Innovation / Technological Development

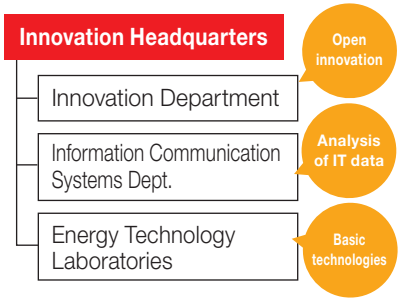
To address the challenge of creating new value beyond conventional frameworks, the Daigas Group will further commit to innovation, including open innovation and digital technologies, with the aim of ensuring optimized solutions for customers and fostering next-generation innovation.

Promotion of Innovation

Set up the Innovation Headquarters

- Set up the Innovation Headquarters with the aim of creating new values through business reforms
- Set up the Innovation Department and integrally promote companywide innovation activities

Challenge of creating new value

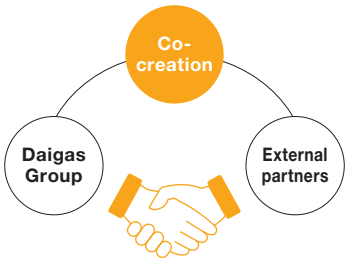


Business reforms in preparation for a paradigm change

Advance Open Innovation

- Collaborate with diverse corporate partners not only in the field of technology but also in the service field
- Strengthen Silicon Valley-based activities
- Collaborate with start-up companies at home and abroad

Co-create New Businesses

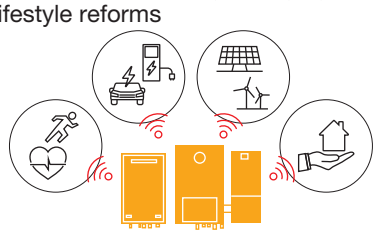


Products and services that go beyond customer expectations

Promote Digitization Exploration of Technology

- More convenient lifestyle services and business solutions utilizing IoT and AI
- New electric power business utilizing distributed energy sources and ICT
- High-level infrastructure operations with digitalization
- Innovative technology development such as fuel cells

Equipment and energy bringing lifestyle reforms



Achieving drastic business reforms

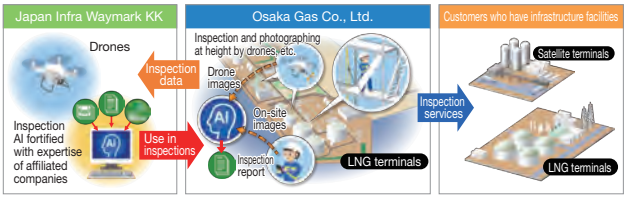
Examples of Major Initiatives

"TORCH": A Program for New Business Creation for Young Employees

We are promoting a program in which young, willing employees share ideas and create new businesses. The program name, "TORCH," stands for both the flame of gas and the passion of young employees. For the creation of ideas, our young employees use the "Foresight Creation" methodology of Osaka Gas Research Institute of Behavior Observation. Project management is entrusted to Loftwork Inc., which has a reputation for supporting the creation of new businesses within a company. Every year, we recruit about 20 young employees within the Group who meet the age requirement of 35 years old or less. These employees are divided into teams and spend about three months considering business ideas. The ideas are presented to Group employees in a contest format. In February 2020, the first new business that originated from TORCH called "Ramune" an app that covers light topics to refresh the user's mind, was released. While aiming to create new businesses that are not confined to existing business frameworks, participants will apply the knowledge gained through the program to their current operations, building a culture of innovation throughout the Group.

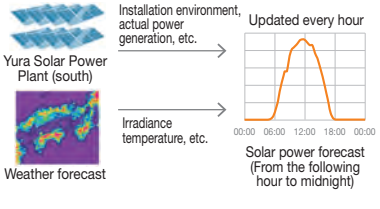
Investment in Company That Offers Infrastructure Inspection Using Drones

In April 2020, we took a stake in Japan Infra Waymark KK, which offers infrastructure inspection solutions using drones. Utilizing the expertise in inspection and other know-how built up over the years, we will improve safety and operating efficiency by developing AI related to corrosion inspection in LNG terminals and by reducing work at height using drones. We will expand new businesses by offering inspection services to plants of other companies.



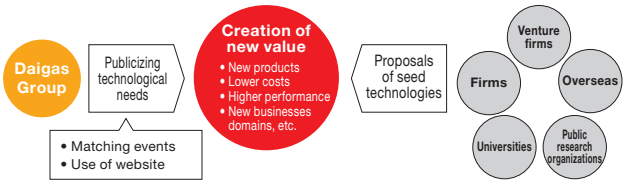
Demonstrative Experiment on Solar Power Forecasting on the Assumption of Revision in the FIT Scheme

We have worked together with Next Kraftwerke, a venture company in Europe, to jointly conduct a demonstrative experiment for the realization of highly-accurate solar-power forecasting services.
In the future, a review of the FIT scheme is planned, and the obligations of power forecasting, etc. currently assigned to power transmission and distribution business operators are expected to be transferred to the power generation business operators. In the face of this process, we aim to provide new services to properly operate and perform business transactions in regard to solar power generation.



Open Innovation Developments

By fusing proprietary and outside technologies, the Daigas Group is developing open innovation, aiming to speed up the pace of technological development while improving functionality and cutting costs. In the fiscal year ended March 31, 2010, we began publicizing technological needs. We have sponsored technology exhibitions, formed alliances with other companies, attended technology-matching conventions and developed alliances with universities.

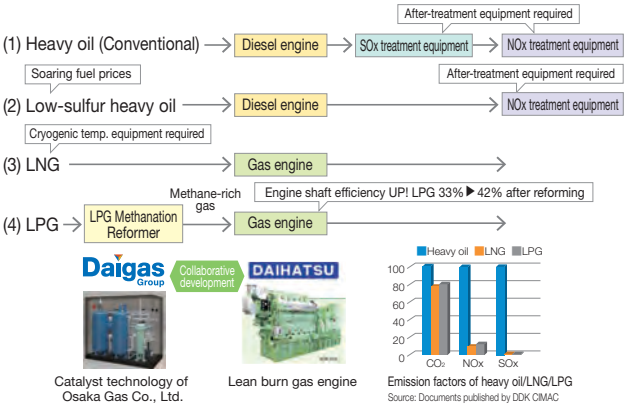


Investment in US Venture Fund

In April 2018, we invested in a venture investment fund operated by WiL LLC, a venture capital company headquartered in Silicon Valley. Through this investment, we aim to invest in and form alliances with start-up companies mainly in Japan and the United States to accelerate the pace of innovation-oriented activities, including the creation of convenient daily services and business solutions using the IoT, AI and other digital technologies, as well as ensuring high infrastructure operational standards.

Development of LPG Methanation Reformer to Contribute to Prevention of Marine pollution

Compared with conventional heavy oil, liquefied petroleum gas (LPG) has attracted attention as a ship fuel because it does not require exhaust gas treatment equipment to be able to significantly reduce the SOx and NOx emissions that are a primary cause of marine pollution. However, when using LPG directly by gas engines, there was an issue with knocking being prone to occur within engines, making high-efficiency operations difficult. Therefore, together with DAIHATSU DIESEL MFG. CO., LTD., we have jointly developed a reformer for the methanation of LPG using our own catalyst technology, and have improved its efficiency to 42%, equivalent to the LNG which has already been introduced as a fuel that complies with environmental regulations. In 2019, this reformer obtained the first Approval in Principle (AIP) for Japan from the Nippon Kaiji Kyokai, and we will continue to accelerate further toward the societal implementation of LPG fuel ships and contribute to the prevention of marine pollution.

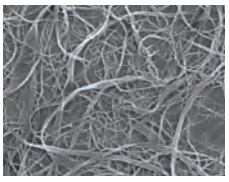


Catalyst technology of Osaka Gas Co., Ltd. | Lean burn gas engine | Emission factors of heavy oil/LNG/LPG

Source: Documents published by DDK CIMAC

Development of Fluorene Cellulose as a Fiber for Strengthening Resin

We have 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.



Electron microscope image of fluorene cellulose

Successful Production of Ketone Bodies, Known for Their Use in Diets

We have developed a method for manufacturing ketone bodies, (R)-3-hydroxybutyric acid (3HB), using bioprocess (fermentation) technology cultivated over many years in collaboration with the National Institute of Advanced Industrial Science and Technology. Recent years have seen rising interest in ketone bodies for their effectiveness in dieting and improving athletic performance. We have succeeded for the first time in effectively generating and isolating 3HB using bioprocesses. We anticipate new applications for their use in the future in health foods, supplements, and cosmetics.

Fermentative production of (R)-3-hydroxybutyric acid (3HB), ethyl (R)-3-hydroxybutyrate (3HB ethyl)