

# Technological Development

40

## Technological Development Is Crucial to Further Strengthen Competitiveness

The Osaka Gas Group views R&D as the most effective means to differentiate itself from competitors and to strengthen its competitiveness. With this aim, the Group is strategically investing resources in fields such as energy and the environment.

### Priority Field in Technological Development

#### Decentralized Energy Systems

The Osaka Gas Group is stepping up its commitment to maximizing efficiencies in power supply from fuel cells\* and gas-engine cogeneration and in low-cost energy supply to help achieve energy security, energy conservation, and peak-saving power demand, which have become leading social priorities since the earthquake disaster in Japan. We are promoting technological development for the commercialization of “smart energy houses” that feature residential fuel cells, solar cells, and rechargeable batteries as well as “smart energy networks” that make the best possible use of decentralized energy systems.



P.28-29

For information on the development of the ENE-FARM residential fuel cell system, please refer to pages 28 and 29.

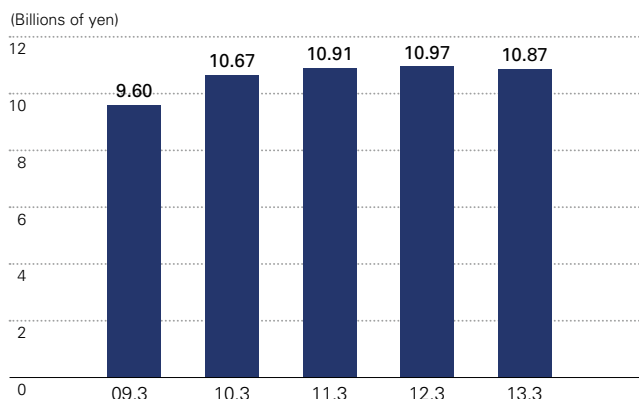
#### Technological Development for Low-Carbon Society

Osaka Gas Group recognizes the important role it plays in preventing global warming through its focus on advancing energy businesses. We are working diligently to promote advanced use of natural gas through means such as increasing the efficiency of gas appliances, optimizing renewable energy and gas systems, and the visualization of energy consumption using information and communications technology (ICT) for energy-saving controls.

#### Developing Technologies That Contribute to Environmental Preservation

By expanding upon its catalyst, bio, carbon material, and other core technologies, the Osaka Gas Group is contributing to environmental preservation, including wastewater treatment technology and methane fermentation technology for raw garbage.

#### Research and Development Expenses (Consolidated)



### Examples of initiatives Smart Energy Houses

The Osaka Gas Group is working to develop “smart energy houses” that combine comfort and environmentally friendly living. The houses employ three types of batteries (residential fuel cells, solar cells, and rechargeable batteries) and IT to facilitate “smart” production, storage, and utilization of electricity and thermal energy. The Group began testing with a view to practical application from February 2011.

Impressed with the Group’s endeavors, the Institute for Building Environmental and Energy Conservation (IBEC) certified it’s “Experimental Home Residence,” as a Lifecycle Carbon Minus (LCMM) home\*<sup>1</sup> in January 2012. This was the first time this designation was accredited in Japan. In addition, steps were taken to determine the installation effects of the “Experimental Home Residence” under actual living conditions over a full year (July 2011 to June 2012). Tests clearly demonstrated wide-ranging benefits in the areas of energy consumption, CO<sub>2</sub> emissions, and utility costs, with reductions of 88%, 103%\*<sup>2</sup>, and ¥310,000, respectively.

\*<sup>1</sup> LCMM homes achieve negative CO<sub>2</sub> balances in their overall lifecycles through the use of solar cells and other renewable energy resources and minimal CO<sub>2</sub> emissions in home construction, installation, and waste disposal.

\*<sup>2</sup> The net balance of reductions in the volume of CO<sub>2</sub> emissions through the use of batteries together with reductions in thermal power plant CO<sub>2</sub> emissions attributable to the electricity sales portion of solar cells exceeds zero with a further reduction of 3%.

#### Conceptual Diagram of a Smart Energy House



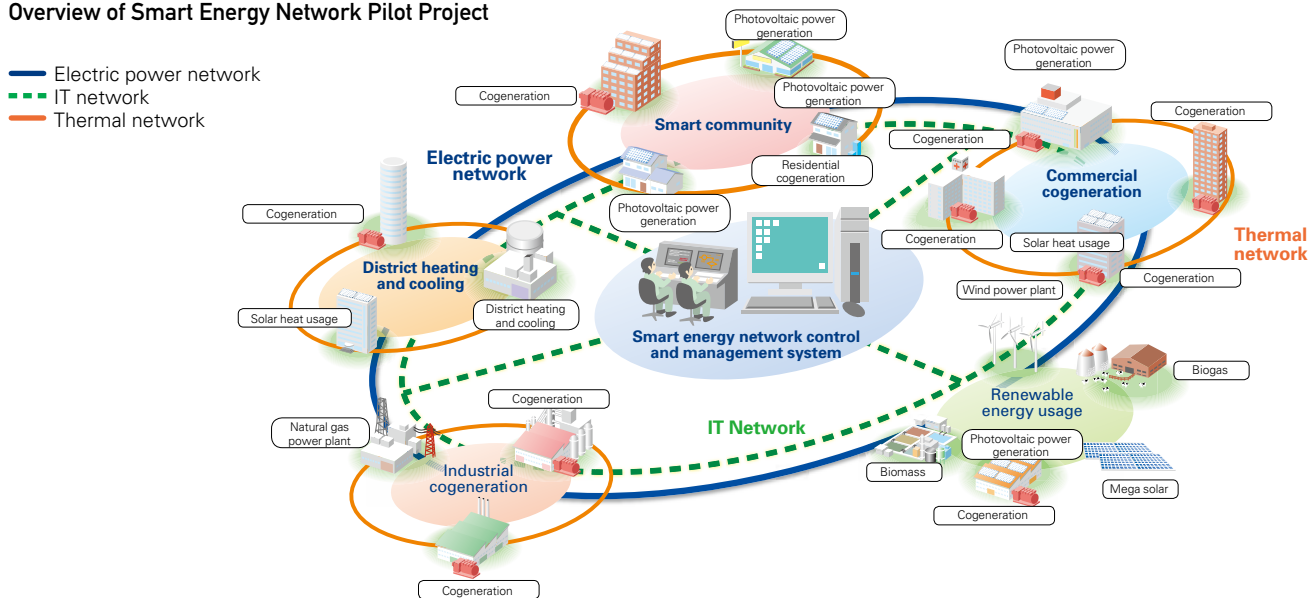
## Examples of initiatives Smart Energy Network

A "smart energy network" is essentially an energy community that is composed of gas cogeneration systems, renewable energy, and information and communication technology (ICT). Far more than providing energy flexibility, "smart energy networks" are next-generation energy systems that create new value by combining distributed energy sources through a process of integrated control. In specific terms, this new value is derived from (1) the pursuit of further reductions in energy consumption and CO<sub>2</sub> emissions, (2) efforts to enhance energy security, and (3) the growing use of renewable energy. Osaka Gas jointly with Tokyo Gas participated in the pilot project funded by Japan's Ministry of Economy, Trade and Industry,

collecting smart energy network data in conjunction with nine customers from the fiscal year ended March 31, 2011. On the results of this project, Osaka Gas commenced smart service provider business demonstrations from June 2012. Furthermore, and from June 2013, Osaka Gas took steps to build a smart energy network for a redevelopment project that includes such participants as AEON Co., Ltd. in the Iwasaki area of Nishi-ku in Osaka. The Company has commenced the supply of electric power\* as a designated electricity supplier.

\* The supply of electric power represents the first designated electricity supplier applied in Japan since the relaxation of requirements following revisions to Japan's Electric Utilities Industry Law in the fiscal year ended March 31, 2012.

### Overview of Smart Energy Network Pilot Project

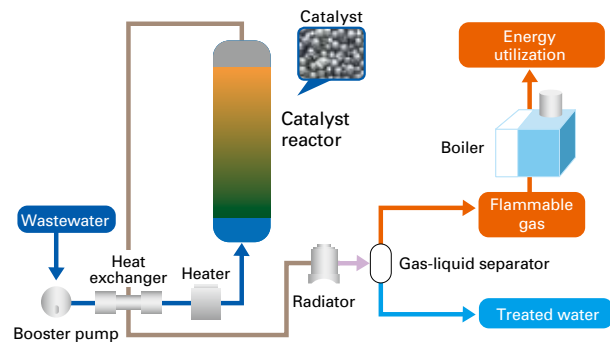


## Examples of initiatives Energy-Creating Wastewater Treatment Process

Osaka Gas has developed a method to rapidly decompose and process organic wastewater produced at semiconductor, chemical, and other plants using catalyst technologies. The process creates a flammable gas composed primarily of methane that can be effectively recycled inside factories as fuel for boilers or other purposes. This reduces CO<sub>2</sub> emissions by roughly 110%\* and wastewater treatment costs by about 40% compared with conventional combustion processes.

Verification operations began at customers' plants from the fiscal year ended March 31, 2011. In recognition of its successive results, Osaka Gas received the Special Engineering Promotion Award from the Engineering Advancement Association of Japan in June 2012 and the Progress Award from the Japan Institute of Energy in February 2013.

### Diagram of the Energy-Creating Wastewater Management Process



\* Figure includes benefits of introducing the treatment process, which cuts emissions by 85%, and the flammable gas produced, which allows fuel used by boilers or other equipment to be reduced by 25%.

(Operating conditions) Temperature: 200–300°C, Pressure: 5–10MPaG, LHSV: 1–10hr<sup>-1</sup>