

## **Supply and demand trends and plans for natural gas in South Korea**

An Tae-Hoon, Senior Researcher, International Strategy Analysis Group, Strategy and Industry Research Unit

### **Introduction**

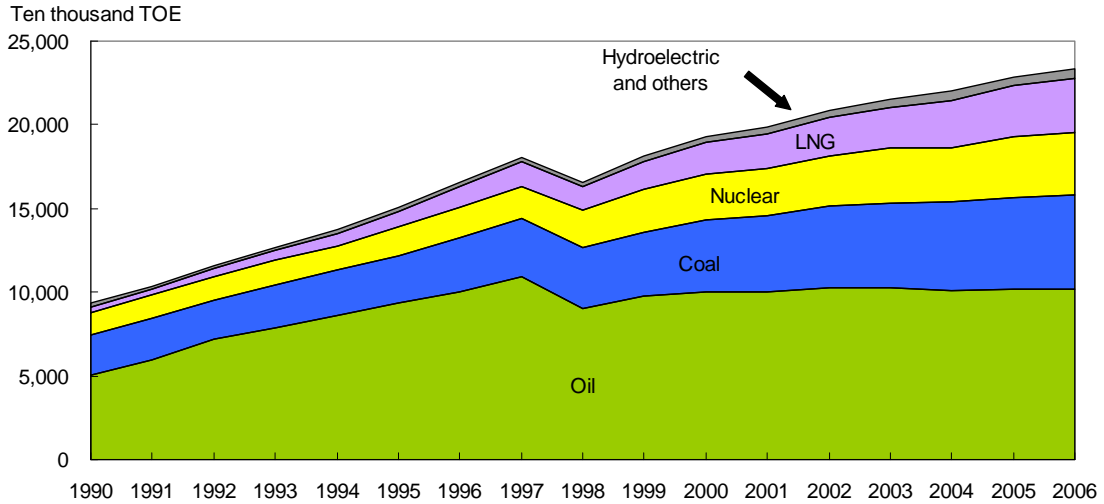
South Korea, which imported around 26 million tons of LNG (Liquefied Natural Gas) in 2007, is the world's second largest LNG importing country after Japan. It has recently experienced a tight supply and demand of natural gas due to both domestic and overseas issues, such as the domestic consumption pattern concentrated in winter, the delay of concluding long-term contracts caused by domestic gas industry restructuring, and rapidly increasing global LNG demand. Meanwhile, both Japan and South Korea, which are close in geographical and cultural terms, also share many similarities in natural gas industries. For example, both countries depend on imports for the majority of their natural gas supply, the total amount of natural gas is imported in the form of LNG, the import volume by spot contract is increasing in order to make up shortfall in winter, and so on. To cope with the LNG market circumstance positively, both countries have recently developed their bilateral business relationship more closely, with the introduction of cargo swapping between their gas and electric power companies. In this report, natural gas supply and demand trends as well as future plans concerning gas industry in South Korea are examined based on the background of South Korea's natural gas demand pattern.

### **1. Outline of South Korea's natural gas industries**

#### **(1) Positioning LNG as a primary energy source**

Although the LNG consumption in South Korea was around three million TOE (ton of oil equivalent) in 1990, accounting for only 3.2 percent of the primary energy consumption, it increased a lot in the 1990s. Consequently, the share exceeded 10 percent in 2001, before expanding to 13.7 percent in 2006, consuming around 32 million TOE. Meanwhile, as LNG and nuclear power has been prioritized as fuels alternative to oil during the 1990s, the share of oil largely declined. The share of oil, which was over 60 percent in the mid 1990s, decreased to 44 percent in 2006.

**Chart 1 Transition of South Korea's primary energy consumption**

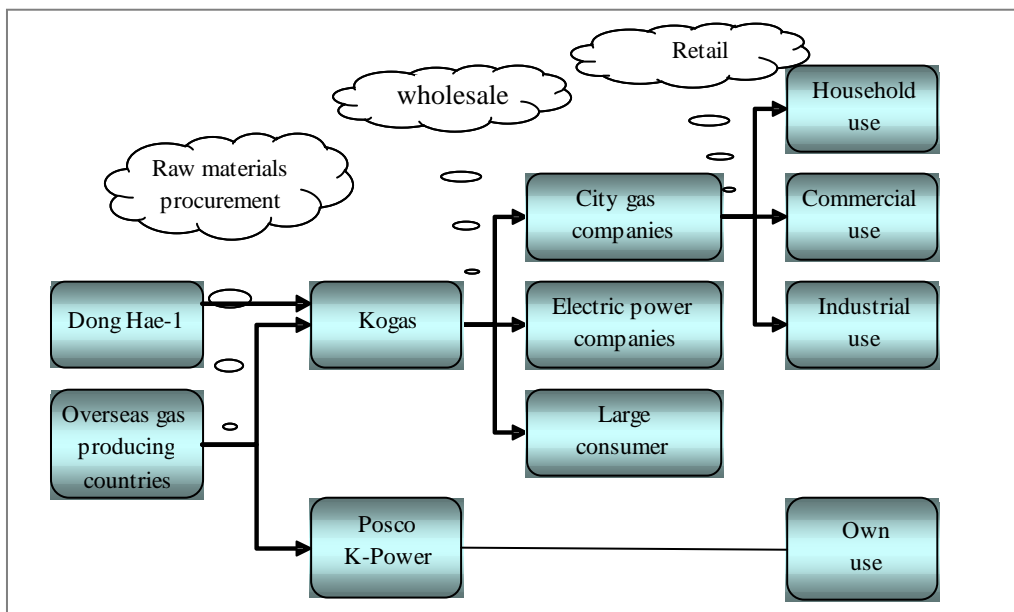


Source: Prepared from KEEI Statistics

**(2) Structure of domestic natural gas market**

The natural gas market in South Korea can be roughly classified into LNG procurement, wholesale, retail and consuming domains. A state-run company, Kogas, is responsible for the procurement of LNG and wholesale, while city gas companies, which are private utility gas operators, are in charge of the retail supply. Meanwhile, procurement / import of LNG are allowed not only for Kogas but also private companies such as Posco and K-Power, following the revision of the related law in 1998.

**Chart 2 Natural gas market structure in South Korea**



**i) Raw material procurement domain**

Until 2005, Kogas had the exclusive right to import LNG since the company first imported LNG from Indonesia in 1986. Following the revision of the Petroleum administration Law<sup>3</sup> in 1998 which allowed private sectors to procure LNG, if they use LNG for their own use, Posco and K-Power began importing natural gas for their own use since 2005. The electric power subsidiaries of Kepeco and GS Caltex etc. are also promoting the import of natural gas for their own use. Meanwhile, 98 percent or more of domestically supplied natural gas is imported in the form of LNG, and around 400 thousand tons a year of natural gas is supplied through pipeline from the first domestic gas field, Dong Hae-1.

**ii) Wholesale domain**

Since 1986, Kogas started<sup>4</sup> its wholesale supply of natural gas to electric power and city gas companies. It has been in charge of wholesale businesses exclusively to date, and it is currently supplying directly to large industrial consumer<sup>5</sup> as well. The ratification for the wholesale businesses is under the jurisdiction of the Minister of Knowledge Economy.

**iii) Retail domain**

Thirty-three private city gas business entities<sup>6</sup>, each of which has exclusive supply right for their respective regions, supply gas to households, commercial and industrial users etc. The ratification for retail businesses is under the jurisdiction of the governors of a city or a province.

**(3) Current status of facilities**

**i) Import facilities**

Currently South Korea has a total number of four LNG receiving terminals, including Kogas-owned Pyongtaek, Incheon, Tongyeong terminals, and Posco-owned Kwangyang terminal. Kogas also plans to construct the fourth import terminal to ensure stable nationwide supply, with a total storage capacity of 2.8 million kl, in Samcheok-si, Gangwon-do by 2019.

---

<sup>3</sup> In 2005, the name was revised to “Petroleum and Petroleum substitute fuel Business Act”.

<sup>4</sup> The supply of natural gas for power generation commenced in November 1986, while that for utility gas use commenced in February 1987.

<sup>5</sup> Consumers to whom supply from a private city gas supplier was refused for lawful reasons or who consume natural gas within a region outside the supply area by the private city gas suppliers, some consume 100 thousand cubic meters a month or more.

<sup>6</sup> Of these, 30 business entities supply LNG.

**Chart 3 Current status of LNG receiving terminals and facilities**



	Number of tanks	Storage capacity (million kl)	Regasification capacity (T/H)
Pyongtaek	12	1.28	3,376
Incheon	18	2.48	3,690
Tongyeong	10	1.40	1,530
Kwangyang	2	0.20	194
Total	42	5.36	8,790

Source: Kogas web site

**ii) Supply facilities**

Kogas completed the nationwide pipeline network in 2002, which is now spanning 27,200km to ensure stable gas supply for the nation. The pressure of gas in the pipeline ranges from a minimum 8.5 kg/square cm (0.83 MPa) to a maximum of 70 kg/square cm (6.86 MPa). In addition, it operates a total of 177 stations, including 94 G/Ss (Governor Stations), 53 V/Ss (Valve Stations) and 30 B/Vs (Block Stations) etc, which perform pressure adjustment, quantity measurement, cutting off in the case of emergency. The total length of the pipeline operated by city gas companies tops 28,313 km, including 9,063 km of main lines and 19,250 km of main branch lines.

**2. Supply and demand trends**

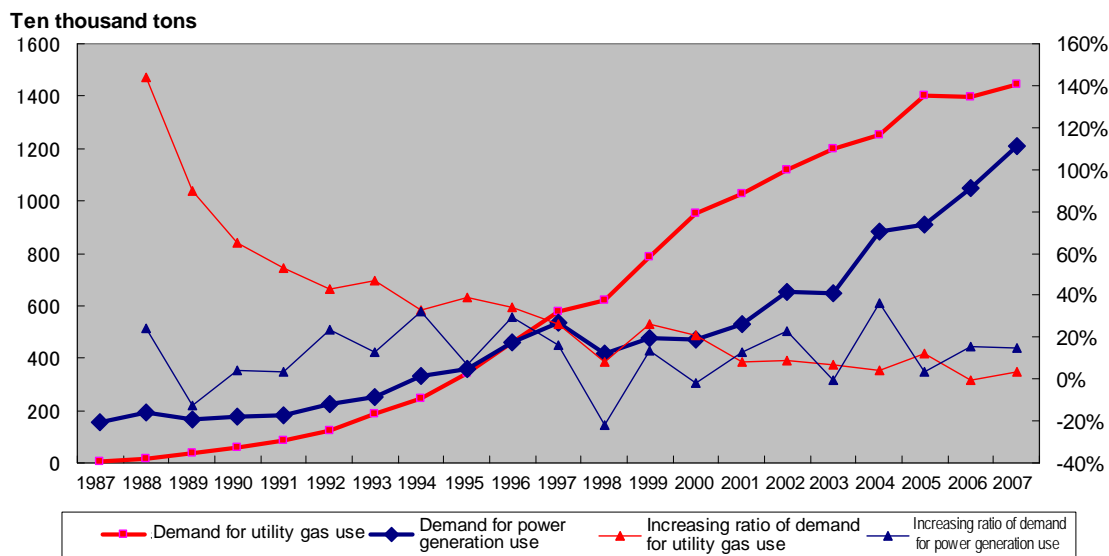
**(1) Demand aspects**

The natural gas industry in South Korea, which started full-fledged supply in 1987 centering on the capital region, have grown remarkably in just 20 years. Its demand, which was only 1.61 million tons in 1987, dramatically increased to 26.52 million tons in 2007, showing an average annual increase of 15 percent. During this period, city gas and power generation’s demands have significantly increased at an average annual rate of 30.1 percent and 10.9 percent respectively. Although most of natural gas demand was for power generation in the initial period, city gas demand, which increased significantly from the early 1990s, surpassed that for power generation in 1997, maintaining a share about 60 percent of total gas use afterwards. Meanwhile, the turning point of natural gas demand in South Korea seems to have been in 1997-1998, when the increase in the demand ratio rapidly dropped due to the stagnant economy caused by the financial crisis, and 2001

to 2002, when the nationwide pipeline network was completed.

The natural gas demand, which hit a record of 21.3 percent of the annual average increase ratio by 1997, decreased in 1998 for the first time since 1989 due to the stagnant economy which stems from the financial crisis having occurred in that year. As for the demand for city gas sector, the increase ratio was dropping to the single-digit range in 2002, when the nationwide pipeline network was completed, and onwards.

**Chart 4 Transition of the demand and increasing/decreasing ratio by use**



Source: Prepared from Kogas Statistics

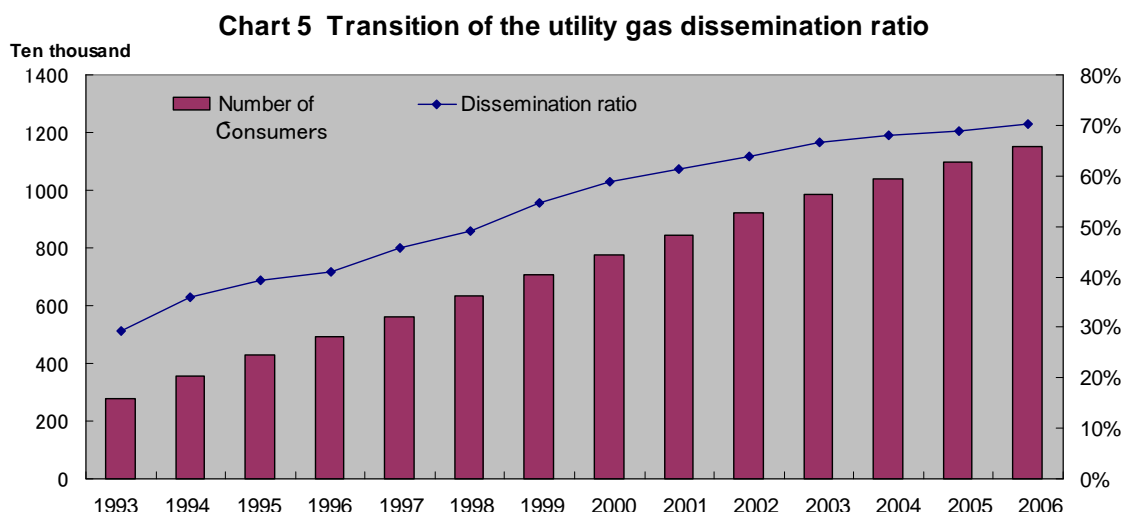
**i) Demand for city gas sector**

The gas demand for city gas sector was 75,000 ton in 1987, the first year of supply, and surpassed one million tons and 10 million tons in 1992 and 2001 respectively. It reached 14.45 million tons in 2007, representing an increase of 190 times or more over 20 years since gas supply commenced.

**a. Demand trends**

- Demand for city gas sector, which began to pick up in the 1980s, increased rapidly from the early 1990s onwards because of the advantage of gas utilization as an environmentally friendly energy and its convenience. Other factors such as the government policy to increase consumption for natural gas, promotion of the nationwide pipeline network, energy choice of convenient energy caused by increased household income, relatively cheap price compared to propane, safety etc, also contributed the demand growth. The annual average increase ratio of city gas consumption over the decade of 1987-1997, until the economic growth began to slow down due to the effects of the financial crisis, reached around 54.3 percent.

- The demand for city gas sector, which showed a rapidly increasing tendency in 1990s, experienced single-digit increasing range for the first time due to the influence of the financial crisis in 1998. It subsequently showed signs of gradual restoration, increase ratio of 20 percent recorded for the second year in a row. In 2001, however, when the diffusion rate reached saturation in the wake of the completion of the nationwide pipeline network, the increase ratio again reverted to the single-digit range, with the same trend of the sluggish demand continuing to date. The annual average increase ratio in demand between 1997 and 2007 was 9.6 percent, representing a significant decrease compared with that in the previous decade (54.3 percent).
- The number of natural gas consumers increased from 2.8 million in 1993 to 11.5 million in 2006, while the dissemination ratio of natural gas increased from 29.4 percent in 1993 to 70.1 percent in 2006.

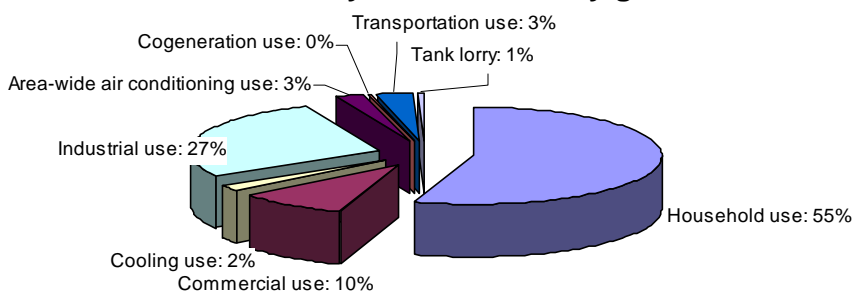


Source: Prepared from Korea City Gas Association Statistics

**b. Demand by city gas users**

City gas sector is dominated by household use, followed by industrial use, commercial use, transportation use, cooling use, and cogeneration use. In 2007, household use, which mainly comprises cooking, heating and water heating, accounted for 55 percent of the total gas demand for the city gas use, while industrial use, which mainly focuses on many large consumers, and commercial use, which includes commercial/business utilities, accounted for 27 percent and 10 percent respectively. The demand for household use, which has seen a rapid slowdown due to the dissemination ratio saturation, is significantly affected by the temperature in winter, while industrial and commercial use is significantly influenced by the economy and fluctuations in the price of natural gas and oil.

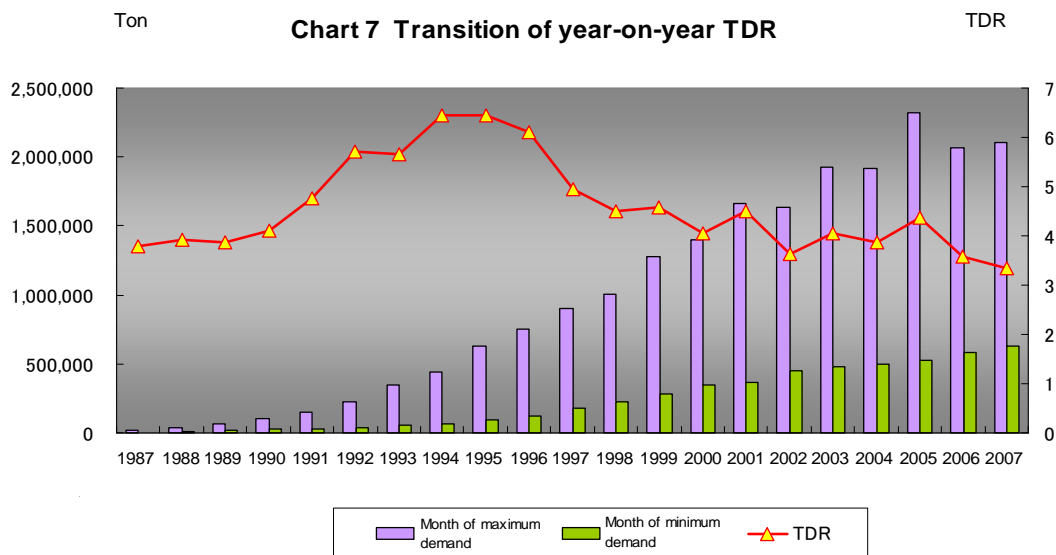
**Chart 6 Demand by the use of utility gas in 2007**



Source: Prepared from Kogas Statistics

**c. Seasonal demand pattern by sector**

Regarding the demand for city gas in South Korea, significant seasonal fluctuation in demand must be noted. This is closely related to the air conditioning in South Korea, whereby there is a significant temperature difference between summer and winter, with cooling in summer mainly reliant on electricity and heating in winter on gas. The TDR<sup>7</sup> of the city gas, however, which rose as high as 6.46 in the 1990s, has fallen to the relatively stable levels of 3.34 to 4.50 since the early 2000s. Since the increasing rate for household demand, which has considerable seasonal fluctuation, has slows down, in addition to the steady increasing trend of industrial and transportation use, where the seasonal demand pattern is stable, thus there are prospects for gradual TDR improvement in future.



Source: Prepared from Kogas Statistics

<sup>7</sup> Turn Down Ratio: The ratio of demand of the month with peak demand relative to that with minimum demand for the year.

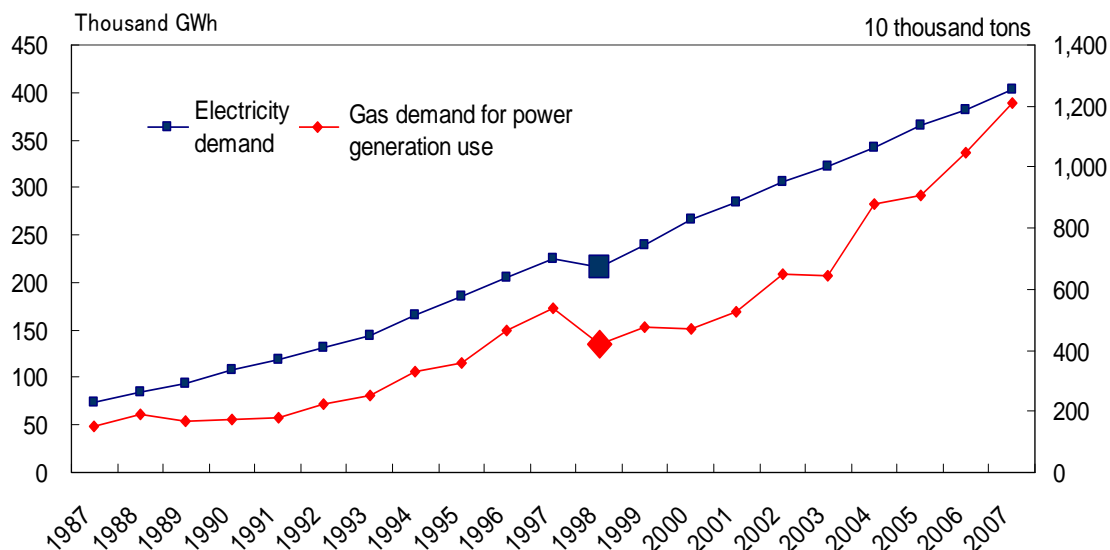
**ii) Demand for power generation sector**

The demand for power generation sector, which started 1.54 million tons in 1987, has been increasing steadily, apart from a period in which demand plummeted due to the sluggish economy and decreased electricity demand stemming from the financial crisis in 1998, surpassing 10 million tons in 2006 for the first time and topping 12 million tons in 2007. The annual average increase ratio until 2007 was 10.9 percent.

**a. Demand trends**

- Depending on the operational characteristics of gas-fueled power plants, which are responsible for providing peak power supply alongside oil-fired plants, the gas demand for power generation sector is significantly influenced by fluctuation of electricity demand. The gas demand for power generation sector had steadily increased in the period of 1987-1997 in line with the increasing electricity demand immediately before the sharp decline in electricity demand caused by the financial crisis. The annual average increase ratio of the electricity demand during the cited period was 11.6 percent, while the gas demand ratio for power generation use was slightly higher at 13.3 percent.

**Chart 8 Transition of electricity and gas demand for power generation use**



Source: Prepared from Kogas, KPX Statistics

- The gas demand for power generation sector, which had continued to increase steadily after 1989, declined 22 percent in 1998 affected by the decline in electricity demand caused by the financial crisis. This phenomenon, namely a significant decline in gas demand, occurred for the first time due to the reduction in electricity demand. The influence of low utilization ratio of



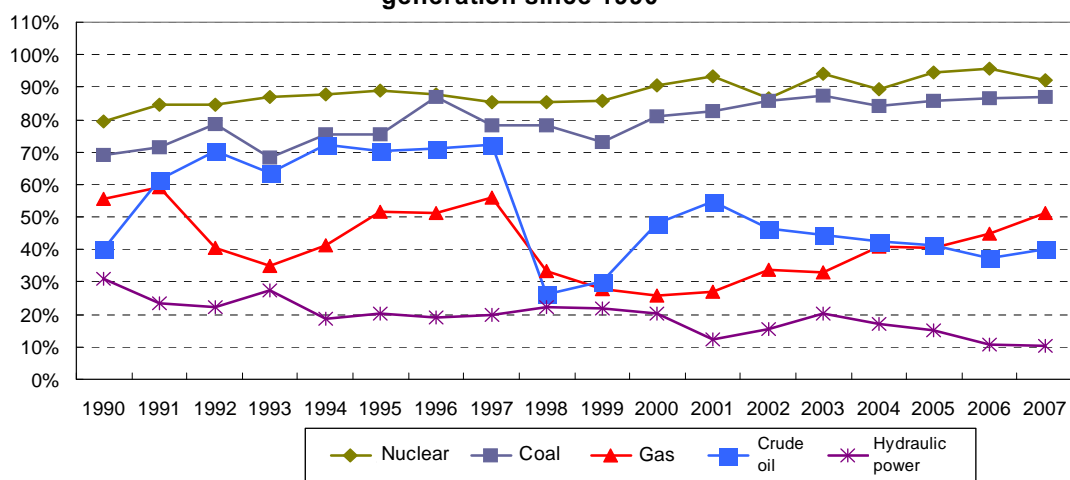
generators was concentrated to oil- and gas-fired power plant, which functioned as peak power supplier, on the contrary to relatively stable operation in nuclear and coal-fired power plant, which functioned as base power supplier.

- The gas demand for power generation sector reverted to a recovery trend in 1999, recording an increase ratio of 13.8 percent. Subsequently, it has maintained this high growth rate, amid repeated rising and falling based on the factors such as the increasing trends in electricity demand, additional installation of non-gas power generators equipment, component ratio of power supplies, utilization ratio by generator, and the price relative to crude oil. The annual average increase ratio between 1999 and 2007 was 12.3 percent.

**b. Recent trends**

- A significant increase in demand at 23.1 percent on year-on-year basis was recorded in 2002, when the natural gas price had a significant advantage compared with crude oil as a competing fuel. Another increase, at 36.3 percent was also recorded in 2004, when alternative power generation provided by gas-fired power plants increased significantly due to the extended shutdown of Yong-Kwang nuclear power plants. Also, year-on-year increasing ratios at 15 percent were recorded in 2006, when K-Power made its debut and achieved a significant reduction in power generation cost through the procurement of low priced LNG, and in 2007, when the utilization ratio of gas-fired power generation increased because of the growing price advantage compared with crude oil. Meanwhile, the utilization ratio of gas-fired power generators, which plunged to around 20 percent level after the financial crisis in 1998, recovered in 2007 at 50 percent.

**Chart 9 Transition of utility utilization ratio by kind of power generation since 1990**



Source: Prepared from KPX Statistics

- In 2000, 2003, and 2005, gas demand was sustained at the level of the previous year, due to the modest decline in the utilization ratio of gas-fired power generators. This can be explained by the price increase of gas compared with crude oil as well as the introduction of new power exchange system in power generation market.

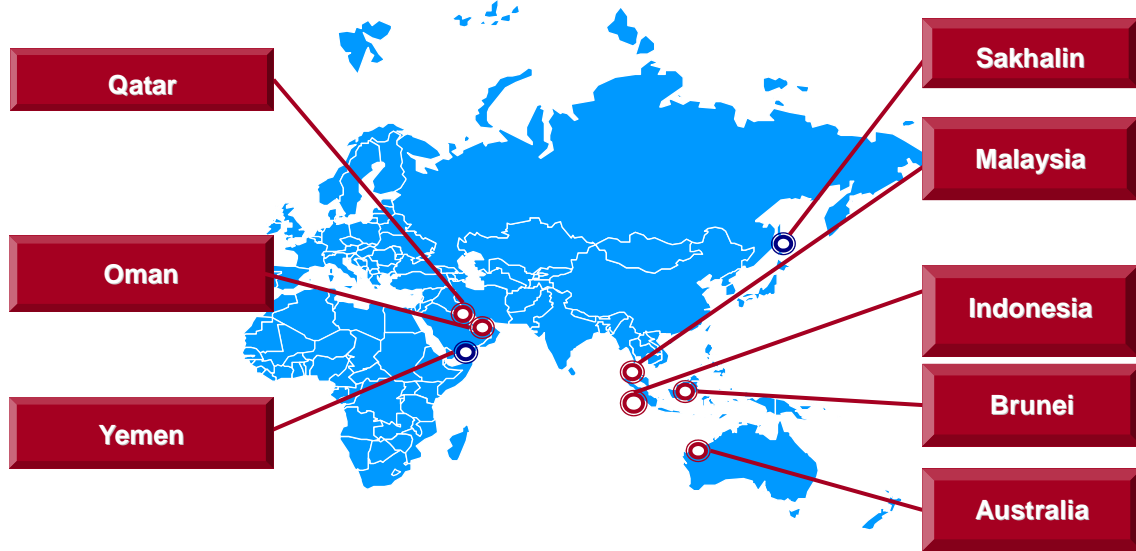
## **(2) Supply aspects**

Natural gas supply in South Korea can be roughly classified into the categories of raw material (LNG) procurement and the wholesale market, for which the state-run Kogas corporation is mainly responsible, and the retail market, for which private city gas business entities are responsible. In this report, in order to describe supply trends based on the aspects of supply and demand, namely to research supply trends from the procurement perspective for the required amount corresponding to demand, raw material procurement is mainly examined, skipping the wholesale and retail domain in the domestic supply market.

### **i) Trends in raw material procurement**

Since 1986, when Kogas first imported LNG based on a long-term contract with Indonesia, the import volume has been increasing every year in line with the demand increase. The import volume of natural gas in South Korea, which was only around 1.6 million tons in 1987, increased to around 25.87 million tons in 2007. The import sources have also been diversified, including many countries other than Indonesia, such as Malaysia, Qatar, Oman, Brunei and Australia, in order to assure stable supply, with plans to add Yemen and Russia to the list from 2009. In 2004, the Dong Hae-1 gas field produced domestic natural gas successfully for the first time, supplying around 400 thousand tons a year through the pipeline. Meanwhile, as for LNG import companies, the state run corporation Kogas imported natural gas exclusively as a business entity for raw-material procurement and wholesale for around 20 years since 1986, when the natural gas businesses started to emerge. Posco and K-Power, however, have been importing natural gas for private consumption since 2005 when the law was revised to allow direct imports by private consumers. Both companies agreed on 20-year contracts for the supply of LNG with Tangguh Project, Indonesia to import 550 and 600 thousand tons a year of LNG respectively separate from the Kogas import.

**Chart 10 Overseas LNG suppliers**

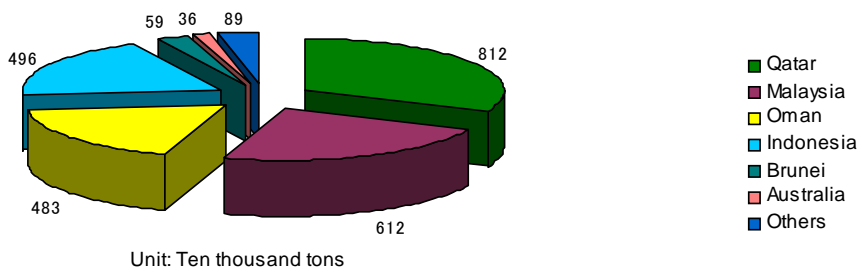


Source : Kogas PR

**ii) Diversification of import sources**

Although the most of South Korea’s LNG was supplied from Southeast Asian countries, such as Indonesia and Malaysia until the mid-1990s, the amount imported from the Middle East has subsequently been increasing on a gradual basis, reflecting the diversification policy for the import sources. Recently, Qatar, from which imports commenced in 1999, has emerged as the biggest supplier, surpassing Indonesia and Malaysia, which were previously major supply sources during the initial stages of the LNG imports. As of 2007, the import volumes of Qatar, Malaysia, Indonesia, Oman, Brunei and Australia were 8.12, 6.12, 4.96, 4.83, 0.59, and 0.36 million tons respectively. In total 25.87 million tons, including a further additional 0.89 million tons, were imported in South Korea in 2007.

**Chart 11 Import volume by country in 2007**

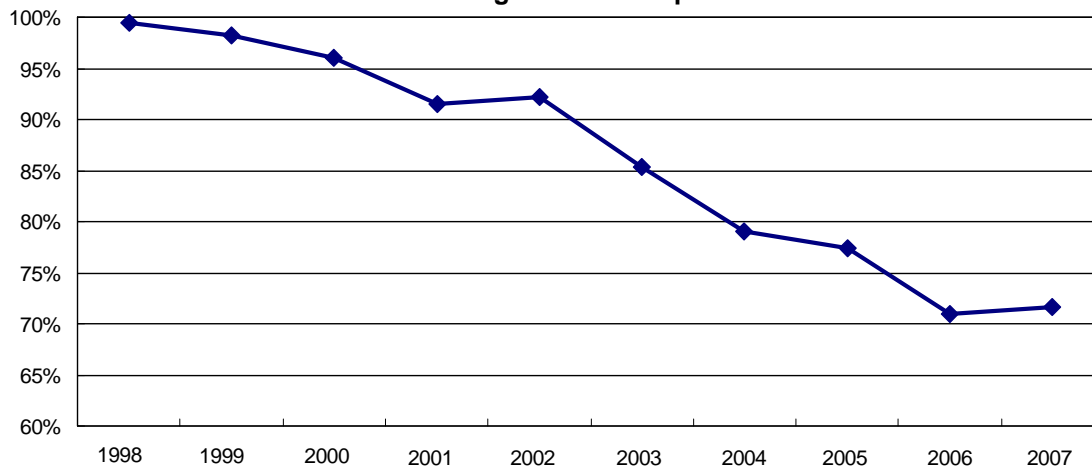


Source: Prepared from Kogas web site

**iii) Increasing transactions based on mid- or short-term contracts and spot contracts**

Since the LNG spot market is relatively under developed compared with crude oil, LNG contract has been usually made in long-term basis, which was also the case in South Korea. However, the restructuring of gas industries in the early 2000’s affected delay for concluding long-term contracts, the ratio of imports through mid- and short-term or spot contracts began to increase significantly, causing the share of imports based on long-term contracts downfall, which topped 99 percent in 1998, to decline to the level of 70 percent in 2007.

**Chart 12 Transition of the yearly ratio of import volume through long term contracts against total import volume**



Source: Prepared from Kogas Statistics

**iv) Current status of raw material procurement contract**

As of August 2008, South Korea has signed 14 natural gas procurement contracts<sup>8</sup> with nine countries, securing a total contract volume of 26.33 million tons per year. Of these, YLNG and Sakhalin II, the delivery of which was scheduled to begin at the end of 2008, are delayed to 2009. Meanwhile, the contract of South Korea’s first LNG import project with Indonesia, ARUN III, expired in November 2007, while short-term contracts with Malaysia for the MLNG II and III projects as well as with Qatar for the Ras Laffan project also expired in March and April 2008 respectively.

<sup>8</sup> Including domestic production of Dong Hae-1. Of these, the total volume is imported from overseas in the form of LNG, except for Dong Hae-1, from which procurement is performed through the pipeline.

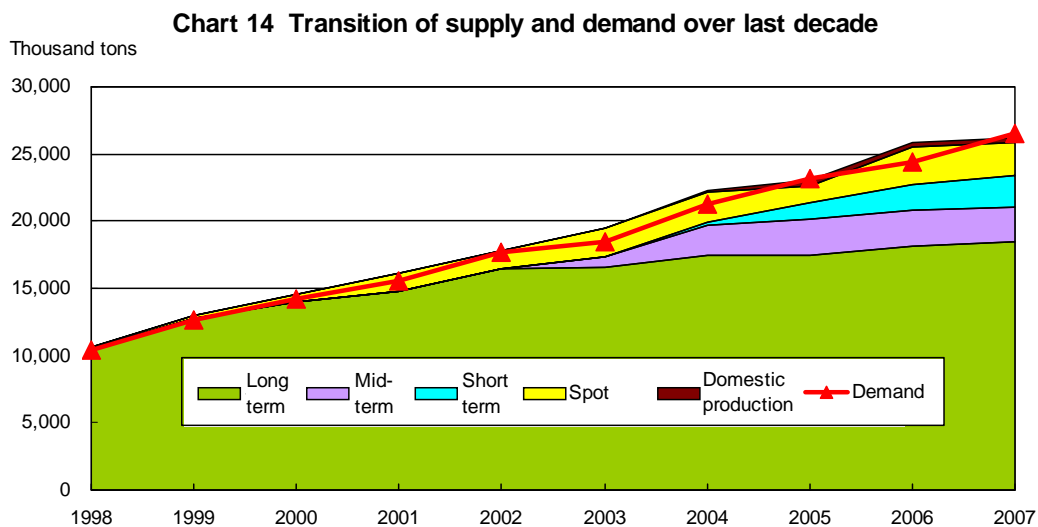
**Chart 13 Current status of natural gas procurement contracts**

Category	Producing country	Project	Contract volume per year (Ten thousand tons)	Contract term	Delivered condition	Ratio in winter (%)
Long-term contract	Indonesia	ARUN III	230	86~07	Ex-Ship	50
		KOREA II	200	94~14	FOB	50
		BADAK V	100	98~17	FOB	50
		TANGGUH	115	05~25	Ex-Ship	50
	Malaysia	MLNG II	200	95~15	FOB	50
		MLNG III	150+50	08~28	Ex-Ship	70
	Qatar	RasGas	492	99~24	FOB	50
		RasGas III	210	07~26	Ex-Ship	50
	Oman	OLNG	406	00~24	FOB	53
	Yemeni	YLNG	200	08~28	FOB	50
Russia	Sakhalin II	150	08~28	FOB	70	
Brunei	BLNG	70	97~13	Ex-Ship	70	
South Korea	Dong Hae-1	40	04~18	PNG	75	
	Total		2,448+50			54.3
Mid-term contract	Malaysia	MLNG III	150+50	03~10	Ex-Ship	80
	Australia	NWS	50	03~16	Ex-Ship	50
	Total		200+50			74.0
Short-term contract	Qatar	Ras Laffan	96 (Average)	04~08	Ex-Ship	86
	Malaysia	MLNG III	71 (Average)	04~08	Ex-Ship	53
		MLNG II	40 (Average)	05~08	Ex-Ship	80
	Total		207			73.5
<b>Total</b>	<b>14 cases, Nine countries</b>		<b>26.33 million tons per year (Including a million tons of buyer option)</b>			

Source: Prepared from Kogas PR

**(3) Supply and demand balance****i) Recent trends**

According to the transition of supply and demand in the last decade, supply and demand balancing management, in which the raw material procurement volume surpassed the demand by a given quantity, was imperatively required, except in 2005 and 2007, when the supply shortage was compensated for by the initial inventory. Although the import volume through long-term contracts covered virtually all demand until 2000, the share of spot and mid- or short-term contracts has risen since 2002 to resolve the issues concerning the delay in long-term contracts as well as cover shortages in winter. Increase of the procurement volume based on mid- or short-term contracts, which especially cover high demand in winter, has eased the concern on supply and demand imbalance caused by delay of concluding long-term contracts.



Source: Prepared from Kogas Statistics

**ii) Unstable factors in supply and demand and countermeasures**

Although South Korea has never experienced significant difficulty in supply and demand management throughout the 1980s and 1990s, except the late 1990s, when the financial crisis triggered a temporarily excessive supply due to the dramatic demand reduction, such difficulties have existed since the early 2000s. The major factors behind imbalance in supply and demand can be put into two categories. The first one includes inherent issues in gas industry characteristics, such as the demand trend concentrating on winter, inflexibility of import contracts, and insufficient storage facilities. The other is induced by the government energy policy, including the delay of import contracts due to the promotion of gas industry restructuring and the loss of the swing (demand adjusting) functions by power generation plants affected by the electric power market restructuring. Meanwhile, Kogas, which is responsible for the natural gas supply in South Korea, has dissolved such concerns over supply and demand through various management methods, such as spot procurements and obtaining mid- or short-term contracts mainly import in winter, swapping with neighboring countries, and shipping schedule adjustments etc.

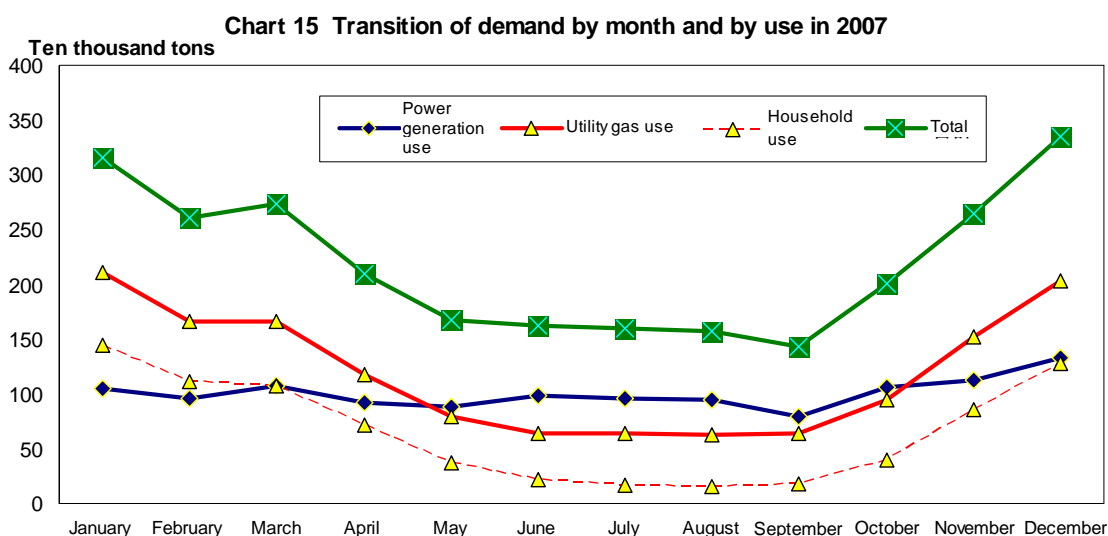
**a. Unstable factors in supply and demand**

● **Demand patterns: high in winter, low in summer, and inflexible contract conditions**

Given the demand pattern in South Korea, in which the natural gas consumption increases in winter, it is desirable that the annual contract volume would be allocated to the demand pattern by month or season. However, because of inflexible LNG contract conditions which basically require an even monthly supply for the annual contract volume, Korea, which has high demand

in winter and low demand in summer, has experienced overflow inventory in summer and low inventory in winter.

- ✚ The so-called ‘high in winter’ and ‘low in summer’ phenomenon, which mean that demand decreases in summer and increases in winter, is more serious to city gas, of which the seasonal demand fluctuation is greater than that of power generation sector, the demand for which remains relatively even throughout the year. Of the city gas consumption, household sector, in which the share of heating in winter is high, has provided the main cause of supply and demand imbalance.
- ✚ Household sector consumption accounts for a significant portion within the city gas demand and the total demand structure (55 percent and 31 percent respectively), becoming the major factor causing TDR to deterioration.
- ✚ In 2007, the TDR for power generation and city gas were 1.81 and 3.34 respectively (of which household sector’s TDR was 9.26), and the total TDR was 2.46.



Source: Prepared from Kogas Statistics

● **Insufficient storage facilities**

Given the pattern and scale of the natural gas demand in South Korea, there is relative insufficiency in storage facilities. Japan had storage capacity of 14.55 million kl and a storage ratio exceeding 10.8 percent in 2006. In contrast, South Korea, which has more acute seasonal variations in demand and requires more storage facilities, has only 5.08 million kl of storage

capacity and a storage ratio that has remained at 9.4 percent. The shortage of storage capacities is a factor responsible for repeated seasonal excessive supplies in summer and shortage phenomenon in winter.

**Chart 16 Comparison of the storage ratio between South Korea and Japan in 2006**

	TDR	Import volume per year of LNG	Storage capacity	Storage Ratio
South Korea	2.47	25.37 million tons	5.08 million kl	9.4%
Japan	1.57	63.31 million tons	14.55 million kl	10.8%

Source: Prepared from Gas Directory 2007, Japan

- **Delay of long-term import contracts**

The conclusions of long-term import contracts by Kogas were delayed for several years because of the gas industries restructuring that started in late 1990s. Although Kogas largely expanded the spot and mid- or short-term import volumes in order to secure the supply corresponding to the increased demand and to substitute volume for Indonesian ARUN III long-term contract, which expired in 2007, amid recent surge of LNG demand worldwide, Kogas has experienced a difficulty to secure spot imports in winter.

- **Lost of supply and demand control malfunction by power generation sector**

The gas demand of power generation sector, which had significantly contributed to supply and demand management through fuel switch of power generation, has lost the existing supply and demand control function due to the breakup of the power generation division of Korea Electric Power Corporation (Kepco) into six companies as part of the restructuring of the electric power industries in 2001 and the introduction of competition among Kepco's 5 subsidiaries companies under new power dealing system. In addition, the supply and demand balance of natural gas suffered a negative impact recently due to the occurrence of the phenomenon whereby, even in winter, in the event of a shortage of natural gas, LNG-fired power generation was prioritized over oil-fired power generation. Furthermore, power generation fuel cost has risen due to the high price of oil, because the priority of electric power supply was determined by the unit cost of power generation. Therefore, the crucial supply and demand crunch in 2002 and 2004 was caused by the excessive consumption by power generation companies<sup>9</sup>.

---

<sup>9</sup> Although Kogas and power generation companies agreed an annual contract regarding the yearly and monthly supply volumes based on their gas trade contracts, the conditions outlining a penalty for the excess / shortage of consumption against the contract figure was unclear and lacked substantial binding power for compliance to the contract figures. The updated contract, however, which was agreed upon by five subsidiaries of Kepco in December 2006, includes more specific description regarding the penalty for the violation of contract figures.



**b. Improving efforts to combat supply and demand discrepancy**

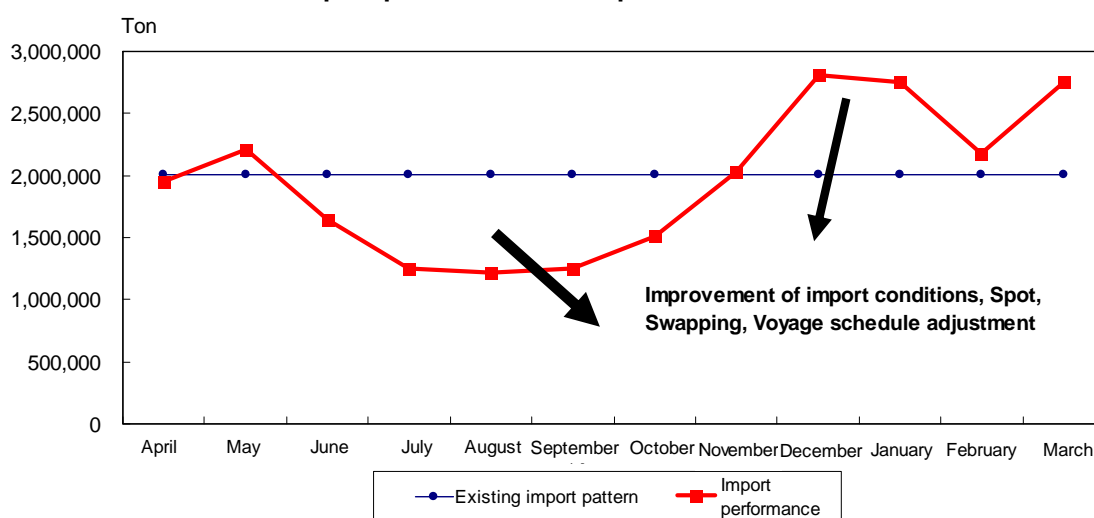
● **Improvement of import conditions (Expansion of the import ratio in winter)**

Although the risk of excessive supply in summer has been slightly eased by the delay of the conclusion in long-term LNG contracts, the winter procurement shortage phenomenon seems to have been intensified. The newly concluded mid- or short-term contracts have a higher import ratio in winter in order to overcome such procurement shortage, which is different from the existing import pattern of receiving LNG evenly throughout the year. The mid-term contracts with NWS, Australia, and MLNG III, Malaysia, accordingly to which supply started in 2003, provide 100 percent and 80 percent of gas delivery in winter respectively, while the short-term contract, MLNG II, in accordance with which supplies started in 2005, also has an 80 percent supply share in winter. In addition, the long term contract with Sakhalin II, Russia, which provides for shipments starting in 2009, will provide 70 percent of LNG delivery in winter.

● **Flexibility of spot contracts, LNG cargo swapping and voyage schedule adjustment etc.**

In order to overcome supply shortage caused by the delay of conclusion of long-term contracts, Kogas has aggressively utilized spot trading as well as the cited mid- and short-term contracts. The spot import volume, which was only a single cargo in 1998, has now increased to around 40 cargoes. These contracts help reduce not only the total supply shortage but also stabilize supply and demand in winter, concentrating on procurement efficiency in winter. Meanwhile, in order to cope with the excessive supply in summer and the temporary supply for shortage in winter, Kogas is aggressively implementing shipping schedule adjustment, LNG cargo swap dealing, and so on, with Japanese gas and electric power companies.

**Chart 17 Import pattern between April 2006 and March 2007**



Source: Prepared from Kogas Statistics and etc.

- **Establishment of a cooperation system with electric power markets**

Every winter, attended by the South Korea government, Kogas, and electric power companies, hold periodic supply and demand management meetings to study various concerns regarding balancing supply and demand for natural gas, and at the time of the supply and demand crunch, the electric power division implements the following countermeasures:

- ✚ Schedule adjustment of periodic maintenance of power generation facilities
- ✚ Operation at a high working mode for coal-fired power generation facilities
- ✚ Prioritized operation of crude oil-fired power generators and alternative power generation by diesel oil, and so on.

- **Other efforts to balance supply and demand discrepancy**

As excessive consumption over the contractual quantities for power generation sector was mainly responsible for the recent supply and demand crunch, the penalty for excessive consumption against yearly/monthly contract figures by power generation companies was introduced in a more specific manner in order to secure compliance with the contract figures and to alleviate the discrepancy. As for the city gas consumption, demand expansion of industrial sector, which is characterized by a flat demand pattern by season, and the cooling consumption, which is effective in easing the mode gap between peak and bottom in demand, is being aggressively promoted.

### **3. Supply and demand plan**

In December 2006, the Minister of Commerce, Industry and Energy<sup>10</sup> issued The Eighth Long Term Natural Gas Supply and Demand Plan<sup>11</sup> (hereinafter referred to as “the Eighth Supply and Demand Plan”). The Eighth Supply and Demand Plan includes a supply and demand forecast for natural gas, an import plan, a plan for the construction of and investment in supply facilities, and stabilizing measures for supply and demand of natural gas between 2006 and 2020.

The outline of the plan is as follows:

#### **1) Supply and demand forecast**

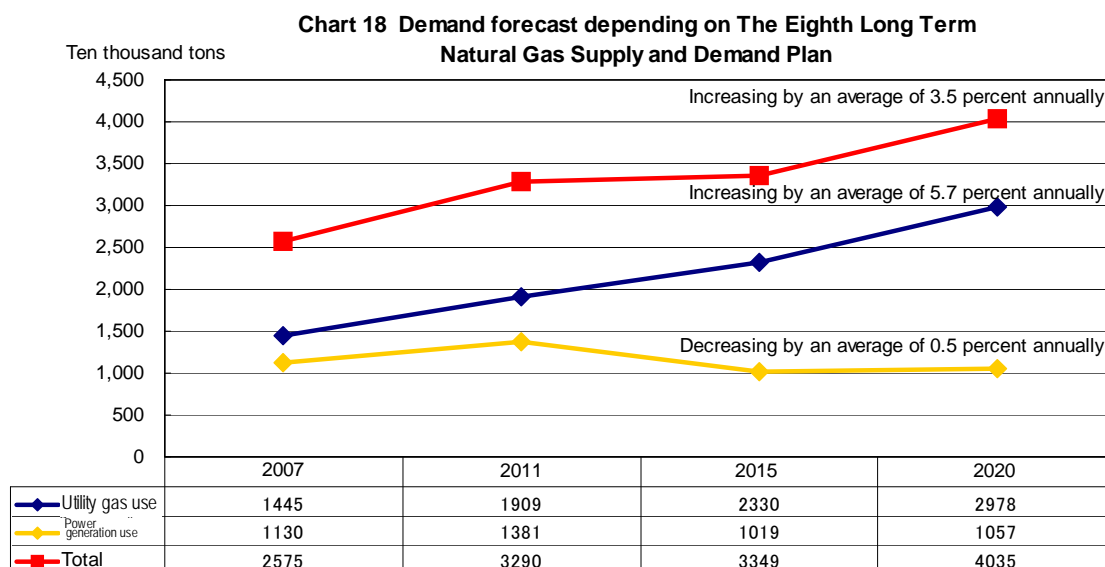
The demand for natural gas in 2020 is expected to increase by an average of 3.5 percent annually based on the 2007 performance, to top 40.35 million tons. Demand in city gas and power generation sectors are 29.78 million tons and 10.57 million tons respectively, with the former increasing by an

---

<sup>10</sup> In 2008, the name was changed to the Ministry of the Knowledge Economy.

<sup>11</sup> The Minister of the Knowledge Economy lays down the long term natural gas supply and demand plan every two years, which includes the relevant year and covers a period of a decade or more, with the Ninth Long Term Natural Gas Supply and Demand Plan due to be issued in December 2008.

annual average of 5.7 percent, while the latter, of which demand is forecast to decline from 2012, decreases by an average annual rate of 0.5 percent. However, as for the power generation consumption, the demand forecast of which involves greater uncertainties, the plan mentions a possibility of future demand variations.



Source: Prepared from The Eighth Long Term Natural Gas Supply and Demand Plan

## 2) Import plan

### i) Basic measures

- Promotion of securing the required amount of LNG in line with national energy security considerations
  - Coordination of interests between domestic importers to prevent excessive competition and maximize national interests
- Improvement of import stability
  - Bolstering import stability by promoting early conclusion of mid- or long-term LNG contracts required in 2010 and afterward
  - Making efforts to secure equity in overseas gas projects as a mean to address country's dependence on LNG import
- Securing competitiveness of import contracts
  - Introduction and promotion of measures to ease the risk of price variation and to cope effectively with market circumstances

### ii) Measures for securing additional gas supplies

- Preferential extension of existing mid-term contracts, which is scheduled to expire in 2010

- To secure stable supply in 2010 and onwards, mid- or long-term contracts shall be concluded earlier, targeting the projects where supply is possible

### **3) Expansion of supply facilities and investment plan**

#### **i) Expansion of supply facilities**

##### **a. LNG receiving terminals**

- In addition to Pyongtaek, Incheon and Tongyeong, the fourth terminal shall be completed until 2013 to ensure stable supply.
- A small-scale LNG terminal shall be completed in Jeju by 2012.
- Securing a site for the construction of an additional storage facility required for future expansion of demand as well as F/S for the construction of the fifth terminal
  - \* For the fifth LNG terminal, various measures are under consideration, including the construction of an underground storage facility or utilizing of depleted Dong Hae-1 gas well, reflecting future environmental changes

##### **● Storage facilities**

- The ratio of storage in line with annual demand shall be raised from 8.9 percent in 2005 to 16 percent in 2020 in order to ensure stable supply.
- As for the mid-term plan, the capacity shall be expanded 9.8 million kl from 2006 to 14.26 million kl in 2012.

##### **● Port and harbor facilities**

- An additional berth of the port and harbor facility (Tongyeong) shall be completed in 2011 to create a total of six berths
- One berth of the port and harbor facility shall be added at the fourth terminal in 2013 or afterwards.

##### **● Re-gasification facilities**

- In line with the forecast for the increase in peak demand, a marginal facility of around 20 percent shall be maintained.

##### **b. Pipeline expansion plan**

- Until 2010, the supply pipeline between Jecheon and Yongwol (30" x 45km) alongside the construction of the Yongwol Combined Power Plant and the pipeline between the Pyongtaek terminal and Suwon (30" x 55 km) in preparation for the low pressure within the metropolitan area and the Yongwol Combined Power Plant, shall be completed.
- By 2012, the pipeline between Cheju City and Seogwipo (20" x 60 km) shall be completed.

- By 2015, the pipeline between the Tongyeong terminal and Pusan (30" x 95 km) shall be completed, in preparation for the low end pressure at Pusan and Gyeongsangnam-do districts.
- In line with the fourth terminal construction plan and the new supply pipeline plan, additional pipeline construction shall be considered, such as northern Gyeongsangbuk-do areas, and so on.

**ii) Investment plan**

**Chart 19 Facility investment plan for 2006 - 2010**

(Unit: 100 million won)

	2006 to 2010	2011 to 2015	2016 to 2020
LNG receiving terminal	32,196	30,163	12,100
Storage tank	26,013	24,773	10,603
Berth facility	1,933	2,111	-
Evaporation facility	4,250	3,280	1,497
Supply pipeline	5,998	2,347	-
Total	38,194	32,510	12,100

Note: Excepting Posco's supply facilities for private consumption

Source: Prepared from The Eighth Long Term Natural Gas Supply and Demand Plan

**4) Stabilizing measures for Supply and demand**

**i) Short term measures**

- The establishment and implementation of management measures for LNG demand by consumption sectors
- Joint measures for supply and demand stabilization through the establishment of a cooperation system with relevant organizations, such as Kogas and power generation companies
- Operation of supply and demand management organization especially in winter, development for the inventory control model and bolstering of an effective supply and demand control system through system improvement, including supply and demand control regulations.

**ii) Mid- or long-term measures**

- Promotion of securing LNG import contracts for the mid- or long-term required amounts
- Development of strategies to secure a stable import volume through the diversification of suppliers and participation to foreign gas field development as an equity partner
- Promotion of early expansion of storage facilities in domestic and overseas storage tank
- Study on gas pricing in preparation for the rapid increase (decrease) of LNG demand

#### 4. Summary

In due consideration of Eighth Supply and Demand Plan and current market environment, it is difficult to forecast accurate demand and supply. However this report will try to summarize the key factors, which could affect the future supply and demand balance of natural gas in South Korea.

The first factor is the supply and demand trends of the international LNG markets. The supply and demand of natural gas in South Korea, in which not only gas consumption definitely depends on long-term contract based imports from foreign countries but also a significant portion depends on spot or short-term contracts, tends to be significantly affected by the supply and demand trends of the international LNG markets. Recently, the international LNG markets have been experiencing serious supply shortages and price surge phenomenon owing to the demand expansion in North America and Europe, the emergence of new consumers such as China and India, and the increase in LNG demand reflecting the search for alternatives to nuclear power generation in Japan. Consequently, the prospect of the international LNG markets, including the supply and demand balance, price and activation of the spot market, is anticipated to be important factors, which will dominate the stability of supply and demand in South Korea. In the long term, the promotion level of the natural gas development project in overseas, which was forced to be delayed due to the increase in EPC<sup>12</sup> cost and shortage of materials, equipment and manpower, is also predicted to influence the stability of supply and demand.

Secondly, the level of the gas industries restructuring, which has repeatedly been discussed in South Korea since the establishment of the basic plan in 1999, could also affect the stability of supply and demand. This is because, within the existing supply and demand system, a state-run corporation, Kogas, is responsible for the raw material procurement and the control of supply and demand, with the exception of private gas consumption. For example, if the multiple import wholesale business companies are allowed to join or private business entities are forced to accept responsibility, some side effects, such as the deterioration of public function for the supply and demand management, excessive import and dissipation of supply and demand responsibility, could occur. Two GS subsidiaries, which were granted the right by the government to import natural gas directly for their private consumption, suddenly gave up the right due to the soaring market price and requested Kogas to supply, it inevitably aggravated instability of supply and demand, especially in winter. Also, considering the fact that the delay in concluding long-term LNG contracts due to the prolonged restructuring argument over gas industries has become a significant threat, swift settlement of the issue or other measures, including the conclusions of long-term import contracts to cover the shortage, seem to become key points of the stable supply and demand. Meanwhile the new

---

<sup>12</sup> Engineering, procurement, and construction

government, which was inaugurated last year, excluded the gas industries from public domain restructuring list. However, considering the precedent of repeated investigations and delays, the gas industries restructuring still remains the issue that may emerge again.

Thirdly, even though the required LNG quantities in the near future are secured, securing sufficient storage facilities is very important to balance seasonal fluctuation. With this in mind, Kogas announced that it had selected the site for the fourth LNG terminal in Samcheok and intends to draw up the storage ratio from the current level of under 10 percent to 16 percent by 2020. According to the Eighth Supply and Demand Plan, Kogas must secure storage capacity of 14.26 million kl in total of 87 storage tanks in 2020, including 20 tanks in Incheon, 23 tanks in Pyongtaek, 17 tanks in Tongyeong, 14 tanks in Samcheok, and 13 tanks in the fifth terminal.

Fourthly, it is necessary to focus on the probability of the timely construction of power generation facilities. The forecast of gas demand for power generation sector in the Eighth Supply and Demand Plan, which was calculated based on the electric power demand and power generation structure by power supply in the Third Electric Power Supply and Demand Basic Plan, is based on the premise of the timely construction of base power supplies, such as nuclear and coal-fired power plants. Meanwhile, there is also an argument that the gas demand for electric power generation consumption stated in the Eighth Supply and Demand Plan was underestimated because of an optimistic assumption drawn from the construction schedule for the base power supplies such as coal-fueled , nuclear power plant and so on. These facts show that the construction delay of the base power supplies could affect future supply and demand instability. Meanwhile, in case of nuclear power plants, which can be seen as problematic due to the risk of radiation leakage, additional construction is very difficult due to the objections by local residents. Moreover, even if the decision was taken to proceed with such construction, with traditional case examples in mind, there is a high probability of delay for a considerable period.

Fifthly, an abnormal cold wave hitting is a factor with a major influence on the short-term aspects of supply and demand. Considering the fact that most of spot cargoes has been imported in winter to meet high demand during the period, if an abnormal cold wave strikes, an additional supply shortage phenomenon is highly probable making difficult to engage in spot procurement.

Finally, the recovery of the domestic economy, which has been delayed because of prolonged depression for the past few years, and the price difference between oil and LNG as a measure of the fuel switching, seem to largely effect to supply and demand.

Contact: [report@tky.iej.or.jp](mailto:report@tky.iej.or.jp)