

## Using Unique Technological Strengths Cultivated in Insulator Manufacturing to Build a Diverse Portfolio of Industries

NGK was founded in 1919 as a manufacturer of porcelain insulators, a key component in the modernization of Japan. Now, 99 years later, our insulators are helping support the electrical power infrastructure of the entire world. Not only that, we have capitalized on—and continue to capitalize on—the ceramics technology, which we cultivated over many years of insulator manufacturing, adapting it to the production of a vast array of products that have made NGK a prominent contributor in a diverse range of industries.

### 1919 High-voltage insulators

Electrification gradually began to gain traction at the end of the 19th century. At the time, Japan relied on imports for high-voltage insulators. “To make a contribution to the country, and not merely for our own profit, we must provide Japan with its own, domestically manufactured insulators.” (Kazuchika Okura, founding president of NGK)

With this sense of mission, NGK managed to get hold of a piece of an American-made insulator, which it began studying in order to develop its own high-voltage insulators. The desire to contribute to people’s lives and the development of industry was integral to our founding and continues to be the cornerstone of our corporate philosophy.



## Electric energy storage system

# NAS<sup>®</sup> battery systems

A product of NGK's proprietary advanced ceramic technologies, the NAS battery was the world's first commercialized battery system capable of megawatt-level electric power storage. It is increasingly being 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.



# 2018



## Ceramic substrates for automotive catalytic converters

# HONEYCERAM<sup>®</sup>

Ceramic catalyst carriers neutralize the harmful substances in automotive exhaust. For maximum exhaust cleaning efficiency, HONEYCERAM was designed with minimum weight and wall thickness: the 0.05 mm walls minimize loss of engine power.

## World's first vehicle-mounted

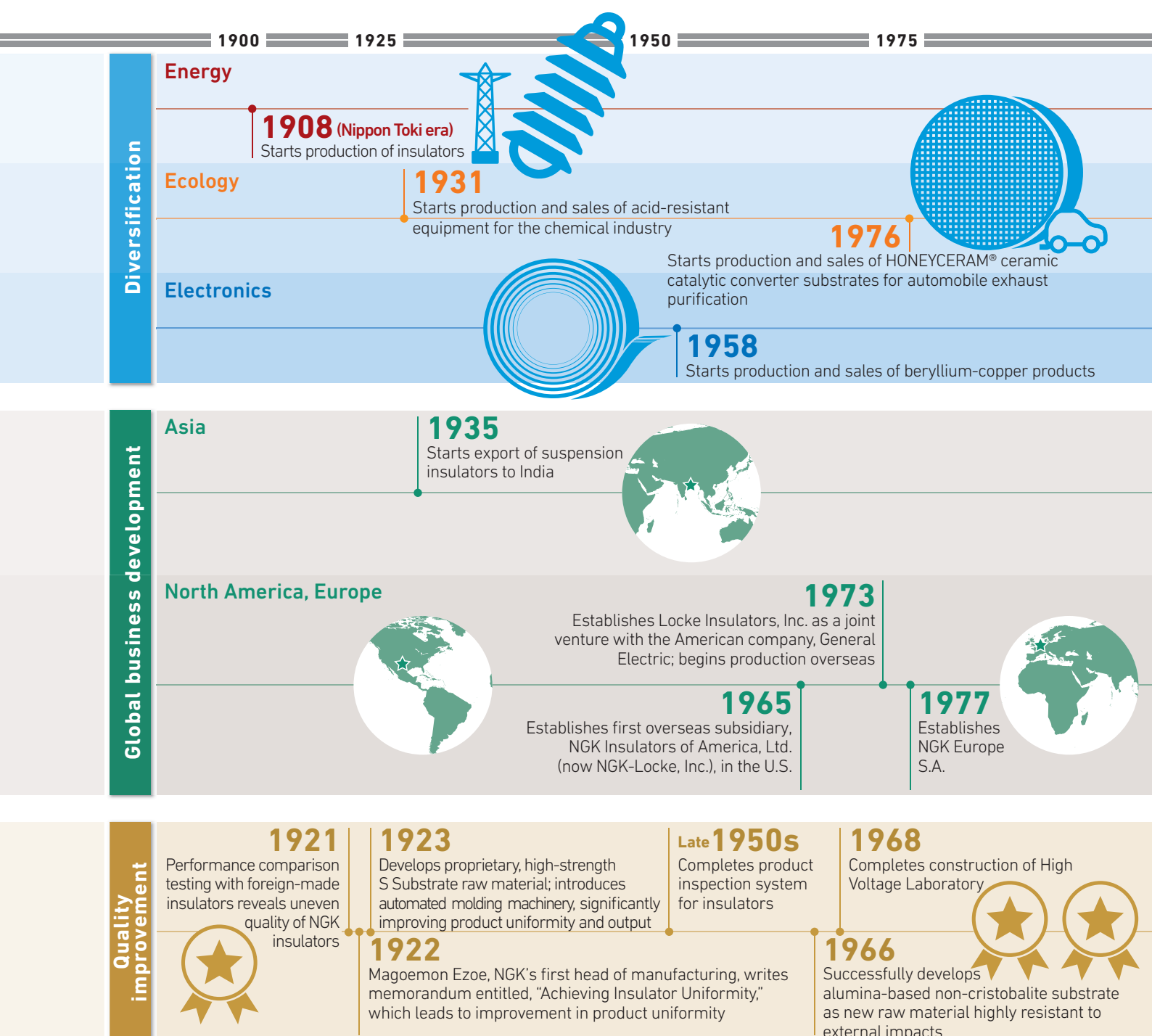
# NO<sub>x</sub> sensors

This sensor is able to measure the concentration of NO<sub>x</sub> (nitrogen oxide) contained in automotive exhaust at the ppm (parts per million) level. Measuring real-time NO<sub>x</sub> concentrations and feeding back that information to the engine controls enables precise control of the exhaust purification system to reduce NO<sub>x</sub> emissions.

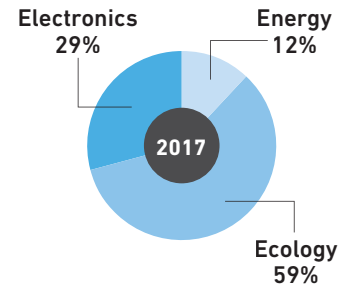
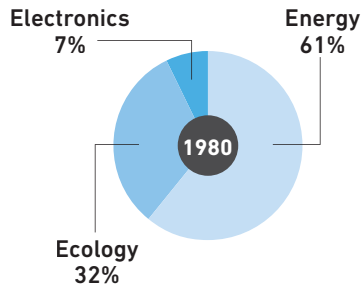
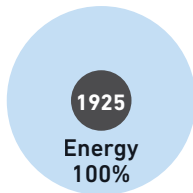


## Preserving the Founding Principles of NGK Business Diversification, Global Business Development, Quality Improvement

Since its founding, NGK has offered products boasting the highest quality and reliability thanks to the incorporation of exceptionally refined ceramics technology. At the same time, NGK has actively sought opportunities for business diversification and global development. This tradition of exploring new fields and seeking new challenges remains alive and well at NGK as we continue to pursue sustainable business growth.



■ Expansion into Diverse Business Sectors  
(in terms of sales amount)



1985

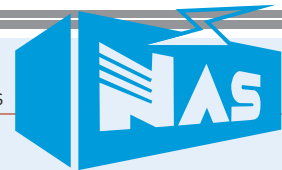
2000

2010

2015

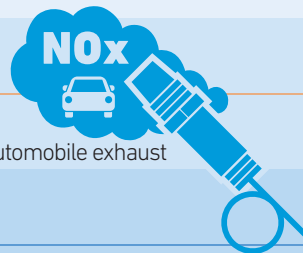
**2003**

Starts mass production of NAS<sup>®</sup> batteries



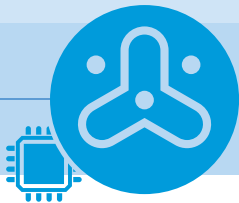
**1989**

Starts production of diesel particulate filters (DPFs)



**1996**

Starts production of NOx sensors for automobile exhaust



**1996**

Starts mass production of ceramics for semiconductor manufacturing equipment



**1996**

Establishes NGK Insulators Tangshan Co., Ltd. for insulator production in China

**1996**

Establishes P.T. NGK Ceramics Indonesia for HONEYCERAM production in Indonesia

**2015**

Establishes NGK Ceramics (Thailand) Co., Ltd. for HONEYCERAM and DPF production in Thailand



**1985**

Establishes NGK Ceramics Europe S.A. in Belgium; begins local production of HONEYCERAM



**1988**

Establishes NGK Ceramics USA, Inc. in the U.S.; begins local production of HONEYCERAM

**2003**

Establishes NGK Ceramics Polska Sp. z o.o. for DPF production in Poland



**1982**

NGK's AC Plant becomes first Japanese manufacturer to receive Ford Motor Company's QI Award

**1999**

High Voltage Laboratory becomes first internationally accredited high-voltage testing laboratory in Japan

**2009**

Implements Reformed Manufacturing Structures; production systems, design, manufacturing equipment, etc., are revised from square one

