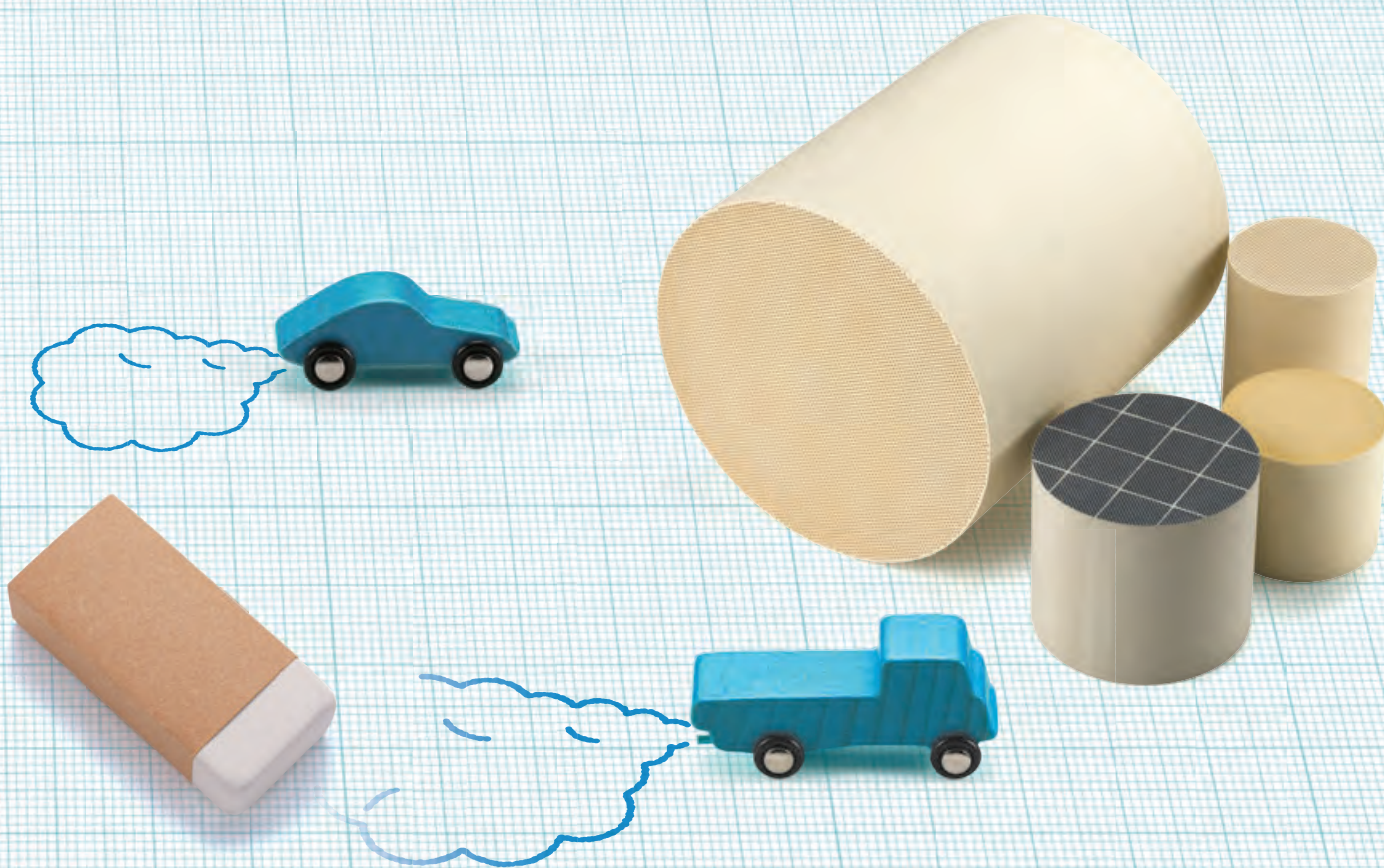


©NGK・kero/dwarf1

# NGK Report 2017

## Digest





# Manufacturing that Contributes to a Better Societal Environment, Creating Value to Cater to Global Needs

The NGK Group develops and supplies products that support social foundations and serve environmental conservation, leveraging its ceramics technologies accumulated over the many decades since its founding.

## Editorial Policy

### Reference Guidelines

Ministry of the Environment's Environmental Reporting Guidelines (2012)  
Global Reporting Initiative (GRI)  
Sustainability Reporting Guidelines (Ver. 4.0)

### Target Organization

Indicated along with each article and data report included in this report.

### Target Period

April 1, 2016–March 31, 2017

**Forward-looking statements** This report includes forward-looking statements, such as business forecasts, concerning the NGK Group. Such statements are based on currently available information and reasonable assumptions and projections. However, please note that these assumptions and projections may be affected by various future factors, causing actual results to differ from the presented statements.

## Details of NGK are available on the company website

This pamphlet has been created to present highlights of issues we believe to be particularly important from the NGK Report 2017, which provides comprehensive information on both financial and non-financial matters. For more detailed information, please see the NGK website. The NGK Report 2017 [full report] (PDF) is available on our website and provides a report on all of NGK's initiatives.



### About NGK

【Japanese】

<http://www.ngk.co.jp/info/>

【English】

<http://www.ngk.co.jp/english/about/>



### Investor Relations

【Japanese】

<http://www.ngk.co.jp/IR/>

【English】

<http://www.ngk.co.jp/english/ir/>



### CSR

【Japanese】

<http://www.ngk.co.jp/csr/>

【English】

<http://www.ngk.co.jp/english/csr/>



### NGK Report 2017 [full report] (PDF)



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### KUROKO ▶

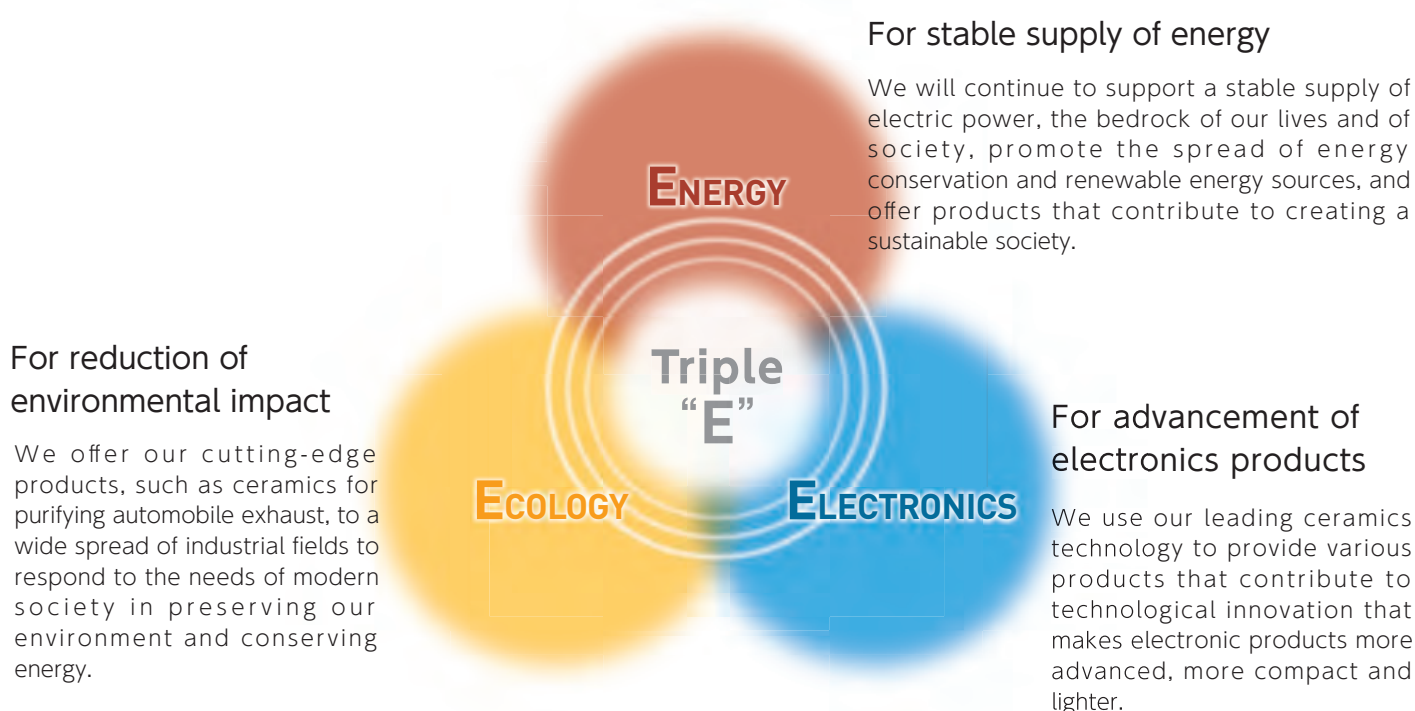
'KUROKO' is a stagehand dressed in black who assists the actors in various ways during the Japanese Kabuki performance. Character 'KUROKO' symbolizes NGK's aim to design and manufacture useful products worldwide.

© NGK・Kero/dwarf

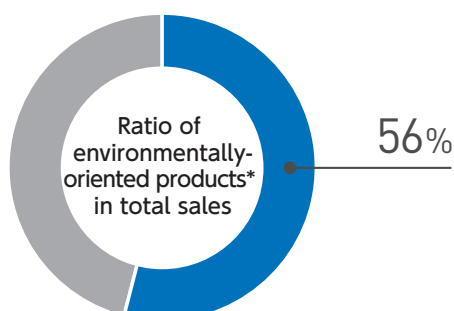


# NGK is Leveraging Our Unique Ceramics Technology to Expand Business in the “Triple E” Business Domain

NGK utilizes ceramics as our core technology to expand our power business, ceramic products business, and electronics business into the business domains of energy, ecology, and electronics. We will continue to test the potential of new ceramics technologies with an eye on the changing needs of the times, and we aim to expand our business profitability while we also make contributions to society and the preservation of our environment.

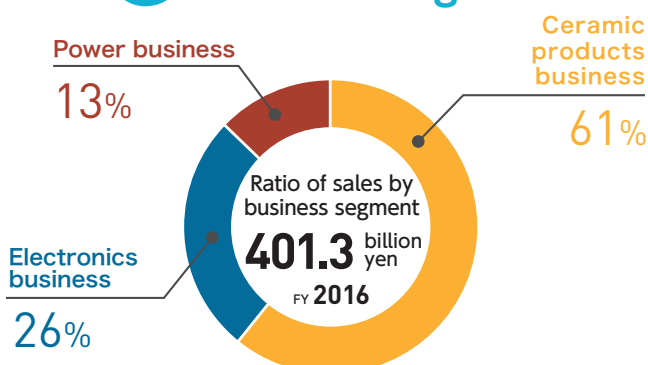


Products contributing to environmental protection **60%**



\*For more details on environmentally-oriented products, see page 47.

**3** business segments





# Building a Reliable Global Network that Brings Together Sophisticated Technological Capacity with Quality Craftsmanship

Consolidated subsidiaries

58

companies

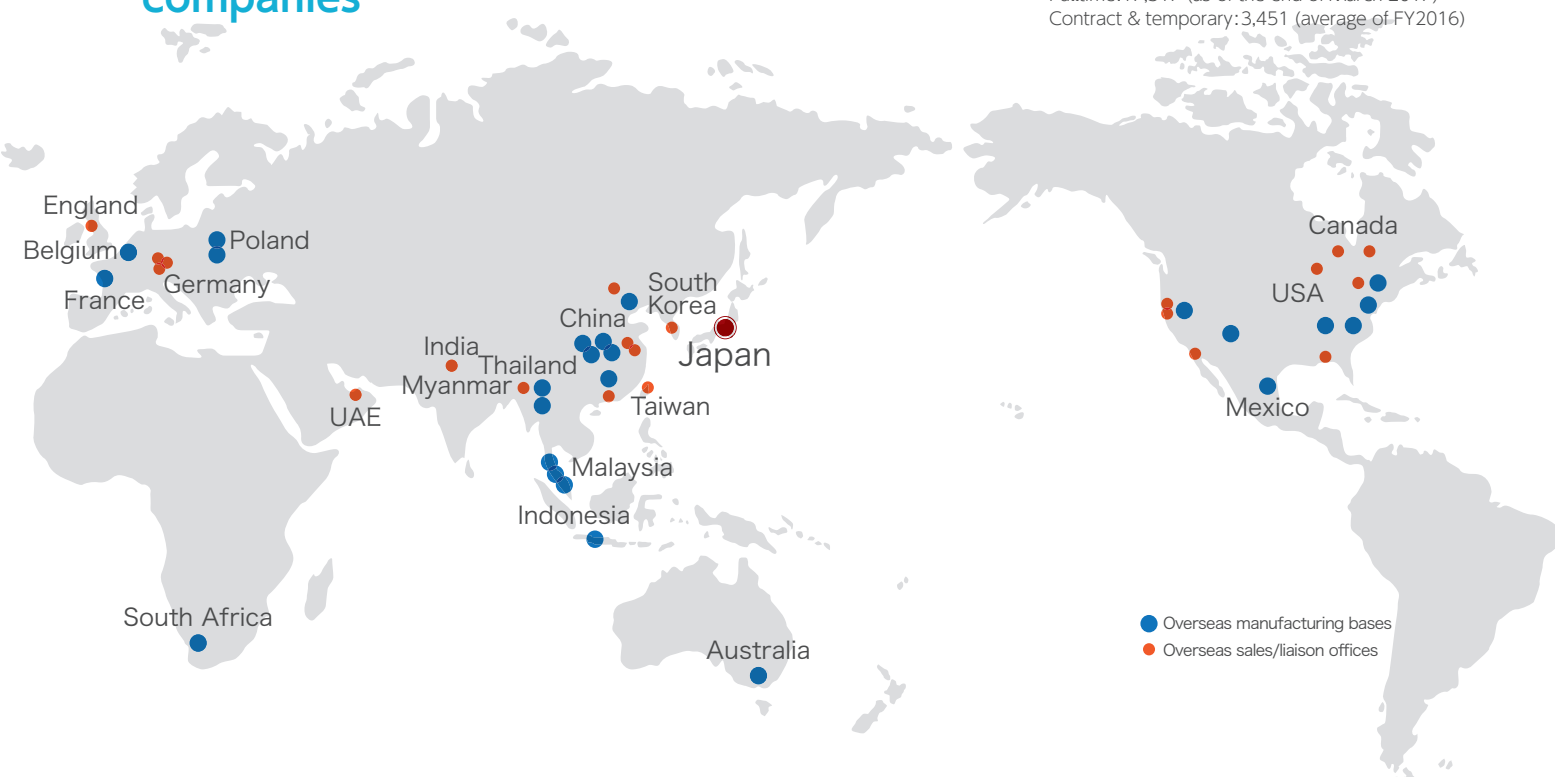
Corporate bases

20 countries and regions around the world

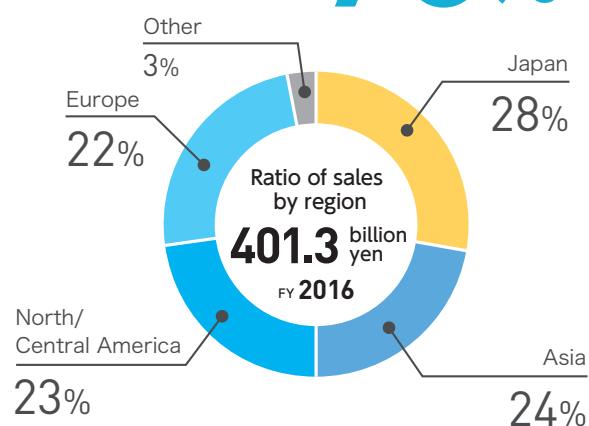
Employees Approx.

21,000

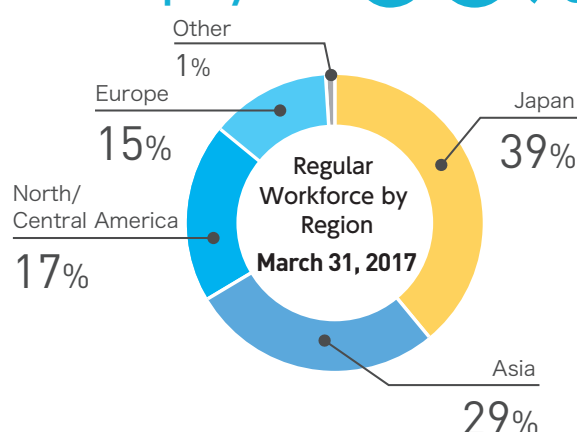
Fulltime: 17,517 (as of the end of March 2017)  
Contract & temporary: 3,451 (average of FY2016)



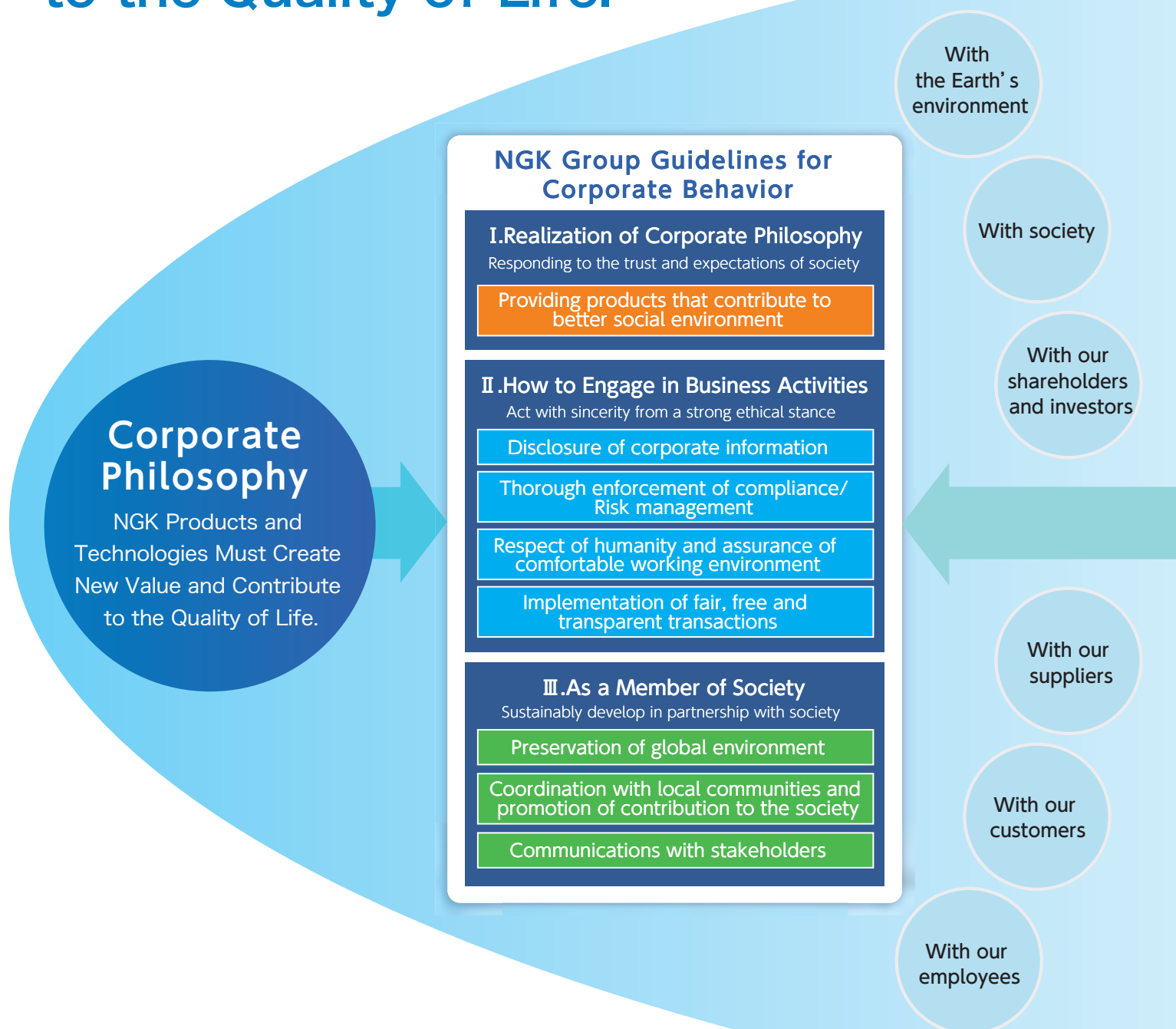
Outside Japan sales: 70%



Outside Japan employees: 60%



# NGK Products and Technologies Must Create New Value and Contribute to the Quality of Life.



## Making contributions to society based on our corporate philosophy

We, at NGK Group, hope to continue to provide products and services that create new value for society so that we may do our part to improving our social environment and to make contributions to society that are tangible representations of our corporate philosophy. In doing so, we hope to gain the trust and expectations of our community, and to carry out the social responsibility. This mentality is shared across the entire NGK Group, and by establishing the NGK Group Guidelines for Corporate Behavior and through our day-to-day business, we aim to make ourselves into a more trustworthy company for all of our stakeholders.



This pamphlet reports  
NGK initiatives in chapter  
form based on CSR objectives.

## Actions and Objectives for Promoting CSR

Providing products that contribute to better social environment	<ul style="list-style-type: none"> <li>● Development and provision of products and services that help to preserve the natural environment</li> <li>● Development and provision of products and services that embody safety and reliability</li> <li>● Realization of higher quality products and services</li> </ul>	P40 >
Disclosure of corporate information	<ul style="list-style-type: none"> <li>● Enhancement of corporate information disclosure</li> <li>● Consistent improvement of internal controls relating to financial reporting</li> </ul>	P23 >
Thorough enforcement of compliance/ Risk management	<ul style="list-style-type: none"> <li>● Thorough promulgation of the NGK Group Guidelines for Corporate Behavior through education</li> <li>● Reinforcement of the risk management system</li> <li>● Respect and protection of intellectual property rights</li> <li>● Creation and consistent improvement of a framework for information security</li> <li>● Strict adherence to the Anti-Monopoly Act, Subcontract Act, and other laws and regulations pertaining to business transactions</li> <li>● Strict adherence to laws and regulations relating to export control</li> </ul>	P41 >
Respect of humanity and assurance of comfortable working environment	<ul style="list-style-type: none"> <li>● Maintenance and consistent improvement of safe and comfortable working environments</li> <li>● Development of human capital and recruiting of human resources across the Group</li> <li>● Utilization of diverse human resources</li> <li>● Support for better balance between work and home life/childrearing</li> </ul>	P42 >
Implementation of fair, free and transparent transactions	<ul style="list-style-type: none"> <li>● Fair and honest evaluation of procurement partners, and extensive resource diversification</li> <li>● Promotion of CSR procurement</li> </ul>	P44 >
Preservation of global environment	<ul style="list-style-type: none"> <li>● Prevention of global warming</li> <li>● Adoption of environmentally friendly production processes</li> <li>● Promotion of resource recycling</li> <li>● Strengthening of global environmental management</li> </ul>	P45 >
Coordination with local communities and promotion of contribution to the society	<ul style="list-style-type: none"> <li>● Provision of scholarships and living assistance to foreign students</li> <li>● Cooperation with local communities, labor unions, and NPOs in social contribution activities</li> <li>● Support for volunteer activities by employees</li> </ul>	P49 >
Communications with stakeholders	<ul style="list-style-type: none"> <li>● Communication with customers and procurement partners</li> <li>● Interaction with local communities via plant tours and open house events</li> <li>● CSR Talk Live (Discussions on implementing CSR with every employee class)</li> </ul>	P50 >

## Contributing to the SDGs through business

### SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD

With our corporate philosophy-NGK Products and Technologies Must Create New Value and Contribute to the Quality of Life-we understand the larger social issues, and we are making contributions to the sustainable development of society through the practical implementation of our CSR objectives.



# Understanding the Needs of Our Age and Continuing to Produce New Value

NGK began in 1919 as a porcelain insulator manufacturer to help Japanese society modernize by meeting the growing demand for electricity accompanying the technological development of industry and the lives of the people.

Since then, NGK has used the technological capacity we've cultivated through the manufacture of high-quality and reliable insulators to actively work towards the diversification and globalization of our business, and to realize sustainable growth through the production of numerous products that support industry and the lives of the people in our community, as well as assist in solving complex social problems.

NGK will continue to provide the world with new value through advanced manufacturing that meets the needs of our age.

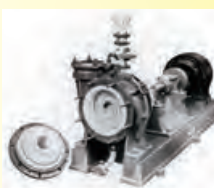
1919

Spin off of the insulator department of Nippon Toki (currently NORITAKE CO., LIMITED) to establish NGK



1931

Acid-resistant equipment for the chemical industry



1958

Beryllium-copper products



1976

HONEYCERAM®, a ceramic catalyst converter substrate for automobile exhaust purification



1978

Low-level radioactive waste treatment equipment



1989

Diesel particulate filter



1919

1930

1940

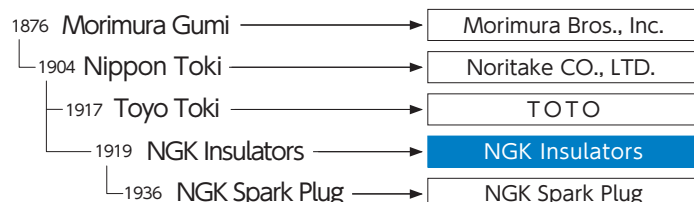
1950

1960

NGK was created to help Japanese society modernize by meeting the growing demand for electricity

## Morimura Group

The ceramics group has its roots in the Morimura Group, a pioneer in the Japan trading industry.



1919



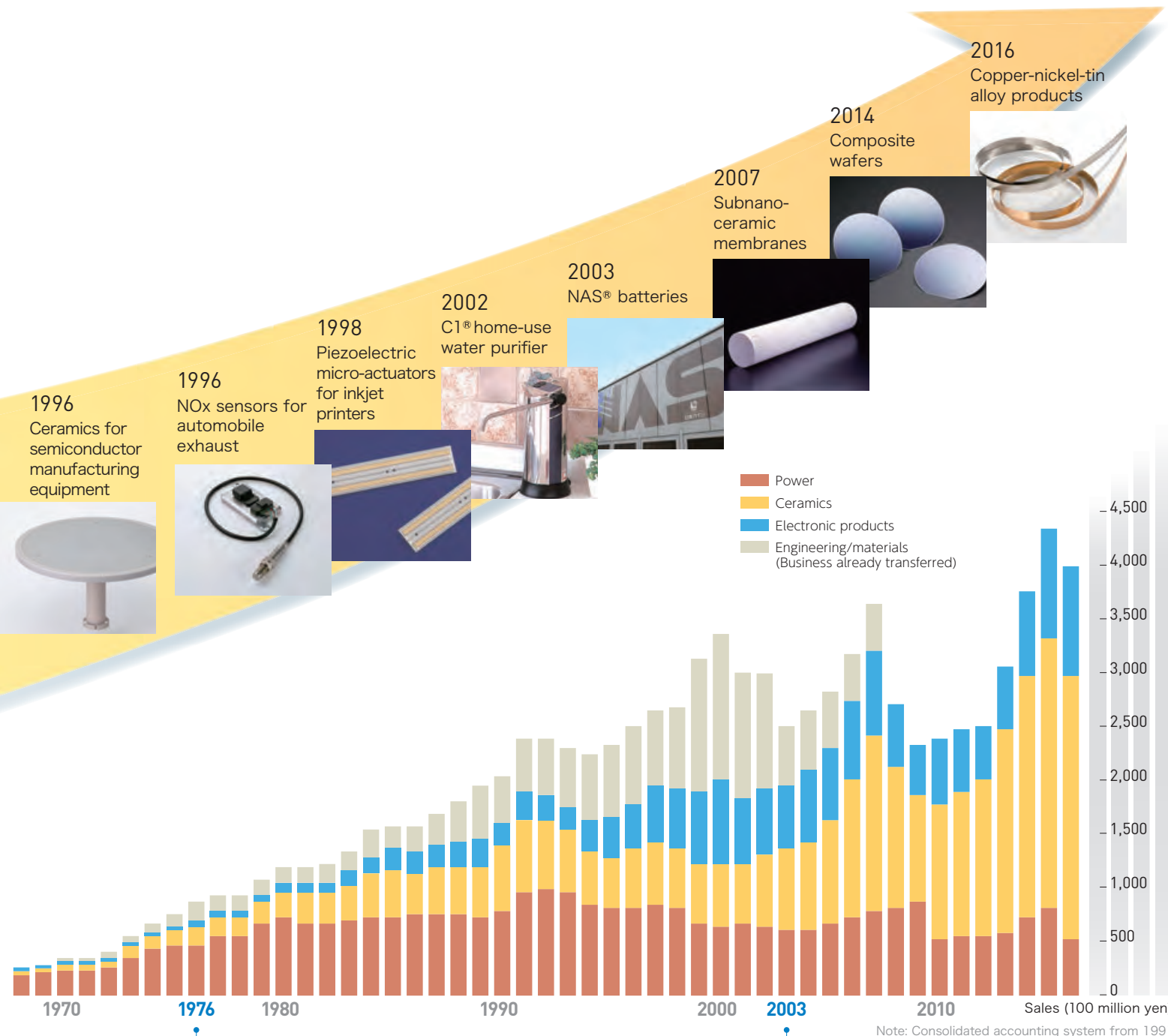
Supporting the development of industry and the lives of people



We solidified our place as the world's number one insulator manufacturer with the completion of our head office and the Atsuta plant in 1957

In 1919, the year after the end of WWI, NGK was founded amidst a time of unprecedented economic growth, and to match the growing demand for electricity, we developed ultra-high-voltage and ultra-high-strength insulators to support the development of industry and the lives of the people. We continue to support the supply of the world's electric power even today as the world's top class insulator manufacturer.





# 1976

## Protecting clean air

As restrictions on car emissions tighten as a response to worsening air pollution, NGK has developed a ceramic substrate for catalytic converter, called HONEYCERAM (see page 32), that can be mounted right after an engine. HONEYCERAM, which can withstand the high heat and shock of high-temperature emissions, is loaded on cars around the world and contributes greatly to solving environment problem.



HONEYCERAM mass-produced product #1. In 2009, it was registered in the important science and technology history collections (Essential Historical Materials for Science and Technology) of the National Museum of Nature and Science

# 2003

## Contributing to making a sustainable society possible

It was in the 1960s when the basic principle was described for the NAS battery, which uses ceramics in electrolytes. However, there were many technical issues and, while the many companies gave up trying to turn it into a product, NGK overcame numerous issues, like how to make it have a larger capacity and reduce costs, to finally begin mass production of the world's first NAS battery in 2003. This product is gaining attention as the key to spread and expanding renewable energy.



There are already approximately 200 working examples of the NAS battery in Japan and overseas.

# Our strengths lie in the growth of our business with the skills we have developed since our founding and the people that support that growth.

Since our founding, we have leveraged our diverse set of skills to develop and offer products that support the infrastructure of society and assist in the solving of environmental problems. It's our people that are the bedrock of our strength, and their mentality to relentlessly pursue quality, to continue to push the envelope, and to give back to society has continued unabated from our founding up to today.

## Pushing the envelope globally and in new fields

NGK goes right back to 1876, when Ichitaro Morimura (Ichizaemon VI) and his younger brother, Toyo, founded Morimura Gumi (currently Morimura Bros., Inc.). In an age when Japan was beginning to modernize, the Morimura brothers were pioneers in globalizing Japan and blazing a trail for Japan-US trade. NGK, having started as an insulator manufacturer, began to develop acid-resistant machinery for use in the chemical industry soon after our founding; we then actively engaged in diversifying and globalizing our business by making our first export of power transmission insulators to India in 1935 and establishing our first overseas production facility in 1973. Even now, we continue to constantly push the envelope in new fields and strive for sustained growth.



A map showing our 30-year history with overseas trading partners. The orders we receive from overseas continue, and we are increasing our factories.



## Contributing to society



Kazuchika Okura, our first president. Okura was the first-born son of Magobei Okura, the brother-in-law of Ichizaemon Morimura, founder of the Morimura Group. At the age of 28, Okura was appointed as the first president of Nippon Toki (currently the Noritake CO., LTD.). He would later serve as president of Toyo Toki (currently TOTO) and NGK Insulators, as well as chairman of INAX (currently LIXIL).

During the Meiji Period when electricity first began spreading throughout Japan, insulators that could withstand high voltage had to be imported. The first president Kazuchika Okura stated, "It is our duty to our country to produce insulators in Japan." Research and development into special high-voltage insulators and the first Japanese insulators began from this keen sense of duty and clues from shards of US-made insulators.

Our founding spirit—the urge to contribute to the development of industry and the lives of the people by meeting the growing demand for electricity with a stable supply of high-quality insulators—continues today still in NGK's corporate philosophy.

Shards of US-made insulators that would serve as the starting point of the founding of NGK. Development began under the belief that with the fine techniques of Japanese craftsmen, they were certain to be able to manufacture special high-voltage insulators.





Ceramics, which are largely determined by natural phenomena like soil, water, and fire, were originally extremely difficult to make with any uniformity. However, with insulators, which have served as the supporting framework for society's lifeline for decades, even a single defective product could have an enormous impact on all of society. For NGK, which broke away from the ceramic ware-making industry and began down the path of industrial manufacturing with insulators, product uniformity was the sought after quality. By refining our core techniques with materials and processes to achieve this, we have continued to provide high quality and reliable products. NGK's manufacturing is made possible by our commitment to quality and our technical capacity.



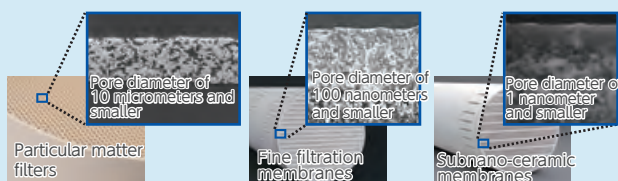
The written pledges (the Founding Pledge) of our first president, Kazuchika Okura, and his five other managers. The pledge includes the expansion of the insulator business and continuous quality improvement.

## The pursuit of quality

### Our Core Techniques

#### Materials techniques

Our materials techniques draw out synergistic effects through the combination of differing materials, rapidly produces ceramics with outstanding qualities, and controls properties like ceramic pore diameter (pore size), crystal orientation, thermal conductivity, ion conductivity, and electrical resistance. With our thorough familiarity with the mechanical, thermal, electrical, and physical properties of ceramics, and our adept manipulation of materials into a plethora of configurations, we are able to manufacture just the right products to meet the needs of society.



By controlling the pore size, ceramic filters can screen out fluids and gases at the molecular level

#### Production techniques

The many innovative and competitive products NGK produces come from the production equipment that we have developed using our own mass production techniques and manufacturing know-how. In order to meet the needs of our customers around the world, we quickly deploy to our overseas locations the cutting-edge production lines we have developed and we promptly build highly efficient global production systems. Additionally, rapidly introducing an analysis of big data into production management leads to improvements in quality and reductions in cost.



Improvements to productivity through innovative mass production processes

#### Process techniques

NGK is adroit at using various molding techniques, such as mold casting, extrusion molding, and tape molding, as well as firing and processing techniques, to achieve a variety of ceramic structures, and we also bind differing materials, such as metals, to ceramics. We develop and manufacture our products of various configurations—everything from fine and complex three-dimensional shapes to the one of the largest porcelain products in the world at 11.5 meters.



Mold casting differs from the conventional casting method where clay was formed and fired in that it is an entirely new molding method where a liquid material is introduced to a mold, and simply cooled and hardened. This method allows for complex and highly-precise shapes.

#### Evaluative/analytical techniques

We are constantly working to innovate in manufacturing by rapidly incorporating, fusing with our own core techniques, and advancing the latest technology, including advanced computer simulation technology that enables significant reductions in development periods and image inspection technology that never fails to overlook even the slightest defects.



Research & development, and manufacturing that utilizes superior evaluative/analytical technology

### The people who underpin manufacturing

We build comprehensive educational programs so that each and every one of our employees can gain the ambition to try new things, work to build an environment of growth, and demonstrate their best performance. We are concentrated on the full training of the people who form the bedrock of our production infrastructure.

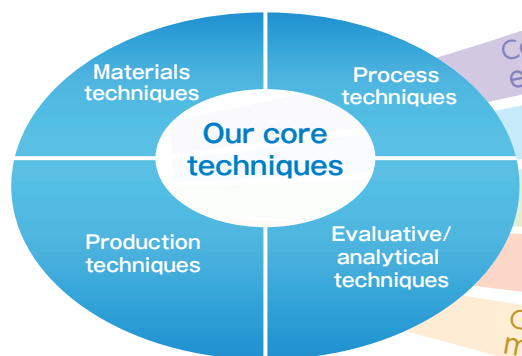
Two months after our founding, a policy to allow employees to use the skills they have in a welcoming environment was promptly created that held the development of business as the same as the advancement of happiness of the workers.



# We provide products/services that contribute to solving various social issues by freely manipulating materials and properties.

Our major strength is our ability to produce a variety of products by combining our techniques with materials, such as porous ceramics and functional ceramics, with our own process techniques involving molding, firing and processing.

NGK products, adept at freely controlling unseen factors, such as electricity and heat, make solid contributions to society in the places we don't often see to help create a better environment, a future for energy, and the advancement of electronics.



Control of electricity

Control of gases/fluids

Control of light

Control of heat

Control of motion

## Removing particulate matter

Removes 99% of particulate matter in car emissions to make the air of our world cleaner.

Diesel particulate filters

## Purifies car emissions

An ultra-thin wall of only 0.05 mm purifies emissions to support the development and evolution of more eco-friendly cars.

HONEYCERAM®

## Warms uniformly

Adapted to the increasing detail and lamination of semiconductors, this technology supports the evolution of IoT and AI.

Ceramics for semiconductor manufacturing equipment

## Moves at high speeds

This is a micro-sized motor that controls electronic devices with high precision at high speeds.

Piezoelectric actuator

## Supporting our electricity supply

Compatible with the highest voltage electricity transmission systems (1 million volts, UHV). Supports transmission wires while providing insulation, to contribute to the stable supply of electric power.

Insulators



## Stores electricity

Electricity storage systems in the megawatt category. This contributes to the spread of renewable energy.



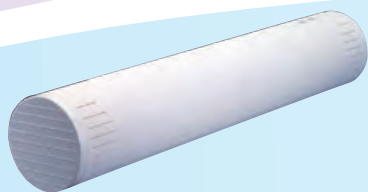
NAS® batteries

Product development and manufacturing that supports the stable supply of **energy** and the creation of a **sustainable society**.



## Separates gases

This molecular sieve can separate fluids and gases at the molecular level.



Subnano-ceramic membrane filter

## Measures concentrations

This is the world's first in-vehicle sensor that can measure NOx concentrations in real time with high precision.



NOx sensor

Product development and manufacturing that resolves **environmental** issues in a wide variety of fields, like automobiles, chemicals, medicine, food, and nuclear power, and contributes to a richer, safer and more secure society



## Allows light to pass

This transparent (99.9%) ceramic material is used in LED circuits.



HICERAM®



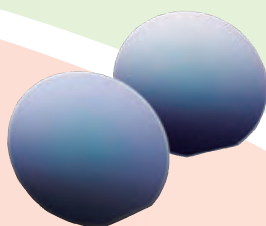
Wavelength control drying system

## Dries with light

This system reduces drying time by half and allows for significant energy conservation.

## Controls heat expansion

Adapted to next-generation LTE. Suppresses heat expansion to 1/3 or less than conventional products, and reduces noise. Also improves sound quality.



Bonded wafers for SAW filters

## Quickly cools

Cools and hardens resin in a short period of time, and contributes to improve production efficiency and quality.



High-cycle metal dies

Product development and manufacturing that contributes to the evolution of **IoT** and **AI**, and the advancement, miniaturization and weight reduction of electronic products.





## TOP COMMITMENT

President  
NGK INSULATORS, LTD.

大島 卓

TAKU OSHIMA



# Development for Sustainable Growth into the Future

## Develop our own strengths for further growth

Since its founding, the NGK Group has been consistently expanding its business engaging in manufacturing and supplying products which make good use of ceramics technology. We have built up high proprietary technologies, expertise and quality in ceramics development, which represent our unrivaled strengths. Application areas of our ceramics technologies range broadly from ceramic catalytic substrates for automotive exhaust gas purification and NOx sensors—key tools for meeting emission regulations that are being progressively tightened around the world—to ceramic components for semiconductor manufacturing equipment, for which demand is soaring driven by the accelerating advancement of the Artificial Intelligence (AI) and the Internet of Things (IoT) technologies.

In fiscal 2016, we recorded a year-on-year decline in net sales and profits due to a generally stronger yen and a considerable increase in facility and development investments. In our plan, those investments have been made to enhance our capabilities to develop and manufacture new products, which will increase net sales and profits in the long run.

In order to develop our strengths and to achieve further growth, we are promoting a number of group-wide initiatives in parallel, including the "New/reformed manufacturing structures" initiative designed to enhance our competitiveness over the medium to long term, and the "2017 Challenge 30\*" project aimed at raising the share of new products to 30% or more of total sales.

## Develop our personnel, a foundation for growth

I have consistently focused on personnel development and work style reform over the past three years since assuming the presidency, which are an essential foundation for

achieving sustainable growth in business. We have been striving to create a workplace where all employees, regardless of age, gender or career, can enjoy satisfying work, demonstrating their capabilities and cultivating forward-looking views. Our efforts have been recently stepped up to particularly address the theme of women's empowerment, that is, by developing appropriate systems and measures to offer an environment where many women can play an important role and build lifelong careers. We will develop a work environment where each employee can fulfill their potential and aim to be a company that continuously achieves sustainable growth.

## Develop a sustainable future

To pursue global business, the NGK Group has signed on to the United Nations Global Compact, an initiative to encourage businesses to adopt sustainable and socially responsible policies. Accordingly, we will work to undertake socially responsible actions to contribute to solving various global challenges in support of the UN Sustainable Development Goals (SDGs) and other international initiatives. It is also vital to comply with competition laws and other applicable laws and regulations and respect human rights. We in addition believe that it is important to follow internationally appropriate corporate behavior, including a fair attitude toward diverse values. Our business activities and the resolution of such social issues are integrated because the products we develop and supply are largely involving social infrastructure projects and environmental issues.

The NGK Group will be challenging by gathering our group strengths to manufacture and supply products that contribute to a better societal environment and create new value into the future.



\* The project will be renamed "Keep up 30," from fiscal 2018.



# Group-wide Endeavors Aimed at Sustainable Growth

**01** Boosting Competitiveness  
of Existing Businesses

**02** Creating New Products  
and Businesses

**03** Strengthening Global  
Business Management

**04** Promoting Personnel Development  
and Work Style Reform

## 01 Boosting Competitiveness of Existing Businesses

### New/Reformed Manufacturing Structures

The NGK Group works to increase product value based on advanced technologies and improve productivity through innovating manufacturing processes.

Looking at our business environment from a medium- to long-term perspective, we are implementing our New/Reformed Manufacturing Structures initiative, which was started in 2014, to build strong capabilities to continue competing successfully in global markets toward 2020 and beyond. The initiative focuses on improving operational efficiency for existing facilities and promoting prioritized investments for greater spending effect.

In the fields of energy, ecology and electronics, NGK's three major business domains, new social and technological needs are emerging, and this is expected to create new market opportunities. Seeking to capture these future opportunities, we plan to invest a total of 300 billion yen over the coming three years. Our plan includes construction of cutting-edge lines for auto-related products outside of Japan in order to respond to the growing demand on a global scale. Thus, we aim to develop solid production capabilities to continue business growth.

### Advanced Technologies

- Increase product value
- Improve productivity through innovating manufacturing processes

### New/Reformed Manufacturing Structures

- Improve operational efficiency for existing facilities
- Increase effectiveness of new investments

### Enhancing Global Production Structures

- Build cutting-edge production lines outside of Japan
- Establish an efficient global production structure

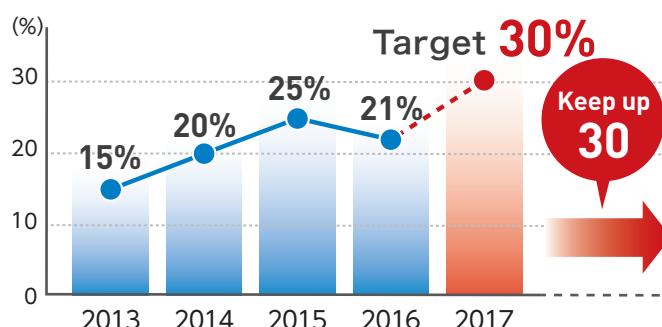


## 02 Creating New Products and Businesses

### 2017 Challenge 30

The NGK Group works to create new products and business. We set a target of raising the share of new products to 30% or more of total sales by fiscal 2017 (2017 Challenge 30), and have progressed steadily to achieve the target in fiscal 2017. From fiscal 2018, we will continue with these efforts to achieve a revised target of maintaining the share of new products at 30% or above (Keep up 30).

Sales percentage for new products  
Target expected to be achieved in FY 2017



### Accelerating Business Development for New Products

To accelerate business development for new products, we organize cross-divisional activities. Our two ongoing projects relate to ceramic batteries and ceramic optical components, and were launched in fiscal 2016 and 2017, respectively. In both, Corporate Manufacturing Engineering,

Corporate R&D, the relevant business division and the head office are working together to engage in the development of commercial products, mass production facilities and potential customers, seeking to expedite the commercialization of target new products.

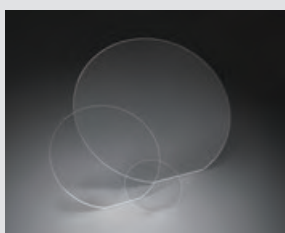
### The Optical Component Project

The company-wide, cross-divisional Optical Component Project was launched in April 2017, with a plan to establish a relevant business within the Electronics Business Group.

#### Gallium nitride (GaN) wafer

##### Features

Created with proprietary liquid phase epitaxial growth technology, our GaN wafer has achieved low defect density over the entire wafer surface. GaN wafer-based substrates can deliver ultra high brightness for lasers and LEDs.



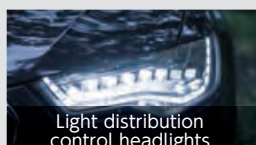
##### Major applications



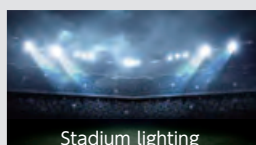
Office projectors



Cinemascope projectors



Light distribution control headlights



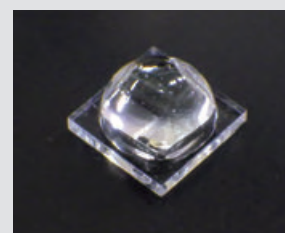
Stadium lighting

Ultra high brightness lasers and LEDs are expected to be employed for projectors, stadium lighting and other purposes that require higher light intensity than can be provided by conventional models.

#### Micro-lens for UV LED lights

##### Features

For the purpose of increasing the use efficiency of ultraviolet (UV) LED lighting, a high-quality complex-shape fused quartz micro-lens has been created by employing our proprietary manufacturing technologies.

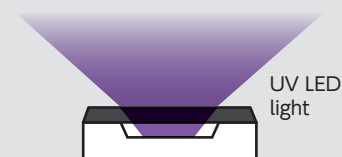
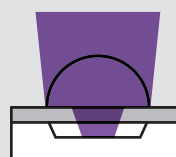


##### Major applications

Micro-lens mounted on a UV LED light (for sterilization)

[With micro-lens]  
UV LED light can condense light to demonstrate stronger sterilization power.

[Without micro-lens]  
UV LED light is distributed widely, resulting in lower sterilization efficacy.



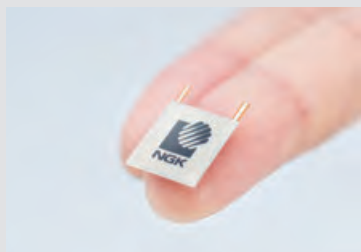
UV LED light

Currently, mercury-vapor lamps are the most popular light source for the purposes of resin cure, sterilization and purification. However, the use of mercury will be restricted from 2020, as stipulated in the Minamata Convention on Mercury. UV LED is expected to be a major alternative light source.

## The Ceramic Battery Project

The Ceramic Battery Project was launched in April 2016, bringing together members from Corporate Manufacturing Engineering, Corporate R&D, the relevant business division and the head office to engage in commercialization-related activities aimed at earlier market introduction.

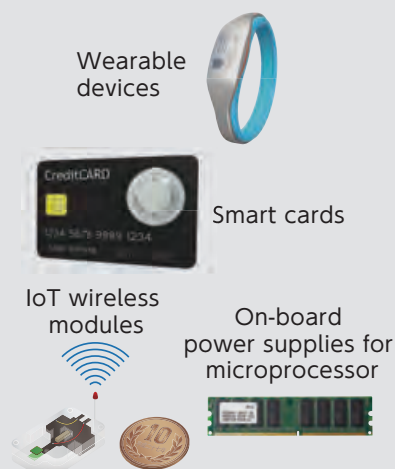
### Chip-type ceramic secondary battery



#### Features

- Crystallographically-oriented ceramic positive electrode plate (Basic patented)
- Super-thin chip, high energy density, high temperature durability

#### Major applications



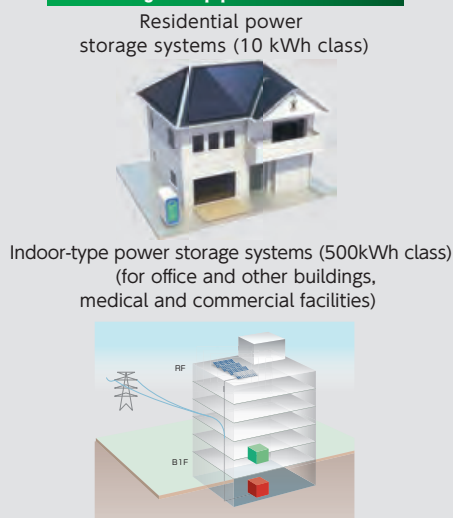
### Zinc secondary battery



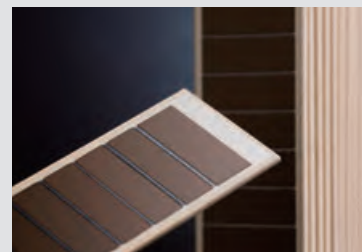
#### Features

- Proprietary ceramic separators of solid electrolyte (new material)
- Water-based electrolyte (high safety), high-capacity, room-temperature functionality

#### Major applications



### Solid oxide fuel cell (SOFC) module



#### Features

- Proprietary structure and materials (ceramics)
- Compact, high power generation efficiency, high durability

#### Major applications

Fuel cell systems for individual and collective housing (each unit)



## Strengthening Marketing and Prototype-related Functions

In order to develop new products and businesses in effective response to market needs, we are strengthening marketing and prototype-related functions. In fiscal 2016, customer contact opportunities were increased to achieve substantial information exchange. Also, we organized collaborative activities involving NGK's head office and business divisions and Group companies throughout the year.

### Creating a constant stream of new products

- Conduct research activities to accurately grasp market needs
- Strengthen proposal-making capabilities





## 03 Strengthening Global Business Management

### Thorough Compliance

We have introduced international-standard competition law compliance programs to establish a group-wide system for thorough compliance. Under the system, various initiatives are conducted to raise the awareness of officers and employees at all Group companies in and outside of Japan, including regular messages from management leaders and the creation of the Competition Law Compliance Handbook in multiple languages based on local legislation.

#### Providing compliance training at all Group companies in and outside of Japan

- Introduce international-standard competition law compliance programs



### Enhancing Head Office Capabilities

To accelerate global business development, the head office is required to perform highly specialist and strategic functions to assist business divisions, thereby underpinning the growth of the entire Group. To build head office capabilities to buttress a global enterprise, we will hold rigorous discussions

and focus efforts on selected themes, such as global personnel development and deployment and actions to reduce increasing legal risks. Also, we are carrying out measures to eliminate operational waste and allow employees to focus on truly important tasks.



- Improve specialist functions
- Enhance capabilities to flexibly respond to changes

#### Enhancing head office functions to support global business development

- ✓ Support safety and health activities at Group companies in and outside of Japan
- ✓ Support technological development through promoting thorough improvement of IP research and analysis systems
- ✓ Support CSR-compliant procurement at Group companies in and outside of Japan
- ✓ Support compliance promotion activities at Group companies in and outside of Japan

## 04 Promoting Personnel Development and Work Style Reform

### Personnel System Reform

To continually pursue global expansion and the creation of new products and businesses, it is essential to raise employee motivation and provide a workplace where each employee can fulfill their potential. Based on this belief, we have reformed personnel systems. Key reforms include lifting the mandatory retirement age up to 65 from the current 60, with the salary level unchanged, to offer senior personnel opportunities to work for longer and with a sense of security.

#### Younger/Mid-career personnel

Encouraged to aim at a higher job grade/position



#### Senior personnel

Can choose to work longer with a sense of security up to the retirement age of 65



#### Enhancing employment systems and women's career activities



MHLW's Eruboshi certification obtained for promoting women's career activities

# Develop Next-generation about Innovative Change to Our



## SPECIAL TALK

President, NGK Insulators, Ltd.

**Taku Oshima**

| Profile |

Joined NGK in 1980; General Manager of NAS Battery Division, Power Business Group (2004); Vice President and General Manager of NAS Battery Division, Power Business Group (2007); Senior Vice President, General Manager of NAS Battery Division, Power Business Group (2011); President of NGK (2014).

Professor at College of Business,  
Rikkyo University

**Mika Takaoka**

| Profile |

PhD in business administration. Field of study: retail business management; franchise systems; sustainable communication and consumer behavior. Membership: Ministry of Economy, Trade and Industry Industrial Structure Council Global Environment Subcommittee Evaluation/Verification WG (low-carbon society action plan follow-up), etc.



# Products that can Bring Future Society and Environment



## NGK's strengths to support its sustainable growth

**Takaoka:** NGK Insulators started as an insulator manufacturer, and from that foundation it has developed business in various areas over many years. In what areas have you been achieving notable growth recently?

**Oshima:** Our business is particularly growing in two key areas. One is associated with automotive exhaust system. We produce exhaust gas purification parts which are our main products with a global market share of around 50% and

NOx sensors for automobiles. The total number of vehicles sold globally in one year has reached around 90 million, and the number is growing at an annual rate of 3 to 4%. The market for zero-emissions cars, such as electric vehicles, has been expanding in recent years, but automobiles equipping internal combustion engines, including buses and trucks, still dominate the automotive market by a wide margin. Against this background, emission regulations are becoming more stringent around the world, pushing up the demand for exhaust gas purification parts and NOx sensors.

**Takaoka:** That indicates the grave responsibility your company bears as a supplier. In order to achieve mass-production on a large scale, what is your situation of





## Seeking to meet this future demand, we are promoting R&D further.

investments in facilities and R&D?

**Oshima:** We are carrying out intensive investments in growth areas, including building new factories in Poland and Thailand. We plan to invest a total of 300 billion yen for all segments over the three years from fiscal 2017. Out of that total amount, 170 billion yen will be spent on automotive-related business. At the same time, we are vigorously increasing investment in the semiconductor-related business, another key growth area, to boost facility and R&D capabilities.

**Takaoka:** The semiconductor market has been expanding to meet soaring demand related to needs for larger-capacity and higher-speed mobile communications and increasingly popularized IoT applications. The market is expected to further grow in response to rising requirements from endeavors to accelerate technological innovation in AI and other frontier realms of social infrastructure.

**Oshima:** NGK plays a part in supporting the rapid progress of the pioneering technologies by supplying essential functional ceramic components of semiconductor manufacturing equipment. There are only a few ceramics companies in the world capable of manufacturing equivalent products.

**Takaoka:** How has NGK acquired those specialty capabilities? Having such multiple specialty technologies and products that enable you to maintain advantages against others gives you a great strength.

**Oshima:** That is our unique value originated with an insulator manufacturer. Insulators are a very long-lived product. To ensure the effective use of our products over decades, we have been persistently striving to achieve ever-higher quality, and developed unrivalled technologies. Also, we began in our early days to pursue business diversification. We have invested our earnings in R&D, seeking to build future growth pillars. We have continued this approach to expand the company.

## Capture future needs and develop technologies

**Takaoka:** To plan successful R&D projects, it is vitally important to carefully read the future to correctly forecast social needs. NGK's successful diversification has proven its insight into future needs.

**Oshima:** The success we have had in the NOx sensors, one of our recently established mainstays, is the result of research efforts continued over two decades. Many years of assiduous works enabled us to supply them timely when the society needs.

**Takaoka:** Within your marketed lineup, I view NAS batteries as having huge growth potential, given the fact that currently very few enterprises commercialize large storage battery systems.

**Oshima:** Global efforts are being exerted to achieve a low-carbon society, where a major power source will be renewable energy. Under such circumstances, a large battery system is indispensable to achieve the stabilization of renewable energy. Seeking to meet this future demand, we are promoting R&D further.

## Development of human resources and work environment to achieve further growth

**Takaoka:** What are your views and actions regarding human resource development?

**Oshima:** Development of human resources and work environment has been an important management theme since I became president. I believe that the key to accomplishing the theme is the self-initiative of individual employees. I wish to create a workplace where each employee is inspired to take up a challenge at their own initiative. I'm wondering all the time what I should do to encourage their initiative or to boost their motivation. Toward

this goal, I took the first step by touring the Group companies and manufacturing sites in Japan and overseas and every division within the company to take a firsthand look at each site in operation.

**Takaoka:** What did you find from this field research?

**Oshima:** Every factory I visited was running at its fullest-ever capacity to continue increasing production, keeping workers extremely busy. I saw this situation as needing immediate improvement so that they can effectively demonstrate their potential to perform truly important tasks. To this end, it is necessary to review each work process and practice to thoroughly eliminate waste. To carry out this task across the company, I have launched the E3 (E-Cubed) activity\*. Since work style reforms require a top-down management approach in part, it has been introduced at each division under the leadership of the division head, who has established organizational policies and announced them to division members.

**Takaoka:** The top commitment can facilitate improvement of frontline operations. Then, the more operational efficiency will increase, the more employee motivation will rise. This is becoming increasingly important as businesses in many industries need to take steps to increase employee satisfaction to address the emerging challenge of a labor shortage.

**Oshima:** To be able to attract and retain quality talent that will continue to contribute to the company over the long term, we have reformed a range of personnel systems, effective from this year. Major reforms include the revision of systems for general employees to encourage mid-career or younger personnel to undertake challenging tasks, and lifting the mandatory retirement age up to 65 to offer senior personnel opportunities to work for longer and with a sense of security. The revised systems also include measures directed at women's career enhancement.

**Takaoka:** The gender equality issue is particularly specific to the manufacturing sector, where rates of female workers and managers are relatively low.

**Oshima:** Contrary to the industry trend, at NGK, the average duration of service of female employees is longer than that of males. This is partly attributable to our systems that have been enhanced to support work-life balance. However, we are behind in terms of employing female managers. To overcome this shortcoming, we have begun to implement initiatives to spur the development of future female managers.

## Aim to attain further growth with bringing together all NGK forces around the world

**Takaoka:** The NGK Group has a sizable workforce employed globally to pursue global business.



## NGK's successful diversification has proven its insight into future needs.

**Oshima:** Our Group currently employs a total of more than 20,000 people, and more than half of them are working outside Japan. It is very important that we uphold a shared vision to unite as one for advancing our business. In two years, NGK will celebrate the centennial of its founding and prior to this major milestone, we have begun to consider revising the corporate philosophy.

**Takaoka:** I am interested in the new philosophy to be announced in the near future while also looking forward to the rollout of new products that can bring about an innovative change in our future society and environment.

**Oshima:** NGK's products are indispensable parts of many products related to electricity, vehicles, communications and other forms of social infrastructure that supports modern lifestyles. We will step up our efforts across the Group to continue manufacturing and supplying quality products to contribute to a better society and environment.

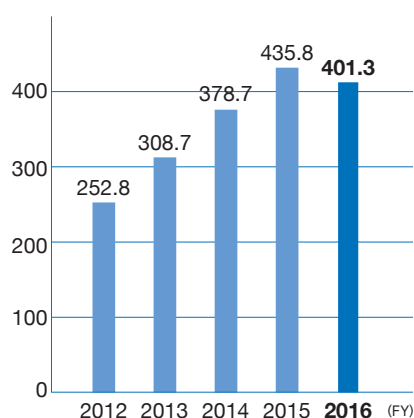
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\* E3 (E-Cubed) activity  
Pursuing our Essence  
Eliminating Waste  
Increasing Efficiency

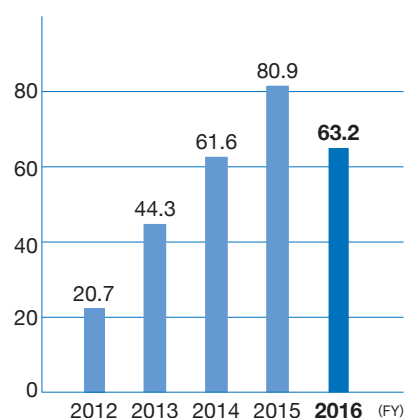
## Financial Highlights

The following data includes financial results of consolidated subsidiaries  
(21 domestic, 37 overseas companies as of March 31, 2017)

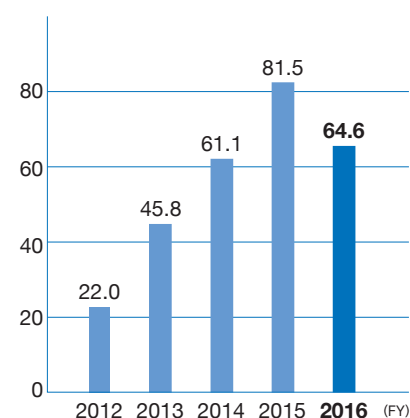
**Net Sales** (Billions of yen)



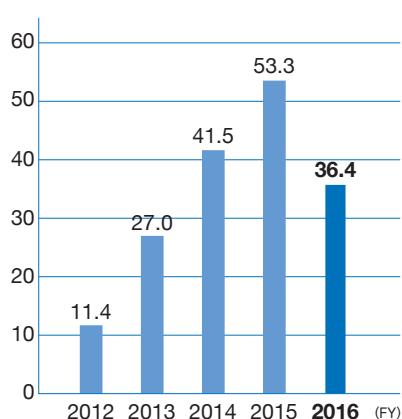
**Operating Income** (Billions of yen)



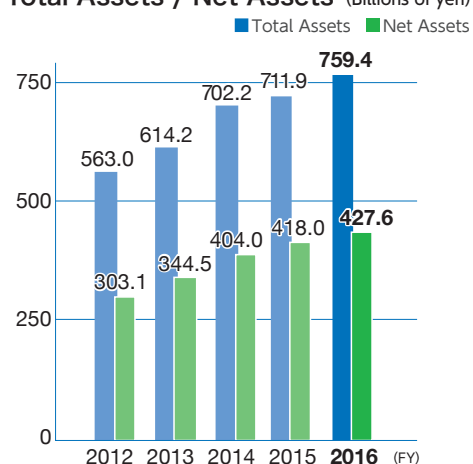
**Ordinary Income** (Billions of yen)



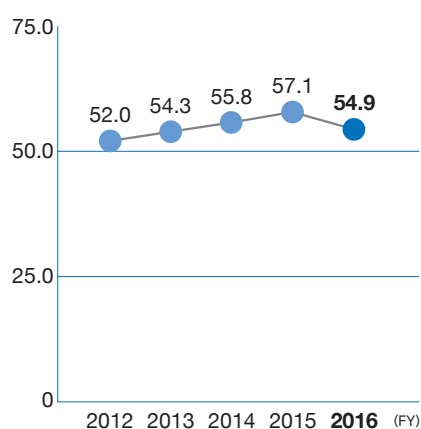
**Net Income** (Billions of yen)



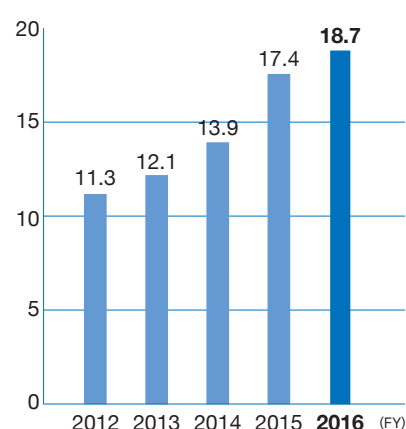
**Total Assets / Net Assets** (Billions of yen)



**Equity Ratio (%)**

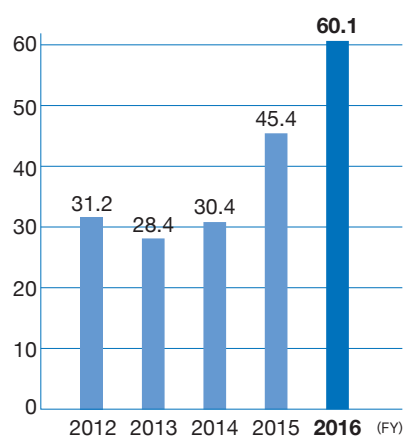


**Research and Development Expenses** (Billions of yen)

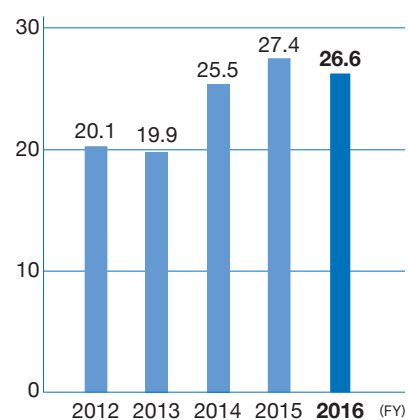




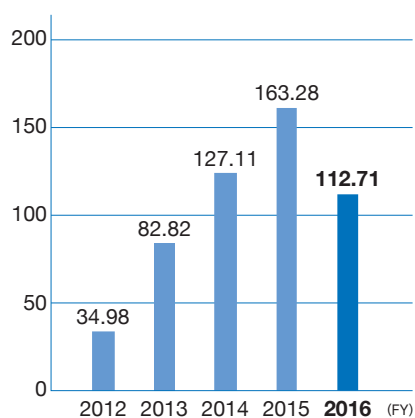
### Capital Expenditures (Billions of yen)



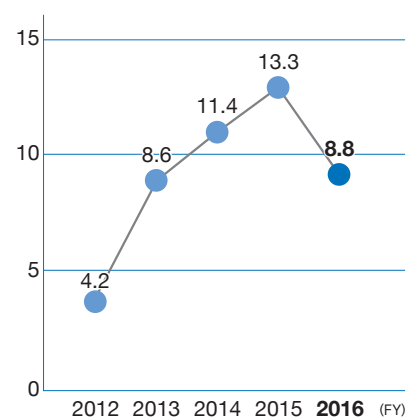
### Depreciation and Amortization (Billions of yen)



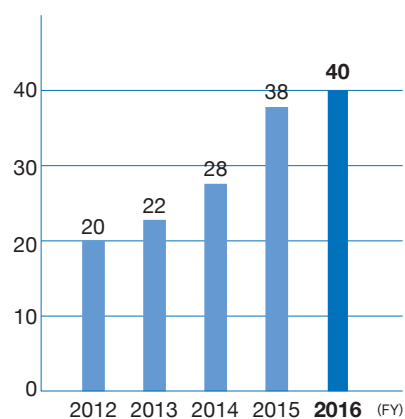
### Net Income per Share (Yen)



### Return on Equity (%)



### Dividends (Yen)



### Stock Price

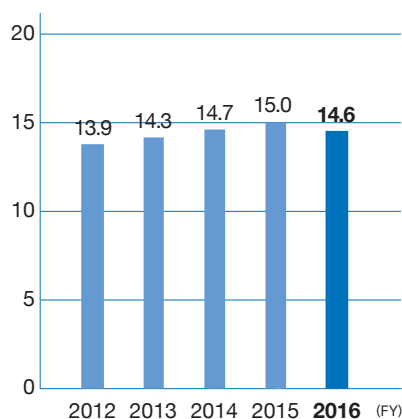
FY	2012	2013	2014	2015	2016
Highest(Yen)	1,181	2,230	2,827	3,345	<b>2,578</b>
Lowest(Yen)	752	946	1,864	1,904	<b>1,800</b>

# Non-Financial Highlights

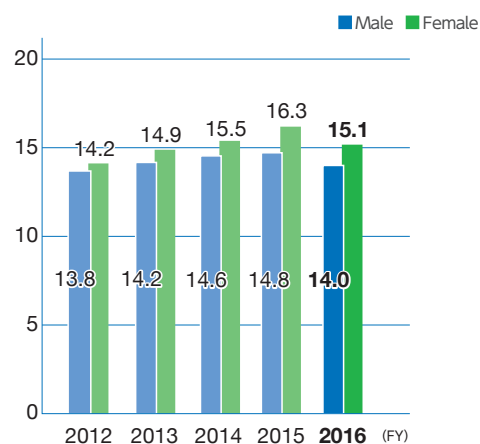
The following data includes non-financial results of consolidated subsidiaries (21 domestic and 37 overseas companies as of March 31, 2017)

## Human Capital

Average Years of Service (overall)

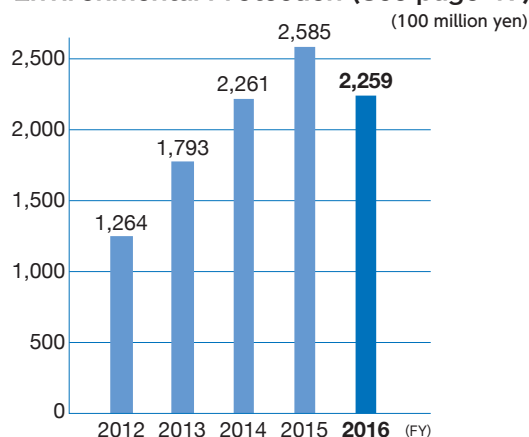


Average Years of Service (by gender)



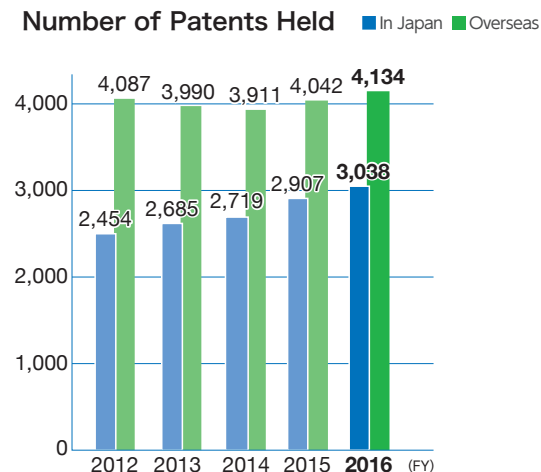
## Environmental Capital

Total Sales for Products Contributing to Environmental Protection (See page 47)



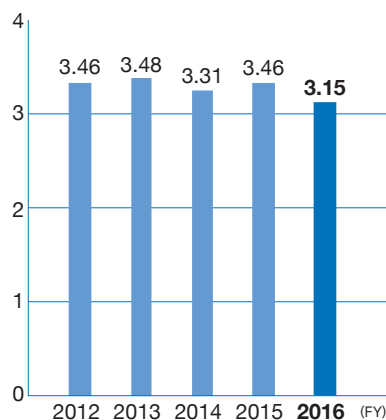
## Intellectual Capital

Number of Patents Held



## Social Relations Capital

Social Contribution Spending (100 million yen)



## Summary of Consolidated Financial Results for Five Fiscal Years

Operating results (fiscal year)	Mar. 2013	Mar. 2014	Mar. 2015	Mar. 2016	Mar. 2017 Millions of yen	Mar. 2017 1,000 USD
Net sales	252,789	308,671	378,665	435,798	401,267	3,582,741
Cost of sales	178,052	208,052	254,387	289,266	272,435	2,432,455
Selling, general and administrative expenses	54,041	56,367	62,701	65,634	65,619	585,884
Operating income	20,696	44,252	61,577	80,898	63,213	564,402
Profit attributable to owners of parent	11,422	27,045	41,505	53,316	36,379	324,813
Capital expenditures	31,216	28,435	30,366	45,437	60,101	536,616
Depreciation and amortization	20,089	19,894	25,532	27,366	26,615	237,634
Research and development expenses	11,316	12,060	13,943	17,410	18,654	166,554
<b>Cash flows</b>						
Cash flows from operating activities	3,680	32,648	73,002	59,445	80,172	715,821
Cash flows from investing activities	(582)	(21,185)	(39,497)	(47,773)	(56,453)	(504,045)
Cash flows from financing activities	12,448	2,027	(26,000)	(373)	(13,013)	(116,188)
Cash and cash equivalents	102,845	119,782	128,617	136,065	144,693	1,291,902
<b>Financial position (end of fiscal year)</b>						
Total assets	563,030	614,220	702,234	711,897	759,434	6,780,661
Interest-bearing debt	155,816	167,296	156,203	163,973	174,150	1,554,911
Net assets	303,073	344,453	404,001	417,973	427,593	3,817,795
<b>Per share information</b>						
Profit per share	34.98	82.82	127.11	163.28	112.71 yen	1.006 USD
Cash dividends per share	20	22	28	38	40	0.357
<b>Financial indicators (%)</b>						
Operating margin	8.2%	14.3%	16.3%	18.6%	15.8%	15.8%
Return on equity (ROE)	4.2%	8.6%	11.4%	13.3%	8.8%	8.8%
Equity ratio	52.0%	54.3%	55.8%	57.1%	54.9%	54.9%



# Power Business

## Promoting Sustainable Energy by Staying ahead of Trends to Consistently Offer Products and Services that Exceed Customer Expectations

The Power Business Group offers products and services aimed at the support and development of electricity infrastructure around the world.

Needs for large-capacity storage batteries that help stabilize power supply have increased with the expansion of renewable energy.

We have further strengthened our business structure for insulators from customer's perspective in order to provide optimal products and services that meet customer demands in a prompt, accurate and flexible manner.

With the aim of becoming our customers' brand of choice, the NGK Group will continue to promote businesses that will contribute to the development of power infrastructure as well as the spread and expansion of renewable energy.



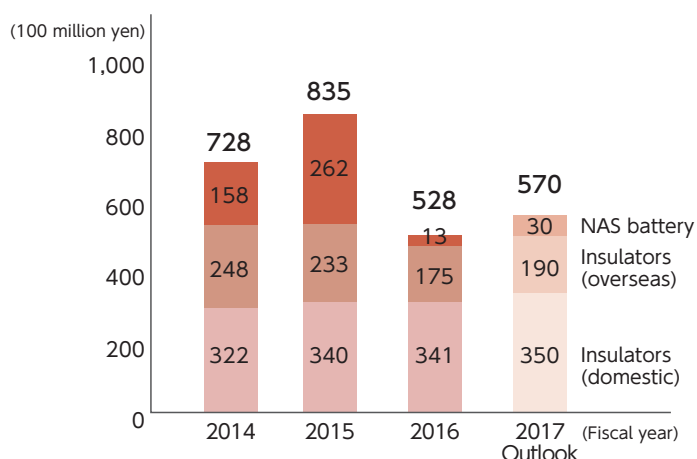
**Hideaki Saito**

Director and Senior  
Vice President  
Group Executive,  
Power Business Group

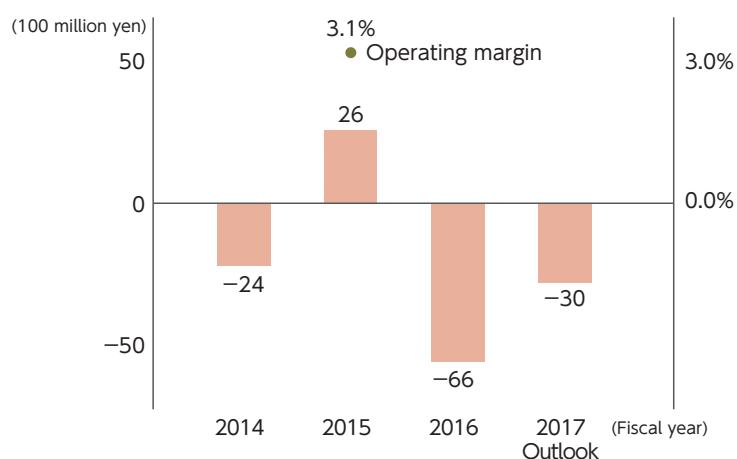
## Financial Data

### Financial results and outlook

#### Net Sales (After elimination of intersegment sales)



#### Operating Income (Loss)



# Products

## Main products

### Insulators

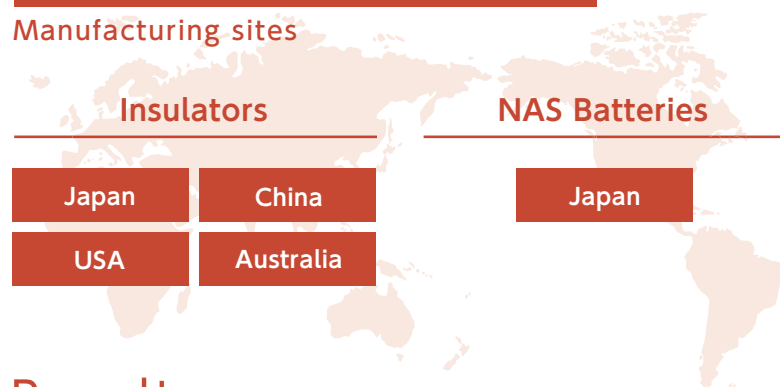
Insulators are the NGK Group's founding products made by ceramics. It helps maintaining staple power supply and ensures that transmission lines and steel towers are completely isolated. As a top insulator manufacturer, NGK manufactures and provides high-quality and highly reliable insulators and equipment for power transmission, substations and distribution.

### NAS Batteries

NAS® battery systems has strengths for Large-capacity, high-energy density and long-life which ensure a stable power supply over the long term. NAS® battery systems also contribute to peak power reduction by leveling out the power load, help stabilize renewable energy, act as countermeasures against surplus power, and facilitate power savings and cost cutting.

## Product Sites

### Manufacturing sites



## Results

### Business overview for fiscal 2016

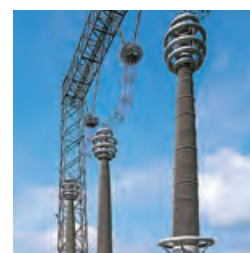
### Steady Progress in Promising Projects that will Lead to Future Growth

Net sales and operating income for both the insulators business and the NAS battery business fell below the forecasts made at the beginning of the fiscal year. In the insulators business, sales decreased due to sluggish replacement demand in North America. In the NAS battery business, sales declined mainly because there were no major shipments for both Japan and overseas.

Meanwhile, there has been steady progress in promising projects that will lead to future growth both for the insulators business and the NAS battery business. In Japan, replacement demand for insulators installed during the period of high economic growth has been strong, and such demand is expected to grow in the future. In overseas, while large-scale projects have been at a standstill due to the effects of economic slowdown and a decline in the price of crude oil, there is a demand of developing power grid system to solve the transmission networks against the backdrop of power shortages in emerging markets in the Middle East, China and Southeast Asia. As for NAS batteries, a large-scale hybrid battery system demonstration project was launched in Germany, which has been actively introducing renewable energy. Conditions for the widespread use of NAS battery systems are emerging since discussions on installing electric power storage batteries have commenced in Japan toward the expansion of renewable energy.



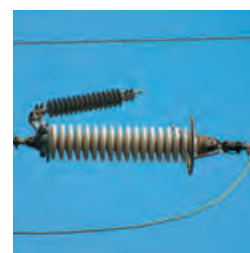
**Insulators for power transmission** which are indispensable for supplying power in a safe and stable manner



**Insulators and equipment for power substations**, the world's largest hollow insulators for substation system which resist up to 1,000kV-power transmission system (megavolt class)



**Polymer insulators for power transmission** which meet customer needs with a broad range of products including those made of porcelain



**Equipment for power transmission** such as line arresters that significantly contribute to reducing power outages



**Equipment for power distribution** that contributes to the maintenance and efficiency of power supply equipment



**NAS battery** which is the first megawatt-class electric energy storage system being utilized in the world

### Summary of Fiscal 2016

**Net sales** 52.8 billion yen  
(30.7 billion yen decrease from the previous year)

**Operating income (Loss)** (6.6) billion yen  
(9.2 billion yen decrease from the previous year)

#### Insulators

**Net sales** 51.6 billion yen  
(5.7 billion yen decrease from the previous year)  
 ■ Japan: Steady replacement demand  
 ■ Overseas: Decreased due to the postponement of large-scale projects, etc. (Asia, Middle East, etc.)

#### NAS batteries

**Net sales** 1.3 billion yen  
(24.9 billion yen decrease from the previous year)  
 ■ Decreased due to no major shipments for both Japan and overseas.

## Present Action

### Challenges and initiatives for fiscal 2017

#### [Insulators]

#### Enhancing Competitiveness and Establishing a Lean Business Structure

In the insulators business, we will continue to respond to strong replacement demand in Japan while strengthening the competitiveness of our products, approaching quality improvement and offering products and services that gain even higher levels of customer trust.

In order to respond to changes in the market conditions and demand swiftly, we will establish a lean business structure by streamlining production lines at plants, reorganizing and integrating business operations, thereby improving profits.

Furthermore, we will promote the procurement and sales of OEM\* products and enhance our market presence, especially in the North American market, with the aim of responding to market calls for a broader product lineup.

#### [NAS Batteries]

#### Aggressively Developing Overseas Markets with the Aim of Generating Demand

While the environment surrounding the NAS battery business is likely to remain extremely challenging for the foreseeable future, the potential needs are high.

For example, we aim to capture the orders in Hokkaido where the discussions are on-going about installing storage battery system to stabilize the power system to help the expansion of wind power generation. Looking at overseas, especially Europe where the expansion of renewable energy is particularly prominent, there is a movement to utilize storage batteries for demand management. Also in the Middle East, the plans have been coming up which introduce solar power systems to replace thermal power generation.

Our extensive experience and track record in the installation of NAS batteries are significant advantages for approaching to such various needs above. As one another example, we have just announced that NGK will provide its NAS batteries for the large-scale hybrid battery system demonstration project to be conducted in Germany from April 2017. By actively leveraging these kinds of opportunities, we will endeavor to further enhance recognition of NAS battery systems and expand their applications.

### Outlook for Fiscal 2017

**Net sales** 57.0 billion yen  
(4.2 billion yen increase from the previous year)

**Operating income (Loss)** (3.0) billion yen  
(3.6 billion yen increase from the previous year)

#### Insulators

**Net sales** 54.0 billion yen  
(2.4 billion yen increase from the previous year)

■ Japan: Replacement demand remained steady

■ China: Long-distance, large-scale power transmission projects increased

■ North America, South Asia, Middle East: Large-scale projects remained stagnant due to the effects of economic downturn, decline in crude oil price, etc.

#### NAS batteries

**Net sales** 3.0 billion yen  
(1.7 billion yen increase from the previous year)

■ Japan: While detailed studies of storage batteries for power systems are underway in Hokkaido, full-fledged adoption will take time.

■ Overseas: A large-scale hybrid battery system demonstration project was launched in Germany, which has been actively introducing renewable energy.

\* OEM is an abbreviation for "original equipment manufacturing," which refers to the manufacture of products to be sold under the brand of the entrusting firm (entrustment of manufacturing using the NGK brand).

### Topics1

#### Contributing to Enhancing Safety and Reliability of Power Distribution Networks Expansion into Myanmar, Asia's Last Frontier

Myanmar has been maintaining a high rate of economic growth, the highest level in Asia, in fact. Following the 2011 shift in power away from military rule, the modernization of the country's infrastructure such as roads, railways, electricity, etc. has progressed.

While the Myanmar government has a national policy to improve its electrification rate from 30% in 2014 to 100% by 2030, the existing power distribution networks that cover the nation are made up of bare power cables and exposed cut-outs, which are susceptible to electric shock hazards and blackouts.

Given such situation, the NGK Group established a local entity in August 2016 by initiating the standardization of sealed cut-outs without exposure in the charger. We have since been providing instructions on manufacturing technologies and quality management to local alliance partners. It is our aim to enhance the safety and reliability of power distribution networks through the isolation of power cables, thus contributing to realizing a better standard of living and economic growth for people in Myanmar.

#### Cut-outs

There is a fuse inside the cut-out, which stops the flow of current when an overcurrent is detected safely and promptly due to an accident involving the power distribution line, etc., thereby protecting power distribution equipment. Cut-outs manufactured by Energy Support Corporation being used by all electric companies and boast significant market share across Japan for their high reliability.



Conclusion of business alliance between Energy Support Corporation and a local company



# Next Vision

## Future outlook and initiatives

### [[Insulators]

#### Establishing Sustainable Business Structure and Enhancing Brand Value

In the insulators business, we will endeavor to establish a business structure that can deliver high profitability. Replacement demand is expected to expand in the future since the aging of power equipment both in Japan and the U.S. NGK's products have been highly recognized for their track records and quality and what we must focus on now is establishing a lean production system and a sustainable business structure. In addition, we will aim to further strengthen our systems from the customers' perspective in order to provide even more optimal products and services in a prompt, accurate and flexible manner.

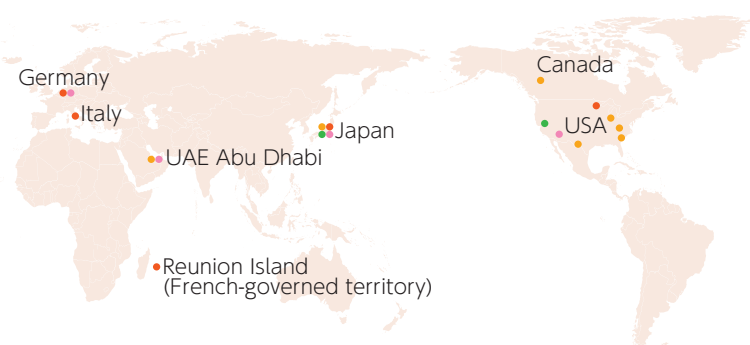
### [[NAS Batteries]

#### Capturing Demand by Taking Advantage of Global Expansion of Renewable Energy

In the NAS battery business, we will strive to grow business in line with the global expansion of renewable energy by leveraging our strengths in large capacity, compact size and superior cost performance as the large capacity storage battery. It is expected that renewable energy will be fully introduced as energy infrastructure around the period between 2020 and 2025. Since NAS® battery systems have high demand potential, we will actively engage in demonstration experiments in various countries and regions in the next few years and prepare for an increase in demand in the future. By doing so, we will be possible to offer more practical solutions by accumulating insights and building up a track record as

## Track record of NAS battery installation

Approximately 200 locations worldwide, with power output amounting to approximately 530,000 kWh and storage capacity of 3,700,000 kWh



#### Applications of NAS batteries

- Peak reduction shift
- Power system measures, built with renewable energy
- Frequency adjustment
- Smart grid

there are significant background differences in reasons for introduction and use environment for storage batteries, depending on the customers. In addition, we are striving to establish operations related to remote monitoring systems after installing and also the after-sales services expected to cause as customers' needs. As a leading company of large-capacity storage batteries, NGK has been preceding its competitors in terms of both track record and performance. Looking ahead to the large-capacity storage battery market to emerge in three to four years' time, we will promote our sales activities and demonstration projects in overseas markets which leads us to be a top brand that is chosen by customers.

## Topics2

### Demonstration Project Commenced in Germany, Environmentally Advanced Country

#### NGK Offers NAS Battery Systems for Three Years from April 2017

The NGK Group has been endeavoring to be a highly proven and known brand for NAS batteries in the European market especially in Germany. Germany is an advanced country actively introducing renewable energy and in the meanwhile, they are facing imbalances and grid voltage instability due to the vulnerable power transmission network while a large amount of power generated in the northern region is sent to south, the consumption area.

To address these problems, Japan's New Energy and Industrial Technology Development Organization (NEDO\*) has worked for the commencement of the "Large-Scale Hybrid Battery System Demonstration Project" with the Ministry for Economics, Labour and Transport of Niedersachsen, where is the region in

Signing ceremony held in March 2017. Germany aims to shift more than 80% of its domestic electric power demand to renewable energy by 2050.



Germany that produces wind power the most. They signed a memorandum of understanding in March 2017. At the same time, one Japanese power company, NGK Insulators, Ltd a company commissioned by NEDO, and the energy provider in Germany have agreed to collaborate the project and concluded an implementation document. Our aim by introducing NAS batteries is to stabilize the distribution grid, and thereby control the electric power supply and demand balance. Another aim is to establish a new business model for electricity trading using the battery system.

# Ceramic Products Business

## Developing Products and Technologies that Contribute to Solving Environmental Issues, Including Automobile Exhaust Gases, and Responding to Energy-saving Needs

The Ceramic Products Business Group offers a line-up of ceramic products, led by ceramic substrates for automotive exhaust gas purifiers, that serves a broad range of industries and provides smart solutions for modern requirements such as environment protection and energy conservation.

It is one of our social responsibilities to ensure a stable supply of high-quality products and to continue to offer products that correspond to new environmental regulations in a timely manner.

We will deliver products that will meet social needs to international markets through our global production system comprising 18 plants located in nine countries.



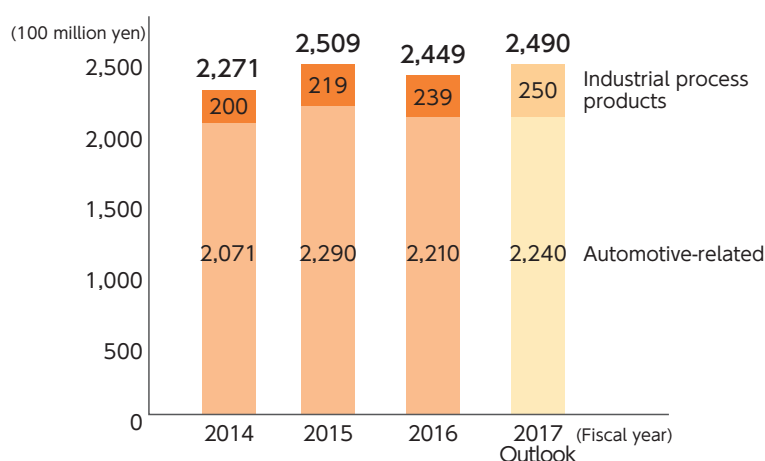
**Hiroshi Kanie**

Director and Senior Vice President  
Group Executive, Ceramic Products Business Group

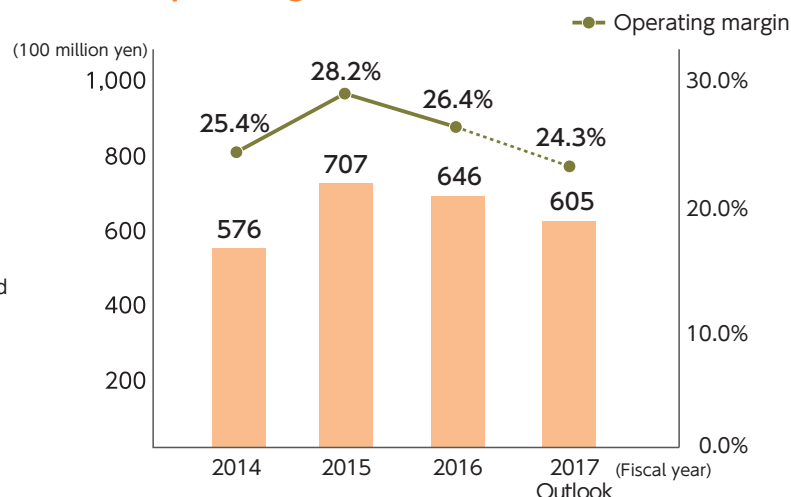
## Financial Data

### Financial results and outlook

#### Net Sales (After elimination of intersegment sales)



#### Operating Income

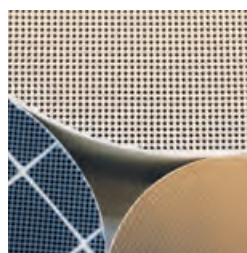


# Products

## Main products

### Automotive-related

Our business is focused on HONEYCERAM® ceramic substrates for automotive catalytic converters used to purify exhaust gases, diesel particulate filters (DPF) and gasoline particulate filters (GPFs) that eliminate particulate matter (PM), and NOx sensors used to measure concentrations of nitrogen oxides (NOx).



**HONEYCERAM**, which holds the world's top share DPFs that eliminate up to 99% of PM



The world's first **in-vehicle high-accuracy NOx sensors** that can measure NOx concentrations in real time with high precision

### Industrial Process Products

We offer a line-up of ceramic products, including heating devices, kilns, refractories, ceramic membranes, separators, corrosion-resistant equipment and low-level radioactive waste treatment systems, that serves a broad range of industries and provides smart solutions for modern requirements such as environment protection and energy conservation.



C1 Home-use water purifier



**Heating devices and refractories** using firing technologies gained through manufacturing of ceramic products



**Low-level radioactive waste treatment systems** that have been adopted by nuclear power facilities around Japan and contribute to reducing waste

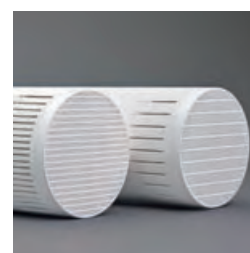
## Product Sites

### Manufacturing sites

Automotive-related			Industrial Process Products	
Japan	Poland	Indonesia	Japan	
USA	China	South Africa	China	
Mexico	Belgium	Thailand	Thailand	
			Production to commence in 2018	



**Corrosion-resistant equipment and systems** including pumps, valves and glass linings with strong corrosion resistance



**Ceramic membranes and separators** used for purification and filtration of pharmaceutical products and food and treatment of wastewater and exhaust gas in chemical and electronics plants

## Results

### Business overview for fiscal 2016

### Profits Improved Backed by Demand Growth and Business Restructuring

While sales and profits decreased from the previous year due to the effect of yen appreciation, production output saw an increase on a year-on-year basis as demand in the automobile market remained brisk globally. The automotive-related business posted net sales and profits exceeding our initial forecasts as the needs for NGK products continued to rise due to favorable factors including tighter automobile exhaust gas regulations around the world and an increase in sales of small-sized passenger vehicles and trucks in China. In the industrial process products business, we saw an increase in demand, mainly in China, for heating devices for cathode materials used in lithium-ion batteries of electric vehicles. In addition, new projects and maintenance demand related to nuclear power facilities have been increasing gradually. Moreover, as a result of our ongoing efforts for business restructuring of kiln and refractory products, profitability continued to improve.

### Summary of Fiscal 2016

**Net sales** 244.9 billion yen  
(6.0 billion yen decrease from the previous year)

**Operating income** 64.6 billion yen  
(6.1 billion yen decrease from the previous year)

#### Automotive-related

**Net sales** 221.0 billion yen  
(8.0 billion yen decrease from the previous year)

- Volume of automotive ceramics increased due to strong sales of passenger vehicles in the Chinese and European markets as well as trucks in the Chinese market.
- Net sales decreased as a result of yen appreciation while profits decreased reflecting increases in development costs and capital investment.

#### Industrial process products

**Net sales** 23.9 billion yen  
(2.0 billion yen increase from the previous year)

- Sales of heating devices for cathode materials used in lithium-ion batteries remained strong in Japan and China.
- Increase in new projects and repairs of nuclear power facilities, and the market conditions remained strong in key industries including the electronics, steel and chemical industries.



## Present Action

### Challenges and initiatives for fiscal 2017

Profits are expected to continue to decrease as in fiscal 2016 against the backdrop of prolonged yen appreciation, capital investment toward boosting supply capacity and active investment in new product development and human resources development, among other efforts. We have been pushing forward with the establishment of additional production lines and the launch of new plants around the world in an effort to further strengthen supply capability, which is one of strengths of the NGK Group.

#### [Automotive-related]

### Strengthening Steady Supply of Uniform Quality around the World

In the automotive-related business, we will aim to improve productivity and strengthen the provision of consistent quality globally by adding new lines in Poland, establishing a new plant in Thailand (see page 15) and renewing equipment at other existing plants. As a global company, it is critical to ensure the steady supply of products with consistent quality. For that purpose, we regularly conduct GOMs (Global Operation Meetings), where plant managers get together to solve issues and share information, and PEMs (Process Expert Meetings), where persons in charge of manufacturing technology divisions gather to exchange opinions. We also tackle the standardization of quality from the equipment perspective.

We have been making constant efforts for technological innovation by placing state-of-the-art production lines to multiple plants. For example, such new production technology for HONEYCERAM® ceramic substrates was initially installed to the Ishikawa Plant then being done to Thailand, and, as same way, for silicon carbide diesel particulate filters (SiC DPFs) initially was to the Komaki Plant then was to Poland. Furthermore, we steadily respond to market and customer needs in the automotive-related business by launching new products and developing mass production systems to coincide with the introduction of new regulations and the establishment of new markets.

#### [Industrial Process Products]

### Enhancing Business Base

In the industrial process products business, equipment demand for automotive materials such as cathode materials used in lithium-ion batteries has remained at a high level. In addition, we are expected to win a project related to a new low-level radioactive waste treatment system. We believe that we will be able to secure steady net sales and profits by making continuous efforts to enhance the business base such as by exploiting our manufacturing and engineering capabilities.

### Outlook for Fiscal 2017

#### Net sales 249.0 billion yen

(4.1 billion yen increase from the previous year)

#### Operating income 60.5 billion yen

(4.1 billion yen decrease from the previous year)

#### Automotive-related

#### Net sales 224.0 billion yen

(3.0 billion yen increase from the previous year)

- Volume of automotive ceramics is likely to increase due to an increase in sales of trucks in the Chinese market and tighter automobile exhaust gas regulations in Europe.
- Profits are expected to decrease as a result of increases in development cost and depreciation cost.

#### Industrial process products

#### Net sales 25.0 billion yen

(1.1 billion yen increase from the previous year)

- Active capital investment for automotive-related materials centering on cathode materials used in lithium-ion batteries.
- Conditions of key industries including the electronics, steel and chemical industries are expected to remain robust.

### Topics1

## Drying through “Light” Wavelength Control Drying System

The Industrial Process Division focuses on the development of wavelength control drying systems that enable low-temperature drying, which was impossible with traditional drying methods utilizing hot air. By using infrared light with specific wavelengths, it becomes possible to dry objects quickly without the need to raise the temperature of the objects. As it produces no heat-related deformation or deterioration, the technology is expected to be utilized for the manufacturing process of various high-functional films in the electronics industry. In addition, selective irradiation of infrared light that is effective to evaporate solvent will help curb unnecessary energy use and significantly reduce power consumption. We are currently working on evaluation testing with a focus on electronics at a heating test laboratory at our Chita Site, with a plan to expand the target to the pharmaceutical and food sectors.



Wavelength control drying systems providing innovative solutions for the drying process in manufacturing

**Conserving heat energy and reducing power consumption by 30-50% compared with traditional methods**

#### Applications

##### Automotive- and lighting

- Lithium-ion batteries
- LEDs (light-emitting diodes)
- Organic EL (electroluminescent)
- Fuel cells
- Circuit boards

##### Information appliances-related

- Ceramic capacitors
- Ceramic sheets
- Polarizing films
- Magnetic sheets

##### Medical

- Pharmaceuticals
- Cosmetics

##### Food

- Packaging materials
- Barrier films

# Next Vision

## Future outlook and initiatives

### [Automotive-related]

## Responding to Market Growth with Extensive Product Line-up

The market environment surrounding the Ceramic Products Business Group is anticipated to significantly grow in and after fiscal 2018, especially in the automotive-related business.

Substantial growth is expected for the gasoline particulate filter (GPF) market in line with the full-fledged introduction of regulations on the number of particulate matter (PM) emitted from gasoline-fueled vehicles. Under such circumstances, the NGK Group has commenced the mass production and shipment of GPFs, mainly in Europe.

Meanwhile, the NGK Group will also start the mass production of a new NOx sensor product. Given the serious air pollution that is plaguing China and India, it is a certainty that automobile exhaust gas regulations will be tightened in the future. As a result, demand for HONEYCERAM®, DPFs, GPFs and NOx sensors is expected to increase from a medium- to long-term perspective.

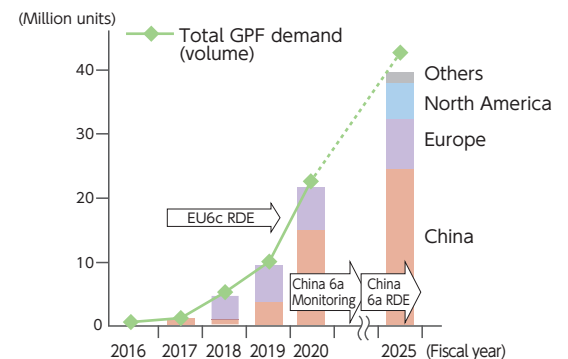
The NGK Group boasts a wide-ranging product line-up that can meet various needs of customers in different regions. Our aim is to establish a position as a top supplier by offering products for passenger vehicles, large-sized vehicles, diesel-fueled vehicles, gasoline-fueled vehicles and hybrid vehicles and attaining large market shares in every market. Through these efforts, we will strive to quickly identify technological trends of automobile manufacturers and push forward with technology and product development that looks ahead to future needs.

### [Industrial Process Products]

## Entering New Markets by Leveraging Broad Industry Channels

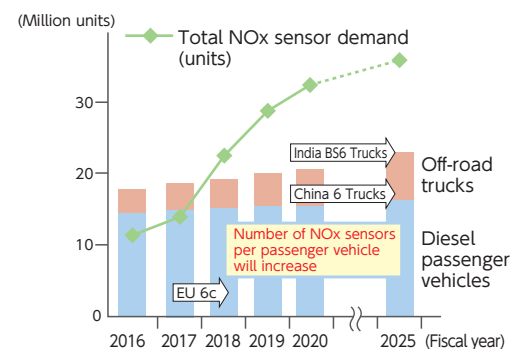
In the industrial process products business, we will promote selection and concentration in prospective markets by leveraging our broad industry channels covering a wide range of products, from various types of corrosion-resistant equipment to heating devices. Specifically, we have been endeavoring to develop new products and explore new applications for existing products in fields such as secondary battery materials, multilayer ceramic capacitors, biopharmaceuticals and medical equipment.

### Number of passenger vehicles with GPFs and total GPF demand



GPF demand will dramatically increase as a result of the introduction of RDE (Real Driving Emissions) testing in Europe and tighter regulations in China (China 6a and China 6b).

### Number of vehicles requiring diesel engine aftertreatment and NOx sensor demand



The number of NOx sensors installed for diesel passenger vehicles will increase as a result of tighter regulations in Europe (Euro 6c).

## Topics2

### Further Measures to Develop Global Human Resources

With the aim of promoting consistent quality globally, we have embarked on a project to establish the training center (provisional name) for developing global human resources. We will develop and inculcate the NGK Group's framework on quality and safety that must be observed in each country regardless of cultural and ideological differences while formulating optimal management and operational methods for each plant. It is our plan to promote discussions and preparations from fiscal 2017 and 2018 and to launch the training center within NGK's headquarters/Nagoya site by fiscal 2019.



## Topics3

### Developing Next-Generation Products

Motor-equipped vehicles that do not require constant engine operation such as hybrid vehicles and electric vehicles produce a shortfall in heat energy used for heating and other purposes compared with diesel-fueled vehicles and gasoline-fueled vehicles. Therefore, a system enabling the effective use of heat energy is crucial for such vehicles. The NGK Group has embarked on the development of heat energy management technology jointly with automobile manufacturers and other companies. Our focus is the development of key systems for the advancement and introduction of next-generation automobiles.

# E l e c t r o n i c s

## B u s i n e s s

### Contributing to the Development of Communications Infrastructure to Bring More Comfortable Living through Functional Enhancements and Miniaturization of Products

With the rise of AI (Artificial Intelligence) and the IoT (Internet of Things), the era of exchanging enormous amounts of information at high speed is upon us. Beryllium copper products widely used in ceramic components for semiconductor manufacturing equipment and electronics components that we develop and manufacture, as well as smartphones, home appliances, automobiles, industrial equipment, etc., are closely associated with such next-generation information infrastructure.

The NGK Group provides products that meet the constantly evolving needs of society by leveraging its unique differentiation technologies for materials and manufacturing processes.



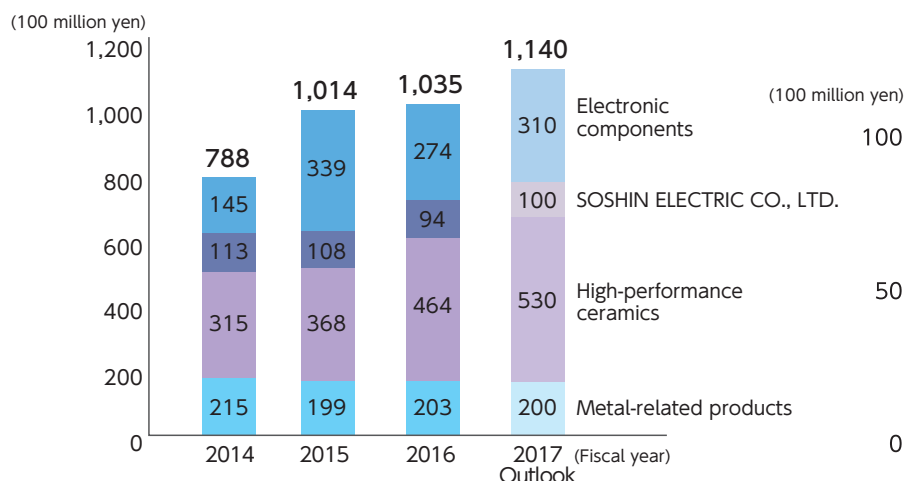
**Shuhei Ishikawa**

Director and Senior  
Vice President  
Group Executive,  
Electronics Business Group

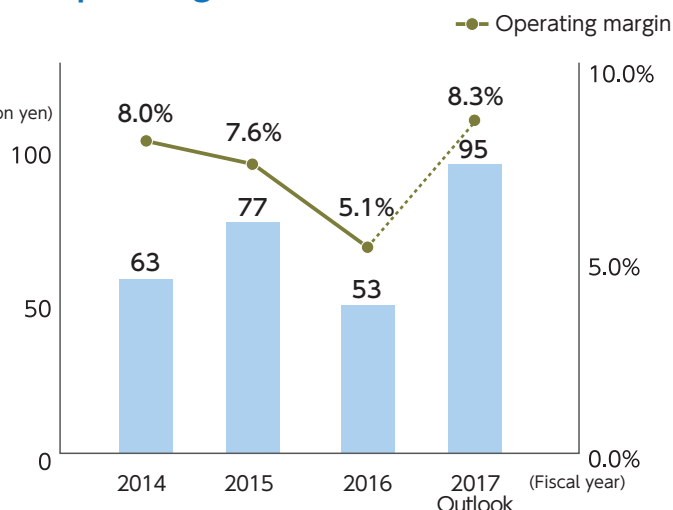
## Financial Data

### Financial results and outlook

#### Net Sales (After elimination of intersegment sales)



#### Operating Income





# Products

## Main products

### High-performance Ceramics (Ceramics for Semiconductor Manufacturing Equipment)

We provide ceramic functional components (susceptors) that support silicon wafers as a semiconductor material inside semiconductor manufacturing equipment as well as chamber components. In the face of the increasing integration of semiconductors, our products respond to increasing demand for memory and miniaturization as well as energy conservation needs for electronics components.

### Metal-related Products

Beryllium copper, which is made by adding a small percentage of beryllium to copper, has characteristics including excellent fatigue resistance and a long service life. It is widely utilized as a material for highly reliable conductive springs and contact points. The NGK Group has also been providing nickel-tin strips since 2016.

### Electronic Components

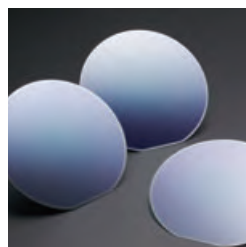
By fully exploiting our proprietary technologies cultivated over years in ceramics projects, we provide substrates for electronic devices and arc tubes for lighting purposes. In addition, electronic components for communication devices are manufactured and sold by Soshin Electric Co., Ltd. and ceramic packages by NGK Electronics Devices, Inc.



**Ceramics for semiconductor manufacturing equipment** that streamline the production process for semiconductors



**Beryllium copper** that improves reliability of electronic devices and realizes miniaturization



**Bonded wafers** delivering a level of performance and functionality that cannot be achieved with wafers made from a single material

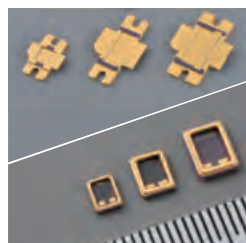


Translucent **HICERAM®** alumina ceramics used as element substrates for LED devices

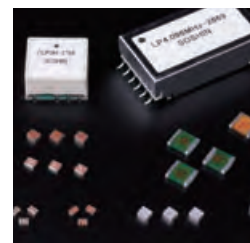
## Product Sites

### Manufacturing sites

High-performance Ceramics	Metal-related Products	Electronic Components
Japan	Japan	Japan
USA	USA	China
	France	Malaysia



**Ceramic packages** for high-frequency devices that hold the world's top market share



**Electronic components for communication devices** such as multilayered dielectric filters and couplers

## Results

### Business overview for fiscal 2016

### Accelerating Capital Investment in Response to Strong Demand

The Electronics Business Group on the whole posted increased sales and decreased profits compared to the previous year. This is attributable to the fact that sales remained strong backed by growth in the semiconductor market while there was a delay in recovery of demand for ceramic packages.

In the high-performance ceramics business, strong results were posted as capital investment by semiconductor manufacturers remained at a high level on the back of increasingly multilayered and miniaturized semiconductors. We also accelerated capital investments in response to strong demand.

In the metal-related products business, sales increased only slightly due to the appreciation of the yen despite an increase in shipment of beryllium copper products for industrial equipment in the Chinese market.

In the electronic components business, sales decreased as a result of the delay in investment in base stations for mobile phones in China, which negatively impacted the demand for ceramic packages.

### Summary of Fiscal 2016

**Net sales** 103.5 billion yen (2.1 billion yen increase from the previous year)

**Operating income** 5.3 billion yen (2.4 billion yen decrease from the previous year)

#### High-performance ceramics

**Net sales** 46.4 billion yen (9.6 billion yen increase from the previous year)

Sales increased from the previous year reflecting strong shipments of ceramic components for semiconductor manufacturing equipment as capital investment by semiconductor manufacturers and foundries (subcontracted semiconductor manufacturers) remained at a high level on the back of increasingly multilayered and miniaturized semiconductors.

#### Metal-related products

**Net sales** 20.3 billion yen (0.4 billion yen increase from the previous year)

Sales increased from the previous year reflecting strong shipments of beryllium copper products mainly for industrial equipment in the Chinese market.

#### Electronic components

**Net sales** 27.4 billion yen (6.5 billion yen decrease from the previous year)

Sales declined from the previous year due to sluggish demand for ceramic packages in the Chinese market despite increased volume of bonded wafers.

#### Soshin Electric Co., Ltd.

**Net sales** 9.4 billion yen (1.4 billion yen decrease from the previous year)

Sales in the fields of both industrial equipment and information communication devices remained sluggish due to a slowdown in the growth of the Chinese economy and a decline in investment in base stations

## Present Action

### Challenges and initiatives for fiscal 2017

#### Increased Sales and Profits Expected on the Back of Continued Booming of the Semiconductor Market

Increased sales and profits are expected for fiscal 2017 in the Electronics Business Group as a whole on the back of the continued booming of the semiconductor market.

In the high-performance ceramics business, capital investment by semiconductor manufacturers and foundries will remain at a high level. In order to respond to robust demand, we will expand production areas of existing plants and build new plants while focusing on the development of next-generation products in line with the increasing integration of semiconductors.

In the metal-related products business, growth has been slowing in the market for beryllium copper products and the prices of raw materials have been rising. We will redevelop our revenue structure of existing products and promote the expansion of sales of new materials and products for new applications with the aim of achieving the steady growth of profits.

In the electronic components business, we have been ramping up mass production of bonded wafers for SAW filters, looking ahead to the expansion of the high-performance filter market for mobile communication devices. As we anticipate that demand for ceramic packages will remain flat for existing products, we will accelerate the development of new products with the aim of contributing to earnings as soon as possible.

### Outlook for Fiscal 2017

#### Net sales 114.0 billion yen

(10.5 billion yen increase from the previous year)

#### Operating income 9.5 billion yen

(4.2 billion yen increase from the previous year)

#### High-performance ceramics

##### Net sales 53.0 billion yen

(6.6 billion yen increase from the previous year)

■ Sales and profits are expected to increase year-on-year as capital investment by semiconductor manufacturers and foundries is likely to continue at a high level on the back of increasing integration and segmentation of semiconductors.

#### Metal-related products

##### Net sales 20.0 billion yen

(0.3 billion yen decrease from the previous year)

■ Demand for beryllium copper products will remain flat. We will aim to expand the sales of new materials and products for new applications.

#### Electronic components

##### Net sales 31.0 billion yen

(3.6 billion yen increase from the previous year)

■ Demand for bonded wafers will increase on the back of expansion of the high-performance filter market for mobile communication devices. As we anticipate that demand for ceramic packages will remain flat for existing products, we will launch and expand the sales of new products.

#### Soshin Electric Co., Ltd.

##### Net sales 10.0 billion yen

(0.6 billion yen increase from the previous year)

■ Sales are expected to increase as a result of the expansion of sales of mainstay products in the businesses related to noise reduction, among others, by launching new products onto the market.

### Topics1

#### Boosting Production System in Response to Demand Increase

##### Boosting Production System in Response to Demand Increase

In the high-performance ceramics business, we have been boosting our production capacity through aggressive capital investment in light of the brisk semiconductor market. It is our aim to remain a top supplier by responding to customer demand for increased production through advanced capital investment during the phase in which makers of semiconductor manufacturing equipment are increasing production.

In Japan, we will expand production areas at our Komaki Site in order to boost production of functional components (susceptors) that support silicon wafers as a semiconductor material while establishing a new plant in Tajimi City in Gifu Prefecture. Overseas, we will open a new plant at FM Industries, Inc., our production site in the U.S., to boost production of chamber components. We will collaborate with customers in swiftly launching next-generation products onto the market, thus staying at the forefront of electronics with our advanced ceramic technologies.



Ceramics for semiconductor manufacturing equipment (susceptors)

Boosting production capacity by  
**25%**

#### Establishing new production site in Tajimi City, Gifu Prefecture

##### Name:

TAJIMI PLANT, NGK CERAMIC DEVICE CO. LTD. (provisional name)

##### Investment amount:

Approx. 20.0 billion yen

##### Commencement of construction:

March 2018 (scheduled)

##### Commencement of production:

April 2020 (scheduled)



### Topics2

#### Intelligent Plants

At this plant for beryllium copper strips, we engage in intelligent projects for production systems by utilizing big data. By accumulating all sorts of production data in real time during the strip manufacturing process and analyzing the interactions of production criteria and quality information using big data, we can produce findings that will contribute to quality management and the forecasting of abnormalities in production lines, among other purposes. These efforts will also result in the enhancement of yield and cost reduction. We will promote similar data gathering and analysis at other plants with the aim of further expanding such efforts to electronic components plants in the future.

# Next Vision

## Future outlook and initiatives

### Achieving Mass Production of High-Function Products

With the arrival of the era of IoT and AI, a wide range of technological innovations are expected to emerge in response to the increasing volume of information and communications as well as next-generation high-speed communications. There will be opportunities for the Electronics Business Group to expand and generate new products in line with such technological innovations.

For example, future growth is expected through business expansion by launching new models of bond wafers, ceramic packages and beryllium copper strips in the areas of infrastructure development for next-generation communications and enhancement of high-speed communications and by delivering high-functional ceramic components for semiconductor manufacturing equipment in response to increased demand for semiconductor memories for data centers. On the manufacturing and development front, we have been promoting the establishment of optimal production and development systems throughout the value chain.

In the high-performance ceramics business, we respond to customer demand for increased production by developing cooperative systems (capital investment, equipment lending, guidance on manufacturing, etc.) with subcontracted processing plants. We work on the development of next-generation manufacturing equipment in close coordination with the development programs of customers.

In the metal-related products business, we promote the

integration and standardization of specifications in collaboration with material manufacturers and customers, thereby addressing the inefficiency of low-volume high-mix manufacturing.

In the electronic components business, we share key factors for quality control with material manufacturers in order to differentiate ourselves in terms of product characteristics, thus achieving mass production of high-function products. Based on material and molding technologies, we carry out a broad range of joint development projects and prototype making with companies and research institutes in various fields with the aim of developing new products.

#### Bonded Wafers for SAW Filters

That Enhance Communication Quality for Smartphones and Other Devices

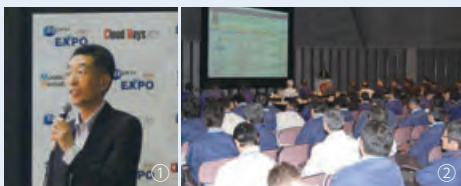


While conventional SAW (Surface Acoustic Wave) filters suffer from the disadvantage of being susceptible to a high degree of expansion and contraction based on temperature, NGK's bonded wafers realize a significant reduction in thermal expansion, thus offering solutions for next-generation LTE that require filtering functions with higher precision.

### that Utilize Big Data



The NGK Group commenced preparations for the introduction of big data analysis in 2013 and has been a leader in this field among material manufacturers.



As the NGK Group's efforts to realize cost reduction through the usage of big data received attention, Senior Vice President Ishikawa was invited to speak about the NGK Group's initiatives.

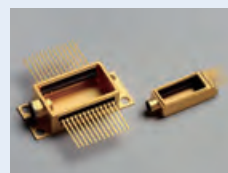
① June 2016: Special program at an IT-related exhibition  
② April 2017: Special lecture organized by a manufacturer

### Topics3

### Generating New Products Targeting New Markets and Next-Generation Products

The NGK Group has embarked on company-wide projects including the Ceramic Battery Project, which was formed last year, and the Optical component Project, which was kicked off this year (see pages 16-17). We aim to commercialize some of the products being developed in these projects within the Electronics Business Group, which will pave the way for us to enter new markets. By engaging in activities to solve problems concerning marketing, quality assurance and manufacturing from the development stage, we will strive to achieve smooth commercialization based on our business operation experience and insights.

We have been strengthening collaboration not only within NGK Insulators, Ltd. but also with Group companies. This includes our collaboration with Soshin Electric Co., Ltd. and NGK Electronics Devices, Inc. in exploring new products for the next-generation high-speed communications market. We will promote the development of new products for future growth by bringing together strengths of each company, including the material technologies of NGK Insulators, Ltd., broad network in the electronic components industry of Soshin Electric Co., Ltd., and mass production process of NGK Electronics Devices, Inc.



Optical communication packages that are used for the conversion parts of optical fiber communications. Demand is expected to increase on the back of the enhancement of high-speed communications.



Insulated circuit boards that maximize the performance of power semiconductors. Our focus has been the expansion of sales targeting the markets for industrial machinery and hybrid and electric vehicles, which offer promising growth prospects.





For more information on our CSR initiatives and corporate governance, please also see the NGK Report 2017 Full Report (PDF file) on our website. It has more detailed information on our basic philosophy and systems as well as on initiatives and data not included in this report.

► <http://www.ngk.co.jp/english/csr/>

# CSR Management

The NGK Group aims to realize its corporate philosophy through the provision of products and services that will bring new value to society and contribute to the creation of a better social environment. We will fulfill our social responsibilities through these activities, establishing and continually strengthening CSR objectives to meet the expectations and earn the trust of society.

## With All Our Stakeholders

The NGK Group promotes an understanding of our business among customers, suppliers, shareholders, investors, regional communities, government and international organizations, and universities and research institutes, as well as employees, continuously improving our activities and initiatives through dialogues with all our stakeholders.



## Promoting Human Rights Initiatives

Having established respect for humanity in its Guidelines for Corporate Behavior, the NGK Group uses its intranet, accessible to all employees in Japan, to explain and disseminate the United Nations' "Universal Declaration of Human Rights" and "Guiding Principles on Business and Human Rights." In April 2015, the NGK Group joined the UN Global Compact\* to engage more proactively in education and awareness activities related to the protection of human rights.

\* The UN Global Compact is a global framework for realizing sustainable growth through companies and organizations acting as good members of society.

## Commencing Human Rights Due Diligence

In reference to the EICC (Electronic Industry Citizenship Coalition) Code of Conduct and the United Nations' Guiding Principles on Business and Human Rights, the NGK Group set specific survey items with support from external consultants. In November 2016, we launched activities involving Group companies in Japan. In fiscal 2017, we will gradually expand the scope of activities to our headquarters and overseas Group companies.

### Topics

#### Holding a Lecture on Human Rights

In March 2017, NGK invited Ms. Mizue Unno of So-Tech Consulting Inc., who supports corporate activities in the areas of CSR and sustainability, to speak at our lecture meeting on human rights. Under the theme of "Human Rights Risks for Businesses in Emerging Countries: Responsible Labor Management," the participants learned about specific issues and countermeasures including how to protect the human rights of workers in the supply chain.



Ms. Mizue Unno of So-Tech Consulting Inc. giving a lecture

# Providing Products that Contribute to Better Social Environment

The NGK Group considers the provision of products and services that contribute to a better social environment to be one of its most important missions. To this end, we strive to create quality that is based on the customer's perspective and trusted by society.

## Quality Activities at Overseas Production Bases

Overseas production bases have created quality systems appropriate to their situations to promote enhanced quality activities. Under the NGK group quality activity system, each base reports on situations regarding customer complaints and manufacturing quality, which are discussed at Quality Activity Meetings to evaluate the Group's overall situations in a timely manner. Other measures are also taken to develop and enhance quality activities.

### Strengthening Quality Education

In recent years, we face increasingly sophisticated and diversifying customer requirements for quality in many different markets. To meet such quality needs required for each product line and business division, we offer more practical programs where issues that are most relevant to participants are addressed.

Program Name	Objective
Quality Basic II	Build problem-solving skills using quality engineering methods
Preventive action training	Learn basic approaches of preventive / corrective actions and risk examination procedures
	Experience the risk identification and countermeasure planning using a development project.
Method of creation and learning from failure	Improve analysis and development skills to learn from failure and apply for the future

### QuiC Activities to Improve Quality with Full Employee Participation

Since 2003, the NGK Group has developed QuiC (Quality up innovation Challenge) quality improvement activities in which all employees participate. These activities consist of quality improvement activities by small groups and suggestions that strive to enhance the quality of products and work; the best practices are shared by the entire NGK Group. In the fiscal 2016 contest, 12 manufacturing practices including overseas plants and 4 office practices were presented.

Fiscal 2016 Suggestion Activity Participation Rate		
Manufacturing Divisions	Non-manufacturing Divisions	Number of Suggestions
100%	93%	Approx. 39,000



In 2016, a representative of the Polish production base won the Grand Prize at the Activities Contest for the second year in a row.

## Topics

### Quality Activities Meeting Held at 5 Overseas Production bases

Discussions were held on the important subject of each plant to improve quality.

Information was also provided on the situations of the NGK Group's quality activities.

#### The seminar was held at:

- NGK Stanger Pty Ltd
- NGK Ceramics Polska Sp. z o.o.
- NGK Electronics Devices (M) Sdn. Bhd.
- Siam NGK Technocera Co., Ltd.
- NGK Ceramics Europe S.A.



The quality activities meeting at Siam NGK Technocera Co., Ltd.

# Thorough Enforcement of Compliance/ Risk Management

Viewing compliance as the foundation of CSR, the NGK Group positions it as the most important initiative to enhance trustworthiness. Based on this perspective, the Group strives to create specific systems to inculcate this view among employees, prevent corruption, and comply with laws and regulations.

Moreover, in line with business expansion, the NGK Group is also engaged in minimizing risks related to globalization and diversification while augmenting our risk management structure.

## Strict Adherence to Competition Laws

The NGK Group strictly adheres to competition laws (Antimonopoly Act) and other laws and regulations pertaining to business transactions. In Japan, seminars led by lawyers were provided to all corporate officers and Managerial class. At overseas Group companies, training sessions were led by lawyers or conducted by using original DVDs. We are also engaged in other initiatives to strengthen education, including creation and distribution of the English and Chinese editions of the Competition Laws Compliance Handbook to Group companies in the U.S. and China.



Competition Laws Compliance Handbook in English and Chinese

### Competition Laws Training Conducted in Fiscal 2016

Title	Content	No. of times conducted
Competition laws training for newly appointed directors	Companies Act, competition laws	1
Competition laws compliance lectures	Antitrust seminar	13 (4 live lectures and 9 DVD lecture presentations)
Competition Laws training for Group companies in Japan	Competition laws, anti-bribery	3 (DVD lecture presentations)
Competition Laws training conducted by internal lecturers	Outline of competition laws, internal regulations	3
Competition laws training for overseas Group companies	Lectures by lawyers	28 companies (including training at 7 companies using DVDs, teleconferencing and printed materials)

## Anti-corruption Measures

The NGK Group has been taking anti-bribery measures in order to ensure fair and transparent transactions. We enacted the internal anti-bribery rules for dealing with foreign public officials in fiscal 2015 and started their operation in 2016. Moreover, we enacted internal rules at 19 Group companies in the U.S., Asia and Australia during fiscal 2016.



Anti-bribery training for employees of NGK Technologies India

## Intellectual Property (IP) Education

The NGK Group encourages the creation of IP rights with IP education, and works to ensure proper acquisition and use of IP rights.

### Topics

#### Overseas IP Training

NGK offers overseas training programs to develop international IP experts, sending young employees to the U.S. and Europe. Since 2016, Mr. Masashi Yasui of the Intellectual Property Department has been undertaking training at the Munich Intellectual Property Law Center (MIPLC) in Munich, Germany. Starting in October, he will also receive practical training at local patent firms.



Mr. Yasui (last row, sixth from the left) and fellow students at MIPLC



# Respect of Humanity and Assurance of Comfortable Working Environment

The NGK Group makes an effort to respect the humanity of its employees and provide a safe and comfortable working environment. In the interest of fair treatment, NGK employs a human resources system that enables employees to maximize their potential.

## Setting the Retirement Age at 65

In April 2017, NGK revised its human resources system for general employees to enable all employees, from the young to the experienced, to work with a sense of enjoyment and fulfillment. As NGK develops its businesses across the globe and promotes the creation of new products and businesses, it is essential to motivate young and mid-level employees who will play key roles and encourage them to demonstrate their full potential. The revised system aims to build the environment that makes this possible.

### Key Points of the Revised System

Qualifications	Developing a mechanism whereby all employees can take on challenges to move to a higher job grade.
	Clarifying the definition of each qualification.
Evaluation	Shifting from age-based evaluation to evaluation based on effort and result.
Retirement age at 65	Maintaining the level of salary after age 60.

### Topics

#### Developing an Environment that Allows Employees to Demonstrate Their Full Potential

In the new human resources system revised in April 2017, we have clarified what kind of human resources the company is looking for and developed a system that allows young and mid-level employees to demonstrate their full potential; I hope they can actively take on challenges to move to higher stages. This system also allows mature workers to keep working in the same way until their retirement age at 65. I hope this revised human resources system can also increase motivation among women and drive the initiatives by the NGK Group to promote women's active participation.

Human Resources Department  
Manager

Yuka Sugiura



## Enhancing Safety and Health Activities

### Promotion of Experience-based Safety Education

We are seeing a growing number of accidents among workers with a shorter work history and those with less experience. In response, we have established training centers at three sites in Nagoya, Chita and Komaki, as well as at the Ishikawa Plant, where trainees can actually experience workplace hazards. Establishing these centers in-house means that more workers can now take enhanced training.

### Training for \*Safety Assessors at the Manufacturing Division

We have been encouraging employees at the Manufacturing Division to acquire Safety Assessor certification. There are four levels of certification in the system, awarded according to applicants' knowledge and skills. In fiscal 2016, we started by encouraging worksite leaders and above at the Manufacturing Division as well as those in charge of safety and health to acquire the entry-level Safety Basic Assessor certification.



In fiscal 2016

**317** acquired the certification

\* Qualification granted by Japan Certification Corporation to recognize people who have a wide range of knowledge and skills necessary for the safe operation of machinery based on international safety standards.

### Promoting the Active Participation of Women

The NGK Group strives to increase opportunities for motivated and skilled people to demonstrate their potential regardless of gender. We are also engaged in the creation of an environment that makes working comfortable for women. We encourage the active participation of women through various systems.

#### Supervisor Training to Promote Women's Active Participation

Since March 2017, NGK has hosted training programs for supervisors of female staff. The goal is to help these supervisors recognize the importance of women's active participation and to learn about their own roles in promoting the speedy career advancement of their staff.



Certified as an "L-Boshi" Company for Its Excellence in Promoting Women's Active Participation



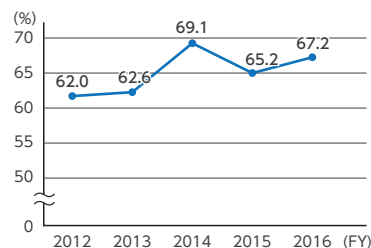
\* Certification granted to companies that have done excellent jobs in accordance with the Act on Promotion of Women's Participation and Advancement in the Workplace.

### Work-Life Balance

#### Initiatives to Limit Overtime Work

Each year, NGK discloses statistics on hours worked and paid leave utilization to its Worker's Union for discussion and countermeasure deliberation purposes. When cases of long working hours are found, the Worker's Union meets with each workplace to devise countermeasures. When long working hours are found for employees who have been temporarily assigned overseas, they must submit in writing the reason for the long working hours and undergo a health check. These measures are taken to identify the reasons for long working hours and to develop countermeasures.

Rate of Paid Leave Utilization



#### Supporting Work-Life Balance

NGK has a flexible system that promotes employees' work-life balance. Regarding childcare and nursing care, in addition to flexible working arrangements, such as the shortened working hour system, we also provide extensive financial support, including subsidies for childcare expenses and allowances to support caregiving.

We have launched a support site for diverse work styles on the company intranet to widely announce our measures to support the balance between work and family life. The new site is a redesigned and more user-friendly version of the Work and Life style, Especially Family Life Support Site. Its new features include, for example, a handbook on childcare and nursing care.



### Focus on Human Resource Development

At NGK, people are our most precious management resource. With respect for employee motivation and ambition, we engage in developing human resources who will lead the next generation.

#### On-site Leader Human Resource Development

As veteran employees retire in large numbers, the ratio of employees with limited experience is increasing at manufacturing sites. In response, the NGK Group provides training to develop in-house instructors with the aim of educating human resources able to lead the manufacturing divisions in order to strengthen worksite capabilities.

#### Topics

#### Encouraging and Developing Young Employees

As global competition intensifies, we urgently need to develop human resources at overseas factories. Accordingly, in-house instructors are taking innovative measures by introducing various mechanisms to develop talented young workers within the context of the daily work environment.

During training and education, I focus on encouraging each employee to take the initiative and on introducing trainees to the joy of work and collaboration with their colleagues. I strive to give trainees a sense of joy and accomplishment at the end of the program.

Manufacturing Section, Insulator Division, Power Business Group  
In-House Instructor

Masato Sujino



# Implementation of Fair, Free and Transparent Transactions

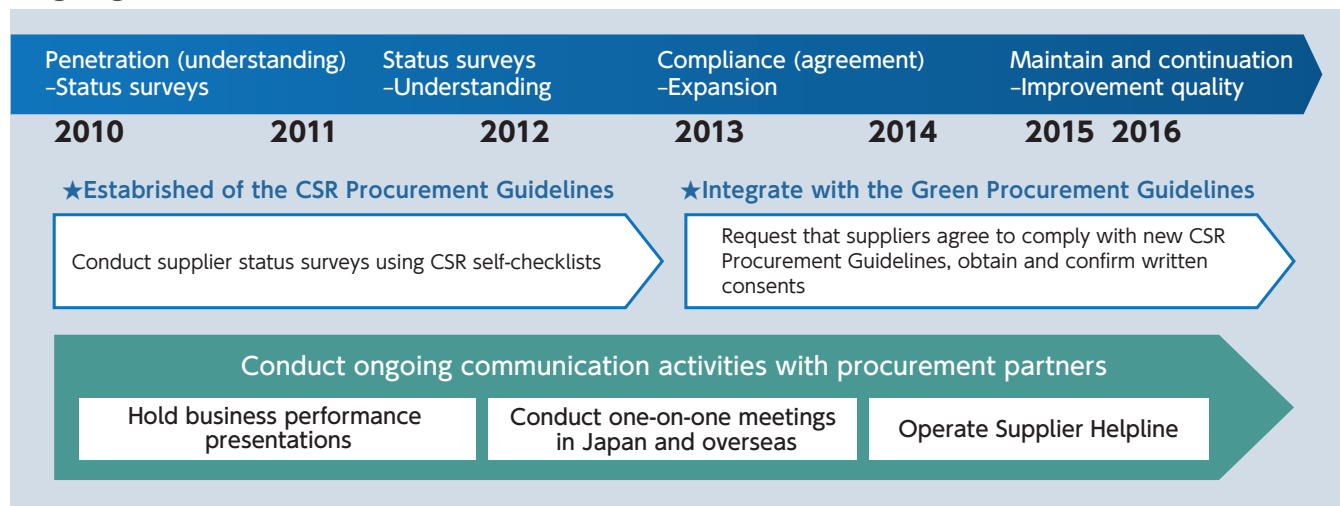
With a basic policy centered on the three principles of openness and fairness, partnership, and relationship with society, the NGK Group is engaged in fair and honest business transactions with the procurement partners in our supply chain.

## Promotion of CSR Procurement

In response to the rising social expectation for CSR-oriented supply chain management, the NGK Group promotes CSR procurement. We preferentially select CSR-aware companies and purchase CSR-based raw materials and services.



### Ongoing Promotion of CSR Procurement



## Organizing Purchasing Liaison Meetings for Overseas Group Companies

In 2016, the Purchasing Department of NGK held a purchasing liaison meeting at NGK Ceramics USA and NGK Ceramics Mexico in May and October, respectively. In the meetings, buyers from each company reported on

their issues associated with purchasing and logistics and conducted cost cutting measures. The meetings helped enhance the relevant expertise of participants and further develop purchasing functions of the two companies.

## Promoting BCP\* through the Diversification of Procurement Resources

\* Business Continuity Planning

In preparation for unforeseen circumstances such as a major natural disaster, we promote the multi-sourcing policy for critical purchased goods as part of our BCP efforts. For items which are available from only one supplier, we are in the process of ensuring sufficient inventory and that the storage facilities for these items are

located in a safe place that cannot be damaged by tsunami. In addition, when selecting a new procurement partner, we take into consideration the existence or absence of multiple supply bases and efforts to ensure inventory.



# Preservation of Global Environment

## NGK's Core Policy on the Environment

Recognizing that protecting the environment is a vital issue that all of humanity must face, the NGK Group formulated its Core Policy on the Environment in April 1996 consisting of its Environmental Philosophy and Environmental Action Guidelines in order to bring its corporate activities into harmony with the environment. On the basis of this policy, the NGK Group works to reduce the environmental impact of business activities, and actively strives to help protect the environment by developing products and technologies to that end.

### Environmental Philosophy

Given its corporate philosophy—"NGK products and technologies must create new value and contribute to the quality of life"—NGK will contribute to tackling environmental issues through its "Triple-E" business segments of **ecology, electronics and energy** to create a comfortable environment for future generations.

## Overall Perspective of Environmental Impact

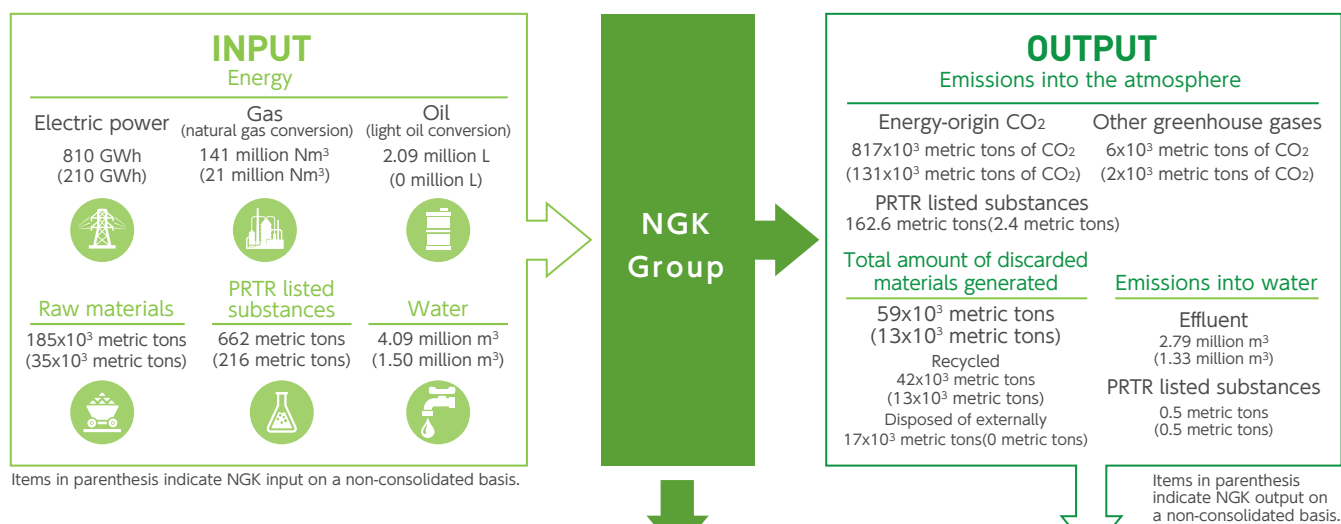
The diagram below shows aggregate inputs to and outputs from manufacturing operations of the entire NGK Group engaged in at all domestic and overseas sites. Inputs represent

data for raw materials and energy etc. and outputs for manufactured products and services as well as substances that are discharged into the atmosphere and into water.

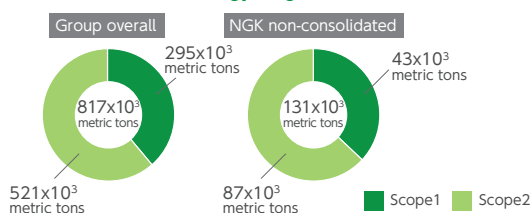
### Activities covered

- NGK Headquarters/Nagoya Site/Chita Site/Komaki Site/Ishikawa Plant (does not include Tokyo Main Office, Osaka Branch and six other sales offices)
- Group companies: 42 manufacturing-related consolidated subsidiaries (19 in Japan; 23 overseas)

## NGK Group Material Balance (Input and Output)



### Breakdown of energy-origin CO<sub>2</sub> emissions








#### Notes:

1. Environmental performance values in this report have been rounded up for convenience; therefore the sum of individual values may not match the totals.
2. "Discarded materials" indicates the total amount of industrial waste and valuables.
3. CO<sub>2</sub> conversion factors (kg-CO<sub>2</sub>/unit) used in calculating NGK's CO<sub>2</sub> emissions on a non-consolidated basis are as follows (units are indicated in parentheses): Purchased electric power (kWh): 0.42, Fuel oil A (liters): 2.677, Diesel fuel (liters): 2.64, Kerosene (liters): 2.49, City gas (Nm<sup>3</sup>): 2.29, LPG (kg): 3.007, LNG (kg): 2.70, Gasoline (liters): 2.322 Sources: The Federation of Electric Power Companies of Japan (actual figures for fiscal 1990), Ministry of the Environment. Some factors calculated independently by NGK have been used. Incidentally, the fiscal 2016 energy-origin actual CO<sub>2</sub> emissions volume for NGK on a non-consolidated basis is 146x10<sup>3</sup> metric tons when using the CO<sub>2</sub> conversion factor provided by the Order for Enforcement of the Act on Promotion of Global Warming Countermeasures (revised in May 2016).

# Results of Initiatives within the Fourth Five-Year Environmental Action Plan (2016-2020)

The NGK Group organizes environmental initiatives by creating five-year action plans. The Fourth Five-Year Environmental Action Plan has been formulated to broadly encompass major global environmental challenges that businesses are expected to take responsible actions to address, and to select two key issues each for two groups of themes, namely, priority themes and focus themes. The two priority themes are reducing both CO<sub>2</sub> emissions and discarded materials, an issue for which the Group

has been taking measures in recent years; and promotion of products contributing to environmental protection, a new area of focus. For focus themes, we have picked water resources-related risk management and biodiversity conservation. For the fiscal 2016 initiatives, almost all yearly numerical targets have been achieved, and for non-numerical targets steady progress was made as initially planned, indicating that we have made a successful start to the Five-Year Plan.

Category		Item	KPI	Fiscal 2016			Fiscal 2017	Fiscal 2020
				Target	Result	Self-evaluation*1	Target	Target
Environmental/social contribution	 Environmental/social contribution through products	Develop and distribute products contributing to environmental protection	Sales growth (%)	Increase by 25% from fiscal 2013 (consolidated)	Increased by 26% from fiscal 2013 (consolidated)	○	Increase by 30% from fiscal 2013 (consolidated)	Reduce by at least 60% from fiscal 2013 (consolidated)
		Promote green procurement	Plan progress (%)	At least 99% of NGK's suppliers in Japan agree to comply with the CSR Procurement Guidelines	99.4% agreed (100% including suppliers who partially agreed)	○	Maintain the level for Japanese suppliers, conduct research on approaches for overseas suppliers (study other companies, etc.)	Maintain in Japan, expand overseas
	 Promotion of environmental communication	Contribute to local community	Plan progress (%)	Send instructors to guest lecture programs	Sent instructors to local children's centers	○	Send instructors to guest lecture programs	Continually enhance actions partnering with communities
		Raise environmental awareness	Plan progress (%)	Provide environmental education for employees, establish employee communication on environmental themes, encourage participation in environmental events	Provided training programs by job grade, organized CSR Talk Live, installed "green curtains"	○	Provide environmental education for employees, establish employee communication on environmental themes, encourage participation in environmental events	Continually enhance environmental training and information disclosure
	 Conservation of biodiversity	Promote actions based on biodiversity conservation guidelines	Plan progress (%)	Explore and implement new approaches/ initiatives	Conducted biodiversity surveys at company-owned sites, requested partner companies to conduct similar surveys	○	Continue biodiversity survey at company-owned sites, promote an action commitment declaration project for employees	Expand and enhance the content of Aichi Target actions
Environmental impact reduction	 Prevention of global warming	Reduce CO2 emitted from manufacturing	Basic unit per net sales	Reduce by 9% from fiscal 2013 (consolidated)	Reduced by 10% from fiscal 2013 (consolidated)	○	Reduce by 11% from fiscal 2013 (consolidated)	Reduce by 20% from fiscal 2013 (consolidated)
			Reduction rate against BAU (%)*2	Reduce by at least 12.3% from fiscal 2013 (consolidated)	Reduced by 15% from fiscal 2013 (consolidated)	○	Reduce by 15% from fiscal 2013 (consolidated)	Reduce by 15% from fiscal 2013 (consolidated)
		Reduce CO2 emitted from supply chains	Basic unit per transport volume*3	Reduce by 1% per year on five-year average (unconsolidated)*4	Increased 2% on average per year (unconsolidated)*4	×	Reduce by 1% per year on five-year average (unconsolidated)*4	Reduce by 1% per year on five-year average (unconsolidated)*4
	 Effective use of resources	Reduce discarded materials emitted from manufacturing	Basic unit per net sales	Reduce by 13% from fiscal 2013 (consolidated)	Reduced by 19% from fiscal 2013 (consolidated)	○	Reduce by 17% from fiscal 2013 (consolidated)	Reduce by 30% from fiscal 2013 (consolidated)
			Reduction rate against BAU (%)*2	Reduce by at least 11.6% from fiscal 2013 (consolidated)	Reduced by 18% from fiscal 2013 (consolidated)	○	Reduce by 19% from fiscal 2013 (consolidated)	Reduce by 20% from fiscal 2013 (consolidated)
		Promote resource recycling	Recycling rate	Maintain at over 99% (in Japan)	Maintained at 99.2% (in Japan)	○	Maintain at over 99% (in Japan)	Maintain at over 99% in Japan
		Manage and respond to water resources risks	Plan progress (%)	Conduct a third-party water risk survey	Conducted surveys at five sites	○	Continue water risk surveys	Strengthen actions by production base for evaluating risks and streamlining water use

Notes:

1. Self-evaluation standards for achievement level: ○: Target achieved ×: Target not achieved

2. Reduction rate against BAU (business as usual) indicates the percentage rate of emissions reduction resulting from implemented actions against a computed value for the hypothetical absence of the actions. By not incorporating the influence of foreign exchange movements and other factors, this indicator allows a direct grasp of the efforts by each site.

3. NGK basic unit per transport volume expresses in metric ton-kilometers the amount of crude oil equivalent fuel used.

4. Based on the computation criteria stipulated in the Act on the Rational Use of Energy

## [Base year, target year, control scope] Base year: fiscal 2013; target year: fiscal 2020

The new Five-Year Environmental Action Plan has been designed to correspond with the business initiative of new/reformed manufacturing structures. Accordingly, the base year and target year of the Plan have been set to coincide with the initiative. In principle, activities will be managed on a consolidated basis, embracing those based in and outside of Japan, in place of the previous method of managing domestic

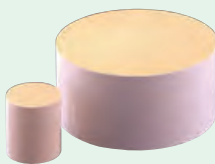
and overseas activities separately. The consolidation method has been adopted to improve management efficiency and effectiveness in response to the recent changes in our global production output structure, particularly increased amounts from overseas manufacturing sites as well as from production chains through multiple global locations.

## Development and Distribution of Products Contributing to Environmental Protection

Under the Fourth Five-Year Environmental Action Plan, initiated in fiscal 2016, NGK is committed to the development and distribution of products contributing to environmental protection as a top priority theme. We aim to achieve a growth in sales for products contributing to environmental protection of 60% compared to fiscal 2013 (and maintain the sales percentage for products contributing to environmental protection at over 50% of all products) by fiscal 2020, the final year of the Five-Year Plan. In fiscal 2016, we achieved sales growth of 26% from fiscal 2013, exceeding the annual target of 25%.

### HONEYCERAM®

HONEYCERAM is a ceramic substrate for catalytic converters to purify harmful contents in the exhaust gases of automobiles. The product is currently manufactured in eight countries around the world with cumulative shipment exceeding 1.2 billion units.



### NOx sensors

NGK has developed the world's first in-vehicle sensor to measure concentrations of nitrogen oxides (NOx) in exhaust gas with high precision.



### Low-level radwaste treatment system

NGK has developed a wide range of systems to safely treat low-level radioactive waste and has supplied these systems to nuclear power stations and related facilities across Japan. The systems are developed utilizing NGK's proprietary treatment technology and high-performance filter-based dust collection technology.



### Sales growth for products contributing to environmental protection



### Diesel particulate filter (DPF)

The DPF is a porous ceramics filter used worldwide in the exhaust systems of diesel vehicles. With a pore structure, the filter ensures particulate matter (PM) is captured to purify the exhaust gas emitted from diesel vehicles.



### NAS® Battery

NGK was the world's first manufacturer to commercialize the NAS battery megawatt-class storage system. NAS systems enable the global spread of stable renewable energy and are thereby contributing to the prevention of global warming.



## Initiatives for Biodiversity Conservation

The NGK Group recognizes the conservation of biodiversity as an important issue for the company in achieving a sustainable society. Specifically, we have been pushing forward with activities pursuant to "Aichi Target" international goals for biodiversity agreed upon at the 10th Meeting of the Conference of the Parties to the Convention on Biological Diversity (COP 10). In fiscal 2016, we prioritized relevant activity areas and set two new ones: biodiversity survey of company-owned sites and cooperation with suppliers.



### Aichi Target \*1

### NGK Activities \*2

Target 1	Spread awareness	Employee environmental education, next-generation education, <b>cooperation with suppliers</b>
Target 4	Sustainable production and consumption	Expanding sales of products contributing to environmental protection, CO <sub>2</sub> reduction, effective use of resources, <b>cooperation with suppliers</b>
Target 5	Prevent loss of all natural habitats	Voluntary employee participation in forestation and other environmental conservation activities, <b>biodiversity survey/appropriate control of company-owned sites</b>
Target 8	Control pollution from chemical substances, etc.	Chemical substance management, management of exhaust and wastewater, expanding sales of products that prevent air pollution, <b>cooperation with suppliers</b>
Target 9	Alien species	<b>Biodiversity survey/appropriate control of company-owned sites</b>
Target 11	Conserve protected areas	Voluntary employee participation in forestation and other environmental conservation activities
Target 14	Ecosystem services	Voluntary employee participation in forestation and other environmental conservation activities, <b>biodiversity survey/appropriate control of company-owned sites</b>

Notes:

- Source: "Guidelines for Action by the E&E Industries concerning Biodiversity Conservation" (The Biodiversity Working Group, The 4 Electrical and Electronic Industry Associations)
- NGK activities commenced in fiscal 2016 are marked in red.

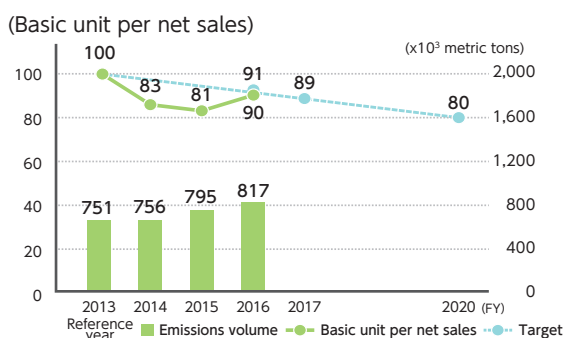


## Reduction of CO<sub>2</sub> Emissions and Discarded Materials

We achieved the fiscal 2016 targets to reduce CO<sub>2</sub> emissions from manufacturing activities by making steady progress under the Five-Year Action Plan. This accomplishment resulted from our successful efforts to carry out reduction measures as initially planned, despite the basic unit per net sales decreasing from the previous year due to a number of negative factors, such as the stronger yen, change in the product mix, and a new production line launched overseas. The reduction rate against BAU reached the 2020 target of 15%, backed by a significant improvement in the basic unit per

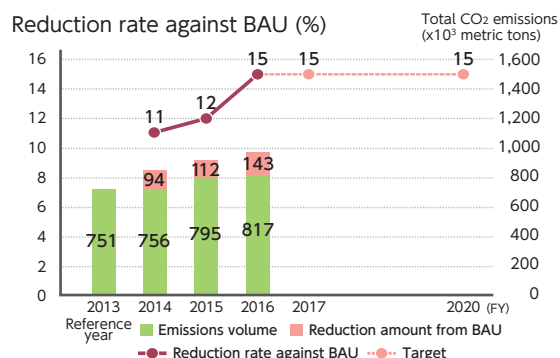
production volume. As for the reduction of discarded materials, we exceeded the annual targets, securing the basic unit per net sales at the level of the previous year, despite negative factors similar to those for reducing CO<sub>2</sub> emissions. This achievement resulted from the manufacturing division's outperforming efforts directed at an increased material utilization rate and production yield for each process and a higher recycling rate within processes. The reduction rate against BAU also saw a substantial improvement.

### CO<sub>2</sub> emissions/basic unit per net sales (NGK Group)



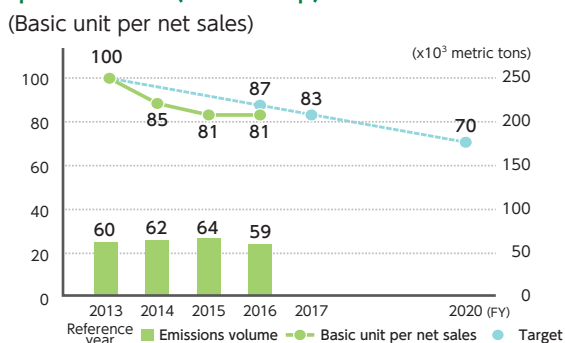
\* Basic unit per net sales calculated with the value in fiscal 2013 set at 100.

### CO<sub>2</sub> emissions/reduction rate against BAU\* (NGK Group)



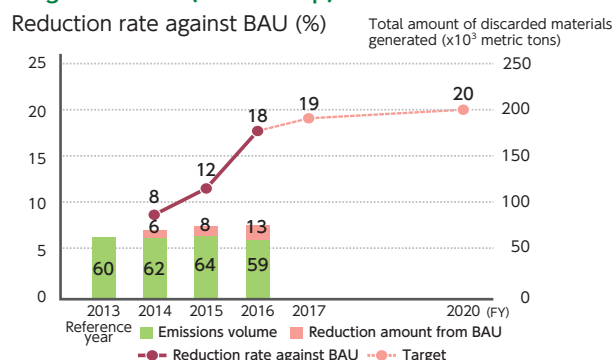
\* Reduction rate against BAU: The percentage rate of emissions reduction resulting from implemented actions against a computed value for the hypothetical absence of the actions.

### Amount of discarded materials generated/basic unit per net sales (NGK Group)



\* Basic unit per net sales calculated with the value in fiscal 2013 set at 100.

### Amount of discarded materials generated/reduction rate against BAU\* (NGK Group)



\* Reduction rate against BAU: The percentage rate of emissions reduction resulting from implemented actions against a computed value for the hypothetical absence of the actions.

## Water Resources Risk Management and Response

The NGK Group has been conducting water risk assessments for all manufacturing sites while carrying out inspections to ascertain the efficiency of water usage using guidelines aimed at managing water usage appropriately. In fiscal 2016, we newly introduced a third-party survey to provide advanced analyses for sites where concerns are identified from the internal screening. The external survey reported that no serious water risks have been identified at any surveyed site. In addition, the NGK Group asks its suppliers to practice water resources-related risk management and efficient water usage via the CSR Procurement Guidelines.

### Example of Group Company Initiatives

At NGK Ceramics Mexico, manufacturing process wastewater is filtered using reverse osmosis membranes and the recycled water is reused as coolant and boiler water or sprinkled on vegetation.



## Coordination with Local Communities and Promotion of Contribution to the Society

The NGK Group has an interest in the social issues of the countries and regions we operate in, and, with the aspiration of being a trusted corporate citizen in our communities, we are engaged in activities that give back to our communities in response to their needs in three main realms: people/education, the environment, and connecting with our regional communities.

### Supporting International Students

To do our part to contribute to training the people that will help develop our global society, NGK has established the NGK Foundation for International Students, and continues to assist international students who visit Japan by primarily providing residence for them as well as a scholarship stipend.

We are also engaged in various events that serve as an opportunity for grassroots international relations among supported students, regional communities and our employees. We offer language classes taught by international students and cross-cultural exchange meetings where international students introduce their native countries.



NGK International House, housing for international students, provided housing for 40 students from 8 countries in 2016



A welcome party for international students with NGK employees participating

Number of  
supported students  
(FY1997-2016)

Total of **752**  
students

### Efforts in Social Contribution Activities

The NGK Group aspires to be a trusted corporate citizen in our communities and we work with regional communities, NPOs, and others, to carry out social contribution activities in response to regional needs.

#### TABLE FOR TWO

NGK has participated in the TABLE FOR TWO (TFT) Program since September 2010. When a meal is ordered from the employee cafeteria's healthy menu, a donation equivalent to one school lunch (20 yen) is provided to children in Africa. This program is provided at all of the NGK cafeterias. The Group companies also participate in the TFT program through vending machines.

Cumulative total FY 2010-2016  
Equivalent of **260** thousand  
school lunches



The "Healthy Box" with reduced calories and sodium

#### Social Contribution Activities by NGK Group Companies

Employee volunteers of NGK Group companies, both in Japan and overseas, are engaged in social contribution activities within their regional communities.



Donation of Christmas presents to children in an orphanage (NGK Metals, a group company in the US)

#### Topics

#### NGK Science Site Awarded Advertising Prize

NGK, being a company involved in manufacturing, set up a website, the NGK Science Site, as a mean to communicate information to teach children, who will be the next generation of leaders, the joys of science. This website demonstrates scientific experiments, under the supervision of a specialist, and the detailed procedures that go into them.

The interesting illustrations of the experiments and their home-based set-up received acclaim, and the NGK Science Site was awarded the 38th 2017 Japan BtoB Advertising Prize, a gold prize in the category of magazine advertisements, from the Japan BtoB Advertising Association.



# Communication with Stakeholders

The NGK Group uses many opportunities to endeavor to communicate as well as build and maintain relations of trust with our various stakeholders, including our customers, suppliers, community members and our employees.

## Communication with Our Customers

As of May 2017, it has been a full 15 years since NGK began our sales of C1, a household water filter, from our desire to use the skills we have cultivated in ceramics as a top industrial ceramics manufacturer to give back to regular households. We set up a dedicated C1 customer consultation helpdesk in-house to create a process for reflecting customer feedback in our products and services. In FY 2016 we also displayed C1 at exhibition and family fairs, introducing the wonderful features of C1 to customers directly.



Customer Cards received from customers who purchased C1



C1 Home-use water purifier

## Interacting with the Regional Community

The NGK Group works to deepen relations with the members of our communities through a variety of opportunities, such as plant visit and regional events, and utilize these relations in our business and CSR activities. In addition to our Komaki office, in 2016, we also held the first Summer Festival at our Ishikawa Plant, where we deepened our relationship with the surrounding residents and expressed our gratitude to local officials.



## Communication with Our Procurement Partners

NGK holds a results review meeting every year, where we invite our main suppliers. At these results review meetings, we highlight our efforts in handling global production and CSR procurement in the supply chain, and we ask our suppliers for their cooperation and understanding with these efforts.



## Communication with Our Employees

To improve our employees' understanding of CSR and our efforts involved with that, the NGK Group holds the CSR Talk Live event where employees have the opportunity to speak directly with the top management. In 2016, as a new effort, we held a Talk Live event, where we openly solicited for participants, entitled "CSR Informed by Corporate History".



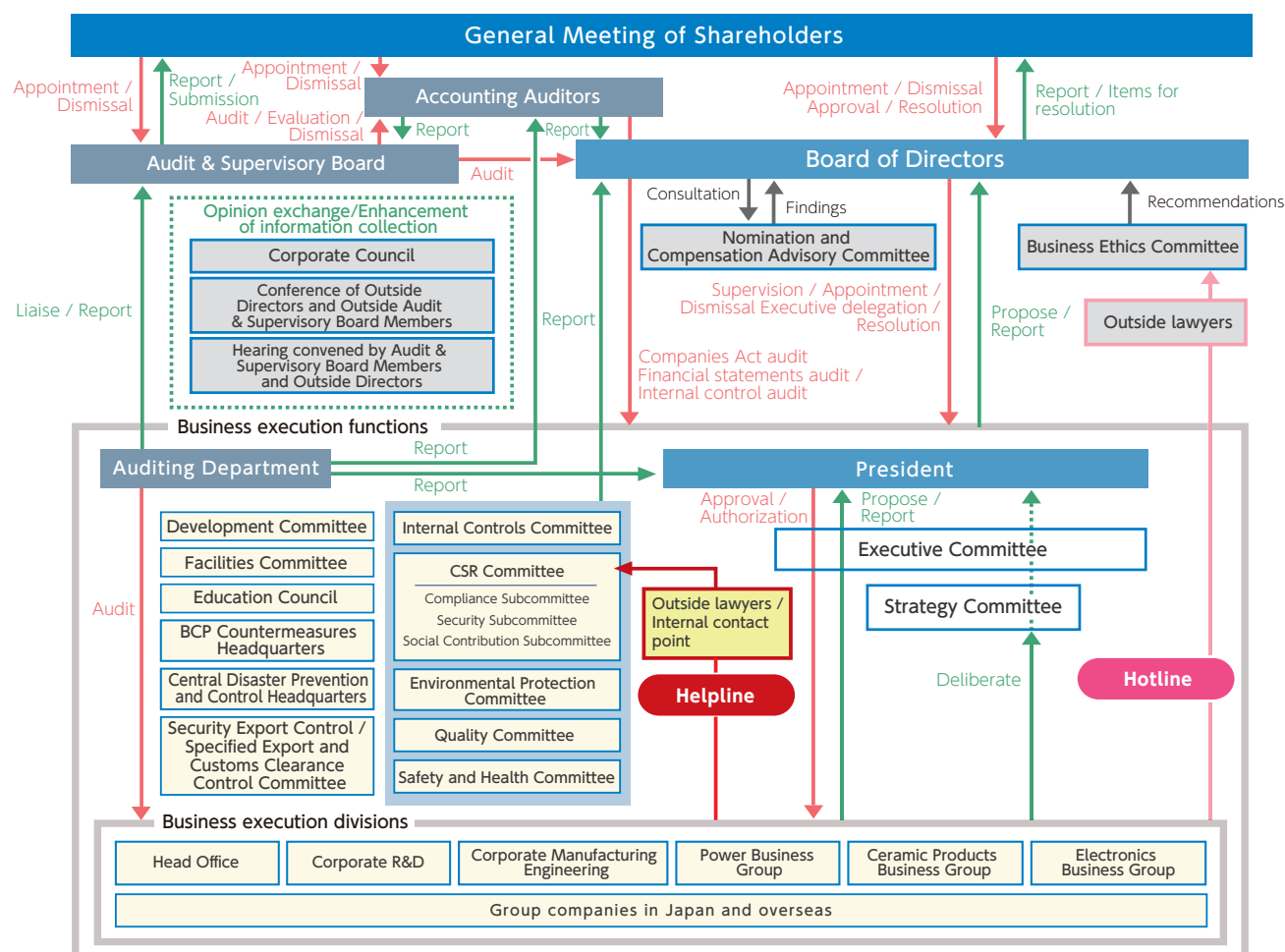


# Corporate Governance

NGK aims to become a trusted company among all of our stakeholders. At the foundation of our corporate governance is the securing of the legal compliance of our business and the transparency of our management, the formation of an organizational scheme that can swiftly respond to changes in the business environment, and the building and preserving of a fair management system that prioritizes shareholders. To these ends, NGK has selected to establish an Audit & Supervisory Board. Further, NGK has established an Executive Committee and various other committees to assist the president in decision-making and to make governance work more effectively.

## Corporate Governance System

We have built the following corporate governance scheme to secure the legal compliance of our business and the transparency of our management, to swiftly respond to changes in the business environment, and to build and preserve a fair management system that prioritizes shareholders.



### Committees to Enhance Transparency

#### Business Ethics Committee

Monitors malfeasant activity with the potential to seriously impact management.

#### Nomination and Compensation Advisory Committee

Reports on the personnel affairs and remuneration of executives.

#### Corporate Council

A venue for the free exchange of opinions by outside executives and representative directors.

#### Conference of Outside Directors and Outside Audit & Supervisory Board Members

Venue for outside executives to exchange opinions among themselves regarding management matters.

#### Hearings convened by Audit & Supervisory Board Members and Outside Directors

Venue for the collection of information on the business environment and issues.

### Whistle-Blowing System

Helpline

Hotline

We have established Helpline to receive inquiries and reports from employees aimed at curtailing and preventing activities contrary to the spirit of the NGK Group Guidelines for Corporate Behavior. We also established Hotline as an internal control system for responding to fraud and legal infractions committed by senior management, including Competition Law and Anti-Corruption laws and regulations violations.

## Comments from Outside Directors

### Understanding Compliance from a Global Perspective

In December of 2015, NGK reformed its governance scheme. In recent years the remuneration of executives has become a hot topic within corporate governance in Japan, and NGK aims to build a governance scheme to address this, including establishment of the Nomination and Compensation Advisory Committee. I also feel that NGK has overcome various problems with respect to compliance, and we are moving in a very positive direction. Originally, compliance was focused on operations in the head office however, we are now advancing to the point where NGK's wide-ranging corporate activities can be viewed from a global perspective. I believe that it is important to enliven discussion on long-term strategy to improve corporate value while citing future problems and to make efforts to optimize our corporate portfolio for the next generation. Business strategy and governance are one in the same thus, as we globalize, we will be called upon to even further strengthen our efforts in this area.



**Hiroyuki Kamano**  
Outside Director

### Remaining Incisive towards Issues Is Crucial

It has been six terms now since I became involved in the management of NGK as an outside director, and I feel that the corporate governance of NGK has progressed very well over these past few years. In the area of risk management, it is crucial to create a system that can discern risks, clarify the decision-making process, and verify and accurately respond when problems do arise. Additionally, it is also important for everyone in the company, from the management to the employees, to share an incisiveness about whether or not there is an internal problem. On this point, I feel that after repeated communication and training, the mentality of the employees has changed. Another important role for corporate governance is to endeavor for the continued success of the company. For NGK, It is important to properly refine basic technology, discern the potential of its technology and seek to apply these in new friends. Specific efforts, such as "2017 Challenge 30", are already underway, so I expect to see momentum develop there for major leaps forward in the future.



**Toshio Nakamura**  
Outside Director

### Using a Technological Perspective to Become Involved in Both the Workplace and in the Business

I have had a strong impression of NGK as a highly technical and research-oriented company from the outside. I was appointed as an outside director beginning in 2017. I hope to bring new potential to NGK when developing new technology by providing my outsider's perspective as the first technological development-related outside director. To that end, I hope to engage in discussions with the people in development and to actively visit the workplace. I also believe that I can play a role in sharing my knowledge on the culture and rules of the electronics industry from my own abundant experience in the field of electronics, when NGK further penetrates the electronics industry. I would like to contribute to the future growth of NGK from perspectives that have been absent within the company and in new ways that no one has been aware of up to now.



**Emiko Hamada**  
Outside Director





## Board of Directors

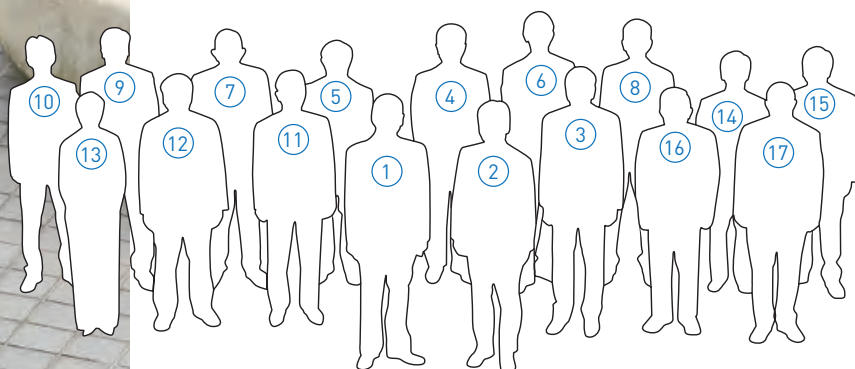
- ① **Eiji Hamamoto**  
Chairman
- ② **Taku Oshima**  
President
- ③ **Yukihisa Takeuchi**  
Executive Vice President  
Group Executive, Corporate R&D, Development Committee Chair
- ④ **Susumu Sakabe**  
Director and Senior Vice President  
Responsible for the Finance Dept. and Purchasing Dept., General Manager, Tokyo Main Office
- ⑤ **Hiroshi Kanie**  
Director and Senior Vice President  
Group Executive, Ceramic Products Business Group, General Manager, Nagoya Site
- ⑥ **Ryohei Iwasaki**  
Director and Senior Vice President  
Responsible for Corporate Strategy Office, New Business Planning Office, Secretarial Office, Corporate Communications Dept., and Human Resources Dept., Senior Officer in charge of Group Companies
- ⑦ **Hideaki Saito**  
Director and Senior Vice President  
Group Executive, Power Business Group, General Manager, Komaki Site

- ⑧ **Shuhei Ishikawa**  
Director and Senior Vice President  
Group Executive, Electronics Business Group, General Manager, Electronic Components Div., Electronics Business Group
- ⑨ **Nobumitsu Saji**  
Director and Senior Vice President  
Responsible for Auditing Dept., Group Compliance Dept., Legal Dept., Intellectual Property Dept., and General Affairs Dept., CSR Committee Chair, Internal Controls Committee Chair, and General Manager, Osaka Site
- ⑩ **Chiaki Niwa**  
Director and Senior Vice President  
Group Executive, Corporate Manufacturing Engineering, Responsible for Environmental Management Dept. Quality Management Dept. and Safety and Health Management Dept., Facilities Committee Chair, NGK Environmental Protection Committee Chair, Quality Committee Chair, and Safety and Health Committee Chair
- ⑪ **Hiroyuki Kamano**  
Outside Director
- ⑫ **Toshio Nakamura**  
Outside Director
- ⑬ **Emiko Hamada**  
Outside Director

## Auditors and Supervisory Board

- ⑭ **Takeyuki Mizuno**  
Audit & Supervisory Board Member
- ⑮ **Ken Sugiyama**  
Audit & Supervisory Board Member
- ⑯ **Setsuo Tanaka**  
Audit & Supervisory Board Member, Outside
- ⑰ **Ichiro Terato**  
Audit & Supervisory Board Member, Outside





## Executive Officers



**Hiroshi Kurachi**  
Senior Vice President  
General Manager,  
Engineering Div., General  
Manager, Sensor Div.,  
Ceramic Products  
Business Group



**Takaya Teshima**  
Senior Vice President  
Group Vice Executive,  
Electronics Business  
Group, General Manager,  
Chita Site



**Atsushi Matsuda**  
Senior Vice President  
General Manager, Worldwide  
Sales & Marketing Div., Ceramic  
Products Business Group,  
General Manager, Overseas  
Sales Dept., Worldwide Sales &  
Marketing Div., Ceramic  
Products Business Group



**Hiroto Matsuda**  
Vice President  
General Manager,  
Manufacturing Div.,  
Ceramic Products  
Business Group



**Hiroyuki Tsuji**  
Vice President  
General Manager,  
Manufacturing Engineering  
Dept., Corporate  
Manufacturing Engineering



**Tomohiro Yamada**  
Vice President  
President, NGK  
Electronics Devices Inc.



**Tadaaki Yamada**  
Vice President  
General Manager, Human  
Resources Dept.



**Akira Katoh**  
Vice President  
General Manager, New  
Metals Div., Electronics  
Business Group



**Shigeru Kobayashi**  
Vice President  
Group Vice Executive,  
Power Business Group,  
General Manager,  
Insulator Div., Power  
Business Group



**Tsutomu Nanataki**  
Vice President  
Group Vice Executive,  
Corporate R&D, Project  
Leader, Functional  
Materials Development  
Project, Corporate R&D



**Masanobu Inoue**  
Vice President  
General Manager,  
Industrial Process Div.,  
Ceramic Products  
Business Group



**Hiroharu Kato**  
Vice President  
President, NGK EUROPE  
GmbH

# Corporate Outline

## Company Name

NGK INSULATORS, LTD.

## Established

May 5, 1919

## Address

2-56 Suda-cho, Mizuho,  
Nagoya 467-8530, Japan  
Telephone + (81) 52-872-7181

## Paid-In Capital

69.8 billion yen  
(As of March 31, 2017)

## Net Sales

401.3 billion yen  
(Consolidated, for FY2016)

## Employees

NGK

Full-time: 3,937 (As of March 31, 2017)

Contract & Temporary: 516 (Avg. in FY2016)

Consolidated

Full-time: 17,517 (As of March 31, 2017)

Contract & Temporary: 3,451 (Avg. in FY2016)

## Business Development by Region

(As of March 31, 2017)

NGK INSULATORS, LTD.

58 consolidated subsidiaries

2 equity-method affiliates

21 in Japan

14 in North/Central America

6 in Europe

17 in Asia and elsewhere

## Organization

### Power Business Group

- Business Planning Dept.
- Sales and Marketing Div.
- Sales Dept.
- Insulator Div.
- Electrical Equipment Dept.
- NAS Battery Div.
- Quality Assurance Dept.

### Ceramic Products Business Group

- Business Planning Dept.
- Worldwide Sales and Marketing Div.
- Engineering Div.
- Manufacturing Div.
- Sensor Div.
- Industrial Process Div.
- Quality Assurance Dept.

### Electronics Business Group

- Business Planning Dept.
- High Performance Ceramics Div.
- New Metals Div.
- Electronic Components Div.
- Quality Assurance Dept.

### Head Office

- Auditing Dept.
- Environmental Management Dept.
- Quality Management Dept.
- Safety and Health Management Dept.
- Corporate Strategy Office
- New Business Planning Office
- Secretarial Office
- Corporate Communications Dept.
- Human Resources Dept.
- Group Compliance Dept.
- Finance & Accounting Dept.
- Legal Dept.
- Intellectual Property Dept.
- General Affairs Dept.
- Purchasing Dept.

### Corporate R&D

- Business Planning Dept.
- Wafer Project
- NCM Project
- Functional Materials Development Project
- SOFC Project
- ZNB Project
- Materials Research Laboratory
- Future Technology Management Center

### Corporate Manufacturing Engineering

- Administration Dept.
- Manufacturing Engineering Dept.
- Information Technology Dept.
- Construction & Maintenance Dept.

# Global Network (List of Group Companies)

## Japan

### ENERGY SUPPORT CORPORATION

Manufacture and sale of power distribution equipment etc.

### AKECHI INSULATORS, LTD.

Manufacture of insulators for power distribution and other ceramic products

### IKEBUKURO HORO KOGYO CO., LTD.

Design and manufacture of glass-lined apparatus

### NGK CHEM-TECH, LTD.

Sale and maintenance services for corrosion-resistant equipment and glass linings

### NGK FILTECH, LTD.

Design and manufacture of pharmaceutical water purification systems and membrane filtration systems

### NGK ADREC CO., LTD.

Manufacture of refractories

### NGK KILNTECH CORPORATION

Design, manufacture, and sale of heating devices

### SOSHIN ELECTRIC CO., LTD.

Manufacture and sale of electronic components for communication devices

### NGK ELECTRONICS DEVICES, INC.

Manufacture and sale of ceramic packages, functional circuit boards, and electronic functional components

### NGK CERAMIC DEVICE CO., LTD.

Manufacture of electronic functional components

### NGK OKHOTSK, LTD.

Manufacture of jigs for ceramics production

### NGK METEX CORPORATION

Processing of beryllium copper wrought products

### NGK FINE MOLDS, LTD.

Manufacture and sale of metal molds

### NGK SPORTS PLANNING CO., LTD.

Management of tennis clubs and golf ranges

### NGK LIFE CO., LTD.

Insurance agency service and golf course management

### NGK YU-SERVICE CO., LTD.

Welfare and business services

### NGK LOGISTICS, LTD.

Transportation and storage of products, raw materials, and equipment

### NGK BUILDING SERVICE, LTD.

Building administration and maintenance

## North America

### LOCKE INSULATORS, INC.

Manufacture of insulators for substations

### NGK-LOCKE INC.

Sale of insulators and other products related to energy supply

### NGK-LOCKE POLYMER INSULATORS, INC.

Manufacture of polymer insulators

### NGK CERAMICS USA, INC.

Manufacture of automotive ceramics

### NGK AUTOMOTIVE CERAMICS USA, INC.

Sale of automotive ceramics

### FM INDUSTRIES, INC.

Processing and coating of metal modules for semiconductor manufacturing equipment; manufacture of modules

### NGK ELECTRONICS USA, INC.

Sale of ceramics for semiconductor manufacturing equipment

### NGK METALS CORPORATION

Manufacture and sale of beryllium copper products

### NGK INSULATORS OF CANADA, LTD.

Sale of insulators and other products related to energy supply and automotive ceramics

### NGK CERAMICS MEXICO, S. DE R.L. DE C.V.

Manufacture of automotive ceramics

## Europe, Africa

### NGK BERLCO U.K. LTD.

Processing and sales of beryllium copper products

### NGK CERAMICS EUROPE S.A.

Manufacturing of automotive ceramics

### NGK EUROPE GMBH

Sales of automotive ceramics etc.

### NGK DEUTSCHE BERYLCO GMBH

Sales of beryllium copper products

### NGK BERYLCO FRANCE

Manufacturing and sales of beryllium copper products

### NGK CERAMICS POLSKA SP. Z O.O.

Manufacturing of automotive ceramics

### NGK CERAMICS SOUTH AFRICA (PTY) LTD.

Manufacturing and sales of automotive ceramics

## Asia, Others

### NGK INSULATORS TANGSHAN CO., LTD.

Manufacture and sale of insulators for power transmission

### NGK INSULATORS (CHINA) INVESTMENT CO., LTD.

Sale of insulators and other products related to energy supply and beryllium copper products

### NGK CERAMICS SUZHOU CO., LTD.

Manufacture and sale of automotive ceramics

### NGK TECHNOCERA SUZHOU CO., LTD.

Design, manufacture, and sale of heating devices; sale of refractories

### NGK AUTOMOTIVE CERAMICS KOREA CO., LTD.

Sale of ceramics for automobiles and semiconductor manufacturing equipment

### P.T. NGK CERAMICS INDONESIA

Manufacture and sale of automotive ceramics

### NGK CERAMICS (THAILAND) CO., LTD.

Manufacture and sale of automotive ceramics

### SIAM NGK TECHNOCERA CO., LTD.

Manufacture and sale of refractories

### NGK TECHNOLOGIES INDIA PVT. LTD.

Sale of automotive ceramics and beryllium copper products

### NGK STANGER PTY. LTD.

Manufacture and sale of power distribution equipment; sale of insulators for power distribution/transmission



**Deloitte**

デロイト トーマツ

(TRANSLATION)

Independent Practitioner's Assurance Report

July 25, 2017

Mr. Taku Oshima,  
President,  
NGK Insulators, Ltd.

Masahiko Sugiyama  
Representative Director  
Deloitte Tohmatsu Sustainability Co., Ltd.  
3-3-1, Marunouchi, Chiyoda-ku, Tokyo

We have undertaken a limited assurance engagement of the energy-origin CO<sub>2</sub> emissions on a non-consolidated basis on page 45 (the "CO<sub>2</sub> information") for the year ended March 31, 2017 included in the "NGK Group NGK Report 2017" (the "Report") of NGK Insulators, Ltd. (the "Company").

**The Company's Responsibility**

The Company is responsible for the preparation of the CO<sub>2</sub> information in accordance with the calculation and reporting standard adopted by the Company (the Report page 45). CO<sub>2</sub> quantification is subject to inherent uncertainty for reasons such as incomplete scientific knowledge used to determine emissions factors and numerical data.

**Our Independence and Quality Control**

We have complied with the independence and other ethical requirements of the Code of Ethics for Professional Accountants issued by the International Ethics Standards Board for Accountants, which is founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behavior. We apply International Standard on Quality Control 1, *Quality Control for Firms that Perform Audits and Reviews of Financial Statements, and Other Assurance and Related Services Engagements*, and accordingly maintain a comprehensive system of quality control including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

**Our Responsibility**

Our responsibility is to express a limited assurance conclusion on the CO<sub>2</sub> information based on the procedures we have performed and the evidence we have obtained. We conducted our limited assurance engagement in accordance with the International Standard on Assurance Engagements ("ISAE") 3000, *Assurance Engagements Other than Audits or Reviews of Historical Financial Information*, issued by the International Auditing and Assurance Standards Board ("IAASB"), ISAE 3410, *Assurance Engagements on Greenhouse Gas Statements*, issued by the IAASB and the *Practical Guideline for the Assurance of Sustainability Information*, issued by the Japanese Association of Assurance Organizations for Sustainability Information.

The procedures we performed were based on our professional judgment and included inquiries, observation of processes performed, inspection of documents, analytical procedures, evaluating the appropriateness of quantification methods and reporting policies, and agreeing or reconciling with underlying records. These procedures also included the following:

- Evaluating whether the Company's methods for estimates are appropriate and had been consistently applied. However, our procedures did not include testing the data on which the estimates are based or reperforming the estimates.
- Undertaking site visits to assess the completeness of the data, data collection methods, source data and relevant assumptions applicable to the sites.

The procedures performed in a limited assurance engagement vary in nature and timing from, and are less in extent than for, a reasonable assurance engagement. Consequently, the level of assurance obtained in a limited assurance engagement is substantially lower than the assurance that would have been obtained had we performed a reasonable assurance engagement.

**Limited Assurance Conclusion**

Based on the procedures we have performed and the evidence we have obtained, nothing has come to our attention that causes us to believe that the Company's CO<sub>2</sub> information is not prepared, in all material respects, in accordance with the calculation and reporting standard adopted by the Company.

The above represents a translation, for convenience only, of the original Independent Practitioner's Assurance report issued in the Japanese language.

Member of  
Deloitte Touche Tohmatsu Limited

## Third Party Opinion



**Mr. Koichi Ikeda**

Visiting Professor  
Management School  
Ritsumeikan University

As the integrated report—a report that presents financial and non-financial information (such as CSR) in an integrated fashion—becomes a pressing task for, at the very least, globally-active companies, so the search for the proper way to accomplish this continues across the world.

With their second integrated report this year, NGK has masterfully shown through their NGK Report 2017 how to best accomplish this task. Indeed this report gets to the point and in a succinct way. The NGK Report 2017 (pamphlet) not only carefully selects the high priority issues from among the voluminous and diverse events happening currently, to happen in the future and having happened along their journey from the founding of the NGK Group, but they presented this information in a clear and easy-to-understand format using wording and illustrations that are succinct and dead on their mark. It hardly needs to be said that readers can search for more information on the NGK website.

Their top commitment is a declaration to aspire for sustained growth going into the future through the cultivation of three factors: their unique strengths, such as advanced technical capacity in ceramics since their founding, their people, who are the foundation for their growth, and a sustainable future, which holds the NGK Group's business activities and the solutions for the social problems of our day to be one and the same. This declaration from the management succinctly gets to the point even more.

Moreover, the company-wide efforts towards sustained growth, such as the New/reformed manufacturing structured initiatives to improve competitive edge in the medium to long terms, and the "2017 Challenge 30" that sets new product ratios of sales to above 30%, as well as the business overviews of the three business groups (Power, Ceramic Products, Electronics) are succinctly and clearly presented. This is especially the case with the business overviews of the three business groups, where the performance trends, outlooks, main products, FY2016 business conditions, FY2017 issues and initiatives, as well as the future prospects and efforts, which are plagued by uncertainty, are laid out in a simple, yet richly appealing form.

Additionally, the fact that they present themselves to be moving full-steam ahead with the pertinent efforts (such as their human rights initiatives with the start of their human rights due diligence, their general employee HR system reform carried out in April 2017 to allow all employees—from young hires to veterans—to work with more purpose, and their continued promotion of CSR procurement in their supply chain) they have selected amidst the on-going internal and external changes in the business environment speaks to the trustworthiness of the NGK Group. In conjunction with this, they make special mention of the increased intensity of their efforts towards the environment that they have been so committed to advance up to now—specifically that they are moving on track to reach the goal of the final year of their Five-Year Environmental Action Plan with the growth rate of sales of Products contributing to environmental protection.

In the future, I have expectations that they will level and even out the report content that varies in density here and there, and attempt to compile an even more succinct and to-the-point integrated report, so that they may incisively discern and swiftly adapt to the dynamics of the global business environment and continue to keep ahead of the competition.

## External Evaluation

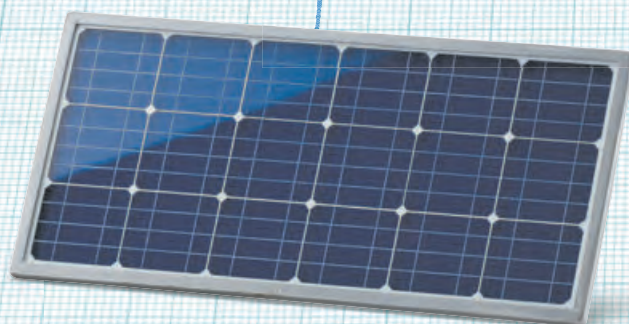
NGK was selected for the first time in September 2016 for the Dow Jones Sustainability Asia Pacific Index in the Dow Jones Sustainability Indices, a major index for socially-responsible investment.

MEMBER OF  
**Dow Jones  
Sustainability Indices**  
In Collaboration with RobecoSAM





← Renewable energy



**NGK INSULATORS, LTD.**

2-56, Suda-cho, Mizuho, Nagoya 467-8530, Japan

For inquiries about this report, please contact

**Corporate Communications Department**

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E-mail: pr-office@ngk.co.jp

Fax: +(81) 52-872-7690

<http://www.ngk.co.jp/english/>

Published in September 2017

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**Plate making:** This report has been published using computer-to-plate (CTP) technology to eliminate the need for the film and other materials required in the conventional platemaking process.

**Printing:** A waterless printing method has been adopted to significantly reduce the usage of developer chemicals and processing water, thereby decreasing the amount of hazardous effluent, compared with conventional methods.

**Ink:** To replace petroleum-based inks, vegetable-based inks with the volatile organic compounds (VOCs) content reduced to below 1% have been employed.

**Design:** This report has been designed, with a focus on typeface, color scheme and diagram style, to improve legibility and readability.

