

*The following member country profile is an excerpt from Chapter 4 of the publication Energy Supply Security 2014 and is not intended as a stand-alone publication.*

### CHAPTER 4: Emergency response systems of individual IEA countries

The ability of the International Energy Agency (IEA) to co-ordinate a swift and effective international response to an oil supply disruption stems from the strategic efforts of member countries to maintain a state of preparedness at the national level. Energy security is more than just oil, as the role of natural gas continues to increase in the energy balances of IEA countries. The most recently completed cycle of Emergency Response Reviews (ERRs) reflected this change by assessing, for the first time, the member countries' exposure to gas disruptions and their ability to respond to such crises. This chapter provides general profiles of the oil and natural gas infrastructure and emergency response mechanisms for 29 IEA member countries.

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# The Republic of Korea

## Key data

Table 4.16.1 Key oil data

	1990	2000	2005	2010	2011	2012	2018*
<b>Production (kb/d)</b>	0.0	13.0	9.8	20.9	20.5	21.3	19.4
<b>Demand (kb/d)</b>	1 048.3	2 135.3	2 191.3	2 268.6	2 257.7	2 301.0	2 263.0
<i>Motor gasoline</i>	64.9	170.5	162.9	188.9	190.5	196.3	-
<i>Gas/diesel oil</i>	279.1	379.1	413.9	399.4	393.3	399.9	-
<i>Residual fuel oil</i>	333.1	487.2	433.7	321.3	276.0	266.0	-
<i>Others</i>	371.1	1 098.6	1 180.9	1 359.0	1 397.9	1 438.9	-
<b>Net imports (kb/d)</b>	1 048.3	2 122.3	2 181.5	2 247.7	2 237.2	2 279.7	2 243.5
<b>Import dependency (%)</b>	100	99.4	99.6	99.1	99.1	99.1	99.1
<b>Refining capacity (kb/d)</b>	867.0	2 540.1	2 576.5	2 790.0	2 790.0	2 790.0	-
<b>Oil in TPES** (%)</b>	53	53	44	38	36	36	-

\* Forecast.

\*\* TPES data for 2012 are estimates.

Table 4.16.2 Key natural gas data

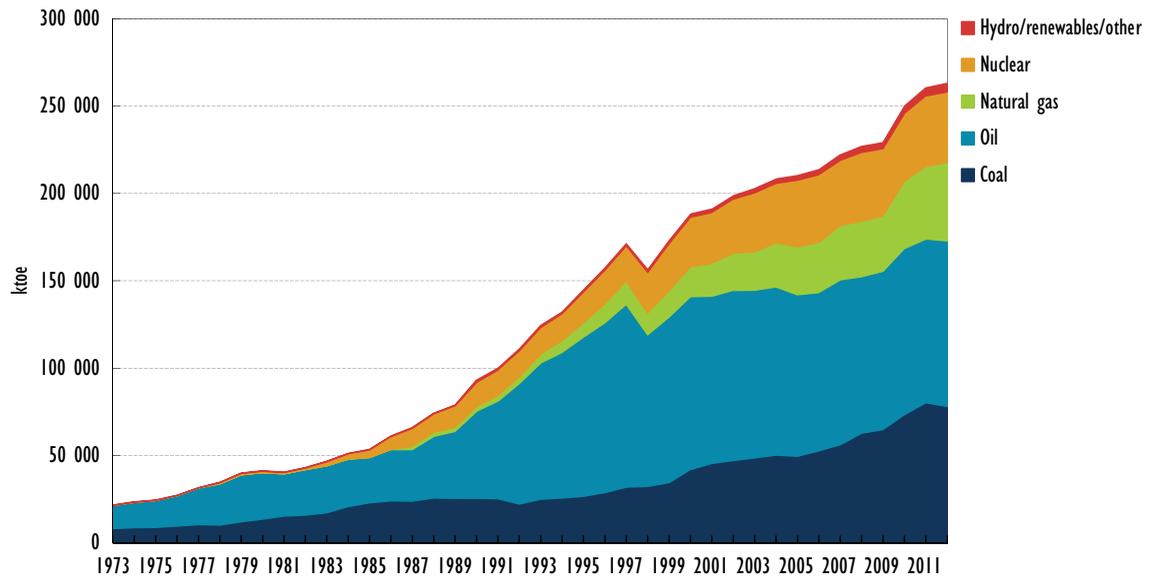
	1990	2000	2005	2010	2011	2012*	2018**
<b>Production (mcm/y)</b>	0	0	492	542	453	436	0
<b>Demand (mcm/y)</b>	3 042	18 932	30 477	43 201	46 460	49 955	59 349
<i>Transformation</i>	2 274	6 407	12 362	20 142	22 155	0	-
<i>Industry</i>	81	3 207	4 652	7 688	9 087	0	-
<i>Residential</i>	519	6 853	9 346	10 002	9 848	0	-
<i>Others</i>	168	2 465	4 117	5 369	5 370	0	-
<b>Net imports (mcm/y)</b>	3 042	18 932	29 985	42 659	46 007	49 519	59 349
<b>Import dependency (%)</b>	100	100	98.4	98.7	99.0	99.1	100
<b>Natural gas in TPES (%)</b>	3	9	13	15	16	17	-

\* 2012 data are estimates.

\*\* Forecast.

Note: This section on the emergency response systems of individual member countries was written by the IEA. All countries provided valuable information and comments. All opinions, errors and omissions are solely the responsibility of the IEA.

Figure 4.16.1 Total primary energy source (TPES) trend, 1973-2012



Map 4.16.1 Oil infrastructure of the Republic of Korea



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Map 4.16.2 Gas infrastructure of the Republic of Korea



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## Country overview

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Oil has been the dominant energy source in the Republic of Korea, accounting for roughly 36% of the country's total primary energy supply (TPES) in 2012. The share of natural gas in the country's TPES steadily increased from 3% in 1990 to 17% in 2012.

Korea has very little indigenous oil production, which averaged 21 thousand barrels per day (kb/d) in 2012, while Korea's oil demand stood at 2.3 million barrels (mb). Korea is a big consumer of naphtha, mainly for the petrochemical industry. Its oil imports in 2012 were 3.4 mb/d, consisting of 2.5 mb/d of crude oil and 0.8 mb/d of refined products. Korea is highly dependent on the Middle East, which accounted for 85% of its total crude oil imports in 2012. Conversely, Korea exported 1.2 mb/d of oil products in 2012. Around one-third of the product exports went to OECD member countries (mainly Japan and Australia), while the remainder was destined for OECD non-member economies, such as China, Singapore and Indonesia.

The main pillars of Korea's energy security policy are diversification of energy fuel sources (energy mix), diversification of import sources of crude oil and liquefied natural gas (LNG), further build-up of government stocks, expansion of storage capacity for oil and gas and promotion of domestic and overseas exploration and production activities.

Korea meets its stockholding obligation to the International Energy Agency (IEA) by holding government stocks and by placing a minimum stockholding obligation on industry. The Korean National Oil Corporation (KNOC) manages the state-owned oil emergency reserves.

Korea held 176 mb of oil stocks at the end of April 2013. Around 65% of total stocks were held in the form of crude oil.

The use of emergency oil stocks is central to Korea's emergency response policy, which is complemented by the possibility of demand restraint measures. During an emergency, the minister responsible for energy will make the political decision whether to participate in an IEA collective action and on emergency response measures, including oil stock release.

Korea's domestic gas production is negligible. In 2012 it produced about 0.4 billion cubic metres (bcm), which covered less than 1% of its total domestic consumption. Gas demand has steadily increased from 19 bcm in 2000 to 50 bcm (137 million cubic metres per day) in 2012.

As there are no cross-border gas pipelines in the country, all natural gas is imported in the form of LNG. The country has four LNG terminals which have a total send-out capacity of 118 bcm per year (324 mcm/d).

In 2012 Qatar was the largest natural gas supplier (30%), followed by Indonesia (18%), Oman (12%), Malaysia (12%) and Yemen (7%). The Korean Gas Corporation (KOGAS) imports 80% to 90% of LNG through mid- to long term contracts.

Diversification of supply sources, ensuring LNG supply on the basis of long-term contracts, and securing sufficient natural gas supplies for high seasonal demand are the key elements of Korea's overall gas security policy. Korea has no government natural gas stocks or mandatory industry stocks. An emergency response plan is in place in the event of a gas supply disruption. The plan contains various emergency response measures that would be implemented in separate phases; these include demand restraint and fuel switching.

# Oil

## Market features and key issues

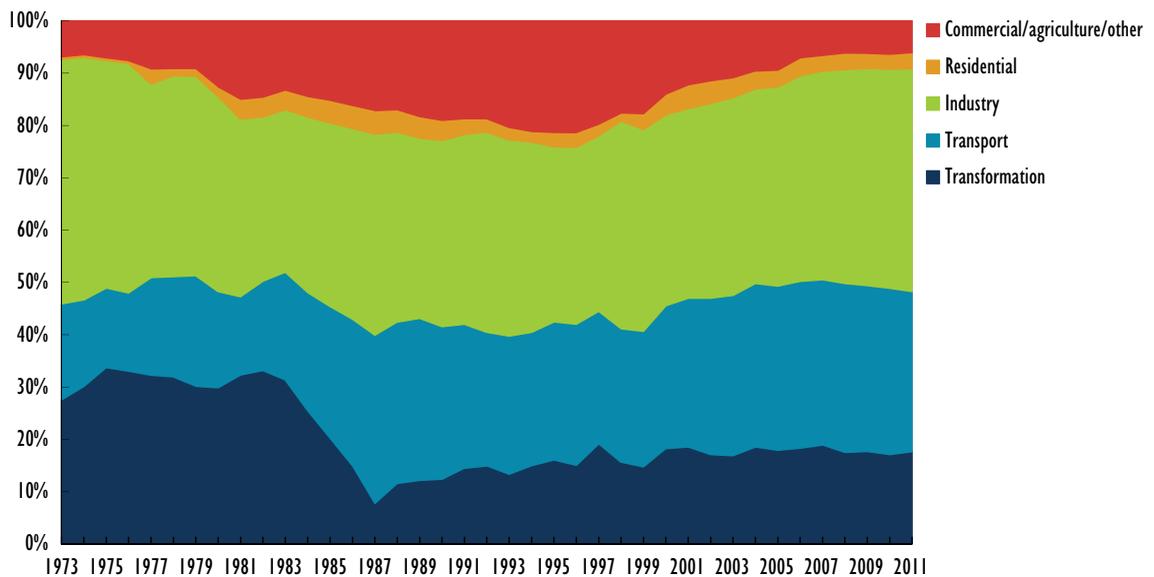
### Domestic oil production

Korea has no significant proven reserves of crude oil and the country has very little indigenous crude oil production. Korea's crude oil production in 2012 averaged only 21 kb/d, which covered less than 1% of the total demand.

### Oil demand

Korea's oil demand has remained relatively flat over the last decade and stood at about 2.3 mb/d in 2012. The industry sector accounted for 42% of the total oil consumption in Korea in 2011, while the transport and transformation/energy sectors represented 31% and 18% respectively. Korea's total oil demand is forecast to stay relatively flat until 2018.

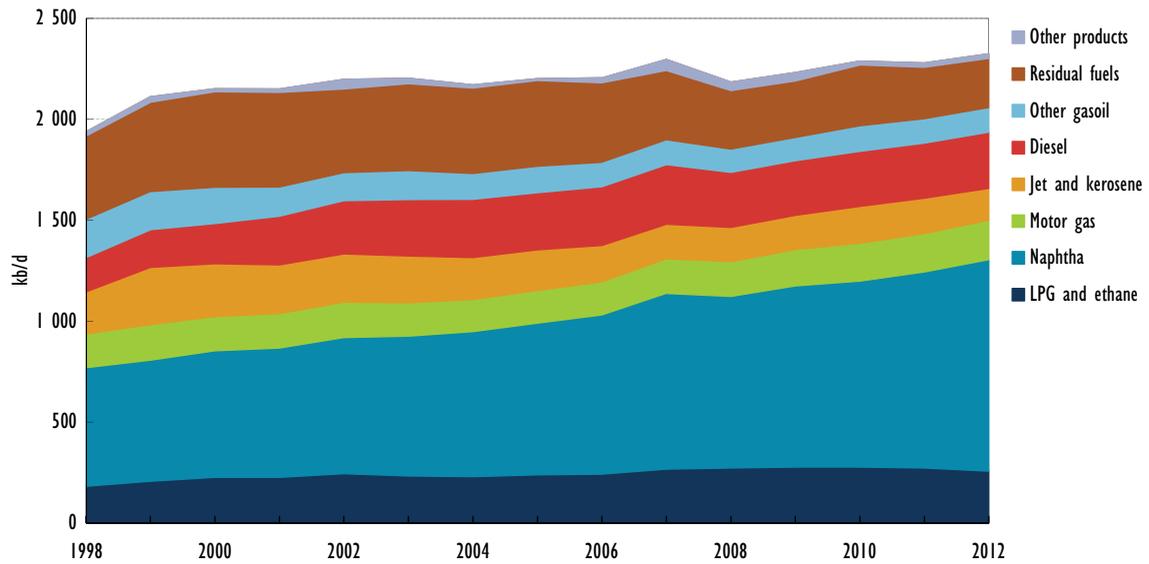
Figure 4.16.2 Oil consumption by sector, 1973-2011



In terms of oil demand by product, demand for motor gasoline increased by 18% from 2003 to 2012. During the same period, there was a rise in demand for naphtha (51%) and LPG/ethane (10%); demand for residual fuel and kerosene dropped by 41% and 32%.

Korea is a big consumer of naphtha, which is mainly used in the petrochemical industry. Demand for naphtha stood at 1 mb/d in 2012, accounting for about 45% of the total oil demand.

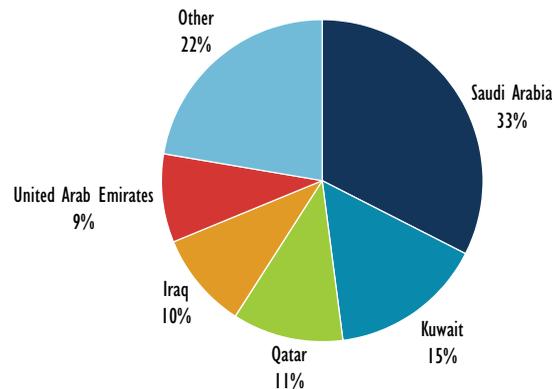
Figure 4.16.3 Oil demand by product, 1998-2012



### Imports/exports and import dependency

In 2012, Korea's oil imports were 3.4 mb/d, consisting of about 2.5 mb/d crude oil, 4 kb/d natural gas liquids (NGLs) and feedstock, and around 0.8 mb/d of refined products. Korea is highly dependent for its crude imports on the Middle East, which accounted for around 85% of the total crude oil imports in 2012.

Figure 4.16.4 Crude oil imports by origin, 2012



By country, Saudi Arabia was the largest supply source of crude oil (33% of the total), followed by Kuwait (15%), Qatar (11%), Iraq (10%) and the United Arab Emirates (12%). In 2012, roughly 54% of Korea's refined product imports came from OPEC countries, mainly from the UAE, Qatar, Saudi Arabia and Kuwait; 11% of refined products were imported from India.

As a net exporter of refined products, Korea exported close to 1.2 mb/d of oil products in 2012. Around one-third of the product exports went to OECD countries, mainly to Japan (14%), Australia (6%) and the United States (5%), while the remainder was destined for OECD non-member economies such as China (26%), Singapore (19%) and Indonesia (10%).

## Oil company operations

KNOC is a key player in domestic and overseas oil exploration and production projects. Korea's refining industry is dominated by four major oil companies: SK Innovation, GS Caltex, S-Oil and Hyundai Oilbank. Saudi Aramco is the controlling shareholder of S-Oil.

Daehan Oil Pipeline Corporation (DOPCO) is the major oil pipeline company in Korea and is in charge of the operation of nationwide oil pipeline systems. The main shareholders of DOPCO are the four Korean refiners – SK Innovation (41%), GS Caltex (29%), S-Oil (9%) and Hyundai Heavy Industries (6%) – and the Korean government (12%).

## Oil supply infrastructure

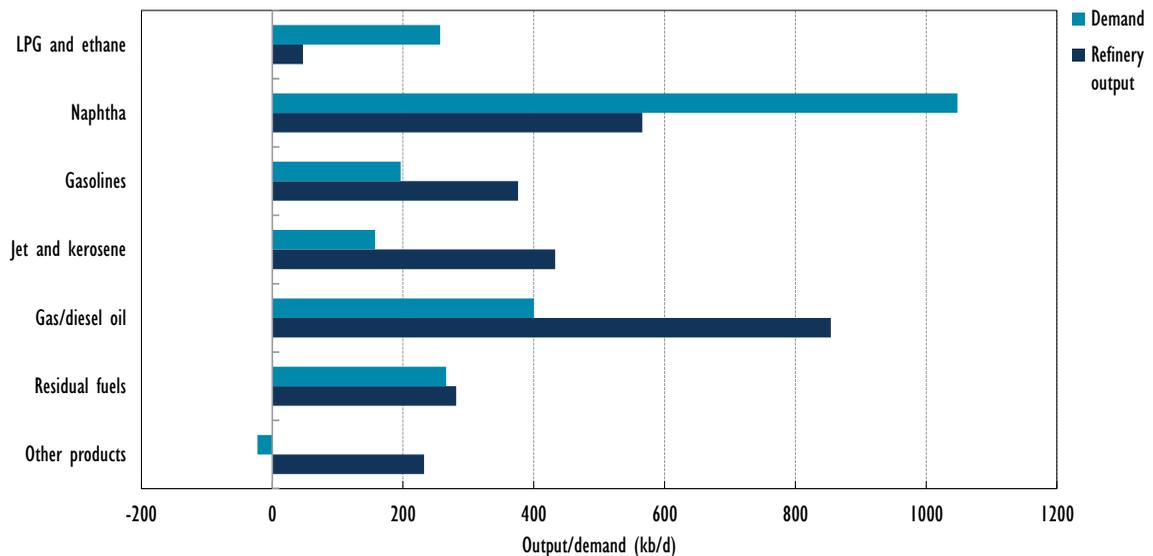
### Refining

Korea's five refineries have a combined crude distillation capacity of around 3.04 mb/d. SK Innovation has two refineries, one in Ulsan (840 kb/d) and another in Inchoen (275 kb/d). The other refineries are held by GS Caltex in Yeosu (865 kb/d), S-Oil in Onsan (669 kb/d) and Hyundai Oilbank in Daesan (390 kb/d).

In 2012, the five refineries processed around 993 mb of crude oil (including NGL and feedstocks), which indicates that the overall capacity utilisation rate was about 89%. In 2012, the refined product output totalled 2.8 mb/d.

The composition of production was gas/diesel oil (31%), naphtha (20%), other middle distillates (16%), motor gasoline (13%) and residual fuel oil (10%).

Figure 4.16.5 Refinery output vs. demand, 2012



Korea had a naphtha deficit of around 405 kb/d in 2012, accounting for 42% of total naphtha consumption. Korea also experienced an LPG deficit of some 225 kb/d in 2012 – with an LPG import dependency of over 80%.

### Ports and pipelines

Eight main oil port terminals receive Korea's imported crude oils. These terminals are owned by KNOC and the four big refiners and have a total crude import capacity of around 12.3 mb/d. Seven oil port terminals are used for both imports and exports of

oil products. The total importing and exporting capacity of these terminals is around 20 mb/d.

Korea has no cross-border oil pipelines for exports or imports. Its six oil product pipelines, with a total length of 1 104 km are operated by DOPCO.

The DOPCO pipeline system connects refineries with major cities, airports, military bases and public storage facilities. The utilisation rate of the pipelines was estimated to be approximately 64% in 2010. The pipelines are reversible, and it would take about three days to change the direction of pipeline delivery. Though restrictions do not exist on access to the pipeline network of DOPCO, companies other than shareholders of DOPCO do not make commercial use of it.

### **Storage capacity**

The government started a 30-year project of securing storage facilities for petroleum in 1980; this was completed in May 2010. At the end of 2012, Korea held a total storage capacity of 291 mb (46.2 mcm), which was composed of 146 mb of KNOC's facilities used for government stocks and international joint oil stockpiling, and 145 mb used for industry operation and mandatory industry stocks.

There are nine government storage sites across the country; 87% of this capacity is for crude oil and the remainder is for oil products. About 73% of government storage capacity exists in the form of underground storage facilities, while 27% is in above-ground tanks.

Roughly 39% of the total industry storage capacity was owned by SK Innovation at the end of 2012. The remaining portions were held by GS Caltex (30%), S-Oil (20%) and Hyundai Oilbank (11%).

## *Decision-making structure*

The President of Korea acts as the head of national crisis management, including responding to oil supply disruptions. In practice, the Ministry of Trade, Industry and Energy (MOTIE) is the main and leading governmental body responsible for dealing with oil supply disruptions, and it will closely consult with other relevant governmental entities as well as with domestic industry.

The Energy and Resource Policy Division and the Petroleum Division of MOTIE function as the core body of Korea's national emergency strategy organisation (NESO). In the event of a domestic or global oil supply disruption, the Petroleum Supply and Demand Committee and the Energy Emergency Response Centre (EERC) are set up in MOTIE. The Petroleum Supply and Demand Committee is headed by the minister of MOTIE and is composed of vice-ministers of related ministries and senior executives of relevant companies. This committee is expected to establish a response plan and to make crucial decisions on response actions.

The EERC is led by the head of the Office of Energy and Resources of MOTIE, and is made up of directors-general and directors of MOTIE as well as the vice-presidents of KNOC, KOGAS, the Korean Electric Power Corporation (KEPCO), executives of refineries and the president of the Korea Energy Economics Institute (KEEI). This centre is in charge of implementing the emergency response measures contained in the response plan and of monitoring the oil supply/demand balance.

The Petroleum and Petroleum-Alternative Business Act, the Energy Act and the Energy Use Rationalisation Act authorise the minister of MOTIE to develop an energy demand and supply plan in case of an energy crisis and to decide on emergency response measures

which include: oil stock release, lowering of the level of compulsory stockholding obligation on industry and demand restraint.

## Stocks

### Stockholding structure

Korea meets its stockholding obligation to the IEA by holding government stocks and by placing a minimum stockholding obligation on industry. KNOC manages the state-owned oil emergency reserves.

Crude refiners are obliged to hold at least 40 days of stocks, in either crude or products (excluding naphtha), based on a 12-month average of their previous year's sales. Product importers, LPG importers and petrochemical companies are also required to hold at least 30 days of stocks, based on their domestic sales.

KNOC has also promoted the International Joint Stockpile (IJS) Project, inviting and storing crude oil for companies of oil-producing countries. Under the IJS, KNOC rents out storage space to foreign firms, but the IJS also gives Korea first rights to purchase crude oil in case of an oil emergency. Stocks held under this scheme are not counted towards Korea's 90-day commitment.

### Crude or products

Korea held 176 mb of oil stocks (90 mb of government stocks and 86 mb of industry stocks) at the end of April 2013 – equal to 238 days of 2012 net imports (122 days of government stocks and 116 days of industry stocks) – to meet its IEA obligation. Around 65% of total stocks were held in the form of crude oil.

Most public stocks were held in the form of crude oil (86%), followed by middle distillates (8%). About 43% of total industry stocks were stored as crude oil while the shares of middle distillates and residual fuel oil were 17% and 10% respectively.

### Location and availability

Korea has no bilateral agreements to hold stocks on foreign territory. Emergency oil stocks are held entirely on the national territory.

Domestic refiners generally hold around 60 to 80 days of industry stocks for their operational and commercial purposes as well as to comply with the domestic stockholding requirement. Compulsory industry stocks may be commingled with operational and commercial stocks.

### Monitoring and non-compliance

KNOC is responsible for monitoring the quantity, quality and location of industry stocks, as well as for collecting data from industry. KNOC is also authorised to visit commercial storage facilities to verify physical stock levels.

The government has the legal authority to penalise non-compliant companies.

### Stock drawdown and timeframe

The minister of MOTIE decides on the drawdown of government stocks and the reduction of the industry stockholding obligation. Upon receiving the stock release order from MOTIE, KNOC will release government oil stocks to Korea's four refining companies in the form of loans. In principle, the amount allocated to each refiner is based upon

its respective market share. It generally takes KNOC one week to deliver oil stocks to the refiners. Korea's government stocks cannot be legally leased to oil companies and traders other than to the four domestic refiners. Domestic refiners may resell government stocks to third parties if product stocks are leased by KNOC, but they are prohibited from reselling government crude stocks. The pricing scheme for the lease of government stocks is based on international oil prices, the Korean economic situation and other relevant factors, including market interest rates.

For the first week following the government decision to release public stock, the maximum drawdown rate will be 5.2 mb/d, falling to 3.4 mb/d during the second week and 1.7 mb/d during the third week.

The minister of MOTIE can also take the initiative to lower the minimum stockholding obligation on industry. The minister has to bring the proposal forward to the National Assembly for approval, which usually takes more than 20 days.

There is a flexibility mechanism in Korea, called a short-term loan, which allows the government to loan small amounts of government stocks to domestic private companies for short time periods in case of temporary supply disruptions. KNOC can lease such oil stocks within one week to private entities; they, in turn, will be required to reimburse the same amount and type of oil with an agreed interest rate at a later stage.

When stock is released under the IJS Project, foreign companies are required to deliver the crude oil to KNOC within 90 days after KNOC exercises its pre-emptive right to buy crude stocks.

### **Financing and fees**

Construction of government stockpiling facilities has been funded by the budget of the central government. Funds to purchase the oil for public stocks have been provided from both the central government budget and KNOC's internal revenues. Operational costs of government stocks are financed from the central government budget or KNOC's revenues. The average maintenance cost for government stocks in 2012 was USD 0.48 per barrel for crude and USD 1.87 for refined products.

The Korean government does not provide financial support for building compulsory industry stocks. All refiners and importers must self-fund the operational costs of meeting emergency requirements, which are then passed on to consumers.

## *Other measures*

### **Demand restraint**

The minister of MOTIE would make a decision on demand restraint measures according to the severity of the oil supply disruption. Measures are expected to be introduced according to the alert levels in a colour-coded system.

Korea's demand restraint measures would range from light-handed measures to medium-handed and heavy-handed. In Korea, the public sector plays a leading role in energy savings. Major demand restraint measures cover not only the transport sector, but also the residential and industry sectors. Violators would be given a seven-day grace period but would thereafter be fined up to USD 2 800 for contravening the regulations.

Under the colour-coded system on the supply side, it is foreseen that voluntary demand restraint measures would be implemented at its initial stage. If the energy alert level is raised from yellow to orange, mandatory demand restraint measures are expected to be introduced in the public sector. In case the energy alert level reaches red, mandatory demand restraint measures will be applied both in the public and in the private sectors.

The administration creates and manages inspection units to monitor the implementation of demand restraint measures. The prime minister's office can establish a joint inspection unit with central government departments and public entities in the energy sector. This unit conducts spot inspections for the public sector and publishes the inspection results. MOTIE can also set up a joint inspection unit with local governments and public entities in the energy sector. MOTIE is in charge of monitoring the private sector, and is authorised to impose fines on individuals and entities for non-compliance with mandatory demand restraint measures.

### Fuel switching

Short-term fuel switching from oil to other fuels is not regarded as an emergency response measure in Korea, as the share of oil in power generation was only 4% in 2012.

### Other

Because of the small amount of indigenous oil production, surge production is not considered an emergency response measure in Korea.

## Gas

### Market features and key issues

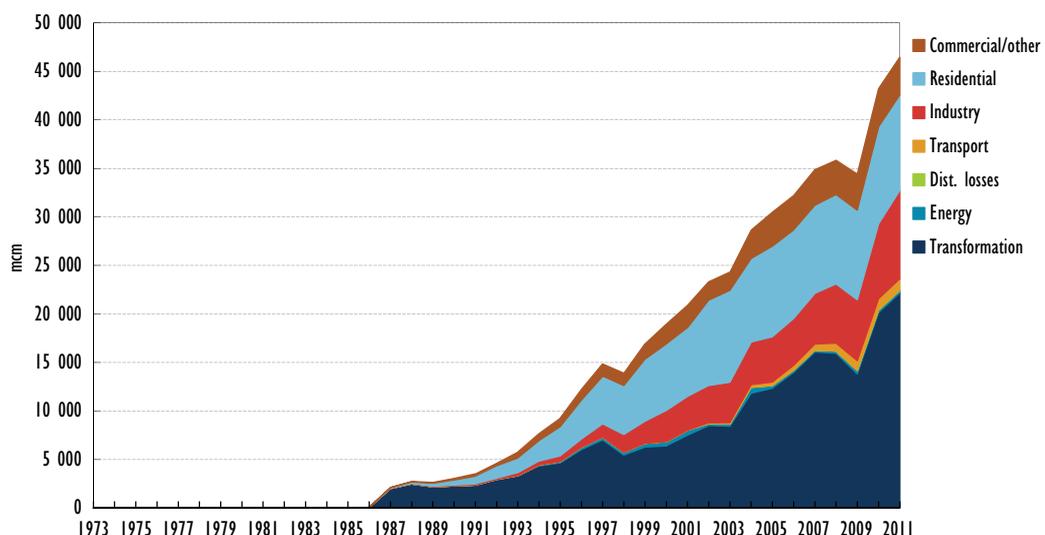
#### Gas production and reserves

Korea produced about 0.4 bcm of natural gas in 2012, which covered less than 1% of total consumption. Because of its very small indigenous gas production, almost all gas demand in Korea is met by imports.

#### Gas demand

Korea's gas demand steadily increased from 19 bcm in 2000 to 50 bcm (137 mcm/d) in 2012. In 2011, the transformation sector represented about 48% of the total gas consumption, with the residential sector representing 21% and industry sectors 20%.

Figure 4.16.6 Natural gas consumption by sector, 1973-2011



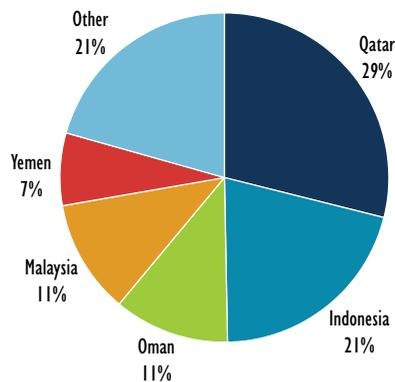
Gas demand in Korea peaks in winter when gas consumption significantly increases for heating and cooking. Daily peak gas demand in 2012 reached 251 mcm/d in January of that year.

### Gas import dependency

Korea's total natural gas imports in 2012 amounted to 49.5 bcm (136 mcm/d). KOGAS is the largest LNG import company in the world, with a share of 95% of Korea's total gas imports in 2012.

In 2012 Qatar was the largest supplier of natural gas to Korea (30%), followed by Indonesia (18%), Oman (12%), Malaysia (12%) and Yemen (7%). KOGAS imports 80% to 90% of LNG through mid- to long-term contracts.

Figure 4.16.7 Natural gas imports by source, 2012



### Gas company operations

KOGAS is listed on the Korean Stock Exchange, but the major shareholders are government entities, such as the central government (26.9%), KEPCO (24.5%) and local governments (9.6%). As a public enterprise, KOGAS dominates the Korean wholesale market for natural gas in all its aspects, including LNG imports, transmission network, storage and sales activities.

The retail market for gas is made up of 30 private city gas companies with exclusive retail sales rights within their respective regions.

## Gas supply infrastructure

### Ports and pipelines

Four LNG terminals operate in Korea; three are owned and operated by KOGAS. In addition to KOGAS, the privately owned Pohang Iron and Steel Company (Posco) operates a LNG terminal in Gwangyang to support the power plants of Posco and K-Power.

The four terminals have the capability to handle and supply about 128 bcm per year (350 mcm/d) to the Korean national gas transmission system. The fourth LNG terminal belonging to KOGAS, which is in Samcheok, has a regasification capacity of 2.3 bcm per year; it is estimated to be completed by 2014.

Korea has no cross-border gas pipelines. Its nationwide trunk lines, with a total length of 3 588 km, are owned and operated by KOGAS. It plans to further expand the nationwide pipeline grid and the pipeline network will increase its length to 4 928 km by 2027.

In September 2008, KOGAS and Gazprom signed a memorandum of understanding (MoU) for Russia to supply the Republic of Korea with 10 bcm of natural gas per year for 30 years via North Korea. North Korea had not given its consent to the construction of an international gas pipeline running through its national territory until a bilateral summit in August 2011, when then President Medvedev of Russia and Kim Jung-Il of North Korea agreed on the development of a gas pipeline to South Korea. It is uncertain however, whether and when the planned pipeline project will materialise. Nevertheless, South Korea and Russia intend to continue to carry forward this project.

### **Storage**

Korea has no underground natural gas storage facilities. Almost all natural gas storage facilities are in the form of LNG storage tanks and their ancillary facilities. At the end of December 2012, Korea had 64 tanks at 4 LNG terminals, with a total storage capacity of 9.3 mcm of LNG (equivalent to 5.8 bcm of natural gas). The total storage capacity was theoretically able to cover about 42 days of average gas demand in 2012. KOGAS owns roughly 97% of the country's total storage capacity at three LNG terminals in Incheon, Pyeongtaek and Tongyeong; the remainder is held by Posco at its LNG terminal in Gwangyang. The maximum withdrawal rate of the three KOGAS storage facilities is about 350 mcm/d.

There are no storage facilities outside of Korea which are accessible to its supply network. Korea's 11th Long-term Natural Gas Supply/Demand Plan envisages that its gas storage capacity will expand from 4.4 bcm to 9.4 bcm in 2017. Under this plan, the Donghae gas field is expected to be converted to a storage facility with a capacity of around 1.5 bcm in 2020.

## *Emergency policy*

Key elements of Korea's overall gas security policy are to diversify supply sources, ensure LNG supply on the basis of long-term contracts, expand storage capacity and secure a sufficient supply of gas for high seasonal demand.

Korea has no government gas stocks or mandatory industry stocks. However, KOGAS has internal criteria for holding gas stocks. KOGAS holds two types of stocks: "minimum stocks" and "safety stocks". Minimum stocks enable storage facilities to operate under normal conditions, whereas safety stocks are used to successfully handle any discrepancy between demand and supply which may arise from unexpected market changes, including sudden gas supply disruptions. The level of the safety stocks varies from some 585 mcm in summer to 920 mcm in winter, depending on the gas demand.

There is no clear legal basis for emergency planning and managing crisis situations that affect the natural gas system in Korea. KOGAS is in charge of Korea's overall domestic supply of natural gas except for large-scale companies which import LNG for their own use. KOGAS, the transmission system operator (TSO), plays a major role in emergency planning and managing crisis situations in consultation with the gas division of MOTIE.

### **Emergency response measures**

In the initial stage of a gas emergency, when a shortage of gas supply is anticipated (Phase I), KOGAS will secure additional volumes of LNG on a commercial basis by securing spot cargoes, cargo swaps and cargo rescheduling. KOGAS has signed master agreements with its major gas suppliers for the supply of LNG in such circumstances. KOGAS has also developed regional co-operation for gas emergency response with Japanese LNG importers, by swapping LNG cargoes.

In case the measures in Phase I are not sufficient, MOTIE will discuss the situation with major gas users and urge them to reduce gas demand for power generation (Phase II). Subsequently, fuel switching at power plants from gas to other fuels such as fuel oil will be implemented.

If the measures taken in Phase I and II do not restore the state of Korea's natural gas security, according to Article 24 of the City Gas Business Act, the minister may decide on the phased reduction of gas supply to power generators or city gas companies (Phase III). Interruptible contracts do not exist in Korea.

The maximum withdrawal rates of the three storage facilities of KOGAS stand at some 350 mcm/d.

Surge production of natural gas is not regarded as an effective response measure in a gas crisis because of the negligible indigenous gas production in Korea.

Fuel-switching capacity from gas to oil is estimated to be about 2.6 mcm/d of natural gas, which was equivalent to less than 2% of the average gas demand in 2012. In order to implement the fuel switching from gas to oil, some 14 kb/d of fuel oil (Bunker-C) would be required. However, gas-fired power plants in metropolitan areas, such as Seoul and Gyeonggi province, are not allowed to conduct fuel switching because of environmental restrictions. Furthermore, gas-fired power producers are not required to hold a certain amount of backup fuel reserves. In practice, about 21 kb of fuel oil is stored as backup fuel on site.