

# COUNTRY ANALYSIS BRIEFS

## South Korea

Last Updated: Oct. 11, 2011

### Background

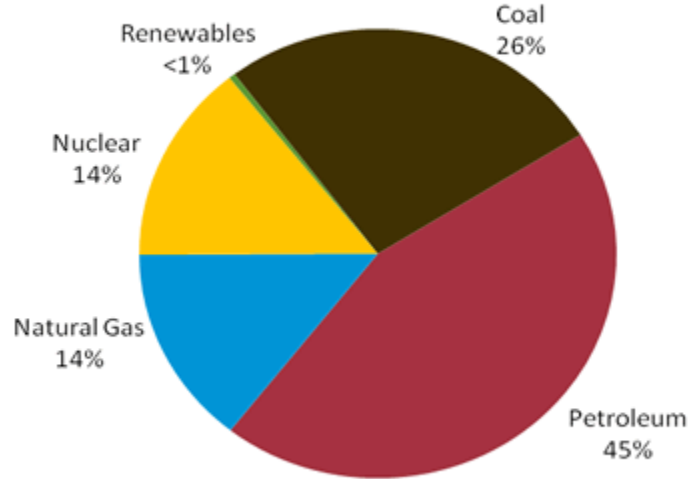
**South Korea is a major energy importer, including oil, natural gas, and coal.**

South Korea was the world's tenth largest energy consumer in 2008, and with its lack of domestic reserves, Korea is one of the top energy importers in the world. The country is the fifth largest importer of crude oil, the third largest importer of coal, and the second largest importer of liquefied natural gas (LNG). South Korea has no international oil or natural gas pipelines, and relies exclusively on tanker shipments of LNG and crude oil. Despite its lack of domestic energy resources, South Korea is home to some of the largest and most advanced oil refineries in the world. In an effort to improve the nation's energy security oil, gas, and electricity companies are aggressively seeking overseas exploration and production opportunities.



Although oil accounted for the largest portion (45 percent) of South Korea's primary energy consumption in 2008, its share has been declining since the mid-1990's, when it reached a peak of 66 percent.

### South Korea's Total Primary Energy Consumption by Type, 2008



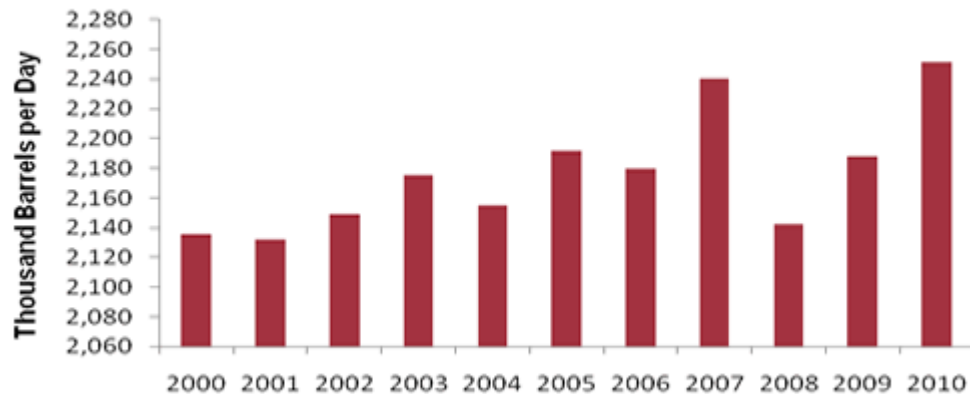
Source: U.S. Energy Information Administration

## Oil

**South Korea has a large refining sector, but relies on crude imports for all of its oil needs.**

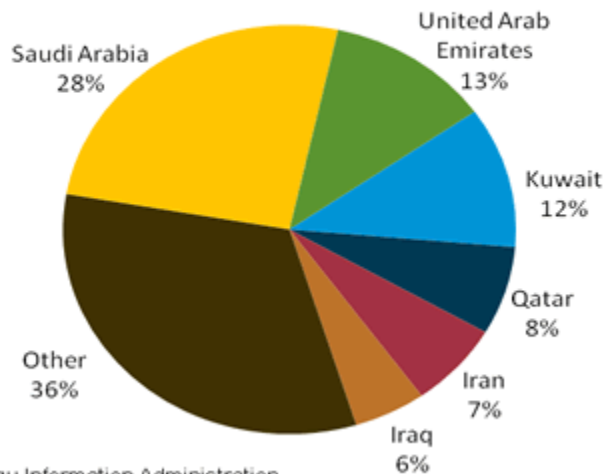
South Korea consumed over 2.2 million barrels of oil per day (bbl/d) in 2010, making it the ninth largest consumer of oil in the world. The country has no proven domestic crude oil reserves, and is wholly reliant on imports to meet its demand. Although there is no domestic crude oil production, both its state-owned and private oil companies engage in numerous overseas exploration and production projects. South Korea is home to three of the ten largest crude oil refineries in the world, and produced almost 2.5 million bbl/d of refined products in 2009.

### South Korean Oil Consumption, 2000-2010



Source: U.S. Energy Information Administration

Following a period of rapid growth that lasted through the 1990's, South Korea's oil consumption has remained relatively steady over the past decade. South Korea imported over 3.1 million bbl/d of total oil in 2010, and was the world's fifth largest crude oil importer in 2010 at 2.4 million bbl/d. South Korea is highly dependent on the Middle East for its oil supply, with the Persian Gulf accounting for nearly 75 percent of its 2010 total oil imports. Saudi Arabia was the leading supplier, and the source of more than a quarter of total oil imports. The industrial sector accounts for more than half of South Korea's oil end-use consumption, largely due to its significant petrochemical industry.

**South Korea's Oil Imports by Source, 2010**

Source: U.S. Energy Information Administration

### Sector Organization

The Korea National Oil Corporation (KNOC) is the largest entity in the country's upstream sector with a daily production capacity of 50 thousand bbl/d in 2009 at its overseas production sites. KNOC has executed its strategic plan to develop into a top-50 oil company by 2012 with a production capacity of 300 thousand bbl/d and 2 billion barrels of oil and gas reserves. KNOC has pursued this goal through both acquisitions of overseas companies as well as cooperation with major international and national oil companies.

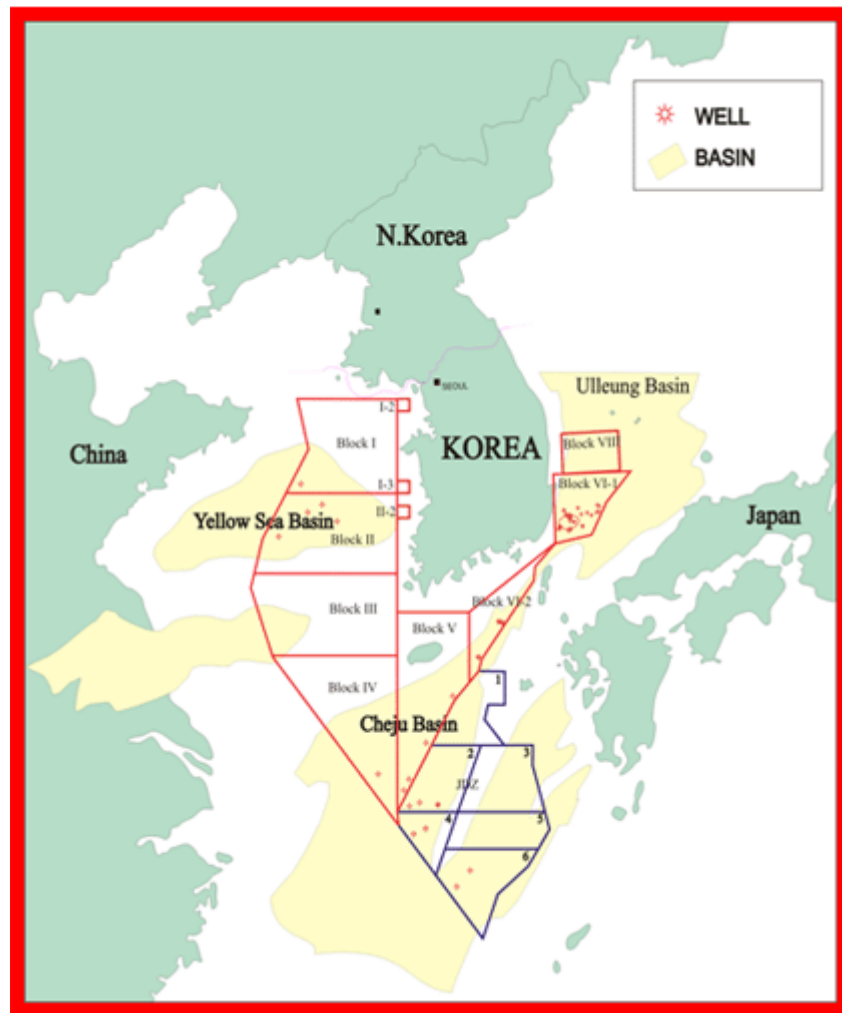
Korea's downstream sector is home to several large international oil companies including SK Energy, the nation's largest International Oil Company (IOC). SK Energy has a roughly 34 percent share of the petroleum product market (excluding LPGs), followed by GS Caltex, S-Oil, and Hyundai Oilbank. These corporations have historically focused on refining, but some have put increasing emphasis on crude extraction projects in other countries. SK Energy also owns the largest stake in the Daehan Oil Pipeline Corporation (DOPCO), which exclusively owns and manages Korea's oil pipelines, although most of the country's oil is distributed in tankers or tank trucks.

The Korea-Oil Producing Nations Exchange (KOPEX) was started in 2006 by the Korea Petroleum Association (KPA) to maintain good relations with supplier nations and to offer technology training to producing nations in the downstream sector. The Ministry of Knowledge Economy has established oil and gas self-sufficiency targets for South Korean companies of 20 percent of all imports in 2012, and the government provides financial support to win bids through the Special Accounts for Energy and Resources (SAER), administered by KNOC, for support on exploration and production projects.

### Exploration and Production

In spite of South Korea's lack of known oil reserves, new technologies have allowed KNOC to begin investigating the largely unexplored Ulleung, Yellow, and Jeju Basins for possible drilling sites. KNOC's domestic upstream earnings come primarily from natural gas production at the Donghae-1 gas field (see Natural Gas section). Although new discoveries might improve domestic oil prospects, overseas exploration and production (E&P) plays an essential role in Korea's oil industry, with 189 projects in 36 countries, 43 of which were in production as of December, 2010.

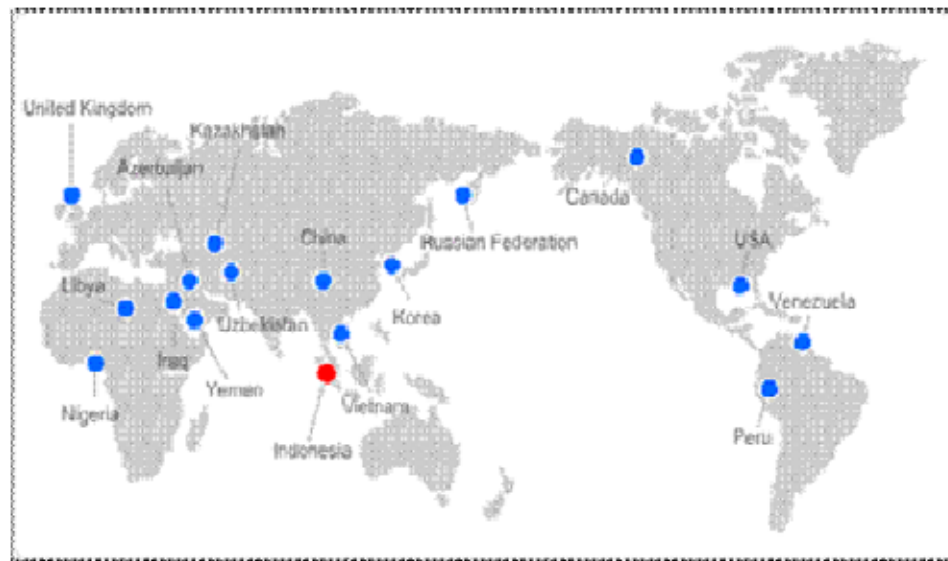
#### *KNOC's Domestic Exploration Blocks*



Source: KNOC

The Korean government has helped to encourage private E&P overseas through tax benefits and the extension of credit lines to IOCs by the Korea Export-Import Bank, as well as by providing diplomatic aid in overseas negotiations. KNOC has oil interests in production fields in Vietnam and the Gulf of Mexico, in addition to exploration and development projects in several other countries (see map below for greater detail). Through the company's oil acquisition of Harvest Energy in Canada, KNOC acquired the lease for BlackGold Oilsands, an oil sands site with an estimated 259 million barrels of recoverable bitumen reserves. KNOC also acquired two other overseas oil companies in 2009 – SAVIA-Peru and Kazakh Sumbe – and obtained a majority share in UK-based oil company Dana Petroleum in September of 2010.

*KNOC's Global Exploration Projects*



Source: KNOG

### Downstream and Refining

According to *Oil and Gas Journal*, South Korea had 2.7 million bbl/d of crude oil refining capacity at six facilities as of January 1, 2011. South Korea has the sixth largest refining capacity in the world. The country's three largest refineries are owned by SK Energy, GS Caltex, and S-Oil, the latter of which is partially owned by Saudi Aramco.

#### South Korea's Oil Refineries, as of January 1, 2011

Owner	Location	Capacity (barrels per day)
SK Energy Corp.	Ulsan	817,000
GS Caltex Corp.	Yeosu	750,000
S-Oil Corp.	Onsan	565,000
Hyundai Oil Refinery Co.	Daesan	310,000
Hyundai Oil Refinery Co.	Inchon	270,000
Hyundai Lube Oil	Busan	9,500

Source: *Oil & Gas Journal Refinery Survey*

Korean refineries are increasingly producing more light clean products as a result of refinery upgrades that have taken place in recent years. The increasing sophistication of the Korean refining market is likely to increase capacity utilization, which is already quite high for some refineries. As a result, Korea is expected to remain a leading refiner in its region, with significant exports to China, Singapore, and Indonesia. Korean refiners are taking their expertise in capacity expansion and construction to other parts of the world as well, with foreign oil companies, especially in the Middle East, granting several major Engineering, Procurement, and Construction (EPC) contracts to Korean oil companies in the first half of 2010.

South Korea is also a major producer of petrochemicals with 7.3 million tons per year of ethylene capacity. Most of the nation's petrochemical plants are integrated into larger refineries such as Inchon, Ulsan, and Daesan. South Korea is home to the single largest aromatics production site in the world, owned by GS Caltex. Upcoming Korean refinery projects include S-Oil's construction of a new Benzene, Toluene, and Xylene (BTX) plant worth \$1.2 billion, which broke ground in spring 2010.

### Oil Dependence and Outlook

According to the Korea Energy Economics Institute, oil will account for less than 40 percent of

total primary energy consumption by 2012 due to an expected increase in the use of natural gas and nuclear power. Other factors affecting long-term demand include more stringent efficiency standards and a population that will begin to decline in 2019. In response to South Korea's new energy demands, oil companies have not only upgraded refining facilities and increased upstream investment, but have also begun investing in alternative energy projects. KNOC also plans to increase its oil inventories to 141 million barrels by 2013, with an additional 101 million barrels to be held by the government as international co-operative stocks.

## Natural Gas

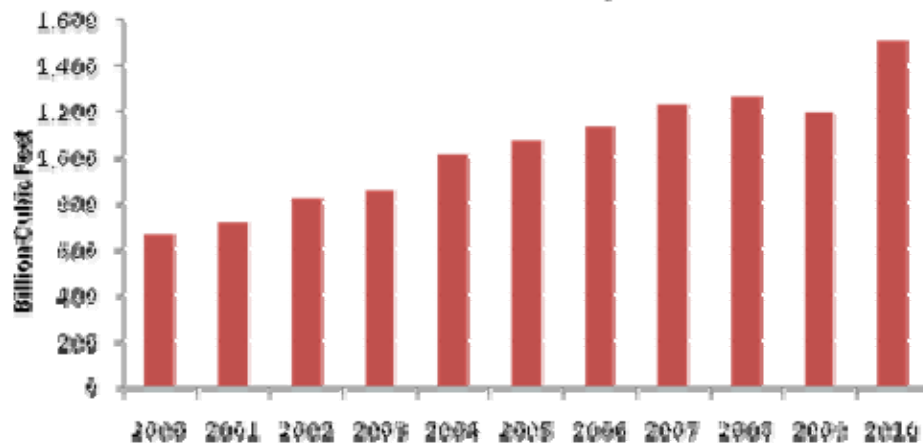
***South Korea is the second-largest importer of liquefied natural gas in the world behind Japan.***

South Korea relies on imports to satisfy nearly all of its natural gas consumption, which has approximately doubled over the previous decade. Domestic gas production is negligible, and accounts for less than two percent of total consumption. South Korea does not have any international gas pipeline connections, and must therefore import all gas via LNG tankers. As a result, although South Korea is not among the group of top gas-consuming nations, it is the second largest importer of LNG in the world after Japan.

### Consumption

South Korea consumed 1.5 Trillion cubic feet (Tcf) of natural gas in 2010, which was an increase of 25 percent from 2009, a year in which gas consumption declined slightly. This recession-driven decrease was primarily the result of reduced demand from the electric power sector. The city gas network - which serves residential, commercial, and industrial consumers - accounts for the majority (64 percent in 2009) of natural gas sales, while power generation companies account for nearly all of the remainder.

**South Korea's Natural Gas Consumption, 2000-2010**



Source: U.S. Energy Information

### Sector Organization

Korea Gas Corporation (KOGAS) dominates South Korea's gas sector, and the company is the largest single LNG importer in the world. In spite of recent efforts to liberalize the LNG import market, KOGAS maintains an effective monopoly over the purchasing, import, and wholesale distribution of natural gas. In addition to operating three of Korea's four LNG receiving terminals, KOGAS owns and operates the 1,726-mile national pipeline network, and wholesales regasified LNG to power generation companies and private gas distribution companies.

The Korean central government is the largest KOGAS shareholder with 26.9 percent direct equity, and an additional indirect 24.5 percent via the Korean Electric Power Company (KEPCO). Korea has 30 private distribution companies, but each has an exclusive sales right within a particular region. These local companies purchase wholesale gas from KOGAS at a government-approved price, and sell gas to end-users. Since June 2011, city gas companies have been allowed to source gas produced from coal or refineries, as gas demand peaks in winters, while wholesale gas prices have been frozen by the government to protect end-users.

In the upstream, KOGAS has historically focused primarily on overseas LNG liquefaction projects, while the Korea National Oil Corporation (KNOC) has handled most exploration and production-

related activities. As KOGAS seeks new opportunities for growth however, its focus on overseas upstream activities is increasing.

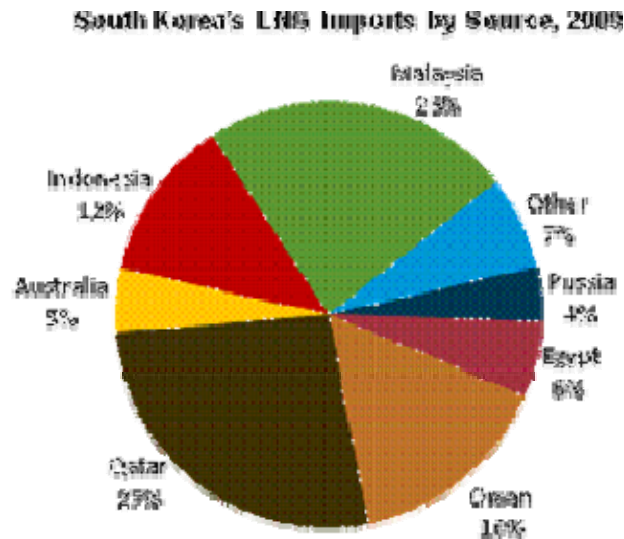
### Exploration and Production

South Korea produced about 19 Bcf of natural gas (about 1.3 percent of consumption) in 2010 from the only domestic gas field in production, Donghae-1 in the Ulleung Basin. The Korea National Oil Corporation (KNOC) will continue production operations until 2018, when the project will be converted into an offshore storage facility. State-owned Gas Hydrate Research & Development has conducted studies of deposits of methane hydrates in the Sea of Japan, and the government has previously announced plans to start extracting methane hydrates from the sea by 2015.

As part of the effort to develop into a global integrated energy company, KOGAS is participating in overseas E&P projects in 17 blocks in over 11 countries. South Korea has a minority equity share in three production-stage projects, namely 3.0 percent in Qatar's RasGas project, 8.9 percent in Yemen's YLNG project, and 1.2 percent in Oman's Oman LNG project. It is KOGAS' mid-term goal to secure 25 percent of imports from equity production sources by 2017.

### Liquefied Natural Gas

There are four LNG regasification facilities in South Korea, with a total capacity of 2.6 Tcf per year. KOGAS operates three of these facilities (Pyongtaek, Incheon, and Tong-Yeong), accounting for more than 97 percent of current capacity. Pohang Iron and Steel Corporation (POSCO) and Mitsubishi Japan jointly own the only private regasification facility in Korea, located on the Southern Coast in Gwangyang. In 2009, South Korea imported 1.2 Tcf of LNG. KOGAS purchases most of its LNG through long-term supply contracts, and uses spot cargos primarily to correct small market imbalances. Almost 80 percent of 2009 natural gas imports came from Qatar, Malaysia, Oman, and Indonesia.



Source: U.S. Energy Information Administration

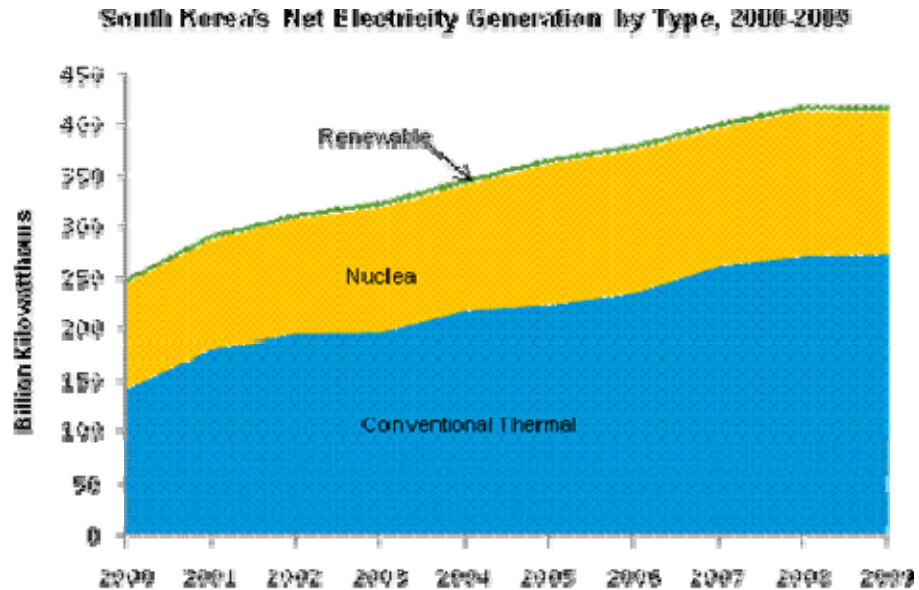
Twenty-three percent of current regasification capacity has been added since 2005, and the government has developed a long term gas supply and demand plan in December 2010 which calls for expanding transmission and pipeline distribution infrastructure, independent development of gas resources with long-term LNG contracts, and increases in gas inventory storage. In addition to recent expansion of existing facilities, KOGAS is currently constructing a new LNG receiving facility at Samcheok, on the Northwest coast. The first stage of 278 Bcf per year is slated for 2013 completion. Additional supplies are expected to be met primarily through gas imported from Vladivostok, Russia starting in 2015. Although the associated 2008 KOGAS-Gazprom memorandum of understanding indicated that the gas could be imported either as LNG or via pipeline from Vladivostok, Russian and Korean leaders recently acknowledged that the

pipeline construction option will most likely not be deemed economically feasible without the cooperation of North Korea.

## Electricity

***Nuclear power accounts for more than one third of South Korea's electricity generation.***

South Korea generated about 417 Billion Kilowatthours (BkWh) of net electricity in 2009. Of this amount, 65 percent came from conventional thermal sources, 34 percent came from nuclear power, and roughly one percent came from renewable sources. Although thermal capacity is dominant in Korea at present, nuclear power is set to expand over the next decade, along with significant investment in offshore wind farms.



Source: U.S. Energy Information

## Sector Organization

Prior to the restructuring of Korea's electricity sector, the state-owned Korea Electric Power Corporation (KEPCO) dominated all aspects of electricity generation, retail, transmission, and distribution. In 2001, KEPCO's generation assets were spun off into six separate subsidiary power generation companies. Although the initial restructuring included plans to subsequently divest KEPCO of these generation companies (excluding the Korea Hydro & Nuclear Power Company), the process was repeatedly delayed. In August of 2010, Korea's Ministry of Knowledge Economy announced that the government will instead take direct control of five of the six generation companies, but Korea Hydro & Nuclear Power Co. will remain independent.

The Korea Electric Power Exchange (KPX), also established in 2001 as part of the electricity sector reform efforts, serves as the system operator and coordinates the wholesale electric power market. KEPCO continues to act as the electricity retailer, and controls transmission and distribution. In 2008, KEPCO's subsidiaries still held about 82 percent of generation assets, even though independent power producers have been allowed to participate in the system since 2001.

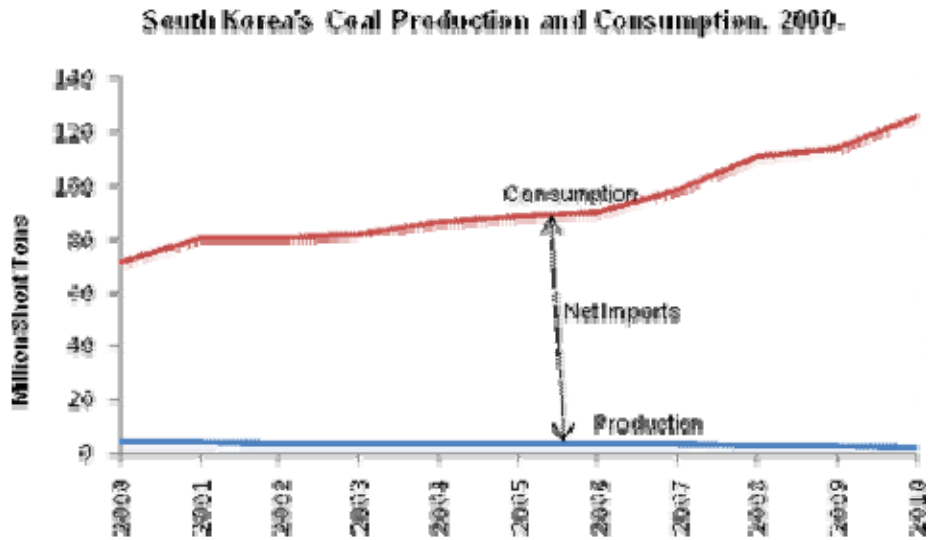
KPX regulates the cost-based bidding-pool market, and determines prices sold between generators and the KEPCO grid. An electricity tariff pricing system, designed to protect low-income residents and industrial consumers, has historically not reflected the true costs of generation and distribution, or provided incentives to conserve electricity. The Ministry of Knowledge Economy (MKE) must approve all changes in end-use electricity prices.

## Coal

South Korea holds only 139 million short tons (MMst) of recoverable coal reserves. Consumption reached 126 MMst of coal in 2010, while production was less than 3 MMst. As a result, South Korea is the third largest importer of coal in the world, following only Japan and China. Australia and Indonesia account for the majority of South Korea's coal imports. Coal consumption in South



Korea increased by over one-third between 2005 and 2010, driven primarily by growing demand from the electric power sector. The electric power sector accounts for more than half of coal consumption, while the industrial sector accounts for most of the remainder.



Source: U.S. Energy Information

### Generation Structure

South Korea generates the majority of its electricity from conventional thermal sources. According to the Korea Energy Economics Institute, in 2008 about 67 percent of thermal generation was coal-fired, 29 percent was natural gas-fired, and less than 3 percent was oil-fired.

South Korea has the sixth-highest nuclear generation capacity in the world. Its first nuclear plant was completed in 1978, and over the following three decades, South Korea directed significant resources towards developing its nuclear power industry. Korea Hydro & Nuclear Power Co. currently operates South Korea's four nuclear power stations, with 20 individual reactors. Fourteen additional reactors are scheduled to be completed by 2024, with the goal of generating nearly half of the power supply from nuclear sources. South Korea's government reaffirmed its nuclear strategy in mid-2011. Emerging as an international leader in nuclear technology, Korea is pursuing opportunities to export its technologies. In December of 2009, KEPCO won a \$20 billion contract to build four 1,400 megawatt nuclear reactors in the United Arab Emirates, the first of which is expected to become operational by 2017.

A renewable portfolio standard was passed by the National Assembly of South Korea in 2010, which will become effective in 2012 with a beginning renewable electricity quota of 2 percent of total generation. Renewable sources remain a small share of South Korea's electricity generation, with hydropower being limited to small dams on the Han River, and a 1 BKW pumped-storage facility at Yangyang, 120 miles from the capital of Seoul. The Korean government plans to invest \$8.2 billion into offshore wind farms in order to reach a wind capacity of 2.5 BKW by 2019, from only 0.3 BKW in 2008.

## Links

### EIA Links

[EIA – South Korea Country Energy Profile](#)

### U.S. Government

[CIA World Factbook - South Korea](#)

[U.S. State Department Background Notes - South Korea](#)

[U.S. Consular Information Sheet - South Korea](#)

[U.S. Library of Congress Country Study - South Korea](#)

[U.S. Embassy in South Korea](#)

**Foreign Government Agencies**

[South Korea - Ministry of Knowledge Economy \(MKE\)](#)  
[South Korea -](#)

**Oil and Natural Gas**

[Daehan Oil Pipeline Corporation \(DOPCO\)](#)  
[GS Caltex Corporation](#)  
[Hyundai Oilbank](#)  
[Korea Gas Corporation \(KOGAS\)](#)  
[Korea National Oil Corporation \(KNOC\)](#)  
[Korea Petroleum Assoc](#)  
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**Electricity**

[Korea Electric Power Corporation \(KEPCO\)](#)  
[Korea Electricity Commission \(KOREC\)](#)  
[Korea Hydro & Nuclear Power Company](#)  
[Korea Power Exchange](#)

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