December 2013

Mitsui Engineering & Shipbuilding Co., Ltd.

・Strategic Development of Energy Conservation Technology Project" (FY2001-2005)

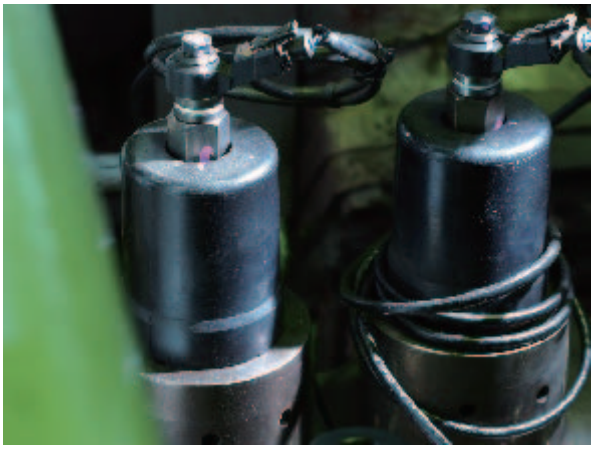
Optimally Adjusting the Ratio between Heat and Electricity to Suit the Place of Utilization - Development of a Gas Engine System that Expands the Scope for the Popularization of Natural Gas Cogeneration

When operating a power generator using a heat engine, the generation of waste heat is unavoidable. Because the supply of electricity in Japan has been mainly based on intensive large-scale power stations, it has not been possible to utilize this waste heat. In recent years, however, "cogeneration" has been gaining popularity. Cogeneration is a mode of power generation wherein both electricity and heat are supplied. That is, power generation equipment is installed at facilities of customers and local areas and the heat generated by the power generation is collected and utilized for such purposes as air conditioning and the production of steam for use in factories.

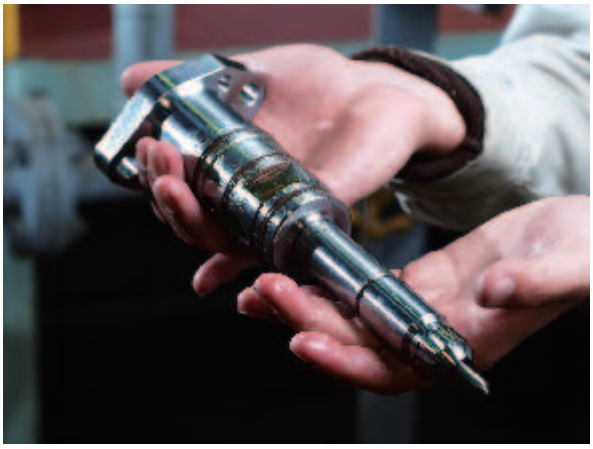
In line with the efforts to alleviate global warming, the voice for promotion of the popularization of "distributed power generation systems" has been strengthening. Distributed power generation systems are systems wherein both electricity and heat are supplied on a locality-by-locality (or building-by-building or factory-by-factory) basis. Cogeneration is attracting attention as a mode of distributed power generation.

However, because cogeneration uses power generation systems that are smaller than those used at conventional thermal power stations, it is difficult to achieve high efficiency (because it is difficult to take advantage of economies of scale). In addition, there are cases where seasonal variations (or variations caused by other factors) in the utilization ratio between electricity and heat reduce the energy-saving performance.

Against this background, Mitsui Engineering & Shipbuilding Co., Ltd., which is a company that has engaged itself in the development and production of diesel engines for ships for many years, participated in the NEDO project and developed a gas engine cogeneration system by combining 1 to 2MW class gas engines (for which the market demand is high) with the world's first fully fired steam generator. This made it possible to achieve the optimal ratio between heat and electricity by making adjustment according to the demand (which had been difficult to achieve with conventional systems), thereby significantly expanding the range of facilities that can benefit from the introduction of cogeneration. With regard to the stand-alone gas engine power generation efficiency, Mitsui Engineering & Shipbuilding Co., Ltd. achieved an efficiency value of 42.5%, which is a value on the world's highest level. At present, five cogeneration system units and four stand-alone gas engine units (a total of nine units) are in operation throughout Japan. In the area of stand-alone engine products, Mitsui Engineering & Shipbuilding Co., Ltd. developed a gas engine product that is one class larger together with Daihatsu Diesel Mfg. Co., Ltd. after completion of the project, and started selling the product in 2012 (three units are already in operation).



Knocking detection sensor attached to the gas engine



Pilot fuel injection valve for ignition - one of the key components that have made it possible to achieve the high efficiency.

Q. Why did this project start?

Japan had vigorously promoted energy saving since the first oil crisis, and had achieved energy utilization efficiency on the highest level in the world. However, the total amount of carbon dioxide emitted in Japan in FY2005 as a result of the use of energy (which is said to represent the majority of the total amount of greenhouse gases emitted in Japan) had been 113.6% of the corresponding amount in FY1990. Because the voice for measures to combat global warming had been strengthening at the time, promoting research and development on new energy-saving technologies had been an urgent task. In addition, the "Energy Saving Front Runner Plan" of the "New National Energy Strategy" established in May 2006 had required that efforts be made to improve the energy consumption efficiency by at least 30% (per GDP) by the year 2030 by establishing a virtuous cycle of technological innovations and social system reforms.

To address these challenges, the Ministry of Economy, Trade and Industry drew up the "Strategy for Energy-Saving Technologies" in April 2007 as the strategy for promoting mid- and long-term technological development in the area of energy-saving technologies by promoting coordinated collaborative efforts between the industry, academia, government organizations and various entities in other fields of business so that large breakthroughs can be achieved in the area of energy-saving technologies. NEDO started this project as a means to overcome the demand side challenges relating to energy saving in the manufacturing sector, (household and business use) consumer products production sector and transportation sector identified in the "New National Energy Strategy" mentioned above and the Strategy for Energy-Saving Technologies established based on it.

Q. What was the aim of the project?

The project aimed at improving the energy consumption efficiency by at least 30% (per GDP) by the year 2030 by establishing a virtuous cycle of technological innovations and social system reforms. The report of the post-project evaluation (conducted in FY2011) of this project estimates that the amount of energy that will have been saved by the year 2030 by the technologies that have already been commercialized and the technologies that may be commercialized in the future will be approximately 30 million kl.

Q. What is the role of NEDO?

NEDO designed the system for implementing the project. The implementation system was so designed that the likelihood of the introduction into the market would be increased by establishing the project into the pilot study phase, commercialization development phase and demonstration study phase and adding a preliminary research phase. For studies with a research and development period of three years, NEDO exercised appropriate research and development management by receiving an interim evaluation by external learned people at the end of the second year, reviewing the resource allocation and project plan, "reviewing the target values and plans," "discontinuing studies or taking drastic improvement measures" and taking other appropriate measures.