November 10, 2003

21. EE&C in the Gas Industry

ガス事業における省エネルギー
(エネルギー管理優秀事例)

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Theme:

Energy Saving by Expansion of Prevalence of Natural Gas in Japan

-- Study Tour to Senju Technology and Development Center that backs up the shift to the greater efficiency in industrial gas apparatuses --

1. Policy on Energy in Japan

(1) The Actual State of Energy Use in Japan

Table 1: The Amount of the Primary Energy Supplied

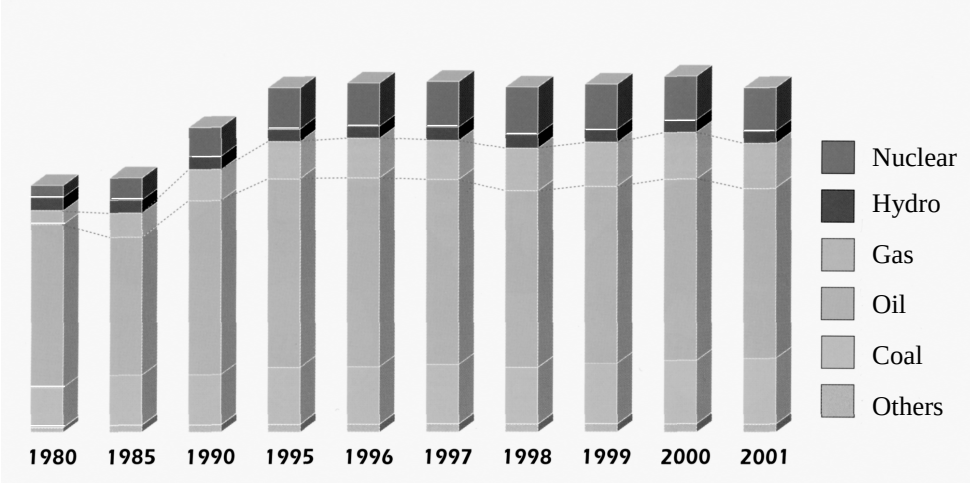


Table 2: Final Consumption of Energy

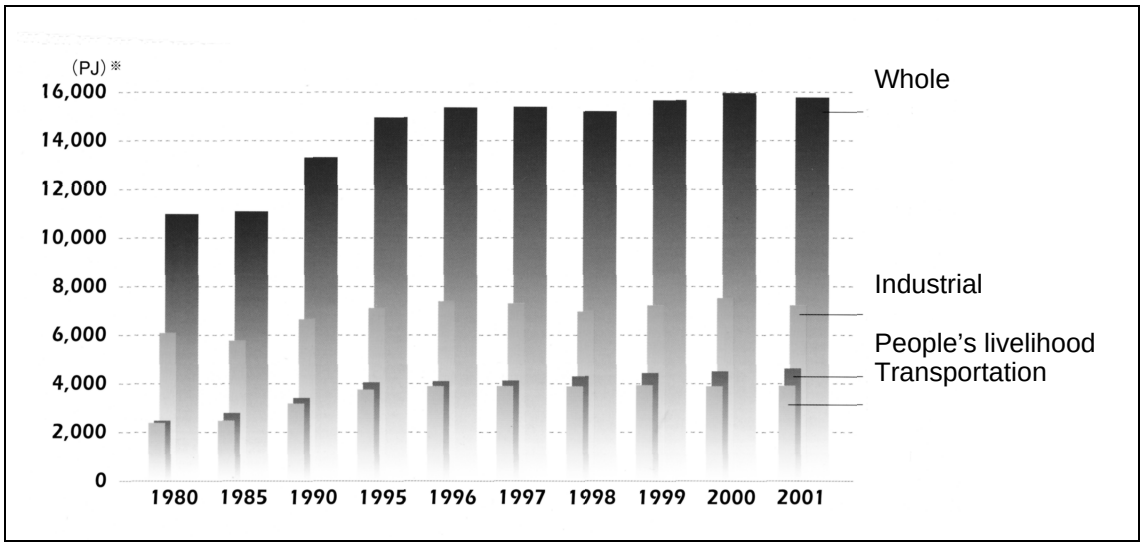
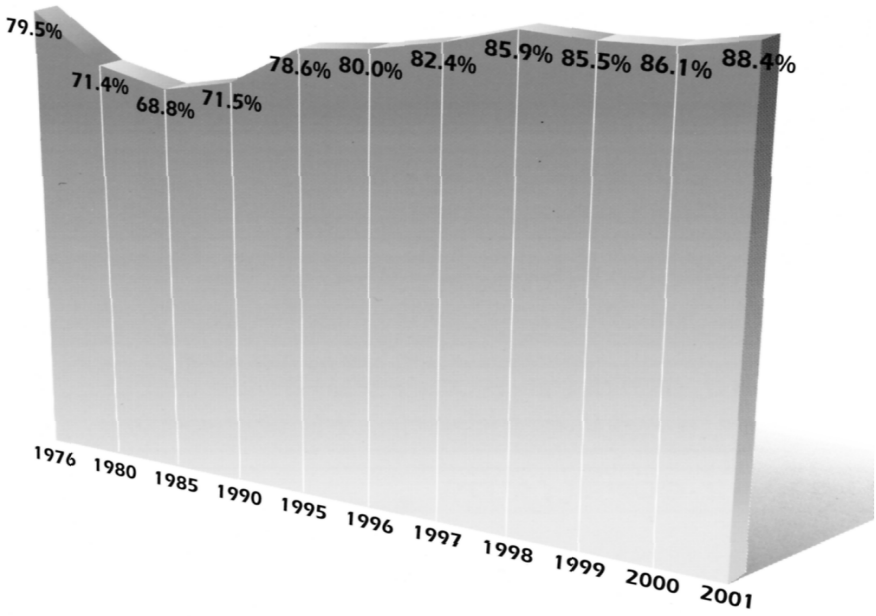


Table 3: Dependence of Japan on the Middle East for Petroleum



(2) Characteristics

① The total amount of energy used is increasing.

② The industrial use has a large share.

③ The dependence on petroleum has decreased. However, the dependence on the Middle East is getting higher.

↓

"The discharge amount of CO_2 shall be suppressed to that of 1990" in 2010.

↓

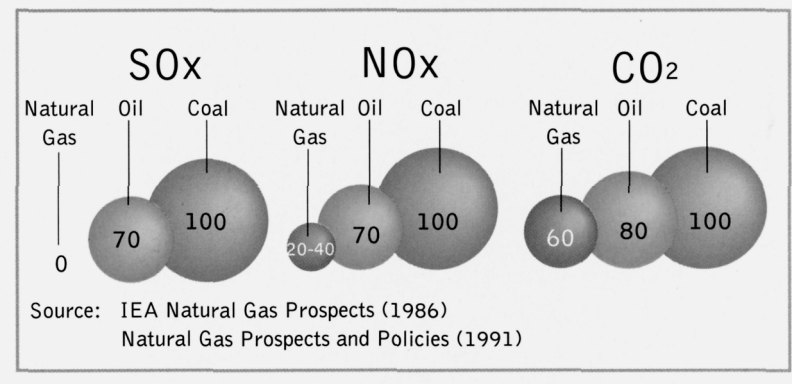
① Facilitation of Saving Energy

② Shift to the energy that imposes a lower environmental load.

2. Why Is Natural Gas Excellent for Energy-Saving and Imposing a Low Environmental Load?

(1) Energy-saving is possible because of the physical properties of the fuel itself and its excellent combustion properties.

Fig. 1: Comparison of the Amounts Discharged with Coal Represented as 100



(2) Systems for Energy-Saving and Low Environmental Load Utilizing the Excellent Combustion Properties

- Co-Generation System
- Small-Sized Once-Through Boiler
- Re-Generative Burner
- Natural-Gas Car
- Absorption-Type Cold/Hot Water Generator
- GHP
- Latent-Heat-Collection-Type Boiler

3. Overview of Tokyo Gas Co., Ltd.

(1) The company supplies fuel gas to the Tokyo metropolitan area that accounts for "one third" in the whole Japan. The company considers that expansion of prevalence of the natural gas is the mission of the company in order also to contribute to the national energy-saving and reduction of the environmental load.

① Foundation: In 1885.

② Capital: 141.8 billion yen

③ Contents of Business: Production, supply and sales of fuel gas
Sale of gas apparatuses and related constructions
Heat supply business
Electricity supply business

④ Total annual sales: 992.2 billion yen

⑤ Annual amount of gas sold: 10,464 million m^3 (46 MJ)

⑥ Number of customers: 9,244 thousand customers

⑦ Number of employees: 11,300 employees

(2) Business Flow

Fig. 2: Business Flow

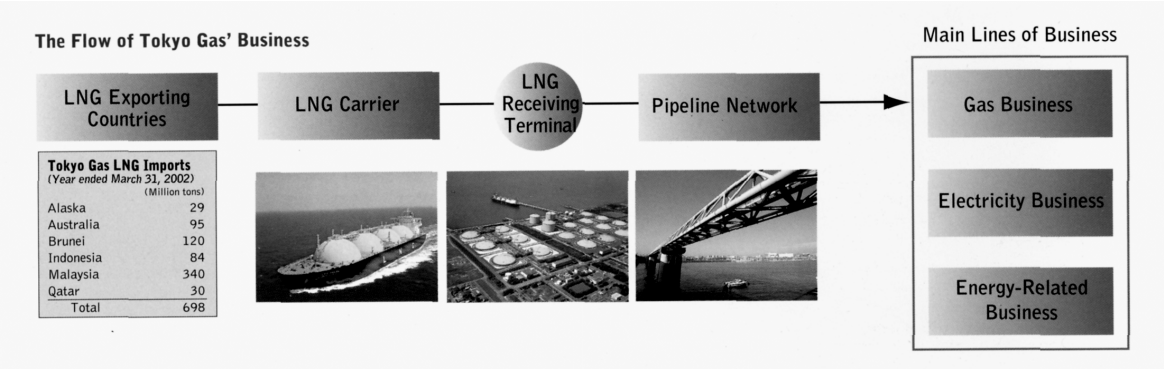
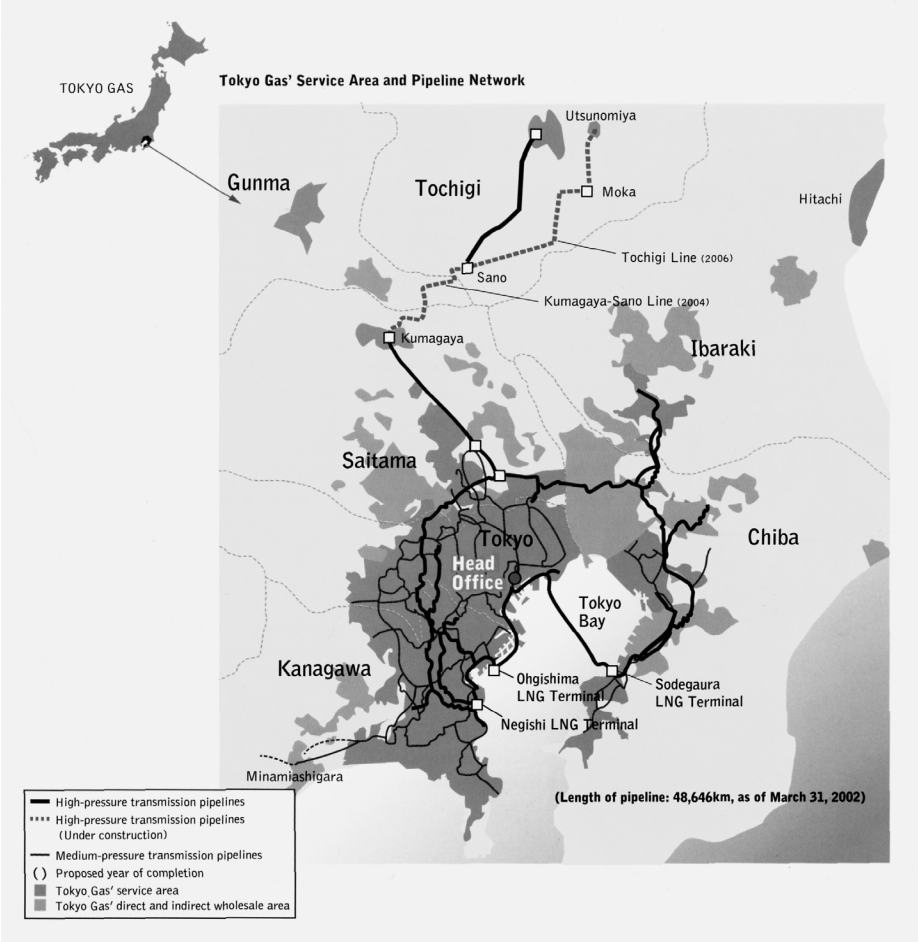


Fig. 3: Area to be Supplied and Guiding Pipe Network

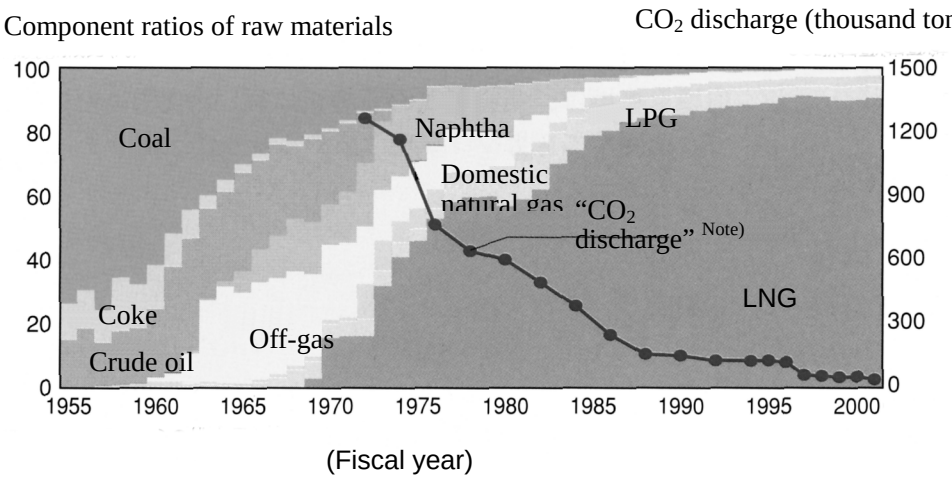


(3) 90% of the raw material of the city gas is accounted for by LNG (Liquefied Natural Gas)

- The natural gas in Japan is scarce. Therefore, it imports most of the natural gas it consumes.
- Because Japan is an island country surrounded by sea, it imports natural gas in the refrigerated and liquefied form (at -162°) called LNG, transporting in tankers.
- The LNG burns clean because impurities have been removed during the liquefaction. The volume of the gas is reduced to 1/600 by liquefaction. Therefore, the gas can be transported efficiently.
- For reference: The History of Raw Material for City Gas; Fig. 4

History of raw materials used in town gas
Coal has been used for a long period of time since the Industrial Revolution. Prior to 1955, coal was used also as the main raw material of town gas. Subsequently we began to use an oil product containing a less amount of sulfur. In 1969 liquefied natural gas arrived at the Negishi Plant of our company from Alaska for the first time in Japan. As a result, a clean natural gas now plays the principal role in town gas.

■ Change in the component ratios of raw materials used in town gas and CO2 discharge from the plant



Note) The value does not include CO2 discharged from purchased electric power.

(4) The Sales Amount of Gas by Use

For industrial uses, commercial uses and household uses

Fig. 5: The Sales Amount of Gas by Use

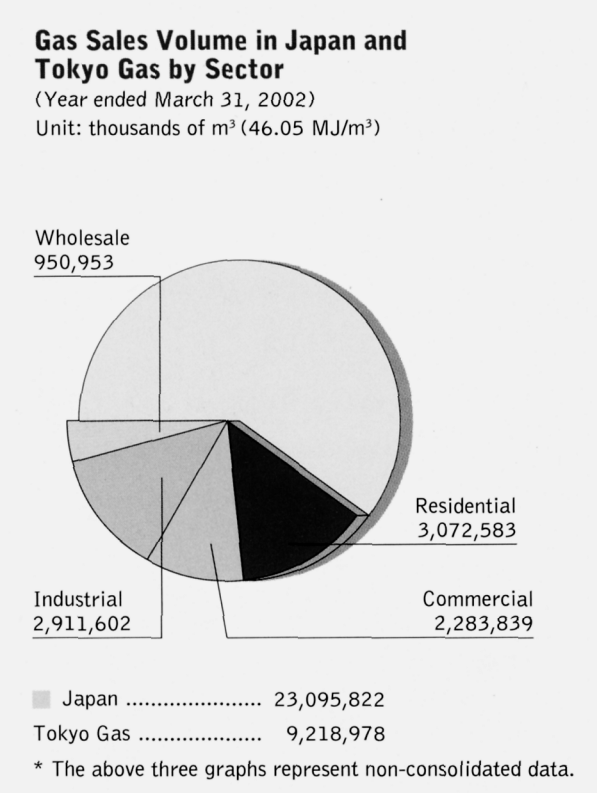


Fig. 6: The Number of Consumers by Use

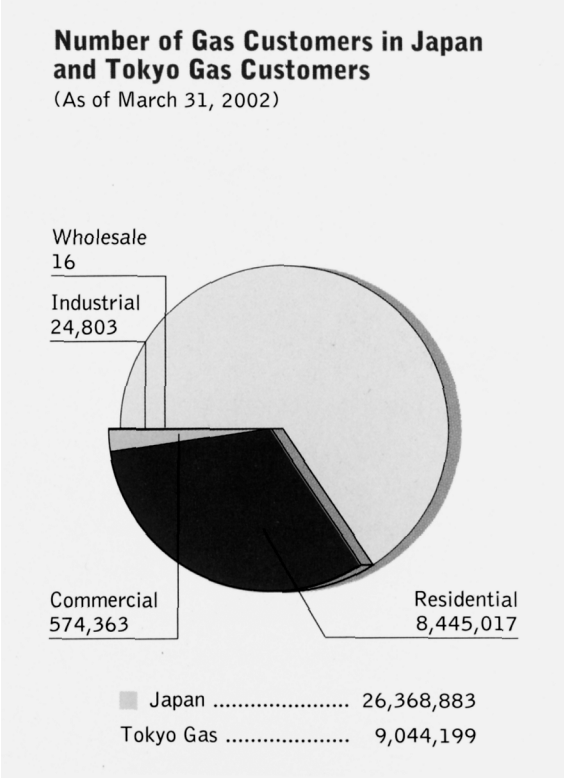
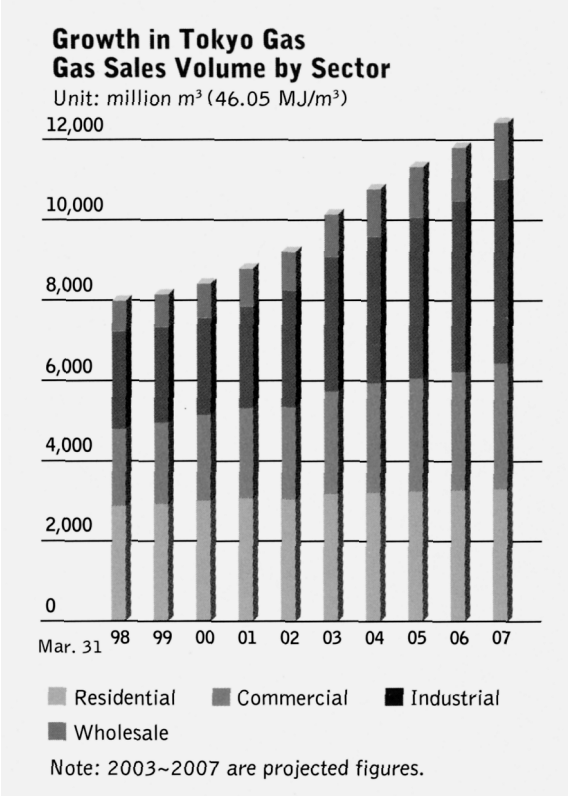


Fig. 7: The Growth of the Sales Amount of Gas by Use



(5) Sales & Promotion Activity and Technology & Development for Dissemination of Natural Gas

- Sales activity for promoting the shift of users to gas (suggestion-type sales activity)
- The company is responsible for facilitating the shift to natural gas in the industrial fields that uses a large amount of oil energy.

4. Senju Technology and Development Center

(1) Purposes of Foundation

① Let the customers actually experience improvement of energy-saving and reduction of the environmental load achieved by using natural gas.

② Development of combustion apparatuses that are excellent in energy-saving ability and impose a low environmental load.

③ To facilitate further energy saving of the customers who are already using natural gas.

(2) Exhibited Equipment for Visitors

① Exhibition Relating to Burners

a. Combustion Safety Devices

The basis of combustion safety devices should be learned because gaseous fuels excellent in combustion ability have a rather higher risk of explosion when combustion control is not carried out securely.

b. Exhibition of Various Burners

Visitors can experience the efficient uses of heat energy achieved by working out the combustion methods.

- PS Burner

  Tip-mixing-type burners having a high flame-holding ability.

- High-Speed Burner

  The blowing-out speed of the flame at the nozzle of the burner reaches at lowest 200 m/s. Therefore, the ability of these burners for agitating in the furnace is so high. The equipment for obtaining a uniform temperature distribution in the furnace is not necessary.

- Flat Frame Burner

  The shape of the flame is made flat and the flame is blown out along the furnace wall. Therefore, the space to be used in the furnace is increased.

- Re-Generative Burner

  High efficiency is realized by alternate combustion of burners and utilization of wasted heat that has been regenerated. Low level of NOx is also realized by working out the combustion

methods.

・ MFB

The shape of the burner can be designed freely according to the shape of the target to be heated. Therefore, efficient heating is possible.

② Equipment for Practical Training

Visitors can participate in the practical training on the difference of efficiency due to the difference of operation methods etc. for "boiler, heating furnace and steam" that are the main components of the equipment utilizing gas fuels in a plant.

a. Boiler

Visitors can learn about the amount of steam generated against the rated amount, the variation of efficiency of a boiler caused by the difference of the air for combustion, and effective uses of the wasted heat.

b. Heating Furnace

Visitors can learn about the difference of heat efficiency in the high-temperature zone between the cases where a recuperater is equipped or not, and the improvement of heat efficiency using the time-chart for the state of temperature distribution in the furnace.

c. Utilization of Steam

Visitors can learn about the efficient uses of steam by drain disposition and air leaking.

③ Heating Test Furnace

Works for processing are heated and processed in a gas furnace and the improvement of productivity is tested.

a. For Each Temperature Zone

Dry heating (at low temperature) to metal high-temperature neat process

b. For Each Heating Method

The direct heating method and the indirect heating method using combustion exhaust gas.

③ Equipment For the Education of Operators

Absorption Refrigerating Machine

An absorption refrigerating machine using a natural substance, water as its coolant, imposes very low environmental load. However, it is important to master the correct method for operating it because the machine needs a high degree of vacuum.

④ Equipment for Verification of Performance

a. Micro gas turbine Endurance Test

b. Co-generation Equipment (Service Equipment)

Electric power generation by gas engines and co-generation by utilization of the discharged neat with hot water and cold water.

c. Hybrid Air Conditioning System

A combination of a compression chiller driven by a gas engine and an absorption chiller utilizing discharged heat

⑤ Combustion Test Equipment

Test equipment for the shift from the existing equipment using oil as its fuel to the equipment using gas

a. Boiler

The amount of steam generated: 0.5-2.0 t/h

b. Heating furnace

Maximum amount to be combusted; 1,500,000 kcal/h