

## Japan's Energy Challenges and the Role of Gas\*

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It is a great honor for me to have this opportunity to make a presentation on the subject of "Japan's Energy Challenges and the Role of Gas". First of all, I would like to emphasize that the world today faces major threats and risks to energy security as well as global warming.

With regard to energy security, crude oil prices have repeatedly hit new highs and the world oil market is expected to remain tight in the coming years. In Japan, oil accounted for 46% of the total primary energy supply in 2006 and almost 90% of its oil is imported from the Middle East. Therefore, the most important energy goal for Japan is to reduce its oil dependency by promoting energy conservation and developing alternative energy sources.

Natural gas and nuclear power are major means of diversifying energy supply sources, and accounted for 16% and 12% of total primary energy supply in 2006, respectively. But unfortunately, due to the severe earthquake in Niigata prefecture last July, the operation of seven nuclear power reactors of Tepco is now suspended.

As far as global warming is concerned, it is crucial for Japan to reduce CO2 emissions since the target years of the Kyoto Protocol have just started this year. According to this treaty, Japan is obliged to reduce its GHG emissions during 2008 to 2012 by 6% compared with the level in 1990. Frankly speaking, this is an extremely difficult target to achieve, because GHG emissions in 2006 were already 6.4% higher than in 1990, and it is not known when Tepco will be able to restart the suspended seven nuclear power reactors.

Under these circumstances, LNG is expected to play an increasingly important role to improve energy security as well as to reduce CO2 emissions. There are three key factors that will drive the demand for LNG in Japan. The first one is the price competitiveness of LNG compared with other fuels; the second is future development of nuclear power; and

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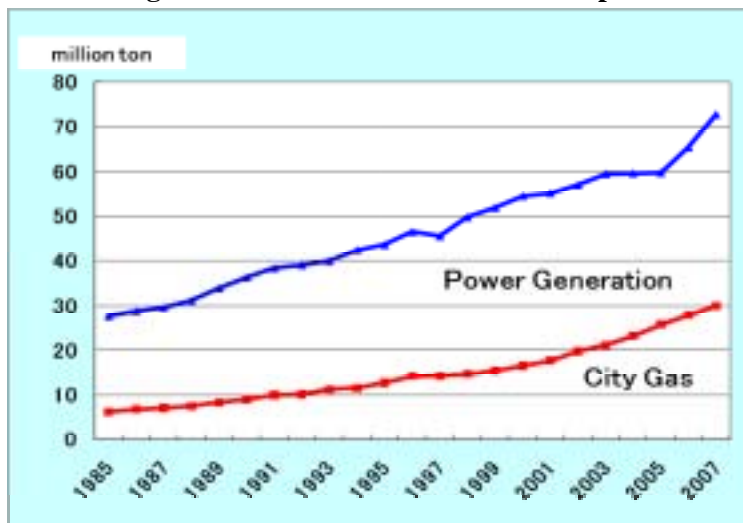
\* This speech was addressed at the Gastech 2008 held in Bangkok on 10-13 March 2008.

the third is global warming and the post-Kyoto framework. Let me briefly touch on these issues.

**LNG Demand for City Gas**

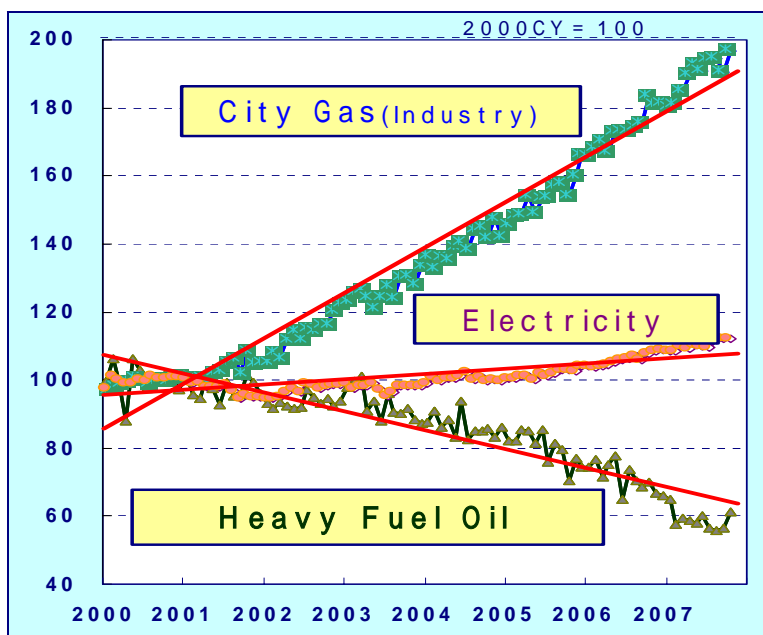
As shown in this figure, LNG demand in Japan has steadily increased from 28 million tons in 1985 to 73 million tons in 2007, of which electric utilities account for 60% and city gas for 40%. We can see two remarkable trends in this figure. LNG demand for city gas has rapidly expanded in recent years and is catching up the demand for electric utilities.

**Figure 1. Trend of LNG Demand in Japan**



The second trend is that although LNG demand for electric utilities had gradually saturated in recent years, it has sharply increased in the last two years.

**Figure 2. Energy Demand for Industrial Sector in Japan**

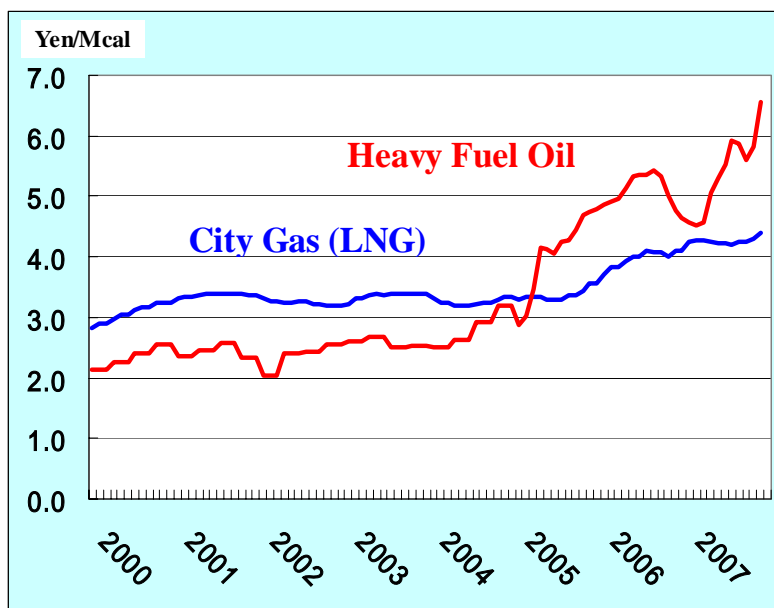


These two trends are surely due to very high oil prices and the spate of troubles at nuclear power plants in recent years.

With regard to city gas, LNG demand in the residential sector is almost flat because Japan's population has started to decline and electric utilities have been aggressively increasing the number of all-electric houses.

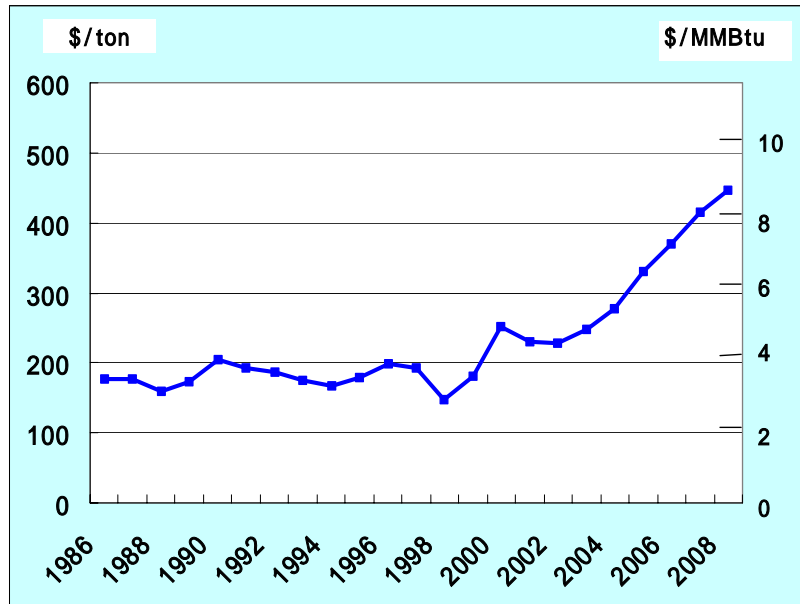
In contrast, LNG demand in the industrial and commercial sectors is rapidly increasing due to the price competitiveness, environment-friendliness and convenience of LNG. In particular, cogeneration systems using city gas have become very popular due to their high end-use energy efficiency. As this figure shows, heavy fuel oil is now more expensive than city gas in the industrial sector, thus encouraging industrial users to switch from heavy fuel oil to LNG of city gas.

Figure 3. Fuel Price for Large Industrial Users in Japan



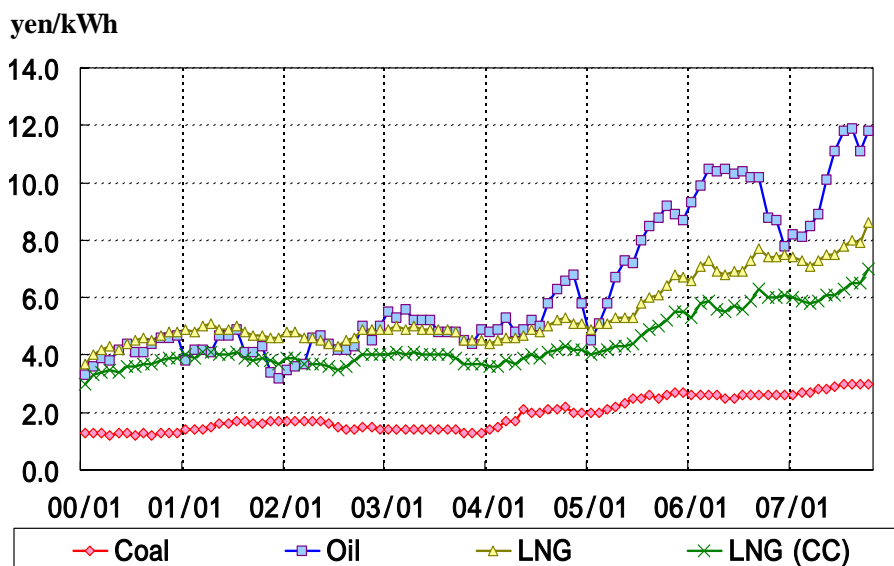
But this is not necessarily good news for city gas companies, because their imported LNG prices have also started to sharply rise in recent years as shown in this figure. Particularly, spot prices of LNG are much higher than those of long-term contract projects due to the very tight supply and demand in the current Asian LNG market.

**Figure 4. Imported LNG Prices in Japan**



On top of this, city gas companies are facing cut-throat competition with electric utilities and many of them are losing market share in the residential and commercial sectors. In Japan there are more than 200 city gas companies, almost half of which are no longer making profits.

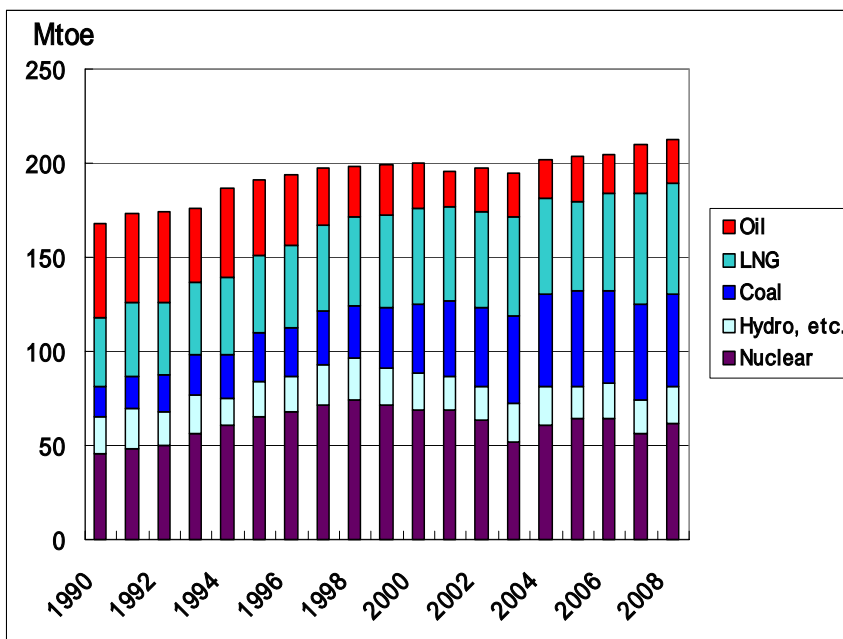
**Figure 5. Fuel Costs of Power Generation in Japan**



**LNG Demand for Electric Utilities**

On the other hand, LNG demand for electric utilities is significantly influenced by two key factors, that is, fuel competition with coal, and nuclear power development. In this figure, you can see how the fuel mix of power generation in Japan has changed dramatically during the last decade.

Figure 6. Energy Mix for Japan’s Power Generation



Firstly, electricity generation by nuclear power has stagnated in the last decade, although it is still a major source of power. A significant number of nuclear power reactors have been suspended due to various reasons such as manipulation of safety data by plant operators, turbine troubles, and major earthquakes near nuclear power plants.

In Japan, we have 55 nuclear power reactors with a total installed capacity of about 50 GW in 2007. As shown in this figure, nuclear power used to account for 38% of total electricity generation in 1998, but its share has dramatically declined to less than 30% these years, because 18 reactors were out of service due to troubles or regular overhaul at the end of 2007.

Secondly, coal-fired and LNG-fired powers have mainly made up for the lost electricity generation by nuclear power in recent years. Since the fuel cost of coal is much lower than

LNG, the share of coal-fired power has remarkably increased, from 14% in 1998 to 24% in 2006. During the same period, the share of LNG-fired power remained almost flat at around 25% of total power generation.

Financially, coal-fired power clearly remains the cheapest, but the Japanese government is reluctant to increase coal-fired power because Japan is committed under the Kyoto Protocol to reduce GHG emissions. When several Independent Power Producers tried to build new coal-fired power plants, they could not get the government's permission to build due to environmental reasons.

Under these circumstances, Japanese electric utilities are finding it very difficult to secure a stable supply of electric power as well as to reduce CO<sub>2</sub> emissions. LNG-fired power with combined cycle gas turbines is clearly one of the most promising candidates to respond to these challenges. But in the short- and medium-term, the top priority is to restart the suspended nuclear power plants as early as possible. It should be emphasized that all nuclear reactors affected by the earthquake were safely stopped and cooled down, and all radioactivity was confined.

There is no question that nuclear troubles in recent years are influencing fuel choices for electric utilities in the short to medium term. We predict that several nuclear reactors now out of service in Japan could restart operation this year, but it will take at least one more year in the case of Tepco's seven reactors in Niigata. According to our estimates, about 40% of the lost power generation of Tepco will be replaced by LNG-fired and 60% by oil-fired power generation. As a result, the additional demand for LNG will be about 3 or 4 million tons in 2008.

#### Japan's Energy Strategy and the Role of LNG

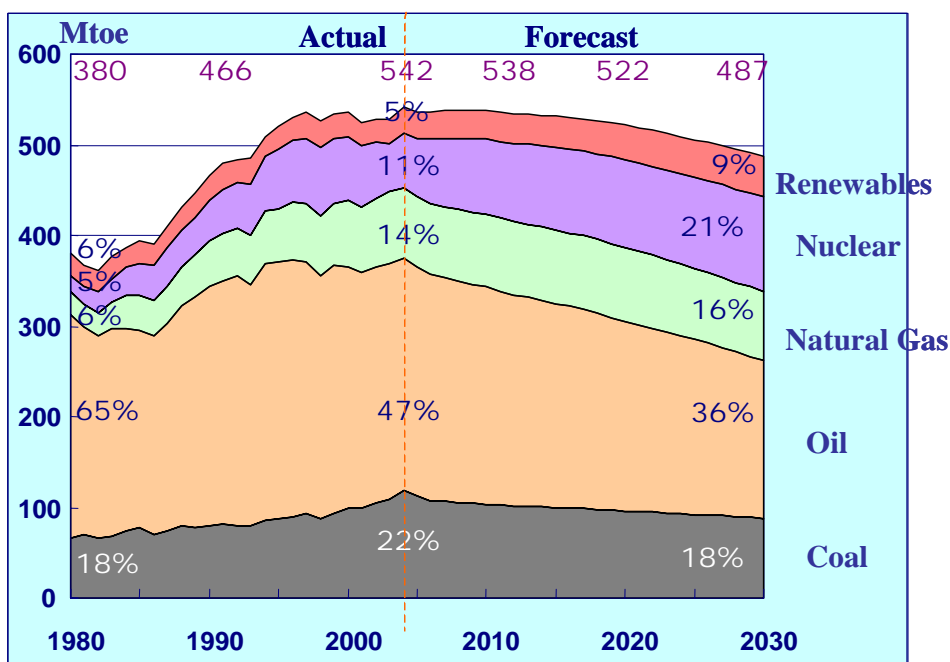
Finally, I would like to touch on Japan's energy strategy and the role of LNG in the future energy mix. In May 2006, the Ministry of Economy, Trade and Industry published a National Energy Strategy report, which emphasized enhancing energy security as well as reducing CO<sub>2</sub> emissions.

In June 2007, Japan's former Prime Minister Mr. Abe proposed setting a long-term target of cutting global emissions by 50% from the current level by 2050 as a common goal for the entire world. This proposal, called "Cool Earth 50", requires developed countries like Japan to dramatically reduce CO<sub>2</sub> emissions in the long term. Therefore, Japan's energy

strategy gives highest priority to energy conservation and developing non-fossil energy sources, especially nuclear power.

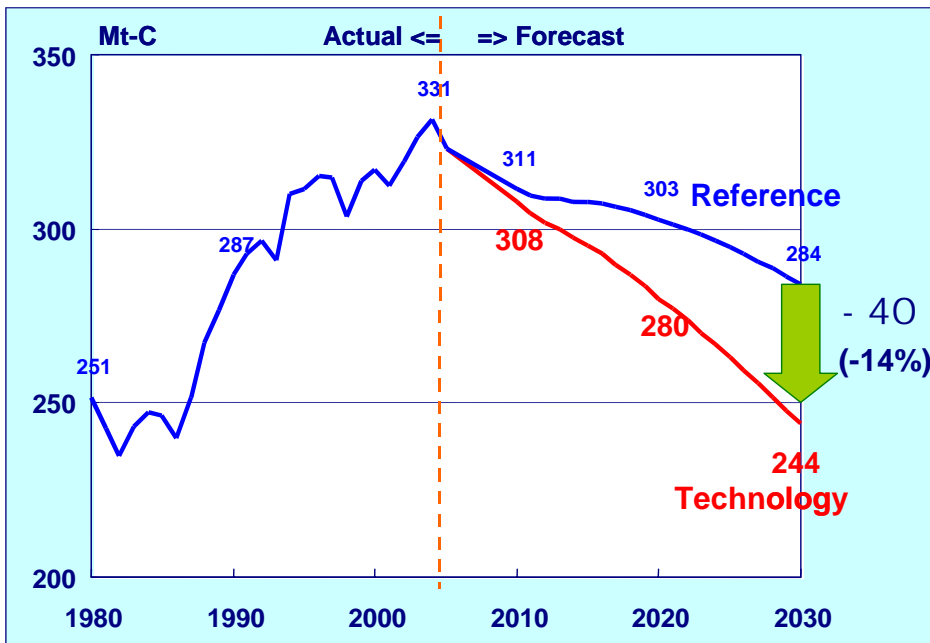
According to our study on Japan’s long-term energy outlook, the major conclusions are as follows in the technologically advanced case. Firstly, energy consumption per unit GDP will be improved by about 40% by 2030. Secondly, non-fossil fuels such as nuclear power and renewable energies will account for 30% of total primary energy supply, assuming that 13 new nuclear power plants will be built by 2030. Thirdly, LNG demand will significantly increase mainly for power generation in the medium term, but will be almost flat by 2030. Fourthly, CO2 emissions in 2030 will be 25% lower than the current level.

Figure7. Total Primary Energy Supply (Technologically Advanced Scenario)



This analysis suggests that LNG demand in Japan will entirely depend on the growth of nuclear power as well as the national target to reduce GHG emissions in the framework of the post-Kyoto Protocol. My view is that public confidence in nuclear power could gradually recover as an indispensable energy supply source to combat global warming in Japan. But this will take time, and so I believe that LNG will play a vital role in Japan’s long-term energy supply mix.

Figure 8. Long-term Prospect of CO<sub>2</sub> Emissions in Japan



(Source) IEEJ, 2006

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