

TECHNOLOGY DEVELOPMENT

Tokyo Gas has always maintained a focus on technical development, and the Company has developed its operations while repeatedly taking on the challenge of new technologies. As we strive to respond rapidly and accurately to changes in the operating environment, we are working to develop technologies that will open up new energy frontiers.

Strategic Direction of Technology Development

In technology development, we focus on three areas: (1) the creation of heart-reverberating concepts and the development of products that give concrete form to the value created by those concepts, (2) the development of innovative environmental technologies that will contribute to the realization of a low-carbon society, and (3) technologies that support the operational platforms for stable administration of gas operations and for realization of higher-level usage and cost reductions. In the fiscal year ended March 31, 2010, the Company allocated about ¥9.2 billion to technology development.

The Technology Development Strategy of Tokyo Gas



Major Outputs and Initiatives in Recent Years

<p>Environmental Technologies</p>	<p>Started general sales in May 2009 of residential polymer electrolyte fuel cell (PEFC) (sales name: "ENE-FARM"). Moving ahead with development to further improve the product, targeting its use in MDUs.</p> <p>Development and demonstration testing of solid oxide fuel cell (SOFC) technologies.</p> <p>Ongoing demonstration testing of CO₂ separation and collection during the production of hydrogen.</p> <p>Started sales in February 2010 of SOLAMO gas hot water system that also uses solar heat and is installed on the railings of MDUs.</p>
<p>Platform Technologies</p>	<p>Ongoing deepening, succession, and utilization of infrastructure construction technologies, maintenance management technologies, combustion engineering-related technologies, and gas quality management technologies, etc.</p>

IN-DEPTH REPORT

THE STORY BEHIND THE DEVELOPMENT OF “ENE-FARM,” THE WORLD’S FIRST RESIDENTIAL FUEL CELL COGENERATION SYSTEM

“ENE-FARM” leverages new technologies to revolutionize energy usage in the home. But the regulatory system had to be revised to accommodate this new technology. This section describes part of the story behind the challenging development of “ENE-FARM.”

Verifying the Safety of an Entirely New Product, Working to Get the Law Revised

In the early stages of “ENE-FARM” development, the Electricity Business Act required fuel cells to have the same safety measures as large-scale power plants. In contrast with solar power generation facilities and other devices in the category of “Electrical Facilities for General Use,” large-scale power plants are required to have chief electricity engineers for supervision and to follow very strict safety standards. If fuel cells were required to meet these same standards, then there was little chance they would be adopted for residential use. Toshiya Omura, from the Fuel Cell Business Development Department, said “We needed to verify the safety of our fuel cells and then work to have the laws and regulations revised.”

First, it was necessary to correct the image of “ENE-FARM” as a large-scale, dangerous device. Omura invited members of the committees that evaluate safety standards and staff from government offices to the test site, where they could observe the quiet, safe operation of these devices. The next issue was to actually verify their safety. However, as entirely new devices, there were no standards for verification methods. “We identified every dangerous event that we could think of and tested them,” said Omura. “We tested power failures and malfunctions when the fuel cell was in operation or in the middle of the shut down process. And we opened up holes in the cell stacks and then operated the units. In these ways, we conducted tests that were certain to make the fuel cells break down.”



Hiroshi Fujiki, Product Development Department

The Passion of the Technical Development Team Made the Impossible Happen

In confirming safety, another task was to verify the safety of the fuel cells without an N₂ purge. Inside the fuel cell, the fuel processor is composed of extremely delicate catalyzers that reform city gas to produce hydrogen and remove the carbon monoxide that is created as a secondary product. In commercial fuel cell systems, to prevent degradation from the residual unreacted gas inside the catalyzer, the inside is purged, typically with an inert gas. Nitrogen is often used for this purpose.

With “ENE-FARM,” however, if nitrogen were used, a large amount would be consumed. “At an early stage of development, we saw that the only choice was to use city gas for purging,” said Hiroshi Fujiki, from the Product Development Department. “That meant we needed to pay careful attention to temperature. If city gas enters the fuel processor when the processor is still hot, the gas will carbonize and soot will clog the catalyzer. And if the temperature is too low, the gas will contract and outside air will be drawn in. The question was, how much city gas should be used for purging, and how long after the fuel cell is stopped. The only way to find out was through trial and error.”

The Idea that It Was Dangerous Was Eliminated with a Simple Image—Two Butane Lighters

We had cleared the technical hurdles, but we still needed to respond to concerns about filling the inside of the fuel processor with combustible gas. In that regard, Toshiya Omura explained that the amount of heat in the residual gas in the unit would be equivalent to what was in “two disposable butane lighters, even with a device that has 10 times the output of ‘ENE-FARM.’” This simple image became a breakthrough in obtaining understanding of the safety of the N₂ purgeless system, and “ENE-FARM” was approved for the category of “Electrical Facilities for General Use,” which does not require the posting of a chief electricity engineer.

The Day that a World-Leading Technology became a World-First Product Known as “ENE-FARM”

In 2005, the first “ENE-FARM” was installed in the official residence of the Prime Minister. Looking back, Toshiya Omura said “I remember hearing the news and thinking, ‘we made it.’ I was very relieved.”



Toshiya Omura,
Fuel Cell Business
Development
Department