SINCE 1919 YEARS

NGK INSULATORS, LTD.

NGK Report 2019

NGK Group Philosophy

Our Mission

Enriching Human Life by Adding New Value to Society.

Our Values

Quality of People	**Embrace challenges and teamwork.**
Quality of Product	**Exceed expectations.**
Quality of Management	**Social trust is our foundation.**

CONTENTS

Establishing the NGK Group Philosophy

The NGK Group has used the occasion of our 100th anniversary to take a new look at the philosophical framework and established the NGK Group Philosophy. Simply put, we seek to capitalize on our history of diversification and global expansion within many different industrial fields, driven by our unique ceramics technology, in order to contribute to the future for energy, the protection of the globalization, and advances in industrialization, all for the sake of bringing happiness and wellbeing into the lives of people everywhere.

We made the NGK Group Philosophy straightforward and concise so that it can be easily understood by the NGK Group's many and varied employees throughout Japan and around the world. We hope that it will serve as the foundation for all members of the NGK Group to act in unity and with a common purpose so that we can achieve our best performance.

Visit the "About NGK" section of our website to read the NGK Group Philosophy.
https://www.ngk-insulators.com/en/info/governance/

Editorial Policy

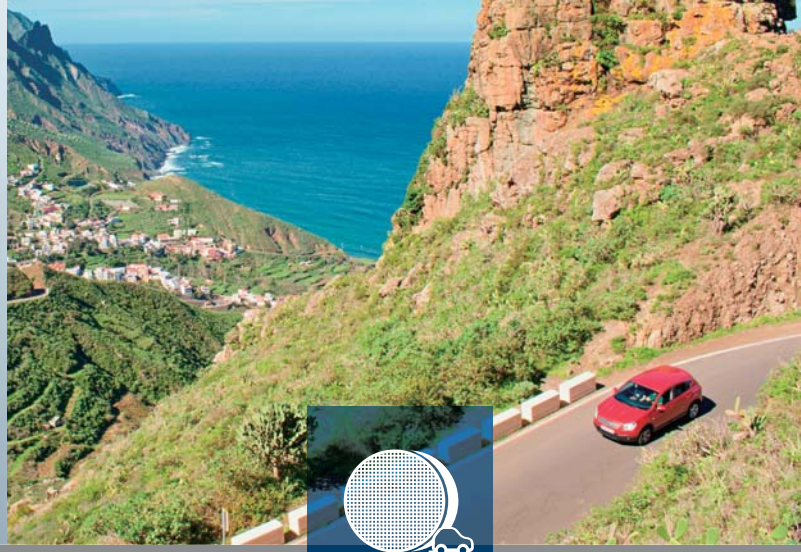
The publication of the NGK Report 2019 is carried out with the intent of communicating to our stakeholders what strengths the NGK Group has to offer, how we are creating value, how we plan to grow further, and how we are contributing to sustainable development of society and the entire world. This report has been prepared and edited in line with the International Integrated Reporting Framework of the International Integrated Reporting Council (IIRC) and the Guidance for Collaborative Value Creation of Japan's Ministry of Economy, Trade, and Industry. Detailed ESG information can be found in the NGK Sustainability Data Book 2019.

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

Target Period April 1, 2018 to March 31, 2019

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.



NOx sensors

NGK has developed the world's first in-vehicle sensor capable of measuring the concentration of NOx (nitrogen oxide) contained in automotive exhaust at the ppm (parts per million) level.

HONEYCERAM®, Gasoline particulate filters (GPFs)

HONEYCERAM ceramic catalyst carriers neutralize the harmful substances in automotive exhaust. Gasoline particulate filters (GPFs) are ceramic filters that remove particulate matter from the exhaust of gasoline engines. Both of these products have a honeycomb design that results in a large surface area—the area that comes in contact with the exhaust—and a very compact installation.

Offering Unique Ceramics Technology

Here at the NGK Group, we seek to harness the strengths of our core ceramic technologies to pursue opportunities in the energy, ecology, and electronics sectors. Through our activities relating to power supply, ceramics, electronics and process technology, we strive to meet the ever-changing needs of society.

NAS® battery systems

NGK manufactures megawatt-level electric power storage systems with superior features including large capacity, high energy density, and long service life. They are utilized in stabilizing output from wind and solar power generators while proving useful to the spread of renewable energies and the establishment of smart grids.

EnerCera®

EnerCera is an ultra-compact, ultra-thin lithium-ion secondary battery ideal for power sources for a range of IoT devices such as IC cards. Because it is a semi-solid battery using NGK's proprietary crystal-oriented ceramic plate for electrodes, it is highly heat resistant and can supply large current.

Bonded wafers for SAW filters, Gallium nitride (GaN) wafers

Bonded wafers give high performance to the electronic components that precisely select radio waves of a certain frequency in communication devices such as smartphones. Gallium nitride (GaN) wafers give lasers higher output and contribute to the realization of 5G. These substrates for electronic devices, driven by proprietary crystal growth technology, will further revolutionize the era of IoT and 5G.

Beryllium copper

Beryllium-copper alloys, which add the strength and durability of special steel to copper's characteristic heat and electrical conductivity, are used in mobile phones, automobiles, industrial machinery, and a host of other things in order to make a major contribution to improving reliability while reducing product size and weight.

to Provide Society with New Value

For details on our proprietary ceramic technologies, visit the "Competitive Strength" section on our website.
https://www.ngk-insulators.com/en/sustainability/value02.html

For details, visit the "Products" section of our website.
https://www.ngk-insulators.com/en/product/index.html
Or, refer to the "Corporate Profile".
https://www.ngk-insulators.com/en/resource/pdf/info/company_en_201901.pdf

Ceramics for semiconductor manufacturing equipment

By leveraging the features of ceramics, NGK is able to make a range of ceramic products for semiconductor manufacturing processes that are exposed to high-temperature corrosive gases and plasma.

Industrial machinery and devices

The breadth of NGK technologies, which were honed over long years of experience in producing ceramics, allows us to provide industrial machinery and devices in a wide range of fields, from kilns to pumps and valves and even low-level radioactive waste treatment systems.

A Century of Continued and Unwavering Commitment

May 2019 marked the 100th anniversary of NGK Insulators' establishment. It is practically impossible to compare NGK Insulators at its birth with what it, and the NGK Group, have grown to become over the past 100 years. Nevertheless, there are some things about NGK that remain the same today as they were 100 years ago. These are our three commitments to globalization, quality, and diversification. It has been through the unwavering cultivation of these three aspects that the NGK Group has become what it is today.

First president, Kazuchika Okura

Global Business Development

The management of NGK has been focused on global growth since the very beginning. Nippon Toki (now Noritake Co., Ltd.), the company from which the NGK Group was born, began as an exporter of Japanese ceramics. The company's first president, Kazuchika Okura, had experience living and working overseas.

This growth began in 1931, following the start of the Great Depression. Demand within Japan was declining, so NGK sought out new markets in North America, starting with small shipments to Canada of insulators for electrical machinery. By 1935, around 12% of NGK's products were being shipped overseas.

The outbreak of the Sino-Japanese War in 1936 made it impossible for NGK to pursue its plans for international expansion, but thanks to collaboration between labor and management, NGK was able to overcome the postwar chaos and resume exports after the war's end. In time, NGK was able to expand its sales channels overseas, with major insulator orders coming from America in 1953 and then from Sweden in 1954, culminating ultimately in NGK becoming the world's top insulator manufacturer.

These days, the NGK Group has secured the world's top market share for a host of products, such as insulators, ceramics for purifying automobile exhaust, and beryllium-copper alloy products. More than 70% of all our sales come from overseas. The NGK Group will continue to maintain the commitment that has been with us since our founding to keep expanding in the global market.

Quality Improvement

The key impetus for the NGK Group's strong commitment to quality control came in 1921 when a shipment of NGK suspension insulators delivered to a major power company were tested alongside those of an American manufacturer. Although the NGK insulators performed as well or better than the American insulators, their quality was shown to be uneven.

Because of these results, the head of the manufacturing department, Magoemon Ezoe, wrote

Prologue

Birth of NGK Insulators

"We do this to serve our country, and not for our own profit."

The history of the NGK Group all starts with this resolution made by our first president, Kazuchika Okura.

It was 1905, and electrical power was rapidly being adopted throughout Japan. Nippon Toki was presented with a piece of an American-made insulator. The majority of the special high-voltage insulators essential to power transmission equipment were only available as expensive imports. So an engineer at Shibaura Seisakusho (now Toshiba) asked Nippon Toki to apply its technical know-how to developing Japan-made insulators. Some within Nippon Toki were opposed to taking the company in this new direction, but it was Kazuchika Okura, who was one of the executives of Nippon Toki at the time, who led the push to take the company into the insulator business. Okura's motivation was rooted in a desire to make a contribution to the country.

After overcoming a multitude of technological difficulties, Nippon Toki developed a ceramic insulator. This insulator saw such rapid growth in sales that in 1919 the decision was made to spin off the insulator division as a separate company. NGK Insulators, Ltd., the head company of today's NGK Group, was born.

A piece of the insulator that sparked the foundation of NGK Insulators

1919

NGK Insulators was established in order to manufacture the special high-voltage insulators for the domestic market that were key to the modernization of Japan.

memorandum entitled, “Achieving Insulator Uniformity,” about what NGK needed to do in order to achieve uniformity in insulator quality. This led to the introduction of across-the-board technological improvements, including raw material, base material, and manufacturing process improvements, which in turn resulted in improved product quality. Before long, these improvement efforts were codified into company policy. This had the effect of not only improving product quality but also reducing costs.

The continued pursuit of uniformity helped create the basis upon which NGK could build its reputation as the world’s top insulator manufacturer in the postwar years, as well as establish a foundation upon which a variety of distinctive technologies and innovative products have been developed. Quality uniformity continues to be one of the defining attributes of the NGK Group.

Diversification

Business diversification within the NGK Group began as early as 1921, not long after our establishment. This first attempt at diversification centered on the development of a plug for airplanes. It was the result of a visit by the head of the manufacturing department, Magoemon Ezoe, to an automotive plug manufacturing factory in America. To Ezoe, this large-scale factory, which made 1.5 million plugs a week represented a vision of the future motorization of Japan.

By 1923, NGK had finished development of a plug that was problem-free in terms of performance but which could not be produced with consistent quality using the manufacturing processes of the time. Full-scale market expansion was put off for the future.

NGK’s first diversified product was acid-proof ceramic for the chemical industry. Although trial production was carried out in 1922, mass production did not begin until 1930, when the Great Depression and the accompanying drop in insulator demand prompted NGK to undertake commercialization. Although these ceramic products had complicated shape requirements, a way was found to apply the production technology for large, hollow insulators to their commercialization. The amount of orders received began to increase from 1931 onward.

Also, sales channels began to be established for the NG spark plug, which was released in 1930. This product diversification helped in the recovery of NGK business performance, particularly in the rapidly growing spark plug business. As a result, NGK Spark Plug was spun off as an independent company in 1936.

New product development focused on diversification has been actively pursued by NGK ever since, but it was during the postwar period of rapid economic growth in Japan that many of our current mainstay products were first developed. In 1955, we extracted beryllium oxide from the beryl used as a raw material in the glaze for our insulator and developed a beryllium-copper master alloy, which we put into production. In 1968, we developed HICERAM® translucent alumina ceramic. In 1976, we began production of HONEYCERAM® honeycomb catalyst substrate for controlling automotive emissions. This marked our full-scale entry into the automotive parts industry.

The background to NGK’s product diversification was that in order to secure its position at the top of the global insulator industry and achieve further growth, it would have to expand business other than insulators. The president at the time, Sanji Nobuchi, put forward the 6:4 plan, whereby 60% of NGK business would come from insulators, while 40% would come from elsewhere. Diversification-focused new product development has continued ever since.

Currently, the NGK Group’s core products are related to automotive parts and semiconductor manufacturing equipment. New and innovative products—such as the EnerCera® chip-type ceramic secondary battery, NAS® batteries, and gallium nitride (GaN) wafers—are coming out one after another. The NGK Group will keep utilizing the century’s worth of ceramics technology that we have cultivated to achieve ever higher levels of growth.

A 100-Year History

Historical Timeline of Our Company

1919
NGK Insulators, Ltd. is established as a spin-off from Nippon Toki's Insulator Division.

1936
NGK Spark Plug Co., Ltd. is established as a spin-off from NGK's Spark Plug Division.

1942
Construction of Chita Plant, located in Handa, Aichi, is completed.

1962
Construction of Komaki Plant, located in Komaki, Aichi, is completed.

1919

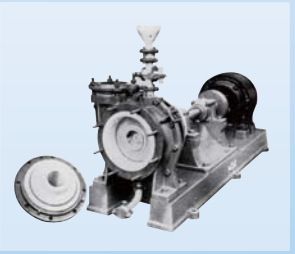
Historical Timeline of Our Products

1919
NGK Insulators, Ltd. is established to produce special high-voltage insulators to support the modernization of society in Japan.

1930
Production of the NG Spark Plug begins. (Renamed the NGK Spark Plug in 1934.)

1931
First deliveries of acid-proof pumps are made.

High-voltage insulator



Acid-proof pump

For 100 years, the NGK Group has used its unique ceramic technologies to produce high-quality products for use in a wide range of business fields, in the process expanding its market from Japan to around the world. Let's take a look back at our 100 years of history and products.

1965
NGK Insulators of America, Ltd. (now NGK-Locke Inc.), NGK's first overseas subsidiary, is established.

1973
Locke Insulators, Inc. is established jointly with the U.S.-based General Electric Company and begins production in the U.S.

1974
The Insulator Museum at the High Voltage Laboratory is completed.

1977
NGK Europe S.A. is established in Belgium.

1984
NGK Electronics is established.

1985
NGK Ceramics Europe S.A. is established and begins production of HONEYCERAM® in Belgium.

1980

1958
Production of beryllium-copper master alloy begins.

1971
Production and sale of HICERAM® translucent alumina ceramic begins.

1974
First deliveries of roller hearth kilns are made.

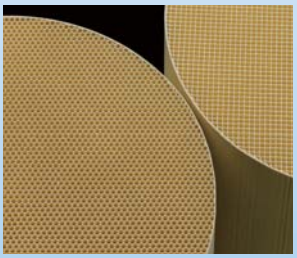
1976
Production of HONEYCERAM, a honeycomb catalyst substrate for controlling automotive emissions, begins.

1978
First deliveries of low-level radioactive waste incineration systems are made.
1,000 kV-class (ultra-high voltage) 70- and 84-ton suspension insulators are developed.

1982
Production of O_2 sensors begins.

Beryllium-copper master alloy


HICERAM translucent alumina ceramic


HONEYCERAM


Low-level radioactive waste incineration system

1986
The company name in Japanese is changed.
NGK Metals Corporation is established in the U.S.

1988
NGK Ceramics USA, Inc. is established and begins production of HONEYCERAM in the U.S.

1991
Capital participation in Soshin Electric Co., Ltd.

1996
NGK Insulators Tangshan Co., Ltd. is established to produce insulators in China.

P.T. NGK Ceramics Indonesia is established to produce HONEYCERAM in Indonesia.

1998
The NGK Foundation for International Students is established.

1999
International House (now NGK International House, lodgings for international students) is established.

2000
NGK Ceramics South Africa (Pty) Ltd.
is established in South Africa.

2001
NGK Ceramics Suzhou Co., Ltd. (ACC)
is established in China.

NGK Technocera Suzhou Co., Ltd.
is established in China.

2000

1984
Research on NAS® battery begins.

1989
Production of diesel particulate filters (DPFs) begins.

1996
Mass production of ceramics for semiconductor manufacturing equipment begins.

Production of in-vehicle high-precision NOx sensors begins.

2002
C1® home-use water purifier is launched.

2003
Mass production of NAS batteries begins.

2012
Production of gasoline particulate filter (GPF) begins.


Ceramics for semiconductor manufacturing equipment

In-vehicle high-precision NOx sensors

NAS battery systems

Gasoline particulate filter (GPF)

We've put up a special website to commemorate our 100th anniversary.
Visit this website to learn more about our century of history. **https://www.ngk-global.com/100th/en/**

2002
Management rights to FM Industries, Inc. in the U.S. are acquired.

2003
NGK Ceramics Polska Sp. z o.o. (ACP) is established to produce DPFs in Poland .

2008
NGK decides to construct a new facility for HONEYCERAM production in Nomi, Ishikawa.

NGK Ceramics Mexico, S. de R. L. de C. V. is established.

2011
NGK Innovation Laboratory is established at the Nagoya Institute of Technology.

2015
Nippon Steel & Sumikin Electronics Devices Inc. becomes a group company as NGK Electronics Devices, Inc.

NGK Ceramics (Thailand) Co., Ltd. is established to produce HONEYCERAM® and DPFs in Thailand.

2018
A new plant in Tajimi, Gifu Prefecture is built to produce ceramics for semiconductor manufacturing equipment.

2020

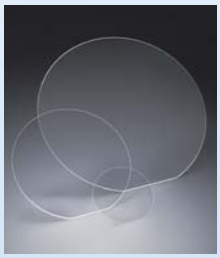
2014
Production of bonded wafers for SAW filters begins.

World's no. 1 market share

2015
Piezoelectric micro-actuators for hard disk drives (HDDs) are commercialized.

World's no. 1 market share

2016
Mass production of copper-nickel-tin alloy begins.

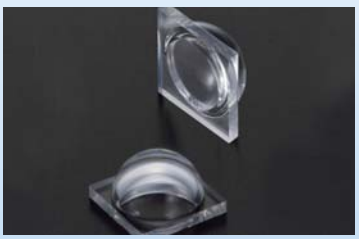


Gallium nitride (GaN) wafer

Piezoelectric micro-actuator for HDDs

2018
- Microlens for ultraviolet LEDs is commercialized.
- Gallium nitride (GaN) wafer for laser light is commercialized.

2019
- EnerCera® series chip-type ceramic secondary battery is commercialized.



Microlens for ultraviolet LEDs

EnerCera series chip-type ceramic secondary battery

Promising new products

Zinc rechargeable battery

Solid oxide fuel cell (SOFC) module

CO_2 separation membrane (subnano-ceramic membranes)

Using Advanced Technology to Power a Unique "Value Creation Engine"

Thanks to the unique ceramics technology it has cultivated over many years, the NGK Group is able to develop a wide variety of high-quality products that it seeks to offer in a growing range of overseas markets. As a result, the NGK Group creates diverse value, which helps to address society's challenges.

Society's challenges

- Social infrastructure building
- Spread and expansion of renewable energy
- Environmental pollution prevention
- IT innovation

Input (fiscal 2018)

Financial capital

- Total assets 863.6 billion yen
- Cash and cash equivalents 124 billion yen

Manufactured capital

- Capital expenditures 105.3 billion yen
- Tangible fixed assets 326.1 billion yen

Intellectual capital

- Investment in R&D 23.3 billion yen
- Number of patents held 4,346

Human capital

- Employees 20,000 people

Social and relationship capital

- Consolidated subsidiaries Domestic 21 companies, Overseas 36 companies

Natural capital

- Electricity 930,000 MWh
- Gas 142 million Nm³
- Oil 2.11 million liters
- Raw materials 180,000 metric tons
- PRTR-listed substances 694 metric tons
- Water 4.53 million m³

Value creation engine of the NGK Group

NGK Group Philosophy

Enriching Human Life by Adding New Value to Society.

Quality improvement

Ceramics technology

See "Competitive Strength" on our website.

Diversification

Global business development

Corporate governance

▸▸See pp. 47–54 "Corporate Governance."

Reference URL		
	Competitive Strength	https://www.ngk-insulators.com/en/sustainability/value02.html
	Business Overview	https://www.ngk-insulators.com/en/info/division/index.html
	Position on SDGs	https://www.ngk-insulators.com/en/sustainability/management02.html

Output

Power business

Insulators

NAS batteries

Ceramic products business

Ceramics for purifying auto-mobile exhaust

NOx sensors

Electronics business

Ceramics for electronic and electrical devices

Beryllium-copper products

Process technology business

Ceramics for semiconductor manufacturing equipment

Industrial machinery and devices

Results (fiscal 2018)

Consolidated net sales

463.5 billion yen

Net income attributable to owners of the parent

35.5 billion yen

ROE

7.6 %

Total sales of products contributing to environmental protection

258.9 billion yen

Social contribution spending

0.3 billion yen

Avoided NOx emissions

4 million metric tons per year

Note: Assumes exhaust systems are equipped on new automobiles that do not have equivalent systems.

Values provided by the NGK Group

Supporting social infrastructure

Ensure access to affordable, reliable, sustainable, and modern energy for all

- Insulators are indispensable to stable power supply
- NAS® batteries allow stable supply of renewable energy

Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation

- Ceramics used in electronics make ICT cheap and ubiquitous
- Ceramics used in semiconductor manufacturing equipment let the semiconductor industry be the foundation for modern daily life
- Metal products are widely used in mobile phones, automobiles, industrial equipment, and other devices that undergird modern life

Protecting the environment

Ensure access to affordable, reliable, sustainable, and modern energy for all

- Ceramics for purifying automobile exhaust make exhaust gas clean, thus enabling clean usage of fossil fuels

Take urgent action to combat climate change and its impacts

- NAS batteries aid in the fight against climate change by allowing stable supply of renewable energy

Conserve and sustainably use the oceans, seas, and marine resources for sustainable development

- Ceramic membrane filters purify wastewater to prevent marine pollution

Improving people's lives

Ensure healthy lives and promote well-being for all at all ages

- Ceramics for purifying automobile exhaust make exhaust gas clean

Ensure availability and sustainable management of water and sanitation for all

- Ceramic membrane filters provide highly safe water
- Ceramic membrane filters purify wastewater

Make cities and human settlements inclusive, safe, resilient, and sustainable

- NAS batteries enable innovation in urban energy management for the creation of sustainable cities

At a Glance

■ Global Production Bases

Consolidated net sales

463.5 billion yen

(up 2.7% year-on-year)

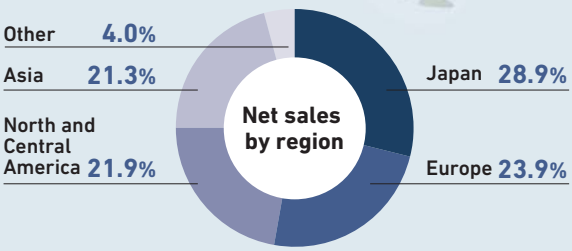
Number of employees

20,115

(up 7.1% year-on-year)

Note: Full-time regular employees.

Net sales by region



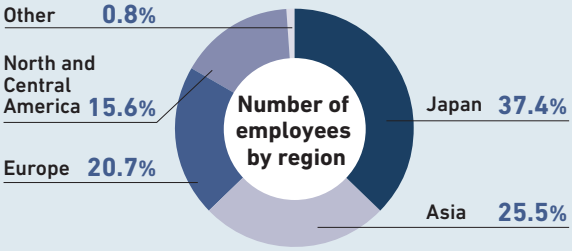
Japan

134.2 billion yen

(up 8.3% year-on-year)

Number of employees by region

Note: Full-time regular employees.

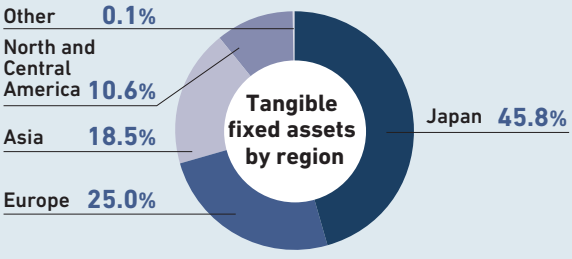


Japan

7,532

(up 6.4% year-on-year)

Tangible fixed assets by region



Japan

149.2 billion yen

(up 25.7% year-on-year)

North and Central America	Europe	Asia	Other
101.5 billion yen	110.7 billion yen	98.9 billion yen	18.2 billion yen
(down 7.2% year-on-year)	(up 15.7% year-on-year)	(down 7.4% year-on-year)	(up 18.6% year-on-year)

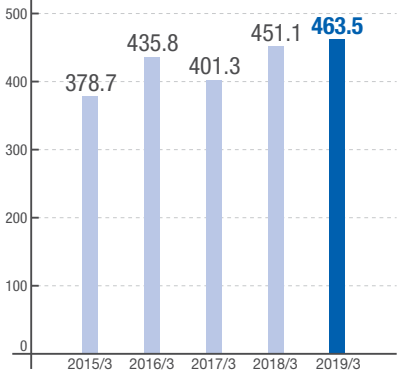
North and Central America	Europe	Asia	Other
3,132	4,161	5,120	170
(up 3.0% year-on-year)	(up 19.7% year-on-year)	(up 2.3% year-on-year)	(down 7.1% year-on-year)

North and Central America	Europe	Asia	Other
34.5 billion yen	81.5 billion yen	60.3 billion yen	0.6 billion yen
(up 0.0% year-on-year)	(up 12.3% year-on-year)	(up 38.4% year-on-year)	(down 27.4 % year-on-year)

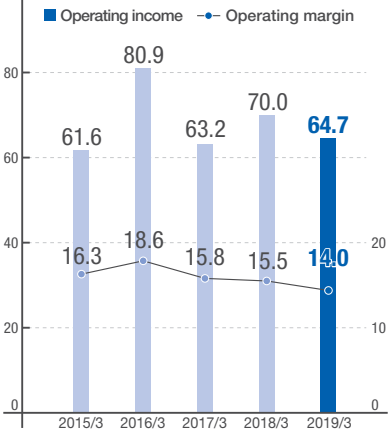
Financial Highlights

Financial indicators

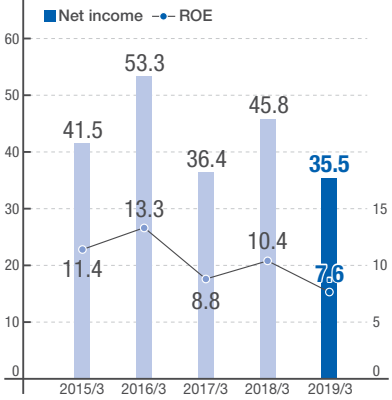
Net sales (billion yen) (Consolidated)



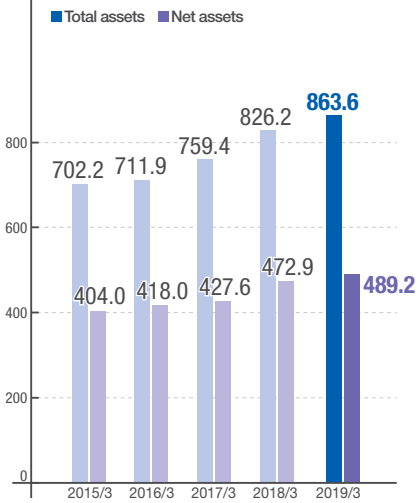
Operating income (billion yen), operating margin (%) (Consolidated)



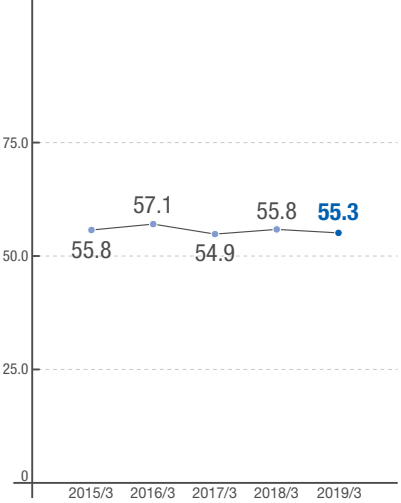
Net income attributable to owners of the parent (billion yen), return on equity (ROE) (%) (Consolidated)



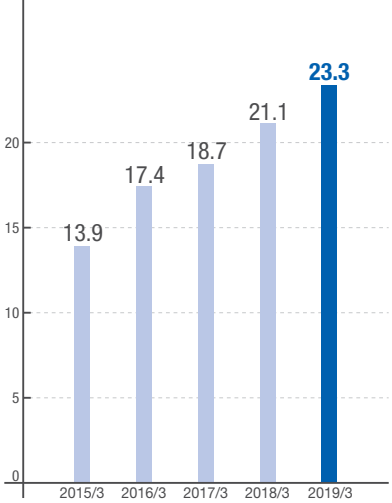
Total assets, net assets (billion yen) (Consolidated)



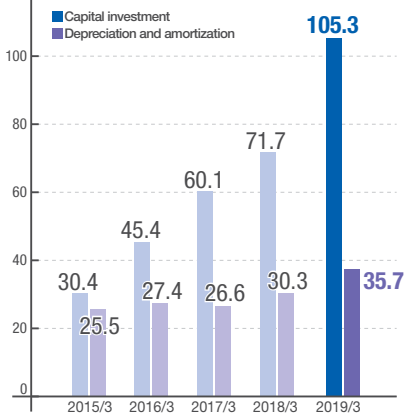
Equity ratio (%) (Consolidated)



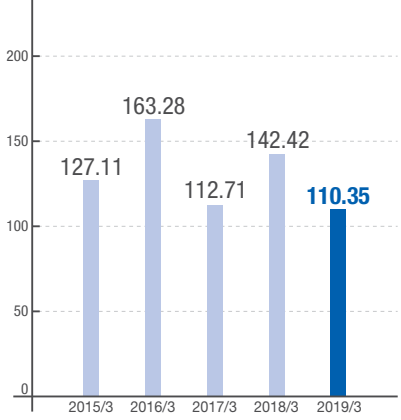
R&D expenses (billion yen) (Consolidated)



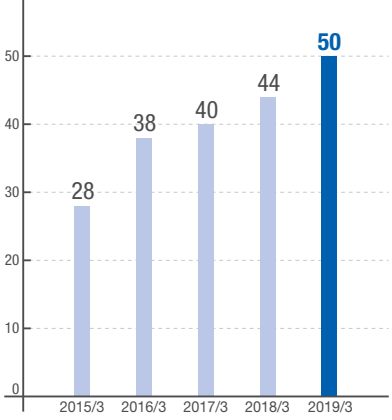
Capital expenditures, depreciation and amortization (billion yen) (Consolidated)



Net income per share (yen) (Consolidated)

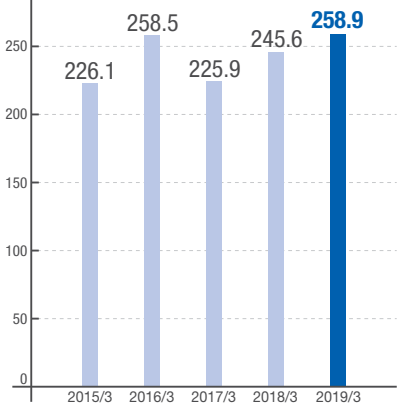


Cash dividends per share (yen)

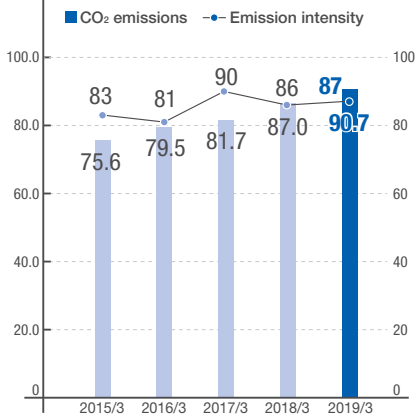


Environmental

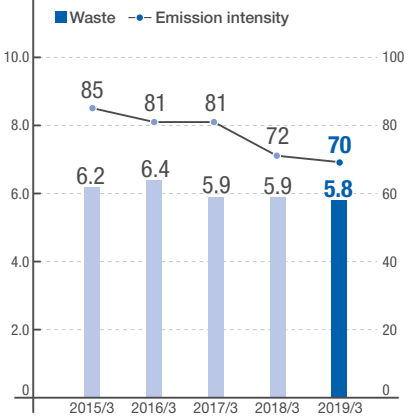
Total sales of products contributing to environmental protection (billion yen)



CO_2 emission intensity of sales (10^3 metric tons) (FY2013=100)

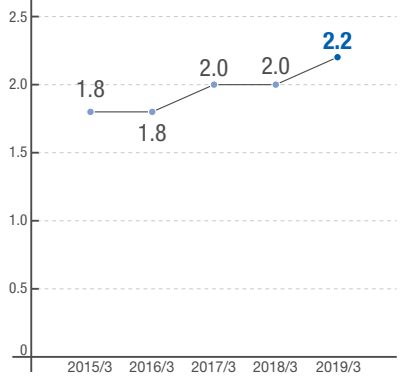


Waste intensity of sales (10^3 metric tons) (FY2013=100)

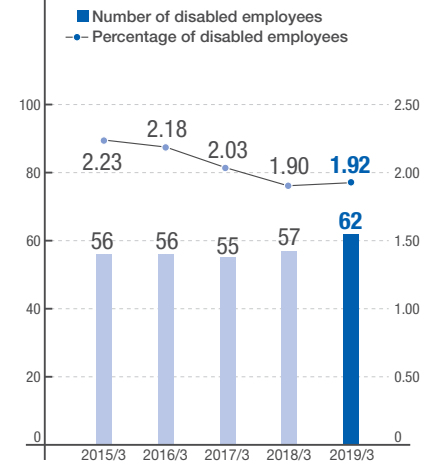


Social

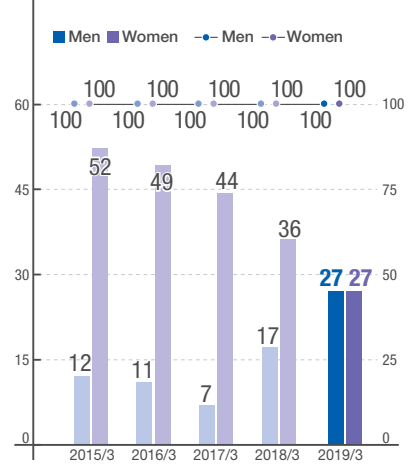
Percentage of women managers (%) (NGK Insulators)



Number of disabled employees (persons), percentage of disabled employees (%) (NGK Insulators)

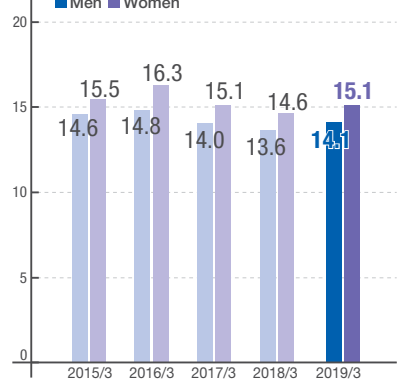


Number of parental leave takers (men/women), retention rate (%) (NGK Insulators)

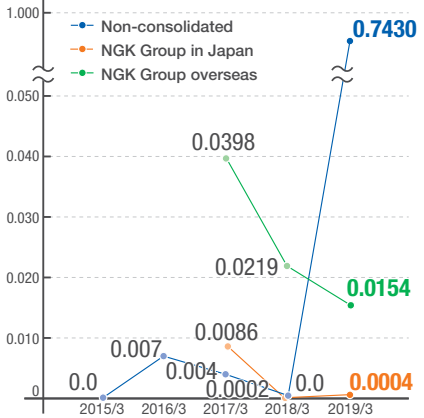


Governance

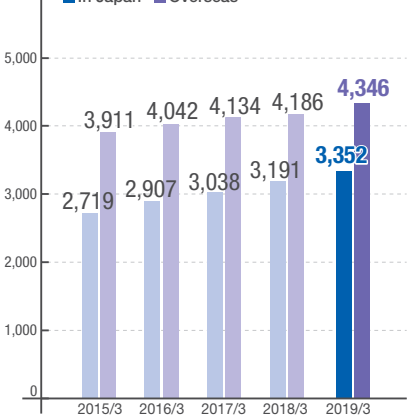
Average duration of continuous employment (men/women) (years) (NGK Insulators)



Severity rate (Number of lost work days per 1,000 work hours)



Number of patents held



Establishing our philosophical framework: A clearer and more memorable expression of our core convictions

In January 2019 we announced the NGK Group Philosophy as our revised philosophical framework. Our mission is “Enriching Human Life by Adding New Value to Society,” and we seek to achieve this by focusing on the values we have set for ourselves with regard to quality of people, quality of products, and quality of management.

In revising the philosophical framework, we sought to ensure, through the words we chose, that our philosophy is both memorable and easily grasped. The NGK Group is committed to preserving the global environment, fostering the development of industry, creating a brighter energy future, and contributing to the wellbeing and happiness of people around the world. It is this longstanding desire to be such a company through the products and services that we offer which we have encapsulated within a clearer and more memorable corporate philosophy.

We also sought to ensure that our corporate philosophy is expressed in a way that can be shared by everyone in the NGK Group. There are approximately 20,000 employees in 20 countries around the world who make up the NGK Group. As our business has diversified and expanded globally, the employee makeup of the NGK Group has been changing significantly. In order for there to be mutual respect and group cohesion from which our best performance can be attained, it is important that everyone in the Group is committed to the common mission and share the same values. Thus, we have chosen simple and concise wording that resonates universally and is accessible among all NGK Group members who have different cultures and languages.

This new expression of our corporate philosophy is a core around which the NGK Group can come together to not only further refine our ceramics technologies but also to revisit our founding principles as we keep working to improve the quality of the products that we provide and the work that we perform in pursuit of our corporate mission.

Capitalizing on What We Have Built to Become a Truly Global Company

On May 5, 2019, the NGK Group marked the 100th anniversary of its founding. The journey of growth that has brought us here would not have been possible without the support of our customers, shareholders, local communities of where we do business worldwide, and our many other stakeholders. For this I offer my heartfelt gratitude.

Looking ahead, we want to capitalize on all that the NGK Group has built up to this point and apply our unrivaled technological strength to the development of products that exceed society's expectations and allow us to contribute to the world as a truly global company. We would like you to expect to see further development of the NGK Group in the future.

NGK Insulators, Ltd.
President

Corporate culture reform: Facilitating essential work performance

The NGK Group needs to do better on a variety of different fronts. Regrettably, since the start of my tenure as president, the NGK Group was found in 2015 to have engaged in an anti-trust laws violation issue and, in 2018, to have caused the non-conformity in testing procedure of insulators and related products. These problems stem from a longstanding and lingering lack of frank communication.

In order to try and effect a fundamental cultural shift in this regard, I have increased the number of visits I make to our many different workplaces. So far I have averaged around 70 workplace visits per year. During my visits I make myself available to employees so that they can tell me about any problems or concerns they may have, or about any ideas they may have for improvements. Recently, my efforts are being rewarded as more and more employees share their thoughts with me and talk about what initiatives they are undertaking.

One department, which is 70% female, has created a workplace built based upon the needs of women and ensuring a healthy work-life balance. In one of the product engineering departments, where the busy pace of work is almost constant, a series of small improvements and novel rules have been introduced, which ensure employees are actually able to get time off.

These examples are the results of an invigoration of corporate culture within the NGK Group that has been occurring in the wake of personnel system reforms implemented in 2017. This innovation in corporate culture is taking place alongside ongoing and persistent communication efforts aimed at encouraging employees to focus on what is essential in their work and have the courage to abandon what is not. In fact, just by talking with employees, I increasingly get the sense that attitudes are changing.

However, in order to ensure the continued momentum of these sorts of initiatives, the attitudes of those at the management level need to change so that they can lead by example. Ten senior executives, including executive vice presidents, have announced changes they are making in their department and have followed up on the status of implementation. We call these initiatives “quality management,” and by ensuring their thorough, company-wide implementation we seek to alter the corporate culture in ways that will facilitate an improvement in the quality of work we perform.

Instituting the ESG Committee: Clarifying and ranking priorities

With the aim of achieving sustainability on a global scale, increasing attention has been paid in recent years to sustainable development goals (SDGs) and environmental, social, and corporate governance (ESG) policies. In order to strengthen the NGK Group’s initiatives in these areas, we established the ESG Committee in April for which I serve as chairman and which is attended by other board members.

At the meetings of this committee, I and the other senior management engage in wide-ranging discussion about environmental practices, quality, safety, and other corporate policies at NGK. Through these discussions we seek to clarify what our priorities are and to prioritize them. Right now, with our current Five-Year Environmental Action Plan set to conclude in fiscal 2020 and deliberations beginning for the next five-year plan, we are solidifying our policies with regard to reducing CO_2 emission intensity and increasing the amount of renewable energy we purchase.

Business overview and future outlook: No change in production increase investments

Fiscal 2018 was a year of drastic market fluctuations. Initial performance predictions were revised for the latter half of the year and, later, had to be revised downward even further, ultimately resulting in decreased profits compared to the previous year despite achieving record-high sales. Group performance was negatively impacted by a variety of factors, including expanding deficits for the Power Business, shrinking profits in the Electronics Business, and operating loss on liquidation of our Chinese insulator manufacturing subsidiary.

Fiscal 2019 also presents us with a chaotic global economic situation stemming from economic friction between the U.S. and China, Brexit, problems in the Middle East, and many other factors. Nevertheless, for our automotive-related business, we anticipate that the more stringent exhaust standards being enacted in various countries will drive major demand for gasoline particulate filters (GPFs) used to remove particulates from gasoline-powered automobile exhaust. Also, there was overall business growth for automotive diesel particulate filters (DPFs), spurred on primarily by demand from large vehicles. Sales of NOx sensors are also growing as a result of more and more customers utilizing multiple NOx sensors per vehicle. These are contributing to an overall upward trend that is expected to continue for automotive-related products. Looking at our electronic components-related business and other business segments, the situation is good with a host of new products coming out one after another. In the power business segment, NGK is removing unprofitable

products, conducting large-scale streamlining via redeployment, and taking steps to improve productivity so as to return to profitability as quickly as possible.

Currently, there is no change in the status of the roughly 300 billion yen NGK is investing to increase production. For GPFs this year, in addition to starting up a second plant in China, NGK will increase production in Poland as well. Also, the new plant in Tajimi, Gifu Prefecture will begin production of ceramics for semiconductor manufacturing equipment in the fall. This plant is characterized by its integrated production system that will boost output by roughly 30% and productivity by around 40% compared with existing plants. This will enable us to finally meet customer demand.

In Fujiyoshida, Yamanashi Prefecture, we will be launching a new plant that will help us meet the growing demand for electronic components, as well as handle production of new products being introduced more widely on the market.

Strengthening Our Global Production System (Major Bases)

● Ceramic products business base ● Process technology business base

NGK Ceramics Polska 2nd plant

Increase production capacity of SiC-DPFs (No. 2 Building)

NGK Ceramics Polska 1st plant

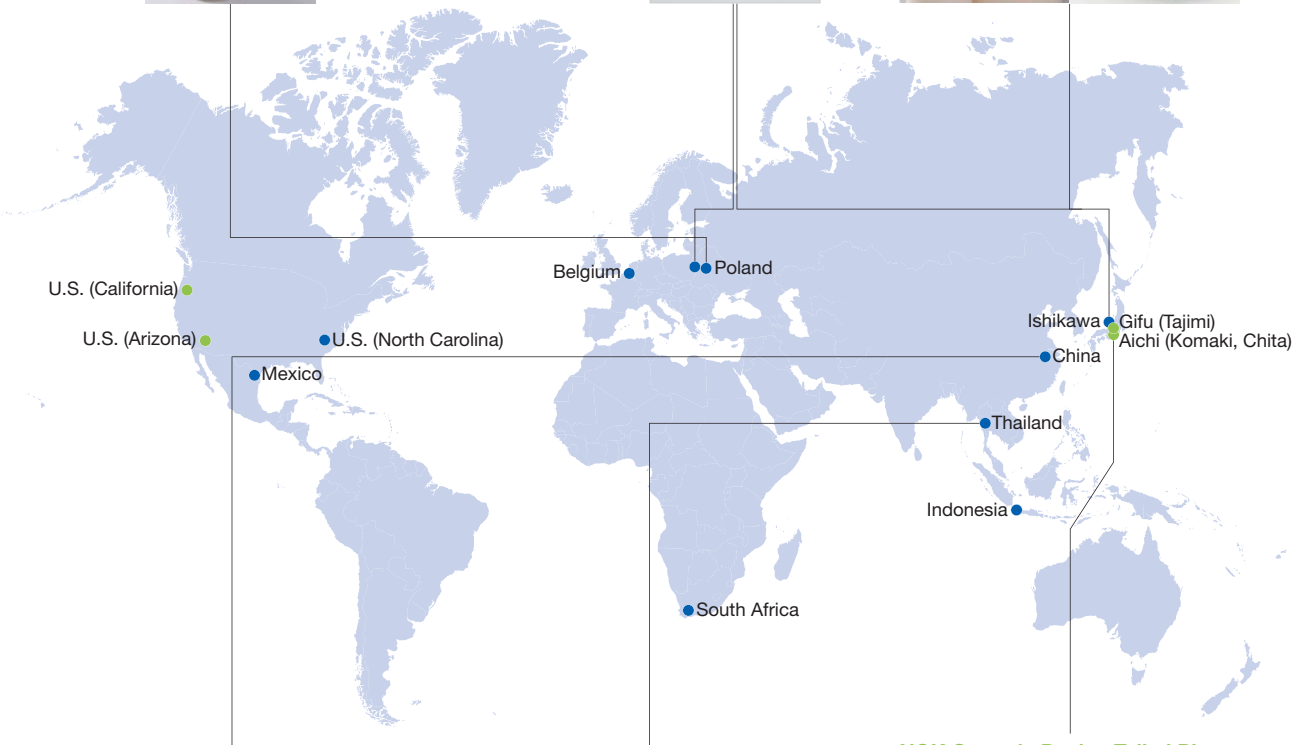
Facilities for assembling sensors

NGK Insulators Ishikawa Plant

Production facilities for sensor elements

NGK Insulators Ishikawa Plant

Increase capacity of raw material mixing equipment



NGK Ceramics Suzhou 2nd plant

Mass production of GPFs

NGK Ceramics (Thailand)

Mass production of LSH

NGK Ceramic Device Tajimi Plant

Increase production capacity of ceramic products for semiconductor manufacturing equipment

From the various initiatives undertaken by NGK have emerged new products that anticipate future demand. A good example is the EnerCera® chip-type ceramic secondary battery. These lithium-ion secondary batteries utilize NGK's own crystal-oriented ceramic plate as electrodes to achieve high energy density within a small and thin body. They have been well received in the industry. One prominent technology journal has lauded their outstanding performance, and at the CES 2019, the world's largest consumer electronics trade show, the batteries received the Innovation Award.

Following sample shipments to customers, we began mass production this April. Used as a power source, these batteries can be used to improve security and convenience, such as by incorporating them into credit cards to power fingerprint authentication or wireless communication. They attracted a high degree of interest from automakers at CES, due to the fact that these batteries can be used with smart keys to resolve the recent problem of car theft that has arisen as a result of thieves performing fraudulent unlocking via exploitation of weak electromagnetic signals. We are very excited about the future of this product.

R&D: Investing financial and human resources in targeted fields to meet the needs of the era

In order to ensure the continued growth of the NGK Group in the medium and long term, we must keep developing products focused on the needs of the next era. This is why we treat active investment of human and financial resources into R&D as a fundamental part of our business.

For the current term, we plan on spending 25 billion yen on R&D, which is equivalent to 5% of our sales. This amount is roughly double what it was five to six years ago. This means there are many research fields we should invest in. In addition to basic R&D activities, we also pursue development and joint research focused on the specific needs of customers.

Our R&D policy is to target growth markets and those fields where our distinctive technology can give us a competitive advantage. We have adopted this policy based on past experience that has taught us that trying to cover as many fields as possible ends up producing very little in any one field. For example, it was by successfully capitalizing on our own crystalline orientation technology that we developed EnerCera®.

One product that has emerged from our R&D for which we anticipate future demand is our gallium nitride (GaN) wafers. These wafers are incredibly defect-free (i.e., little positional aberrations of atoms in GaN crystals), making them suited for use in the base substrates of semiconductor laser devices, power semiconductors, and 5G high-frequency wireless communication amplifiers (high-frequency devices). These wafers are already available for commercial applications in semiconductor laser devices. However, just like silicon wafers, this material is one that will underpin a variety of different industries, which means it has interesting potential in power semiconductors and high-frequency devices, as well. As plug-in hybrid vehicles (PHVs) and electric vehicles (EVs) become more widespread, a variety of commercial applications for these wafers will emerge, such as in the light source of laser headlights, or in the on-board inverter required for electrification of vehicles. We are already developing and introducing products to meet these needs.

Another commercial application that we are currently developing and which is geared towards PHVs and EVs is an all-solid-state battery that we call "all-ceramic battery." Many companies make use of a sulfide-based electrolyte, but the NGK Group has adopted an oxide-based ceramic material, which is highly safe. While this makes it more difficult to manufacture due to the fact that crystalline orientation technology is required, we are well along in the development process thanks to our existing ceramic material technologies, which we can capitalize upon.

Additionally, a demonstration testing with large ceramic membranes for CO_2 separation that we are currently developing will be launched soon. When CO_2 is injected into oil fields, it improves the fluidity of the highly viscous crude oil and allows more of it to be extracted, but the associated gas that emerge with oil extrusion contain CO_2 as a contaminant to methane gas that is major component of the associated gas. These membranes would be used to separate CO_2 from useful methane gas. This separated CO_2 can once more be injected into the oil field. Not only does this increase the amount of crude oil extracted, it traps a portion of the CO_2 within the ground, thereby helping to mitigate global warming.

With regard to the development of solid oxide fuel cells (SOFCs), a basic agreement has been concluded by four companies in the Morimura Group—Noritake, TOTO, NGK Spark Plug, and NGK Insulators—to establish a four-party joint venture.

SOFC systems are small-scale power generation systems that achieve output efficiency equal to or exceeding that of large, cutting-edge thermal power stations. There is great expectation surrounding this technology in terms of how it can contribute to the realization of a low-carbon society. The details of the joint venture is now under discussion by the four participant companies.

Towards the next hundred years: Charting our path for the decade to come and beyond

We see our current blueprint for NGK up through 2030 as being realistic. In the areas of automobiles, semiconductors, batteries, and much more, our existing derivative technologies have a variety of potential applications that will keep current growth trends going.

However, with regard to questions of social structure and humanity's needs from 2030 onward, more study is needed. Global demographics are inexorably changing, and it will not be long until the central loci of growth shift to Asia and Africa. How will these changes affect spending consumption, and what is required to adapt to them? What will already well-established developed countries need in this changing world? Extrapolating backward from these predictions, what do we need to be doing now in order to prepare? We should be devoting our creativity and time to considering these questions.

Moreover, the fate of humanity depends on whether we can reduce CO_2. Surely this is a challenge that the entire world needs to come together to address. In this sense, it is a challenge that presents us with business opportunities. For example, in order to meet the ever-growing need for renewable energy, storage batteries such as our NAS® batteries capable of large-scale and long-term power discharge are indispensable.

Reflecting upon the situation in the NGK Group reveals that we, too, need to invest more time and resources on achieving better thermal efficiency, cutting energy consumption, and reducing emissions connected with our use of kilns to fire ceramics. In the mind of the public, having a focus on ESG is taken as a given, and there has been a pronounced trend among investors as well to choose companies that emphasize ESG. Discussion of how best to incorporate ESG into corporate policies is ongoing.

In January of each year, I announce to the company my key *kanji* character for that year, but this year I have forgone a single *kanji* in favor of a key phrase: "Never forget the first resolution."

When I reflect on past incidents such as the non-conformity in testing procedure of insulators and the related products, I wonder if they were due in some degree to arrogance on our part. Such an attitude is out of alignment with the founding spirit of our first president, Kazuchika Okura, who declared, "We do this to serve our country, and not for our own profit." This is the sentiment I wanted to convey with this year's key phrase.

I want all of our employees to think once more about why companies exist. A company's survival depends upon its ability to operate within the rules of society in such a way that a relationship of trust is established. On the occasion of our 100th anniversary, I want that thought to be the starting point of our new journey.

We have cultivated a great many seeds that can grow into future business. If we sow them with confidence, I believe they will reward us with results. Our preparations for the next five to ten years are largely in place. And it is my hope that we will look to the future beyond that and make use of this year as a fresh start.

Finance Policy

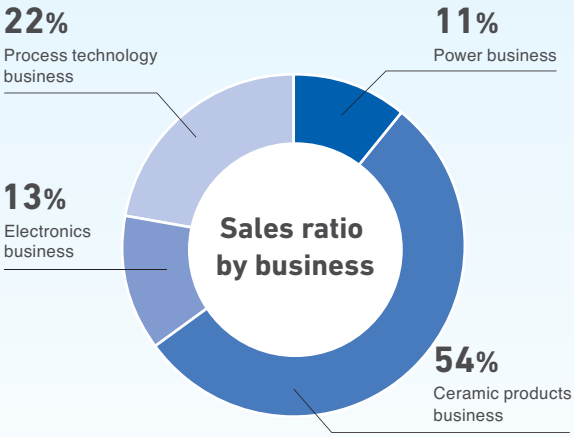
Major Target Management Indicators and Capital Policy

The NGK Group seeks to apply a brand of management that focuses on its shareholders, with return on equity (ROE) as the key management indicator. While focusing on an ROE level of 10% or more from the medium- to long-term perspective, the NGK Group will pursue capital policy that contributes to sustainable improvement in corporate value in line with changes in business risk. As well as striving to reduce capital cost through communication with shareholders and investors, we will efficiently put management resources into the expansion and cost-cutting of core businesses, and the development of new products and the launching of new businesses so that we can ensure that profitability exceeds capital cost. While striving for financial soundness, we will return as much profit as possible to shareholders in line with factors such as payout ratio and ratio of dividends to net worth. In this way, we will aim to maintain the elements of ROE—profit margin, asset turnover, and financial leverage—at sound levels in accordance with business strategies.

Dividend Policy

NGK views the return of profits to shareholders as one of its most important management policies. As a basic policy, we strive for shareholder-oriented management that emphasizes ROE, and distribute the benefits of successful management with a medium-term target consolidated payout ratio of approximately 30% after consideration of a comprehensive range of factors, including business performance, financial position, and future business development. Meanwhile, NGK plans to utilize retained funds primarily to extend its existing core business and capital expenditures in new business projects, with a view to enhancing its corporate value.

Major Financial Indicators and Financial Summary



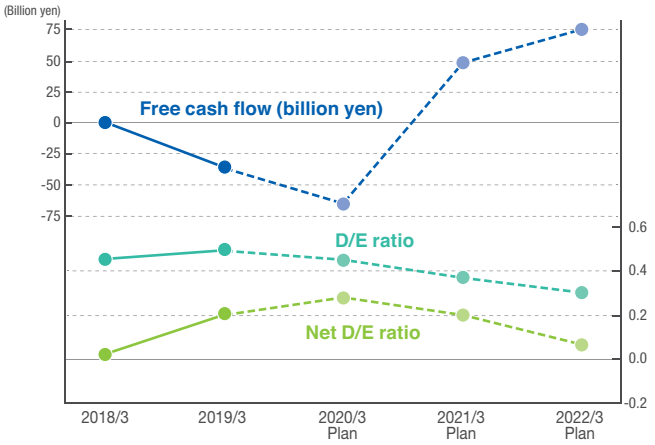
Key: Net sales once again at record levels

- Net sales increased 3% year-on-year to 463.5 billion yen to reach a record high.
- While revenue decreased in the power business and electronics business, revenue increased in the ceramics products business and the process technology business.
- Operating income fell 8% year-on-year to 64.7 billion yen.
- There were extraordinary losses due to a fixed asset impairment loss of 10.9 billion yen in businesses including the package business and the insulator business, and an operating loss on the dissolution of a subsidiary of 3 billion yen following the decision to dissolve an insulator production subsidiary in China.
- Net income decreased 22% year-on-year to 35.5 billion yen.

Free Cash Flow and Financial Composition

In cash flow and financial composition, free cash flow is expected to move to the negative side for the financial periods ended March 2019 and ending March 2020 as capital expenditure moves ahead. The result is that for the time being, it is predicted that interest-bearing debts will exceed outstanding funds and the net D/E ratio will continue on the positive side. In the fiscal year ending March 2021, forecasts are for investment to cycle back and profit to increase, and for free cash flow to turn positive.

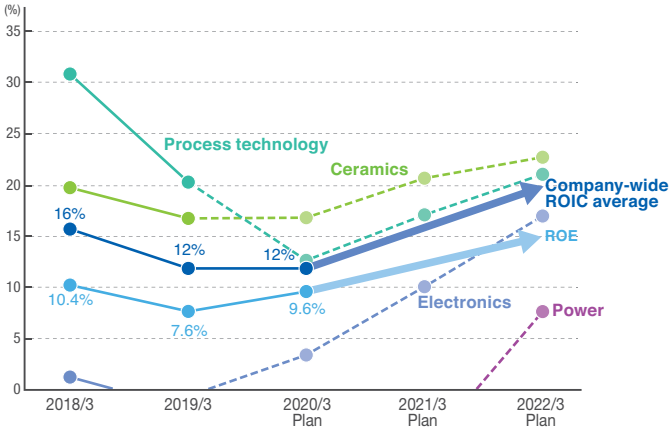
With regard to financial composition, from the standpoint of financial soundness, an equity ratio of 50% or higher and a D/E ratio of around 0.4 will be maintained while we seek to find opportunities for financial leverage, such as through the procurement of necessary capital via interest-bearing debts.



Return on Invested Capital (ROIC)

While focusing on an ROE level of 10% or more from a medium- to long-term perspective, in achieving this the NGK Group will raise ROIC and maintain a set level of financial leverage. On the management control side, we intend to carry out major capital expenditure centering on automotive-related products and the HPC business. Looking ahead, with increases in working capital to increase revenue, we are focusing on maintaining and raising business efficiency.

ROE for the fiscal year ending March 2020 looks like it will fall short of 10% under current plans, but we see it exceeding 10% for the fiscal year ending March 2021 and afterwards thanks to increases in net sales and profitability.



Net sales

463.5 billion yen

(up 2.7% year-on-year)

Operating income

64.7 billion yen

(down 7.6% year-on-year)

Net income attributable to owners of the parent

35.5 billion yen

(down 22.5% year-on-year)

ROE

7.6%

(Down 2.8 points year-on-year)

Capital expenditures

105.3 billion yen

(up 46.9% year-on-year)

Depreciation and amortization

35.7 billion yen

(up 17.9% year-on-year)

R&D expenses

23.3 billion yen

(up 10.3% year-on-year)

Honing NGK's Distinctive Technologies As a Source of Competitive Strength

Research and development is the key to the medium and long-term growth of the NGK Group.

We have become the market leader thanks to our unshakable commitment to distinguishing ourselves from our competitors by setting unique development themes and delivering unprecedented products.

There are around 800 employees in the NGK Group who are involved in research and development in some capacity. We are engaged in ongoing research in the three sectors of energy, ecology, and electronics. In all of these sectors, our aim is to keep honing the distinctiveness of NGK technology. Our competitive strength in the marketplace is derived precisely from the fact that we offer features and affordability that other companies cannot match. By maintaining a commitment to distinguishing ourselves through our technology and improving the sophistication of the materials we develop, focusing chiefly on fine ceramics, we aim to bolster the competitive strength of our existing products as well as create new and competitive technologies and products.

NGK is strong in such techniques as extrusion, mold-casting, crystalline orientation, joining of differing materials, and hydrothermal synthesis. Thanks to these strengths we were able to put the EnerCera® chip-type ceramic secondary battery into mass production in April 2019.

In fiscal 2017, we achieved our "2017 Challenge 30" goal of ensuring at least 30% of consolidated net sales comes from new products. We have set a company-wide "Keep up 30" goal to maintain this percentage for fiscal 2018 onward and are focused on creating new products and businesses.

Concentrating resources into specific sectors

Research and development expenses in fiscal 2018 were 23.3 billion yen, which was equivalent to 5.0% of net sales. We anticipate a very similar result for fiscal 2019, with research and development expenses equivalent to 5.1% of a projected 25.0 billion yen in net sales. Our aim is to keep research and development expenses at a level equivalent to 4% to 6% of sales, regardless of business conditions and performance trends. In terms of monetary amount, this represents a level that is more than double what we were spending 10 years ago.

With regard to the creation of new business based on the new technologies and sectors cultivated primarily by Corporate R&D, we keep resource investment limited to

Distinctive technologies:

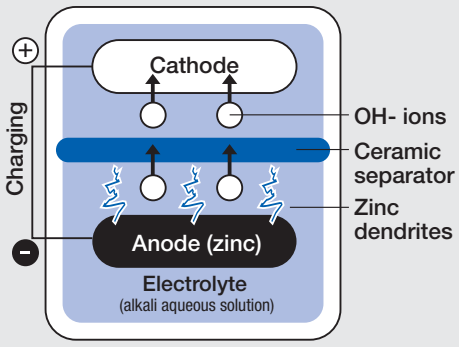
OH- ion-conducting ceramic separator—a key part in the zinc rechargeable battery

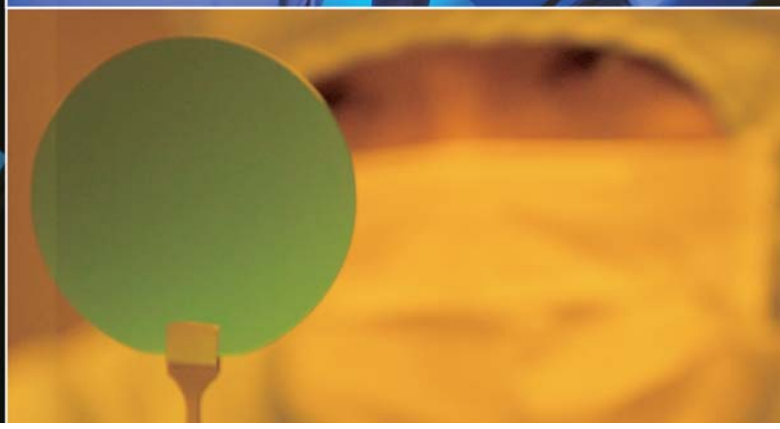
The zinc rechargeable battery provides performance on a par with lithium-ion secondary batteries while being much less prone to catching fire due to the use of an alkali aqueous solution as the electrolyte. The basic principles of the zinc rechargeable battery with zinc anode have long been understood, but applying it to a commercial product has eluded researchers until now. Because of its inherent properties, zinc anodes develop dendrites during charging. These dendrites penetrate through conventional polymeric porous separators to reach the cathode and short the battery.

Now, the NGK Group has developed dense OH- ion-conducting ceramic separators, which allow the OH- ions necessary for cell reaction to pass through but which block dendrites, thereby successfully keeping the battery from shorting.

The zinc rechargeable battery is currently undergoing in-house and outside demonstration testing as a stationary storage battery, with the aim of bringing it to market.

● Configuration of zinc rechargeable battery





specific sectors. In order to ensure we can generate new business, we concentrate our resources into those sectors where growth is expected, based on market trends, as well as those sectors where our distinctive technologies give us a competitive advantage over our competitors.

In addition, we do not rely solely on Corporate R&D for new product development. Rather, we treat it as a company-wide endeavor comprising the business divisions that will market the new product, Corporate Manufacturing Engineering that will determine how and where of mass production, the Intellectual Property Department that will handle patents, the Purchasing Department that will secure the necessary materials, and all the other departments that will have some connection to the new product. This approach has already produced some results. One advantage of this is that it allows us to consider mass production during development and facilitates the creation of a pilot line for test production during the latter half of new product development. Just prior to EnerCera entering mass production, Corporate R&D took the lead in creating a pilot line, which could produce one million units a month, thereby facilitating trial and error improvement.

Collaborating with outside research organizations

In order to help NGK cultivate new and distinctive technologies, we seek out collaboration with universities and other outside research organizations. In 2011, we established the NGK Material Innovation Laboratory (NIL) together with Nagoya Institute of Technology (NITech) as a result of a comprehensive collaboration agreement. NIL is a virtual research institution without its own research facilities and equipment. It comprises six to seven professors, associate professors, etc., from NITech and 20 to 30 employees from the NGK Group. NIL members come and go between the university's laboratories and NGK Corporate R&D as they undertake the challenges of developing next-generation battery materials, transparent semiconductor materials, and various other materials with revolutionary properties.

NGK Material Innovation Laboratory
(From left) Naomi Teratani Corporate R&D member, Professor Masaki Tanemura (NITech), Naomi Fukui Corporate R&D member, Associate Professor Kalita Golap (NITech), Associate Professor Noriyuki Sonoyama (NITech)

Capitalizing on distinctive technology to drive the development of innovative and competitive products

Emiko Hamada Outside Director

Program Officer at the Japan Science and Technology Agency. Spearheaded the invention and commercialization of the CD-R (Compact Disc-Recordable) at Taiyo Yuden. Later, joined the faculty of the Nagoya Institute of Technology and Nagoya University, where she is engaged in mainly industry-academia-government collaborative research.

How important would you say research and development are for the NGK Group?

Nanataki: No company can continue selling the same exact thing forever. For a company to endure, it has to keep coming up with something newer, which it can then commercialize. The NGK Group has the “Keep up 30” target, which aims to ensure that new products always make up 30% of the Group’s total product offerings.
Hamada: Companies need to always have something new. And companies expect research and development to play a major role in providing that ‘something new’. I too have high expectations for what R&D can produce.

What are the NGK Group’s R&D policies and strategies?

Nanataki: We are focused on advancing our material technologies, centered on fine ceramics, for the sake of improving the competitive strength of our existing products and developing new products. The important thing is for us to narrow down to some degree our development efforts into areas where our distinctive technologies can make us competitive against other companies, all while meeting the needs of the times. We look for niches in a number of different areas, such as wafers, batteries, and separation membranes, and then quickly identify workable research themes to which we allocate resources.

Also, a major key to success is working in concert with the Business Groups from the early stages of development. Getting the Business Groups, Corporate Manufacturing Engineering, and others involved in product development and then having customers evaluate the trial products facilitates a smooth transition from product development into mass production-focused commercialization.
Hamada: I think this is a good approach to have, as successful development requires that everyone connected with a new product have a sense of personal investment in its success. Often times, R&D ends up just coming up with a product and not thinking about launching it into the market. But the success rate is immensely higher when all departments have a sense of mutual responsibility for a new product’s success.

What are your major focuses in research and development?

Nanataki: Compared with other companies NGK is strong in terms of elemental technologies like ceramic crystalline orientation technology, hydrothermal synthesis technology, techniques for combining differing materials, and co-firing technologies. We capitalize on these distinctive technologies to drive the development of innovative and competitive products. All of our new products, including our bonded wafers for SAW filters, gallium nitride (GaN) wafers, and EnerCera® chip-type ceramic secondary batteries, were developed using this approach.

However, creating an innovative and competitive product takes time, sometimes requiring two to three years to commercialize, and even 10 or more in some cases.
Hamada: It certainly took more than 10 years for NGK’s GaN wafers. Research into solid oxide fuel cells (SOFC) has been ongoing for the past 30 years.
Nanataki: Nevertheless, it is important that we are committed to using those technologies where NGK stands apart from its competitors to create innovative and competitive products.

At the same time, it is also important to pursue an open innovation approach to our work, such as by collaborating with universities, in order to help us develop more new and distinctive technologies. At present, we have over 40 collaborative development projects underway.
Hamada: University researchers and companies have different focuses. That means when they work together, it can often produce results that neither side was expecting.
Nanataki: That’s why our expectations for open innovation are high. We are pursuing joint research not only with universities but also with public institutions, and we seek a broad range of partners with whom to undertake research and development.
Hamada: By interacting with a variety of different researchers, it opens up all sorts of new perspectives in terms of materials and processes. One approach is to collaborate with user companies while having a university in the middle.

The NGK Group draws its strength from research and development. We interviewed Emiko Hamada, outside director who has a wealth of experience in R&D at a company and universities, and Tsutomu Nanataki, Senior Vice President and Group Vice Executive of Corporate R&D on future goals and what makes the NGK Group's R&D so unique.

Tsutomu Nanataki Senior Vice President

(Group Vice Executive, Corporate R&D)

Group Vice Executive of Corporate R&D and Project Leader of the Functional Materials Development Project. Studied industrial chemistry at Shizuoka University Graduate School before setting out on a career at NGK in the R&D sector.

I think that the truly core aspects of ceramics technology should be pursued in the way that they currently are, with research being carried out in conjunction with the country's top specialists. In the area of ceramics, Japanese universities are quite strong.

Tell us about any memorable experiences you have had while doing research and development.

Nanataki: One time I got anomalous data when doing measurements of a prototype. I usually ignore that kind of data, but on this particular occasion, that abnormal data caught my attention. I kept analyzing it to find its cause, only to realize that the data pointed to an essential phenomenon, which ended up significantly advancing the creation of marketable product. It is times like these when I feel my persistence as a developer has paid off. I always tell those under me not to ignore that sort of anomalous data.
Hamada: It really is thrilling for a researcher to discover something. Even if it is something that only occurs only one out of 100 times, that excitement when it does turn into something is tremendous.
Nanataki: The skill of a researcher lies in not letting that sort of data go unnoticed. You could describe it as the ability to listen to what the material is telling you. It is crucial to pay close attention to all data in order to recognize even the smallest clues that will lead you to the underlying mechanism explaining the phenomenon.

What are some things that leaders in your position need to be aware of?

Nanataki: You need to be able to recognize when it is time to stop and when it is time to put more effort into it. Stopping is particularly hard. No matter how much you may want to keep going, resources are limited. If you do not stop when you should, you will hinder your ability to concentrate resources on promising research. It is a hard thing to recognize and will likely remain a perpetual challenge for those in charge.
Hamada: There comes a time when you have to stop. And when that time comes, the person in charge has to be the one to take full responsibility for the decision.

As an outside director, what sort of advice do you have for the NGK Group's research and development?

Hamada: NGK is still not very good at explaining things from the customers' perspective. For example, when NGK increases battery capacity, instead of explaining this in terms of what advantages this larger capacity has for the customer, they tend to focus on how much the battery capacity numbers have been improved. It is not enough to only talk about how fantastic a product's features are; researchers need to also be able to talk about what real value the product can provide.

Take EnerCera, for example. The fact that its capacity has been doubled is fantastic. But doubled capacity is not enough to make customers ignore a high price tag. You need to first determine the price you want to sell them at and, based on that, determine what the necessary production costs would be. And then you carry out development towards that goal. It is important to think about what the customer will value, and this includes not just performance but price as well.
Nanataki: That is definitely an area where we are lacking. We will need to work harder.
Hamada: Also, I would like to see NGK researchers not be so overly focused on their own areas of specialization but, rather, pay more attention to the technological trends happening in various other fields so that they are more sensitive to how the world is changing.

Where is NGK research headed to in the future?

Nanataki: I would like for NGK to focus more on coming up with proposals for customers that explain how they can utilize the products we develop. For those of us in R&D, product integration, utilization ideas, improvements, and other marketing-esque jobs are likely to take precedence in the future. This is already what is happening with EnerCera. We are focused on identifying customer needs and then working with them to develop products with diverse applications to meet those needs.
Hamada: I would add that there are quite a few ceramic materials and technologies that are essential to the production processes of a variety of industries. HPC (ceramics for semiconductor manufacturing equipment) is a truly amazing product. The possibilities for expansion are limitless, and it is important that NGK continue to explore them.

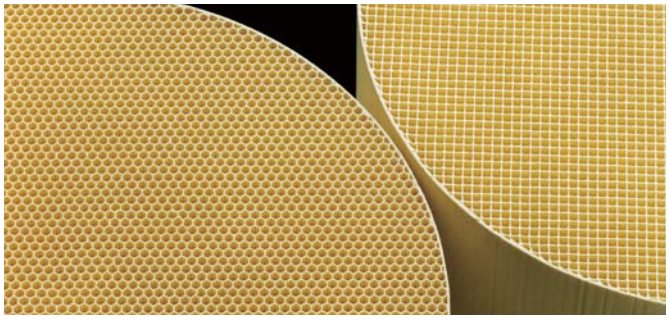
Power Business

Business overview for fiscal 2018

Insulator revenues declined as a result of continued sluggish demand in Japan caused by a contraction in capital investment among power companies, as well as a drop in overseas shipments, particularly shipments to China. Sales of NAS® batteries were flat due to a lack of major shipment orders.

Ceramic Products Business

Business overview for fiscal 2018



Shipments of HONEYCERAM® ceramic substrates for automotive catalytic converters and SiC diesel particulate filters (DPFs) declined as a result of lower automobile sales in the Chinese market and a decrease in the percentage of diesel automobiles within the European market. Meanwhile, shipments of sensors and gasoline particulate filters (GPFs) for gasoline-powered light vehicles increased as a result of more stringent exhaust gas regulations in Europe. At the same time, however, costs and expenses were higher as a result of depreciation and amortization, increased research and development expenditures, and also increased start-up cost for equipment for expanding production.

Electronics Business

Business overview for fiscal 2018

With regard to electronic components, an increase was seen among bonded wafers for SAW filters and piezoelectric micro-actuators for hard disk drives (HDDs), while ceramic packages saw a decline due in large part to stagnant investment in base stations in China. For metal-related products, demand for beryllium copper products remained unchanged from the previous period, but shipments of tire molds declined.

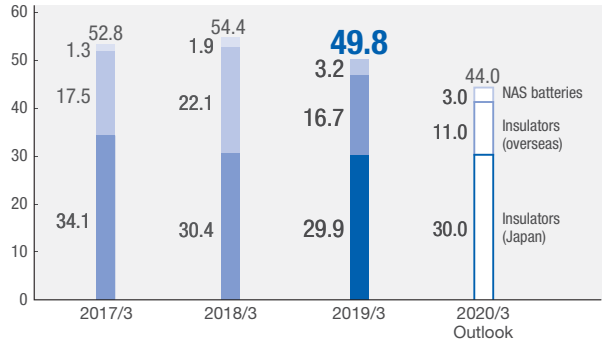
Process Technology Business

Business overview for fiscal 2018

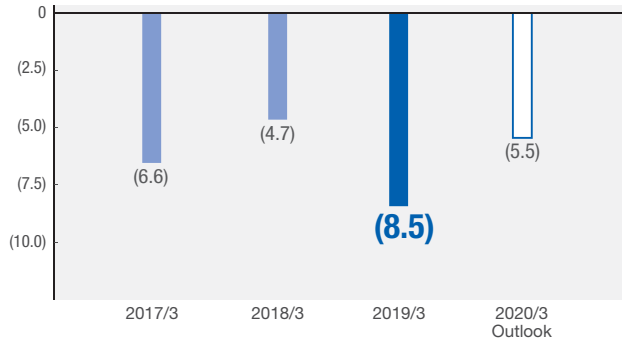
With regard to HPC (ceramics for semiconductor manufacturing equipment), because the trend toward multi-layered semiconductors and their microfabrication has ensured capital investment among semiconductor manufacturers remains high, product volume saw a year-on-year increase despite a slowdown in the latter half of the fiscal year. In industrial process-related products, increased shipments of low-level radioactive waste treatment systems and heating devices contributed to increased revenues.

Financial results (after elimination of intersegment sales)

Net sales (Billion yen)

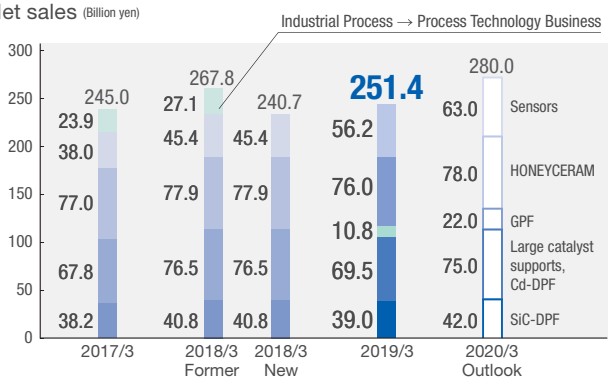


Operating income (Billion yen)

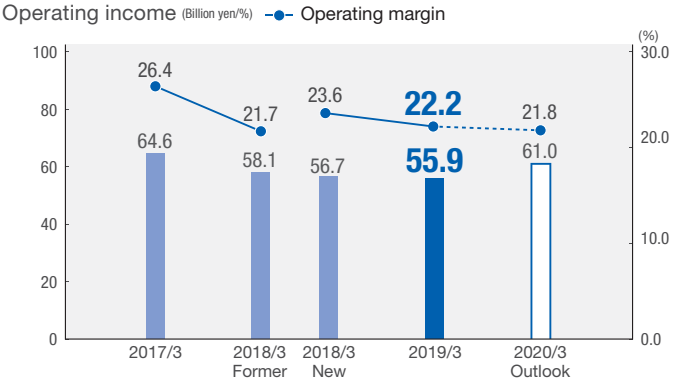


Financial results (after elimination of intersegment sales)

Net sales (Billion yen)

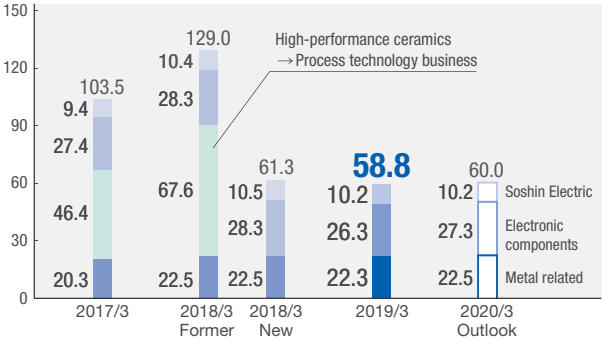


Operating income (Billion yen/%) Operating margin

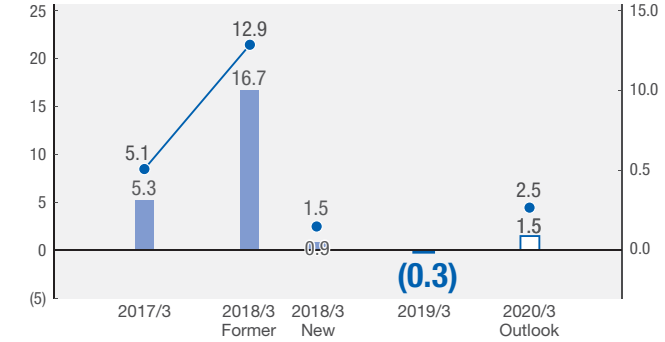


Financial results (after elimination of intersegment sales)

Net sales (Billion yen)

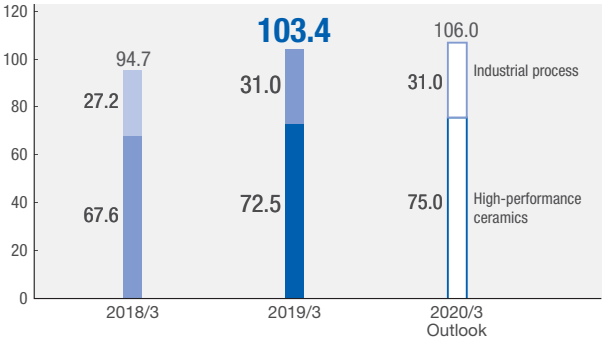


Operating income (Billion yen/%) Operating margin

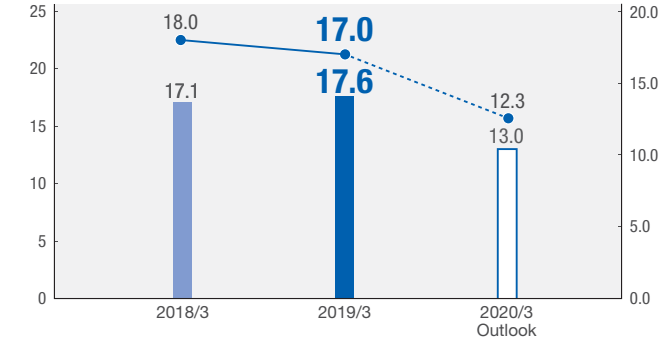


Financial results (after elimination of intersegment sales)

Net sales (Billion yen)



Operating income (Billion yen/%) Operating margin



Streamlining the Insulator Business and Making Batteries a Core Business Focus

Fiscal 2019 outlook (after elimination of intersegment sales)

Net sales

44.0 billion yen

Operating income (loss)

(5.5) billion yen

Insulators:

Expediting profitability by concentrating on markets where quality is emphasized

The business environment for both insulators and NAS batteries was severe and unfortunately, we recorded the second largest loss for NGK over the past 10 years, or the worst excluding an emergency situation.

Competition in the overseas market was harsh for insulators, and NGK has seen a significant decline in insulator orders. As a result, NGK's insulator manufacturing subsidiary in China, NGK Insulators Tangshan Co, Ltd., was dissolved in March 2019, and NGK has pulled everything but a few of its transformer products from the Chinese power market. This decision was a painful and challenging but necessary one for the turnaround of NGK's insulator business,

Moving forward, NGK will focus on the Japanese and Taiwanese markets, where the quality of the NGK Group's products is highly valued, as well as on government-backed yen loan projects. In the Japanese market, many of the NGK insulators supplied 40 to 50 years ago are reaching the age to be replaced. NGK is working to stimulate this demand even further by, among other things, offering high-value-added products capable of mitigating corona discharge.

Additionally, NGK will get out the business from unprofitable products, significantly streamlining back-office departments, and improving productivity in order to protect and expedite a return to profitability for the insulator business upon which the company was founded and, thereby, fulfilling our responsibility in maintaining power networks, a crucial social infrastructure.

NAS batteries:

Pursuing new growth by helping to balance supply and demand for renewable energy

Despite the downturn in the NAS battery business recently, it remains an area with tremendous future potential. Renewable energies, in particular solar and wind power, are steadily being adopted around the world as part of an effort to move to a carbon-free society. In Japan, 10% of all power produced comes from renewable energy sources, and this figure exceeds 20% in some other countries.

Because the volume of power generated by renewable energy sources is not constant, storage batteries are necessary to ensure that power supply meets demand. This is an application perfectly suited to NAS batteries, which are capable of holding and discharging power over a long period of time. As renewable energy becomes more widespread, so too will the demand for storage batteries.

At present, NGK is working to secure demand in the Middle East, Europe, and Kyushu and Hokkaido in Japan. Following the full-scale introduction of a power supply-and-demand balancing market and the launch of VPPs (virtual power plants) in 2021 and after, NGK will pursue orders within these new markets.

In addition, in-house and external demonstration testing of zinc rechargeable batteries has also begun. Since these batteries are highly safe and can be easily footprint downsizing, it is suitable for installation at more locations than the other batteries, such as inside buildings and enables decentralization of power sources. By combining storage batteries with photovoltaics installed on buildings and convenience stores, communities can achieve power self-sufficiency. And when further combined with blockchain technology, power can be bought and sold among people on an individual level.

In the near future, contracts for power, gas, telecommunications, waterworks, and other infrastructural elements will all be available to users via 'one-stop' service. That is when the true value of zinc rechargeable batteries as a power source will be evident.

Both NAS batteries and zinc rechargeable batteries hold the potential to become cornerstones of NGK's power business for the future. When the rules of society change, it always opens the door to new opportunities.

Non-conformity in testing procedure :

Change the business culture so the one can express with honesty and openness

We sincerely regrets the issue of non-conformity in testing procedure of insulators and related products that we did not carried out the required tests as per agreements with customers, which we disclosed last year. We will continue initiatives to prevent reoccurrence and to regain customers' confidence .

One underlying factor, which led to this situation is an organizational culture that disincentivized honesty and openness. It is the responsibility of senior management to foster a relationship so that everybody can express what

Manufacturing sites

● **Insulators:** Japan, US, Australia ○ **NAS batteries:** Japan

Senior Vice President; Group Executive,
Power Business Group

Shigeru Kobayashi

they want to say and realize feedback from the management. After much debate and discussion as to how this sort of organizational change can be effected, we have begun implementing a variety of initiatives. These include increasing the frequency with which division general managers visit different workplaces to make themselves more accessible for discussion and consultation with employees.

Such fundamental organizational change does not happen in a day, but with the various initiatives that are being instituted, change is occurring—one step at a time.

Power business

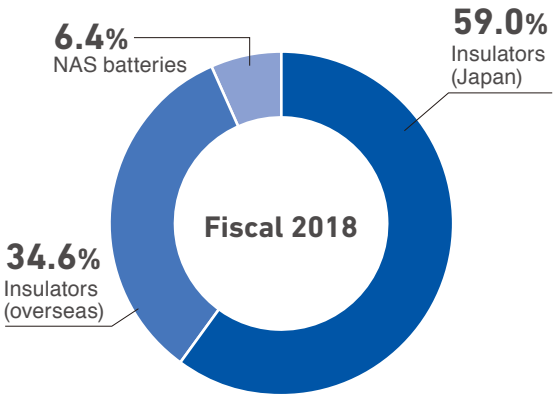
Insulators

Ceramic insulators play a role in insulating power transmission lines and steel towers. Ceramic insulators are an indispensable part in ensuring stable energy lifelines and were the NGK Group's founding products. As a top insulator manufacturer, NGK manufactures and provides high-quality and highly reliable insulators and equipment for power transmission, substations, and distribution, both in Japan and overseas.

NAS batteries

NGK manufactures and sells NAS® batteries capable of ensuring power supply stability over the long term and with an array of superior features, including large capacity, high energy density, and long service life. NAS battery systems also contribute to peak power reduction by leveling out the power load, help give a stable supply of renewable energy, act as countermeasures against surplus power, and facilitate power savings and cost cutting.

Sales ratio by business



NAS battery systems

NGK developed the world's first commercialized battery system capable of storing hours of electricity. These systems, which enable a high output of electric power for long periods of time, have been installed in around 200 locations worldwide

Start of a demonstration project of a large-scale hybrid storage battery system in Germany

NGK, NEDO, Hitachi Chemical Co., Ltd., and Hitachi Power Solutions Co., Ltd. have begun a demonstration project for a large-scale hybrid storage battery system in Germany, a country with an increasingly high usage rate for renewable energy. Made up of two types of storage battery (lithium-ion and sodium-sulfur), each with different characteristics, the system boasts high output, high capacity, and the ability to charge and discharge electricity. This means it offers economic adjustment of the electricity supply-demand balance.

Challenge to the EV Trend by Exploring Environmental Performance that Goes beyond Zero Emissions

Fiscal 2019 outlook (after elimination of intersegment sales)

Net sales
280.0 billion yen

Operating income
61.0 billion yen

Current situation and future outlook:
Steady growth for GPFs and NOx sensors

While sales have grown as a result of more stringent exhaust regulations in place, a combination of depreciation and amortization together with new plant startup costs have kept profits down, ultimately resulting in increased revenues but decreased profits.

The product for which we expect to see growth in sales is gasoline particulate filters (GPFs). More stringent environmental regulations have raised the demand in the European market and will lead to full-fledged demand in the Chinese market. NGK's production of GPFs takes place primarily in Poland and China, but in response to growing demand we are increasing investment in production and are in the process of building a second plant in China.

With regard to diesel particulate filters (DPFs), demand in the European market is shrinking when it comes to DPFs for diesel-powered light vehicles. On the other hand, however, demand for DPFs for trucks, agricultural machinery, construction machinery, and other off-road vehicles is expected to grow.

In addition, production and delivery of NOx sensors has increased significantly over the past several years. This increase is predicted to continue for another two to three years. Demand is mainly centered on diesel-powered vehicles, and the primary factor driving this is the increased number of NOx sensors needed per vehicle in order to satisfy the stricter regulations being introduced.

Promising products:
Exploring NOx sensors for gasoline-powered vehicles

We are currently carrying out R&D into NOx sensors for gasoline-powered vehicles, and from this a variety of possibilities have emerged. Currently, oxygen sensors are employed for detecting degradation of three-way catalysts*1 used in cleaning vehicle exhaust. However, if NOx sensors could be employed to measure NOx directly, this would not only enable more highly precise control but also shorten development time and reduce the amount of precious metal content in catalysts, among other potential benefits. Although the cost of such sensors would be an issue, we believe that they provide added value over and above their higher cost and would allow NGK to develop new markets.

Challenge to the EV trend via negative emissions

Steady progress is being made in the development of innovative exhaust purification systems, EHCs (electrically heated catalysts), with small-scale production expected to commence sometime in 2023 or later. By combining these technologies with existing products, it will be possible in the future to achieve "negative emissions," whereby the air coming out of the exhaust is cleaner than the air going into the engine.

Currently, plug-in hybrid electric vehicles (PHEVs) enjoy the same preferential status as EVs under the various environmental regulations in place around the world. However, because PHEVs produce emissions, it is not certain that this regulatory preferential treatment will continue as regulations become more stringent. But if EHCs are incorporated into PHEVs, although they will not eliminate CO_2 emissions, they will make it possible to achieve negative emissions with regard to other toxic substances, thereby making it likely that PHEVs can continue to receive the same regulatory preferential treatment as EVs.

Among the various challenges that EVs still need to address, some of the most prominent include cruising range, charging time, and cost. And when we consider the amount of CO_2 released from burning fossil fuels to generate electricity as well as from manufacturing batteries, we cannot say that EV are truly CO_2-free. NGK predicts that the market for internal-combustion engine vehicles will continue to grow until some time between 2025 and 2030, exceeding the current level to reach around 100 million vehicles per year.

It is in this context that the NGK Group has devoted itself to exhaust purification innovation. EHCs represent one of many exhaust purification possibilities that we are exploring as a means of challenge to the EV trend.

Challenges for the future:
Incorporating automation and streamlining to improve productivity for challenging products

Environmental performance requirements continue to

*1: Catalysts capable of simultaneously treating NOx, hydrocarbons, and carbon monoxide.
*2: Robotic process automation (software-driven automation of routine tasks)

Manufacturing sites

●Automotive-related products:
Japan, Belgium, US, Indonesia, South Africa, China, Poland, Mexico, Thailand

Director and Senior Vice President; Group Executive, Ceramic Products Business Group **Atsushi Matsuda**

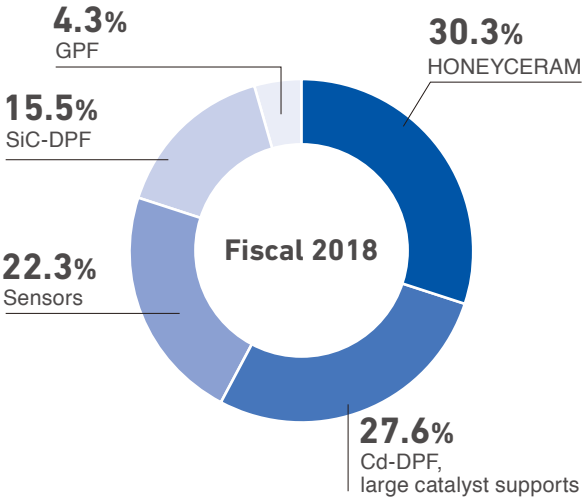
increase, even for existing products. While this makes product manufacturing more challenging for NGK, it is important that we use it as an opportunity to enhance our productivity. In addition to introducing better manufacturing technologies, we are working to incorporate collaborative robots, RPA*2, and other automation and streamlining approaches into all of our work processes, including office work, that will help us to improve our overall productivity.

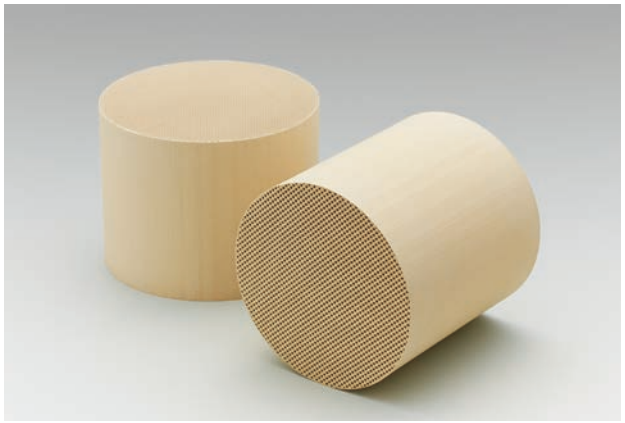
Ceramic products business
Automotive-related products

The HONEYCERAM® ceramic substrates for automotive catalytic converters are indispensable in cleaning vehicle exhaust. They have been adopted by automakers around the world and are manufactured by plants in Japan, Belgium, the U.S., Indonesia, South Africa, China, Poland, Mexico, and Thailand.

NGK offers a range of other environmentally friendly and energy-efficient products, including diesel particulate filters (DPFs) and gasoline particulate filters (GPFs) which remove particulate matter (PM), and NOx sensors which measure nitrogen oxide (NOx) concentration in automobile exhaust.

Sales ratio by product





Gasoline particulate filters (GPFs)
These particulate filters for gasoline-powered vehicles are used mainly in direct-injection gasoline engines that provide high horsepower and excellent fuel economy.

In-vehicle high-precision NOx sensors
These sensors contain elements that utilize zirconia's oxygen pump function. They are now incorporated in clean diesel vehicles around the world because of their superior detection capabilities and greater durability.

Our Role Is to Create New Products and Expand Their Sales

Fiscal 2019 outlook (after elimination of intersegment sales)

Net sales
60.0 billion yen

Operating income
1.5 billion yen

Current situation and future outlook:
Investing in data centers and 5G to facilitate a recovery in demand from the second half of the fiscal year

Both electronic components and metal-related products have struggled in difficult market environment resulting primarily from the soft Chinese market, which began in the fall of 2018. Nevertheless, thanks to production system optimization, smoothed production, cost cutting, and other measures, we have been prepared for this changing market and have been able to minimize its impact on our business performance.

Although there is concern that trade friction between the U.S. and China will negatively impact the market, we have been investing in data centers and 5G (fifth-generation mobile telecommunications systems) and anticipate that this will stimulate a recovery in demand from the second half of the current fiscal year.

Promising products:
Improving performance for both piezoelectric micro-actuators for HDDs and bonded wafers to expand business

As AI and IoT become more widespread in society, this spurs a variety of technological innovation aimed at increasing the amount of, and speed at which, telecommunications data can be processed. The primary aim of NGK's electronics business is to be at the forefront of these changes where we will innovate and grow the range of products on the market. Towards this end, within our electronics components business we are expanding production capacity of piezoelectric micro-actuators for hard disk drives (HDDs) and bonded wafers for SAW filters in order to meet growing demand for electronics components.

With the global data volume projected to keep increasing, demand for storage at data centers is also expected to increase. We are anticipating the increased demand that will come for near-line servers by increasing production of piezoelectric micro-actuators for HDDs, which are a key device that storage media depend upon. Additionally, with regard to mobile communications, the proliferation of technologies enabling ever faster telecommunications speeds is expected to expand the market for NGK's bonded wafers for high-performance SAW filters. We are increasing our lineup of products that will provide more improved communication quality in line with our customers' program specifications, thereby expanding the scope of our electronics components business.

With our metal-related products, as well, we are working on increasing the scope of telecommunications infrastructure applications that we offer, such as by using base station connectors as a vector for increased sales. Also, in addition to our core beryllium copper products, we are introducing to the market a new copper-nickel-tin alloy material that is used in high-performance conductive springs. Currently, this alloy is primarily used in automotive micro motors and clock gears. By capitalizing on its superior abrasion and thermal resistance, we are working to expand sales among automotive and industrial machinery axel-bearing manufacturers, among others.

In addition to the rapidly evolving state of information technology, increasingly stringent environmental regulations within the automotive industry are driving a worldwide trend towards electrification and a growing push for EVs. NGK is focusing on demand for on-board power modules, which is the result of increasingly high-powered electronics, to expand sales and development of insulated circuit boards.

Challenges for the future:
Cultivating new product potential for the future

The Electronics Business Group began commercial production of gallium nitride (GaN) wafers in fiscal 2018 and EnerCera® chip-type ceramic secondary batteries in fiscal 2019. Both of these products were brought to market in advance of the full-scale demand expected to manifest in the future. The challenge for NGK in the present is to steadily cultivate the potential of these new products in order to ensure their long-term growth.

Gallium nitride (GaN) wafers are for semiconductor lasers, which are growing in demand as alternatives to mercury lamps. They are made using proprietary NGK crystalline growth technology (liquid phase crystalline growth method), which produces GaN wafers exceptionally free from defect. Because they have so few defects, they are able to produce a high-powered, highly efficient laser. We are aiming to expand sales of these

Manufacturing sites

● **Metal-related products:** Japan, US, France ○ **Electronic components:** Japan, Malaysia
○ **Soshin Electric:** Japan, Malaysia

Director and Senior Vice President; Group Executive, Electronics Business Group

Shuhei Ishikawa

wafers among projector and automotive headlight manufacturers.

The EnerCera series of ultra-small lithium-ion secondary batteries are perfectly suited to powering IoT devices. They make use of NGK's own crystal oriented ceramic plate as electrodes to achieve a high energy density, low resistance, and high thermostability within a small and thin body. EnerCera began mass production at NGK Ceramic Device in April, and we are now working to expand adoption of them among our customers.

Electronics business

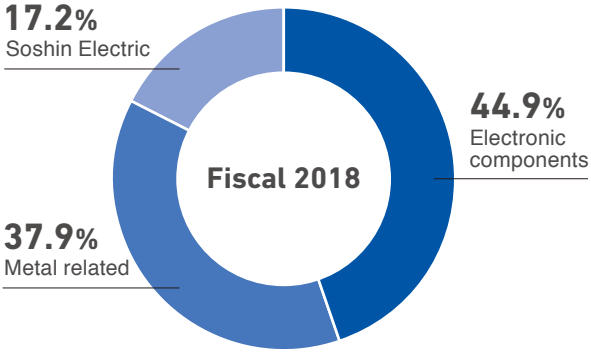
Metal-related products

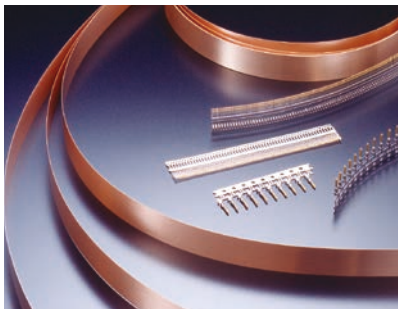
Beryllium copper, which is made by adding a small percentage of beryllium to copper, is resistant to fatigue and has a long service life, making it the ideal material for reliable conductive springs and contact points in a broad range of applications. The manufacture and sale of beryllium copper is the primary business of NGK's metal-related product business. Since 2016, copper-nickel-tin alloy has been added to the product lineup as a non-beryllium copper product.

Electronic components

In addition to HDD piezoelectric micro-actuators, bonded wafers for electronic devices, and other products developed using the proprietary ceramics technology which NGK has cultivated over the years, our product lineup includes Soshin Electric's components for telecommunications devices and NGK Electronics Devices' ceramic packages for high-frequency devices.

Sales ratio by business





Beryllium copper alloy
We can provide the right alloy mix to suit your needs. Beryllium copper alloys offer high strength, high conductivity, fatigue resistance, high temperature properties, workability, and corrosion resistance.

Piezoelectric micro-actuators
Micro-actuators are indispensable for performing precise control of magnetic heads in HDDs. Our ultra-compact micro-actuators are used in data centers throughout the world.

EnerCera
This is a chip-type ceramic secondary battery with an ultra-thin body just 0.4-mm thick. Thanks to the incorporation of our unique crystalline orientation technology, it achieves high energy density.

Cultivating Growth from a Broader Market and More Diverse Customer Connections

Fiscal 2019 outlook (after elimination of intersegment sales)

Net sales
106.0 billion yen

Operating income
13.0 billion yen

Current situation and future outlook:
Temporary curbing of semiconductor-related investment

For the fiscal period ending March 2019, the HPC-related (ceramics for semiconductor manufacturing equipment) business saw a drop in demand coinciding with market variability beginning in October. However, industrial process products were not significantly affected.

In the case of the HPC-related business, the emergence of market variability threw cold water on the "super cycle" of straight growth, which has occurred over the past two to three years. However, unlike the "silicon cycle" of many years ago, this downturn is due to a temporary unbalance semiconductor supply and demand caused by a variety of factors, as well as a curbing of investment in anticipation of trade friction between the U.S. and China. Growth is expected to get back on track by the first half of next year. Thus, work on the new plant in Tajimi, Gifu Prefecture is proceeding as scheduled.

With regard to industrial process products, our kilns for cathode materials used in lithium-ion batteries, which are one of our core products, have become the standard on the Chinese market, resulting in a 50% year-on-year growth in sales for the period ending March 2019. Demand for cathode materials is being driven by a shift in China towards electrical motors in automobiles. With this trend expected to continue, we started operations at a new plant in Suzhou in February in order to boost our production capacity. At the same time, however, we need to be careful when doing business in China. When demand emerges in a certain field in China, investments tend to concentrate in that particular field. More and more competitors enter the market and we end up falling into a harmful cycle of excessive competition. To avoid this, we want to focus on delivering solutions to a broad range of needs, and be open to collaborate with other companies.

Group synergy:
Fusing the distinctive qualities of NGK's industrial process products with the technological strengths of the NGK Group

The Process Technology Business Group is now over a year old. The initial plan was to produce synergy by combining the broad span of business sectors covered by NGK's industrial process business, as well as the deep and valuable long-standing customer relationships, with cutting-edge HPC technology. Now we expect to expand that synergy by incorporating any and all of the various technologies found throughout the NGK Group so that we can provide even more applications for our industrial process and HPC customers. We have already begun exploring some interesting ideas with the New Business Planning Office and the Electronics Business Group. We look forward to seeing the developments that come out of these ideas.

In order to facilitate integration of the different business groups' cultures, we utilize a variety of ongoing approaches, including social events, sales conferences, and plant tours. We are particularly focused on strengthening our sales department network, as they are the ones who interact directly with the market. As part of our efforts to integrate the various teams at the business group level, we have expanded the industrial process team's sales training this year to also include HPC staff members. Moving forward, we are also considering implementing a personnel exchange system.

Towards future growth:
Establishing NGK out of competitors' reach by meeting customers' challenging needs

Demand for HPC-related business is expected to recover from its ongoing slump. However, the medium-term growth in demand is looking to be taking slightly longer than previously anticipated. Thus, in light of long-term demand, we are thinking very carefully about what sort of plant to make the No. 2 Building of our Tajimi Plant. It will take three to four years from the start of construction until products begin shipping. Hence, we are deeply engaged in communication with our customers and studiously watching the market in order to hit the ground running.

In this sector, customer needs become more and more sophisticated every year, and the challenges to maintain stable production appear one after another. But we are continuously meeting those challenges and will establish ourselves out of reach of our competitors.

The industrial process business has several product lines, and they each have a possibility of growth that we look forward to. We aim to achieve significant sales growth through new products and businesses including reactor decommissioning business carried out in conjunction with overseas manufacturers, advanced refractories, hybrid GL,

Manufacturing sites

● **High-performance ceramics:** Japan, US ○ **Industrial process products:** Japan, China, Thailand

Director and Senior Vice President; Group Executive, Process Technology Business Group **Ryohei Iwasaki**

new ceramic film filters, and CO_2 separation membranes. We are wasting no time in investing our corporate resources, as well as instituting job rotations, providing training opportunities, and undertaking other proactive efforts to build up the human resources that are fundamental to the success of our business.

Process technology business

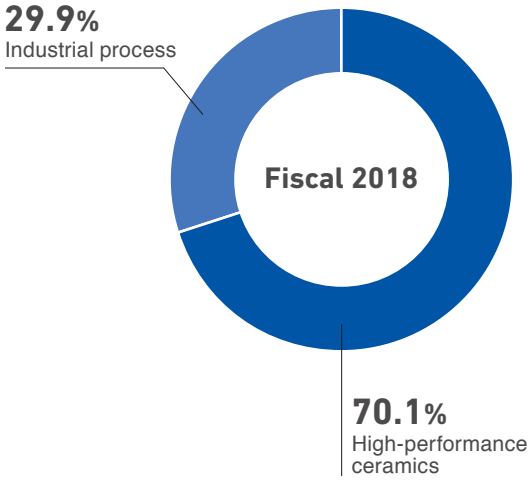
High-performance ceramics (ceramics for semiconductor manufacturing equipment)

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

Industrial process products

We offer a lineup 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 environmental protection and energy conservation.

Sales ratio by business



Ceramic heaters

These are used to keep the temperature of silicon wafers constant during the membrane formation process. Our unique heater structure sees a shaft attached to the underside of the heated stage on which wafers are placed. This way, we can protect terminals and conducting wires from halogen gas.

Low-level radioactive waste treatment systems

Our treatment systems are used at nuclear facilities throughout Japan, and are rated highly for their outstanding dust removal performance and steadfast safety. What's more, they make a real contribution to waste reduction.

Wavelength-control drying systems

By selectively irradiating light at specific wavelengths, the unit can dry at low temperatures (approximately 40°C) while limiting thermal damage to products, helping to enhance product quality, and improving productivity.

Looking ahead to the next 100 years by looking back on the commitment to trust upon which NGK was founded

NGK has discovered that there were instances where insulators and related products of the Power Business Group shipped by NGK did not undergo tests required by customers in accordance with the agreements between customers and NGK (“Non-Conformity Issue”). To deal with this issue, the NGK Group has spent the past year implementing a variety of initiatives aimed at preventing a recurrence and improving quality compliance. Director and Senior Vice President Chiaki Niwa, who serves as the chair of the NGK Quality Committee, talks about the current state and future direction of quality compliance within the NGK Group.

Director and Senior Vice President **Chiaki Niwa**

Occurrence and causes:

A complicating confluence of pressure, opportunity, and rationalization

The Non-Conformity Issue occurred in insulators, the product upon which NGK was founded and upon which the infrastructure of society depends. The issue shook customer confidence in the NGK Group and has drawn quite severe and pointed feedback.

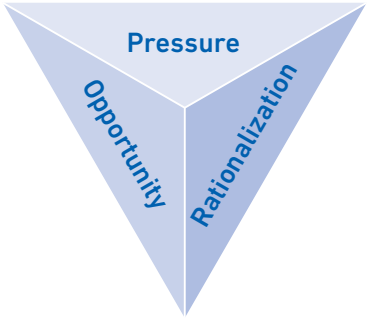
We retained outside counsel and asked them to investigate a transparent and fair analysis of the causes of this issue. The pressure was found to be a desire to make the testing operations more efficient. If NGK was going to revise the inspection items stipulated in the agreement, it should have explained why this was appropriate to the customer and applied to change the inspection agreement. The opportunity that allowed the issue to arise was an integration of the inspection and manufacturing departments, such as the incorporation of automated inspection processes into the production line. This obscured the distinction of the position that led to confusion about which department would be responsible for ensuring the testing specification as prescribed by the customers. As for the rationalization used to excuse the issue, those involved felt confidence that the quality of our insulators manufacturing process and the sufficient margin to the specified values.They also had the belief that stringent in-house inspections would have already found and removed defective units and that there had been no market complaints in the past. It is believed that the confluence of these three factors led to this issue.

Strengthening the system:

Stronger recurrence prevention measures by the Head Office and Business Groups

As soon as NGK learned of this issue, it became the Group’s top priority, with President Oshima spearheading efforts to address the issue and prevent it from reoccurring. The president now participates in and directly

■ Three factors that led to the compliance violation



■ Key points of the Quality Compliance Program for preventing recurrence

- Clear statements by management
- Thorough dissemination of rules
- Education and training
- Auditing
- Improvement in quality of business
- Email monitoring (*1)
- Review of the implementation status of the Program by a third-party expert

*1: Begun in fiscal 2019

supervise the Quality Committee, and the frequency of Committee meetings has been increased to four times per year. In addition, whereas product quality has traditionally been the Committee's central focus, in-house rules have been revised to extend business quality, specifically whether operations comply with customer agreements and whether the processes used, as well as their quality, are appropriate.

At the Head Office, we have strengthened the authority of the Quality Management Department to audit quality control for the entire Group. In addition to the conventional ISO 9001 auditing framework, systemic changes have been implemented to enable auditors to better assess the actual situation. In conjunction with this, detailed rules governing what measures should be taken when a violation is discovered are being codified. Email monitoring is also being developed.

Within the Power Business Group, the Inspection Department has been split from the Insulator Division and moved to the Quality Assurance Department directly under the authority of the Power Business Group. Operational processes have been changed, and the number of inspection team members has been doubled to augment the inspection system.

Improving corporate culture:

Getting back to basics, listening to employees, and providing compliance training

It is not enough to only strengthen quality compliance system. We are also focusing on improving our corporate culture. President Oshima has conveyed his message to company-wide and the Group Executives and General Managers have communicated numerous times. Because unless it reaches those who are actually performing the work of the NGK Group, it has no value.

Within the Power Business Group in particular, a concerted effort to talk with and listen to each employee has been made. In these interviews, a variety of questions, issues, and other work-related topics were discussed. It appears that employees came away with a deeper understanding of the importance of quality and contracts.

At the same time, corporate executives and managers were given lectures on quality management. Quality compliance training was also provided to general employees.

Results and future outlook:

Strengthening check systems and automating inspections

In fiscal 2018, quality compliance measures were developed, operational discrepancies were improved, and business quality was reviewed.

With regard to auditing, adding a member from the Quality Assurance Department of a different Business Group that being audited was found to be extremely effective. This is due to the completely different business focuses of the four Business Groups. For example, a member of the Ceramic Products Business Group handling automotive parts would be dispatched to the Power Business Group to perform an audit. This interaction of different perspectives allows the good points from each to be utilized.

In addition to all of this, starting this year NGK contracts a third-party expert to review the effectiveness of the NGK Group's Quality Compliance Program. A three-tier system is put in place to check quality compliance, with the first tier being internal auditing by each Business Group, the second being auditing by the Head Office, and the third being a fully objective review by an outside organization.

We are also looking into changing the inspection process itself. Steps are being taken company-wide that data related to product quality such as test data will be automatically collected and processed as electronic data so as not to involve employees discretion. Active capital investment and technological development are being undertaken towards this end.

In cases where inspection methods are outdated and the latest technologies should be incorporated, we need to deliberate with customers and revise contracts as appropriate.

As our newly enacted Group Philosophy, social trust is the foundation of everything. As we look ahead to the next 100 years, we go back on the founding principles that motivate us to provide new value to society with our unique technology, contribute to improving quality of life, foster the development of industry, and conserve the global environment.

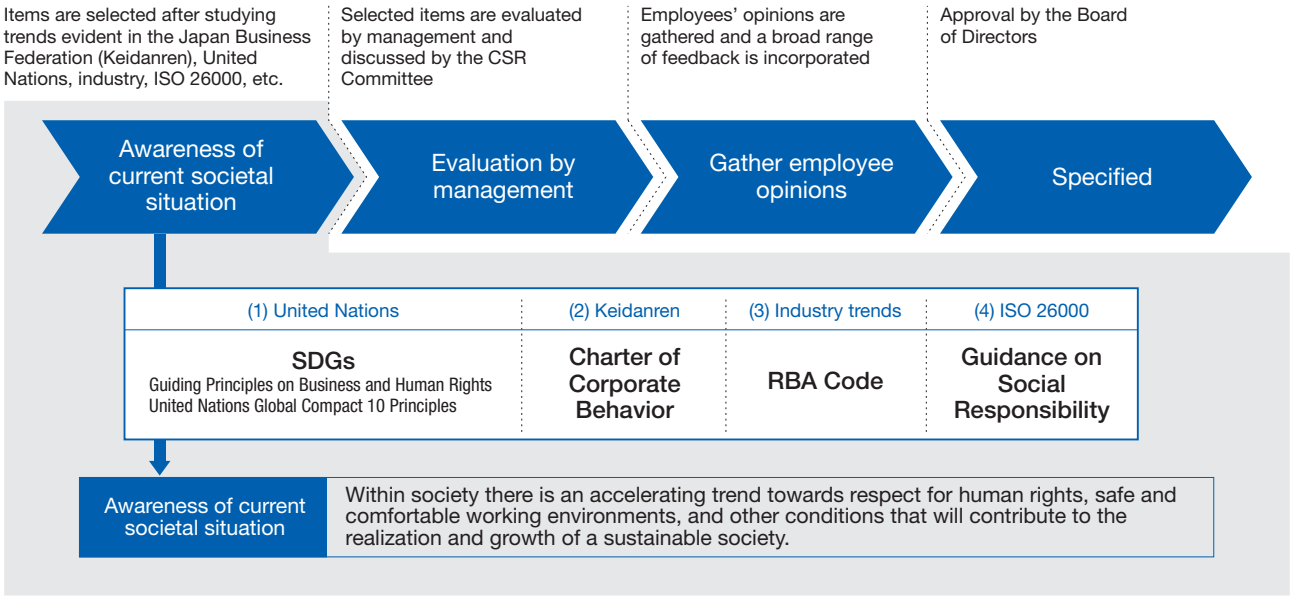
CSR Activities Concepts and Systems

The NGK Group seeks to provide new value to society with our unique technology, and contribute to improving quality of life, foster the development of industry, and conserve the global environment. It seeks to do all of this in a way which is socially responsible and which wins the positive expectations and trust of society.

NGK Group Code of Conduct	Initiatives	KPIs
1. Realization of a Sustainable Society We will create new value through the provision of products and services that contribute to society, protect the world environment, and strive to realize a sustainable society.	• Quality objectives • Overhaul and thorough strengthening of quality assurance measures	Number of inspection sites, time spent on inspections
	• Introduction of QuiC quality improvement activities • Strengthening of quality management system (QMS) training • Quality-related education	Number of participants
2. Respect for Human Rights We will strictly comply with international standards of human rights and respect the diversity of all people.	• Signed on to UN Global Compact • Participation in outside study groups • Human rights due diligence	Number of participations in study group, number of participants
	• Education via in-house training • Diversity promotion • Expansion of job opportunities for the disabled	Number of participants Employment rate of persons with disabilities Number of female managers (percentage)
	• Establishment and publication of helpline • Anti-harassment training	Number of helpline consultations
3. Provide a Safe and Enjoyable Work Environment We will provide a safe and enjoyable work environment that is comfortable for everyone to work in for all.	• Acquisition of international standards certification	External certification coverage rate
	• Initiatives to reduce long work hours • Initiatives to facilitate work-life balance • Raising of mandatory retirement age, etc.	Rate for taking of paid leave Number of system users
	• Investigation of how to achieve organizational activation • Labor–management initiatives	Frequency
	• Human resource development	Number of participants Training cost
4. Honest Business Activities We will undertake fair and transparent business activities with integrity and strictly comply to international standards, laws and regulations of each country and region.	• NGK Group Code of Conduct • Compliance-related education	Number of sessions Number of participants
	• Quality-related education • Helpline • Restructuring of quality-related activity framework	Number of sessions, number of participants
	• Initiatives to strengthen compliance with the Competition Laws	Number of sessions, number of participants
	• Implementation of bribery-related education	Number of participants
	• E-learning	Number of participants
	• Lectures	Number of participants Number of e-learning participants
	• Utilization of administration systems • Study groups	Coverage rate Number of participants
	• Corporate risk surveys (CRS)	Response rate, improvement rate
	• Establishment of a helpline • Raising of awareness about whistleblowing system (hotline)	Results
5. Disclosure of Company Information and Accountability We will increase healthy and transparent management by active disclosure of information and discussion with stakeholders.	• Publication of NGK Report and NGK Sustainability Data Book • Website • News releases	
	• Investor relations (IR) • Booths at IR and investment fairs	Frequency, number of participants
6. Permeate Social Responsibility into our Supply Chain We will promote a structure that fulfills societal responsibilities to our trade counterparts and the supply chain overall.	• Business results briefing sessions • Establishment of helpline for business partners	
	• Thorough enforcement of CSR Procurement Guidelines and Green Procurement Guidelines	
	• Written consent • Individual visits	Rate of consent Number of visits
7. Preservation of Environment We will work to preserve and resolve the problems of the world environment.	• Development and provision of products contributing to environmental protection	Sales ratio
	• Five-Year Environmental Action Plan • Introduction of environmentally friendly processes • Net-zero energy buildings (ZEBs) • Reduction in CO_2 from distribution processes	Achievement rate of five-year plan
	• Biodiversity surveys of company-owned site	
	• Acquisition of ISO 14001 certification	Rate of acquisition
8. Cooperation with the Region and Society We will contribute to the expansion of the region and society as a good corporate citizen.	• Support for foreign students • Science volunteers	Number of supporters, amount of money
	• Participation in Table for Two initiative, provision of marathon volunteers	Number of meals, number of participants

Revision Process for the NGK Group Code of Conduct

In setting CSR promotion items, we have disclosed eight items in the NGK Group Code of Conduct in order to establish a framework that is integrated with the Code of Conduct while disclosing information and restructuring activities.



Reference URL NGK Group Code of Conduct https://www.ngk-insulators.com/en/sustainability/guideline/index.html

CSR Promotion Framework

To promote CSR activities, the NGK Group has established the CSR Committee, the Environmental Protection Committee, the Quality Committee, the Safety and Health Committee, and the Internal Controls Committee.

In terms of legal and corporate ethics compliance activities, the CSR Committee discusses items necessary to assist decision-making by the president and CSR Committee chair. Also, in April 2019, the ESG Committee was established with the president serving as its chair. In line with the NGK Group Philosophy, this committee discusses management issues pertaining to ESG.

Position on SDGs

The NGK Group is a signatory to the United Nations Global Compact, which advocates for independent action on the part of companies. We believe that addressing a broad range of social problems through our business activities, while measuring progress against indicators such as the Sustainable Development Goals (SDGs) adopted by the UN, is an important corporate social responsibility.

For more information about NGK's approach to SDGs, access the NGK Sustainability Data Book 2019 from the link below.
https://www.ngk-insulators.com/en/sustainability/booklet.html

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 based on Environmental Philosophy and Environmental Action Guidelines in order to bring its corporate activities into harmony with the environment (revised in June 2019). 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

The NGK Group continues our commitment to improving the global environment through our "Triple E" businesses representing the energy, ecology, and electronic sectors.

For more information about NGK's environmental initiatives, access the NGK Sustainability Data Book 2019 from the link below.
https://www.ngk-insulators.com/en/sustainability/booklet.html

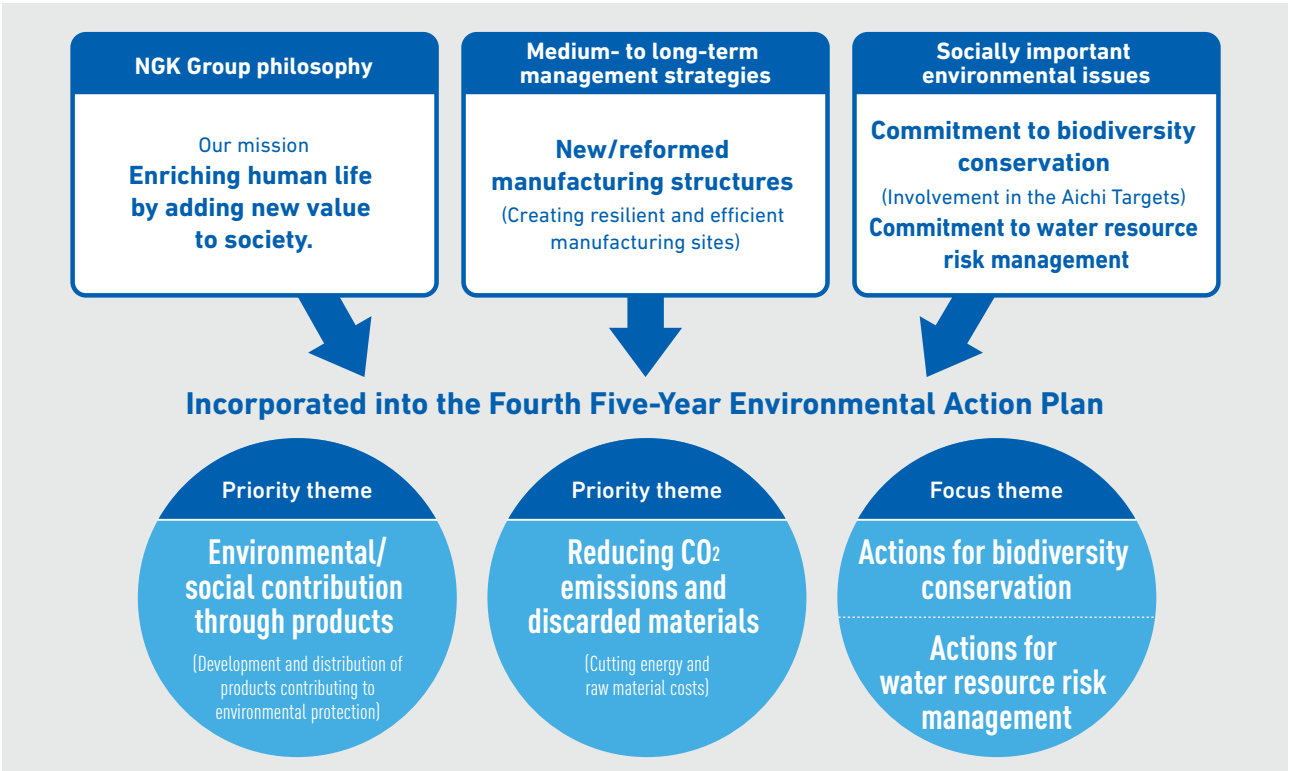
Five-Year Environmental Action Plan

The NGK Group has established the Fourth Five-Year Environmental Action Plan (2016–2020). To achieve the goals of the Plan, we are promoting environmental activities, setting annual targets.

Outline of 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, initiated in fiscal 2016, has been formulated to broadly encompass major global environmental challenges that businesses are expected to take, and to select two key issues each for two groups of themes, namely, priority themes and focus themes.

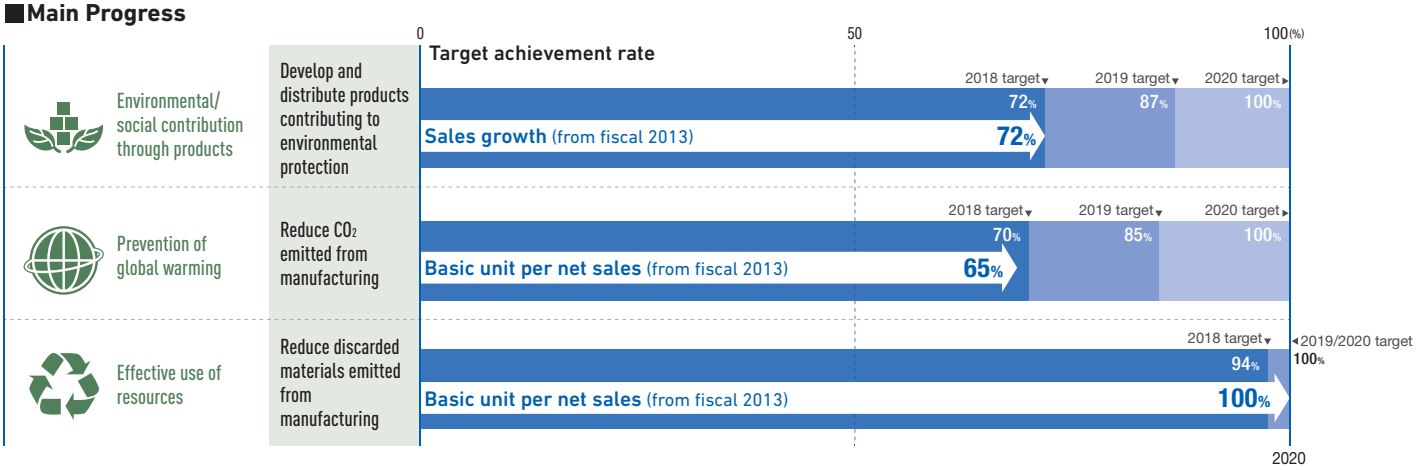
The two priority themes are: environmental/social contribution through products; and reducing CO_2 emissions and discarded materials. The first priority theme directly reflects the core concept of the corporate philosophy, while the other theme closely relates to NGK's medium- to long-term initiative of New/Reformed Manufacturing Structures for increasing competitiveness. For focus themes, we have also set two issues: biodiversity conservation and water resource risk management/response, both being major challenges for which socially responsible corporate action is required with greater urgency.



Five-Year Environmental Action Plan Progress Report

Compared with the projections made at the start of the fiscal year, declining numbers for NGK's core products and a variety of other worsening factors resulted in the Group failing to meet several fiscal 2018 annual targets established as part of cumulative quantitative objectives. Other than these targets, NGK's progress matched the plan established at the start of the fiscal year. For fiscal 2019, targets have been set that reflect projections that numbers for core NGK products will recover and that the other negative factors will be resolved.

■Main Progress



Protecting Biodiversity

In the NGK Group, we view the challenge of protecting biodiversity as an integral part of achieving a sustainable society, and towards that end we are undertaking the following activities.

Activities for Achieving the Aichi Targets

The NGK Group has been pushing forward with activities pursuant to the Aichi Targets (international goals for biodiversity) agreed upon at the 10th Meeting of the Conference of the Parties to the Convention on Biological Diversity (COP 10).

Since the start of the current Five-Year Plan, which began in fiscal 2016, we have conducted biodiversity surveys of company-owned sites, participated in the "My Action Declaration" initiative run by the Ministry of the Environment, and undertaken joint initiatives with suppliers.

Aichi Targets	NGK Activities
Target 1 Spread awareness	Employee environmental education, next-generation education, cooperation with suppliers, promoting participation in My Action Declaration initiative
Target 4 Sustainable production and consumption	Expanding sales of products contributing to environmental protection, CO_2 reduction, effective use of resources, cooperation with suppliers
Target 5 Inhibit loss of all natural habitats	Voluntary employee participation in forestation and other environmental conservation activities, biodiversity survey/appropriate control of company-owned site
Target 8 Control pollution by chemical substances, etc.	Chemical substance management, management of exhaust and wastewater, expanding sales of products that prevent air pollution, cooperation with suppliers
Target 9 Alien species	Biodiversity survey/appropriate control of company-owned site
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, biodiversity survey/appropriate control of company-owned site

Notes:
1. Source: "Guidelines for Action by the E&E Industries Concerning Biodiversity Conservation" (The Biodiversity Working Group, The 4 Electrical and Electronic Industry Associations)
2. Red text shows NGK activities that started in fiscal 2016.

Participating in the "My Action Declaration" Initiative

In fiscal 2017, as a way of raising awareness among employees, we began promoting participation in the "My Action Declaration" initiative led by the Japan Business Federation and the Ministry of the Environment. This project aims to have by 2020 a million people make a declaration to take action to conserve biodiversity.

NGK Insulators has capitalized on this initiative as an opportunity to raise awareness among all employees and has thus far received around 4,800 employee declarations. We continue to promote horizontal expansion of this initiative throughout the NGK Group in Japan. We have received a total of about 6,200 declarations from NGK Group employees.

Risk Management of Water Resources and Response

Within the NGK Group, we perform water risk assessments for all of our production sites, as well as promote more efficient water usage according to independently established guidelines. With regard to water risk, we utilize public tools to carry out self-assessments at all production sites, and at sites where there are water shortage concerns, we bring in third parties to perform detailed analyses. Although no serious water-related risks have been identified to date at any of our facilities, we will continue to monitor the situation and stay abreast of regulatory trends to ensure stable operations in the future.

Employees

The NGK Group strives to create a safe and comfortable working environment in which every employee is respected. The NGK Group implements a human resource system that enables every employee to perform at their full potential under fair treatment.

Basic Approach

The NGK Group Code of Conduct was revised in January 2019 to express the Group's commitment to respecting human rights and providing a safe and enjoyable work environment for employees.

●We will strictly comply with international human rights standards and respect diversity of all people.

- We will respect human rights and undertake business activities without the use of forced labor or child labor.
- We will respect the individuality and independence of each employee and will not engage in discrimination relating to race, nationality, gender, age, religion, belief, existence of handicaps, sexual diversity or any other aspect.
- We will prevent the occurrence of harassment in the workplace and will take prompt and appropriate action in case it occurs.

●We will provide a safe and enjoyable working environment that is comfortable for everyone.

- We will strictly comply with laws and regulations of each country and region relating to labor, safety, and health.
- We will aim to harmonize work and life, and support variety of working styles.
- We will build a relationship of trust through sincere discussions with employees.
- We will give educational opportunities to employees and provide opportunities to develop their motivation and abilities.

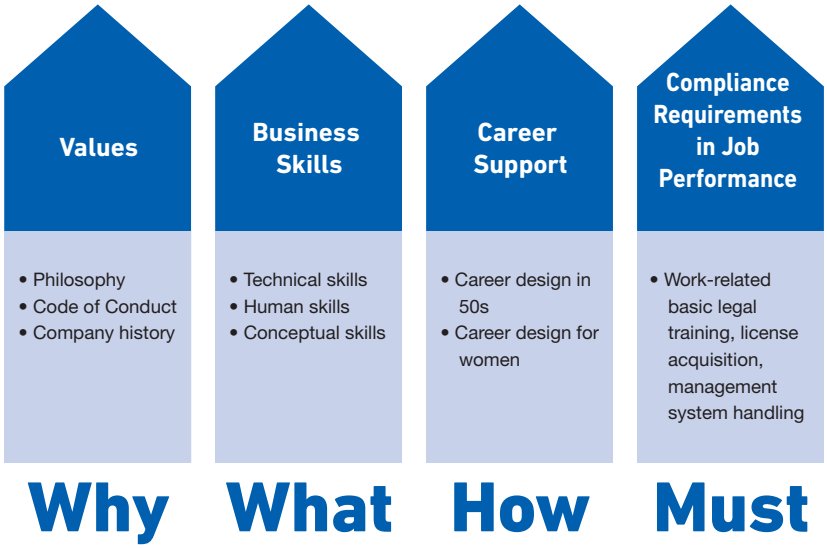
For more information about NGK's employee-focused initiatives,
access the NGK Sustainability Data Book 2019 from the link below.
https://www.ngk-insulators.com/en/sustainability/booklet.html

Human Resource Development

The success of all our business activities depends upon the caliber of our human resources. More than anything else, the NGK Group values and seeks to empower employees who have a broad vision, who do not fear change, who are tenacious, who welcome challenge, who have respect and seek to mutually enhance one another, and who demonstrate the ability to work in teams across border.

Human Resources We Aim to Develop

① Individuals who are bold and tenacious when overcoming challenges
② Individuals who are able to work in teams to get results
③ Individuals with the skills and sense needed to carry on business activities across borders



NGK Insulators undertakes systematic human resource development, which encompasses every job category in the NGK Group in Japan, from employment to every promotion milestones in his or her career.

The comprehensive education and training we provide for the NGK Group in conjunction with each employee's department is divided into four areas: the "Values" necessary to put the NGK Group Philosophy into practice, the "Business Skills" necessary to successfully carry out their work, the "Career Support" necessary for your advancement and, lastly, "Compliance Requirements in Job Performance."

Promoting the Success of Women

The NGK Group strives to increase opportunities for motivated and skilled people to enhance their skills regardless of gender. We are also engaged in creating comfortable working environment for women. The number of female key personnel (Managers) of NGK in fiscal 2018 was 20.

NGK Ratio of Female Key Personnel (Managers)

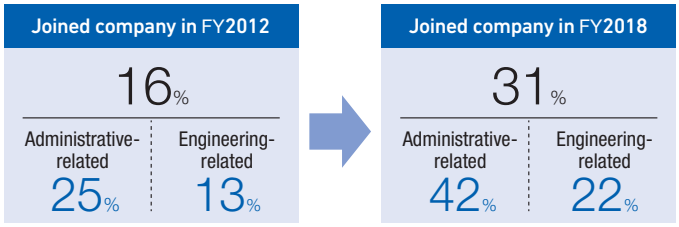
	FY2015	FY2016	FY2017	FY2018
Number of female key personnel	14	16	17	20
Ratio of female key personnel	1.8%	2.0%	2.0%	2.2%

Ratio of Female Key Personnel (Managers) at Overseas Group Companies

FY2015	FY2016	FY2017	FY2018
16.6%	15.3%	21.0%	16.0%

Increased Percentage of Women among New Graduate Hires

NGK Insulators has set a goal to hire more women. Between fiscal 2012 and 2016, the percentage of women hired increased from 16% to 29%. In fiscal 2017 and 2018, the percentage was 23% and 31%, respectively. We will continue to undertake various initiatives in line with our corporate action plan to achieve our targets.



Establishment of a Career Consultation Helpdesk

In March 2016, we established a career consultation helpdesk for female employees to discuss career-related concerns. At the helpdesk, certified career consultants provide support and consultation services to employees, while strictly observing confidentiality. Since May 2017, we have expanded the service to make it available not only to women but to all employees.

Promoting Participation of Older Employees

As part of changes made to the NGK Insulators personnel system in April 2017, the mandatory retirement age has been raised to 65. Salary levels, bonuses, and benefits have all been kept at the same level as of age 60. Our goal is to ensure employees to work without worries even after they turn 60. More robust systems and support have been introduced for employees with illness or nursing care needs, such as more flexible work schedules offering shorter hours and three-day work weeks, or a lump sum nursing care support allowance for employees caring for their parents or spouse.

I want to keep delivering new products to the world right up until retirement

I turned 60 in 2017, which is the same year that NGK raised the mandatory retirement age. My job is designing and drawing plans for new sensors used in automobiles. I have worked with sensors for the past 36 years, having been involved with everything from sensor design to production technology and production control. There are a lot of young developers working in the same office with me, so I also help to train them. I have so much that I have to do, but it also means that I have new and interesting challenges every day.

Before the raise of mandatory retirement age, employees had the option of applying to be rehired mostly as a support role, but now that I am able to remain right on the front line, it naturally enhances my sense of motivation.

I have three and a half years until mandatory retirement age of 65. Until then, my primary goal is to keep delivering new sensors to the world. I will also devote my energies to help my young colleagues become worthy successors.

Advanced Development Department, Sensor Division, Ceramic Products Business Group

Nobukazu Ikoma

Corporate Governance

NGK is conducting measures to expand and strengthen its corporate governance to increase corporate value with the intent of becoming a company trusted by all its stakeholders.

Basic Policies

Thorough observance of the NGK Group Code of Conduct

To ensure appropriate operations and transparent management, NGK has set its sights on establishing and maintaining an organization capable of swiftly responding to changes in the business environment, and a fair and open management system emphasizing the interests of shareholders. These components make up NGK's basic approach to corporate governance.

To put this approach into practice, NGK has chosen a corporate governance structure anchored by an Audit & Supervisory Board. In addition to the General Meeting of Shareholders, the Board of Directors, and the Audit & Supervisory Board, NGK corporate governance includes the Executive Committee and several other committees established to assist the president in management decision-making. These bodies help to enhance governance efficacy by deliberating and reviewing important matters. In recognition of needs to execute swift and optimal decision-making and respond promptly to changes in the operating environment, NGK introduced an executive officer system, thus separating the management decision-making and supervision functions from business execution functions, and clearly defining the responsibilities of both.

Furthermore, to strengthen the supervision and monitoring functions of the Board of Directors, major committees among those tasked with mitigating the various risks surrounding NGK are obligated to report to the Board of Directors. NGK has also established a committee scheme, including a Nomination and Compensation Advisory Committee, a Corporate Council, a Conference of Outside Directors and Outside Audit & Supervisory Board Members, and a Business Ethics Committee to ensure the effectiveness of the Corporate Governance Code.

In addition, we have formulated the NGK Group Code of Conduct to stipulate how everyone working for the NGK Group should execute their jobs so that they abide by society's laws and the company's articles of incorporation and comply with corporate ethics. All executives and employees are well versed in the code and are obligated to abide by it. To reflect changes in society since the previous revision, in January 2019 the NGK Group Code of Conduct was revised with an emphasis on respect for human rights, thorough compliance, and the realization of a sustainable society through business activities.

Corporate governance enhancement

Ongoing structural enhancements aimed at strengthening corporate governance include the introduction of an executive officer system and an outside director system to improve the management supervision and monitoring functions and facilitate recommendations with respect to overall management.

April 1999	Formulated NGK Code of Conduct
April 2003	Revised guidelines into NGK Group Code of Conduct
June 2005	Introduced an executive officer system Introduced a stock option Introduced an outside director system
July 2005	Established the CSR Committee
April 2007	Established the CSR Office
June 2010	Appointed independent directors
July 2011	Revised NGK Group Code of Conduct
April 2015	Signed on to UN Global Compact
June 2015	Established the Global Compliance Office
December 2015	Established committees for corporate governance
June 2017	Appointed one additional outside director
October 2018	Appointed a chief compliance officer
January 2019	Revised NGK Group Code of Conduct

Reference URL: Corporate Governance Report
https://www.ngk-insulators.com/en/resource/pdf/sustainability/governance_en.pdf

Committees on Corporate Governance

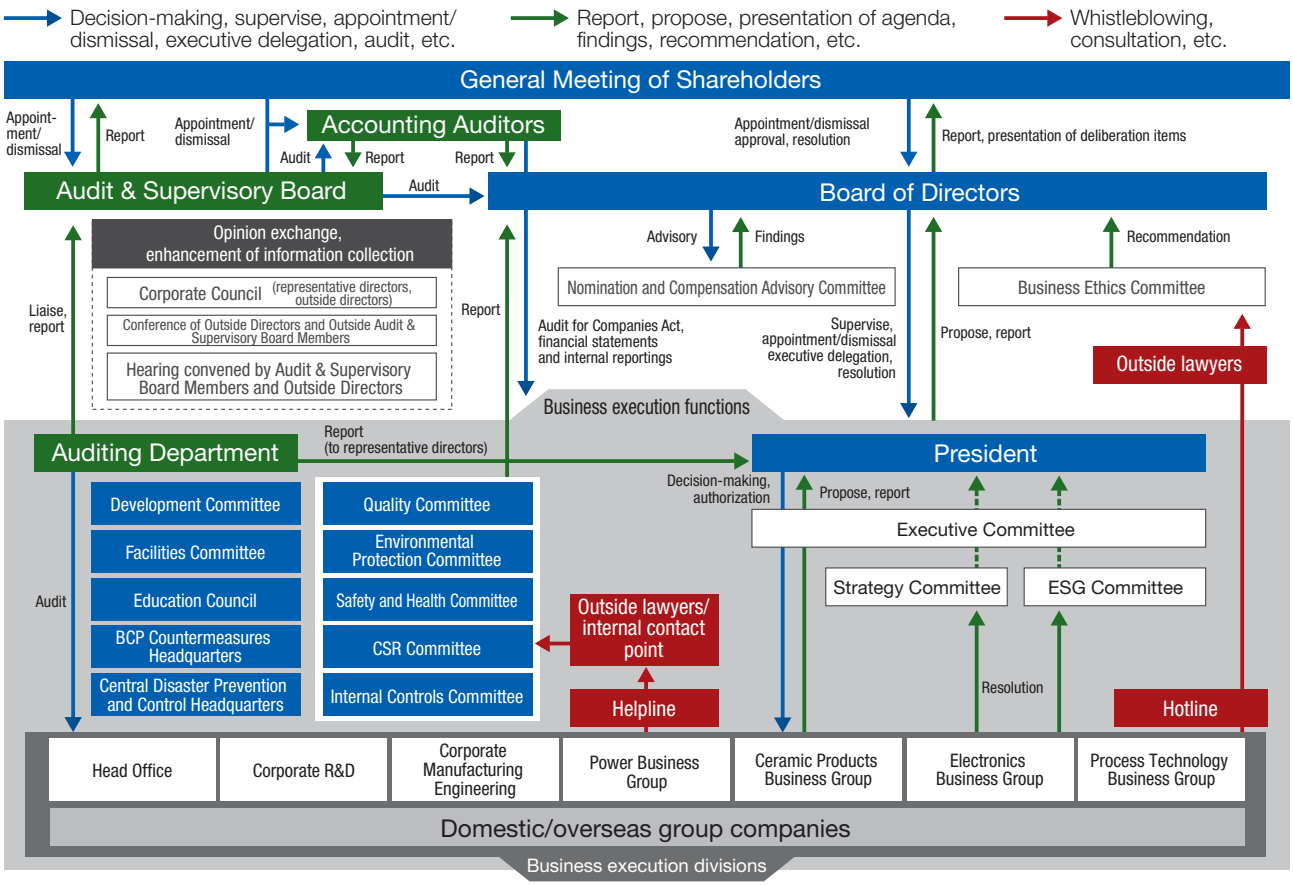
NGK has further strengthened and enhanced its corporate governance structures by establishing committees to bolster the supervision and monitoring functions of the Board of Directors.

	Overview	Members	No. of people	Times held
Board of Directors	Deliberates matters prescribed in the Companies Act, as well as other important management issues, providing oversight for the execution of duties by directors.	Directors	12	14
Audit & Supervisory Board	Members attend Board of Directors meetings to audit the execution of duties by directors, business operations, and the company's financial position	Audit & supervisory board members	4	14
Executive Committee	This body deliberates the matters necessary to help the president with decision-making.	President, directors, audit & supervisory board members, and executive officers and division heads designated by the president	16	21
Business Ethics Committee	This committee monitors for fraud or illegalities involving senior management, as well as for compliance with the Competition Laws and the Foreign Corrupt Practices Act.	Outside directors, audit & supervisory board members, internal director responsible for compliance	6	8
Nomination and Compensation Advisory Committee	This committee deliberates matters related to the appointment of directors and audit & supervisory board members; the remuneration of directors, executive officers, and audit & supervisory board members; and chief executive officer succession planning.	Outside directors, audit & supervisory board members, representative directors	8	5
Corporate Council	Outside directors and audit & supervisory board members give advice to senior management regarding various management-related issues.	Outside directors, audit & supervisory board members, president, executive vice presidents	8	2
Conference of Outside Directors and Outside Audit & Supervisory Board Members	These meetings facilitate an exchange of opinions regarding NGK management issues, with the intent of proactively contributing to discussions at Board of Directors meetings.	Outside directors	5	1
Hearing convened by Audit & Supervisory Board Members and Outside Directors	These hearings gather information from internal sources regarding the business environment and issues surrounding NGK.	Audit & supervisory board members, outside directors	7	9

Note: No. of people is as of March 31, 2019. Times held is for the period from April 2018 to the end of March 2019.

Corporate Governance Structure Scheme

To ensure lawful business activities and management transparency, respond quickly to changes in the management environment, and create and maintain a fair management system from the shareholder's perspective, NGK has created the following systems. In April 2019, we established the ESG Committee, chaired by the president, to promote comprehensive discussion on key issues, strategies, and action plans related to the environment, society, and governance.



Policies for Determining Remuneration of Directors

The remuneration of directors (excluding outside directors) and corporate officers consists of the following three components: (1) basic remuneration as fixed annual remuneration according to respective positions; (2) a performance-linked bonus, which is based on the business performance each year; and (3) stock-related remuneration to enhance the motivation, etc. of directors to improve the medium- to long-term corporate value through appropriate corporate management by increasing sensitivity toward the NGK stock price and sharing with shareholders both advantages and risks generated by ups and downs of the stock price. NGK does not pay any performance-linked bonus or stock-related remuneration to outside directors and Audit & Supervisory Board Members and only pays basic remuneration since they assume roles in supervising and auditing management from an independent standpoint.

With regard to the ratio between this variable remuneration and fixed annual remuneration, the ratio of basic remuneration, performance-linked bonuses, and stock-related remuneration is set from a perspective of putting priority on the stability and enhancement of medium- to long-term performance. The total amount of remuneration, including basic remuneration, is determined in accordance with officers' positions, taking into consideration remuneration levels according to the size of companies and other factors, using data from reliable external research institutions.

Remuneration of Directors and Audit & Supervisory Board members (fiscal 2018)

Director category	Total remuneration (million yen)	Total remuneration by type (million yen)				Applicable directors (people)
		Fixed remuneration	Performance-linked remuneration	Stock options	Retirement benefits	
Directors (excluding Outside Directors)	570	388	129	53	–	11
Audit & Supervisory Board Members (excluding Outside Audit & Supervisory Board Members)	62	62	–	–	–	2
Outside Directors and Outside Audit & Supervisory Board Members	66	66	–	–	–	6

Directors Receiving Total Remuneration of ¥100 Million or More (fiscal 2018)

Name	Director category	Company category	Total remuneration by type (million yen)				Total remuneration (million yen)
			Fixed remuneration	Performance-linked remuneration	Stock options	Retirement benefits	
Taku Oshima	Director	Submitting companies	68	30	10	–	110

Evaluation on the Effectiveness of the Board of Directors

With regard to its effectiveness, the Board of Directors issues a survey at the end of every fiscal year to directors and Audit & Supervisory Board Members. The results are reported at the Board of Directors' meeting, after the analysis and evaluation by an external organization, and NGK implements specific initiatives to enhance the effectiveness of the Board of Directors based on issues identified in the results of this evaluation.

In the evaluation of the Board of Directors conducted in fiscal 2018, the external organization found that foundational elements required of the Board of Directors have been established, such as the leadership of the Chairman of the Board of Directors, the commitment of its members, and its sound culture and operation, as well as that the Board of Directors are making continuous improvements and recognizes issues toward further progress. Accordingly, the external organization judged that the Board of Director possesses sufficient effectiveness. On the other hand, it was pointed out that further efforts to improve effectiveness by considering specific measures would be desirable, based on opinions from some members that there was room for improvement in areas such as the understanding of risks for important, large-scale projects, analysis of the reasons behind past management decisions, and the treatment and development of senior managers in key business departments. Based on the results of this evaluation, NGK will continue endeavoring to maintain and strengthen the effectiveness of the Board of Directors, including implementing specific measures suited to actual circumstances at the Company.

Policy on Cross-Shareholdings

NGK holds shares of listed companies which contribute to the NGK Group's long-term business development as cross-shareholdings, primarily in order to maintain and strengthen business relationships. In addition, NGK holds the shares of each company in the Morimura Group, which was established by the same founders of NGK, for the mutual benefit of enhancing management quality, as the Morimura Group brand forms a part of NGK's corporate value through its philosophy and heritage. As all cross-shareholdings are a part of the asset portfolio, they are positioned as assets to supplement the amount of liquidity considered necessary in the business plan. NGK constantly strives to reduce the scale of cross-shareholdings from the perspective of capital efficiency. Furthermore, the scale of cross-shareholdings may fluctuate due to factors including changes in overall business trends and risks, financial conditions, and the status of NGK's business relationship with each business partner. Regarding the specific stocks held, at its Board of Directors' meeting, NGK regularly reviews the appropriateness of the continuous holding of shares as cross-shareholdings along with the capital policy, by determining the significance of holding from the business relationship, the safety of ratings and so forth, and the efficiency of dividend yields and so forth. On the other hand, when comparing cross-shareholdings to NGK's cost of capital, evaluations based solely on shares are not conducted. Instead, ROIC management is conducted for each business with differing risks and expected returns, and cross-shareholdings are evaluated after being included in each business's balance sheet.

Comments from Outside Directors

NGK Group Code of Conduct: make them your own, put them to work

Hiroyuki Kamano
Outside Director

On the occasion of its 100th anniversary, NGK revamped its NGK Group Philosophy and subsequently revised the NGK Group Code of Conduct. This was a truly significant undertaking. The revisions—regarding helping realize a sustainable society and taking human rights issues head on—go hand-in-hand with the SDGs that are currently gaining steam around the world.

The success of the Code of Conduct now depends on how much NGK Group employees are willing to take ownership of the code and apply it in everything they do. There is no point in simply making slogans. We have to put the code to work by applying it to everything that NGK Group employees do at worldwide group companies.

To this end, everyone must thoroughly understand the Code of Conduct, cement it as their ideal behavioral guidelines, and monitor whether it is being properly enforced. When matters related to compliance occur, checks must be carried out by company departments in charge of legal affairs and internal auditing. When they relate to environmental protection, the Environmental Management Department must take charge. Besides the Board of Directors overseeing governance, each and every department must execute its duties from its own unique standpoint.

Regarding the problem last year of the Non-Conformity Issue occurred in insulators, we have investigated internal audits and whether the case has been fairly addressed from the standpoint of the chairperson of the assessment committee, and we have received a point-by-point report to prevent a reoccurrence. Relevant divisions will thoroughly check that contracts and standards are adhered to, the Quality Management Department and the Group Compliance Department of the Head Office will audit this, and an external third-party institute will assess whether rules are being followed.

Help apply state-of-the-art technologies to business

Kazuo Furukawa
Outside Director

When NGK celebrated its 100th anniversary, I was extremely honored to be appointed an outside director and join in propelling the company through its second century. I hope that I can use my experience in the private and public sectors to contribute to making NGK an even better corporate group.

In my more than 30 years of experience in the manufacturing industry, the NGK Group's ceramic technologies and other manufacturing expertise stand out as something not easily replicated by other companies. NGK is an excellent company that has given the world many significant products.

But science and technology is advancing at an accelerating pace. How well can companies apply state-of-the-art technology to business? Their success in this respect will provide opportunities for growth, and I hope to be of assistance in this area.

I believe that as an outside director, it is my role to view things from a different perspective than company executives in helping raise corporate value. Another role of mine is to monitor from a corporate governance standpoint whether the company is being properly operated in light of social justice and social norms. I will use my experience in running a company to provide practical, easy-to-apply advice to NGK company executives through the Board of Directors and other forums.

Ever since my days of working in a factory, I have made the philosophy of "fundamentals and righteousness" central to all my work. I believe that one of the values of the NGK Group Philosophy—"Quality of Management: Social trust is our foundation"—leads to my philosophy of "fundamentals and righteousness." What's most important is that each one of us takes action. I look forward to speaking with NGK employees on topics such as the company's philosophy and mission.

Board of Directors (as of June 30, 2019)

Taku Oshima
President

Attendance at Board of Directors meetings
14/14

March 1980	Joins NGK
June 2007	Appointed as vice president
June 2011	Appointed as senior vice president
June 2014	Appointed as president (incumbent)

Yukihisa Takeuchi
Executive Vice President

Attendance at Board of Directors meetings
14/14

March 1978	Joins NGK
June 2004	Appointed as director
June 2005	Appointed as vice president
June 2008	Appointed as senior vice president
June 2011	Appointed as director and senior vice president
June 2015	Appointed as executive vice president (incumbent)

Group Executive, Corporate R&D; Development Committee Chair

Hiroshi Kanie
Executive Vice President

Attendance at Board of Directors meetings
14/14

March 1981	Joins NGK
June 2010	Appointed as vice president
June 2012	Appointed as senior vice president
June 2014	Appointed as director and senior vice president
June 2018	Appointed as executive vice president (incumbent)

Responsible for Corporate Planning Office, New Business Planning Office, Secretarial Office, Corporate Communications Dept., Human Resources Dept., General Affairs Dept., and Power Business Group; Senior Officer in Charge of Group Companies; General Manager, Osaka Branch; in charge of overall personal information management, privacy protection, and Construction Business Act compliance

Susumu Sakabe
Director and Senior Vice President

Attendance at Board of Directors meetings
14/14

March 1981	Joins NGK
June 2007	Appointed as vice president
June 2010	Appointed as director and executive officer
June 2011	Appointed as director and senior vice president (incumbent)

Responsible for Finance & Accounting Dept. and Purchasing Dept.; General Manager, Tokyo Main Office

Ryohei Iwasaki
Director and Senior Vice President

Attendance at Board of Directors meetings
14/14

March 1982	Joins NGK
June 2008	Appointed as vice president
June 2009	Appointed as director and executive officer
June 2012	Appointed as director and senior vice president (incumbent)

Group Executive, Process Technology Business Group; in charge of management affairs

Chiaki Niwa
Director and Senior Vice President

Attendance at Board of Directors meetings
13/14

March 1984	Joins NGK
June 2013	Appointed as vice president
June 2015	Appointed as director and executive officer
June 2016	Appointed as director and senior vice president (incumbent)

Group Executive, Corporate Manufacturing Engineering; responsible for Quality Management Dept., Environmental Management Dept., and Safety and Industrial Health Management Dept; Facilities Committee Chair, Quality Committee Chair, Environmental Committee Chair, and Safety and Industrial Health Committee Chair

Shuhei Ishikawa
Director and Senior Vice President

Attendance at Board of Directors meetings
14/14

March 1984	Joins NGK
June 2010	Appointed as vice president
June 2014	Appointed as senior vice president
June 2015	Appointed as director and senior vice president (incumbent)

Group Executive, Electronics Business Group

Nobumitsu Saji
Director and Senior Vice President

Attendance at Board of Directors meetings
14/14

March 1984	Joins NGK
June 2013	Appointed as vice president
June 2014	Appointed as director and executive officer
June 2015	Appointed as director and senior vice president (incumbent)

Chief Compliance Officer; responsible for Auditing Dept., Group Compliance Dept., Legal Dept., and Intellectual Property Dept.; Chair of CSR Committee and Internal Controls Committee; in charge of company-wide Competition Law compliance; Data Protection Officer

Atsushi Matsuda
Director and Senior Vice President

Attendance at Board of Directors meetings
10/10
Note: Since being appointed to current post in June 2018

March 1985	Joins NGK
June 2012	Appointed as vice president
June 2017	Appointed as senior vice president
June 2018	Appointed as director and senior vice president (incumbent)

Group Executive, Ceramic Products Business Group; General Manager, Global Sales & Marketing Div., Ceramic Products Business Group; General Manager, Nagoya Site

Independent Director
Hiroyuki Kamano
Outside Director

Attendance at Board of Directors meetings
13/14

Apr. 1971	Joins Ministry of Foreign Affairs
Apr. 1979	Trains at Legal Training and Research Institute, Supreme Court of Japan
Apr. 1981	Becomes registered attorney
Oct. 1988	Becomes representative attorney, Kamano Sogo Law Offices (incumbent)
June 2007	Appointed as outside auditor, Komatsu Ltd.
July 2007	Appointed as outside director, Sumitomo Life Insurance Company
Apr. 2009	Appointed as vice president, Tokyo Bar Association
June 2011	Appointed as director, NGK (incumbent)
June 2015	Appointed as outside auditor, House Foods Group Inc. (incumbent)

Independent Director
Emiko Hamada
Outside Director

Attendance at Board of Directors meetings
14/14

Apr. 1984	Joins Taiyo Yuden Co., Ltd.
Dec. 2001	Appointed as general manager, Quality Assurance Control R Technology Div., Engineering Group, Taiyo Yuden
Sept. 2003	Appointed as chief engineer, Basic Research Div., General Research Laboratory, Engineering Group, Taiyo Yuden
Nov. 2008	Appointed as associate professor, Center for Social Contribution and Collaboration, Nagoya Institute of Technology (NITech)
Apr. 2011	Appointed as professor, Center for Social Contribution and Collaboration, NITech, and professor for Master of Techno-Business Administration, NITech Graduate School
Apr. 2012	Appointed as professor, Center for Research on Assistive Technology for Building a New Community, NITech
May 2015	Appointed as third-area program officer, A-STEP (Adaptable and Seamless Technology Transfer Program through Target-driven R&D), Japan Science and Technology Agency (incumbent)
July 2016	Appointed as part-time lecturer, NITech (incumbent)
Aug. 2016	Appointed as visiting professor, Nagoya University (incumbent)
June 2017	Appointed as director, NGK (incumbent)
June 2019	Appointed as outside director, Taiyo Yuden (incumbent)

Independent Director
Kazuo Furukawa
Outside Director

Attendance at Board of Directors meetings
Newly appointed

Apr. 1971	Joins Hitachi, Ltd.
Apr. 2005	Appointed as representative executive officer, executive vice president, and executive officer; general manager and CEO, Information & Telecommunications Group; general manager, Export Control Div.; Hitachi
Apr. 2006	Appointed as representative executive officer and president, Hitachi
June 2006	Appointed as director, representative executive officer, and president, Hitachi
May 2007	Appointed as vice chair, Keidanren (Japan Business Federation)
Apr. 2009	Appointed as director, representative executive officer, and vice chair, Hitachi
June 2009	Appointed as special advisor, Hitachi
June 2011	Appointed as president, Information Processing Society of Japan
Oct. 2011	Appointed as chair, New Energy and Industrial Technology Development Organization
June 2019	Appointed as director, NGK (incumbent)

Audit & Supervisory Board (as of June 30, 2019)

Ken Sugiyama
Audit & Supervisory Board Member

Attendance at Board of Directors meetings
14/14

Attendance at Audit & Supervisory Board meetings
14/14

Mar. 1980	Joins NGK
July 2002	Appointed as general manager, Finance Dept.
Apr. 2007	Appointed as general manager, Auditing Dept.
June 2015	Appointed as Audit & Supervisory Board member (incumbent)

Takeshi Shimazaki
Audit & Supervisory Board Member

Attendance at Board of Directors meetings
Newly appointed

Attendance at Audit & Supervisory Board meetings
Newly appointed

Mar. 1982	Joins NGK
Apr. 2010	Appointed as manager, Finance Dept.
June 2015	Appointed as general manager, Auditing Dept.
June 2019	Appointed as Audit & Supervisory Board member (incumbent)

Independent Director
Junichi Itoh
Audit & Supervisory Board Member, Outside

Attendance at Board of Directors meetings
10/10

Attendance at Audit & Supervisory Board meetings
10/10
Note: Since being appointed to current post in June 2018

Apr. 1975	Joins Mitsubishi Bank (now MUFG Bank)
June 2002	Appointed as executive officer, Bank of Tokyo-Mitsubishi (now MUFG Bank)
May 2005	Appointed as managing executive officer, Bank of Tokyo-Mitsubishi
June 2005	Appointed as managing director, member of the board, Bank of Tokyo-Mitsubishi
Jan. 2006	Appointed as managing director, member of the board, Bank of Tokyo-Mitsubishi UFJ (now MUFG Bank)
May 2009	Appointed as senior managing executive officer, Bank of Tokyo-Mitsubishi UFJ (now MUFG Bank)
June 2011	Appointed as representative director, senior executive vice president, and CFO, Nikon Corporation
June 2016	Appointed as corporate advisor, Nikon; outside Audit & Supervisory Committee member, Hyakujushi Bank
June 2017	Appointed as outside director (Audit & Supervisory Committee member), Hyakujushi Bank (incumbent)
June 2018	Appointed as Audit & Supervisory Board member, NGK (incumbent)

Independent Director
Masayoshi Sakaguchi
Audit & Supervisory Board Member, Outside

Attendance at Board of Directors meetings
Newly appointed

Attendance at Audit & Supervisory Board meetings
Newly appointed

Apr. 1980	Joins National Police Agency
Feb. 1999	Appointed as chief, 1st District, Metropolitan Police Department
Sept. 2001	Appointed as commissioner, Akita Prefectural Police
Jan. 2003	Appointed as chief, Criminal Investigation Dept., Osaka Prefectural Police
Oct. 2011	Appointed as commissioner, Osaka Prefectural Police
Jan. 2013	Appointed as chief, Commissioner-General's Secretariat, National Police Agency
Jan. 2015	Appointed as deputy commissioner, National Police Agency
Aug. 2016	Appointed as commissioner-general, National Police Agency
May 2018	Appointed as special advisor, Nippon Life Insurance Company
June 2019	Appointed as Audit & Supervisory Board member, NGK (incumbent) Appointed as vice president, Japan Automobile Federation (incumbent)

Executive Officers (as of June 30, 2019)

Shigeru Kobayashi
Senior Vice President
Group Executive, Power Business Group; General Manager, Komaki Site

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

Takaya Teshima
Senior Vice President
Group Vice Executive, Process Technology Business Group

Hiroto Matsuda
Senior Vice President
General Manager, High Performance Ceramics Div., Process Technology Business Group

Tadaaki Yamada
Senior Vice President
General Manager, Human Resources Dept.; in charge of General Affairs Dept.

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

Tomohiro Yamada Vice President
President, NGK Electronics Devices Inc.

Akira Katoh Vice President
General Manager, New Metals Div., Electronics Business Group; General Manager, Chita Site

Masanobu Inoue Vice President
General Manager, Industrial Process Div., Process Technology Business Group

Hiroharu Kato Vice President
President, NGK Europe GmbH

Atsushi Miyajima Vice President
General Manager, Manufacturing Engineering Div., Corporate Manufacturing Engineering Group

Hideaki Shindo Vice President
General Manager, Finance Dept.

Jun Mori Vice President
General Manager, Manufacturing Div., Ceramic Products Business Group

Hiroyuki Shinohara Vice President
General Manager, Corporate Planning Office

Iwao Ohwada Vice President
General Manager, Advanced Device Components Div., Electronics Business Group

Compliance and Risk Management

Viewing compliance as the foundation of CSR, the NGK Group positions enhancing trustworthiness as the most important initiative, and takes concrete measures to disseminate compliance awareness among employees and ensure that we abide by international norms and the laws and regulations of all countries and regions. 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.

Compliance Promotion Structure

We established the Compliance Subcommittee under the CSR Committee to ensure strict observance of laws, regulations, and corporate ethics within the Group. The Security Subcommittee has also been established to ensure accident prevention measures are in place, widely known, and strictly practiced.

Observing the Competition Laws and Other Laws and Regulations Pertaining to Business Transactions

In addition to mandating compliance with Competition Laws in the NGK Group Code of Conduct, we have established the Competition Laws Compliance Rules, set forth to comply with international standards, which are strictly enforced by the NGK Group both in Japan and its overseas locations. We have established these policies and procedures in order to eradicate unfair business practices and maintain fair and equitable business relationships with our business partners.

We also provide education and training aimed at ensuring widespread awareness and thorough compliance with the Competition Laws Compliance Rules and the Competition Laws Compliance Handbook. Furthermore, since fiscal 2015, we have contracted PwC Advisory LLC (hereinafter, “PwC”) as our independent compliance professional. PwC is engaged to annually review the implementation status of the NGK Group’s Competition Law compliance program per the Competition Law Compliance Rules as well as assessing the overall oversight and reporting structures in place for NGK Group companies, both in Japan and overseas locations. On top of this, starting in fiscal 2017, PwC has also conducted interviews with the directors overseeing NGK’s various business groups in order to: 1) assess the tone of each director’s approach toward competition law compliance; and 2) to further enhance their awareness of these efforts. The results of these reviews are being leveraged for a variety of purposes, such as operating and improving the Competition Law compliance program.

Harassment Measures

As measures against harassment in workplace, we hold training in this area for all executives and employees at NGK and its group companies in Japan (including contract employees and dispatch employees).

In fiscal 2017, we held 17 harassment training sessions attended by 324 managers from group companies. We are planning to hold training for general employees so that everyone attends sessions during a four-year period. In 2018 fiscal year, the first year of this four-year period, training was held 24 times and attended by 2,403 employees. The trainings are aimed at improving workplace environments by having employees and their bosses learn exactly what constitutes harassment and how to prevent it.

Risk Management System

Risk Analysis and Response

There are six types of risk which are viewed as common to all companies within the NGK Group, including compliance, information, and employment/labor. These risks are the topic of periodic questionnaires that we give to employees, with responses allowing us to determine and analyze risks and formulate measures that can be implemented to prevent them. The CSR Committee monitors how well these measures are being implemented and reports this to the Board of Directors.

Business continuity planning (BCP) was formulated to ensure the continuation of critical business functions in the event of large-scale natural disasters including wind and flood damage and earthquakes, massive transportation accidents or other emergency situations, which will be addressed by the Central Disaster Prevention and Control Headquarters and BCP Countermeasures Headquarters.

Refer to the NGK Sustainability Data Book 2019 for risks related to business and other matters.
https://www.ngk-insulators.com/en/sustainability/booklet.html

Information Security Structure

The NGK Group CSR Committee's Security Subcommittee takes responsibility for supervising overall information security, and supports the General Affairs and Information Systems divisions based on the Basic NGK Group Information Security Policy, in an attempt to properly manage and operate information assets. Every year, personnel of NGK's Information Technology Department visit several Group companies to conduct on-site checks and provide guidance on their implementation of IT security measures.

Privacy Policy and Structure

The NGK Group has established internal rules for privacy policy management in an effort to handle, manage, and protect personal information provided by customers. In fiscal 2015, NGK formulated and made public our Basic Policy on Specific Personal Information in response to the enforcement of the Act on the Use of Numbers to Identify a Specific Individual in Administrative Procedures. Moreover, our policies are fully compliant with the revised Act on the Protection of Personal Information, which came into effect on May 30, 2017.

Reference URL	Protection of personal information https://www.ngk-insulators.com/en/utpolicy/

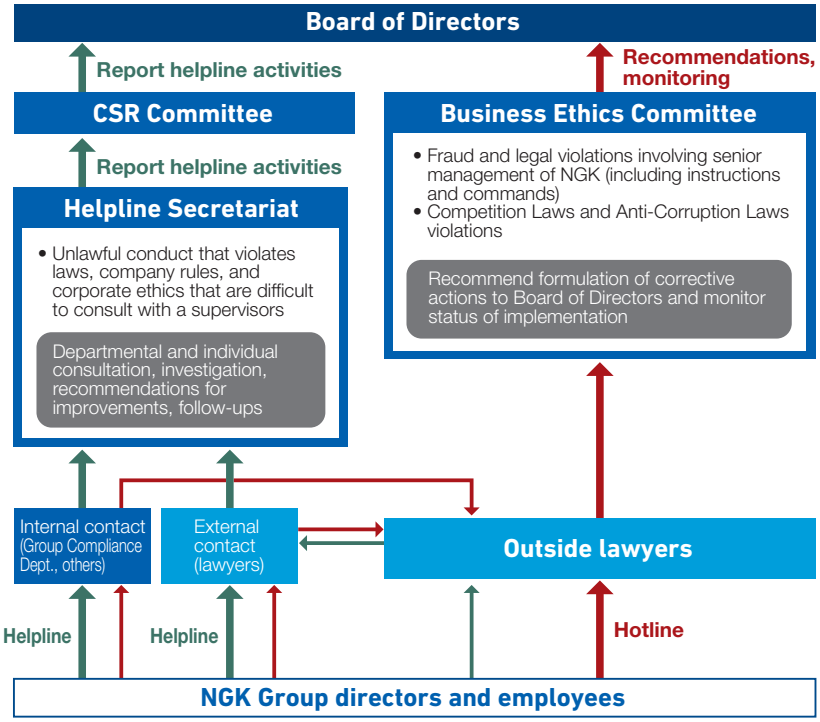
Whistleblowing System

Helpline

We have established a helpline to receive inquiries and reports from employees aimed at curtailing and preventing activities contrary to the spirit of the NGK Group Code of Conduct and to facilitate the quick resolution when issues occur. Each overseas Group company has its own helpline. Those seeking advice or reporting issues are promised protection under corporate regulations. There were 75 consultation cases in fiscal 2018.

■ No. of helpline consultation cases
(in Japan)

Fiscal 2016	17
Fiscal 2017	43
Fiscal 2018	75



Hotline

We have established a hotline as an internal whistleblowing system for responding to fraud, and legal infractions committed by senior management, and Competition Laws and Anti-Corruption Laws violation.

Establishing Response Measures That Accelerate Business Growth

The environment surrounding the NGK Group continues to change moment to moment, presenting us with both opportunities and risks that can fundamentally affect the course of business. In order to maintain and grow our competitive advantage while avoiding future hazards, the NGK Group is always vigilant in identifying opportunities and risks and in establishing response measures that will ensure accelerated business growth.

Item		Materiality	Risk
Business Opportunities and Risks		• Realization of a sustainable society	• Decrease in internal combustion engines • Delays in the transition to renewable energy • Changes in the market environment (China, semiconductor demand) • Transfer of technology • Labor shortages • Exchange rate fluctuations • Abnormal weather and disasters
ESG Opportunities and Risks	**E**	• Preservation of environment	• Climate change • Water shortages
	S	• Respect for human rights • Provide a safe and enjoyable work environment • Permeate social responsibility into our supply chain • Cooperation with the region and society	• Human rights violations • Child labor and forced labor • Occupational hazards • Stoppage of raw material or component supply
	G	• Honest business activities • Disclosure of company information and accountability	• Compliance violations • Loss of trust from stakeholders due to passive disclosure and insufficient explanation of corporate information

Opportunity	Response	Related SDGs
Strengthened environmental regulations Carbon-free society (expansion in renewable energy use) Expansion of the IoT society	• Achieve negative emissions with GPFs, EHCs, and NOx sensors • Develop a diverse range of battery business, including NAS® batteries, zinc rechargeable batteries, and chip-type batteries • Create and expand new products that flexibly accommodate technological innovation • Draw up a BCP	
Strengthened environmental regulations Transition to a carbon-free society (expansion in renewable energy use)	• Promote the Five-Year Environmental Action Plan • Create products contributing to environmental protection	
Securing diverse human resources via work style reforms and diversity promotion Local social contribution activities Sustainable procurement of raw materials and components	• Human rights due diligence • Human rights education • Effectively operate the whistleblowing system • Reduce long working hours • Promote diversity • Expand job opportunities for the disabled • Provide support for better work-life balance • Raise the mandatory retirement age • Develop human resources	
	• Thoroughly enforce the CSR Procurement Guidelines • Strengthen communication with the supply chain	
Maintaining and improving corporate value and securing business continuity through appropriate risk management Increase in trust from stakeholders as a result of active disclosure	• Thoroughly enforce the NGK Group Code of Conduct • Compliance education • Effectively operate the whistleblowing system (helpline, hotline)	
	• NGK Report, annual reports, news releases	

Summary of Consolidated Financial Results for Five Fiscal Years

(Millions of yen)

	March 2015	March 2016	March 2017	March 2018	March 2019
Net sales	378,665	435,798	401,267	451,125	463,505
Cost of sales	254,387	289,266	272,435	312,107	323,224
Gross profit	124,278	146,532	128,832	139,018	140,281
Ratio of gross profit to sales (%)	32.8	33.6	32.1	30.8	30.3
Selling, general, and administrative expenses	62,701	65,634	65,619	68,991	75,575
Operating income	61,577	80,898	63,213	70,027	64,706
Operating margin (%)	16.3	18.6	15.8	15.5	14.0
Net income attributable to owners of the parent	41,505	53,316	36,379	45,814	35,507
Net income margin (%)	11.0	12.2	9.1	10.2	7.7
Capital expenditures	30,366	45,437	60,101	71,714	105,337
Depreciation and amortization	25,532	27,366	26,615	30,316	35,729
Research and development expenses	13,943	17,410	18,654	21,101	23,271
Net cash provided by operating activities	73,002	59,445	80,172	50,554	61,225
Net cash used in investing activities	(39,497)	(47,773)	(56,453)	(49,414)	(109,743)
Net cash provided by financing activities	(26,000)	(373)	(13,013)	22,546	3,564
Cash and cash equivalents, end of year	128,617	136,065	144,693	169,918	123,984
Total assets	702,234	711,897	759,434	826,243	863,636
Interest-bearing debt	156,203	163,973	174,150	211,574	229,423
Net worth	392,054	406,743	416,740	460,983	477,516
Equity	404,001	417,973	427,593	472,863	489,245
Profit per share (yen)	127.11	163.28	112.71	142.42	110.35
Cash dividends per share (yen)	28	38	40	44	50
Ratio dividends to net worth (%)	22.0	23.3	35.5	30.9	45.3
Return on equity (ROE) (%)	11.4	13.3	8.8	10.4	7.6
Equity ratio (%)	55.8	57.1	54.9	55.8	55.3
Total asset turnover (%)	57.5	61.6	54.5	57.3	54.9
Price-earnings ratio (PER)	20.2	12.7	22.4	12.9	14.6
Price-book value ratio (PBR)	2.1	1.7	1.9	1.3	1.1
Closing stock (yen)	2,565	2,079	2,520	1,834	1,608
Number of employees, end of year (persons)	16,217	16,657	17,517	18,783	20,115

Summary of Consolidated Non-Financial Results for Five Fiscal Years

			March 2015	March 2016	March 2017	March 2018	March 2019
Environmental	GHG emissions (Scope 1)	(10^3 metric tons, NGK Group)	29.0	31.1	31.7	32.0	32.3
	GHG emissions (Scope 2)	(10^3 metric tons, NGK Group)	46.1	52.1	56.2	61.2	63.7
	GHG emissions (Scope 3)	(10^3 metric tons, non-consolidated)	–	–	–	87.7	104.7
	Total water consumption	(10^3 m^2, NGK Group)	276	285	409	432	453
	VOC emissions	(metric tons, NGK Group)	6.3	6.8	155.4	145.3	145.2
	PRTR substance emissions	(metric tons, NGK Group)	15.4	14.0	163.1	154.6	154.9
	Total water discharge	(10^3 m^2, NGK Group)	196	197	279	287	281
	Waste emissions	(10^3 metric tons, NGK Group)	5.7	5.9	5.9	5.9	5.8
	Environmental management system certification rate	(%, NGK Group)	90	90	90	88	88
Social	Number of employees	(persons, non-consolidated)*1	3,569	3,700	3,937	4,142	4,119
	Employee breakdown (women)	(persons, non-consolidated)*2	12.9	12.6	12.7	12.5	12.6
	Percentage of women among managers	(%, non-consolidated)	1.8	1.8	2.0	2.0	2.2
	Percentage of women among managers	(%, overseas NGK Group companies)	–	16.6	15.3	21.0	16.0
	Employee retention rate (men)	(%, non-consolidated)	95.6	94.8	89.2	94.8	97.6
	Employee retention rate (women)	(%, non-consolidated)	90.9	90.0	100.0	80.0	83.9
	Paid leave usage rate	(%, non-consolidated)	69.1	65.2	67.5	68.7	72.5
	Number/percentage of disabled employees	(persons/%, non-consolidated)	56 (2.23)	56 (2.18)	55 (2.03)	57 (1.90)	62 (1.92)
	Lost time incident rate	(%, non-consolidated)	0.00	0.29	0.34	0.11	0.40
	Training expenses	(10^3 yen, non-consolidated)	11.0	7.8	7.0	6.6	6.3
	Total amount of training time	(hours, non-consolidated)	21.0	21.0	24.8	21.7	21.3
	Social contribution expenditure	(100 million yen, non-consolidated)	3.31	3.46	3.15	3.00	3.02
	Percentage of ISO 9001 certified sites	(%, NGK Group)	100	100	100	97*3	97*3
Governance	Number of directors	(persons, non-consolidated)	12	12	13	12	12
	Number of outside directors	(persons, non-consolidated)	2	2	2	3	3
	Percentage of female directors	(%, non-consolidated)	0	0	0	8.3	8.3
	Attendance rate of Board of Directors meetings	(%, non-consolidated)	98.5	99.3	98.9	100	98.2
	Total remuneration of directors	(million yen, non-consolidated)	581	723	803	799	698
	Attendance rate of information security e-learning sessions	(%, non-consolidated)	100	100	100	100	100
	Number of patents held (Japan)	(non-consolidated)	2,719	2,907	3,038	3,191	3,352
	Number of patents held (overseas)	(non-consolidated)	3,911	4,042	4,134	4,186	4,346

*1 Full-time regular employees (excluding employees transferred from NGK to Group companies and outside companies, but including employees transferred from Group companies and outside companies to NGK).
*2 Calculated based on regular employees including those transferred from NGK to Group companies and outside companies, but excluding those transferred from Group companies and outside companies to NGK.
*3 Newly established NGK Ceramics (Thailand) Co., Ltd. is preparing to acquire certification.

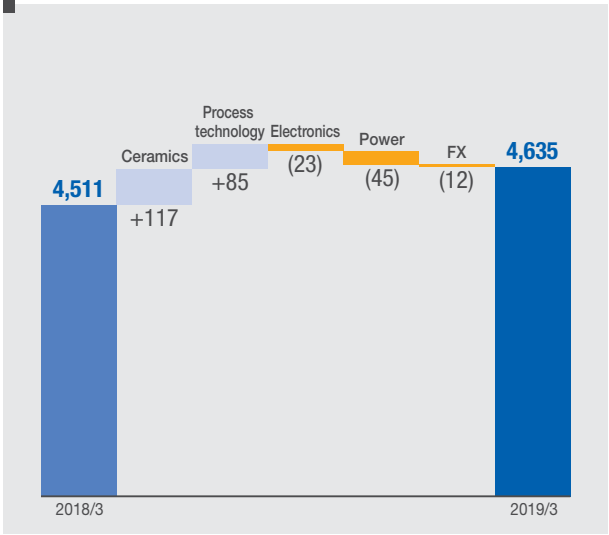
Operating Results

During the fiscal year ended March 31, 2019, the Japanese economy remained on a moderate recovery, underpinned by improvements in the employment and income environment. Overseas, the economies of the U.S., European states and other developed countries continued to recover while the Chinese economy decelerated as reflected in its slower pace of growth.

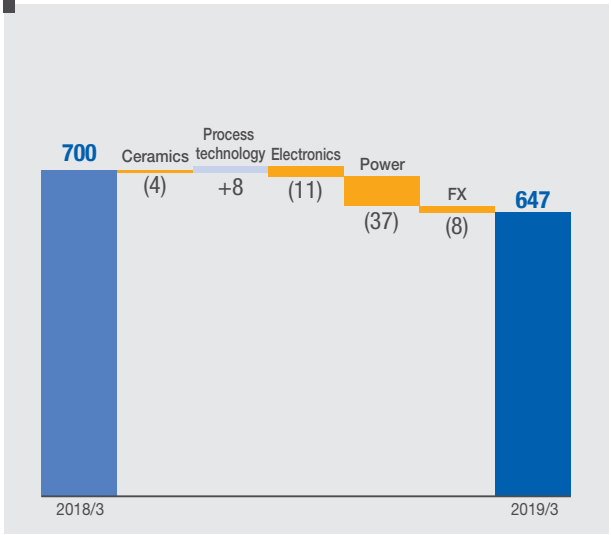
The NGK Group experienced weak overseas shipments of insulators in the Power Business Segment. In the Ceramic Products Business Segment, shipments of automotive ceramics increased due mainly to the tightening of emission regulations in Europe. In the Electronics Business Segment, demand for ceramic packages declined against the backdrop of stagnant capital expenditure for mobile phone base stations in China. In the Process Technology Business Segment, the distribution volume of products for semiconductor manufacturing equipment rose in response to the trend toward multi-layered semiconductors and their microfabrication. As a result of the above, consolidated net sales for the fiscal year ended March 31, 2019 increased 2.7% year on year to ¥463,505 million.

In terms of earnings, despite increased net sales, depreciation and amortization, and R&D expenses increased, causing operating income to fall 7.6% year on year to ¥64,706 million. Net income attributable to owners of the parent decreased 22.5% year on year to ¥35,507 million due to the recording of an impairment loss of ¥10,935 million and a loss on the dissolution of a subsidiary of ¥2,961 million following the decision in March 2019 to dissolve an insulator production subsidiary in China.

Sales Change Analysis for FY2019 (100 million yen)



Operating Income Change Analysis for FY2019 (100 million yen)



	2018/3	2019/3
FX rate	¥111/USD	¥111/USD
	¥129/EUR	¥128/EUR

Segment Overview

Power Business

Net sales of the Power Business Segment decreased by 8.4% year on year to ¥49,853 million.

Sales of insulators decreased due to sluggish domestic shipments against the backdrop of reduced capital expenditures by electric power companies, coupled with a decrease in overseas shipments to China, North America, and the Middle East. Sales of NAS® batteries were sluggish due to a lack of large shipments.

In terms of earnings, there was an operating loss of ¥8,498 million compared with an operating loss of ¥4,715 million in the previous fiscal year.

Ceramic Products Business

Net sales of the Ceramic Products Business Segment increased by 4.5% year on year to ¥251,451 million.

Regarding automotive ceramics, shipments of honeycomb catalyst substrates for controlling automobile emissions (HONEYCERAM®) and SiC-based DPF dropped in conjunction with a slowdown in passenger car sales in the Chinese market and the lower ratio of diesel passenger cars in Europe. On the other hand, the distribution volumes of sensors and GPF for passenger cars increased, due to the tightening of emission regulations in Europe.

In terms of operating income, although net sales increased, costs of launching equipment for production expansion increased in addition to increases in depreciation and amortization, and R&D expenses. As a result, operating income decreased 1.4% year on year to ¥55,920 million.

Electronics Business

Net sales of the Electronics Business Segment decreased by 4.0% year on year to ¥58,843 million.

Regarding metals, shipments of tire molds decreased. Regarding electronic components, the distribution volumes of bonded wafers for SAW filters and piezoceramics actuators for HDD increased. On the other hand, the distribution volume of ceramic packages dropped against the backdrop of stagnant capital expenditure for mobile phone base stations in China. Shipments of noise filters decreased at Soshin Electric Co., Ltd., our consolidated subsidiary, due to a deterioration of market conditions in China.

In terms of earnings, due to a decrease in the distribution volume of ceramic packages, there was an operating loss of ¥315 million yen compared with an operating income of ¥917 million in the previous fiscal year.

Process Technology Business

Net sales of the Process Technology Business Segment increased by 9.3% year on year to ¥106,508 million.

The distribution volume of products for semiconductor manufacturing equipment increased from the previous fiscal year, despite a slowdown in the second-half period, as capital expenditure of semiconductor manufacturers remained high in response to the trend toward multi-layered semiconductors and their microfabrication. Regarding components for industrial equipment, sales increased, reflecting an increase in shipments of low-level radioactive waste treatment systems and industrial heating systems.

In terms of earnings, while depreciation and amortization increased, sales of products for semiconductor manufacturing equipment and components for industrial equipment increased. As a result, operating income increased by 3.1% year on year to ¥17,630 million.

(100 million yen)

	2015/3	2016/3	2017/3	2018/3	2019/3
Power business					
Sales	728	835	528	545	499
Operating income	(23)	26	(66)	(47)	(85)
Ceramic products business					
Sales	2,272	2,511	2,452	2,407	2,515
Operating income	576	707	646	567	559
Electronics business					
Sales	788	1,014	1,035	613	588
Operating income	63	77	53	9	(3)
Process technology business					
Sales	–	–	–	975	1,065
Operating income	–	–	–	171	176

From the beginning of fiscal year ended March 31, 2019, following organizational changed, the segment classification of the NGK Group has been changed from the "Power Business Segment," Ceramic Products Business Segment," and "Electronics Business Segment" to the "Power Business Segment," Ceramic Products Business Segment," "Electronics Business Segment," and "Process Technology Business Segment." Note that figures for the fiscal year ended March 31, 2018 have been calculated based on this new segment classification.

Financial Position, Operating Results, and Cash Flow Analysis

Financial Position

As of March 31, 2019, total assets were increased by 4.5% from the previous fiscal year-end to ¥863,636 million.

Current assets decreased by 2.8% from the previous fiscal year-end to ¥443,370 million, mainly reflecting decreases in cash and bank deposits despite an increase in inventories. Non-current assets were increased by 13.5% from the previous fiscal year-end to ¥420,266 million, mainly due to an increase in tangible fixed assets.

Current liabilities increased by 16.5% from the previous fiscal year-end to ¥147,787 million. This was mainly due to increases in current portion of long-term borrowings and notes and accounts payable trade despite a decrease in income taxes payable. Long-term liabilities were comparable to the result of the previous fiscal year-end at ¥226,604 million, mainly reflecting transferring long-term borrowings into current portion of long-term borrowings despite an increase in bonds payable.

Total net assets stood at ¥489,245 million, up 3.5% year on year, due to an increase in retained earnings despite a decrease in foreign currency translation adjustments.

As a result, the ratio of net worth to total assets as of March 31, 2019 was 55.3% (compared with 55.8% at the previous fiscal year-end), with net worth per share standing at ¥1,483.98, up ¥51.31 from the previous fiscal year-end.

(100 million yen)

	2015/3	2016/3	2017/3	2018/3	2019/3
Financial position					
Total assets	7,022	7,119	7,594	8,262	8,636
Net assets	4,040	4,180	4,276	4,729	4,892

Cash Flows

There was a net decrease ¥45,934 million in cash and cash equivalents from the previous fiscal year-end to ¥123,984 million. As of March 31, 2019, this reflected ¥61,225 million in net cash provided by operating activities, ¥109,743 million in net cash used in investing activities, and ¥3,564 million in net cash provided by financing activities.

Net Cash Provided by Operating Activities

As of March 31, 2019, net cash provided by operating activities was total ¥61,225 million. This was mainly attributable to posting an income before income taxes and non-controlling interests of ¥50,448 million and depreciation and amortization, despite cash outflows mainly due to increases in income taxes paid, inventories and other current assets. In comparison with the previous fiscal year, net cash provided by operating activities increased by ¥10,670 million.

Net Cash Used in Investing Activities

As of March 31, 2019, net cash used in investing activities was total ¥109,743 million. This was mainly due to purchases of property, plant and equipment and marketable securities, despite cash inflows due to proceeds from sales and redemption of marketable securities. In comparison with the previous fiscal year, net cash used in investing activities increased by ¥60,330 million.

Net Cash Provided by Financing Activities

As of March 31, 2019, net cash provided by financing activities was total ¥3,564 million. This was mainly due to proceeds from long-term borrowings and issuance of bonds payable, despite cash outflows due to cash dividends paid and repayment of long-term borrowings. In comparison with the previous fiscal year, net cash provided by financing activities decreased by ¥18,981 million.

(100 million yen)

	2015/3	2016/3	2017/3	2018/3	2019/3
Net cash provided by operating activities	730	594	802	506	612
Net cash used in investing activities	(395)	(478)	(565)	(494)	(1,097)
Net cash provided by financing activities	(260)	(4)	(130)	225	36
Cash and cash equivalents	1,286	1,361	1,447	1,699	1,240

Capital Expenditure Overview

For the current consolidated accounting year, capital expenditure for the NGK Group totals ¥105,337 million.

For Power Business, ¥1,698 million in capital expenditure is being spent primarily on insulator production facility upgrades.

For Ceramic Products Business, ¥61,960 million in capital expenditure is being spent primarily on production facilities for automotive-related ceramic products.

For Electronics Business, ¥4,952 million in capital expenditure is being spent primarily on production facilities for semiconductor manufacturing equipment-related products.

For Process Technology Business, ¥23,937 million in capital expenditure is being spent primarily on production facilities for semiconductor manufacturing equipment-related products.

For Headquarters, ¥12,790 million in capital expenditure is being spent primarily on equipment and facility upgrades and new business equipment and facilities.

Basic Policy for Profit Sharing and Dividends for the Current and Next Fiscal Years

NGK views the return of profits to shareholders as one of its most important management policies.

As a basic policy, we strive for shareholder-oriented management that emphasizes return on equity (ROE), and distribute the benefits of successful management with a medium-term target consolidated payout ratio of approximately 30% after consideration of a comprehensive range of factors, including business performance, financial position, and future business development.

NGK plans to pay a year-end dividend of ¥25 per share for the fiscal year ended March 31, 2019. This and the interim dividend of ¥25, which has already been paid, brought the total annual dividend per share to ¥50.

Considering the forecast of dividend payout ratio and ratio of dividends to net worth, NGK expects both the interim and the fiscal year-end dividend per share to be ¥25 for the fiscal year ending March 31, 2020. The total annual dividend per share will therefore be ¥50.

Meanwhile, NGK plans to utilize retained funds primarily to extend its existing core business and capital expenditures in new business projects, with a view to enhancing its corporate value.

	2015/3	2016/3	2017/3	2018/3	2019/3
Overview of capital expenditures, depreciation and amortization					
Capital expenditures (100 million yen)	304	454	601	717	1,053
Depreciation and amortization (100 million yen)	255	274	266	303	357
Basic policy for profit sharing and dividends for the current and next fiscal years					
Dividend per share (yen)	28	38	40	44	50
Payout ratio (%)	22.0	23.3	35.5	30.9	45.3

Consolidated Financial Statements

Consolidated Balance Sheet

(Millions of yen)

ASSETS

As of March 31, 2019	Millions of yen		Thousands of U.S. dollars
	2019	2018	2019
Current assets:			
Cash and cash equivalents	¥ 123,984	¥ 169,918	$ 1,116,976
Time deposits	4,149	3,410	37,380
Marketable securities	36,029	29,029	324,587
Notes and accounts receivable:			
Trade notes and accounts	106,414	104,030	958,682
Other	14,052	12,498	126,594
Allowance for doubtful accounts	(125)	(124)	(1,123)
Total	120,341	116,404	1,084,153
Inventories	148,032	130,817	1,333,620
Prepaid expenses and other current assets	10,835	6,356	97,612
Total current assets	443,370	455,934	3,994,328
Property, plant and equipment:			
Land	30,919	27,672	278,549
Buildings and structures	197,447	174,612	1,778,798
Machinery and equipment	480,933	451,894	4,332,733
Construction in progress	58,145	36,722	523,829
Total	767,444	690,900	6,913,909
Accumulated depreciation	(441,382)	(420,799)	(3,976,415)
Net property, plant and equipment	326,062	270,101	2,937,494
Investments and other assets:			
Investment securities	48,751	54,682	439,201
Investments in unconsolidated subsidiaries and associated companies	21,109	19,967	190,174
Intangible assets	3,701	3,659	33,338
Net defined benefit assets	7,468	7,816	67,283
Deferred tax assets	10,442	11,021	94,069
Other assets	2,733	3,063	24,621
Total investments and other assets	94,204	100,208	848,686
Total	¥ 863,636	¥ 826,243	$ 7,780,508

(Millions of yen)

LIABILITIES AND EQUITY

As of March 31, 2019	Millions of yen		Thousands of U.S. dollars
	2019	2018	2019
Current liabilities:			
Short-term borrowings	¥ 4,231	¥ 5,970	$ 38,115
Current portion of long-term debt	29,198	10,572	263,045
Notes and accounts payable:			
Trade notes and accounts	51,032	45,697	459,744
Other	22,180	18,231	199,827
Total	73,212	63,928	659,571
Accrued expenses	21,492	19,408	193,622
Provision for NAS Battery safety measures	2,029	2,561	18,281
Provision for loss related to competition law	1,178	1,175	10,610
Income taxes payable	11,731	16,510	105,687
Other current liabilities	4,716	6,776	42,481
Total current liabilities	147,787	126,900	1,331,412
Long-term liabilities:			
Long-term debt	195,994	195,032	1,765,716
Net defined benefit liability	20,935	20,910	188,600
Provision for product warranties	1,632	2,837	14,698
Deferred tax liabilities	1,869	1,569	16,840
Other long-term liabilities	6,174	6,132	55,628
Total long-term liabilities	226,604	226,480	2,041,482
Contingent liabilities			
Equity:			
Common stock: Authorized—735,030 thousand shares Issued—327,560 thousand shares at March 31, 2019 and 2018	69,849	69,849	629,272
Capital surplus	71,978	71,948	648,454
Stock acquisition rights	923	858	8,317
Retained earnings	343,324	322,622	3,093,007
Treasury stock—at cost: 5,780 thousand shares and 5,794 thousand shares at March 31, 2019 and 2018, respectively	(12,122)	(12,153)	(109,208)
Accumulated other comprehensive income			
Unrealized gain on available-for-sale securities	21,260	24,659	191,534
Deferred loss on derivatives under hedge accounting	(136)	(31)	(1,229)
Foreign currency translation adjustments	(11,057)	(7,990)	(99,608)
Defined retirement benefit plans	(5,580)	(7,920)	(50,274)
Total	478,439	461,842	4,310,265
Noncontrolling interests	10,806	11,021	97,349
Total equity	489,245	472,863	4,407,614
Total	¥ 863,636	¥ 826,243	$ 7,780,508

Consolidated Financial Statements

Consolidated Statement of Income

(Millions of yen)

For the year ended March 31, 2019

	Millions of yen		Thousands of U.S. dollars
	2019	2018	2019
Net sales	¥ 463,505	¥ 451,125	$ 4,175,718
Cost of sales	323,224	312,107	2,911,929
Gross profit	140,281	139,018	1,263,789
Selling, general and administrative expenses	75,575	68,991	680,852
Operating income	64,706	70,027	582,937
Other income (expenses):			
Interest and dividends income	1,942	2,223	17,491
Interest expense	(2,763)	(2,418)	(24,896)
Loss on sales of and disposals of property, plant and equipment—net	(352)	(319)	(3,172)
Equity in earnings of unconsolidated subsidiary and associated company	1,565	1,280	14,100
Reversal of allowance for doubtful accounts	33	750	295
Foreign exchange loss	(736)	(2,070)	(6,630)
Gain on sales of investment securities—net	676	1,236	6,089
Impairment loss on fixed assets	(10,935)	(3,769)	(98,515)
Provision of reserve for loss related to competition law	(389)	(2,146)	(3,508)
Loss on liquidation of subsidiaries	(1,425)	(1,804)	(12,842)
Loss on the dissolution of a subsidiary	(2,961)	–	(26,680)
Other—net	1,087	2,782	9,822
Other expenses—net	(14,258)	(4,255)	(128,446)
Income before income taxes	50,448	65,772	454,491
Income taxes			
Current	13,824	18,773	124,542
Deferred	1,013	664	9,129
Total income taxes	14,837	19,437	133,671
Net income	35,611	46,335	320,820
Net income attributable to non-controlling interests	104	521	941
Net income attributable to owners of the parent	¥ 35,507	¥ 45,814	$ 319,879
Per share of common stock	Yen		U.S. dollars
Basic net income	¥ 110.35	¥ 142.42	$ 0.994
Diluted net income	110.17	142.18	0.993
Cash dividends applicable to the year	50.00	44.00	0.450

Consolidated Statement of Comprehensive Income

(Millions of yen)

For the year ended March 31, 2019

	Millions of yen		Thousands of U.S. dollars
	2019	2018	2019
Net income	¥ 35,611	¥ 46,335	$ 320,820
Other comprehensive income (loss)			
Unrealized (loss) gain on available-for-sale securities	(3,453)	1,195	(31,108)
Deferred loss on derivatives under hedge accounting	(110)	(13)	(987)
Foreign currency translation adjustments	(3,046)	7,731	(27,445)
Share of other comprehensive income in associated companies	106	97	958
Defined retirement benefit plans	2,056	2,809	18,522
Total other comprehensive (loss) income	(4,447)	11,819	(40,060)
Comprehensive income	¥ 31,164	¥ 58,154	$ 280,760
Total comprehensive income (loss) attributable to:			
Owners of parent	¥ 31,276	¥ 57,284	$ 281,766
Noncontrolling interests	(112)	870	(1,006)

Consolidated Statement of Changes in Equity

(Millions of yen)

For the year ended March 31, 2019

	Thousands	Millions of yen				
	Outstanding number of common stock	Common stock	Capital surplus	Stock acquisition rights	Retained earnings	Treasury stock
Balance at April 1, 2017	321,645	¥ 69,849	¥ 72,055	¥ 899	¥ 289,996	¥ (12,408)
Net income attributable to owners of the parent	–	–	–	–	45,814	–
Cash dividends, ¥41 per share	–	–	–	–	(13,188)	–
Purchase of treasury stock	(1)	–	–	–	–	(4)
Disposal of treasury stock	122	–	(107)	–	–	259
Net change in the year	–	–	–	(41)	–	–
Balance at March 31, 2018	321,766	69,849	71,948	858	322,622	(12,153)
Cumulative effect of accounting change	–	–	–	–	640	–
Net income attributable to owners of the parent	–	–	–	–	35,507	–
Cash dividends, ¥48 per share	(3)	–	–	–	(15,445)	–
Purchase of treasury stock	18	–	–	–	–	(5)
Disposal of treasury stock	–	–	(6)	–	–	36
Change in the parent's ownership interest due to transactions with noncontrolling interests	–	–	36	–	–	–
Net change in the year	–	–	–	66	–	–
Balance at March 31, 2019	321,781	¥ 69,849	¥ 71,978	¥ 923	¥ 343,324	¥ (12,122)

	Millions of yen						
	Accumulated other comprehensive income						
	Unrealized gain on available-for-sale securities	Deferred loss on derivatives under hedge accounting	Foreign currency translation adjustments	Defined retirement benefit plans	Total	Non-controlling interests	Total equity
Balance at April 1, 2017	¥ 23,458	¥ (21)	¥ (15,474)	¥ (10,714)	¥ 417,640	¥ 9,953	¥ 427,593
Net income attributable to owners of the parent	–	–	–	–	45,814	–	45,814
Cash dividends, ¥41 per share	–	–	–	–	(13,188)	–	(13,188)
Purchase of treasury stock	–	–	–	–	(4)	–	(4)
Disposal of treasury stock	–	–	–	–	152	–	152
Net change in the year	1,201	(10)	7,483	2,794	11,427	1,069	12,496
Balance at March 31, 2018	24,659	(31)	(7,991)	(7,920)	461,841	11,022	472,863
Cumulative effect of accounting change	–	–	–	–	640	(30)	610
Net income attributable to owners of the parent	–	–	–	–	35,507	–	35,507
Cash dividends, ¥48 per share	–	–	–	–	(15,445)	–	(15,445)
Purchase of treasury stock	–	–	–	–	(5)	–	(5)
Disposal of treasury stock	–	–	–	–	30	–	30
Change in the parent's ownership interest due to transactions with noncontrolling interests	–	–	–	–	36	–	36
Net change in the year	(3,399)	(105)	(3,066)	2,339	(4,165)	(186)	(4,351)
Balance at March 31, 2019	¥ 21,260	¥ (136)	¥ (11,056)	¥ (5,580)	¥ 478,439	¥ 10,806	¥ 489,245

	Thousands of U.S. dollars				
	Common stock	Capital surplus	Stock acquisition rights	Retained earnings	Treasury stock
Balance at March 31, 2018	$ 629,272	$ 648,184	$ 7,727	$ 2,906,507	$ (109,491)
Cumulative effect of accounting change	–	–	–	5,765	–
Net income attributable to owners of the parent	–	–	–	319,879	–
Cash dividends, $0.43 per share	–	–	–	(139,144)	–
Purchase of treasury stock	–	–	–	–	(42)
Disposal of treasury stock	–	(58)	–	–	325
Change in the parent's ownership interest due to transactions with noncontrolling interests	–	328	–	–	–
Net change in the year	–	–	590	–	–
Balance at March 31, 2019	$ 629,272	$ 648,454	$ 8,317	$ 3,093,007	$ (109,208)

	Thousands of U.S. dollars						
	Accumulated other comprehensive income						
	Unrealized gain on available-for-sale securities	Deferred loss on derivatives under hedge accounting	Foreign currency translation adjustments	Defined retirement benefit plans	Total	Non-controlling interests	Total equity
Balance at March 31, 2018	$ 222,154	$ (281)	$ (71,988)	$ (71,349)	$ 4,160,735	$ 99,293	$ 4,260,028
Cumulative effect of accounting change	–	–	–	–	5,765	(269)	5,496
Net income attributable to owners of the parent	–	–	–	–	319,879	–	319,879
Cash dividends, $0.43 per share	–	–	–	–	(139,144)	–	(139,144)
Purchase of treasury stock	–	–	–	–	(42)	–	(42)
Disposal of treasury stock	–	–	–	–	267	–	267
Change in the parent's ownership interest due to transactions with noncontrolling interests	–	–	–	–	328	–	328
Net change in the year	(30,620)	(948)	(27,620)	21,075	(37,523)	(1,675)	(39,198)
Balance at March 31, 2019	$ 191,534	$ (1,229)	$ (99,608)	$ (50,274)	$ 4,310,265	$ 97,349	$ 4,407,614

Consolidated Financial Statements

Consolidated Statement of Cash Flows

(Millions of yen)

For the year ended March 31, 2019

	Millions of yen		Thousands of U.S. dollars
	2019	2018	2019
Operating activities:			
Income before income taxes	¥ 50,448	¥ 65,772	$ 454,491
Adjustments for:			
Income taxes—paid	(18,407)	(23,306)	(165,826)
Depreciation and amortization	35,729	30,316	321,880
Impairment loss on fixed assets	10,935	3,769	98,515
Decrease of provision for NAS battery safety measures	(532)	(1,089)	(4,792)
Increase (decrease) of provision for loss related to competition law	3	(7,993)	25
Equity in earnings of unconsolidated subsidiary and associated company	(1,565)	(1,280)	(14,100)
Gain on sales of investment securities—net	(676)	(1,236)	(6,089)
Changes in assets and liabilities:			
Increase in notes and accounts receivable—trade	(3,595)	(10,196)	(32,390)
Increase in inventories	(18,193)	(10,342)	(163,902)
Increase in other current assets	(6,352)	(427)	(57,228)
Decrease in net defined benefit assets	1,821	2,691	16,407
Increase in notes and accounts payable—trade	5,454	7,318	49,134
Increase (decrease) in other current liabilities	1,996	(2,856)	17,980
Other—net	4,159	(587)	37,470
Total adjustments	10,777	(15,218)	97,084
Net cash provided by operating activities	61,225	50,554	551,575
Investing activities:			
Purchases of marketable securities	(68,000)	(57,400)	(612,612)
Proceeds from sales and redemption of marketable securities	62,220	55,805	560,542
Proceeds from sales and redemption of investment securities	831	12,182	7,482
Purchases of property, plant and equipment	(102,826)	(67,062)	(926,361)
(Increase) decrease in time deposits	(807)	6,481	(7,270)
Other—net	(1,161)	580	(10,458)
Net cash used in investing activities	(109,743)	(49,414)	(988,677)
Financing activities:			
(Decrease) increase in short-term borrowings—net	(1,919)	14	(17,286)
Proceeds from long-term debt	31,853	42,444	286,963
Repayments of long-term debt	(10,845)	(6,825)	(97,698)
Cash dividends	(15,445)	(13,188)	(139,144)
Other—net	(80)	101	(723)
Net cash provided by financing activities	3,564	22,546	32,112
Foreign currency translation adjustments on cash and cash equivalents	(980)	1,539	(8,830)
Net (decrease) increase in cash and cash equivalents	(45,934)	25,225	(413,820)
Cash and cash equivalents, beginning of year	169,918	144,693	1,530,796
Cash and cash equivalents, end of year	¥ 123,984	¥ 169,918	$ 1,116,976

Corporate Outline

Company name	NGK Insulators, Ltd.
Address	2-56 Suda-cho, Mizuho, Nagoya 467-8530, Japan Telephone + (81) 52-872-7181
Established	May 5, 1919
Paid-in capital	69.8 billion yen (as of March 31, 2019)
Net sales	463.5 billion yen (consolidated, for FY2018)
Consolidated subsidiaries	57 consolidated subsidiaries (21 in Japan, 14 in North/Central America, 6 in Europe, 16 in Asia and elsewhere)
Equity-method affiliates	2
Employees	NGK 4,119 (as of March 31, 2019) Consolidated 20,115 (as of March 31, 2019)

Organization

Head Office

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

Corporate R&D

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

Corporate Manufacturing Engineering

- Administration Department
- Manufacturing Engineering Department
- Information Technology Department
- Construction & Maintenance Department
- Global Engineering Department

Power Business Group

- Business Planning Department
- Quality Assurance Department
- Insulator Division
- NAS Battery Division

Ceramic Products Business Group

- Business Planning Department
- Quality Assurance Division
- Global Sales & Marketing Division
- Engineering Division
- Manufacturing Division
- Sensor Division

Electronics Business Group

- Business Planning Department
- Quality Assurance Department
- New Metals Division
- Electronic Components Division
- Advanced Device Components Division
- General Management Department
- Electronic Sales & Marketing Department

Process Technology Business Group

- Business Planning Department
- Quality Assurance Department
- High Performance Ceramics Division
- Industrial Process Division

Subsidiaries and Affiliated Companies

Sites, Main Office, Branch, Sales Offices

Head office / Tokyo Main Office / Osaka Branch / Chita Site / Komaki Site / Ishikawa Plant / Sapporo Sales Office / Sendai Sales Office / Hokuriku Sales Office / Hiroshima Sales Office / Takamatsu Sales Office / Fukuoka Sales Office

Group Companies in Japan

Energy Support Corporation / Kansai Energys Corporation / Hokuriku Energys Corporation / Energys Sangyo Corporation / Kyushu Energys Co., Ltd. / Tokai Energys Corporation / Akechi Insulators, Ltd. / NGK Okhotsk, Ltd. / Soshin Electric Co., Ltd. / Soshin Device Co., Ltd. / Soshin Powertech Co., Ltd. / Risshin Electronics Co., Ltd. / NGK Electronics Devices, Inc. / NGK Ceramic Device Co., Ltd. / NGK Metex Corporation / NGK Fine Molds, Ltd. / Ikebukuro Horo Kogyo Co., Ltd. / NGK Chem-Tech, Ltd. / NGK Filtech, Ltd. / NGK Adrec Co., Ltd. / NGK Kilntech Corporation / NGK Sports Planning Co., Ltd. / NGK Life Co., Ltd. / NGK Yu-Service Co., Ltd. / NGK Logistics, Ltd.

Group Companies Overseas

America
NGK-Locke Inc. / NGK-Locke Polymer Insulators, Inc. / NGK Ceramics USA, Inc. / NGK Automotive Ceramics USA, Inc. / NGK Metals Corporation / FM Industries, Inc. / NGK Electronics USA, Inc. / NGK Insulators of Canada, Ltd. / NGK Ceramics Mexico, S. de R.L. de C.V.

Europe, Africa
NGK Berylco U.K. Ltd. / NGK Ceramics Europe S.A. / NGK Europe GmbH / NGK Deutsche Berylco GmbH / NGK Berylco France / NGK Ceramics Polska Sp. z o.o. / NGK Ceramics South Africa (Pty) Ltd.

Asia, Oceania
NGK Insulators (China) Investment Co., Ltd. / NGK Ceramics Suzhou Co., Ltd. / NGK Technocera Suzhou Co., Ltd. / NGK Automotive Ceramics Korea Co., Ltd. / P.T. NGK Ceramics Indonesia / Siam NGK Technocera Co., Ltd. / NGK Ceramics (Thailand) Co., Ltd. / NGK Technologies India Pvt. Ltd. / NGK Stanger Pty. Ltd.

Other Group Companies
NGK Italy S.r.L. / Energys Electric Shanghai Corporation / NGK Electronics Devices (M) Sdn. Bhd. / Soshin Electronics of America Inc. / Soshin Electronics (HK) Limited / Taiwan Soshin Electric Co., Ltd. / NGK Material USA, Inc. / NGK Energys Myanmar Co., Ltd. / NGK Globetronics Technology Sdn. Bhd. / Soshin Electronics Europe GmbH / Soshin Electronics (SZ) Limited / Soshin Electronics (M) Sdn. Bhd.

Details of NGK are available on the company website

The NGK Report 2019 provides comprehensive information on both financial and non-financial matters.
For more detailed information, please see the NGK website.
The NGK Sustainability Data Book 2019 (PDF) is available on our website and provides a detailed report on NGK's ESG initiatives.

About NGK
【English】
https://www.ngk-insulators.com/en/info/
【Japanese】
https://www.ngk.co.jp/info/

Investor Relations
【English】
https://www.ngk-insulators.com/en/ir/
【Japanese】
https://www.ngk.co.jp/ir/

Sustainability
【English】
https://www.ngk-insulators.com/en/sustainability/
【Japanese】
https://www.ngk.co.jp/sustainability/

NGK Sustainability Data Book 2019

Professor, Ph. D. in Law (LL.D.), Graduate School and Faculty of Safety Science, Kansai University; Executive Director of Japan Society for Business Ethics; Senior Researcher of Business Ethics Research Center

Mr. Kazuhiko Takano

1. Key features of the NGK Group's ESG management and developments since last year

There is no debating the fact that the NGK Group is an important part of a key industry supporting the Japanese economy and that there is strong, ongoing demand in society for the business that it undertakes. In last year's Third-Party Opinion, I discussed the terrific design and operation of the NGK Group's corporate governance and compliance and risk management systems, which are foundational to business continuity.

After reading this year's report, I felt it appropriate to discuss the following four ways in which the NGK Group made improvements over the last year.

The first improvement is the formulation of a new corporate philosophy. The year 2019 is the 100th anniversary of NGK's founding, and it has been marked by the creation of a new philosophical framework. This new NGK Group Philosophy revisits and revises the founding values of the Group, expressing them in clear language that fosters a shared purpose and identity among all employees in the 20 different countries where the NGK Group does business. Research has shown that long-standing companies are those whose corporate philosophy and values are shared by both executives and employees. President Oshima in his introductory message for this year's report explains the importance of universally sharing values within the Group. I think this importance is underscored by the strong, ongoing demand in society for the business that this Group undertakes.

The second improvement is seen in the revisions that have been made to the Code of Conduct. The NGK Group Code of Conduct was revised in January 2019 in advance of the formulation of the new corporate philosophy. These new guidelines require respect for human rights and compliance with laws and regulations by not only Group companies but by everyone in the NGK supply chain. They show the NGK Group's stance that, as its business becomes increasingly global, every part of its supply chain will adhere to international norms, such as those pertaining to child labor and anti-corruption practices.

The third improvement is the establishment of an ESG Committee. This new committee was established in April 2019 and is chaired by the president. It is indicative of a strong motivation to work towards the Sustainable Development Goals (SDGs) and undertake environmental, social, and corporate governance (ESG) initiatives across the entire NGK Group in order to contribute to the realization of a sustainable global society.

The fourth improvement is quality compliance. The Non-Conformity Issue occurred in insulators, which arose in January 2018 became a catalyst for quality compliance improvement initiatives, which have developed into specific and detailed company-wide activities.

As demonstrated by all of the above points, it is very pleasing to read the NGK Report 2019 and see how much has improved since last year.

2. Expectations for further development

While the improvements that have been made attest to the high level of ESG management within the NGK Group, I feel there is room for further improvement in the following two areas.

The first area for improvement is long-term vision. Japan's ESG investment balance has growing sharply since 2014, and this means that improving one's ESG evaluation is a way to contribute to higher corporate value in the long term. In particular, including initiatives focused on SDGs as a key part of value creation will help to better demonstrate one's vision looking ahead 10 to 20 years into the future.

The second area for improvement is disaster preparedness. As mentioned earlier, the NGK Group maintains a robust risk management system, but they could communicate their resiliency even more by describing more in the report their natural disaster preparedness measures. It would be good to read about NGK's business continuity plans (BCPs), which address how to handle large-scale earthquakes, storm and flood damage, and the large-scale power outages and other widespread, complex disasters that such natural disasters cause. A description of other measures such as training to improve the effectiveness of BCP implementation would also make for a better report.

By offering a long-term vision and better communicating its resiliency, I expect that the NGK Group will further enhance its corporate value and experience sustainable business growth.

WE SUPPORT UN GLOBAL COMPACT

External Evaluation

In September 2018, NGK was selected for the third consecutive year for the Dow Jones Sustainability Asia Pacific Index in the Dow Jones Sustainability Indices, a major index for socially responsible investment.

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NGK

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