Vision of the City Gas Industry toward 2030

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November 25, 2010
Gasex 2010
Taipei, Taiwan
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1. Japan’s Energy/Environmental Policies and the Gas Industry

Development of Japan’s Environmental Policies and Growth of the Gas Industry

- **Evolution of city gas sales in Japan**

- **The reduction of CO2 emissions in industrial sector**

*Equivalent to 20% of 7.5 million t-CO2, the reduction to be achieved between 2008 and 2012 to meet the Kyoto Protocol target.*

Share of Natural Gas in Industry and CO₂ Reduction Potential

 Shares of energy options in industry*

* Excludes demand for use as raw material for chemical products.

Source: IEA Energy Balance 2007
# Recent Events concerning Japan’s Energy/Environmental Policies

## Democratic Party’s Manifesto 2009

1. Mid-term target for the reduction of GHG emissions  
   By 2020: 25% reduction from 1990 (30% reduction from 2005)
2. Establishment of Emission trading system (cap and trade)
3. Establishment of a global warming tax
4. Introduction of new and renewable energies  
   By 2020: 10% share of primary energy supply
5. Feed-in-tariff of the whole renewable energy

## Bill on the Basic Law for Prevention of Global Warming

## New Growth Strategy

## The Strategic Energy Plan

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### 1. Japan’s Energy/Environmental Policies and the Gas Industry

- **Sep. 2009**: Change in government to Democratic Party of Japan
- **2010**: Bill on the Basic Law for Prevention of Global Warming
- **2010**: The Strategic Energy Plan

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Recent Events concerning Japan’s Energy/Environmental Policies
Revision of the Strategic Energy Plan

1. Japan’s Energy/Environmental Policies and the Gas Industry

0.5 billion tons of CO\textsubscript{2} emission will be reduced from the current level in about 20 years until 2030.

<table>
<thead>
<tr>
<th>Targets and index for achievement by 2030</th>
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<tbody>
<tr>
<td>Maintain and enhance energy efficiency in the industrial sector at the highest level in the world</td>
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<tr>
<td>Half CO\textsubscript{2} emissions from the residential sector</td>
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<tr>
<td>Raise the next-generation vehicles’ share in new vehicle sales to up to 70% by 2030</td>
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<td>Raise the zero-emission power source ratio from current 34% to about 70%</td>
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- Fossil fuels will continue to be used for energy supply because of their advantages of supply potential, convenience, economy, etc.  
- Natural gas
  - is the least CO\textsubscript{2}-intensive of fossil fuels.
  - is available from relatively diverse locations around the world as well as unconventional sources such as shale gas.

<table>
<thead>
<tr>
<th>Shift to natural gas</th>
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<tbody>
<tr>
<td>Ensuring its stable supply (e.g. securing upstream development rights)</td>
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<tr>
<td>Accelerating the switching of fuel in industry</td>
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<tr>
<td>Expanding the use of cogeneration systems</td>
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<tr>
<td>Speeding up the development and their deployment of fuel cells</td>
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Source: METI
### Shift to Natural Gas as Described in the Strategic Energy Plan

#### Demand structure
1. Industrial sector: Switching to natural gas for meeting the heat demand; expanding the use of cogeneration systems
2. Residential sector: Expanding the use of highly efficient water heating systems; enabling self-sustained growth of the residential fuel cell market
3. Transport sector: Expanding the use of next-generation vehicles
4. Cross-sectoral: Optimizing energy utilization in cities and urban areas by district heating/cooling and the utilization of unused energy sources

#### Supply structure
1. Strengthening gas distribution networks
2. Expanding the use of renewable energy
3. Developing hydrogen supply infrastructure

Source: METI
Decarbonization by Fuel-Switching and Advanced Use of Natural Gas

1. Energy conservation by developing and deploying highly efficient gas appliances
   1) Highly efficient water heating systems for residential use: thermal efficiency improved from 80% to 95%
   2) Highly efficient gas air conditioners for commercial and industrial use: coefficient of performance improved from 0.87 to 1.60
   3) Highly efficient boilers for commercial and industrial use: boiler efficiency improved from 95% to 98%

2. Switching to natural gas to meet industrial heat demand and ensuring its advanced use

   Advanced use
   Reducing CO2 emissions to 45%
   1) Energy metering and diagnosis at site
   2) Energy conservation and decarbonization plan
   3) Research and combustion test at a laboratory
   4) Installation of gas equipment
   5) Energy-related services

   Technological development
   Pursuit of further decarbonization
   1) Highly efficient heat exchange systems
   2) Highly efficient oxy-fuel burner systems
   3) CCS (CO2 separation and recovery)

Heavy Oil-A + Conventional burner

Switching to natural gas

Use of highly efficient burner

Further decarbonization

☐: CO2 emissions (present level = 100)
Cogeneration Systems for Energy-Efficient Production of Heat and Power

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

- **For home use**: Low (High electricity demand)
- **For commercial/retail shop use**: Low
- **For commercial/industrial use**: Middle
- **For industrial use**: High heat demand

- **Office building**: Metalworking, machine industries
- **Restaurant**: Small size cogeneration
- **Retail shops**: Small size cogeneration
- **Hotel**: Middle size cogeneration
- **Hospital**: Middle size cogeneration
- **Chemical industry**: High heat demand
- **Paper industry**: High heat demand
- **Metalworking, machine industries**: High heat demand
- **Chemical industry**: High heat demand
- **Paper industry**: High heat demand

**Cogen Energy**
- **Gas engine**: PEFC
- **Micro cogeneration**
- **SOFC (under development)**

2. Shift to Natural Gas: Decarbonization Efforts toward 2030
Synergy between Renewable Energy and Natural Gas

2. Shift to Natural Gas: Decarbonization Efforts toward 2030

- **Biogas**
  - Biogas production sites (sewage treatment plants, food plants, waste treatment plants, etc.)

- **NGV fuel**

- **Terminals**
  - Used as feedstock at city gas production plants

- **LNG tanker**

- **Pipelines**
  - Injection into gas distribution pipeline

- **Gas system**

- **Mixed combustion with city gas**

- **Renewable energy**
  - Solar heat utilization
    - Solar heat + gas air cond.
    - Solar heat + highly efficient water heater

- **Unused thermal energy**
  - Factory waste heat
  - Urban waste heat (at waste incineration plant, etc.)

- **Power**

- **Heat**

- **Consumption**

- **Double generation options**
  - (fuel cell + photovoltaic)

- **Factory waste heat**

- **Urban waste heat** (at waste incineration plant, etc.)

- **Onsite utilization**
Decarbonization in the Transport and Agricultural Sectors

1. Deployment of natural gas vehicles
- Large natural gas trucks for long-distance transportation

2. Fuel cell vehicles for mid- and long-distance transportation
- Preparation of hydrogen stations for fuel cell vehicles and buses

3. Tri-generation at agricultural and gardening facilities
- Decarbonization by tri-generation (simultaneous production of power, heat and CO₂)

Source: TOYOTA MOTOR CORPORATION Website
The Challenge of Smart Energy Networks

1. Energy network for integrated management of heat demand
   - Demonstration by Tokyo Gas

2. Interchanging energy between dispersed energy consumers
   - Demonstration by Osaka Gas

From Site-Specific to District-Based Approach: Creation of Low Carbon Cities –
3. Efforts to Reduce CO2 Emissions by 80% by 2050

Development of a Hydrogen-Based Society

1. Utilization of hydrogen in natural gas networks

- Natural gas network
- Gas pipeline
- Residential FC
- LNG terminal
- Local hydrogen network

2. Development of local hydrogen networks

- Hydrogen production
- Hydrogen pipeline
- Hydrogen combustion
- Fuel cell vehicle
- Hydrogen station

3. Utilize hydrogen generated from renewables

- Wind power generation
- Solar ray

- Polymer electrolyte fuel cell (PEFC)
  - City gas model
  - Released in 2009
- Solid oxide fuel cell (SOFC)
  - Under development
- Fuel cell vehicle
  - To be released in 2015
- Hydrogen station

Source: TOYOTA MOTOR CORPORATION Website
4. Vision for Japan’s City Gas Industry toward 2030

Vision for Japan’s City Gas Industry toward 2030

2. Development of new markets

1) Capturing new demands from newly developed applications
2) Responding to the needs of a hydrogen-based society
3) Development of technologies that lead to future business expansion

1. Expansion of existing markets

1) Shift to natural gas particularly in industry
2) Integration with renewable energy
3) Development of smart energy networks

Vision for Japan’s City Gas Industry toward 2030

1990: 15bcm
2000: 25bcm
2009: 34bcm
Thank you for listening.