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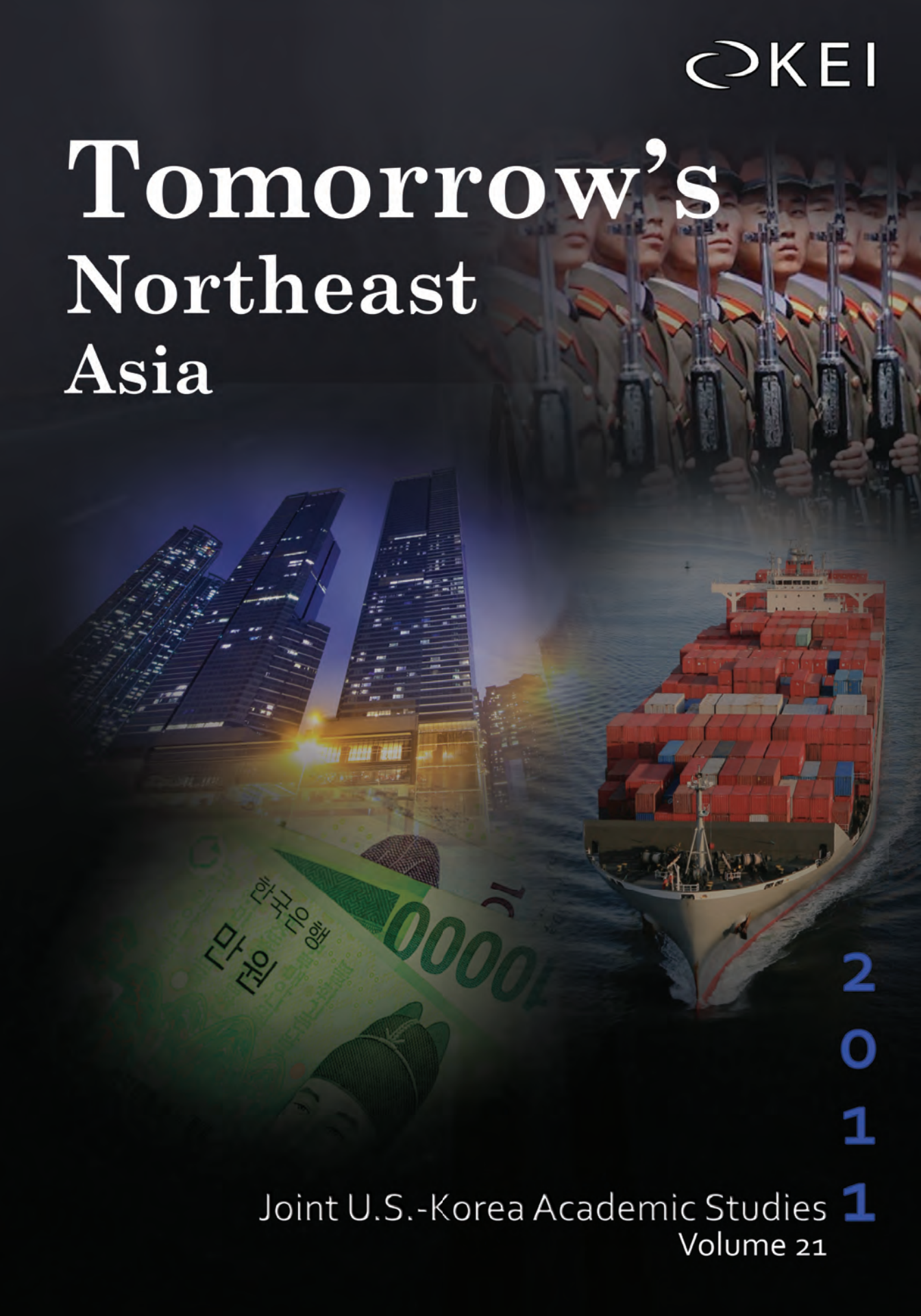
Tomorrow's Northeast Asia



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Volume 21, 2011

Prospects for Emerging East Asian Cooperation and Implications for the United States

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20–22 October 2010

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PREFACE

The Korea Economic Institute (KEI) in Washington, D.C., in cooperation with the School of International Service (SIS) at American University, also in Washington, D.C., cosponsored an academic symposium at SIS on 20–22 October 2010 on "Tomorrow's Northeast Asia." This volume contains the papers that were presented at the symposium and subsequently refined.

The 2010 symposium focused on emerging and future challenges facing Northeast Asia. Papers and discussions fell under five broad topics:

- Prospects for emerging East Asian cooperation and implications for the United States
- The emerging role of South Korea on a global stage
- The future of energy security in Northeast Asia
- Engaging and transforming North Korea's economy
- Finding room for a six-party solution to North Korea's nuclear crisis.

The sponsors and authors welcome comments on the material in this volume. This is the 21st in a series of annual academic symposia on Asia-Pacific economic and security issues that bring together leading academics and policy professionals from throughout the region.

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December 2010

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2010 American University, School of International Service, Washington, D.C.

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2008 New York University,
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2007 University of Southern California, Korean Studies Institute

2006 Harvard University,
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PROSPECTS FOR CREATING A GREAT, GREEN PATH TO POWER

George Hutchinson

ABSTRACT

China, Japan, and South Korea are dependent on fossil fuels. This reliance perpetuates vulnerabilities to energy supply, incites resource competition, and exposes each country to fossil energy market volatility. Although the countries share geographic proximity and highly integrated trade, they do not belong to a common organization through which to seriously influence energy issues. The emerging renewable energy industry provides a pathway for China, Japan, and South Korea to leverage technology, manufacturing, and trade into a robust partnership that enhances energy security, stimulates growth, and provides cleaner alternatives to conventional fossil fuels.

George Hutchinson is the Director of Strategic Development and Client Relations for Power and Energy, Concurrent Technologies Corporation. He retired from the U.S. Air Force as a logistics readiness officer and foreign area officer. As a Korean linguist, he served at Osan Air Base, the Special United States Liaison Adviser Korea (SUSLAK), and the National Security Agency.

Introduction

Collectively, the Northeast Asian countries of China, Japan, and South Korea have an enormous impact on the global economy as both consumers of energy and suppliers of manufactured goods. As a bloc, the countries represent the largest energy market in the world (BP 2010). This, along with the countries' shared geographic proximity and highly integrated trade relations, highlights the need for a shared vehicle through which to influence energy issues.

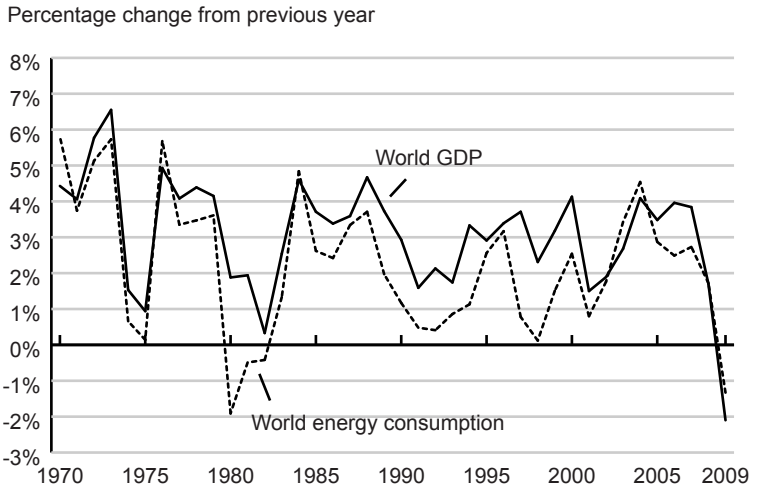
To sustain economic growth and prosperity, each country must continue to have uninterrupted access to affordable and increasingly cleaner supplies of energy. Each of the three countries is heavily dependent on fossil fuels—coal being China's predominant fuel source, followed by oil; oil being Japan and South Korea's major source of energy. Dependency on fossil fuels creates vulnerabilities and produces competitive behaviors that challenge each country's pursuit of energy security.

The intense energy needs of all three countries, coupled with China's skyrocketing demand, create extraordinary global market pressure. Because the countries do not behave as a unified bloc, each must scramble to secure its conventional energy resources. In addition to fomenting territorial disputes, this competitive drive to secure energy resources adds to the volatile cycle of increasing demand, tightening supplies, and upward-trending prices.

Fossil fuels are produced, exchanged, and consumed in global energy markets built up and internationally integrated over the last hundred years. China, Japan, and South Korea must each operate within the constraints imposed by these markets. In the meantime, growing international efforts could transform into a legal basis that would limit the use of fossil fuels.

For all three countries, reliance on fossil fuels perpetuates vulnerabilities to supply disruption, fuels resource competition and territorial disputes, and exposes each country to global market volatility. The nascent renewable energy industry may provide a better pathway for China, Japan, and South Korea to leverage technology, manufacturing, and trade into a regional partnership that enhances energy security, stimulates economic growth, and provides a cleaner alternative to conventional fossil fuels.

Figure 1: **Rates of Growth in World GDP and World Energy Consumption, 1970–2009**



Sources: Trading Economics 2009; World Bank 2010; BP 2010.

The Link between Energy and Prosperity

Each country requires affordable, accessible, and increasingly cleaner energy supplies to power its societal, governmental, and economic engines. Because energy is required to produce and transport goods and is a key input to industry and commerce, energy consumption tracks alongside economic growth (***Figure1***).

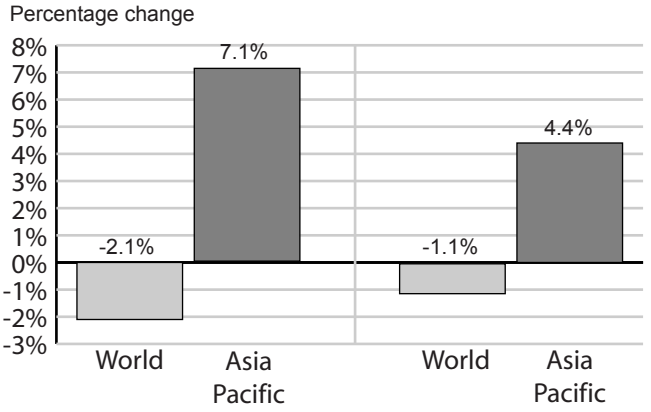
The global economy generally suffered in 2009, resulting in an overall 2.1 percent decline in world GDP. Conversely, GDP increased in the Asia-Pacific region by 7.1 percent (World Bank 2010). World energy consumption also declined in 2009 over the previous year by 1.1 percent, but consumption in the Asia-Pacific region grew by 4.4 percent (BP 2010). See ***Figure 2.***

In 2009, Asia-Pacific countries consumed 37 percent of the world's' energy (***Figure 3***). China, Japan, and South Korea consumed nearly 70 percent of the Asia-Pacific total, or 26 percent of the world's total (BP 2010). The countries' collective share of world's GDP for 2009 was proportionally similar (World Bank 2009).

Energy Characteristics of China, Japan, and South Korea

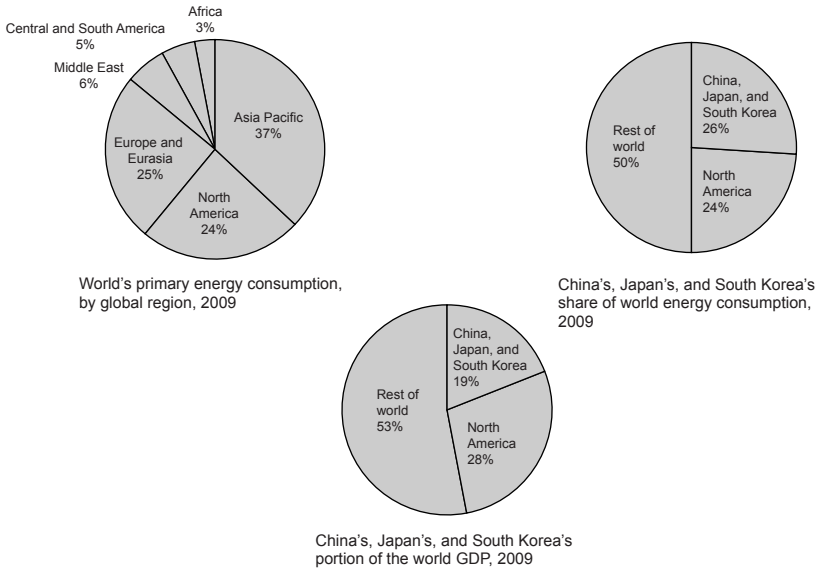
China, Japan, and South Korea are all extraordinarily dependent on fossil fuels. China relies on coal, and Japan and South Korea primarily depend on oil. After

Figure 2: **Rates of Growth for GDP and Energy Consumption, in the World and Asia Pacific, 2009**



Sources: World Bank 2010; BP 2010

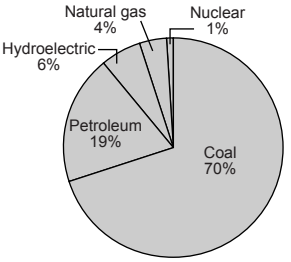
Figure 3: **World's Energy Consumption by Region and Energy Consumption and GDP of China, Japan, and South Korea, 2009**



Sources: BP 2010; World Bank 2009.

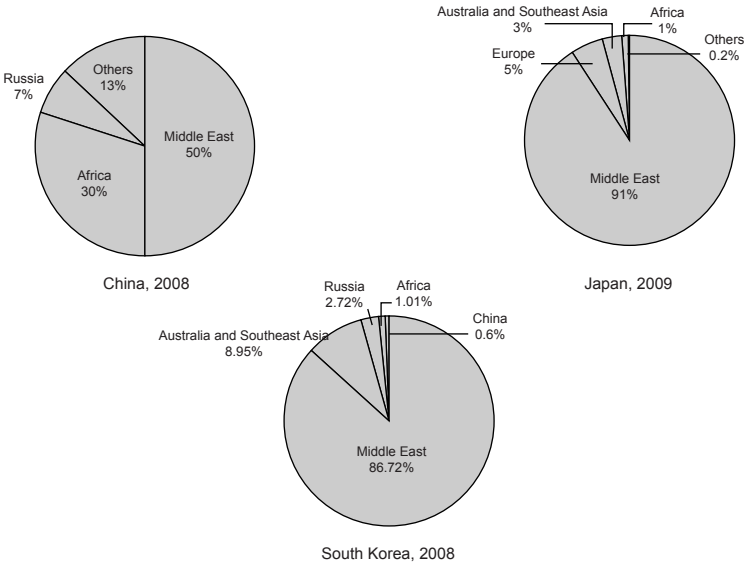
coal, China's second-largest fuel source is oil (***Figure 4***). All three countries are dependent on the Middle East for their oil imports (***Figure 5***). This exposes each country to potential supply disruptions, the causes ranging from activities of the Organization of the Petroleum Exporting Countries (OPEC) to disrupted

Figure 4: **China's Energy Consumption by Fuel Type, 2008**



Source: BP 2010.

Figure 5: **Sources of Oil Imports to China, Japan, and South Korea, 2008 and 2009**



Sources: EIA 2009b; Petroleum Association of Japan 2010; Korea Petroleum Association 2008.

shipments. Located between Malaysia, Indonesia, and Singapore, the Strait of Malacca connects the Indian Ocean with the South China Sea and the Pacific Ocean and provides the shortest sea route between the Middle East and Northeast Asian markets. About 80 percent of oil imports destined for China, Japan, and South Korea' flow through the strait. At its narrowest point, the strait is only 1.7 miles wide, making the sea lane perpetually vulnerable to piracy, hijackings, and terrorist activity (Lugar Energy Initiative 2004; EIA 2006).

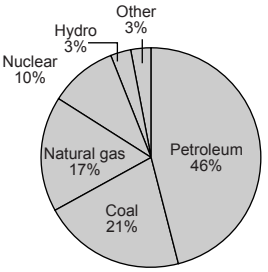
China's Energy Portfolio

In July 2010, the International Energy Agency (IEA) reported that China had overtaken the United States as the world's largest energy consumer, a claim that China immediately disputed (IEA 2010a; Swartz and Oster 2010). Nonetheless, China is the world's largest consumer of coal and second-largest consumer of oil (EIA 2010a). Partially self-sufficient in terms of oil supply, China had been a net exporter of oil in the early 1990s; however, the country is now the world's third-largest net importer of oil, behind the United States and Japan. The Energy Information Administration (EIA) forecasts that China's energy consumption will continue to grow, averaging annual increases of 3.1 percent through 2035 (EIA 2010b). To meet its growing energy needs, China is seeking to increase supplies throughout its entire energy portfolio.

The Chinese government recognizes its dependence on coal, the most carbon-intensive and environmentally harmful fossil fuel, and is taking measures to diversify and create efficiencies. The government is replacing small, inefficient coal plants with larger, more efficient ones. China is also expanding its use of natural gas and promoting nuclear power as an efficient, clean source of electricity. In March 2010, the government approved construction of 28 new nuclear power plants to be built by 2020 (Wang 2010; EIA 2009a). The government is also reviewing plans to invest $738 billion on a package focused on developing cleaner sources of energy (Wang and Duce 2010). China is the world's largest producer of hydroelectric power and plans to increase its share of wind and solar energy. By 2020, China wants renewable energy to account for 15 percent of the country's energy (Fu 2009).

China is implementing several strategies to increase and secure its oil supplies. The country is pursuing offshore and on-shore oil exploration and through its national oil companies is increasing financing and acquisition of overseas oil exploration and production projects. In addition, China is expanding refining capacity, increasing strategic oil reserves, and improving its domestic oil pipeline network. The country is also establishing pipeline connections with neighboring countries to diversity oil import routes (EIA 2009c). China and Russia are collaborating on the development of a pipeline spur into China. The spur will connect Russia's Eastern Siberia-Pacific Ocean (ESPO) pipeline to Daqing, located in northeastern China (Xinhua 2010). China is also partnering with Myanmar on the construction of a 2,380-kilometer-long oil pipeline that will deliver oil to Kunming (*China Daily* 2010). The pipeline is intended to reduce China's reliance on the shipments through the Strait of Malacca.

Figure 6: **Japan's Energy Consumption by Fuel Type, 2008**



Source: Ministry of Internal Affairs and Communications, Tokyo.

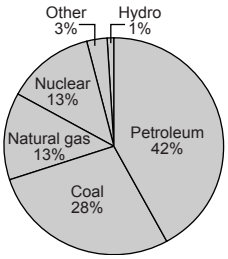
Japan's Energy Portfolio

Unlike the continued growth expected for China, the EIA (2010b) forecasts a slight decline for Japan in average annual energy consumption through 2035. Part of this is due to the active efforts of the Japanese government in targeting energy conservation. Outside of limited production from 13 fields concentrated along its western coastline, Japan relies on oil imports to meet demand (***Figure 6***). Japan is the second-largest net importer of oil in the world, and after the United States and China the country is the world's third-largest petroleum consumer. Japan is also the world's largest coal importer. The country is expected to continue working at decreasing its dependence on oil and coal by conserving energy and expanding its use of natural gas, nuclear, and renewable forms of energy (EIA 2010c; EIA 2008a).

Although petroleum consumption is expected to decline in Japan, oil will continue to be a critical component of the country's energy mix. To secure its oil supplies, the Japanese government maintains strategic oil stocks and requires refiners to maintain 70 days of petroleum products to guard against disruption. Japanese oil companies are also active overseas in petroleum exploration and development projects, and they invest directly in refinery projects (EIA 2010c).

Japan is the world's largest importer of liquefied natural gas (LNG). Although Japan is reliant on LNG imports, its overseas sources are more diverse than its sources for oil imports. To further bolster supplies, Japanese companies actively collaborate in natural gas exploration and production projects abroad. In addition to expanding its use of natural gas, Japan is increasing its use of nuclear energy. Currently, the country has 55 reactors in operation and 2 additional reactors under construction, with plans to build 12 more by 2022 (World Nuclear Association 2010a). The country is the third-largest nuclear power generator in the world,

Figure 7: **South Korea's Energy Consumption by Fuel Type, 2008**



Source: Korea Energy Economics Institute database, various years.

behind the United States and France (EIA 2008a). Japan is also looking to invest heavily in renewable energy.

South Korea's Energy Portfolio

South Korea has extremely limited domestic energy resources. Outside of small coal reserves and a very limited natural gas production capability, the country is virtually entirely dependent on energy imports (***Figure 7***). In 2008, the country was the world's 11th-largest consumer of oil and the sixth-largest net importer of petroleum. South Korea was also the world's second-largest net importer of coal and the second-largest importer of LNG, behind Japan in both categories. The country is expected to increase its average annual energy consumption through 2035 by 1.5 percent and is also expected to increase consumption of all energy types within its portfolio—oil, coal, natural gas, nuclear, and renewable energy (EIA 2010b, 2010d, 2010e).

Since the country lacks international pipeline connections, all oil must be delivered to its ports. The South Korean government has thus implemented a strategic oil reserve program comprising both crude oil and refined petroleum products to protect against potential disruption. South Korea has a robust refining capability. The country hosts the world's second- and third-largest refineries and has sufficient capacity to import excess petroleum and reexport refined petroleum products to neighboring Asian countries. In an attempt to further diversify its sources of supply, South Korea's oil firms are actively involved in overseas exploration and production projects.

South Korean firms are also involved in overseas natural gas projects, and South Korea's sources of LNG are diverse. Coal is the predominant energy source used for electricity generation; however, the country has plans to increase its use of nuclear and renewable energy. Nuclear energy is a strategic priority for South

Korea. There are currently 20 nuclear reactors operating in South Korea, and 12 more are planned to be built by 2021 (World Nuclear Association 2010b).

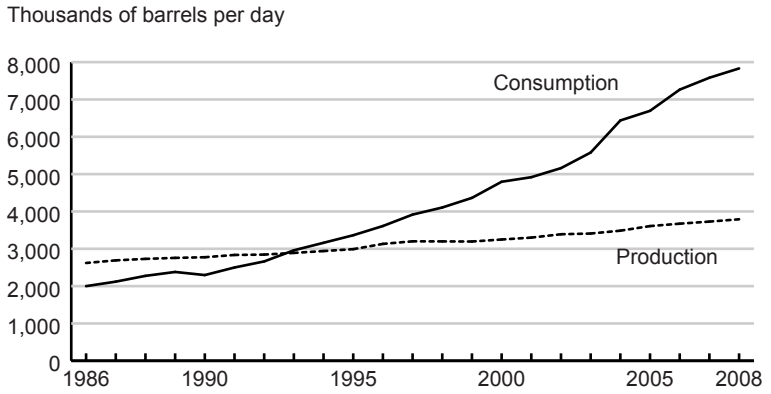
Barriers to Effective Energy Cooperation

The link between sustained economic prosperity and energy consumption requires that China, Japan, and South Korea take measures to ensure uninterrupted access to affordable and increasingly cleaner supplies of energy. Together, the three countries represent the largest energy market in the world (BP 2010). In a global context, each of the countries has a highly productive economy and enormous clout. In light of this fact and along with the countries' shared geographic proximity, it makes sense to consider a cooperative framework through which to influence energy issues. To a degree, China, Japan, and South Korea recognize this. Each country belongs to international or regional organizations that address energy; however, the three countries do not have a distinct framework through which to coalesce and directly influence energy issues (Van Veenstra 2008, 7).

Japan is a founding member of the International Energy Agency (IEA), an international organization established in 1974 made up of industrial, oil-consuming countries that was intended to act as a counterbalance to OPEC. South Korea joined in 2002 after being invited to become the 26th member of the organization in 2001. China, however, is not a member, despite the IEA's overtures to China to join the organization (Gao 2010). Another example is membership in the Association for Southeast Asian Nations (ASEAN) Plus Three forum. China, Japan, and South Korea make up the Plus Three component. The forum provides an avenue to pursue cooperation in 20 areas, of which energy is one. On 22 July 2010, the 7th ASEAN Plus Three Ministers on Energy Meeting (AMEM + 3), focusing on "stronger regional energy cooperation and integration" was held in Da Lat, Vietnam (ASEAN Vietnam 2010). Although this forum represents a positive development in regional cooperation, China, Japan, and South Korea appear to be peripheral members. China, Japan, and South Korea are also members of the East Asia Summit (EAS) and the Asia-Pacific Economic Cooperation (APEC). Energy is certainly an important topic for these organizations, but in a much broader context than what would be considered intrinsic to the concerns shared by China, Japan, and South Korea as a bloc. Besides not having an optimal organizational framework through which to collaborate on mutually beneficial energy solutions, there are other detractors.

The countries do not share highly complementary supplier-customer energy resource arrangements. Although the countries are within geographic proximity to one another, none of the countries supplies nor consumes much of the others'

Figure 8: **Consumption Compared with Production of Petroleum in China, 1986–2008**



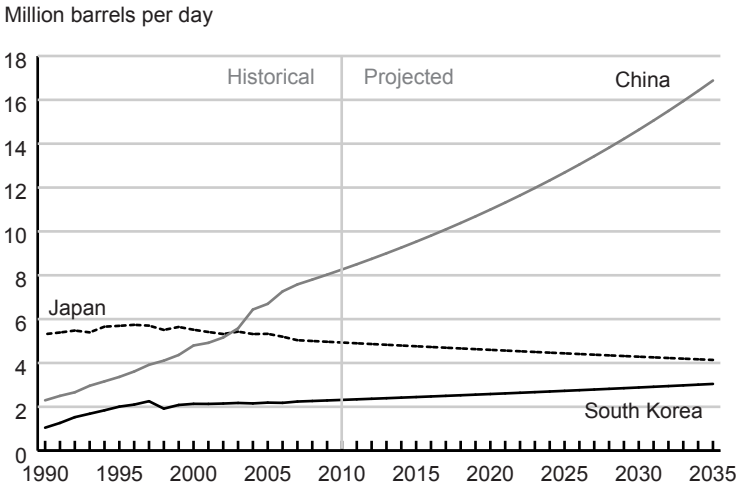
Source: Energy Information Administration database, various years.

energy resources. This is in stark contrast with the arrangement the United States enjoys with its two border countries—Mexico and Canada, two major oil suppliers to the United States. Finally, owing to the finite nature of conventional energy resources and the fact that these raw resources are not evenly distributed throughout the world, the countries behave competitively as they seek to maintain or increase their energy supplies and diversify supply sources. To capture the depth of this, an examination of the primary conventional sources of energy is required.

Oil

Japan and South Korea are virtually entirely dependent on imports for oil. China became a net importer of oil in 1992 (***Figure 8***). China actually exported oil to Japan from 1974 to 2004 (Calder 2007, 7), when disagreements over quantity and price resulted in the suspension of exports (*China Daily* 2004). Looking out to 2035, the EIA forecasts a slight decline in Japan's consumption of liquid fuels, offset somewhat by slightly increased consumption for South Korea. However, consumption is expected to soar for China (***Figure 9***), placing greater pressure on already tightening global supplies of crude oil and thus leading to increasingly competitive market behavior. Competition over resources is perpetually manifested in Japan's and China's disputed maritime boundaries in the East China Sea in an area thought to contain enormous oil and natural gas deposits. Tensions have escalated recently over Japan's 7 September 2010 arrest of a Chinese fisherman within the disputed area (Reuters 2010; Associated Press 2010).

Figure 9: **Liquid Fuel Consumption in China, Japan, and South Korea, 1990–2035 (est.)**



Source: Energy Information Administration database, various years.

To sustain or meet their oil supply needs, China, Japan, and South Korea have long vied for the vast resources contained in the Russian Far East. At times, China and Japan have appeared to be involved in a bidding war over access to Russian oil (Gelb 2006, 9). In the near term, it appears China has been successful in its negotiations, considering the recent announcement by Russia to open a pipeline spur off its ESPO line to the Chinese city of Daqing (Xinhua 2010). Russia signed a 20-year contract with China worth up to $100 billion to deliver 300,000 barrels of oil per day after the pipeline is fully connected and in operation (Platt's 2009, 3). China lent the Russians $25 billion to expand the pipeline in Russia to a point where the connection could be built to Daqing (Blank 2010, 5–6).

South Korea had previously expressed open interest in Russia's energy supplies. During a state visit to Russia in September 2008, President Lee Myung-bak proposed that Seoul and Moscow work toward opening a "New Silk Road" era by strengthening cooperation in energy development and linking railways between the two countries through North Korea (Na 2008; Yoon 2008). China, Japan, and South Korea are competing not only for Russian oil supplies. All three countries have also worked vigorously to enhance their respective oil holdings through global acquisition and diversification strategies. By September 2009, China's investments in overseas oil and gas were spread among 28 countries and 73 projects (Economides and Xie 2010).

The Japanese government's 2006 Energy Strategy Plan emphasizes secure and stable supplies of energy and encourages Japanese companies to increase energy exploration and development projects around the world (EIA 2010c). As of September 2009, Japanese firms are spread around the globe, actively involved in 139 oil and gas development projects in the Middle East, Southeast Asia, Africa, South and North America, and the former republics of the Soviet Union (PAJ 2009, 26). South Korea is also active overseas, with operations spearheaded by the Korea National Oil Corporation (KNOC), established in 1979 as the country's sole upstream oil development company (EIA 2010f). As of December 2009, KNOC is involved in 48 projects in 17 countries (Kang Y. 2009). Oil is not the only sector where competition is keen.

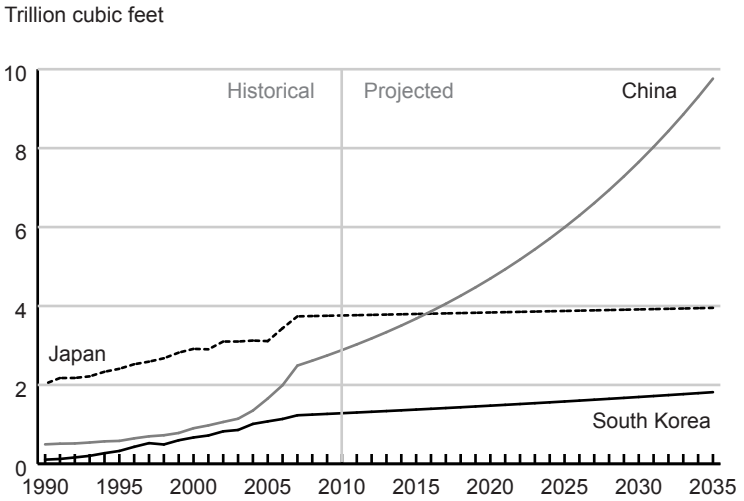
Natural Gas

Similar to their dependence on oil, Japan and South Korea are almost entirely dependent on imports to meet natural gas demand. Because the two countries lack international pipeline connections, natural gas must be imported as liquid natural gas (LNG), whereby the gas is temporarily liquefied to about 1/600th of its gaseous volume to facilitate storage and transport. China, in contrast, is endowed with proven reserves of natural gas, and the country is steadily increasing the use of this fossil fuel.

The EIA forecasts slight increases in Japan's and South Korea's consumption of gas through 2035. China, however, is expected to see much larger year-over-year percentage increases (***Figure 10***). This steadily increasing demand obviously places increasingly more pressure on global supplies of natural gas, which in turn increases competitive market behavior. Again, this is perhaps best manifested by the increased diplomatic tensions surrounding Japan's and China's disputed maritime boundaries in the East China Sea. Although the two countries share robust trade relations (since 2009, China has been Japan's largest trade partner), the territorial dispute in the East China Sea has strained diplomatic relations (Fujioka and Buckley 2010). As a result, productive joint exploration for natural gas and has fallen flat. Beijing and Tokyo agreed in June 2008 to work on a solution to jointly develop the disputed gas fields, and they began to conduct negotiations over a joint development treaty in July 2010. Because of the friction caused by Japan's arrest of a Chinese fisherman, however, China has postponed the next round of talks, which were due in mid-September (Reuters 2010).

China produces much of its own natural gas and transports the gas throughout China using domestic pipelines. In December 2009, the country inaugurated a pipeline connection from Turkmenistan that will transport gas to Xinjiang in

Figure 10: **Natural Gas Consumption in China, Japan, and South Korea, 1990–2035 (est.)**



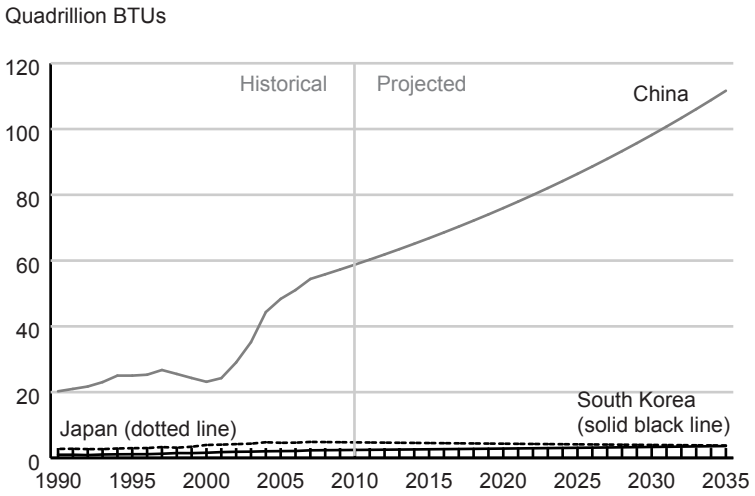
Source: Energy Information Administration database, various years.

western China (BBC News 2009). In addition, China has been negotiating with Russia since 2006 to obtain Russian natural gas; however, no deal has occurred yet (Gronholt-Pedersen 2010). Imported gas mainly comes in the form of LNG. China imports LNG from Australia and Southeast Asia. In this respect, China faces stiff competition from South Korea and Japan since both countries rely on imported LNG to meet their natural gas requirements.

Japan is one of the first countries to pioneer LNG trade. The country began importing LNG from Alaska in 1969, and the Japanese government has encouraged the use of natural gas since. Today, Japan is the world's largest importer of LNG. Japan's LNG imports are mostly spread among Australia, and Middle East, and Southeast Asian countries, making its source of supply much more diverse than its sources for oil imports (EIA 2009b). Japanese natural gas companies are also active abroad. For example, Japan is a major stakeholder in Russia's Sakhalin II project (EIA 2008b).

Similar to Japan, South Korea produces only small amounts of natural gas and thus must rely on imports of LNG. It is the second-largest importer of LNG in the world, behind Japan. South Korea also has a diverse supplier source for its imports and is active overseas in exploration and production (EIA 2010e). South Korea views Russia as a valuable source of natural gas. During President Lee's "New Silk Road" visit to Russia in September 2008, South Korea and Russia

Figure 11: **Coal Consumption in China, Japan, and South Korea, 1990–2035 (est.)**



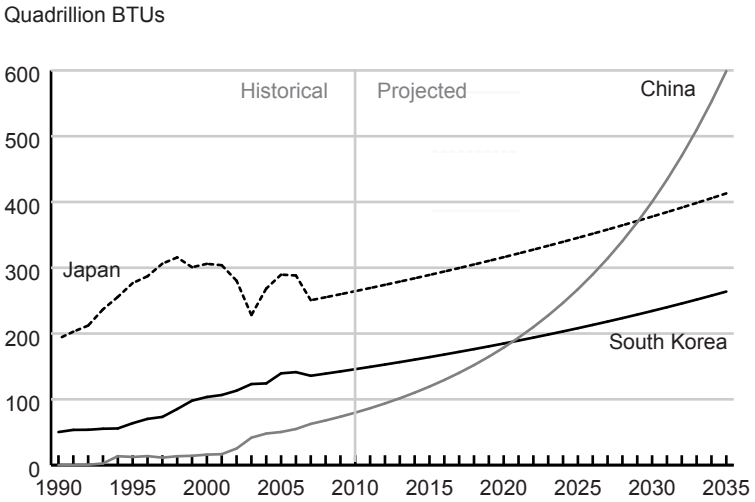
Source: Energy Information Administration database, various years.

signed a preliminary agreement whereby South Korea would import $90 billion of pipelined natural gas from Russian gas fields on Sakhalin via North Korea. The agreement would have gas deliveries beginning in 2015 and lasting 30 years, with North Korea earning $100 million a year for allowing the project to pass through its territory (Kang S. 2008). South Korea receives some LNG from the Russian Sakhalin project and as of September 2010 is negotiating agreements with Russia to increase supplies (UPI 2010b).

Coal

China is the world's largest producer and largest consumer of coal. Japan ceased producing coal in 2002 and today is the largest importer of coal in the world. South Korea is the world's second-largest importer of coal. Although the world's largest producer, China actually became a net importer of coal in 2009 (Yu 2010); its top suppliers for the year were Australia and Indonesia (Zhu 2010). Australia and Indonesia were also Japan's and South Korea's major suppliers of coal (Cho 2010b; Tamaru 2010). The EIA expects China's demand for coal to grow considerably out through 2035. South Korean consumption of coal is expected to grow at a more moderate pace, and Japan should see a decline in coal use (see ***Figure 11*** and EIA 2010b, 10). The three countries are taking measures to keep up with demand.

Figure 12: **Nuclear Energy Consumption in China, Japan, and South Korea, 1990–2035 (est.)**



Source: Energy Information Administration database, various years.

In July 2010, a South Korean consortium led by Korea Electric Power Corporation (KEPCO) acquired five Australian coal fields worth $488 million (Cho 2010a). In August 2010, China agreed to lend Russia about $6 billion in exchange for increased coal supplies over the next 25 years. Russia is expected to use the loan to improve and expand its logistical capacity to transport coal (Kueppers 2010). China's dealings with Mongolia have not been as productive. Of the plans it is reviewing, Mongolia has announced that it prefers to connect a new coal mine to its national rail network rather than build a direct link to China. By doing so, exports would bypass China and be open to Japan and South Korea (Bloomberg 2010). Recognizing the imperative of moving away from burning coal, China, Japan, and South Korea are all looking at nuclear power as a way to increase domestic energy supply while decreasing reliance on coal.

Nuclear

The EIA assesses that China, Japan, and South Korea will see average annual increases in nuclear energy consumption—dramatic increases in the case of China (***Figure 12***). As climate change and energy security concerns cause countries to seek ways to decarbonize, nuclear energy becomes an increasingly attractive option. However, nuclear energy poses several challenges. The top concerns involving nuclear energy that tend to grab the headlines involve peaceful civilian use of nuclear power versus nuclear weapons proliferation, along with the safe

and secure disposal of spent nuclear fuel. The other reality involving nuclear power is the feedstock used in the power generating process—uranium.

Roughly five million tons of recoverable uranium is believed to exist around the world, the majority of which is located in Australia, Kazakhstan, Canada, South Africa, and the United States. About 67,000 tons of uranium is mined each year, a rate that means the world has a little more than 70 years of supply available, and demand is expected to increase significantly during the next decade (Johnson 2010). All of this of course means global competition for existing uranium supplies will likely rise. There are analysts who estimate that China could build up to 300 new nuclear power plants by 2050, a building boom that would put tremendous pressure on global uranium supplies (Daub 2010).

In September 2010, China and Russia agreed to expand cooperation involving nuclear power in seven areas, including exploring uranium mines, eliminating old plants, developing markets abroad, and building controversial floating nuclear power plants (Bai and Miles 2010; White 2010). In another controversial move involving nuclear power, China has publicly acknowledged that it plans to sell Pakistan two nuclear reactors in addition to one it has already built and a second that is currently under construction (Dyer and Bokhari 2010).

Taking note of the explosive growth of nuclear power on the horizon for China, Japan and South Korea are taking measures to secure supplies. Japan and Kazakhstan are exploring arrangements that could result in Japan's share of Kazakhstan uranium moving from 4 to 40 percent (RIA Novosti 2010). Apparently Japan has in turn agreed to supply nuclear-energy technology to Kazakhstan in return for a stable supply of uranium (Cyranoski 2010). In the meantime, Japan has started talks with India over possible joint development of nuclear power reactors, a move that would give Japanese firms access to a potentially rapidly rising market (Takenaka and Kubota 2010). South Korea is also in talks with India, as both countries agreed in June 2010 to launch talks on forging a pact for nuclear energy cooperation (AFP 2010a). According to South Korea's Ministry of Knowledge Economy, the country's goal is to export 80 nuclear power reactors, worth $400 billion, by 2030, making it the world's third-largest reactor supplier with 20 percent of the global market (World Nuclear News 2010).

South Korea is carrying out a plan to achieve its objectives. After winning a $20 billion deal in December 2009 to build four nuclear power plants in the United Arab Emirates by 2020, South Korea is now in talks with Turkey over the possible construction of a nuclear power plant (*Today's Zaman* 2010). Another South Korean goal is to secure by 2020 up to 50 percent of its uranium

demand from the foreign mines that have been developed by South Korea (Pistilli 2010). China, Japan, and South Korea consider renewable energy to be another important avenue in order to decrease fossil fuel reliance and increase the use of clean energy.

Renewable Energy— An Enabler for Effective Energy Cooperation

China, Japan, and South Korea have each identified investment plans for ambitious low-carbon, green targets. Renewable energy offers a bright opportunity for the three countries to leverage their robust trade relations and highly developed industrial economies while enhancing energy security and producing cleaner forms of power.

China

Comprehensive renewable energy legislation was brought about in China in February 2005 when the country passed its Renewable Energy Law. The law stipulates numerous measures intended to foster development of a renewable energy industry. It also mandated China's share of renewable energy to increase from 3 to 10 percent of total energy consumption by 2020 (NPC 2005; REW 2005). The law was revised in April 2010 to grant the central government power over the acquisition of renewable energy power generation programs. In addition, it authorizes the central government's finance department to establish a renewable energy development fund (China CSR 2010).

China revised its renewable energy targets with the publication of the "Medium and Long-Term Development Plan for Renewable Energy" in September 2007. The plan upped the renewable energy target from 10 percent by 2020 to 10 percent by 2010 and 15 percent by 2020. It also specified specific target amounts for solar, wind, hydro, biomass, and other types of renewable sources (IEA 2010b). A portion of China's $586 billion stimulus package passed in 2008 contained provisions for renewable energy, energy efficiency, and improvements to the electricity grid (Seligsohn 2008). In July 2010, China's National Energy Administration announced that the government was working on a plan to spend $738 billion during the next decade, beginning in 2011. The plan targets development of clean energy to help further reduce emissions caused by burning oil and coal (Wang and Duce 2010). China is already the world's largest producer of hydroelectric power, and its near-term investments in other forms of renewable energy appear to be paying off with the country more than doubling wind

generation capacity from 12.1 gigawatts in 2008 to 25.1 gigawatts by the end of 2009 (REW 2010). The global accounting firm Ernst & Young ranked China as the world's most appealing country for investing in wind and solar energy projects for second quarter 2010 (Morales 2010).

Japan

Japan has long promoted energy efficiency. Since the oil shocks of the 1970s, Japan has improved energy efficiency by around 30 percent. As a result, Japan's primary energy consumption per GDP is one of the lowest in the world (IEA 2009, 55). Japan's Ministry of Economy, Trade, and Industry released the country's "New National Energy Plan" in 2006. The plan's targets included a 30 percent increase in energy efficiency by 2030, reduced oil dependency, and expanded nuclear power (Evans 2006, 19–20). In a speech, Prime Minister Yasuo Fukuda (2008) announced that Japan was planning to cut greenhouse gas emissions by 60–80 percent by 2050 to bring about a "low-carbon society." Almost concurrently, Japan's Low Carbon Technology Plan was published, detailing technology solutions required to achieve the 2050 target (CSTP 2008). Directly thereafter, the Japanese government approved its Action Plan to Achieve a Low Carbon Society to provide a road map for developing technologies with an emphasis on increasing solar power generation (OPMJ 2008). In December 2008, the Japanese government announced a $9 billion subsidy package for solar roofs, and in April 2009 it announced a $154 billion stimulus package, of which $22 billion is intended to be spent on Japan's "low-carbon revolution." Primary attention is to be given to solar energy, electric cars, and energy efficiency. Japan seeks to increase solar photovoltaic energy production 10 times from 2005 levels by 2020 (UNEP 2009b, 20, 60; Tabuchi 2009). In September 2010, Japan unveiled a new, $11 billion stimulus package, a portion of which is intended to promote green business (Mochizuki and Osawa 2010).

South Korea

On 15 August 2008, in a speech commemorating the 60th anniversary of the founding of the Republic of Korea, President Lee Myung-bak unveiled South Korea's imperative of creating new growth engines and jobs with "green technology and clean energy." Included in the goals introduced was a target to increase the use of new and renewable energy from 2 percent to more than 11 percent by 2020, and to more than 20 percent by 2050 (Lee 2008). The following month, the government announced it was planning on funneling $87 billion into 22 "growth engine" sectors, including clean and renewable energies (Yoo 2008).

In December 2008, the Third Basic Plan for New and Renewable Energy (NRE) Technology Development and Deployment was released. The plan breaks down the 11 percent target into specific goals by type of renewable energy (KEMCO 2008). In January 2009, South Korea launched the Green New Deal—a stimulus package worth $38 billion, of which $31 billion was allocated for renewable energy, energy efficiency, and environmental-type projects (UNEP 2009a, 9). In July 2009, South Korea's Presidential Council on Green Growth introduced a five-year investment plan worth $87 billion intended to foster green technologies and make the country one of the world's top seven "green economic powers" by 2020 (Kim J. 2009). The Five-Year Green Growth Plan focuses on 27 core technologies, mainly in the areas of clean energy and energy efficiency (UNEP 2010, 37). Earlier, in April, financial institutions and the government jointly formed the Green Finance Council to develop an avenue for businesses to obtain financing (Kim J. 2009).

South Korea's National Assembly passed the Framework Act on Low Carbon, Green Growth in January 2010. In April, the act was put into effect. The act enforces the goal of reducing the country's greenhouse gas emissions by 30 percent by 2020 and gives South Korea's green growth strategy legal basis. Additionally, the law certifies 61 key technologies involving 10 sectors as green technologies (KBS World 2010; MOLEG 2010).

The United Nations Environmental Program (UNEP 2010) released a report in April 2010 lauding South Korea as moving to "a green economy model" with the "potential of creating a domino effect on the other Major Asian economies." In June 2010, President Lee announced the establishment of the Global Green Growth Institute (GGGI). The institute will be headquartered in Korea and is intended to serve as a base for the development and spread of green technology throughout the international community. South Korea will fund GGGI with $10 million per year for the next three years (Kim H. 2010). In July 2010, the investment aperture opened when the Presidential Committee on Green Growth announced that South Korea's 30 major industrial groups were planning to invest $18 billion in the green growth sector (UPI 2010a).

By no means complacent, the South Korean government is currently working on a new Renewable Portfolio Standard (RPS). The RPS will require all electric power companies generating more than 500 megawatts of electricity per hour to gradually increase their renewable energy sources to 10 percent by 2022. Also, government facilities with 1,000 square meters or more of office space will have to use renewable energy sources for at least 10 percent of their energy needs. It

is expected that the RPS will create a new market worth $42 billion for renewable energy by 2022 (*JoongAng Daily* 2010).

In the meantime, business is booming for South Korea. In the first half of 2010, South Korea's renewable energy sector exports more than doubled from the previous year's amount. Solar and wind products surged to $2.14 billion in the January–June period from around $1 billion the previous year, and 80 companies from the solar and wind sector secured more than $8 billion worth of orders during the period, an almost sevenfold increase from the year before (Yonhap 2010).

Conclusion

Conventional fossil fuels (oil, coal, and natural gas) and nuclear energy (uranium) are the primary sources that supply power to the highly industrialized economies of China, Japan, and South Korea. Because these resources are finite and unequally distributed around the world, the three countries must compete in order to obtain and sustain them. As a result, there has been little traction in establishing a serious regional approach to formulating a cooperative energy strategy. Renewable energy has the potential to change this reality.

Renewable sources of energy such as solar, wind, hydro, and woody crops are locally derived, thus eliminating the geopolitical complexities and high stakes involved with resource competition. Also, when compared with fossil fuels as a global industry, renewable energy is a newcomer. China, Japan, and South Korea have an opportunity "get in on the ground floor" and help form the global basis of the technology and infrastructure that supports deployment and implementation of renewable energies.

The countries already share highly integrated trade relations. In 2009, Japan was China's second-largest trade partner behind the United States; South Korea was the fourth largest. Japan and South Korea were China's number one and number two import suppliers in 2009 (U.S.-China Business Council 2009). China was South Korea's and Japan's largest trade partner in 2009 for both imports and exports (*Daily Yomiuri* 2010; AFP 2010b).[1] In a positive development, the three countries agreed at a summit in 2009 to push for research on a free trade pact that would create a single economic bloc. In May of 2010, leaders from the three nations agreed to complete a joint study on the free trade agreement by

1 China supplanted the United States as the Japan's major export market for the first time since the end of World War II.

2012 (AFP 2010b). Should the free trade pact come into existence, a powerful Northeast Asian economic bloc would be formed and, along with it, a potential revolution in the global deployment and use of clean, renewable energy.

List of References

AFP (Agence France-Presse). 2010a. "S. Korea, India Agree to Launch Nuclear Energy Talks." 18 June. www.google.com/hostednews/afp/article/ALeqM5jHM7j5WrkiL-pXcXuMiRev6ypWByw.

———. 2010b. "S.Korea, Japan and China to Speed up Trade Accord." Bilaterals.org, 30 May. www.bilaterals.org/spip.php?article17455.

ASEAN Vietnam. 2010. "The 7th ASEAN+3 (China, Japan and Korea) Ministers on Energy Meeting." 29 July. http://asean2010.vn/asean_en/news/36/2DA928/The-7th-ASEAN3-China-Japan-and-Korea-Ministers-on-Energy-Meeting.

Associated Press. 2010. "Japan Frees 14 Crew from Chinese Fishing Boat." 13 September. www.guardian.co.uk/world/2010/sep/13/japan-frees-crew-chinese-boat.

Bai, Jim, and Tom Miles. 2010. "China, Russia Agree to Expand Nuclear Power Cooperation." Fox Business, 2 September. www.foxbusiness.com/markets/2010/09/02/china-russia-agree-expand-nuclear-power-cooperation/.

BBC News. 2009. "China President Opens Turkmenistan Gas Pipeline," 14 December. http://news.bbc.co.uk/2/hi/8411204.stm.

Blank, Stephen. 2010. "Russia's Far East Policy: Looking Beyond China." Paris: IFRI. www.ifri.org/downloads/ifriblankrussianfareastengjuly2010proof.pdf.

Bloomberg. 2010. "Mongolia Reroutes Rail Link with New Coal Mine to Avoid China, Group Says," Bloomberg, 24 August. www.bloomberg.com/news/2010-08-25/mongolia-reroutes-rail-link-with-new-coal-mine-to-avoid-china-group-says.html.

BP. 2010. "Statistical Review of World Energy 2010: Historical Data." www.bp.com/productlanding.do?categoryId=6929&contentId=7044622.

Calder, Kent E. 2007. "Sino-Japanese Energy Relations: Prospects for Deepening Strategic Competition." Paper presented at conference, "Japan's Contemporary Challenges in Honor of the Memory of Asakawa Kan'ichi," Yale University, 9–10 March.

China CSR. 2010. "China Promulgates Revised Renewable Energy Law." 6 April. www.chinacsr.com/en/2010/04/06/7415-china-promulgates-revised-renewable-energy-law/.

China Daily. 2004. "China Suspends Crude Oil Exports to Japan." 21 February. www.chinadaily.com.cn/english/doc/2004-02/21/content_308123.htm.

———. 2010. "Construction of Sino-Myanmar Pipeline Starts." 10 September. www.chinadaily.com.cn/china/2010-09/10/content_11288046.htm.

Cho Mee-young. 2010a. "RPT-S.Korea Consortium Buys Aussie Coal Fields for $488 Mln." Reuters, 5 July. http://uk.reuters.com/article/idUKSGE6640HR20100705.

———. 2010b. "S. Korea Utilities Find Alternatives to Costly Australia Coal," Reuters, 14 May. http://in.reuters.com/article/idINTOE63R06L20100514.

CSTP (Council for Science and Technology Policy [Tokyo]). 2008. "Low Carbon Technology Plan." 19 May. http://www8.cao.go.jp/cstp/english/doc/low_carbon_tec_plan/low_carbon_tech_plan.pdf.

Cyranoski, David. 2010. "Japan Plans Nuclear Power Expansion," Naturenews, 31 March. www.nature.com/news/2010/100331/full/464661a.html.

Daily Yomiuri. 2010. "China Now Japan's Top Trade Partner." Asia News Network, 28 January. www.asianewsnet.net/news.php?id=9808&sec=2&t=9785.

Daub, Travis. 2010. "China's Nuclear Power Building Boom." *PBS Newshour,* 30 July. www.pbs.org/newshour/rundown/2010/07/nuclear-power-is-critical-in-china.html.

Dyer, Geoff, and Farhan Bokhari. 2010. "China-Pakistan Reactor Deal to Open Fresh U.S. Rift." *Financial Times*, 23 September. www.ft.com/cms/s/0/83db2ac8-c72d-11df-aeb1-00144feab49a.html.

Economides, Michael, and Xina Xie. 2010. "China Global Oil Shopping Spree." Energy Tribune, 2 March. www.energytribune.com/articles.cfm/3356/China-Global-Oil-Shopping-Spree.

EIA (U.S. Energy Information Administration). 2006. "World Oil Transit Chokepoints, Malacca." www.eia.doe.gov/cabs/World_Oil_Transit_Chokepoints/Malacca.html.

———. 2008a. "Japan, Electricity." www.eia.doe.gov/emeu/cabs/Japan/Electricity.html.

———. 2008b. "Sakhalin Island." www.eia.doe.gov/emeu/cabs/Sakhalin/Background.html.

———. 2009a. "China: Electricity." www.eia.doe.gov/emeu/cabs/China/Electricity.html.

———. 2009b. "China, Natural Gas." www.eia.doe.gov/emeu/cabs/China/NaturalGas.html.

———. 2009c. "China: Oil." www.eia.doe.gov/emeu/cabs/China/Oil.html.

———. 2010a. "China Energy Profile." http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=CH.

———. 2010b. *International Energy Outlook 2010.* Washington, D.C.: EIA. Appendix A: Reference Case Projections. www.eia.doe.gov/oiaf/ieo/pdf/ieorefcase.pdf.

———. 2010c. "Japan, Oil." www.eia.doe.gov/emeu/cabs/Japan/Oil.html.

———. 2010d. "South Korea Energy Profile." http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=KS

———. 2010e. "South Korea, Natural Gas." www.eia.doe.gov/emeu/cabs/South_Korea/NaturalGas.html

———. 2010f. "South Korea, Oil." www.eia.doe.gov/cabs/South_Korea/Oil.html.

Evans, Peter C. 2006. "Japan." *Energy Security Series* (Brookings Institution), December. www.brookings.edu/fp/research/energy/2006japan.pdf.

Fu Jing. 2009. "China Considers Higher Renewable Energy Targets." *China Daily*, 6 July. www.chinadaily.com.cn/bizchina/2009-07/06/content_8380826.htm.

Fujioka, Chisa, and Chris Buckley. 2010. "China Snubs Japan PM over Boat Row, Rules Out Meeting." Reuters, 21 September. www.reuters.com/article/idUSTRE68I0652 0100921?pageNumber=1.

Fukuda, Yasuo. 2008. "In Pursuit of Japan as a Low-Carbon Society." Speech by the prime minister at the Japan Press Club, 9 June. www.kantei.go.jp/foreign/ hukudaspeech/2008/06/09speech_e.html.

Gao Xiaohui. 2010. "Time Not Yet Ripe for China's IEA Membership: Analyst." *Global Times,* 1 April. http://business.globaltimes.cn/comment/2010-04/518029.html.

Gelb, Bernard A. 2006. "Russian Oil and Gas Challenges." CRS Report for Congress, no. RL33212. Washington, D.C.: Congressional Research Service. http://fpc.state.gov/ documents/organization/58988.pdf

Gronholt-Pedersen, Jacob. 2010. "Russia, China in Deal On Refinery, Not Gas." *Wall Street Journal*, 22 September. http://online.wsj.com/article/SB1000142405274870 412920457550537336568556 4.htm.

IEA (International Energy Agency). 2009. "Progress with Implementing Energy Efficiency Policies in the G8." www.iea.org/G8/docs/Efficiency_progress_g8july09.pdf.

———. 2010a. "China Overtakes the United States to Become World's Largest Energy Consumer." 20 July. www.iea.org/index_info.asp?id=1479.

———. 2010b. "Medium and Long Term Plan for Renewable Energy, China." 4 September. www.iea.org/textbase/pm/?mode=cc&id=4129&action=detail.

Johnson, Toni. 2010. "Global Uranium Supply and Demand." Council on Foreign Relations, 14 January. www.cfr.org/publication/14705/global_uranium_supply_and_ demand.html.

JoongAng Daily. 2010. "New Renewable Energy Goals Are Set." 20 September. http:// joongangdaily.joins.com/article/view.asp?aid=2926233.

Kang Shinhye. 2008. "South Korea Seeks $90 Billion of Russian Natural Gas (Update 2)." Bloomberg, 29 September. www.bloomberg.com/apps/news?pid=newsarchive &sid=aVSHCOotVoDQ&refer=asia.

Kang Young-won. 2009. "Message from CEO." Korea National Oil Corporation. www. knoc.co.kr/ENG/sub01/sub01_1_1.jsp.

KBS World. 2010. "The Basic Act on Low Carbon, Green Growth." 15 April. http:// world.kbs.co.kr/english/news/news_commentary_detail.htm?No=18127.

KEMCO (Korea Energy Management Corporation). 2008. "The 3rd Basic Plan for NRE Technology Development and Deployment." December. www.kemco.or.kr/new_eng/pg02/pg02040500.asp.

Kim Hee-sung. 2010. "President Lee Announces Establishment of Global Green Growth Institute." Korea.net, 16 June. www.korea.net/news.do?mode=detail&guid=47660.

Kim Jae-kyoung. 2009. "Korea Braces for 'Green Finance' Era," *Korea Times,* 11 August. www.koreatimes.co.kr/www/news/biz/2010/02/283_49962.html.

Korea Petroleum Association. 2008. "Crude Oil Imports."

Kueppers, Alfred. 2010. "China to Lend Russia $6 Bln for Coal Supplies." Reuters Africa, 7 September. http://af.reuters.com/article/energyOilNews/idAFLDE6861MB20100907.

Lee Myung-bak. 2008. "President's Speech on August 15." Ministry of Foreign Affairs and Trade, 2 September. http://news.mofat.go.kr/enewspaper/articleview.php?master=&aid=1333&ssid=23&mvid=576.

Lugar Energy Initiative. 2004. "World Oil Chokepoints." http://lugar.senate.gov/energy/security/chokepoints.cfm

Mochizuki, Takashi, and Juro Osawa. 2010. "Japan Unveils Stimulus Amid Growth Worries." *Wall Street Journal*, 11 September. http://online.wsj.com/article/SB10001424052748704644404575482462179189680.html

MOLEG (Ministry of Government Legislation). 2010. "Laying Legal Foundation to Make Korea an Advanced Country in Green Growth." 15 April. www.moleg.go.kr/english/notice;jsessionid=fBWqT4yM55x2iX0Akfaigi6EOai2LIy8RPR2Cq6zEqyjIGTNZQke88ePytGjixhf?pstSeq=52048.

Morales, Alex. 2010. "China Beats U.S. on Renewable-Energy Investor Ranking." Bloomberg, 8 September. www.bloomberg.com/news/2010-09-07/china-supplants-u-s-at-top-of-ernst-young-ranking-for-renewable-energy.html.

Na Jeong-ju. 2008. "Lee Proposes 'Energy Silk Road' Plan to Russia." *Korea Times*, 29 September. http://koreatimes.co.kr/www/news/nation/2008/09/116_31881.html.

NPC (Standing Committee of the National People's Congress). 2005. "The Renewable Energy Law of the People's Republic of China." China Climate Change Info-net, 28 February. www.ccchina.gov.cn/en/NewsInfo.asp?NewsId=5371.

OPMJ (Office of the Prime Minister of Japan). 2008. "Action Plan for Achieving a Low-Carbon Society." 29 June. www.kantei.go.jp/foreign/policy/ondanka/final080729.pdf.

PAJ (Petroleum Association of Japan). 2009. "Petroleum Industry in Japan, 2009." www.paj.gr.jp/english/data/paj2009.pdf.

———. 2010. "Oil Statistics." www.paj.gr.jp/english/statis/.

Pistilli, Melissa. 2010. "Nuclear Battle: Japan vs. South Korea." Uranium Investing News, 9 February. http://uraniuminvestingnews.com/2731/nuclear-energy-battle-japan-vs-south-korea.html.

Platt's. 2009. "Russian Crude Oil Exports to the Far East—ESPO Starts Flowing." www.platts.com/IM.Platts.Content/InsightAnalysis/IndustrySolutionPapers/espo1209.pdf.

Reuters. 2010. "Q&A: China, Japan and the East China Sea Gas Dispute." 20 September. www.reuters.com/article/idUSTRE68J0NX20100920.

REW (RenewableEnergyWorld.com). 2005. "China Passes Renewable Energy Law." 9 March. www.renewableenergyworld.com/rea/news/article/2005/03/china-passes-renewable-energy-law-23531.

———. 2010. "Global Wind Installations Boom, Up 31% in 2009." 4 February. www.renewableenergyworld.com/rea/news/article/2010/02/global-wind-installations-boom-up-31-in-2009.

RIA Novosti. 2010. "Kazakhstan Plans to Capture 40% of Japan's Uranium Market." 24 March. http://en.rian.ru/exsoviet/20100324/158300048.html.

Seligsohn, Deborah. 2008. "A 'Green Lining' in China's economic Stimulus Plan," Guardian Environment Network, 28 November. www.guardian.co.uk/environment/2008/nov/28/china-climate-change.

Swartz, Spencer, and Shai Oster. 2010. "China Tops U.S. in Energy Use." *Wall Street Journal,* 18 July. http://online.wsj.com/article/SB10001424052748703720504575376712353150310.html.

Tabuchi, Hiroko. 2009. "In Japan, a $154 Billion Stimulus Plan." *New York Times*, 10 April.

Takenaka, Kyoshi, and Yoko Kubota. 2010. "Japan to Start Nuclear Power Talks with India." Reuters, 25 June. www.reuters.com/article/idUSTRE65O1US20100625.

Tamaru Kazuhiro. 2010. "Japan's Clean Coal Policy." Slide no. 6 from presentation, "Coal Reserves, Consumption and Trade." www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/343465/Tamaru_Japans-clean-coal-policy.pdf.

Today's Zaman. 2010. "Turkish Energy Minister: Talks Continue with S. Korea on Nuclear Power Plant." 22 September. www.todayszaman.com/tz-web/news-222360-105-turkish-energy-minister-talks-continue-with-s-korea-on-nuclear-power-plant.html.

Trading Economics. 2009. "GDP Growth (Annual %) in World." www.tradingeconomics.com/world/gdp-growth-annual-percent-wb-data.html.

UNEP (United Nations Environment Program). 2009a. "Global Green New Deal: An Update for the G20 Pittsburgh Summit." September 2009. www.unep.ch/etb/publications/Green%20Economy/G%2020%20policy%20brief%20FINAL.pdf.

———. 2009b. *Global Trends in Sustainable Energy Investment 2009.* Nairobi: UNEP. 20, 60, www.unep.org/pdf/Global_trends_report_2009.pdf

———. 2010. "Overview of the Republic of Korea's National Strategy for Green Growth." April. www.unep.org/PDF/PressReleases/201004_UNEP_NATIONAL_STRATEGY.pdf.

UPI. 2010a. "Boost for South Korea's Green Sector." 13 July. www.upi.com/Science_News/Resource-Wars/2010/07/13/Boost-for-South-Koreas-green-sector/UPI-28761279040517/.

———. 2010b. "South Korea Wants More Gas from Russia." 7 September. www.upi.com/Science_News/Resource-Wars/2010/09/07/South-Korea-wants-more-gas-from-Russia/UPI-90961283874941/.

U.S.-China Business Council. 2009. "Table 9: China's Top Import Suppliers 2009 ($ billion)." (Data from *China's Customs Statistics,* PRC General Administration of Customs.) www.uschina.org/statistics/tradetable.html.

Van Veenstra, Anne. 2008. "Establishing Energy Cooperation in Northeast Asia: Implications from the Experiences of the European Union." Paper prepared for Institute of Energy Economics Japan. www.eaber.org/intranet/documents/96/977/IEEJ_van-Veenstra_08.pdf.

Wang Ying. 2010. "China to Build 28 More Nuclear Power Reactors by 2020 (Update 2)." Bloomberg Businessweek, 23 March. www.businessweek.com/news/2010-03-23/china-to-build-28-more-nuclear-power-reactors-by-2020-update1-.html.

Wang Ying and John Duce. 2010. "China May Spend $738 Billion on Clean Energy Projects." Bloomberg Businessweek, 20 July. www.businessweek.com/news/2010-07-20/china-may-spend-738-billion-on-clean-energy-projects.html.

White, Garry. 2010. "'Floating Chernobyls' to Hit the High Seas." Telegraph.co.uk, 6 September. www.telegraph.co.uk/finance/markets/7982927/Floating-Chernobyls-to-hit-the-high-seas.html.

World Bank. 2009. "Gross Domestic Product 2009." http://siteresources.worldbank.org/DATASTATISTICS/Resources/GDP.pdf.

———. 2010. "Global Economic Prospects: Regional Detailed Forecasts." http://web.worldbank.org/external/default/main?contentMDK=20381640&menuPK=659183&theSitePK=659149&pagePK=2470434&piPK=2470429.

World Nuclear Association. 2010a. "Nuclear Power in Japan." October. www.world-nuclear.org/info/inf79.html.

———. 2010b. "Nuclear Power in South Korea." www.world-nuclear.org/info/inf81.html.

World Nuclear News. 2010. "South Korea Seeks to Boost Reactor Exports." 13 January. www.world-nuclear-news.org/NP-South_Korea_seeks_to_boost_reactor_exports-1301104.html.

Xinhua. 2010. "Putin Opens Russian Section of Russia-China Oil Pipeline." 30 August. http://news.xinhuanet.com/english2010/business/2010-08/30/c_13468842.htm.

Yonhap. 2010. "S. Korea's Renewable Energy Sector Exports Surge in H1." 19 July. http://english.yonhapnews.co.kr/business/2010/07/19/42/0501000000AEN20100719003400320F.HTML.

Yoo Choonsik. 2008. "South Korea Lists 22 New Growth-Engine Sectors," Reuters, 22 September. http://in.reuters.com/article/idINSEO14559620080922.

Yoon Sojung. 2008. "President Lee Begins State Visit to Russia." Korea.net, 29 September. www.korea.net/detail.do?guid=24273.

Yu Hongyan. 2010. "China Becomes a Net Coal Importer in 2009." *China Daily*, 23 February. www.chinadaily.com.cn/bizchina/2010-02/23/content_9490004.htm.

Zhu, Winnie, and Baizhen Chua. 2010. "Coal Imports May Drop in China on Less Growth, More Hydro: Energy Markets," Bloomberg, 3 August. www.bloomberg.com/news/2010-08-02/coal-imports-may-drop-in-china-on-less-growth-more-hydro-energy-markets.html.

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