

Technological Development

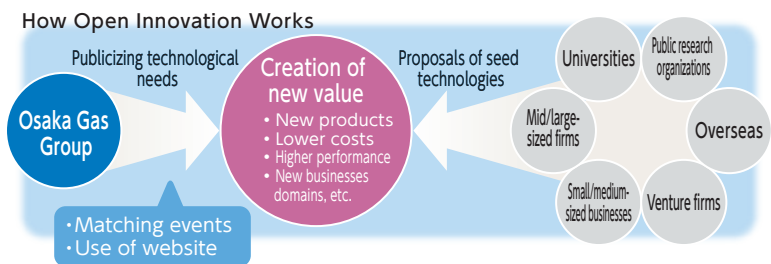
[Technological Development Strategy]

Technology-Driven Solutions and Innovation

The Osaka Gas Group aims to spur innovation for the next generation and provide optimal solutions to its customers by leveraging its accumulated core technologies.

<p>Development of technologies for business solutions</p> <ul style="list-style-type: none"> ● Accumulated data used to predict equipment failure and improve services ● Development of new carbon and chemical materials and the creation of new applications for those materials 	<p>Development of technologies to expand the use of natural gas</p> <ul style="list-style-type: none"> ● Increased efficiency and decreased size of residential fuel cell ENE-FARM ● Built-to-order engineering using combustion technologies ● "Smart" gas appliances created using information and communications technology (ICT)
<p>Development of technologies in the environmental field</p> <ul style="list-style-type: none"> ● Lowered price and improved efficiency of hydrogen generator HYSERVE ● Wastewater treatment systems developed ● Equipment developed to generate biogas from kitchen waste 	<p>Promotion of projects using engineering technologies</p> <ul style="list-style-type: none"> ● Resource development and gas liquefaction engineering ● LNG facility engineering ● Power generation engineering

The Osaka Gas Group aims collaborate with new partners to speed up technology development, improve the performance of products it develops, and increase the investment efficiency of developing technology, so we are promoting the concept of "open innovation," which will boost added value by merging our own technologies with technologies from outside the Group.

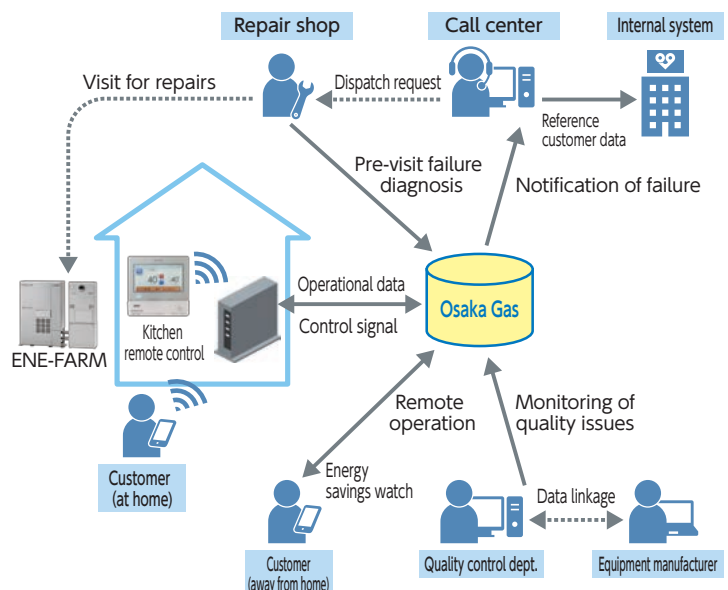


Development of Technologies for Business Solutions (Major Initiatives)

The creation of new services utilizing IoT functionality built into the ENE-FARM residential fuel cell system

As of April 2016, residential fuel cell systems, such as the next-generation ENE-FARM type S feature an always-on connection to the Internet and uses the cloud for remote monitoring.

This capability allows detection of any abnormality in the system's power generation. In that event, Osaka Gas will then call to notify the customer of the situation and provide an emergency repair service visit when necessary. This power generation monitoring service gives customers peace of mind. The on-site repair time can also be shortened by analyzing the data sent to the cloud in the event of a failure, thereby streamlining maintenance work. Customers also get improved convenience through such remote control features as filling the bath with hot water or controlling the floor heating using their smartphones.

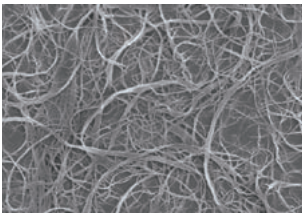


Development of fluorene cellulose as a fiber for strengthening resin

Osaka Gas developed fluorene cellulose, a cellulose fiber with uniform dispersion, by reacting the cellulose fiber surface with a fluorene derivative. Fluorene cellulose does not mix easily with water but mixes easily with resin.

Fluorene cellulose is a resin fiber material with low environmental impact and has strong potential for use in home appliances and as a structural material in automobiles.

Fluorene derivatives with excellent optical properties and heat resistance have been used for liquid crystal displays, smartphone camera lenses, and more. We now aim to develop new applications through the commercialization of fluorene cellulose.



Electron microscope image of fluorene cellulose

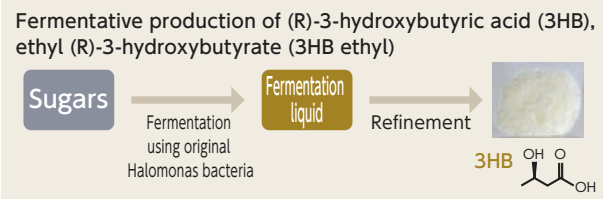
Osaka Gas can now produce ketone bodies, known for their use in diets

Osaka Gas has developed a method for manufacturing ketone bodies ((R)-3-hydroxybutyric acid) using bioprocess (fermentation) technology cultivated over many years in collaboration with the National Institute of Advanced Industrial Science and Technology.

(R)-3-hydroxybutyric acid, a ketone body, is produced from fatty acids in the liver to supply energy to the brain in place of glucose.

Recently, there has been growing interest in ketone bodies for their effectiveness in dieting and improving athletic performance. Osaka Gas was the first in the world to discover the skin anti-aging effects of ketone bodies.

We anticipate new applications for their use in the future in health foods, supplements, and cosmetics.



Intellectual Property Strategy

The Osaka Gas Group positions intellectual property rights as an important management resource. At the same time, the Group takes proactive steps to secure and utilize intellectual property rights in concert with its business and technology development strategies.

Strategically Acquiring Intellectual Property Rights

We acquire patents on a steady basis by focusing on invention and discovery that is closely related to specific development sites, incorporating judgments on patentability from external authorities after filing. Through patent analysis and mapping we are able to build a thorough and complete network of patents, which is an important motif. In fiscal 2016, 457 patents were filed, totaling 3,421 held by the Osaka Gas Group, including patents for upstream gas production, distribution and supply, and downstream gas appliances and material technologies. The intellectual property rights that we possess are used for business and are actively licensed to other companies.

In addition, we are careful to acquire trademarks for services and products we offer and protect company brands. As of March 31, 2017 the Osaka Gas Group holds 1,056 trademarks.

Strengthening Intellectual Property throughout the Group

We employ a variety of educational and instructional tools to further improve Osaka Gas Group employees'

understanding of intellectual property rights. For example, instructors from both inside and outside the Company conduct training sessions based on both goals and employee career level. We also publish an email magazine and distribute the latest news articles on relevant topics.

The Group's Patent Portfolio by Business Type (number)

