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Natural Gas Demand Prospects in Korea

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Abstract

Korea's natural gas demand has increased enormously since 1986. Natural gas demand in Korea will approach to 29 million tonnes by the year 2010, from little over 9 million tonnes in 1996. This rapid expansion of natural gas demand is largely due to regulations for environmental protection by the government as well as consumers' preference to natural gas over other sources of energy. Especially industrial use of gas will expand faster than other use of gas, although it will not be as high as that in European and North American countries. To meet the enormous increase in demand, Korean government and Korea Gas Corporation (KOGAS) are undertaking expansion of capacities of natural gas supply facilities, and are seeking diversification of import sources, including participation in major gas projects, to secure the import sources on more reliable grounds.

1. Introduction

Natural gas demand in Korea has come through an enormous expansion. Total demand for natural gas in Korea is estimated to be 9.3 million tonnes in 1996. The average annual growth rate of the demand until 1996 is 67.7% per annum, since 1986 when natural gas was first imported. Initially, natural gas was brought in as an alternative source of energy to strengthen the nation's energy security and stability. However, increasing regulatory actions for environmental protection, a steady economic growth and user preference to gas over other forms of energy have all contributed to the acceleration of demand increase afterwards.

The environmental regulation is expected to become tougher, especially as Korea was accepted as a member of OECD last year, in the midst of so much talks about the Green Round trade negotiations and the need for strategies to accommodate them. This situation may lead Korea's gas consumption to even more increase. Current forecasts for natural gas demand are 20.2 million tonnes and 28.5 million tonnes in the year 2001 and 2010, respectively. These estimates reflect a consistent growth of natural gas demands in the coming years, largely due to the rapid increase in industrial use of natural gas after completion of nation-wide gas pipelines which connects almost all the corners of the country.

2. The natural gas market in Korea

Before a discussion of natural gas demand in Korea, it is worthwhile to note the market situation of Korea briefly. In Korea, natural gas was first imported as an alternative energy source for power generation in 1986. The gas demand for power generation has expanded rapidly as the demand for electricity soared up in the late 80's and the early 90's. While the gas demand for power generation has been increasing, Korean government decided to supply natural gas to the general public to meet the growing needs of clean energy. Currently, Korea Gas Corporation (KOGAS) is responsible to import and transmit the natural gas in the country via the nation-wide transmission pipelines.

Power plants owned by Korea Electric Power Corporation (KEPCO), receive gas directly from the KOGAS' transmission lines, whereas domestic needs are supplied by the local distribution companies (LDCs). LDCs that are located within the service region of KOGAS pipelines buy natural gas from KOGAS, then redistribute it to end-users using their own distribution lines, while the other distributors which are not in the service region, distribute the petroleum gas to their customers. As of 1996, there are 32 local distributors in Korea, among which a total of 15 local distributors are engaged in distributing natural gas to residential, commercial and industrial gas premises, while

the others are distributing petroleum gas which will be replaced to the natural gas as the nation-wide pipelines expand.

The total length of the trunk lines is 1,334 km as of the end of 1996, which will be extended to 2,313 km by the year 2006 and expand further as the gas demand increases. As KOGAS expands its gas pipelines, most parts of the country will come into KOGAS' service area by 1999 according to its plan. Currently, natural gas service regions include two-thirds of the whole nation - the northern and the central parts of the country; and are being expanded toward the southern areas.

3. Natural gas as a source of primary energy

Total primary energy demand in Korea was 150.4 million toe in 1995, which is now forecasted to be 287.5 million toe in 2010 as shown in Table 1 below. According to Korea Energy Economics Institute, the primary energy demand is predicted to increase at 4.4 % per annum in the period between 1995 and 2010. Compared to the national income growth rate of 6 % per annum over the same period, the predicted pace of growth in the energy demand is relatively low, and the energy intensity, the ratio of total primary energy to GNP, will be improved substantially during the period. However, natural gas supply as a primary source of energy will grow from 9.2 million toe in 1995 to 34.8 million toe in 2010 - the annual growth rate of 9.3 %, thanks to the more toughening environmental protection measures by government and public desire to use the clean energy. Therefore, the share of natural gas among the primary energy needs would expand up to 12.1 % in 2010 and in 2020 from about 6 % in 1995.

Table 1. Outlook on primary energy demand in Korea

mtoe, %

	1995		2001		2006		2010		2020	
Oil	94.0	62.5	119.7	55.0	134.3	51.9	147.5	51.3	178.1	50.7
LNG	9.2	6.1	24.8	11.4	30.3	11.7	34.8	12.1	42.5	12.1
Coal	28.1	18.7	43.1	19.8	54.1	20.9	52.9	18.4	61.8	17.6
Hydro	1.4	0.9	1.7	0.8	1.3	0.5	1.4	0.5	1.8	0.5
Nuclear	16.7	11.1	25.5	11.7	34.7	13.4	45.7	15.9	58.7	16.7
Renewable	1.1	0.7	2.8	1.3	4.1	1.6	5.2	1.8	8.4	2.4
Total	150.4	100.0	217.7	100.0	258.7	100.0	287.5	100.0	351.2	100.0

Source: Korea Energy Economics Institute, 1996

Nonetheless, natural gas share to the total energy needs in Korea is far below the average of its share in other major industrial countries. In 1995, major countries supply 20 to 50 % of their primary energy needs with natural gas depending upon their gas resource abundance: Russia 51 %, United States, Canada, United Kingdom and Italy showed approximately 30 %, and France and Japan were 13 % and 11 % respectively (see Table 2). Thus, in terms of natural gas share to the total primary energy, Korea would be in a similar status to those of Japan or France in the year 2010.

Table 2. Primary energy consumption in the major countries

mtoe, %

	Oil		Natural Gas		Coal		Nuclear		Hydro		Total	
U.S.A	807	39	560	27	494	24	183	9	26	1	2070	100
Canada	80	35	67	30	25	11	25	11	29	13	226	100
U.K.	82	37	66	30	48	22	23	10	1	1	220	100
France	89	37	30	13	13	6	97	41	7	3	236	100
Germany	135	39	67	20	93	28	40	12	2	1	337	100
Italy	95	62	43	28	11	7			4	3	153	100
Russia	146	23	318	51	119	19	26	5	15	2	624	100
Japan	267	54	55	11	86	18	74	15	8	2	490	100
Korea	95	64	9	6	27	18	17	11	1	1	149	100

Source: BP Statistical Review of World Energy, 1996

4. Outlook for natural gas consumption in Korea

Total natural gas demand in 1996 is estimated to be 9.3 million tonnes in Korea. The volume of gas consumption will increase to 20.2 million tonnes in year 2001 based on a conservative forecast. The growth rate is 16.7 % per annum between 1996 and 2001. A major reason for the increase in demand for this period is the expansion of gas pipelines, in the atmosphere of growing public concern on environmental protection, particularly as Korea has joined recently the advanced country's club - OECD. As mentioned before, the customers who are provided with the petroleum gas by the local distributors that are as yet unconnected to KOGAS' transmission lines will switch their services to the natural gas after KOGAS' pipelines reach through their regions around 2000. After completion of KOGAS' nation-wide gas pipelines, the growth rate of gas consumption will be slowed as can be expected naturally. Natural gas demand will

grow 3.9 % on average annually from 2001 to reach 28.5 million tonnes in 2010 as shown by the forecast (see Table 3).

Table 3. Outlook on natural gas demand by user sector

thousand tonnes, %

	1996*		2001		2006		2010		Annual Growth Rate	
									'96-'01	'01-'10
City Gas	4,809	51.5	11,492	56.9	15,275	62.6	17,519	61.4	19.0	4.8
• Residential	3,130	33.5	7,426	36.7	9,965	40.8	11,459	40.1	18.9	4.9
• Commercial	906	9.7	1,765	8.7	2,306	9.4	2,655	9.3	14.3	4.6
• Industrial	773	8.3	2,301	11.4	3,005	12.3	3,405	11.9	24.4	4.5
Power Generation	4,527	48.5	8,719	43.1	9,116	37.4	11,028	38.6	14.0	2.6
Total	9,336	100.0	20,211	100.0	24,391	100.0	28,547	100.0	16.7	3.9

* Figures in the column of 1996 are preliminary estimates.

Alternative forecasts may possibly be made depending on developments of gas projects considered currently. KOGAS is considering to participate in several gas projects in collaboration with other Korean companies to meet the growing needs of gas in the economy and to diversify the source of gas import. One of the project considered positively is a pipelined natural gas project connecting gas pipelines from a gas field in the eastern part of Russia to Korea through Mongolia and China. If it is successfully proceeded, KOGAS will supply pipelined natural gas along with the liquefied natural gas (LNG). Thereby KOGAS would be able to reduce the cost of service for supply and the service rate of gas. A substantial reduction of gas rate would change the structure of energy consumption in Korea. Because all the natural gas supplied in Korea has been imported in the form of LNG, mostly from the South-East Asia, natural gas price is relatively higher than those of competitive sources of energy such as oil. If Korea can deploy the low priced gas such as pipelined natural

gas as like European countries, it may induce new usage of gas, and the demand for natural gas could increase even more than expected currently.

5. Outlook on natural gas demand by user sector

To see the gas demand by user-sector, a major sector for natural gas consumption in Korea is the power generation sector. In 1996, power generation consumed 4.5 million tonnes of natural gas, which was 48.5 % of total gas consumption, while the city gas for domestic gas needs consumed 4.8 million tonnes of gas, whose share to the total gas consumption was 51.5 %. As the gas industry in Korea being matured, domestic needs of natural gas increase faster than the needs for power generation. Hence in 2010, the share of gas used in the power generation will shrink to about 38.6 %, while the share of city gas will grow up to 61.4 % of the total gas demand.

Within the city gas sector, the main area for gas is the residential use, where the natural gas is mostly used for heating and cooking. The residential sector consumed 3.1 million tonnes of natural gas in 1996 and will consume 11.5 million tonnes in 2010 - share to the total gas consumption will be 40.1 %. The increase in gas demand in the residential sector can be explained by two facts in the coming years. First, as the steady increase in household living standard continues, many consumers switch the source of heating and cooking energy to natural gas because they prefer the cleanness and convenience of gas, even though the price of gas is relatively expensive in Korea. Second, many residential complexes have to modify their heating system to be able to use natural gas. This is because most of central heating system in apartment complexes in urban areas must meet the environmental regulation set by the government.

A focus must be given to the industrial use of gas to overview the prospect of gas demand in Korea for the future. Industrial sector consumed 773 thousand tonnes of natural gas in 1996, which is only 8.3 % of the total gas consumption in the year. Though it is classified as the industrial demand, so far a majority of the gas consumed in the industrial sector is for heating, cooling as well as cooking in factories rather than a

use in manufacturing processes of the production lines. As gas-firing equipment for production processes are introduced for practical use as gas industry continues to grow, many industrial fields such as iron and steel industry and ceramic industry are expected to see more of their production facilities incorporate gas-burning equipment because the regulation of air pollution on the use of energy in the industrial sector will be reinforced in the coming years. In the period between 1996 and 2001 when the construction of nation-wide gas pipelines is completed, the demand for gas in the industrial sector may be increased to 24.4 % per annum and after completion of the pipelines, the demand will increase 4.5 % per annum. Therefore, a total of 3.4 million tonnes of natural gas is expected to be consumed in 2010 and the share of gas in this sector would be increased to 11.9 % of the total consumption, by the current forecast.

Gas demand for heating, cooling and cooking in hotels, restaurants, or office buildings is classified as the commercial use of gas. In 1996, a total of 906 thousand tonnes of natural gas was consumed in the commercial sector. Gas consumption in the commercial sector will increase to 2.7 million tonnes in 2010, which is 9.3 % of the total consumption in the year 2010.

Comparing the structure of gas demand by sectors with major countries in the world as shown Table 4, it is seen that many advanced industrial countries in North America and Europe consume a large amount of natural gas in the industrial sector and residential / commercial sector, while Korea and Japan, in which most of natural gas are imported from abroad in the form of LNG, consume most of natural gas for power generation and residential / commercial uses. In Japan and Korea, the cost of service for distributing natural gas is relatively higher than in other countries, and natural gas is expensive compared to oil which is a close substitute for an industrial energy source. As long as Japan and Korea supply only LNG for their gas services, it can be expected that the industrial share of gas consumption will remain limited because of the poor competitiveness in price against other sources of energy for the industrial sector.

**Table 4. Share of natural gas consumption by sector
in major industrial countries**

%

	Power Generation	Industrial	Residential/ Commercial	Raw Material /Others
U.S.A.	14	45	38	3
Canada	6	44	42	8
U.K.	15	25	54	6
France	2	35	56	7
Germany	16	40	44	0
Italy	20	36	42	2
Russia	36	44	17	3
Japan	70	11	19	0
Korea	53	5	42	-

Source: Cedigaz and KOGAS, 1996

- Figures are of 1995 for Korea, of 1994 for the others.

6. Outlook on natural gas import

Showing diversified import origin, KOGAS brought in 9.6 million tonnes of LNG in total in 1996 from four countries: Indonesia, Malaysia, Brunei and Australia. Until 1993, Korea depended for its import source on Indonesia and Malaysia only. In order to diversify the LNG sources, KOGAS signed new long-term Purchase contracts with Qatar and Oman, from which the delivery of gas will start in 1999 and 2000, respectively.

For the supply of short and medium-term demands that are not covered by the long-term contracts, and at the same time, from new projects such as Canadian Pac-Rim LNG Project which is now under negotiation. Looking after even long-term security of supply sources, pipeline gas imports such as from Russia are also examined positively.

Russian pipe line project is under pre-feasibility study, to import natural gas from there in the late 2000', and feasibility study will follow soon when the result being confident.

Table 5. Current and future LNG Imports

thousand tonnes, %

	1996		2001		2006		2010	
Total Import	9,595	100	20,717	100	25,011	100	29,316	100
Contracted(Total)	9,595		13,700		13,760		11,460	
- Indonesia	6,262	65	5,300	26	5,300	21	3,000	10
- Malaysia	2,527	27	2,000	10	2,000	8	2,000	7
- Qatar			2,400	12	2,400	10	2,400	8
- Oman			4,000	19	4,060	16	4,060	14
- Australia	56	1						
- Brunei	705	7						
To be secured			7,017	33	11,251	45	17,856	61

7. Concluding remarks

Natural gas consumption in Korea has been and will be expanding due to a combined stimulant of environmental regulations, convenience of natural gas use and improvement of standard of living. Since the beginning of natural gas use in 1986, natural gas consumption has grown at 67.7 % per annum until 1996. More upgraded environmental regulation and expansion of national gas pipelines may bring about an even further increase in natural gas demand, a new acceleration taking place in the

industrial sector. After completion of national gas pipelines, pace of increase in demand will be lowered somewhat. On a baseline forecast, natural gas demand in Korea will reach around 29 million tonnes in year 2010, about 3 times more than current consumption and the share of natural gas among the total primary energy needs will be about 12 %, which would be similar to those of Japan or France of 1995. However, a successful execution of pipelined gas project under consideration may give an opportunity for further growth in all demand in sectors of gas consumption.

Even though continued strong growth in demand may provide with a vibrant source of great opportunity to the players in the industry, a number of challenges must be overcome in order to take full advantage of the opportunity. These include: the increasing difficulty in siting new supply facilities; the ways to improve the efficiency of supply facility utilization; the need to develop safety technology and environmental measures that are to be practically used; and the need to secure import sources on a stable contract basis.

In the face of these tasks, Korean government and KOGAS are determined to reinforce supply capability by constructing a new receiving terminal and more storage tanks on one hand, as well as to improve the security of supply sources on the other hand. For the latter, policies like import source diversification as well as participation in gas projects, and demand-side management of gas market are also pursued.