GROWTH IN ENERGY NEEDS IN NORTHEAST ASIA: PROJECTIONS, CONSEQUENCES, AND OPPORTUNITIES

Paper based on a Presentation at the Korea Economic Institute Policy Forum "2008 Northeast Asia Energy Outlook" Washington, DC, USA, May 6, 2008

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1. Introduction[1]

Over the last two decades and more, rapid economic growth in Northeast Asia—a region of more than1.5 billion people—has rapidly increased regional needs for energy services. In China and the Republic of Korea (ROK) in particular, growth in the need for energy services, and for the fuels—gasoline, coal, electricity, natural gas, and others—that are used to supply those needs, has brought with it a raft of environmental problems, including rapidly mounting greenhouse gas emissions, and increased emissions of other air pollutants, with significant impact on local and regional air quality. As a recent, eye-opening example of these increased needs, China added more than 100 GW of generating capacity—equivalent to 150 percent of the total generation capacity in the ROK as of 2007—in the year 2006 alone, with the vast bulk of that added capacity being coal-fired. The countries of the region already constitute the largest importer market for liquefied natural gas (LNG), and are a major oil import market as well. The Northeast Asian regional share of world primary energy use has been increasing as well; even as energy use in the rest of the world has increased, Northeast Asia's share has increased from 18.6 percent in 1999 to 24.1% in 2006.

Though the region as a whole possesses resources that could contribute substantially toward its future energy needs, many major energy resources—including natural gas, oil, coal,

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[1] This article in part updates, a paper entitled Regional Energy Infrastructure Proposals and the DPRK Energy Sector: Opportunities and Constraints prepared by the authors for the KEI-KIEP Policy Forum on "Northeast Asian Energy Cooperation", Washington, DC, January 9, 2003. Please see http://www.keia.org/2-Publications/2-6-Other/NortheastAsiaEnergy/northeastAsiaEnergy.html for the full workshop paper. This article also draws upon material included in "Future Northeast Asian Regional Energy Sector Cooperation Proposals and the DPRK Energy Sector: Opportunities and Constraints", published by the authors in ERINA REPORT, June, 2008. This article is based on a presentation entitled "Growth in Energy Needs in Northeast Asia: Projections, Consequences, and Opportunities", prepared by D. Von Hippel for the Korea Economic Institute Policy Forum "2008 Northeast Asia Energy Outlook", Washington, DC, USA, May 6, 2008.

and hydroelectric power in the Russian Far East, and gas and hydro in Western China—are far from population centers. As such, major infrastructure investments will be required to bring these resources to market, and additional economic, political, technical, and environmental considerations also apply, particularly when these resource cross one or several borders, and most particularly when one or more of the borders (as for pipelines or powerlines from Russia to the Republic of Korea) are shared by the Democratic People's Republic of Korea (DPRK). Further, the Six-Party Talks process of negotiating the removal of nuclear weapons from the DPRK links consideration of providing assistance in rebuilding the DPRK's economy and energy sector with nuclear weapons issues, such that regional energy cooperation, the solution to the DPRK nuclear weapons dilemma, and perhaps even partial solutions to global and regional environmental problems are intertwined.

In the remainder of this article, we begin with brief sketches of the recent, current, and future drivers of energy supply and demand in each of the countries of Northeast Asia, provide a summary of regional projections of energy use, noting some of the probable consequences of energy use expansion, touch on some of the opportunities for regional energy cooperation, noting the prospects and limits of cooperation to meet needs for energy services, touch upon the challenges and opportunities in a regional context posed by the DPRK energy and security situation, and end with notes on what the United States, in particular, might do to influence the path of energy cooperation in Northeast Asia.

2. Energy Use in the Countries of Northeast Asia—Trends, Drivers and Projections

The countries that make up the region referred to here as "Northeast Asia" range from industrialized, heavily populated, and energy-resource-poor nations (Japan and the Republic of Korea), to nations with limited energy resources seeking development or redevelopment (Mongolia, DPRK), to China, with significant resources but a huge population and rapidly growing energy demand, to the sub-nation that is the Russian Far East, with a small population inhabiting a vast, resource-rich (but forbidding) landscape. Not surprisingly, these countries show very different trends and projections of energy use. Energy use trends and projections, and the driving forces behind them, are discussed briefly below for each country.

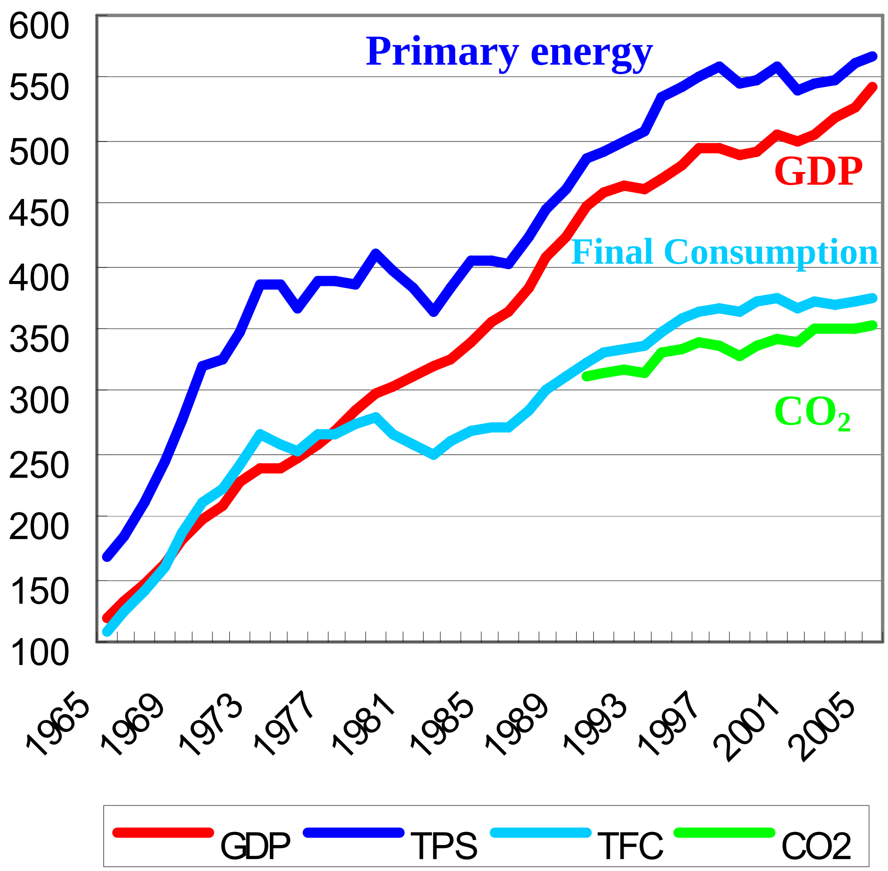
2.1 Japan

Japan's population—about 127.5 million as of 2005[2]—is nearly stable, and will start to decline in the next decade. After a period of quite slow or no growth—average GDP growth of about 1.2 percent from 1990 through 2005--Japan's economic picture has begun to improve somewhat in recent years. Japan has modest hydroelectric output, very small domestic gas production, and while it has some coal reserves—about 360 million tonnes—the high production costs of domestic coal relative to the cost of imported coal has caused Japan to all but shut down its indigenous coal industry. As a result, Japan's economy is highly dependent on imports—particularly imported coal, oil (largely from the Middle East), LNG (liquefied natural gas), and

[2] Based on data from United Nations Department of Economic and Social Affairs, Population Division, "World Population Prospects, The 2006 Revision Population Database", available at http://esa.un.org/unpp/index.asp?panel=2.

uranium for its nuclear power industry. Japan's energy use and carbon dioxide emissions also continue to grow, but more slowly than the economy (see Figure 1).

Figure 1: Trends of GDP, Primary Energy Use, Final Energy Consumption, and Carbon Dioxide Emissions in Japan. Units, Trillion 2000 Yen (GDP), Million Tonnes Oil Equivalent (Primary Energy and Final Consumption), and Million tonnes (CO_2)[3]

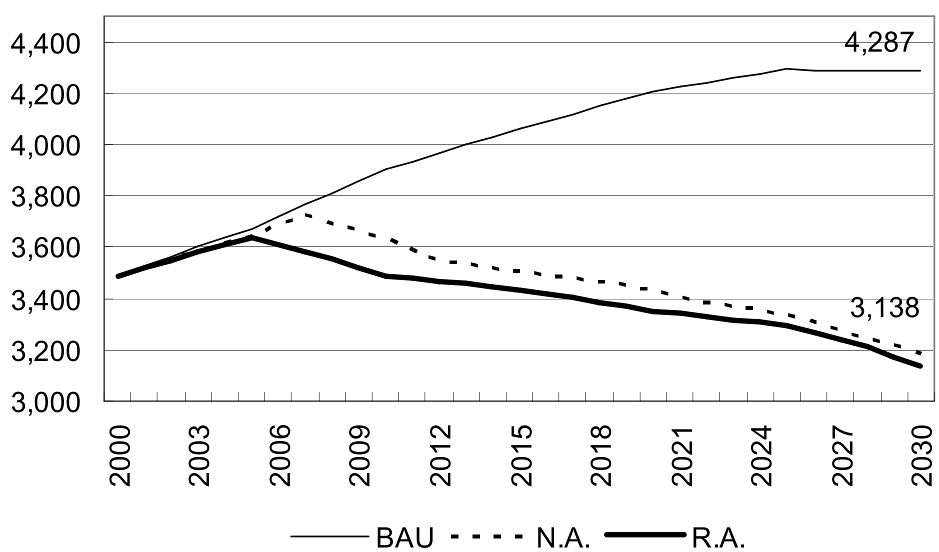


Despite relatively slow recent growth in energy use, meeting Japan's greenhouse gas emissions reduction commitments under the Kyoto Protocol to the United Nations Framework Convention on Climate Change will require significant modifications to business as usual. Japan's policies for achieving emissions reduction Government policies emphasize energy efficiency, but largely using voluntary measures. Though policies such as emission trading and an "Environmental Tax" are under discussion, they have yet to be implemented. Japan's government policy calls for expansion of nuclear power generation capacity from 50 GW

[3] Kae Takase, Tatsujiro Suzuki, and Tadahiro Katsuta (2007), "Japan Energy Update & LEAP Japan Model 2007", prepared for the "Asian Energy Security Project Meeting", Beijing, PRC, October 31-November 2, 2007, and available as http://www.nautilus.org/energy/2007/beijingworkshop/papers/PRCEnergy.ppt..

(gigawatts, or billion watts) in 2007 to about 66 GW in 2020, with implementation of life extension for existing plants, and ultimately, fast breeder reactors to conserve uranium. The high cost of nuclear fuel reprocessing facilities (on the order of $180 Billion to build and operate the Rokkasho reprocessing facility and related spent-fuel management infrastructure, over its lifetime), difficulties in obtaining new sites for reactors and reprocessing facilities (due to safety, and other concerns), and issues related to the storage of nuclear spent fuel (storage pools at reactors are filling up, and long-term storage has been hard to site and seismically problematic), however, suggest that significant expansion of Japan's nuclear power program faces serious obstacles. At the same time, growing inventories of Plutonium separated both in domestic facilities and in at reprocessing centers abroad create both an inventive for using the separate Plutonium in conventional or breeder reactors, and also, potentially, a proliferation concern[4]. Several studies have indicated that despite Japan's relatively high efficiency of energy use, much more could be done, and that a commitment to aggressive implementation of energy efficiency measures and implementation of renewable energy options are likely to be effective in helping Japan meet it's greenhouse gas emissions reduction targets. Figure 2, for example, compares "Business as Usual" (BAU) projections of future energy use in Japan with paths (NA and RA) including significantly greater energy efficiency and renewable energy—and resulting in energy use and emissions about 25 percent lower by 2030.

Figure 2: Three Scenarios of Future Energy Use in Japan. National Alternative (NA) and Regional Alternative (RA) cases shows reduction in Final Energy Consumption due to implementation of energy saving technologies. Units: Trillion kcal[5]



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[4] Tadahiro Katsuta and Tatsujiro Suzuki (2006), Japan's Spent Fuel and Plutonium Management Challenges, Research Report No. 2, International Panel on Fissile Materials, September 2006. Available as http://www.fissilematerials.org/ipfm/site_down/rr02.pdf.

[5] Takase et al (2007), ibid.

2.2 Republic of Korea

Like Japan, the Republic of Korea (ROK) is heavily dependent on imports of oil, natural gas (as LNG), and coal to drive its economy—with an overall import dependence of over 96 percent. Like Japan, the ROK does have some coal reserves, but the expense of mining them has caused domestic production to dwindle to a small fraction of national needs. Like Japan, the ROK, has little in the way of significant oil or gas reserves, though some resources may exist in areas near or on maritime boundaries with other nations. Like Japan, the ROK population is near its peak, and will begin to decline in just over a decade (by 2019[6]) from a high of about 49.2 million. Unlike Japan, however, the ROK's economy and energy use continues to grow quite rapidly, with an annual average growth rate of GDP from 1998 through 2005 of 5.6 percent, and an annual average growth rate of primary energy consumption of 4.7 percent[7]. In 2006, the ROK GDP grew 5.2 percent, but Energy Consumption rose only 2.1 percent, suggesting a continuing trend of decoupling of energy consumption and economic growth.

Ongoing policy directions in the ROK, which will help to shape energy consumption in the coming decades, include policies to enhance energy efficiency to reduce energy imports dependence and respond to oil costs (a quarter of the outlays for all imports to the ROK in 2006 were for petroleum), move toward sustainable energy system in response to environmental challenges, and pursue regional energy cooperation (on oil, gas, and/or electricity infrastructure). Other factors influencing energy policy in the ROK include a movement toward a more open policy framework, and the existence of no more new nuclear sites (in South Korea, at any rate). An ongoing process of market development and privatization is scheduled to continue, starting with the recent breakup of the elements of KEPCO (the Korea Electric Power Corporation), the selective privatization of electricity and KNOC (Korea National Oil Company) assets, and the revision of tax structures for some fuels (including biofuels). Figure 3 shows a projection for roughly "Business as Usual" growth in primary energy use in the ROK, showing continuing, though slowing, expansion in the energy use, but with the fraction of energy provided by oil and eventually coal declining at the expense of expanded use of natural gas, nuclear power, and renewable energy.[8]

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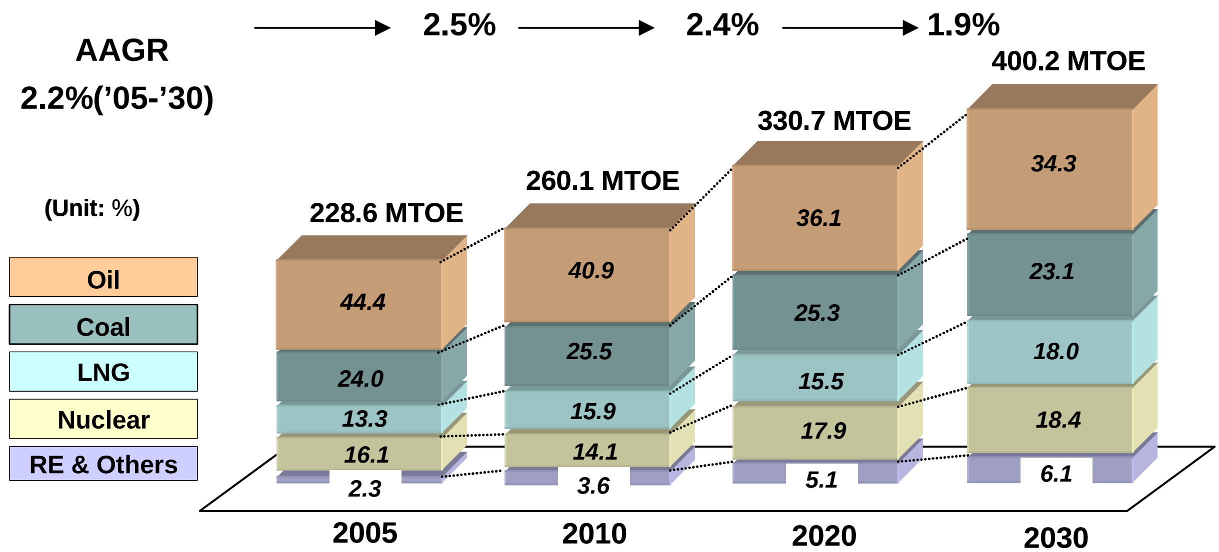
[6] Based on data from United Nations Department of Economic and Social Affairs, Population Division, "World Population Prospects, The 2006 Revision Population Database", available at http://esa.un.org/unpp/index.asp?panel=2.

[7] Note that the first year of this period, 1998, was the year of adjustment following the 1997 "Asian Financial Crisis", when economic growth and growth in energy consumption in the ROK were both negative.

[8] Figure 3 is from Chung Woo-jin (2006), "Energy Demand Forecast and Policy Directions in Korea", presentation prepared for the Asian Energy Security Workshop 2006. Available from http://www.nautilus.org/energy/2006/beijingworkshop/papers.html. Figure is based on projections prepared by the Korea Energy Economics Institute. "AAGR" stands for "annual average growth rate".

Figure 3: Projections of Primary Energy Use by Fuel Type in the Republic of Korea, 2005 through 2030 (Million Tonnes Oil Equivalent and Fraction of Total Supply by Fuel)



2.3 Mongolia

Landlocked Mongolia had a population of 2.6 million as of 2006, living in a territory of 1.57 million square kilometers set between Russia and China. After growing at 2 to 3 percent per year through the 1980s, Mongolia's population growth rate declined rapidly to under 1 percent by the late 1990s, and is projected to continue to decrease slowly, so that the nation's population is projected to reach stasis by 2050. Despite robust economic growth in recent years—no lower than 6 percent annually since 2002—Mongolia's use of electricity and coal (used for electricity generation, industry, central-station heat production, and residential energy use in urban areas) grew relatively little[9]. Mongolia imports all of its oil as refined products, and growth in refined products use has averaged about 5.4 percent annually from 2002 through 2006[10]. As much of the growth in Mongolia's GDP in recent years has stemmed from increases in commodity prices (for copper and livestock, for example) received for its exports to China and other rapidly growing economies, it is perhaps not surprising that growth in energy use has not tracked growth in GDP.

Projections for energy use in Mongolia are not numerous. A set of projections for Mongolia prepared under the ALGAS (Asia Least-cost Greenhouse Gas Abatement Strategy[11]) project forecasts growth in energy demand from 2000 to 2020 averaging nearly 10 percent annually. Other estimates, including an estimate of total energy demand for Mongolia averaging

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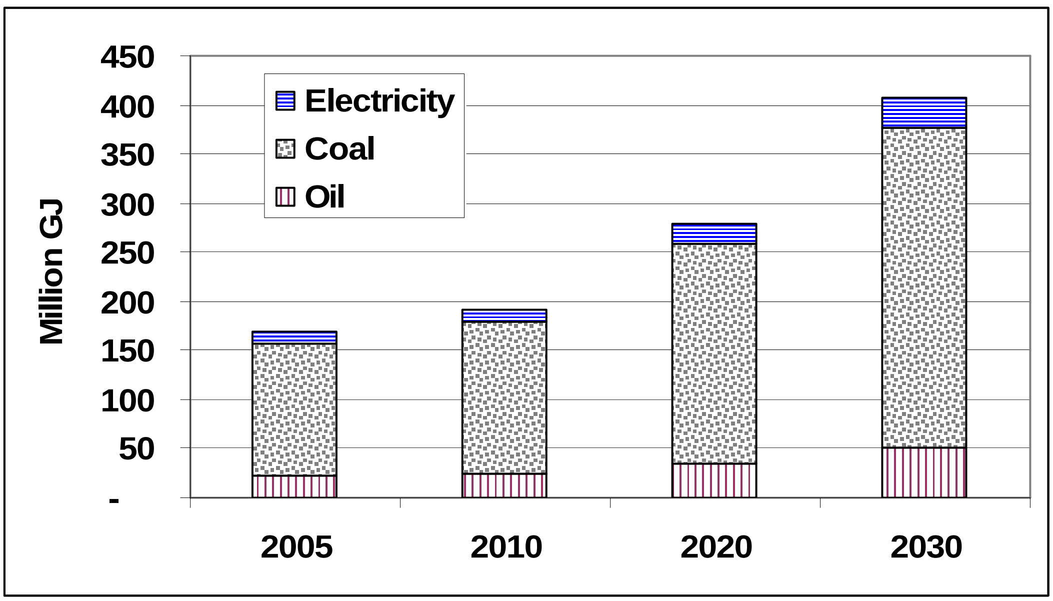
[9] Asian Development Bank (2008), Asian Development Outlook, 2007, "East Asia: Mongolia", http://www.adb.org/documents/books/ADO/2007/MON.asp.

[10] U.S. Department of Energy, Energy Information Administration (2008), International Energy Annual. See, for example, "Mongolia Energy Profile", at http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=MG.

[11] Asian Development Bank (1998), Asia Least-cost Greenhouse Gas Abatement Strategy: Mongolia. October, 1998. Available from http://www.adb.org/Documents/Reports/ALGAS/MON/default.asp#contents.

less than 2 percent annually for the same period[12], and Mongolian estimates for electricity and heat demand showing growth from 2005 to 2020 in the range of 2 to 3 percent annually[13], suggest that growth in energy use will be significantly less than the ALGAS projections. In order to achieve sustainable economic growth, Mongolia must address its aging energy infrastructure, problems with transparency and other governance-related issues in the operations of its energy sector, poor energy efficiency on both the supply- and demand- sides stemming partially from market inefficiencies due to fuel price subsidies, and environmental concerns, particularly related to coal consumption. Our rough projection of oil, electricity and coal demand for Mongolia, provided in Figure 4, assumes that these issues are addressed over time, but that growth in energy use occurs at only a fraction of the level suggested by the ALGAS study.

Figure 4: Projections of Energy Use by Fuel Type in Mongolia, 2005 through 2030



2.4 Democratic Peoples' Republic of Korea

The economic, if not social and political, landscape in the DPRK changed markedly during the 1990s, following the breakup of the Soviet Union. This economic decline has been both a result and a cause of substantial changes in energy demand and supply in North Korea. Though recent anecdotal evidence suggests that the economy in some parts of the DPRK,

[12] Kim, Jinwoo (2004), "2004 Energy Security of Northeast Asia: Current State, Energy Demand/Supply Projection Current State, Energy Demand/Supply Projection and Investment Needs", prepared for KEEI KEEI-IEA Joint Conference, Seoul, March 16~17, 2004. Available as http://www.iea.org/Textbase/work/2004/seoul/JinWoo_Kim.pdf.

[13] Tsegmid Sukhbaatar and Chogdon Ouynchimeg, (2005), "Updates on the Mongolia Energy Sector and the LEAP –Mongolia", prepared for the Asian Energy Security Workshop, 13-16 May, 2005, Beijing, China, and available as http://www.nautilus.org/aesnet/2005/AUG1705/Country-Update-Mongolia.ppt.

particularly near Pyongyang, may have improved somewhat between about 2003 and 2006, it is not clear that the energy supply situation has changed substantially for the better nationwide since 2000. Elements of this economic and decline and subsequent mixed (at best) performance include:

- A decline in the supply of crude oil in early 1990s, though supplies—all or virtually all imports from China—have been approximately stable since 2000.
- Continuing degradation of electricity generation, transmission, and distribution infrastructure. There have been reports of somewhat improved electricity availability in recent years, but improvement, if any, appears to be highly variable by location and even year-to-year[14].
- Continuing degradation of industrial and district heating facilities, and of transportation infrastructure, the latter resulting in difficulties with transport of all goods, especially coal.
- Some international trade in the refractory and rather rare mineral magnesite, expanding trade with China in coal (over 3 million tonnes in 2006) and metal ores, and the beginning of ROK investments, particularly in the mining sector.
- Difficulties in coal production related to lack of electricity and mine flooding.
- Sporadic, highly localized economic revival, but mostly associated with foreign aid and/or in areas of the economy that are not energy intensive (such as markets, restaurants, small agriculture).
- Cessation of KEDO (Korean Peninsula Energy Development Organization) heavy fuel oil deliveries in (new HFO under 6 PT)
- Construction of small power plants, mainly small hydroelectric plants, but sometimes small thermal (coal or biomass-fired) plants as well. These plants are often not connected to main power grid—thus serving only local areas—and may have produce relatively little energy per unit of capacity.

Figure 5 compares estimated final energy demand by sector for the years 1990, 1996, 2000, and 2005, and Figure 6 provides the same comparison for energy demand by fuel category[15]. In addition to the marked decrease in overall energy consumption, there are two notable features of these comparisons. The first is the continuation of the trend of 1990 to 1996 whereby the residential sector uses an even larger share (42 percent in 2005) of the overall energy budget, while the industrial sector share shrinks to a third of the total. This change is the combined result of continued reduction in fuel demand in the industrial sector, relatively constant use of wood and other biomass fuels in the residential sector, and reductions in the use of other residential fuels (notably coal and electricity) that are not as severe as the reductions experienced in the industrial sector. Second, and for similar reasons, the importance of wood/biomass fuels

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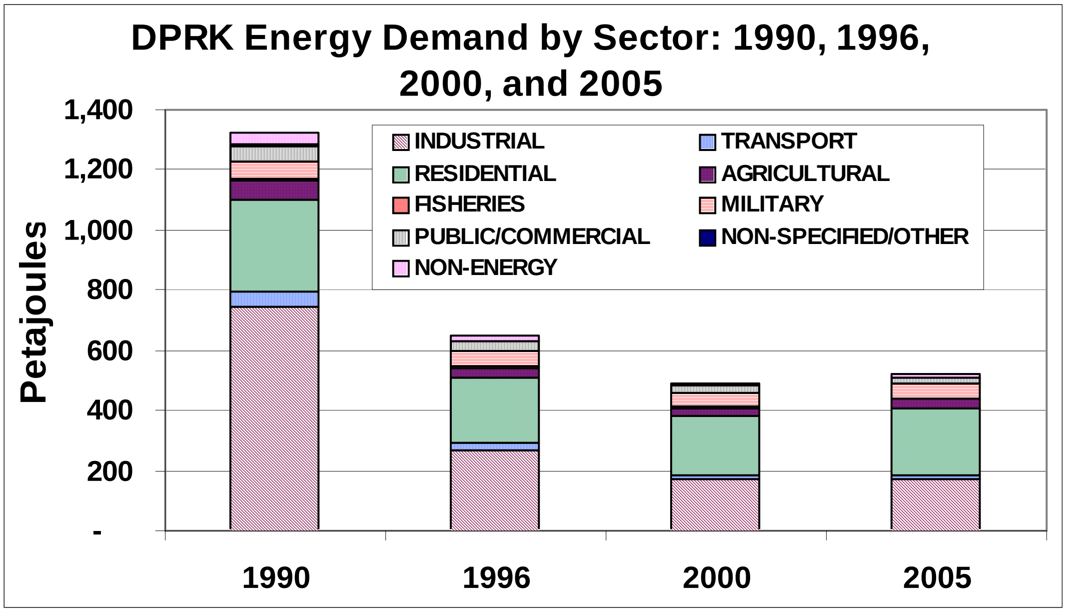
[14] Based on anecdotal information from a number of sources, our preliminary assessment is that the overall power supply situation in the DPRK was likely somewhat worse in 2007 than it was in 2005.

[15] See D.F. Von Hippel and P. Hayes (2007), Fueling DPRK Energy Futures and Energy Security: 2005 Energy Balance, Engagement Options, and Future Paths (Nautilus Institute Report, available as http://www.nautilus.org/fora/security/07042DPRKEnergyBalance.pdf), for details on the estimates provided in these figures and for related information.

to the energy budget as a whole is estimated to have increased dramatically over the course of the 1990s, and into the current decade, while the importance of commercial fuels has decreased. Increased use of wood and other stresses have resulted in significant deforestation and degradation of forest lands in the DPRK.

Figure 5:



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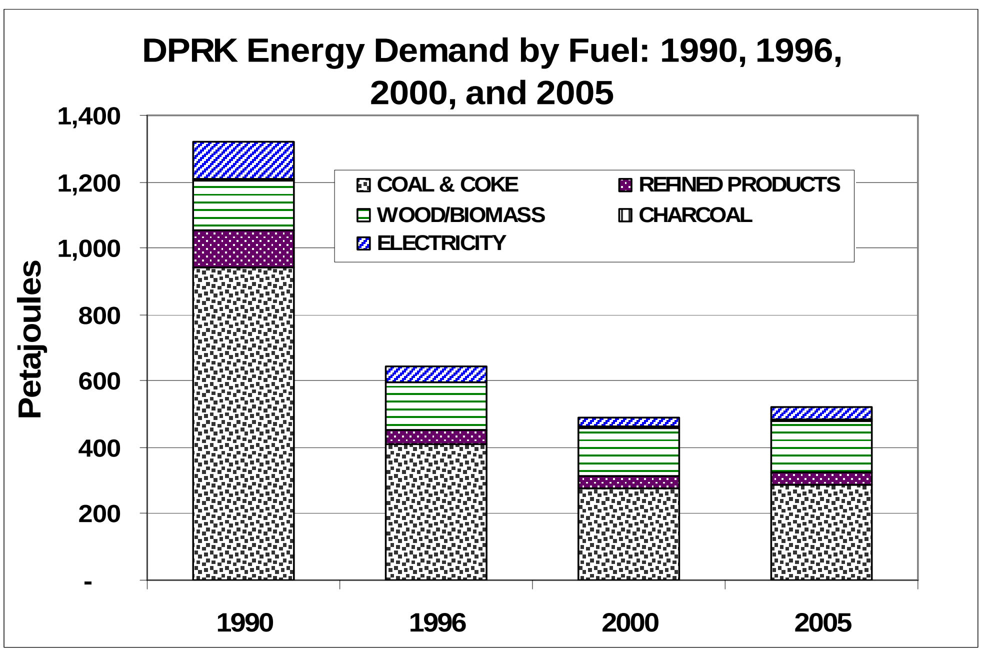
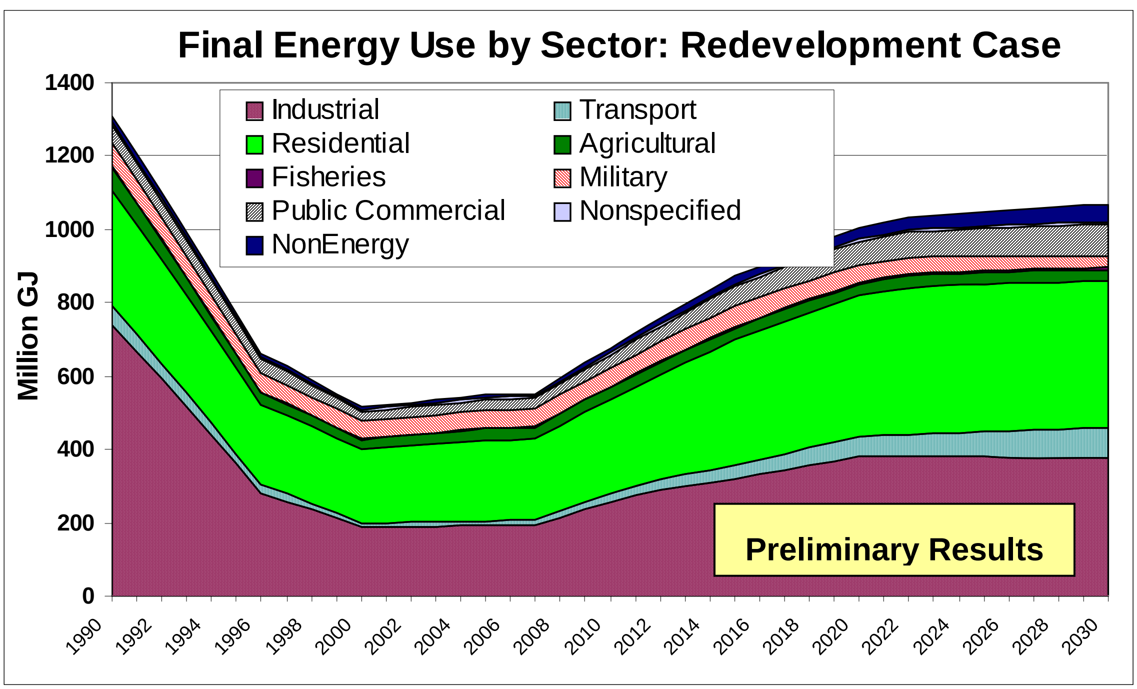


We have prepared (and are currently updating) future scenarios of energy-sector development for the DPRK, using the Long-range Energy Alternatives Planning energy/environment software tool (LEAP[16]). The choice and shape of DPRK energy "paths" are highly dependent on resolution of the nuclear weapons issue, and on the timing and nature of investments/assistance that would flow from such a resolution. Preliminary results, in which we compare a "Redevelopment" path that has no significant emphasis on energy efficiency improvement (see Figure 7), with a "Sustainable Development" path emphasizing energy efficiency and (to a lesser extent) renewable energy, and a "Regional Alternative" path also including DPRK participation in the regional energy infrastructure (for example, gas pipelines and electricity trading), showed a significant reduction in, for example, electricity needs (Figure 8) and greenhouse gas emissions (Figure 9) for the latter two cases. The net costs of those reductions may be relatively small or even negative—our earlier work showed negative net costs (that is, net savings) for the Sustainable Development and Regional Alternative paths, relative to the Redevelopment path, even assuming future oil prices much lower than today's levels. We are continuing to update these analyses, but expect that revised results will show the same general trends, reinforcing the conclusion that the least expensive way to redevelop the DPRK will be as an energy-efficient economy, and underscoring the benefits of the energy-efficiency-related regional cooperation options noted later in this article. Some energy efficiency cooperation options may offer opportunities for application of Clean Development Mechanisms to share costs—and carbon credits—between the DPRK and investor countries.

Figure 7:



[16] The LEAP software tool is developed and maintained by Stockholm Environment Institute—United States. Please see http://www.energycommunity.org/ for information about the LEAP tool.

Figure 8:[17]

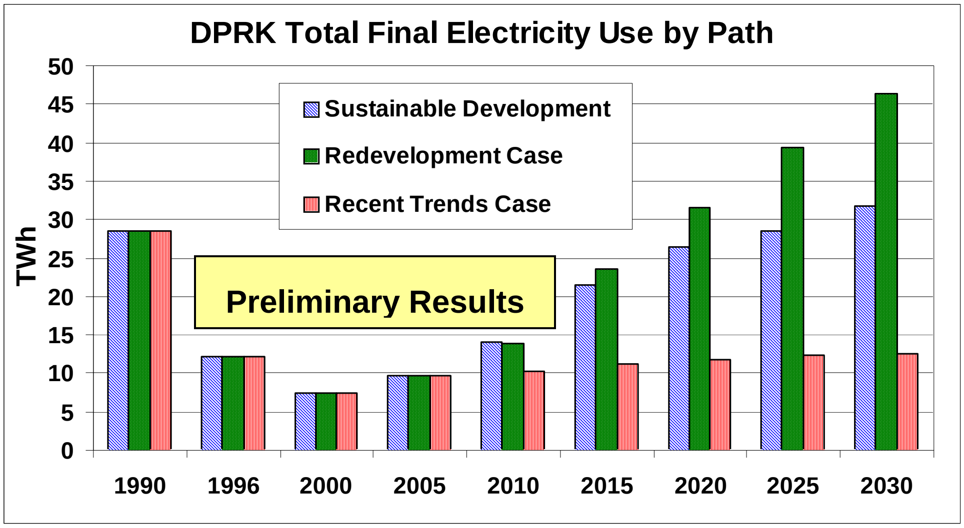
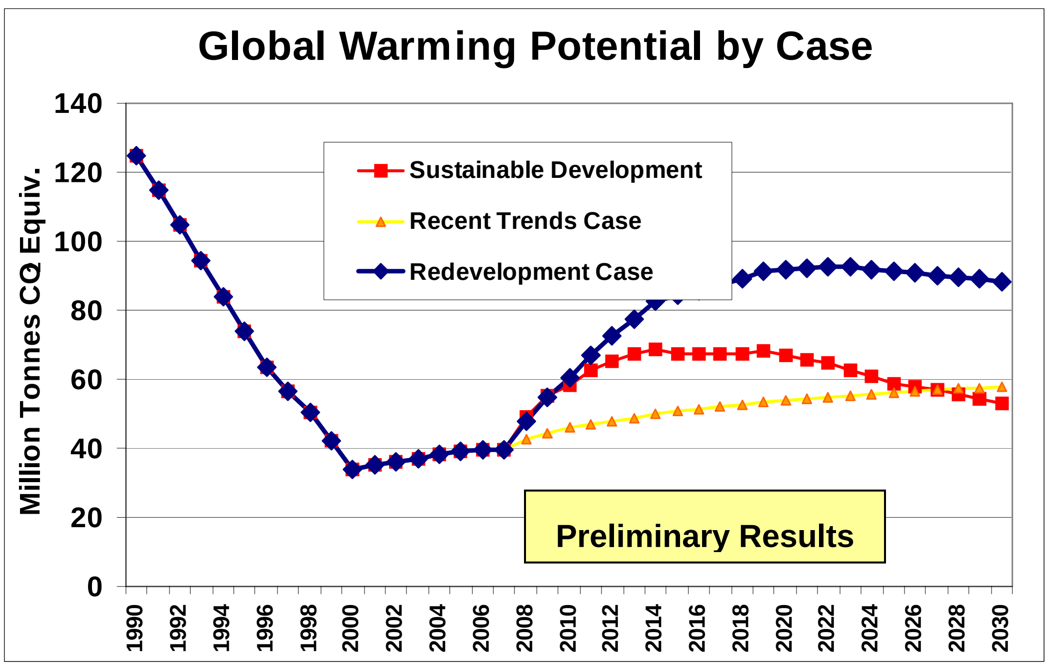


Figure 9:



2.5 China

China's economic rise continues to be nothing short of stunning, with annual rates of GDP growth in this decade ranging from a "low" of 8 percent to over 11 percent[18]. Though the

[17] An additional path shown in Figures 8 and 9, the "Recent Trends" path, assumes that a substantial solution to the DPRK nuclear issue is not forthcoming, and recent trends in the DPRK economy continue.

focus of the economy is shifting as it matures—from agriculture and primary industry toward secondary industry and services—growth in the need for energy resources to fuel economic development continues at a rapid pace. During 2006, for example, China's primary energy production grew 7.2 percent, and its total energy demand grew 9.6 percent, including a10.4 percent increase in coal use (to 2.4 billion tons), a 14.6 percent increase in power generation (and a 19.6 percent increase in capacity, to nearly 620 gigawatts), a 7.2 percent increase in oil consumption, and a nearly 20 percent increase in natural gas consumption[19]. China's domestic oil production and resources are insufficient to sustain the growth in oil products use, and as a result net crude oil and oil products imports rose 17.9 percent in 2006. Though China's population is stabilizing (current growth is less than 0.6 percent/yr, and the population is estimated to peak at 1.46 billion just after 2030), increasing industrialization and urbanization continues to drive growth in energy use, along with (among other factors) growth in per-capita income, a trend toward increasing floor area per household (including in rural areas), and increasing demand for warmer/cooler homes.

In recognition of the economic and environmental costs of rapidly increasing energy use, China's government is pushing forward with policies in areas such as nuclear power expansion, increased use of renewable fuels, and energy efficiency. Even with increasingly aggressive implementation targets, however, nuclear power will likely provide less than 5 percent of power generation by 2030. Though the implementation of renewable energy sources and the use of natural gas are rising, including considerable construction of large hydroelectric facilities in the near term, coal is still estimated to supply 50 of China's energy needs by 2030. Future scenarios for implementation of energy efficiency (and renewables) have suggested significant (13 - 26 percent) savings in primary energy use[20], but it will require an incredible (though entirely worthwhile) effort in capacity building alone to achieve those targets. Simply considering the amount of training required to equip officials in all parts of China to enforce the stringent building energy codes being promulgated by the national government is a mind-boggling exercise. A recently-announced program to save 3 exajoules (3 billion gigajoules) by 2010 by focusing on energy efficiency improvements in the 1000 largest industrial enterprises in China is certainly a laudable start to what will need to be a vast, sustained, and well-organized program, if energy efficiency goals are to be met. Figure 10 shows the results of a "business as usual" projection of future energy use by sector in China in which final demand grows to over 5 billion tons of coal equivalent by 2030[21].

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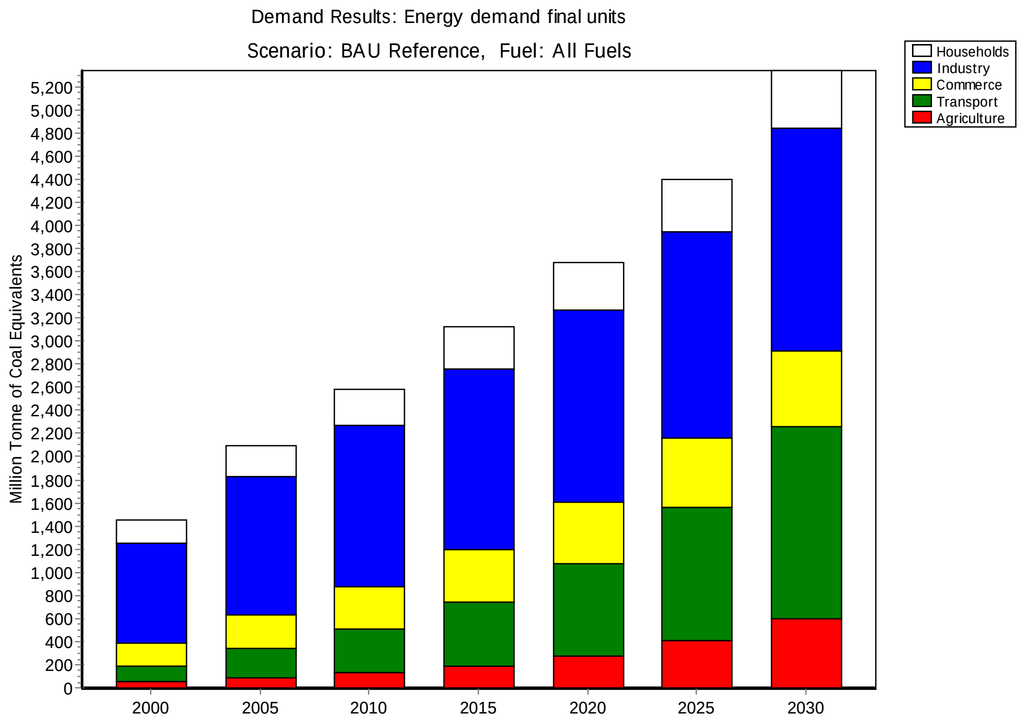
[18] Chinability (2008), "GDP growth 1952-2007", http://www.chinability.com/GDP.htm.

[19] Yanjia Wang (2007), "Updates on the Chinese Energy Sector", prepared for the "Asian Energy Security Project Meeting", Beijing, PRC, October 31-November 2, 2007, and available as http://www.nautilus.org/energy/2007/beijingworkshop/papers/PRCEnergy.ppt.

[20] See, for example, ERI and LBNL (2003), Summary, China's Sustainable Energy Future: Sceanrios of Energy and Carbon Emissions. Lawrence Berkeley National Laboratory Report LBNL-54067, October, 2003, available as http://china.lbl.gov/publications/scenarios_summary_01apr04.pdf.

[21] Gu Alun, GU Alun, ZHANG Aling, WANG Yanjia (2007), "China LEAP Modeling Efforts", prepared for the "Asian Energy Security Project Meeting", Beijing, PRC, October 31-November 2, 2007, and available as http://www.nautilus.org/energy/2007/beijingworkshop/papers/PRCLEAP.ppt.

Figure 10: Projection of "Business as Usual" Energy Demand by Sector in China



2.6 Russian Far East

The vast (6.2 million square kilometers) Russian Far East (RFE) region[22] is home to a population of about 4.6 million people. The RFE is rich in mineral (including coal), oil and gas, and hydraulic resources, but has limited infrastructure, at present, to extract those resources and move them to international markets. Both the economy and population of the region declined following the breakup of the Soviet Union, and though the RFE has seen positive economic growth in recent years, that growth has been at a lower rate than Russia as a whole. The region's earlier population decline has been stemmed in recent years. Oil and gas production in the RFE has increased recently as new projects have come on line (particularly in the Sakhalin area), but coal, electricity, and heat production and consumption have remained largely stable during the last few years, even as gross regional product has increased.

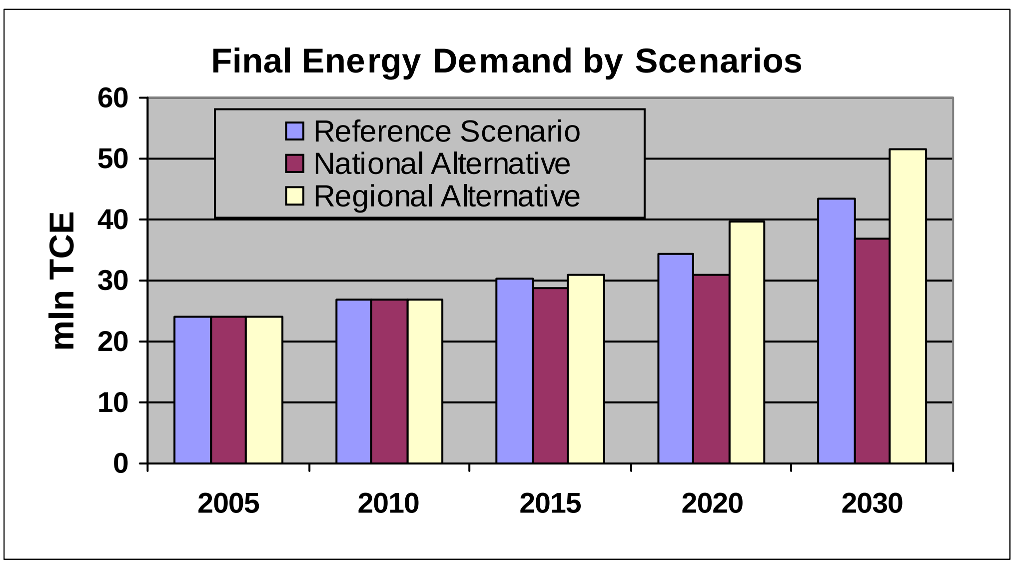
Though the RFE has been actively seeking ways of developing its resources, key features of RFE energy policy in recent years have included enhanced state control in national oil and gas sector, including granting exclusive rights for international exports and imports of natural gas to Gasprom, and of electricity to InterRAO. There have also been limitation set on foreign companies' participation in Russia's energy sectors, with all deals subject to federal control, but

[22] Officially referred to as the Far East Federal Okrug of Russia, the RFE includes the Sakha Republic, Primorskiy Krai, Khabaravoskkiy Krai, Amurskaya Oblast, Kamchatskaya Oblast, Magadanskaya Oblast, Sakhalinskay Oblast, Yevreiskaya Autonomous Oblast, and Chukotskiy Autonomous Okrug. P.A. Minakir, Editor (2007), Economic Cooperation between the Russian Far East and Asia-Pacific Countries. Published by the Economic Research Institute, Far Eastern Branch, Russian Academy of Science, and the Sasakawa Peace Foundation.

at the same time there are ongoing efforts to build domestic energy markets, and to attract foreign capital into Russian Federation energy firms.

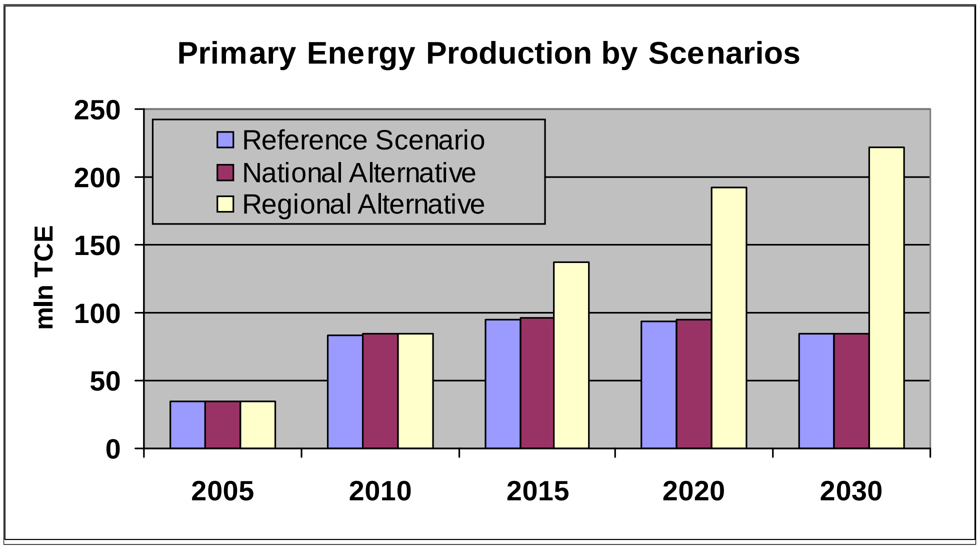
Future energy demand and economic growth in RFE is likely to be, to a significant extent, a function of the development of resource exports. Recent federal policies, including the revival of long-term planning for energy sectors of Russia in general, and the RFE in particular (oil/gas, nuclear, electricity), the 2006 presidential announcement of the "Global Energy Security" concept, and the emphasis on "multilateral and open energy security optimization on both demand and supply sides, stressing energy interdependence", underscore this link[23]. The Russian federal government has increased its attention on the RFE with respect to potential exports to Northeast Asia, and as a result a number of major strategic initiatives are in the process of consideration/elaboration for the RFE, including projects for economic and social development and investments in the refining industry, in gas/oil extraction and transportation, and electricity infrastructure development. Figures 11 and 12 present, respectively, projections for final energy demand and primary energy production in scenarios reflecting "reference", "national alternative" (emphasizing energy efficiency and renewable energy), and "regional alternative" (in which the RFE engages in major energy exporting projects with countries of the region). The impact of energy exports on the regional economy shows in the higher energy demand by 2030 (relative to the other scenarios), as well as in the much higher energy production by that year.

Figure 11: Final Energy Demand for Three Scenarios of Energy Sector Development in the Russian Far East



[23] Ruslan Gulidov, Victor Kalashnikov, and Alexander Ognev (2007), "Update on the RFE Energy Sector and on the RFE LEAP Modeling Effort", prepared for the "Asian Energy Security Project Meeting", Beijing, PRC, October 31-November 2, 2007, and available as http://www.nautilus.org/energy/2007/beijingworkshop/papers/RFEEnergy.ppt. Figures 11 and 12 are drawn from this presentation.

__Figure 12: Primary Energy Demand for Three Scenarios of Energy Sector Development in the Russian Far East__



3. Energy Use and its Impacts in Northeast Asia

Table 1 shows the distribution of primary energy use by fuel in the countries of Northeast Asia[24]. Northeast Asia already collectively constitute the world's largest market (64 percent of 2006 global exports[25]) for liquefied natural gas (LNG), and one of the world's largest markets for crude oil and petroleum products (nearly 20 percent of global demand). It also uses nearly half (over 46 percent—up from about 33 percent in 1999) of global coal production, with about two-thirds of regional coal use being in China. The countries of Northeast Asia consumed slightly under 20 percent of the world's petroleum and nuclear energy, 17.5 percent of hydroelectric generation, and 6.7 percent of natural gas use, up from 5.5 percent in 1999.

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[24] Data for this table were compiled from a number of sources including British Petroleum Co. (2007), BP Statistical Review of World Energy June 2007 (see details in following footnote) for most countries; United States Department of Energy, Energy Information Administration (USDOE/EIA, 2008) figures from http://tonto.eia.doe.gov/country/index.cfm for Mongolia; D.F. Von Hippel and P. Hayes (2007), Fueling DPRK Energy Futures and Energy Security: 2005 Energy Balance, Engagement Options, and Future Paths (Nautilus Institute Report, available as http://www.nautilus.org/fora/security/07042DPRKEnergyBalance.pdf) for the DPRK; and Russian Far East data from R. Gulidov, V. Kalashnikov and A. Ognev, (2006), draft chapter for Asian Energy Security Project Final Report (manuscript in preparation).

[25] British Petroleum Co. (2007), BP Statistical Review of World Energy June 2007. Downloaded as Excel workbook "statistical_review_full_report_workbook_2007.xls" from http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2007/STAGING/local_assets/downloads/spreadsheets/statistical_review_full_report_workbook_2007.xls.

Table 1: Primary Energy Use in Northeast Asia and the World, 2006

	Primary Energy Use in Northeast Asia and the World, 2006* Unit: Million tonnes of Oil Equivalent							
Country/Area	**Oil**	**Natural Gas**	**Coal**	**Nuclear Energy**	**Hydro-electric**	**Total**	**Fraction of NE Asia**	**Fraction of World**
China	349.8	50.0	1,191.3	12.3	94.3	1,697.8	64.8%	15.6%
Chinese Taipei	52.5	10.7	39.5	9.0	1.8	113.6	4.3%	1.3%
DPRK (North Korea)	1.0	-	9.7	-	0.8	11.4	0.4%	0.1%
Hong Kong (China SAR)	13.2	2.2	7.5	-	-	22.9	0.9%	0.3%
Japan	235.0	76.1	119.1	68.6	21.5	520.3	19.9%	6.1%
Mongolia	0.6	-	1.5	-	-	2.0	0.1%	0.0%
ROK (South Korea)	105.3	30.8	54.8	33.7	1.2	225.8	8.6%	2.6%
Russian Far East	10.6	2.9	11.5	-	1.1	27.0	1.0%	0.3%
Total Northeast Asia	**768**	**173**	**1,435**	**124**	**121**	**2,621**	**100.0%**	**24.1%**
NE Asia Fraction of World	**19.7%**	**6.7%**	**46.4%**	**19.4%**	**17.5%**	**24.1%**		
Total Rest of World	3,122	2,402	1,655	512	567	8,258		**75.9%**
TOTAL WORLD	**3,890**	**2,575**	**3,090**	**636**	**688**	**10,878**		**100.0%**

Table 2 provides 2005/2006 estimates of population in each of the countries (or, in the case of the Russian Far East and Hong Kong, sub-country region) of Northeast Asia, and shows the use of primary energy per capita by country. The DPRK consumed approximately 0.8 tonnes of oil equivalent (TOE) of primary commercial fuels per capita in 1996, and China use about 0.6 TOE/capita in 1999, while South Korea used 3.9 TOE per capita, and Japan used 4.0 TOE per capita in 1999.[26] Since that time, as shown in Table 2, energy use per capita has increased slightly in Japan, significantly in the ROK, and more than doubled in China, while decreasing in the DPRK.

[26] Population figures used for these calculations are from USDOE Energy Information Administration International data file "tableb1.XLS" "Table B1 World Population, 1980-2005", downloaded from http://www.eia.doe.gov/emeu/iea/wecbtu.html, except for the DPRK, which is from Von Hippel and Hayes, 2007 (see above), and the RFE, which is based on an estimate for 1997 from "National Energy Futures Analysis and Energy Security Perspectives in the Russian Far East", by V. Kalashnikov, prepared for The Nautilus Institute East Asia Energy Futures Project, June, 2000, and available as http://www.nautilus.org/archives/energy/eaef/Reg_RFE_final.PDF.

Table 2: Population and Energy use Per Capita in Northeast Asia, 2006

Country/Area	Population (million)*	Primary TOE/cap*
China	1,313.8	1.29
Chinese Taipei	22.8	4.98
DPRK (North Korea)	22.4	0.51
Hong Kong (China SAR)	6.9	3.30
Japan	127.6	4.08
Mongolia	2.9	0.71
ROK (South Korea)	48.9	4.62
Russian Far East	4.6	5.87
Total Northeast Asia	1,550	1.69

*Estimates for 2006 except DPRK, Mongolia, RFE, which are for 2005

The major point here is that energy use in Northeast Asia—and particularly in China, North Korea, and Mongolia—would seem to have substantial "room to grow" before it reaches the levels currently maintained by Japan, the ROK, and other developed nations. The consumption of transport services, which Chinese and North Koreans currently use relatively lightly and very lightly, respectively, is one of the key areas of growth (as any recent visitor to a major Chinese city will attest), and in all probability will result in a significant increase in transport energy use in these countries.

Figures 13 and 14 present views of projections of primary energy use by country and by fuel for the countries of Northeast Asia. These projections were largely derived from "reference" or "BAU" case projections as described above, most of which have been developed or conveyed by country working groups in Nautilus Institute's collaborative Asian Energy Security project[27]. This composite suggests that energy use in Northeast Asia will roughly double in the next 25 years, with on the order of 90 percent of that growth, not surprisingly, coming from China.

[27] Projections for China used for this composite regional picture were derived and extrapolated from energy use trends shown in Energy Use in China: Sectoral Trends and Future Outlook, by Nan Zhou, Michael A. McNeil, David Fridley, Jiang Lin, Lynn Price, "Stephane de la Rue du Can, Jayant Sathaye, and Mark Levine, Lawrence Berkeley National Laboratory, January 2008, Report # LBNL-61904. These figures appear to reflect more of a maturing trend in the Chinese economy than the projections shown in Figure 10.

Figure 13:

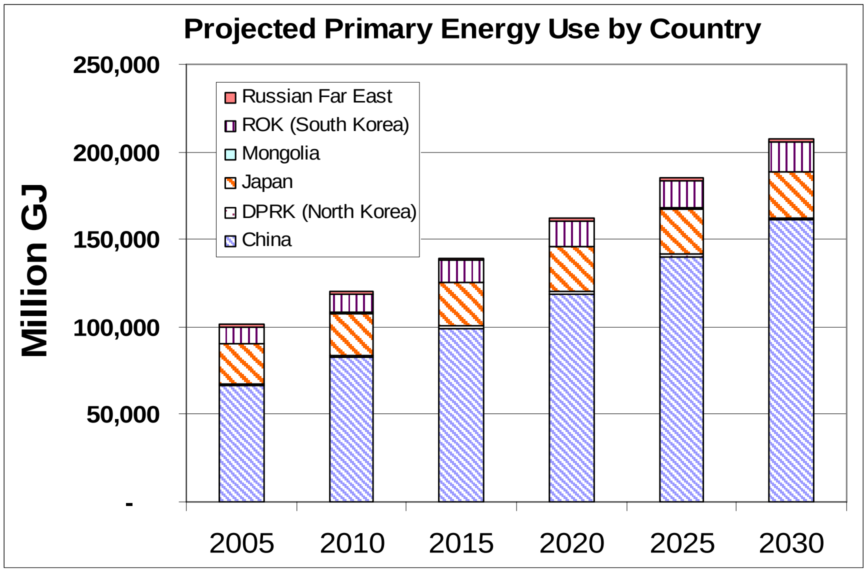
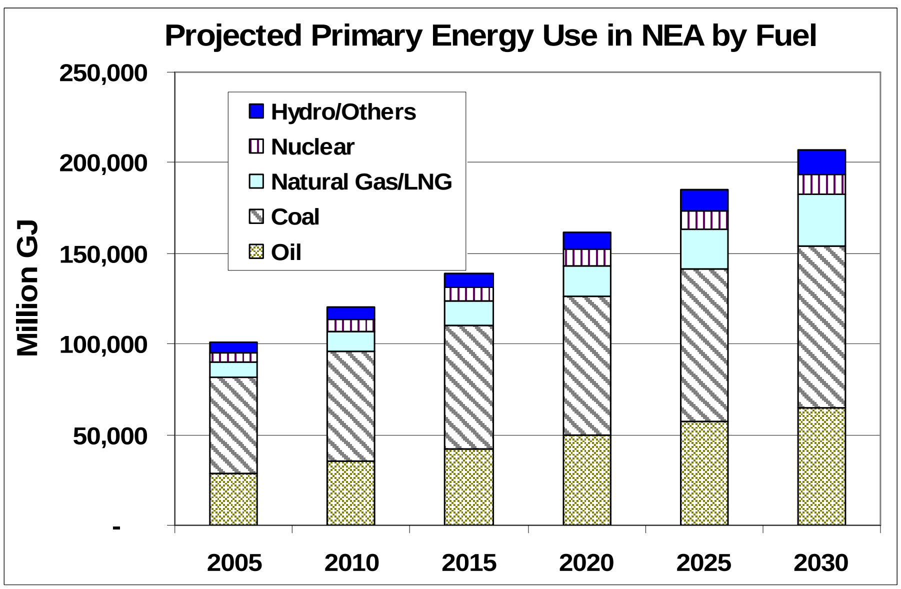


Figure 14:



Growth in demand for energy services in Northeast Asia, and for the fuels used to provide those services, have had (and, as growth continues, will continue to have) significant implications in a number of areas. Expansion in energy use is causing and, based on current trends, will continue to cause major consequences for:

- Global and regional fuels markets, as the countries of the region require increasing amounts of energy—oil, natural gas, and even coal—from outside the region.

- Global financial markets, as funds are increasingly needed to obtain energy and build needed energy infrastructure, and thus may be less available for other investments (within the region and elsewhere).
- Local, regional, and global “criteria” air pollutants, including particulate matter (“smoke”, sulfur oxides, nitrogen oxides, and volatile organic compounds, emissions of which are increasingly of concern, and requiring increasing investments in control technologies, in China and elsewhere in the region.
- Global greenhouse gas emissions, which are increasingly of concern worldwide.
- Local land use for energy infrastructure, including land requirements for hydroelectric reservoirs (which have displaced millions of people in the region in recent years), as well as for thermal power plants and energy transport infrastructure.

For one of the implications above, global greenhouse gas emissions, Table 3 and Figure 15 provide, respectively, a summary of historical estimates and projections for emissions in the countries of Northeast Asia, and a view of the increasing importance of emissions of carbon dioxide (CO_2) from the region relative to the rest of the world. Northeast Asia’s share of world CO_2 emissions increased from 20.6 percent to nearly 28 percent by 2005, and, based on a variety of estimates, will account for over a third of global emissions by 2030[28,29].

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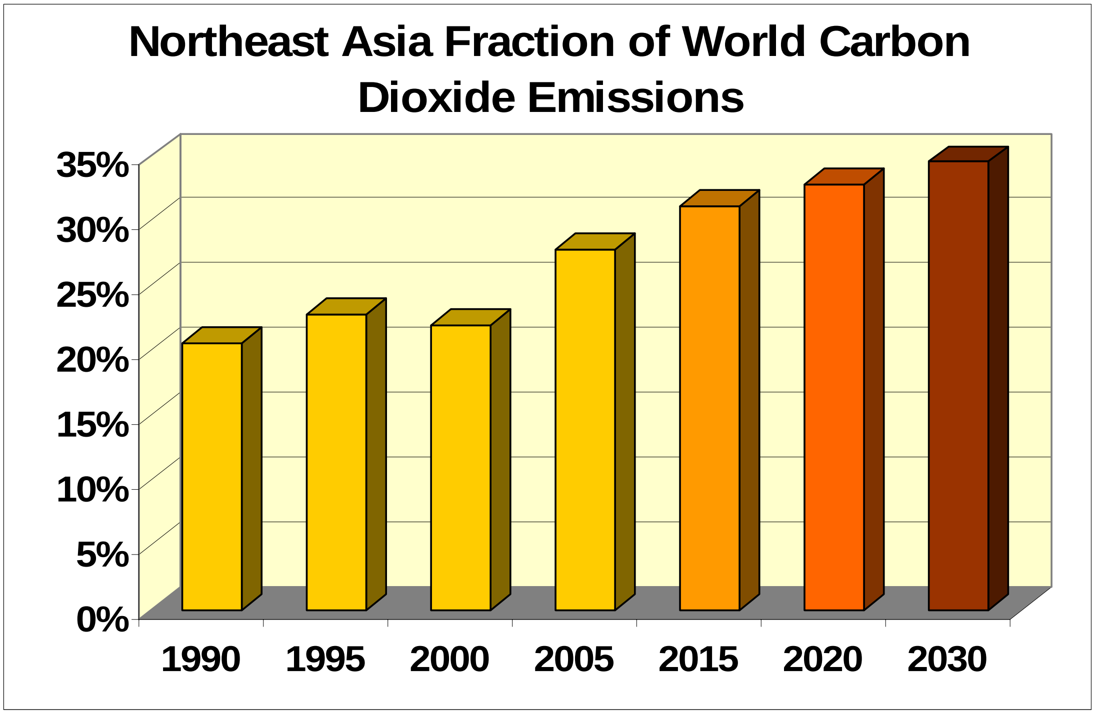
[28] Historical data on carbon dioxide emissions by country for 1990 through 2005 are taken from Energy Information Administration USDOE EIA (2007) International Energy Annual 2005, table H.1, “World Carbon Dioxide Emissions from the Consumption and Flaring of Fossil Fuels, 1980-2005”, with the exception of data for the DPRK (from D. Von Hippel and P. Hayes, 2007) and RFE (rough estimates from data from R. Gulidov, V. Kalashnikov and A. Ognev, (2006), and V. Kalashnikov (1997), Electric Power Industry of the Russian Far East: Status and Prerequisites For Cooperation In North-East Asia, Draft Report Prepared for the Working Group Meeting on “Comparisons of the Electricity Industry in China, North Korea and the Russian Far East”, Organized by the East-West Center, Honolulu, Hawaii, 28-29 July 1997). Projections for future global CO_2 emissions taken from USDOE EIA International Energy Outlook 2006, “Table A10: World Carbon Dioxide Emissions by Region, Reference Case”, available as http://www.eia.doe.gov/oiaf/ieo/pdf/ieoreftab_10.pdf. Projections for individual countries/areas within Northeast Asia are a composite of estimates from country teams participating in the Nautilus Institute “Asian Energy Security” (AES) project, as presented at the 2006 and 2007 AES Project Meetings (see, for example, http://www.nautilus.org/energy/2006/beijingworkshop/papers.html and http://www.nautilus.org/energy/2007/beijingworkshop/papers.html. Projections for the DPRK are preliminary estimates by Nautilus Institute.

[29] The apparent decline, in 2000, in the fraction of global emissions from Northeast Asia, may be in large part an artifact of a change in reporting of coal production and use in China in the years around 2000.

Table 3: Historical and Projected Emissions of Carbon Dioxide in Northeast Asia

	Carbon Dioxide Emissions Unit: Million tonnes of Carbon Equiv.						
Country/Area	**1990**	**1995**	**2000**	**2005**	**2015**	**2020**	**2030**
China	611	776	794	1,452	2,143	2,558	3,318
Chinese Taipei	32	49	68	78	95	106	130
DPRK (North Korea)	126	63	32	38	82	87	83
Hong Kong (China SAR)	11	13	15	20	[Included in China total]		
Japan	275	293	325	336	363	372	381
Mongolia	3	2	2	2	3	4	5
ROK (South Korea)	66	103	120	136	166	190	225
Russian Far East	80	71	71	80	98	105	135
Total Northeast Asia	1,204	1,371	1,427	2,142	2,950	3,421	4,278
NE Asia Fraction of World	20.6%	22.9%	22.0%	27.9%	31.2%	32.9%	34.6%
Total Rest of World	4,631	4,627	5,051	5,547	6,492	6,974	8,072
TOTAL WORLD	5,835	5,997	6,478	7,689	9,442	10,394	12,350

Figure 15:



4. Potential Energy-sector Cooperation in Northeast Asia, and Potential Influence of Solutions to the DPRK Nuclear Issue

4.1 Regional Energy-sector Cooperation Options

The growth in energy use in the region, and its attendant problems, together with the energy, financial, human, and technological resources available in the countries of the region, create opportunities for energy-sector cooperation in Northeast Asia. These opportunities include:

- Integration of conventional energy supply infrastructure, such as gas and oil pipelines from the RFE to the ROK—potentially including the DPRK—and/or from the RFE to China and possibly Japan; LNG terminals shared between nations (such as between the DPRK and ROK), and electricity grid interconnections from the RFE to the ROK/DPRK, to China, and possibly to Japan via Sakhalin Island and Hokkaido.
- Cooperation on energy efficiency and renewable energy development, including such technologies as district heating, and solar, wind, and biomass energy.
- Cooperation on regional emergency and strategic fuel storage.
- Cooperation on nuclear fuel-cycle facilities, including (potentially) shared facilities for enrichment and/or spent nuclear fuel management.

When considering cooperation options, in the context of Northeast Asia and its energy needs, it is necessary to keep in mind that even the largest single supply infrastructure proposal, on its own, will supply no more than a modest fraction of Northeast Asia's fuel or electricity needs. For example, the Eastern Siberia to Pacific Ocean Oil Pipeline (ESPO) may ultimately provide 100 Mte/yr of Russian oil to China and/or Japan, but even at that will yield only about 15 percent of 2006 Northeast Asia oil demand, and about 10 percent of projected 2020 oil demand in China alone. In addition, many of the infrastructure proposals will require investments in the tens of billions of USD and involve significant technical complexities, as well as unprecedented (in the region) international legal arrangements (related, for example, to energy pricing, environmental compliance, infrastructure security, and other issues). In addition, most supply-side cooperation options now under consideration will do little or nothing to reduce regional GHG emissions and other pollution. The options with arguably the best prospects for overall emissions reduction, cost savings—energy efficiency and renewable energy—may face implementation (such as intellectual property) hurdles, but may also offer "win-win" opportunities for cooperating countries.

4.2 The Role of the DPRK in Northeast Asian Energy Cooperation

During the decade of the 1990s, and continuing through much of this first decade of the 21st century, a number of issues have focused international attention on the DPRK. Most of these issues—including nuclear weapons proliferation, military disagreements, economic collapse, trans-boundary air pollution, floods, food shortages, droughts, and tidal waves—have their roots in a complex mixture of Korean and Northeast Asian history, global economic power shifts, environmental events, and internal structural dilemmas in the DPRK economy. Energy demand and supply in general—and, arguably, demand for and supply of electricity in particular—have played a key role in many of these high-profile issues involving the DPRK.

Solving the DPRK nuclear issue may not be a strictly necessary condition to allow significant regional cooperation on energy issues and infrastructure, but it would certainly be helpful, and would probably accelerate activities in a number of ways, and for a number of reasons—including the advantages of a regional context for engagement of the DPRK on energy issues. Even once the nuclear issue is (at least largely) addressed, however, considerable challenges to bringing the DPRK into regional cooperation activities will remain. To cite just a few examples, significant efforts will be needed to upgrade DPRK infrastructure, provide capacity building, and help to reform legal and administrative systems to allow DPRK to participate fully in regional initiatives (in many cases, similar efforts will be needed in other countries as well). "Geopolitics", that is, consideration of the impacts of regional energy cooperation activities on the relations between powers great and smaller both within and outside the region, are also likely to come into play—in ways that may be difficult to predict—as resolution of the DPRK nuclear issue nears.

In addition to the challenges noted above, resolution of the DPRK nuclear issue would undoubtedly open opportunities for cooperation on energy issues. For example, as the DPRK economy becomes more integrated with the economies of the region, pipelines and transmission lines could be developed to pass through to take direct route to ROK, providing service to the DPRK as well. Additional markets for all types of technologies (and services) would open as the DPRK is redeveloped. In fact, the redevelopment of the DPRK will provide a considerable opportunity to install efficient end-use equipment and renewable energy systems, as the DPRK economy (and infrastructure) will need to essentially be rebuilt from the ground up. In the process the DPRK may in a way provide a "laboratory" for application of energy efficiency and renewable energy measures in a way that other nations, with infrastructure that has been more recently updated, cannot. Regional cooperation on energy sector initiatives also provides an opportunity to utilize DPRK labor, and to help to build a sustainable economy in the DPRK. Finally, as the final international rules for applying Clean Development Mechanisms (CDM), which allow the credit for greenhouse gas emissions reduction between nations, are worked out, redevelopment in the DPRK may provide a host of opportunities for countries within and outside the region to apply CDM in energy sector investments in the DPRK.

A special challenge—and opportunity—related to energy sector cooperation in Northeast Asia is related to the potential influence of the Simpo/Kumho (DPRK) nuclear reactors on grid interconnection proposals. As the major element of a 1994 agreement between the United States (and its allies) and the DPRK, a consortium of nations (the United States, ROK, Japan, and the European Union), organized as the Korean Peninsula Energy Development Organization (KEDO). Until the beginning, in late 2002, of the current impasse between the DPRK and the United States (in particular, though other countries are involved in and assisting in attempting to resolve the dispute as well) over the DPRK's alleged nuclear weapons programs, KEDO was providing financing for and constructing two 1150 MW light water reactors (LWRs) at the Kumho site near Simpo on the East coast of the DPRK. Though KEDO was been officially shut down, as of mid-2006, and the LWR project "terminated" (see http://www.kedo.org/), completion of the reactor project remains, as noted above, a key point of negotiation in the Six-Party Talks, and a key political demand of the DPRK.

The Simpo/Kumho reactors were intended to help alleviate DPRK electricity shortages, but use of these reactors in the DPRK grid was always problematic, at best[30]. First, the DPRK grid is highly fragmented, and reactors even a fraction as large as those being operated could not be operated without tripping on and off to a dangerous degree. Second, even if the DPRK grid were fully integrated and its plants were operating at their nominal (as of 1990) 10,000-12,000 MW capacity (of which we estimate that on the order of 2000 to 3000 MW were actually currently operable as of 2005), the grid would be too small to safely operate the reactors without serious grid stability concerns. Third, no source of reliable back-up power is now available to the Kumho site that would allow the reactors to be operated within international nuclear safety rules. What these technical constraints mean, effectively, is that some type of interconnection with the ROK or Russia/China (or, more likely, both), will be required if the reactors (if completed) are ever to generate power. This requirement, if reactor construction is restarted, is likely to add a significant political (and economic) impetus to the development of Northeast Asia grid interconnections, potentially affecting the timing, and type, of North-South grid interconnections[31].

5. The Potential Role of the United States in Northeast Asian Energy Cooperation

Though not located in the Northeast Asia region, the policies of the United States have traditionally had considerable influence in regional affairs. Many of the infrastructure and other cooperative activities described above, and most of the types of energy cooperation involving the DPRK, will stand a much better chance of success if joined and/or encouraged by the U.S., and, conversely, may have little chance of succeeding if the U.S. remains on the sidelines, or worse, actively discourages cooperation initiatives.

The United States could play a number of positive roles in encouraging NE Asian energy cooperation, including:

- Working with U.S. companies and others to promote the licensing of key technologies for manufacture and use in the region. Leading candidates for technology licensing would be renewable energy technologies for solar, wind, and tidal power, and energy efficiency technologies (advanced lighting products, appliances, transportation equipment, building energy efficiency technologies, combined heat and power systems, and building/motor control electronics, for example), but other opportunities may include waste-treatment and environmental control technologies, fossil-fuel-extraction-related technologies (coal mining safety equipment, coal-bed methane technologies, and technologies for oil and gas exploration and extraction under harsh conditions, for example), and electricity sector control

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[30] For more detailed discussions of issues related to operation of the KEDO reactors, see John H. Bickel (2001), Grid Stability and Safety Issues Associated with Nuclear Power Plants. Paper prepared for the Workshop on Power Grid Interconnection in Northeast Asia - May 2001, Beijing, China, and available at http://www.nautilus.org/archives/energy/grid/papers.html.

[31] This discussion should not be taken as an argument on the part of the authors that completion of the Simpo reactors is either the best thing for the DPRK economy or the most cost-effective—in terms of providing energy aid—use of funds for DPRK energy assistance, as it is neither. Our discussion, rather, is designed to point out the political and technical realities associated with the reactor project.

technologies. In some cases, promoting these technologies may mean lowering or modifying U.S. barriers to export or licensing.

- Assisting with capacity building and technical training. There are a number of topic areas where the United States could assist the countries of the region with developing the human infrastructure needed to efficiently and effectively participate in the cooperative activities identified above. These will vary by country and include, but are certainly not limited to, development and regulation of energy markets, energy and environmental law, environmental regulation, energy management in buildings, energy-efficient building design and construction, environmental management, renewable energy system design and implementation, development and implementation of energy-efficiency programs, and environmental emissions control, and environmental clean-up.
- Co-development and co-marketing of key energy-efficiency and renewable energy products. The United States has significant domestic opportunities for improving energy efficiency and expanding the use of renewable energy, and there are likely to be a number of opportunities to form research and development consortia—possibly between national laboratories in the U.S. and in Northeast Asian countries and with key industries on both sides of the Pacific—as well as to promote, through coordinated national policies (for example, energy codes for buildings and appliances, greenhouse gas emissions restrictions), markets for the resulting energy-efficiency and renewable energy products. Adding the 1.5 billion consumers of Northeast Asia to the 300 million in the U.S. would create formidable markets for these products, and should, if designed properly, accelerate the movement to mass market of technologies such as very efficient automobiles, electronics, lighting, appliances, high-efficiency/low-cost solar photovoltaic systems, combined heat and power systems, and other devices.
- Setting a positive example by making a serious effort to reduce national greenhouse gas emissions and to improve and aggressively promote energy efficiency and renewable energy, including setting stringent energy efficiency/renewable energy standards. Most observers of the international environmental scene would agree that the United States government has not, particularly in the current decade, provided strong and positive international leadership in the areas of climate change mitigation, energy efficiency, or renewable energy. Reversing this trend is highly likely to provide a boost to the efforts of the countries of Northeast Asia to make improvements in this area, both through the effect that U.S. policies would likely have on markets for related energy efficiency and renewable energy goods (increasing the speed of development, and ultimately bringing down prices through economies of scale), and by setting an example for policymakers and consumers in the region.
- Encouraging productive investment in the DPRK. U.S. policies toward the DPRK to a large extent determine the degree to which countries closely allied to the U.S. (Japan and the Republic of Korea, for example, as well as the European Union, Australia, and others) interact economically with the DPRK. U.S. policies may have a more limited effect on how China and Russia, for example, interact with the DPRK, but there is little doubt that if the United States were to reach an agreement with the DPRK and other parties whereby the U.S. could set out workable guidelines for encouraging investment in and business with the DPRK, the result would be a considerable increase in the opportunities available for all

parties for energy cooperation involving the DPRK, bringing some of the opportunities outlined earlier in this article closer to fruition.

Alternatively, U.S. policies may develop in such as way as to frustrate attempts at energy-sector cooperation by the countries of the region. For example:

- The U.S. may feel threatened by cooperation between the countries of Northeast Asia. One possibility here is that United States policymakers may feel that geopolitical considerations regarding the influence of Russia and/or China with Japan, the ROK, and the DPRK make the promotion of energy cooperation—including, for example, the economic linkages and dependencies that major international energy infrastructure would imply—are not in the United States' best interests. Among a listing of considerations that show the potential complexities involved in multi-nation cooperation in Northeast Asia (specifically, on Korean reunification), P.A. Minakir, paraphrasing R. Scalapino, notes "The USA is not interesting in the easing of the tension in this region, as under these conditions the 'natural' reasons for the US military and political control will stop existing"[32].
- The US may (continue to) provide a negative example on energy efficiency and greenhouse gas emissions reduction. For those countries whose people often look to U.S. lifestyles as models (deserving or not), it will be more difficult to make significant progress on improving energy efficiency and reducing greenhouse gas emissions—and participating in regional cooperation to do so—if the U.S. continues to resist taking significant steps to address its greenhouse gas emissions.

U.S. Policies in general, and with regard to the Northeast Asia region in particular, may change substantially when a new administration takes office early next year. Given the inertia built into the U.S. political process, however, rapid and substantial change is far from certain. Although the U.S. is much more than a marginal "player" in the energy sector of the region, it is not a central player, and if energy sector cooperation sufficiently benefits the countries of the region, regional resources—including financial, labor, technological, and natural resources—should be adequate to make cooperation a reality, given the countries have the political will to work together.

[32] From P.A. Minakir, 2007, Economic Cooperation between the Russian Far East and Asia-Pacific Countries, Chapter 2, "Russia and the Russian Far East in Economies of the APR and NEA", page 52. While this quote does not directly address the U.S. position on energy cooperation in Northeast Asia, it is generally indicative of potential U.S. fears over loss of influence in a more cooperative, and thus less U.S.-dependant, Northeast Asian region.