Addressing South Korea's Greatest Strategic Vulnerability: Options for Decreasing Energy Dependency

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ABSTRACT

South Korea is almost entirely dependent on foreign imports for its energy needs. For oil, the country is completely reliant on imports. Korea is actually one of the world's leading petroleum importers, depending on the Middle East for over 80 percent of its imports. This form of dependency, or "super-dependency," presents perilous risks for the country's strategic outlook. In order for Korea to avoid becoming hopelessly marginalized by global petroleum price volatility, increasingly competitive world demand, and associated geopolitical hazards, South Korea must develop a viable strategy to address this strategic vulnerability. This paper explores Korea's energy super-dependency, examines past and present energy policies and mitigating strategies, and assesses whether the current path will effectively put the country on course to reduce risk, overcome its fragility and move forward with a sound energy plan. Finally, options and ideas are proposed for further consideration and evaluation by Korea's energy strategists.

Key Words: Korea, Energy, Strategy, Oil, Petroleum, Import, Vulnerability, Dependency, KNOC, KOGAS, LNG, Lee Myung-bak, Low Carbon, Green Growth

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Introduction

Energy is the lifeblood which powers the world's economic and societal engines. It is required to produce and move goods, as well as to support all aspects of daily human activity. Without it, modern societies cannot function. Therefore, a pragmatic country strives to create and shape conditions which favor adequate supplies of affordable energy for its people, businesses and institutions. Unfortunately, the raw materials required to produce energy are not evenly distributed throughout the world. Thus, countries lacking sufficient resources must develop careful plans to seek out and obtain unobstructed access to supplies. In this regard, the Republic of Korea (referred to as 'Korea' from this point forward) is a case in point.

Korea's requirement for energy is large, and it continues to grow. From the machines that power its steel mills through the day to the lights that burn brightly through the night at its multitudinous *hagwon*, Korea needs enormous supplies of uninterrupted energy to provide power for its 48 million people. A constant and ubiquitous flow of energy is required to sustain the country's households, businesses, transit, and particularly, its bountiful industrial output. In fact, most of Korea's daily energy flow is directed to the county's industrial sector, where it feeds a manufacturing wellspring of ships, cars, electronics, and other machines and goods for entry into the global marketplace. Virtually all of the energy produced to support these vital activities can be attributed to a steady stream of imported feedstock. This is because Korea possesses virtually none of the natural resources needed to produce energy in its country. Korea is thus rendered almost entirely dependent on expensive foreign imports for its energy needs, an unenviable position for any country, but particularly unpalatable for one that depends on energy intensive industrial capacity to produce goods for export. This extreme form of dependency, or "super-dependency", is perhaps Korea's greatest strategic vulnerability.

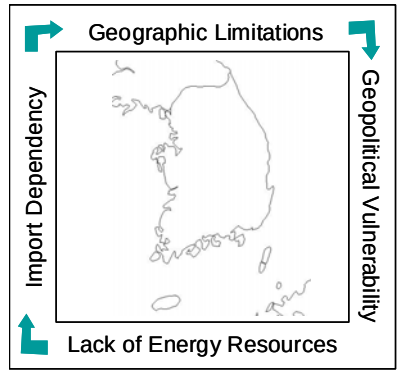
It should be noted at the outset of this article that Korea has successfully adopted measures over the years to enhance and increase its energy security. However, while strides have been made to diversify both foreign suppliers and the mix of natural resources streaming into the country, questions remain as to whether significant progress has been made to address import dependency. Accordingly, Korea is increasingly at risk of being tossed about in a perfect storm composed of volatile petroleum price swings, ballooning global demand for oil, and dangerous geopolitical maneuverings of supplier countries. In order to avoid becoming marginalized, Korea must develop a viable strategy to address its strategic vulnerability of super-dependency. This article will explore

Korea's energy super-dependency, examine past and present policies and strategies intended to mitigate energy vulnerabilities, and determine whether the current strategic trajectory will effectively put the country on course to reduce risk, overcome its fragility and move forward with a sound energy plan.

"Boxed in"

Korea's evolving strategic approach to energy and energy-related policy has been contiguously bounded by four daunting constraints: (1) lack of resources; (2) dependency on imports; (3) geographic limitations; and, (4) vulnerability to geopolitics. These limitations can be viewed as a set of causally-connected conditions, with the foremost being Korea's dearth of natural resources required to produce energy. Lacking the necessary raw materials, Korea is almost totally dependent (super-dependent) on imported energy resources. As such, Korea must reach beyond its borders to secure supplies of energy resources. However, Korea's geographical position on the globe does not make this an easy task. Since countries in close proximity to Korea are not conjoined in a complementary regional energy arrangement, the country must reach well beyond its regional neighbors for sources of supply, relying in large measure on the Middle East and the Organization of the Petroleum Exporting Countries (OPEC). This leaves Korea highly susceptible to geopolitical hazards which can occasionally result in shock and disruption. The aforementioned constraints are bound tightly together, leaving Korea "boxed in" with limited working space to enhance its energy policies and strategies.

Figure 1. "Boxed in"[1]



Lack of Resources

Korea's prevailing energy constraint lies in the materials it lacks to produce the very energy it consumes. In terms of consumption, Korea's primary energy resources are petroleum, coal, uranium, and natural gas.

Petroleum constitutes 43 percent of Korea's total energy consumption. Following petroleum is coal at 24 percent, uranium at 16 percent and natural gas at 14 percent. Roughly 3 percent comes from hydro-electric and other renewable sources. Korea must import all of the oil, uranium, and nearly all the coal and natural gas that it consumes, resulting in a 97 percent dependency rate.[2] The industrial sector soaks up 56 percent of all the energy produced in the country. Korea, a global leader in shipbuilding, semiconductors, digital electronics, and automobiles, was ranked 11th in the world in 2007 for overall trade volume.[3] Energy consumption in the industrial sector is critically needed to fuel the individual industries which are hallmarks of Korea's export-led economy. Roughly 54 percent[4] of the energy used to sustain Korea's industrial sector comes from petroleum. Simply stated, Korea's economy relies on its industrial sector to produce goods for export and its industrial sector relies on imported petroleum. Thus, in general, while Korea is dependent on imports for all the major constituent materials to produce its energy—oil, coal, natural gas, and uranium—the country is dangerously dependent on imported oil.

Dependency on Imports

Lacking requisite materials, Korea has become a major global importer of non-renewable and fossil energy resources. Currently, Korea is the third largest importer of crude oil in the world.[5] Additionally, the country is the second largest importer of liquefied natural gas (LNG). The Korea Gas Corporation (KOGAS) is the sole provider of LNG in Korea and the largest purchaser of LNG in the world.[6] As of 2007, Korea is also the world's second largest importer of coal.[7] Uranium rounds out the list of energy resource imports. Korea is the world's sixth largest importer of the radioactive element, consuming roughly 4,000 tons per year. Korea's uranium suppliers are diverse, with the country importing mostly from Australia, Canada, Kazakhstan, the United States, and France. Additionally, an agreement was signed with Uzbekistan in May 2008, for supplies to begin in 2010.[8] Similarly, Korea's imported coal comes from a diverse set of countries, including Indonesia, China, Australia, Russia, Canada and South Africa.[9] Along similar lines, Korea's LNG suppliers include Indonesia, Malaysia, Qatar and Oman.[10] The storyline changes with regard to petroleum imports. While Korea's petroleum supply is spread out among 16 different countries, 81.7 percent of the total imports come from the Middle East.[11] This further underscores Korea's extreme oil dependence and begins to explain the country's particular susceptibility to oil supply disruption. Korean industry, and thus by extension, the Korean economy and the country's sustained prosperity, is dependent on Middle East oil.

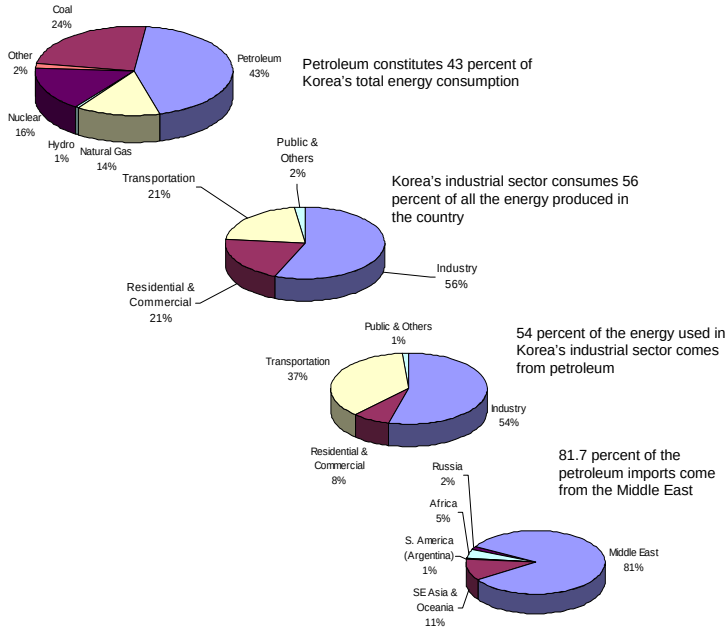


Figure 2. Dependency links tying petroleum and Korean industry to Middle East Oil.

Geographic Limitations

Korea's geographical location presents disadvantages and has led to an arrangement that is a markedly different than, say, the United States. For example, in 2007 the United States' top suppliers of imported crude oil were its border countries, Canada and Mexico.[12] For its energy needs, Korea lacks the convenience of having major suppliers close at hand. The country's entire northern border is cordoned by the Democratic People's Republic of Korea (North Korea). North Korea arterially clogs possible overland pipeline access to the enormous energy supply potential of the Russian Far East, not to mention access to its own coal and uranium resources. Directly to Korea's west lies China, the world's second largest consumer of petroleum and the third largest net importer of oil. To its east lies Japan, the world's third largest petroleum consumer and second largest importer of crude.[13] Japan's energy portfolio and associated vulnerabilities are strikingly similar to Korea's.

China, Japan, and Korea have each expressed great interest in tapping into Russia's Far East energy resources. However, as the country is sandwiched tightly between China and Japan with overland access blocked by its northern neighbor, Korea is not positioned advantageously to compete for Russia's energy supplies. The Korean saying, "The backs of shrimp break when whales fight" comes to mind should a scenario develop where competition heats up. Blocked at its northern border and unable to turn to its immediate neighbors for relief, Korea must reach beyond the region and rely upon the Middle East and costly oceangoing conveyances.

Vulnerability to Geopolitics

Korea's reliance on the Middle East for energy resources means the country is always at risk of injury due to the geopolitics of the region and resultant potential for energy supply disruption. According to the Energy Information Administration, world oil production totaled approximately 85 million barrels of per day in 2007, of which roughly one-half, or over 43 million barrels, was moved by tankers on fixed maritime routes. Roughly 74% of this tanker traffic moves through the Strait of Hormuz and the Strait of Malacca. The Strait of Hormuz is located between Oman and Iran and leads out of the Persian Gulf and the Strait of Malacca links the Indian and Pacific Oceans. Together, these are two of the world's most strategic chokepoints. At its narrowest point, the Strait of Malacca is 1.7 miles wide.[14] Eighty percent of Korea's oil passes through this strait.[15] A disruption to free movement within these shipping lanes would have an immediate and direct effect on Korea's economy. Apart from this very specific scenario, Korea's ties to OPEC oil leave the country vulnerable to disruptions and shocks, the origins of which may not even involve Korea.

When Arab members of OPEC declared an oil embargo in 1973 against the United States and other countries that supported Israel in the Yom Kippur War, oil prices quadrupled, drastically increasing costs for consumers worldwide.[16] Then, during 1979-80, events involving Iran—the Iranian Revolution, deposition of the Shah, the taking of U.S. hostages, and Iraqi invasion of Iran—contributed to nearly tripling the price of oil.[17] The impacts of these "oil shocks" were devastating to Korea's then fragile economy, which suffered a consumer price hike in 1974 close to 25 percent, along with a 29 percent jump in 1979.[18] Korea was hit hardest by the 1979 shock and by 1980, the country's economy moved into a period of temporary decline. For the first time since 1962, Korea posted negative growth, inflation was soaring, and the country's balance-of-payments position had deteriorated.[19] At the time of the shocks, Korea was highly dependent on Middle East oil, and thus very

vulnerable. In 1973, the country was oil-dependent for 54 percent of its energy needs with 85 percent of its imported oil coming from an OPEC triumvirate comprised of Saudi Arabia, Kuwait, and Iran. In 1979, Korea's oil-dependence had increased to 63 percent, with 96 percent of its oil coming from the triumvirate.[20] Amid this second oil crisis, with its economy rapidly degenerating, Korea embarked on a plan of action that still resides at the core of its energy strategy.

Korea's Implicit Core Strategy: Increase Supply, Reduce Dependency

To lessen its vulnerability and enhance its energy security, the Korean government established the Korea National Oil Corporation (KNOC) in 1979 with a charter to manage two major initiatives intended to secure a more stable supply of crude oil: (1) stockpiling and (2) petroleum exploration and development.[21] In the same year, the Korean government promulgated the Rational Energy Utilization Act to address energy efficiency and conservation policies.[22] Also around the same period, Korea began to diversify systematically. First, the country began expanding its energy supply options by developing nuclear power, and by the mid-1980s, LNG was added to its energy portfolio. Korea also expanded its crude oil supplier base well beyond the three-country block of Saudi Arabia, Kuwait, and Iran. Aggregate action taken by Korea to mitigate dependency and bolster supply resulted in the advancement of an apparent, although not stated, energy strategy: *increase supply* and *reduce dependency* through diversification.

Increase Supply – Korea's Cornerstone Strategy

The cornerstone of Korea's energy strategy has been a relentless drive to enhance the "increase supply" piece to Korea's energy strategy through stockpiling and exploration & development. Through the efforts of state-run KNOC, beginning in 1980 and continuing today, Korea has built up a significant strategic reserve of crude oil and petroleum products. The original stockpiling target of 60 days' supply, based on petroleum consumption rates which had been decreasing annually since 1979, was reached in 1988. However, beginning in 1989, Korea's oil consumption started to accelerate and the stockpile level declined precipitously to 26 days.[23]

By 1992, the Korean government enacted a law which imposed mandatory stockpiling of private sector oil. Since 1993, mandatory annual stockpiling quotas based on the previous year's domestic sales volumes and set at a 40-day supply level have been levied on oil refiners and independent oil importers.[24] After the 1997-98 Asian financial crisis, Korea expanded strategic storage capabilities in 1999 through an

International Joint Stockpiling program. Under the program, foreign companies lease surplus storage capacity, thus providing Korea with rent revenue along with a stipulation that in the event of a supply emergency, Korea will have preference to purchase stored stocks at market prices.[25]

In 2001, Korea was invited to become the 26th member of the Paris-based International Energy Agency (IEA). Founded in 1974 in the wake of the first oil shock, IEA is an autonomous body with the Organization for Economic Cooperation and Development (OECD), and represents major energy-consuming nations to work for stability in global energy markets. The key requirement for IEA members is that they hold over 90 days of emergency oil stocks, a milestone Korea, by that time, had surpassed.[26] Thus, the IEA is essentially the industrialized, oil consuming nations' counterbalance to the OPEC cartel. IEA member countries have an obligation to take joint measures to meet oil supply emergencies in accordance with the Agreement on an International Energy Program, the treaty upon which the IEA was established in 1974. Oil supply emergencies and disruptions have numerous potential causes, including geopolitical tensions, terrorism, natural disasters, oil production capacity constraints, and uncertain investment climates. In the event a severe oil supply disruption occurs or is anticipated, the IEA assesses global market impact and the potential need for an IEA response. If it is determined that a response is required, each member country is obligated to make oil available to the market. A member country's share of the response is intended to be proportionate to its share of the total consumption of IEA member countries.[27] As a significant global consumer of oil, this places a heavy burden of responsibility on Korea. Events occurring in a distant corner of the world which negatively impact the global oil market can result in Korea drawing down its stocks. Hurricane Katrina is a case in point.

Hurricane Katrina slammed into the U.S. Gulf Coast in late August 2005, causing death and wide scale destruction. The Gulf Coast is an important U.S. center for natural gas and petroleum production, refining, and distribution, with refineries, storage tanks, pumping stations, pipeline, and ports connected together as a singular strategic supply chain. Hurricane Katrina severely disrupted that system. Concerned that the disruption would have a damaging effect on the global oil market, the IEA took collective action on 2 September 2005 with the support of all IEA member countries. The decision was made to release 60 million barrels of oil to the market over a 30-day period. Korea's Ministry of Commerce, Industry, and Energy (MOCIE, now the Ministry of Knowledge Economy or MKE) met with KNOC and domestic refiners over a two-day period, 4-5 September, and agreed on a plan to release

2.9 million barrels of fuel (2.5 millions barrels of crude, and 0.4 million barrels of refined fuel) from 10 September through 10 October. KNOC successfully completed the stock release on 10 October, as planned. [28] Claude Mandil, IEA's Executive Director, announced that collective action by IEA's member countries had successfully terminated on 22 December.[29] With the country's stock release representing less than 2 percent of its reserves, Korea's participation in the collective event can be positively characterized as a safe and successful exercise in the implementation of the country's petroleum drawdown plan.

By June 2007, KNOC had an operating storage capacity of 121 million barrels, with an actual aggregate inventory of 75.7 million barrels of petroleum stored in both above-ground tanks and underground caverns in nine locations throughout the country. This represented over 140 days of supply when industry-held stocks of 92.6 million barrels were added to the total.[30] KNOC plans to increase storage capacity to 146 million barrels by 2009 with 141 million barrels of petroleum inventory by 2010.[31] In addition to stockpiling initiatives, KNOC is charged with increasing the country's energy supplies through overseas exploration and development projects. These projects also serve to diversify Korea's dependence away from the Middle East. Correspondingly, KNOC is actively engaged, compiling equity in overseas oil production and exploration projects.

Reducing Dependency by Enhancing Supply Diversification

KNOC is currently involved in 16 countries in at least 35 projects involving exploration, development or production of oil or natural gas. Of these projects, eight are producing either oil or gas.[32] According to the Ministry of Knowledge Economy (MKE, formerly MOCIE), Korea is investing $18.5 billion in KNOC to expand production capacity about six times, with a target of reaching 300,000 barrels (of oil equivalent) per day by 2012. This is a six-fold increase from the current 50,000 barrel per day output. Thus by 2012, KNOC will be able to meet roughly 25 percent of Korean's crude oil demand, a significant increase from the current 4 percent. To do this, KNOC will form a strategic alliance with Korea's state-run gas company (KOGAS).[33] It is not clear what the natural gas to oil ratio will be. Active projects are depicted below, according to the country in which the activity is occurring. Also shown is Korea's percentage share of the corresponding projects.

Since 1979, when the country initiated its determined drive to increase energy supplies and reduce dependency through diversification of suppliers and resources, Korea's energy mix has fluctuated in accordance with microeconomic trends, oil prices, and regard for the environment. In general, over the years, there have been slight but

steady increases in the use of LNG and nuclear energy. On the other hand, coal and oil have alternated gains. When oil consumption has increased, coal has decreased, and vice versa.[34] These fluctuations notwithstanding, the basic core energy strategy of "*Increase Supply, Reduce Dependency*" can still be found, both in the recently stated initiatives of President Lee Myung-bak as well as subtly embedded in Korea's current National Energy Plan. The current plan was considered and confirmed by State Council in December 2002 and still appears to be relevant and official. As of this writing, the plan can be viewed on the Korea Energy Economics Institute website.[35]

Table 1. KNOC Worldwide Exploration and Production Activity[36]

Country	Project	Working Interest	Phase of Activity
Azerbaijan	Inam	8%	Exploration
Indonesia	NEM I	50%	Exploration
	NEM II	56.25%	Exploration
	WOKAM	80%	Exploration
	SES (South East Sumatra)	8.91%	**Production**
Kazakhstan	ADA	22.50%	Exploration
	Egizkara	25.00%	Exploration
	South Karpovsky	17.50%	Exploration
China	Mahuangshan West	30.80%	**Production**
Uzbekistan	Aral	10.20%	Exploration
Vietnam	15-1	14.25%	**Production**
	11-2	39.75%	**Production**
Canada	BlackGold Oil Sand	100%	Development
Peru	115	30%	Exploration
	8	20%	**Production**
USA	Jaguar area	15%	Exploration
	Cougar I area	15%	Exploration
	Cougar II area	25%	Exploration
	Sabco area	15%	Exploration
Venezuela	Onado	6%	**Production**
Libya	Elephant NC174	2%	**Production**
Nigeria	OPL321	43.88%	Exploration
	OPL323	43.88%	Exploration
Russian Federation	Tigil	27.50%	Exploration
	Icha	27.50%	Exploration
	West Kamchatka	20%	Exploration
United Kingdom	Captain	14.24%	**Production**
	13/22d	30%	Exploration
Iraq	Bazian	38%	Exploration
Yemen	Marib LNG	1.06%	Development
	4	28.50%	Development
	4	28.50%	Exploration
	16	45.13%	Exploration
	70	58.66%	Exploration
	39	45.13%	Exploration

Korea's Stated National Energy Plan

Pursuant to Article 4 of the Rational Energy Utilization Act of 1979, a National Energy Plan which targets all areas of Korea's energy sector must be renewed every five years. The current standing plan was

formulated and confirmed at the end of the Kim Dae-jung administration in 2002. The policy goals under the current plan include: (1) Sustainable Development of Energy; (2) Market-Driven Operations; (3) Maintaining an Open, Interconnected System; and, (4) Development of Market-Creating Technologies. The outline below lists supporting objectives of these major policy goals.[37]

Sustainable Development of Energy

1. Establishment of an Environment-Friendly Energy System to Address the United Nations Framework Convention on Climate Change
2. Rational Energy Utilization
3. Continuous Implementation of a Stable Energy Supply Basis
4. Reinforcement of Local Government Energy Policy Functions

- Market-Driven Operations
  1. Restructuring and Privatization of the Energy Industry
  2. Establishment of an Independent Regulating Body and Competitive Market System
  3. Promotion of the Energy Price Function
  4. Promotion of General Energy Industry Basis and Electronic Commerce
- Maintaining an Open, Interconnected System
  1. Strengthening International Energy and Resources Cooperation
  2. Building Northeast Asian Energy Cooperation Network
  3. Promoting Energy Cooperation between South and North Koreas in Preparation for a Unified Korea
  4. Expanding Overseas Resource Development
- Development of Market-Creating Technologies
  1. Reinforcing the Support System for Technological Innovation in the Energy Sector
  2. Reinforcing New and Renewable Energy Technology Development
  3. Developing the Energy Industry into an Export Industry

Enter President Lee Myung-bak

While the above policy goals are still published as Korea's national energy plan, words and actions by President Lee, inaugurated in February 2008, are indicative of a clearer and comprehensive approach targeting increasing energy supplies, decreasing reliance on oil, and reducing greenhouse gas emissions. Speaking at a G8 Summit in Toyako, Japan in July 2008, President Lee pointed to the high cost of oil and outlined an approach focusing on demand and supply-side measures:[38]

- Demand
    1. ". . . employ all possible measures to mitigate the rise in the demand for oil"
    2. Take active measures to "adjust domestic oil prices in order to control demand"
    3. Share "our experiences and best practices . . . in curbing the demand for oil"
    4. ". . . advanced countries (such as G8 countries) share their technological and policy know-how with the developing countries"
- Supply
    1. ". . . increase the exploration and production of oil throughout the world"
    2. ". . . lessen our excessive dependence on oil…with a long-term view, to diversify our energy resources" (including nuclear and renewable energy such as wind, solar, and hydrogen fuel cells)

A month later on 15 August 2008, at Gyeongbok Palace in Seoul, President Lee unveiled the vision, *Low Carbon, Green Growth*, during a speech commemorating the 63rd Anniversary of National Liberation and the 60th Anniversary of the Founding of the Republic of Korea. This time, the Korean president pointed not just to the cost of oil, but to Korea's economic difficulties—a "growing sense of crisis that we might collapse"—that stemmed from "the energy crisis." He went on to describe "an age of new energy" which was "leaving behind the era of wood, coal and oil." As he called for turning "the recent surge in oil prices into an opportunity to transform economic fundamentals and create new growth engines," he listed the elements to the country's new core vision, tying it to a new national paradigm of development to create growth and jobs with "green technology and clean energy"[39]

- With energy security as the primary focus, increase the energy self-sufficiency rate from 5 percent to 18 percent during his (President Lee's) term in office, eventually raising the rate to more than 50 percent by 2050
- Explore and research the Arctic Ocean and Antarctic for natural resources
- Boost use of new and renewable energy from 2 percent to more than 11 percent by 2030, and more than 20 percent by 2050
    - More than double R&D investments in green technology
    - Increase use of solar, wind and tidal energy
    - Promote the Green Home Project to get a million homes using new and renewable energy
    - Develop technology for pollution-free coal and light-emitting diodes
- Place great emphasis on nurturing environmentally friendly and highly efficient green cars
    - Empower Korea to emerge as one of the world's top four green-cars producing nations
- Move toward becoming a low-carbon society by implementing measures against climate change

Coinciding with President Lee's announcements were reports in July and August that appeared in the press. In early July, KBS reported that construction of a tidal power plant would be completed in November 2009. Along with another planned plant, the west coast of Korea "is now expected to become the world's largest tidal power plant belt."[40] In late July, an official from MKE announced that Korea planned to spend roughly $193 million in 2008 on alternative energy technologies such as solar, wind, and biofuels.[41] Then on 13 August, a German company, Conergy, stated that it had reached an agreement on a $29 million project to expand a solar plant in southwest Korea. The solar plant is already the largest in Asia. When the expansion is completed, the plant will cover an area equivalent to 96 football fields and provide enough energy to supply over 7,000 homes.[42]

The day following the solar expansion project, it was reported that Korea had decided to focus on nuclear power as a way to reduce reliance on fossil fuels while meeting global environment regulations. An MKE official disclosed that the country was planning on building 11 new

nuclear reactors by 2030, which would make nuclear power Korea's biggest source of power for electricity. These new reactors would be added to 20 existing reactors and an additional eight that were under construction as of August 2008, for a total of 39.[43]

Two weeks after the nuclear reactor expansion report, another MKE official reported that Korea will spend $103 billion through 2030 to develop new renewable energy to cut reliance on fossil fuels and reduce carbon dioxide (CO2) emissions. The plan will expand renewable energy use to 11 percent from its current 2.4 percent and lower fossil energy from 83 percent to 61 percent by 2030. In what is likely to be an initial installment of this plan, the MKE announced in September that Korea would spend $2.7 billion to focus on nine areas including solar, wind, fuel cells, carbon capture and storage, and gas-fired power plants, expanding the use of alternative energy by 2012 to counter high oil prices and reduce greenhouse-gas emissions.[44] Finally, two weeks later, MKE announced that the Korean government had established 22 new "future growth engines" that will help achieve President Lee's vision for "low carbon and green growth" while creating new jobs for the Korean economy. Accordingly, a decision was made on 22 September to invest $87 billion into the 22 "future growth engines" which include the following:[45]

- Marine bio-fuel[1]
- Solar cells
- Pollution-free[2] coal energy
- Use of carbon dioxide as an energy source
- Cultural content
- Robots
- LED lighting
- New nano-fusion materials
- Next-generation wireless communications
- Ship & marine systems
- Displays
- Software design
- Nuclear power plants
- Fuel cell development systems
- Healthcare
- Green cars
- Fusion media
- New bio-medicines
- Medical equipment

[1] This initiative aims to replace eight percent of domestic petroleum with synthetic fuel while recycling carbon dioxide generated during the process; the industry is expected to create 150,000 jobs by 2018.

[2] Seaweed is expected to be used as a feedstock to produce bio fuel substitute for petroleum; the goal is to replace 20 percent resources, which will contribute to replacing 20 percent of liquid petroleum based fuel.[46]

President Lee has also been active in ongoing engagement efforts with Russia. The oil and natural gas possibilities of the vast Russian Far

East have long been eyed by Russia's energy-intensive neighbors—China, Japan, and Korea. In late September, on the heels of the aforementioned government announcements concerning alternative and renewable energy projects, President Lee traveled to Moscow. He began a three-day trip on 28 September, becoming the first South Korean president to visit Russia during his inaugural year. The following day, at a forum between Korean and Russian business leaders, President Lee proposed that Seoul and Moscow open a "New Silk Road" era, imploring Russia to speed up efforts to link the trans-Korean railway with Russia's trans-Siberian railway, for an eventual connection to Europe. Additionally, President Lee explained his desire to play a role in promoting closer cooperation with Russia in developing oil and gas resources, as well as agricultural and forestry resources from the Russian Far East.

A total of 26 agreements were signed at the forum with the intent of accelerating cooperation in energy, resources and industrial technologies. One of the agreements was a plan for Korea to import $90 billion of natural gas from Russian gas fields on Sakhalin Island via North Korea. According to MKE, the agreement would have Korea importing natural gas for 30 years, with deliveries beginning in 2015. North Korea could earn $100 million a year for allowing the project to pass through its territory. If an arrangement with North Korea does not come to fruition, Russia will supply the fuel in the form of liquid or compressed natural gas from Vladivostok. A final agreement will be signed in 2010 by Russia and Korea when a study on the supply route is completed. The gas is expected to fulfill about 20 percent of Korea's annual natural gas consumption.[47]

Assessment of Korea's Energy Plans – Will Korea Climb "Out of the Box"?

Through the years, Korea has managed its large and continually growing energy requirement in spite of severe limitations. With an economy dependent on an industrial sector that relies on uninterrupted supplies of secured energy so the country can continue to produce and move goods, Korea has been literally boxed in by four major constraints: (1) lack of resources; (2) dependency on imports; (3) geographic limitations; and, (4) vulnerability to geopolitics. The country's lack of raw materials makes Korea terribly dependent on imported energy resources. However, due to its geography, Korea must reach far beyond its borders to secure supplies, resulting ultimately in a reliance on mostly Middle East and OPEC oil. Thus, Korea has been, and continues to be, highly susceptible to geopolitical hazards which result in occasional shock and disruption. Barely weathering the oil shocks of the 1970s,

Korea continues to work on supply and dependency issues to avoid the possibility of a next great energy crisis. President Lee Myung-bak has rolled out an enormously ambitious plan atop a sturdy foundation of past policy measures, presenting a robust set of initiatives intended to increase energy supplies, decrease reliance on oil, and reduce greenhouse gas emissions. Will these initiatives, only recently announced, ensure Korea is truly on course to reduce super-dependency risks and push the country forward with a sound energy plan?

Addressing Lack of Resources

As the country severely lacks energy resources, much emphasis has been placed on increasing supplies. Korea has made great strides in creating and cultivating a large stockpile of petroleum and petroleum-based products. Beginning with modest KNOC initiatives in 1979, and reaching by 2007 a stockpile of 140 days of supply, Korea has put in place assured strategic supplies that will greatly lessen the impact of any future supply disruptions. With KNOC's plans to increase inventory stocks to 141 million barrels by 2010, Korea will have roughly 200 days of supply—almost seven months—with which to absorb the impact of any future oil shocks. In addition to these safety reserve stocks, Korea is also determined to increase supplies of new and renewable energy to cut reliance on fossil fuels and reduce carbon dioxide (CO2) emissions.

President Lee's goal calls for an increase in the use of new and renewable energy from 2 percent to more than 11 percent by 2030. An increase of this magnitude could significantly decrease reliance on Middle East resources, should it actually be realized. Thus far, Korea has publicly shown a high degree of resolve, announcing plans to spend $193 million in 2008, $2.7 billion by 2012, and ultimately $103 billion through 2030 to develop and expand renewable energy use.

Major R&D areas being carried out by the Korea Institute of Energy Research seem to support President Lee's goals. These research areas are indicative of accelerated efforts to enhance and develop renewable energy, alternative and synthetic fuels, and hydrogen fuel cell technologies.[48]

Finally, if Korea follows through and builds 11 new nuclear reactors by 2030, nuclear power will become Korea biggest source of power for electricity, greatly reducing fossil fuel dependency as well as greenhouse gas emissions. Factored together with the natural gas Korea is hoping to obtain from Russia, these efforts could greatly decrease the coal and especially the oil Korea requires to power its industrial sector.

Addressing Dependency on Imports

Korea has also made great strides in reducing its dependency on imports while increasing its ratio of self-sufficiency. KNOC is currently involved in 16 countries in at least 35 projects involving exploration, development or production of oil or natural gas. If KNOC's overseas production expansion plans targeting 300,000 barrels per day of crude output come to fruition by 2012, KNOC self-sufficiency would increase from 4 to 25 percent, again significantly decreasing reliance on Middle East oil. President Lee hopes to further this by boosting energy self-sufficiency to 40 percent by 2030 and more than 50 percent by 2050. Part of this strategy appears to be an ambitious plan to explore the Arctic Ocean and Antarctic. Similarly, Korea's agreement with Russia to obtain natural gas through North Korea, should it come to fruition, will enhance Korea's position away from its oil dependency.

Addressing Geographic Limitations

If Korea's plans to increase supplies of new and renewable energy are carried out, its geographic limitations won't vanish, but they will diminish somewhat in intensity because the country's energy self-sufficiency and supplies will increase while its super-dependency on oil will decrease. Regional arrangements with China and Japan could blossom or sputter, depending on how the countries manage their respective energy strategies in the near-mid-and long-term. Russia, through its actions over the last couple of years, may not be desirable as an energy provider for some countries, particularly European countries. However, as President Lee's plan shows, Korea is willing to deal with Russia. Should a mutually beneficial arrangement be concluded, especially one that draws North Korea into a productive role, the deal would be a boon not only to Korea, but for the region. Russia has the resources to spur on additional cooperative arrangements to supply natural gas and oil to Northeast Asia. The region could benefit by entering into mutually beneficial infrastructure development projects and other joint ventures. Regardless of Russia's current and expected behavior, Korea cannot and should not ignore possibilities involving natural gas from Russia. In the meantime, Korea should continue active participation with forums such as the Association of Southeast Asian Nations (ASEAN) Plus Three and Asia Pacific Economic Cooperation (APEC).

Addressing Vulnerability to Geopolitics

Korea's vulnerability to geopolitics stems from the country's reliance on the Middle East for energy resources. Should a war, terrorist event, or decision by OPEC cause a sudden disruption to global

petroleum supply, Korea must tough it out until the disruption is over. Korea is much better prepared to deal with a disruption, even a prolonged one, as the country has developed robust stockpiles of reserve petroleum supplies. Korea successfully exercised an orderly drawdown of its stocks when Hurricane Katrina severely damaged the petroleum supply chain along the U.S. Gulf Coast and threatened global disruption. Korea's stockpile, along with its plans to increase energy supplies and further decrease oil dependency, greatly reduce the country's geopolitical vulnerabilities. As the need to explore the possibilities of regional cooperation with Russia, China and Japan becomes more apparent, the tenor and variety of Korea's geopolitical risk may change.

Conclusion and Recommendations

Korea has established goals that, if pursued and accomplished, will greatly diminish the severity of the above-mentioned constraints. As energy markets move through their respective business cycles, the price of commodities such as oil will fall, rise, and fall again. There will be a natural proclivity for countries to weigh the economics of the day and turn away from the commitment to R&D and investment that new and renewable energies require. Korea should ignore the capriciousness of fleeting business cycles and follow through with President Lee's vision, and effectively put an end to the era of energy super-dependency. In the meantime, there are some additional considerations, ideas and approaches which are worthy of further evaluation by Korea's energy strategists:

Coal-to-Liquid Fuels

Korea can make supply inroads through the commercialization of alternative and synthetic fuels while simultaneously reducing the requirement for petroleum-based liquid transportation fuels. Coal is an attractive resource, because it is found throughout the world, and unlike oil, its heaviest concentrations are not found in the Middle East. Considering its proximity to Australia, China, Indonesia, and Russia and the vast coal resources contained in those countries, Korea appears to be suited to develop Fischer-Tropsch synthetic fuel using clean coal technology. Korea could leverage its robust petroleum refining model and develop a "liquid fuels" hub in Northeast Asia. The high levels of interest China and Australia have shown in developing indigenous coal-to-liquid plants presents Korea with an opportunity to join a new regional market drive towards a viable alternative to petroleum.

Plug-in Hybrid Vehicles

Among Korea's many slated initiatives, one surprising omission is the apparent lack of a plug-in hybrid vehicle plan. With increased supplies of renewable and nuclear energy, Korea's streets and highways appear to be a friendly environment for battery-powered electric vehicles. It is possible that this technology, although not well publicized, is being considered among the many others.

Less Emphasis on Solar

With regard to renewable energy, while wind power makes sense, considering Korea's long coast line and incessant supply of this renewable source on Cheju-do and other islands surrounding the peninsula, solar power doesn't seem to offer the same "bang for the buck." Korea does not receive intense sun, and usually experiences a full month of rain during its hottest season in the summer—*chang-ma*.

Careful Negotiations with Russian and Caspian Sea Countries

Turning to Korea's efforts to conclude deals with Russia, it must be pointed out that while these negotiations have the potential to produce phenomenally productive results, these strategies are inherently both costly and risky. It is quite possible that Russia's intent is to entice Korea to join China and Japan in a bidding war for Russia's natural resources. Regardless of its true intent, Russia's behavior has caused widespread concern. Russia's recent actions in Georgia caused BP to shut down an oil pipeline, temporarily stopping the natural gas flow through Georgia and calling into question plans for a Eurasian corridor free from Russian interference.[49]

Previously in 2006, Russia cut off gas supplies to Ukraine and Moldova and also threatened to cut off gas to Belarus and Georgia over price disputes.[50] Considering this and the complex issues surrounding the countries in the Caspian Sea region (KNOC's efforts include dealings with Azerbaijan, Kazakhstan, Uzbekistan and Russia), Korea must realistically conclude that some, if not many, of these KNOC expansion plans may not conclude as planned. Finally, Korea should stay vigilant for the potential to clash with other countries who are seeking similar deals with these countries, particularly China and Japan. Heated competition with China or Japan would exacerbate the challenges that Korea's geographic limitations pose.

Notes:

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