Action plans of Japan’s City Gas
for the efficient and advanced use of natural gas

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Hokuriku Gas Co., Ltd.

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1. Hokuriku Gas: Profile

<table>
<thead>
<tr>
<th>Head Office</th>
<th>1-2-23 Higashi-ohdoiri, Chuou-ku, Niigata City 950-8748, Japan</th>
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</thead>
<tbody>
<tr>
<td>Established</td>
<td>June 2, 1913</td>
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<tr>
<td>Service area</td>
<td>Niigata City, Nagaoka City, Sanjo City, Kamo City, Tagami Town</td>
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<tr>
<td>Number of gas customers</td>
<td>359,754 (As of March 31, 2011)</td>
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<td>Net sales</td>
<td>36,499 millions yen (As of March 31, 2011)</td>
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<td>Gas sales volume</td>
<td>337,315 thousands m3 (As of March 31, 2011)</td>
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2. Advanced Use of Natural Gas

Proportions of heat demand and power demand in gross energy consumption

![Diagram showing heat demand and electric power for residential and commercial sectors.]

Advanced use of natural gas toward creating a low-carbon society

1. Shift to natural gas for meeting heat demand
2. Development of cogeneration systems including fuel cell systems
3. Combining natural gas with renewable and unused energy sources
4. Advanced use of natural gas in transport

3. Residential High-efficiency Gas Appliances

- The sales volume of “Eco-Joez” (residential condensing boiler) and “Eco-Will” (gas engine cogeneration system for residential use) is increasing year by year.
- Gas industry intends to make Eco-Joez the de facto standard by 2013.
4. Gas Air Conditioning Systems

- The gas air conditioning system offers a multitude of benefits including economic efficiency, energy conservation, space conservation, and easy management.
- Contributing to the peak shaving of electricity demand in summer.

**GHP (Gas Heat Pump) type**

Examples of installation sites:
- Small retail stores, schools, hospitals, etc.
- Medium-size buildings, etc. (total floor area up to approx. 10,000 m²)

**Absorption type**

Examples of installation sites:
- Office buildings, shopping centers, public facilities, etc.

![Diagram showing electricity use of gas cooling system](source: The Japan Gas Association)

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5. Residential Fuel Cell

- "ENE-FARM" is a new energy generation system, which simultaneously produces electricity and hot water at home.
- In Niigata, the sales start of the "ENE-FARM" was carried out from June, 2011.

**PEFC (Polymer electrolyte fuel cell) system**

Overall efficiency: 72%*
- Power generation efficiency: 31.5%*
- Waste heat recovery ratio: 40.5%* [HHV]
6. Wide variety of Cogeneration Systems

We provide a wide variety of cogeneration systems, differently balanced between the demand for heat and the demand for power.

![Diagram of Cogeneration Systems]

- PEFC
- SOFC (under development)
- Miller cycle gas engine
- Micro cogeneration
- For industrial use
- For Commercial/industrial use
- For home use
- For Commercial/Retail shop use

7. Expanding the Use of Residential Fuel Cell Systems

“Smart house” will optimize the energy supply and demand and minimize CO2 emissions for entire house by allowing harmonious interconnection with renewable and unused energy.

“Smart House” The Energy System for the Next Generation

![Diagram of Smart House Energy System]
8. Shift to and the Advanced Use of Natural Gas in Industrial Sector

Shift to natural gas and use of highly efficient gas systems will reduce CO2 emissions from the use of heat energy in industry by about half.

Heavy oil + Conventional burner

100 CO2 emissions

Shift to natural gas

Use of highly efficient burner

75

Shift to low-carbon fuel

Coal 100 Oil 80 Natural gas 60

Advanced use of energy

Maximum use of heat energy in industry by using highly efficient gas systems

Regenerative burner Walking beam type reheating furnace

Technological development

Breakthrough in technologies reducing CO2 emissions

1. Highly efficient heat exchange system
2. Oxygen burning technology
3. CCS

9-1. Utilization of Renewable and Unused Energy Sources

1. Dual mode generation system
   - Photovoltaic + Fuel cell
   - Photovoltaic + Gas engine cogeneration

2. Combining solar heat with gas appliance systems
   - Residential sector
     - Solar heat
     - Highly efficient gas water heating
   - Commercial sector
     - Solar heat + Gas air conditioning
     - Gas air-conditioning (Absorption type)
     - City gas

Gas-powered fuel cell

Solar heat panel + Highly efficient gas water heating

Source: The Japan Gas Association

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9-2. Utilization of Renewable and Unused Energy Sources

3. Using urban waste heat
   - Using industrial waste heat for heating

4. Using biogas from sewage and waste treatment plant
   - Using biogas (mixing with city gas)

Source: The Japan Gas Association

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10. Natural Gas Vehicle

A wide variety of vehicles, from light vehicles to trucks and buses, run on natural gas, and these low emission vehicles are expected to be used more widely.

Use of natural gas for a cargo truck

Greater use of fuel cell vehicles

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11-1. Development of New Energy Network Systems

“Smart energy networks” combining gas cogeneration systems with renewable energy, solar energy etc, or unused energy, waste heat from waste incineration plant and factory, optimize the energy supply and demand (heat and electric power) and minimize CO2 emissions.

11-2. Development of New Energy Network Systems

“Smart energy networks” in urban area by connecting consumers with various sources of heat and electric power, including local sources of renewable and unused energy, will optimize the heat and electric power allowing harmonious interconnection with existing power grid networks, and minimize CO2 emissions for entire area.
Thank you for your kind attention.

Hokuriku Gas Co., Ltd.