer of 2011. In addition, power monitors were installed to enable

the head office’s administrative divisions to monitor peak energy usage at key plants. Furthermore, all Japanese sites in the NSK Group implemented energy saving measures such as thorough control of air conditioning temperature, turning off equipment when not in use, dimming lighting, and adding inverters to pumps.

In fiscal 2012, the Group will further reduce electricity consumption by installing cogeneration systems and operating air conditioning systems that utilize waste hot water.

Figure 2: CO<sub>2</sub> Emissions from Manufacturing in Japan: Total Volume and per Production Unit

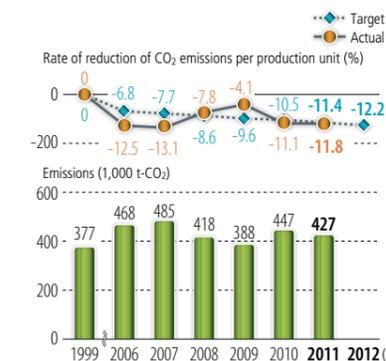


Figure 3: CO<sub>2</sub> Emissions from Manufacturing Outside Japan: Total Volume and per Production Unit

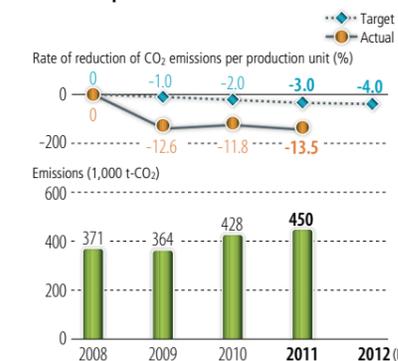
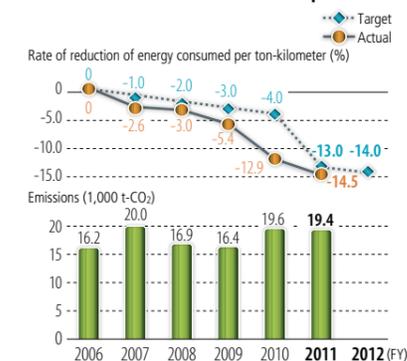


Figure 4: Energy Consumed per Ton-kilometer and CO<sub>2</sub> Emissions from Distribution in Japan



Reference data is available on NSK’s website.  
[www.nsk.com](http://www.nsk.com) > Sustainability > CSR Reports

• CO<sub>2</sub> Emissions

### Switchover to Clean Energy

NSK is switching over from fuels with high CO<sub>2</sub> emissions such as heavy oil and kerosene to electricity and natural gas, which have lower emissions.

### Manufacturing: Spindle Working Group

#### Energy Saving in the Grinding Process

A spindle is a unit that rotates a grindstone at a high speed and high level of precision to grind bearing parts to very precise measurements. A huge amount of compressed air is used to spray lubrication oil on bearing parts while spindles rotate at a high speed with high precision, and a lot of electricity is needed to create the compressed air.

To save energy, the NSK Group developed an energy-efficient spindle that uses grease lubrication, greatly reducing the compressed air needed. The Group has been systematically making the switchover at each plant. It is also undertaking initiatives to reduce energy consumption by shutting down the rotation of spindles when parts are not being processed and automatically shutting off the compressed air.

### Manufacturing: Heat Treatment Working Group

#### Identifying Energy Losses and Implementing Improvements

Plants in the NSK Group use many heat treatment furnaces to heat bearing parts. Since a lot of energy is consumed during the

heat treatment process, each furnace has been equipped with a wattmeter and a gas flowmeter to ascertain energy usage. At the same time, the input and output of heat used by each furnace is analyzed based on the measurement results, and furnaces of the same type are compared to identify those that consume energy wastefully. Improvements are then devised and implemented in an effort to reduce energy consumption.

### Manufacturing: Examples of Energy-saving Measures Outside Japan

The photos below show some examples of energy-saving measures implemented by sites outside Japan.



Photo 1: NSK Bearings Europe Ltd., Peterlee Plant (England) Monitoring compressed air

Photo 2: NSK Bearings Polska S.A., Kielce Plant (Poland) Reducing heat loss from a gas boiler

Photo 3: Suzhou NSK Bearings Co., Ltd. (China) Switching to LED lighting

Photo 4: PT. AKS Precision Ball Indonesia (Indonesia) Installing energy-saving hydraulic units

### Distribution: Overview of Initiatives Saving Energy in Distribution of Both Products and Procured Parts

Under its Environmental Logistics Policy, the NSK Group strives to reduce the environmental impact of transport by improving loading efficiency by combining product distribution and procured part distribution and by shifting to modes of transport with lower impact.

### Combination of Product and Procured Parts Distribution

The NSK Group is improving distribution efficiency through joint transport that combines the transport of products and parts. It is working to reduce the number of vehicles and the distance driven by using milk runs to collect shipments from several suppliers in the same area and adopting transport routes that make effective use of the return trip after delivering products to customers.

### Modal Shift

The NSK Group is using more ship transport, which has lower CO<sub>2</sub> emissions than transport by truck, while adjusting for transport lead-time and cost. It is also working to improve loading efficiency.

### Offices: 23% Energy Savings Achieved at the NSK Head Office

The NSK Head Office building began renovation work in December 2009 and has installed inverter-controlled florescent lights, lighting that automatically adjusts the illumination based on motion sensors, and air conditioning equipment that can adjust the temperature separately for each floor. After the Great East Japan Earthquake, it carried out even more rigorous energy-saving activities than usual, such as dimming lighting, reducing usage of hot water, and thoroughly controlling air conditioning temperature, which resulted in an energy savings of 23% in fiscal 2011 compared to fiscal 2010.

## NSK Action

### Rejuvenating Facilities and Staff: Renovation of the NSK Head Office Building

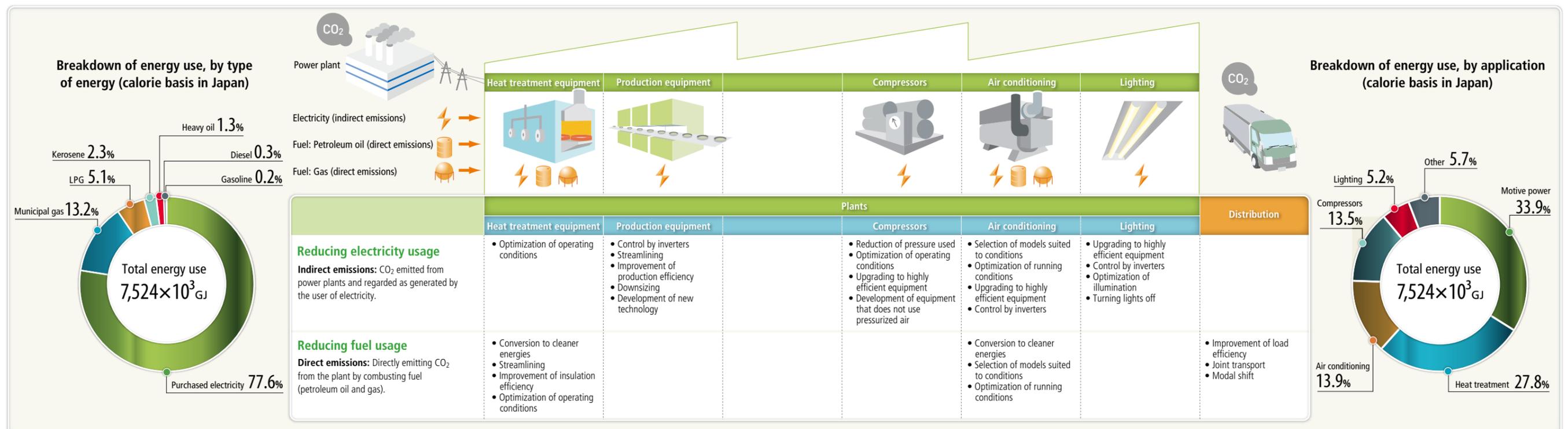
Twenty years had passed since the Nissei Building, where NSK's head office is located, was completed in 1987, and the time had come when the entire building needed renovation, including repairs to the exterior wall and upgrading of fixtures. Air conditioning and lighting equipment in particular could hardly match up to recent standards of functionality and energy savings, and tenants had started asking for improvements so that the air conditioning system could be operated efficiently in response to the Japanese government's Cool Biz and Warm Biz energy-saving campaigns. Moreover, there were strong calls to strengthen information security. Upgrading the building to provide comfortable office space and reassurance equal to that of the latest intelligent buildings had become a pressing issue.

The renovation work, which is scheduled for completion in June 2013, will upgrade air conditioning, lighting, elevators, toilets, and other features, thereby increasing the building's value as an office building and achieving substantial energy savings. The building is being updated to one suitable for the head office of NSK, which aims to protect the global environment in all fields of its business.



Youichi Kajikawa  
Manager, General Affairs Department, NSK Ltd.

Figure 5: Main Initiatives to Reduce CO<sub>2</sub> Emissions





# Measures for Resource Conservation and Recycling

Efforts to Make Optimal Use of Resources



There is growing concern around the world that an economic system based on mass production, mass consumption, and mass disposal will end up depleting a wide range of resources in the future. Against this backdrop, companies are required to help build recycling-oriented societies by ensuring the efficient use of resources throughout the entire product lifecycle—from the extraction of resources through product use, to disposal.

## NSK's Approach

### Promoting Efficient Use of Resources in All Areas of Business Activity

The NSK Group is working on reducing, reusing, and recycling (the 3Rs) to do its part in building recycling-oriented societies around the world. The Group's development and design divisions strive to develop products that can be produced without wasting raw materials and that can be easily recycled when disposed after use. At the manufacturing and distribution stages, the Group attempts to reduce the generation of waste and also works to recycle waste that is generated, aiming to eliminate landfill waste disposal (see Figure 1). See Global Warming Countermeasures on pages 44–47 for information about NSK's efforts to reduce its use of energy resources.

## Goals and Performance

### Goal

#### Improving 3R Efforts

In fiscal 2011, the NSK Group changed its definition of zero emissions from no more than 0.5% landfill disposal to no

more than 0.05%, raising the bar on its 3R efforts. Attainable goals up through fiscal 2012 are shown below.

### Fiscal 2012 Resource Conservation and Recycling Targets

#### Development and design, manufacturing

Reduce waste of resources such as raw material and water by changing processing methods

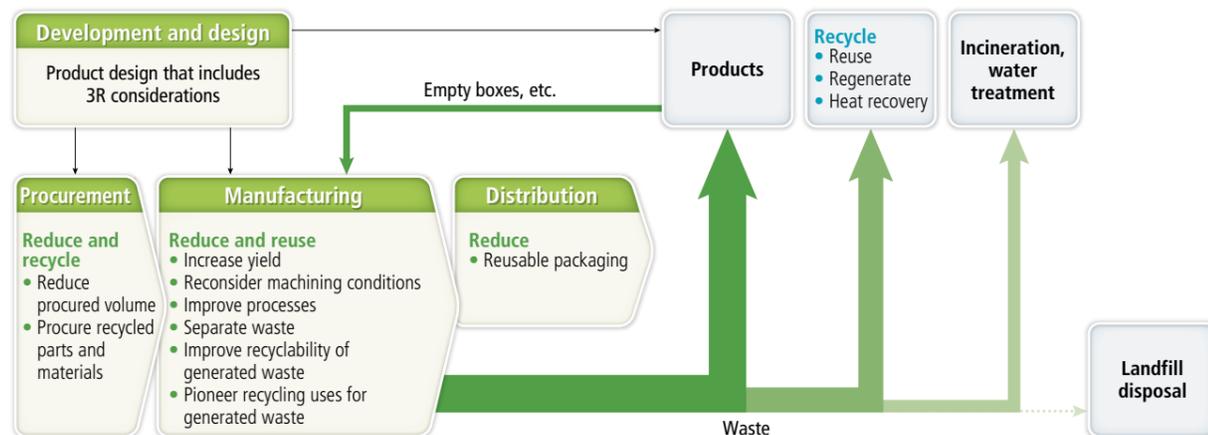
#### Manufacturing

In Japan: Achieve a recycling rate\*1 of at least 99.5% for waste and maintain zero emissions\*2  
 Outside Japan: Achieve a waste recycling rate of at least 92%

#### Distribution

In Japan: Reduce packaging material waste by 5% from fiscal 2007

Figure 1: 3Rs to Help Build Recycling-oriented Societies



## FY2011 Activities

### Goals Achieved at Plants In and Outside Japan

The NSK Group's plants in Japan achieved a waste recycling rate of 99.2% and a landfill disposal rate of 0.02% by strengthening waste separation and selecting new disposal contractors. This performance met the Group's fiscal 2011 targets. Plants outside Japan also achieved a waste recycling rate of 91.9%—attaining their target. Packaging material waste from distribution in Japan, however, was 10.7% higher than in fiscal 2007 on a per production unit, falling short of the Group's target due to the effects of the Great East Japan Earthquake.

The Group's plants in Japan steadily reduced steel material waste by changing the forging format for raw steel. Water usage at plants in Japan was 7.6% higher than in fiscal 2010 as a result of growth in production of products that use a relatively large amount of water during manufacturing processes (see Figure 2 and 3).

$$*1 \text{ Recycling rate (In Japan)} = \frac{\text{Recycled amount}}{\text{Total waste} - \text{reduction by water treatment}} \times 100$$

\*2 The NSK Group has defined zero emissions as a landfill disposal rate of no more than 0.05% (no more than 0.5% for fiscal 2011).

$$\text{Landfill disposal rate (In Japan)} = \frac{\text{Landfill disposal amount}}{\text{Total waste} - \text{reduction by water treatment}} \times 100$$

## FY2011 Highlights

### Development and Design: Development of Manufacturing Technology That Saves Both Energy and Resources

#### Warm and Cold Forging of Yokes

Yokes connect to the shaft that turns the steering wheel in a vehicle. The typical way to process yokes is with a hot forging technique that requires steel to be heated to at least 1,000°C and then pressed. The NSK Group has now reduced the use of steel by over 40% by developing cold forging and warm forging techniques. Less steel is wasted by forming the steel into a shape that is closer to the final product, at a lower temperature. With this method, work hardening is used to harden the material during forging, ensuring sufficient strength even without heat treatment after processing. This results in substantial energy savings, as well.



Photo 1: Warm forged yoke



Photo 2: Cold forged yoke

### Manufacturing: Strengthening Waste Management

#### On-site Inspections of Waste Disposal Contractors and Amendment of Contracts

In Japan, the law requires waste generators to manage waste disposal and prevent illegal dumping by checking to make sure that waste is disposed appropriately through to its final disposal, even if waste is consigned for recycling, incineration, or burial. Aiming for a higher level of management, the NSK Group conducted on-site inspections of all contractors and reviewed all contracts by fiscal 2011.

### Distribution: Reducing Packaging Material Strengthening the Reuse and Recycling of Used Packaging Materials

The NSK Group is working harder than ever at the 3Rs to reduce packaging materials by meticulously sorting used packaging. The Group is also striving to reduce waste wood by repairing broken wood pallets instead of disposing of them.

Figure 2: Total Waste, Rate of Recycling, and Landfill Volume (Plants in Japan)

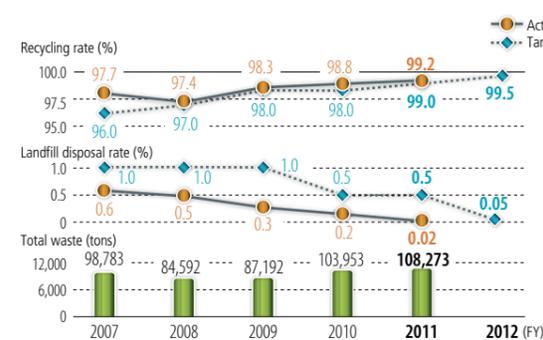
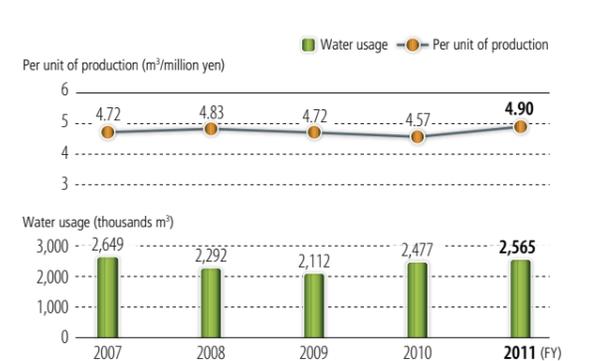


Figure 3: Water Usage per Unit of Production (Plants in Japan)



Reference data is available on NSK's website. [www.nsk.com](http://www.nsk.com) > Sustainability > CSR Reports



# Reducing Use of Environmentally Harmful Substances

## Appropriate Management of Environmentally Harmful Substances

Related stakeholders: Customers, Employees, Suppliers, Local Communities, Future Generations, Shareholders and Investors

Chemical substances have made modern life much more convenient. However, some chemicals can have adverse effects on human health and the environment. At the World Summit on Sustainable Development held in Johannesburg in 2002, the nations of the world reaffirmed their commitment to "aim by 2020 to use and produce chemicals in ways that do not lead to significant adverse effects on human health and the environment." Since then the international community has been working cooperatively to regulate chemical substances more strictly.

### NSK's Approach

#### Staying Ahead of Regulatory Progress

The NSK Group is striving to create products that use no environmentally harmful substances, in anticipation of tougher laws and regulations around the world and stricter voluntary standards from its customers. The Group tightly controls environmentally harmful substances through each stage of development and design, procurement, manufacturing, and distribution to ensure that safe products are delivered to customers (see Figure 1).

### Goals and Performance

#### Goal

#### Enhance the System for Managing Environmentally Harmful Substances

To ensure the products it delivers are safe, the NSK Group is reinforcing its system for reliably ensuring that products contain no environmentally harmful substances. The goals the Group expects to attain in fiscal 2012 are shown to the right.

In fiscal 2012, the Group is focusing on expanding green procurement at plants in Asia that manufacture NSK products. The NSK Group is also updating its database by conducting surveys to identify the inclusion of environmentally harmful substances in parts and raw materials based on the latest List of NSK Environmentally Harmful Substances. Efforts like these demonstrate the Group's commitment to the global management of environmentally harmful substances.

#### Fiscal 2012 Targets for Reducing Use of Environmentally Harmful Substances

##### Development and design

Reduce four types of environmentally harmful substances contained in products

##### Development and design, manufacturing

Manage the use of chemical substances for the products of all plants using the Chemical Substance Management System

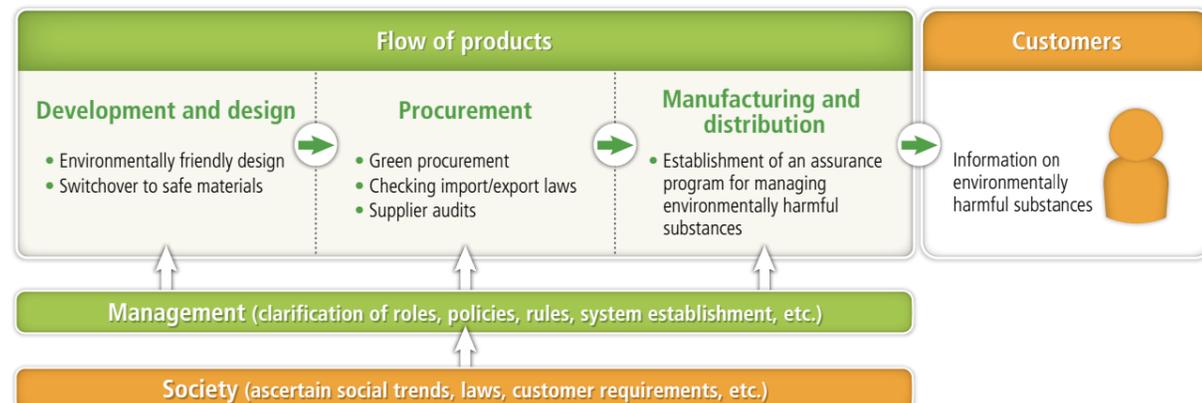
##### Procurement

Complete the extension of green procurement to suppliers in Japan, China, and the ASEAN region

##### Manufacturing

Complete a chemical substance quality assurance system for products  
Eliminate machining fluids containing chlorine additives  
Reduce PRTR-designated substances by 3% from fiscal 2011

Figure 1: Management of Environmentally Harmful Substances



### FY2011 Activities

#### Staying Ahead of Regulatory Progress and Strengthening Global Response

The Group is striving to manage chemical substances contained in products and used in manufacturing processes. The Group has a List of NSK Environmentally Harmful Substances based on Japanese and European laws related to chemical substances and chemical substance guidelines established by the automotive and electrical/electronic devices industries.

In fiscal 2011, NSK updated the list in response to the strengthening of regulations in Europe and Japan and the revision of guidelines in the automotive and electrical/electronic devices industries. The Group is determined to stay ahead of regulatory progress. It plans to conduct surveys to investigate the inclusion of environmentally harmful substances in parts and raw materials not only in Japan but also at production sites globally.

### FY2011 Highlights

#### Management: Chemical Substance Management System

##### Expanding System to Main Plants in Asia

In 2006, the NSK Group started introducing a chemical substance management system, which it has used to share and centralize information needed in surveys to investigate the inclusion of environmentally harmful substances in products.

Through fiscal 2011, the Group had registered data for all 11 plants in Japan as well as its main plants in China, South Korea, Thailand, Indonesia, and Malaysia. It will expand the plants and products covered in order to strengthen the chemical substance management system for global operation.

#### Design: Aiming for Zero Environmentally Harmful Substances

##### Taking Action Based on the List of NSK Environmentally Harmful Substances

NSK has established a List of NSK Environmentally Harmful Substances (Prohibited Substances, Reduced Substances, and Observation Substances) covering nearly 3,000 chemical substances. The Group is aiming for zero use of environmentally harmful substances in the manufacture of its products. In fiscal 2011, it completed the replacement of two environmentally harmful substances that had been contained in products.

#### Procurement: Green Procurement

##### Eight Briefing Sessions on Green Procurement Held In and Outside Japan

The NSK Group is working closely with suppliers to strengthen the management system for chemical substances in order to ensure that parts and materials it procures are environmentally friendly. In fiscal 2011, the Group revised NSK Green Procurement Standards (6th edition) to further strengthen the environmental quality assurance system. It revised not only the Japanese version, but also the English and Chinese versions to assist suppliers worldwide. Furthermore, green procurement briefing sessions were held six times in Japan and twice in China to ensure suppliers understand the content of the Green Procurement Standards.

#### Procurement: Supplier Audits

##### Facilitating Improvements through Self Audits and On-site Audits

The NSK Group has all suppliers that could conceivably use environmentally harmful substances conduct self audits using a check sheet made by NSK. The check sheet is intended to assess the establishment of an assurance system for managing

### NSK Action

#### Mutually Enhancing Business Partnerships through Audits

The cooperation of suppliers is imperative in the NSK Group's manufacturing of products that are free of prohibited substances. In fiscal 2010, I was certified as an NSK environmentally harmful substance auditor. I visit rubber and plastic manufacturers. The purpose of my visits is to work with suppliers to identify issues that are difficult to ascertain using submitted documents only. I inspect the on-site environmentally harmful substance management system, reviewing processes from design and manufacturing to shipping. If there is a gap with what our Statement of Green Procurement Standards requires, we tie that into improvement efforts and mutually enhance our business partnership. This is a very meaningful job for me.

We will expand these audits to production sites outside Japan and firmly establish them in each region.

Naoya Kasai

Product Engineering Department, Engineering Division, NSK-WARNER K. K.



Reference data is available on NSK's website. [www.nsk.com](http://www.nsk.com) > Sustainability > CSR Reports

• NSK Group Green Procurement Standards and the List of NSK Environmentally Harmful Substances

environmentally harmful substances. NSK Group staff members with internal qualifications as auditors visit suppliers and conduct on-site audits. They focus on suppliers who deliver parts and materials with a high likelihood of having environmentally harmful substances included or adhered them. In fiscal 2011, 56 suppliers were audited. The NSK Group follows up on the status of issues identified through on-site audits in cooperation with suppliers.

**Manufacturing: Reducing Use of Environmentally Harmful Substances**  
**Striving to Totally Eliminate Machining Fluids Containing Chlorine Additives**

Machining fluids containing chlorine additives may generate harmful dioxins when incinerated at disposal. The NSK Group is striving to totally eliminate their use. After repeated tests to confirm effects on workability and quality, the Group was able to switch to four new alternatives in fiscal 2011. However seven fluids used in machining under some of the harshest conditions for broaching and multi-daylight press machining remained.

The goal of full phase-out remains just barely out of reach. In fiscal 2012, the Group will continue working to complete the elimination process (see Figure 2).

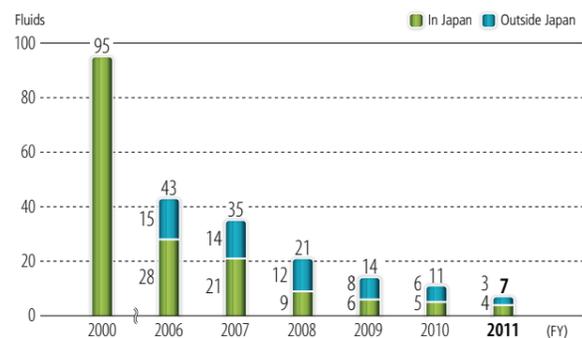
**Handling of PRTR\*1-designated Substances Reduced by 3.4%**

The number of PRTR-designated substances increased from 354 to 462 with the revision of the law in Japan in fiscal 2008. The NSK Group's handling of those substances increased from 270 tons in fiscal 2009 to 635 tons in fiscal 2010. The Group set the goal of a 3% reduction in fiscal 2011 from fiscal 2010 in order to reduce its handling of PRTR-designated substances contained in fluids and fuels used in manufacturing processes.

In fiscal 2011, the Group systematically implemented measures such as switching the fuel for air conditioning and reducing the number of forklifts, enabling it to achieve a 3.4% reduction from fiscal 2010 (see Figure 3).

\*1 PRTR Law: Act on Confirmation, etc., of Release Amounts of Specific Chemical Substances in the Environment and Promotion of Improvements to the Management Thereof (Law concerning Pollutant Release and Transfer Register / PRTR). Japan's law intended to facilitate improvement of chemical substance management by ascertaining and reporting to authorities the amounts released into the environment.

Figure 2: Number of Machining Fluids Containing Chlorine Additives



**Manufacturing: Reducing Emission of Environmentally Harmful Substances**

**VOC Emissions Reduced by 1%**

Some manufacturing processes use solvents and adhesives that contain volatile organic compounds (VOCs) such as toluene and xylene. By taking steady action such as limiting the time that lids of storage containers are open during those processes, emissions to the atmosphere in fiscal 2011 were reduced by 1% from fiscal 2010 to 95.6 tons.

**Manufacturing: Countermeasures Against Soil and Water Pollution**

**Four Underground Tanks Decommissioned and Three Upgraded**

Since tanks and piping buried underground cannot be checked visually, an oil leak may not be noticed right away. Accordingly, air tightness tests are conducted periodically on underground tanks and piping to make sure there are no leaks. At the same time, NSK has set its own standards and is working systematically to decommission underground tanks and piping. In fiscal 2011, it decommissioned four tanks. For tanks that are difficult to move above ground or when installing tanks in basements, the NSK Group is switching the tanks to a double-hull structure. In fiscal 2011, three tanks were switched.

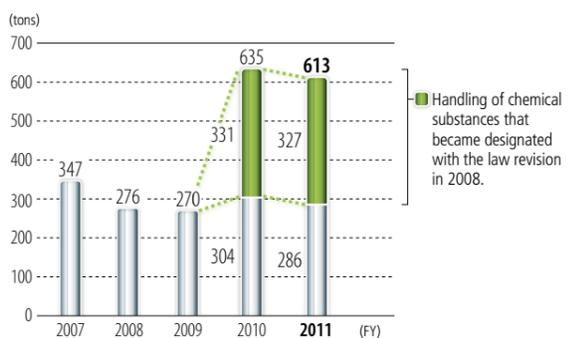


Photo 1: Switching to a double-hull tank

**Cleanup Ongoing at Six Sites**

The NSK Group completely eliminated the use of chlorinated organic solvents in fiscal 2003. However, the cleanup of groundwater is continuing at six sites where soil and groundwater pollution remains from past use. The Group regularly monitors groundwater and reports the cleanup progress to the authorities.

Figure 3: Handling of PRTR-designated Substances



**Environmental Accounting**

The environmental conservation cost in fiscal 2011 included approximately 1.9 billion yen in investments and about 7.8 billion yen in expenses. The economic benefits came to roughly 1.6 billion yen.

The NSK Group is focused on contributing to the environment through its products, resulting in comparatively higher R&D costs for environmentally friendly products and technologies.

Table 1: Environmental Conservation Cost

(millions of yen)

Category	Investments				Expenses				
	FY2009	FY2010	FY2011		FY2009	FY2010	FY2011		
	Millions of yen	Millions of yen	Millions of yen	(%)	Millions of yen	Millions of yen	Millions of yen	(%)	
1. Business area costs	(1) Pollution prevention costs	81.7	119.4	202.2	10.6%	607.5	663.4	592.3	7.6%
	(2) Global environment conservation costs	269.1	942.5	475.9	25.1%	497.3	585.8	720.5	9.3%
	(3) Resource circulation costs	47.5	285.3	306.8	16.2%	549.0	668.3	632.5	8.2%
	Subtotal	398.3	1,347.2	984.8	51.9%	1,653.8	1,917.5	1,945.4	25.1%
2. Upstream and downstream costs	0.3	0.3	0.3	0.0%	166.2	223.2	196.9	2.5%	
3. Administration costs	0.2	74.6	71.2	3.7%	596.3	642.0	630.8	8.1%	
4. Research and development costs	335.3	627.7	843.0	44.4%	3,438.0	4,322.5	4,937.4	63.6%	
5. Social activity costs	0.0	0.0	0.0	0.0%	37.2	34.4	41.9	0.5%	
6. Environmental remediation costs	0.0	0.0	0.0	0.0%	4.6	4.6	6.2	0.1%	
<b>Total</b>	<b>734.1</b>	<b>2,049.8</b>	<b>1,899.4</b>	<b>100.0%</b>	<b>5,895.9</b>	<b>7,144.2</b>	<b>7,758.6</b>	<b>100.0%</b>	

Category	Main activities	
1. Business area costs	(1) Pollution prevention costs	<ul style="list-style-type: none"> <li>Maintained and inspected dust collectors and smoke removal units</li> <li>Deodorized noxious smells</li> <li>Brought to the surface and repaired underground tanks and pipes</li> <li>Maintained and inspected facilities affected by environmental impact</li> <li>Maintained and inspected the handling procedures for discharged water and other fluids</li> </ul>
	(2) Global environment conservation costs	<ul style="list-style-type: none"> <li>Followed energy conservation policies including installation of inverters and high-energy-efficient equipment</li> <li>Converted to natural gas and other green energies</li> <li>Took countermeasures to reduce ozone-depleting substances</li> </ul>
	(3) Resource circulation costs	<ul style="list-style-type: none"> <li>Installed grinding-dust briquette-making equipment</li> <li>Took countermeasures to reduce and recycle waste material</li> <li>Disposed and handling of general and industrial waste</li> </ul>
2. Upstream and downstream costs	<ul style="list-style-type: none"> <li>Practiced green procurement (low-polluting vehicles, paper, uniforms, and office equipment and supplies)</li> <li>Undertook environmental impact-reducing measures, including packaging materials</li> </ul>	
3. Administration costs	<ul style="list-style-type: none"> <li>Performed landscaping and "greening" work</li> <li>Maintained and followed procedures for ISO 14001</li> <li>Measured and analyzed environmental impact</li> </ul>	
4. Research and development costs	<ul style="list-style-type: none"> <li>Conducted research and development with the main goal of environmental protection for new product development</li> </ul>	
5. Social activity costs	<ul style="list-style-type: none"> <li>Participated in and donated to the Keidanren Nature Conservation Fund and the Electro-Mechanic Technology Advancing Foundation</li> <li>Participated in environmental protection programs</li> </ul>	
6. Environmental remediation costs	<ul style="list-style-type: none"> <li>Maintained discharge treatment facilities</li> </ul>	

Table 2: Economic Benefits Associated with Environmental Conservation Activities

Area	Amount (millions of yen)		
	FY2009	FY2010	FY2011
Cost savings of energy conservation policies	68.1	61.0	176.3
Cost savings of waste material reduction policies	48.0	69.4	77.4
Sales of recyclable waste material	692.9	1,187.4	1,313.8
<b>Total</b>	<b>809.0</b>	<b>1,317.8</b>	<b>1,567.5</b>

Table 3: Physical Benefits Associated with Environmental Conservation Activities

Area	Comparison with earlier FY			
	FY2009	FY2010	FY2011	
Plants	CO <sub>2</sub> emissions / production unit	4.1% worsened	7.3% improvement	0.7% improvement
	Water use / production unit	3.5% worsened	5.8% improvement	7.6% worsened
	Landfill waste disposal ratio	0.2% improvement	0.1% improvement	0.2% improvement
	Waste recycling ratio	0.9% improvement	0.5% improvement	0.4% improvement
Distribution	Energy / production unit	2.7% improvement	6.5% improvement	3.1% improvement

**Method of Calculation**

Accounting term: Fiscal years from April 1 to March 31

Sites included: Table 1: NSK Ltd. (corporate head office, plants, technology divisions); NSK Steering Systems Co., Ltd.; NSK Precision Co., Ltd.; NSK Logistics Co., Ltd.; NSK-Warner, K.K.; NSK Kyushu Co., Ltd.; NSK Machinery Co., Ltd.; Inoue Jikuu Kogyo Co., Ltd.; NSK Micro Precision Co., Ltd.; Micro Precision Co., Ltd. (Nagano); AKS East Japan Co., Ltd.; Asahi Seiki Co., Ltd.; Shinwa Seiko Co., Ltd.; Kuribayashi Seisakusho Co., Ltd. (added in fiscal 2009)

Table 2 and 3: All sites of NSK Group companies in Japan

**Criteria for environmental protection costs**

Environmental costs and expenses determined in accord with the *Environmental Accounting Guidelines 2005* issued by the Ministry of the Environment in Japan. Depreciation is entered as a cost using the 5-year straight-line depreciation method. Compound costs are divided in proportion to the relevant environmental objective. Costs incurred through green procurement are entered as full amounts and not as differential amounts.

**Criteria for environmental protection benefits**

Includes economic benefits (in monetary units) calculated from tangible evidence and physical benefits gained from environmental policies. Does not include imputed benefits (risk avoidance benefits, estimated profit contribution benefits, etc.)

# Relationship with Shareholders and Investors

## Basic Policy on Shareholder and Investor Relations

NSK is committed to meeting the expectations of shareholders and investors by disclosing a variety of management information in a timely and fair manner and by striving to provide stable returns.

## Communication with Shareholders and Investors

NSK has established a dedicated IR division to provide information that shareholders and investors can use to help guide their investment decisions. The Company strives to disclose business and financial information in a clear manner in cooperation with other relevant departments.

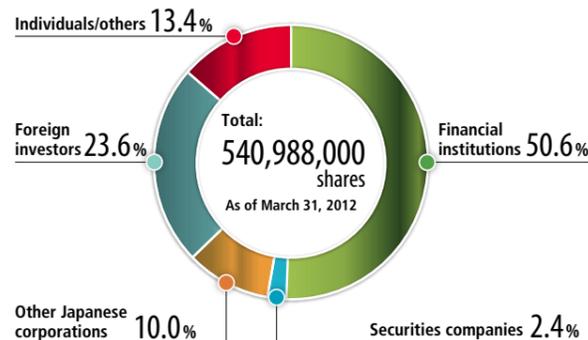
## IR Events

The Company outlines its business performance, medium- and long-term strategies, and other progress at the Financial Conference (held twice a year) and at the Mid-term Business Strategy Conference. The Company also communicates actively with shareholders and investors in and outside Japan via individual interviews and conference calls. In September 2012, NSK held a special briefing for individual investors to meet them directly. As the general public does not usually see NSK's products in daily life, the direct conversation helped to deepen understanding of NSK. The Company intends to hold more of these kinds of briefings in the future.



Photo 1: Briefing for individual investors

## Breakdown of Shareholders (Number of Shares)



## Information Tools

NSK reports on its financial situation and business topics through the publication of an annual report and a business report, the *NSK Group Report* (in Japanese only). It also discloses these reports along with financial briefings materials on the Investors section of its website. Going forward, the Company will strive to continue disclosing information in a timely manner and to enhance the content of disclosed information.

## Dividend Policy

The return of profit to shareholders is an important management policy for NSK. The Company's basic policy is to continuously provide a stable dividend, which it sets based on consideration of the dividend payout ratio and business performance criteria on a consolidated basis.

## Assessment by External Organizations

Social responsibility indexes (SRIs) include companies that promise long-term sustainable growth because they merit high evaluations for environmental and social contributions as well as financial performance. Moreover, a broad range of institutional investors are attributing greater importance to such companies. As of March 2012, NSK is included in four internationally recognized SRIs.

**Dow Jones Sustainability Indexes**  
<http://www.sustainability-index.com>




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**FTSE4Good Index Series**  
[http://www.ftse.com/Indices/FTSE4Good\\_Index\\_Series/index.jsp](http://www.ftse.com/Indices/FTSE4Good_Index_Series/index.jsp)



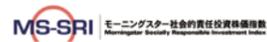

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**Ethibel Investment Register**  
[http://forumethibel.org/content/ethibel\\_sustainability\\_index.html](http://forumethibel.org/content/ethibel_sustainability_index.html)




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**Morningstar Socially Responsible Investment Index**  
<http://www.morningstar.co.jp/sri/about.htm>



# Third-Party Opinion

NSK asked Professor Yoshinao Kozuma of Sophia University's Faculty of Economics to provide a third-party opinion of this report.



**Yoshinao Kozuma**  
Professor, Faculty of Economics,  
Sophia University, Japan

After leaving the Sophia University Graduate School of Economics upon earning credits in the latter half of the doctoral program, Professor Kozuma worked as a research assistant at the Nagoya Institute of Technology, a visiting researcher at the Limperg Instituut in the Netherlands, an associate professor at the University of Shizuoka, and an associate professor in the Faculty of Economics at Sophia University, before taking up his current position. He has held successive positions as the chair or member of various CSR- or environment-related advisory panels, study groups, and research conferences for the Ministry of the Environment; the Ministry of Economy, Trade and Industry; the Ministry of Land, Infrastructure and Transport; the Ministry of Agriculture, Forestry and Fisheries; the Cabinet Office; and the Japanese Institute of Certified Public Accountants. His specialty is environmental accounting, and his recent work includes *Carbon Labeling to Visualize CO<sub>2</sub>* (Chuokeizai-sha, Inc., in Japanese).

## 1. Management Transparency

I think that the phrase "management transparency," which is included in the title of the message from the president, aptly describes the characteristics of this year's report. While the report is an information platform combining a booklet and Web-based content, the approach of trying to disclose highly important information at a glance in the booklet has become stronger, as NSK has remarkably increased convenience for stakeholders. For instance, progress in terms of disclosure, compared to the previous year, can be seen throughout. This includes the clear yet compact inclusion of more information than ever before and increased page count; the explicit indication of which stakeholders each piece of information applies to; the greatly expanded table of CSR management goals and performance, especially for environmental issues; the enhancement of the social report with an increase in quantitative employment information; and the lucid explanation of the Company's business model, which creates business opportunities while contributing to the creation of sustainable societies through advanced bearing technology. I hope that this direction will be continued in the future.

## 2. Responding to Important Matters

The publication of negative information is an important part of transparent information disclosure. Representational faithfulness is a basic reporting principle for securing the reliability of disclosed information, and to fulfill that principle appropriately, highly important information must be disclosed without intentionally discriminating between good and bad. This year's report reveals the administrative investigations related to competition laws in Germany, the U.S., and South Korea in addition to the antimonopoly incident in Japan, which was already mentioned in brief the year before. While the occurrence of these incidents themselves is certainly regrettable, I think that the way they were handled later was appropriate. The establishment of the Compliance Committee and the Compliance Enhancement Office, the expansion of the compliance framework outside Japan, and the development and strengthening of a compliance education system were carried out very quickly, and the disclosure of information was comprehensive and detailed. However, it will take a lot of time to systemically instill adherence to competition laws, and so there may be a need to continuously assess the effectiveness of compliance education.

## 3. Future Issues

Considering that two-thirds of employees work outside Japan, I think that an issue is to give these reports a global perspective, expanding the disclosure boundaries to the consolidated scope. There is room for improvement on a global basis especially in information pertaining to labor practices. It is also possible to improve and expand supply chain information for the entire value chain, and so it would also be good to consider expanding the scope of disclosure in this regard.

## Response to Mr. Kozuma's Third-Party Opinion



**Toshihiro Uchiyama**  
Director, Senior Vice President  
Corporate Planning Division HQ—Head  
Responsible for IR & CSR Office

Thank you for your valuable opinion.

First of all, I appreciate your evaluation of the progress made in our information disclosure. The NSK Group believes that building better relationships with stakeholders through the disclosure of highly transparent information is crucial for our business growth. Going forward, we will continue strengthening our activities, raising the bar on our initiatives and information disclosure and further increasing management transparency.

I agree that the future issues about which you gave your opinion—giving the report a global perspective and improving and expanding supply chain information—are both important. We will raise our awareness of our stakeholders' perspectives in each region and will steadily pursue green procurement, CSR procurement, and other activities throughout the supply chain. These efforts will be reflected in future reports.

## Responses to Opinions of the NSK CSR Report 2011

As part of his opinion of the *NSK CSR Report 2011*, Mr. Eiichiro Adachi, a counselor at the Japan Research Institute, Limited, recommended that the NSK Group "progress to the second stage" with its CSR activities and articulate "a statement of CSR that includes the Company's vision of the future world."

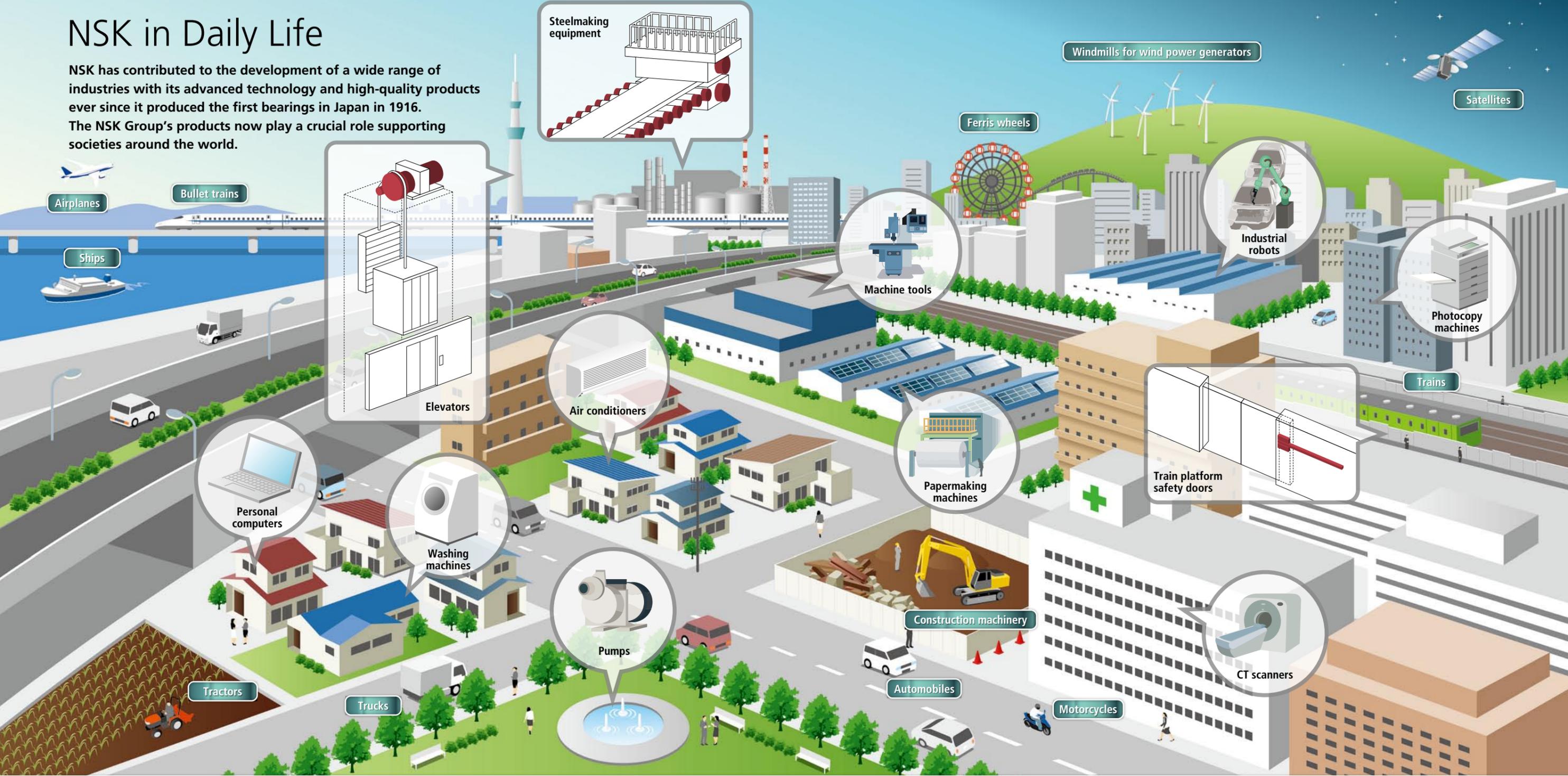
The NSK Group steadily carried out activities to create quality, improve workplaces, and protect the environment. It also strove in this report to

enhance information disclosed from the perspective of contributing through business to the creation of sustainable societies. (See, for example, "NSK's Efforts to Improve Automotive Fuel Economy" on page 10.)

Going forward, the Group will continue to improve the level of its initiatives and information disclosure while deepening its internal discussion of what kind of CSR activities are possible in order to contribute as a B-to-B parts manufacturer to the development of a better society.

# NSK in Daily Life

NSK has contributed to the development of a wide range of industries with its advanced technology and high-quality products ever since it produced the first bearings in Japan in 1916. The NSK Group's products now play a crucial role supporting societies around the world.



## NSK Group Businesses and Product Areas

### Industrial Machinery Business

#### Industrial Machinery Bearings

Bearings reduce friction in the rotating parts of machinery and enable smooth rotation. NSK's bearings are used in a range of products and machines, including home appliances such as vacuum cleaners, railway vehicles such as bullet trains, steelmaking equipment, wind turbines for power generation, large industrial machinery, airplanes, and satellites.



Angular contact thrust ball bearings for ball screw support for machine tools



Miniature ball bearings

#### Precision Machinery and Parts

The NSK Group's precision machinery and parts are the core components in the machine tools and industrial robots used to manufacture automobiles, personal computers, and other products. They are also found in equipment used to produce semiconductors and in injection molding machines. The NSK Group's precision machinery and parts play a crucial role on the front-line of manufacturing.



Nut cooling ball screws for machine tools



NSK Linear Guide™ roller guide equipped with high-performance side seals

### Automotive Business

#### Automotive Bearings

Some 100 to 150 bearings are incorporated into a single automobile. The NSK Group provides numerous products that support the diverse automotive needs of society, including various bearings used in the engine, transmission, and electrical components as well as the hub unit bearings that support the axle.



High-performance sealing hub unit bearing



Low-torque ball bearings for hybrid vehicles

#### Automotive Parts

The NSK Group's automotive parts include many important components that control forward motion, turning, and stopping in automobiles, such as steering systems that transmit the driver's movement of the steering wheel to the vehicle's wheels, and clutches that are used in automatic transmissions. The Group's products also contribute to automobile safety, comfort, and environmental performance.



Column type electric power steering (EPS) systems



Friction clutch assemblies for automatic transmissions

# Our CSR is...

## Americas

## Europe

## Asia & Oceania



Conducting activities with consideration, ethics, and responsibility.



Creation of new technology and environmental friendliness.



Human resources development that brings continuous growth for the organization, and hard work to contribute to sustainability.



Delivering the "it" factor that everyone wants.



Environmental protection activities, starting with things close by.



Starting from each individual, protecting resources and the environment and living happily.



Mutual assistance, consideration, and fulfillment of responsibility.



Passion for service.



Safer and more eco-friendly.



Kindness.



Consideration and giving back.



A bond with the Earth.



Sharing things that have good value for our society & nature environments in order to keep world's smile...



Development while maintaining harmony among people, society, and the environment.



Dialogue.



A true relationship between the company and its community.

### Your Opinions Are Invited

Thank you for reading the NSK Group's CSR Report 2012. In order to further improve our CSR activities and the quality of this report, NSK would like to receive your opinions and impressions. Please take a moment to fill out the included questionnaire or visit the following website.

[www.nsk.com](http://www.nsk.com) > Sustainability > CSR Reports <http://www.nsk.com/sustainability/voice/>



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**Date of Issue**

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next report scheduled for October 2013)

