A NEW INTERNATIONAL ENGAGEMENT FRAMEWORK FOR NORTH KOREA?

Contending Perspectives

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Coping with North Korea's Energy Future: KEDO and Beyond

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The subject of the energy future of North Korea (the Democratic People's Republic of Korea or DPRK) has many dimensions, conceptualized in a broad variety of ways. For engineers, the energy future can be a problem in boiler efficiency and reactor safety. For energy economists, the future is an issue of trade-offs among fuel sources such as coal, natural gas, and nuclear power.

For economists with structural perspectives, energy is a constraint on economic growth in North Korea. For specialists in regional integration, energy is a catalyst for bringing Northeast Asia together. And for many security analysts and policymakers, energy is a lever for simultaneously blocking dangerous nuclear proliferation and subverting unwanted geopolitical change.

The central economic and security elements of the North Korean energy equation are inseparable in policy terms. Nuclear proliferation in North Korea, a security problem of global importance, deserves its central place in the minds of policymakers. Yet for analytical purposes it is important to disentangle economic and security aspects of the energy problem without denying their legitimate policy interdependence. North Korean politics, after all, could change radically over the coming years, altering the security equation profoundly. Yet the DPRK's resource endowments, which must inevitably shape economic calculations, will remain constant.

Amid the myriad uncertainties of the North Korean energy equation, one strong likelihood is that the Korean Peninsula Energy Development Organization (KEDO), as presently constituted, has little future. Much of the U.S. Congress, not to mention the Bush administration, has been consistently skeptical of KEDO, and economic assistance to North Korea has never had much constituency in the United States in any case (Sigal 1998). The program has, to be sure, survived a remarkable number of crises, including the

North Korean submarine incursion into South Korean waters in the fall of 1996 and the North Korean Taepo-dong missile launch of August 1998 (Snyder 2000). Yet KEDO will find it much harder to survive the major, direct violation of the Agreed Framework involved in North Korea's covert highly enriched uranium (HEU) program, especially given the December 2002 suspension of the heavy fuel oil supply program, the extended suspension of reactor construction activities after November 2003, the lack of U.S. congressional budgetary authorization for future operations, and the continuing heavy skepticism in the Bush administration regarding a seemingly dysfunctional institution inherited from the past.

During KEDO's more than seven years of operation, from its establishment in March 1995 until the HEU program revelations in late 2002, that tri-national organization did, to be sure, quietly foster useful interpersonal networks between North Korea and the broader world while it scored important technical accomplishments in consolidating U.S.-Japan-Korea triangular relations. There are also substantial sunk costs that—rhetoric aside—it is rational to recoup. The United States has expended more than $700 million on heavy-fuel-oil supplies to North Korea and on the administrative costs of running KEDO. South Korea (also, Republic of Korea, or ROK) and Japan have together already invested well over $1 billion in construction of a now partly built light-water reactor (LWR) in Kumho, North Korea (KEDO 2001; KEDO 2002; Brooke 2004).

Future international efforts to cope with North Korea's energy problems can reasonably build, either figuratively or even literally, on these foundations. Yet the duplicity in the covert North Korean HEU program, coupled with the economic irrationality of much of the 1994 Agreed Framework that established KEDO, and domestic political controversies regarding the organization in virtually all of the participating nations make it likely that KEDO will need to be scrapped and reconfigured. Thus, a pressing need exists for a post-KEDO framework for North Korean energy, which is the analytical focus of this paper.

North Korea's Dire Current Energy Realities

Like South Korea, North Korea has historically had a high-energy-use economy (Noland 2000, 143; Calder 2000, 2–9). Primary commercial energy use in the DPRK was approximately three times the level of China in 1990 and about half the level of Japan, which had a gross domestic product (GDP) per capita 20 times as high as North Korea at that time (Noland 2000, 144). North Korean energy use has been relatively high for three reasons:

- Industrial structure, with a high concentration of energy-intensive sectors like steel and fertilizer production;
- Inefficient use of fuels owing to obsolete equipment as well as lack of market pricing; and

- Reliance on relatively less efficient fuels, such as coal, as a source of energy.

This high energy intensity of the economy, together with a critical lack of oil and the importance of oil to North Korea's military, make energy in general, and oil in particular, priority concerns for the DPRK's political-military leadership.

North Korea's domestic energy situation needs to be considered in terms of four basic dimensions, and the DPRK's circumstances are dire in all four. The energy problems that the DPRK confronts in all these areas are interrelated, yet the nature of the difficulties involved is somewhat different in each area.

Supply of basic energy. In terms of basic energy supply—that is, the availability of coal, hydroelectric power, oil, natural gas, and nuclear power—North Korea's energy insecurities are broadly similar to those of South Korea, Taiwan, and Japan. North Korea has, for example, no operating oil fields, although mostly since mid-2002 Sweden's Taurus Petroleum and Singapore's Sovereign Ventures have conducted some modest positive seismic surveys. A Norwegian firm, Global Geo Services, reportedly contemplates initial offshore seismic work in the first half of 2004 (DOE 2002b).

Most of North Korea's neighbors experience underlying energy-resource scarcity similar to the scarcities confronting the DPRK. Indeed, not a single major producing oil field exists in the vast, economically powerful swath of Northeast Asian territories stretching from Hokkaido and the rest of the Japanese archipelago, across the Korean peninsula, to the southern tip of Taiwan (Calder 1996, chap. 1). And there are no major natural gas fields either. With respect to oil and gas, the economies of Northeast Asia are all heavily dependent on the politically volatile Middle East. For North Korea, Iran is an important traditional energy supplier as well as a political-military ally, even though it is 7,000 miles distant from Pyongyang.

With virtually no indigenous oil or natural gas production, North Korea's only substantial domestic fossil-fuel source is coal. The DPRK has substantial reserves of anthracite and lignite coal, mostly produced from underground mines (Von Hippel et al. 2002, 12). This domestic coal is North Korea's main fuel for electricity generation, but coal mining itself usually requires electricity for lighting, jackhammers, and transporting coal out of the mines. In addition, many important coal seams are actually beneath the seabed, especially off the western coast near Anju, which requires sea water to be continuously pumped out for the mines to operate. Several of these mines were flooded in the mid-1990s. The coal that can be produced is uneven in quality, creating significant operational problems, especially for new coal-fired power plants.

In 2001 coal provided about 86 percent of North Korea's primary energy consumption, a share that has been rising as the country's isolation from the

broader world has intensified since 1990 (DOE 2002a). Yet estimated coal output in the DPRK declined more than 50 percent between 1990 and 1996, and it has probably declined considerably more since then (DOE 2002a, 10). Coal shortages thus contribute substantially to North Korea's overall energy problem, even though the country has, ironically, relatively plentiful domestic coal supplies. In addition, most coal supplies for coal-fired power plants are transported by rail, as is 90 percent of North Korean freight cargo generally, so chronic problems with rolling stock and railroad safety further constrain electricity production. As a consequence, most coal-fired plants in the DPRK operate well below capacity owing to difficulties in securing suitable inputs.

Electric-power generation. Electric-power generation is a second serious domestic energy problem that North Korea confronts. In 2001, hydroelectric power plants generated about 69 percent of North Korea's electricity, and thermal plants 31 percent (DOE 2002a, 2). All except one thermal plant, which relies on the heavy fuel oil that the United States has been supplying to the North since 1995 under the KEDO agreement, is coal fired and thus subject to the difficulties described above. As much as 85 percent of the DPRK's hydroelectric capacity has also been damaged by flooding (Ivanov 2002, 13). Overall, as little as 20–30 percent of installed capacity for electric-power generation may actually be operable (Von Hippel et al. 2002, 13).

Electric-power transmission. Electric-power transmission is, as noted, a third major domestic energy-supply difficulty. North Korea's original power grid was created in Japanese colonial days, well over 60 years ago, and was decimated during the Korean War. Refurbished by the Soviet Union in the 1960s and 1970s, the grid has had inadequate servicing since the collapse of the USSR more than a decade ago. The lack of spare parts, scavenging of metal (as barter for food) from remote lines in the countryside, and general physical deterioration have severely degraded the system. Power outages are thus common throughout the country—even in Pyongyang—and energy loss through inefficient transmission is enormous.

The poor state of North Korea's power-transmission grid has major implications for the functional role of the Agreed Framework and KEDO in North Korea's relations with the world. The grid is in such a deplorable state of disrepair that the LWRs to be provided through the KEDO framework could not be connected to the grid without raising major safety problems. Without an extensive modification of the grid and a connection to another system, such as that of South Korea, Russia, or China, the promised nuclear reactors could not be used. In addition, as Von Hippel and Hayes (2003) point out, LWRs need a stable source of backup power for coolant pumps and other equipment and must be operated such that the sudden loss of load is kept to an absolute minimum (DOE 2002a, 12). Neither of these requirements could be met with the DPRK grid as it is currently configured.

Secondary energy use apart from electric power. North Korea's energy problems are even more acute outside the electric-power sector than within it. Since 1990, when China and the former Soviet Union began demanding payment at commercial rates in hard currency for oil, crude oil imports into North Korea have dropped by roughly 85 percent (Harrison 2002–03, 31). China has also recently been using oil supplies as a strategic lever, reportedly suspending pipeline deliveries for three days in early 2003 to protest North Korea's HEU nuclear program.

Oil shortages have immobilized important petroleum-dependent industries, including fertilizer factories. These bottlenecks have in turn precipitated low agricultural production, intensifying the impact of the 1995–96 famines. Oil shortages also shut down tractor operations and many of the power generators in rural areas that were needed to run irrigation pumps.

The energy sector of the North Korean economy, in short, is in a highly precarious state. Underlying resources are scarce outside the coal sector, and production and distribution of coal itself are antiquated and inefficient. Moreover, the energy generation and distribution systems themselves are close to nonfunctional.

Implications for the North Korean Political Economy and Beyond

Energy is clearly North Korea's Achilles' heel. Neither its military nor its organized civilian economy can function effectively for any prolonged period without adequate energy supplies. Therein lie both the danger and the opportunity for the broader world as it addresses North Korea's energy problems. Ignoring the security dimensions of energy could make North Korea prospectively more dangerous as an adversary and enhance its ability to aid subversive, even terroristic, efforts by others. Yet, failing to see the positive contribution that, under the right security circumstances, energy cooperation with North Korea could make to Northeast Asian and, indeed, global economic growth—not to mention its positive impact on the miserable living circumstances of the North Korean people—would be equally shortsighted. It is thus crucial to stand back and assess the linkages between North Korean energy and broader national, regional, and global concerns.

Energy shortages have clearly inhibited DPRK economic performance in recent years. They have, for example, constrained rail and motor transport as well as industrial production. The lack of energy also contributed to the chronic food shortages of the mid-1990s and to the massive famines of 1995–98 through their impact on fertilizer production. More recently, energy shortages and the constraints that the lack of functional electric pumps places on rural water supply have also been linked, by UNESCO and others, to deterioration in public sanitation (Choi 2004, 3).

Beyond North Korea itself, the DPRK's energy situation has broader implications for nations throughout the North Pacific. For the United States, of course, the central concern is security related: the potential of North Korean nuclear programs for generating fissile materials that might be used as warheads and other explosive devices, either by the North Korean military or by terrorists. For Russia, China, and South Korea, an additional, and often more immediately expressed, concern is more cooperative: the prospect of addressing North Korea's energy problems through regional solutions such as natural gas pipelines and electric-power grids, potentially transiting North Korea and thus transforming South Korea from a geostrategic island, as it has been for over a half century, into an interactive part of the Asian continent.[1]

The resolution of North Korea's energy problems could potentially be linked to the broader resolution of the entire Northeast Asian region's fundamental energy need: to diversify its supply of energy away from oil and away from heavy dependence on the Middle East. Northeast Asia is, after all, the only major region of the industrialized world without a well-developed natural gas grid, and the region has a correspondingly low reliance on that highly attractive fuel source: natural gas.

As is suggested later in greater detail, there are strong complementarities between South Korea and China's rapidly rising energy demand, on the one hand, and the massive natural gas reserves and hydroelectric power potential of Siberia, on the other. This equation could be resolved through pipelines and power grids someday transiting North Korea once the nuclear crisis is resolved. Virtually all parties to the ongoing six-party talks[2] on North Korean nuclear issues—which, after all, represent the major participants in the prospectively integrated Northeast Asian energy economy of the future—also have economic interests in a cooperative resolution of the nuclear crisis. Such a resolution could rationally involve large, new infrastructural projects in the area of energy if security concerns are resolved, and any such resolution should certainly also involve technical assistance to cope with the extraordinary energy inefficiency now prevailing in the North.

KEDO as a Vehicle for Addressing Northeast Asian Energy Issues

It is increasingly clear that KEDO, in its present form, does not and cannot address North Korea's central energy problems, pressing as they are. KEDO emerged originally to defuse a security crisis, not to address an economic agenda. KEDO's deficiencies as a vehicle for resolving energy problems—together with its subtle value as a forum for midlevel technical communica-

1 On the geopolitical transformations implicit in a changing relationship of North Korea to Northeast Asia, see Calder (2001, 106–22) and Kim and Lee (2002).

2 Participants in the six-party talks are China, Japan, North Korea, Russia, South Korea, and the United States.

tion with North Korea—are clear from a brief review of that fragile, controversial organization's origins and original mandate.

KEDO emerged after a long history of confrontation and North Korean belligerency on the Korean peninsula. In the spring of 1993, North Korea test-fired a potentially nuclear-capable missile, the No-dong 1, into the Sea of Japan, and threatened to withdraw from the Nuclear Non-Proliferation Treaty. In May 1994, the DPRK defied the antiproliferation regime by removing spent fuel from its experimental reactor at Yongbyon, thus making verification of its nuclear stockpile impossible and precipitating a major crisis with the United States. After a confrontation that came, in the view of many participants and observers, perilously close to war, Jimmy Carter and Kim Il-sung achieved a breakthrough in informal discussions leading ultimately to the formal Agreed Framework of October 1994. Even the negotiators of the agreement admitted it to be imperfect, viewing it only as the best among many unsatisfying options. At its heart were calculated ambiguities that made this agreement controversial and difficult to operationalize from the start.

KEDO itself was created in March 1995 to implement the Agreed Framework between the United States and the DPRK, under which North Korea agreed to freeze and ultimately dismantle its existing nuclear program. In return KEDO was to provide the DPRK with alternative sources of energy in the form of two 1,000 MW light-water reactors by a target date of 2003, and 500,000 metric tons of heavy fuel oil annually until the reactors were operational, to replace the potential energy supply from the suspect nuclear projects on which North Korea was to suspend construction under the Agreed Framework. Upon completion of the reactors, North Korea was to begin repaying the cost of these new reactors over 17 years, after a 3-year grace period.

Effectively, the Agreed Framework, upon which KEDO was and is based, traded ambiguity about past North Korean nuclear activities for a cessation of future activities. It thus postponed the moment of reckoning about the North Korean nuclear program and gave the North for nearly a decade the advantage of a certain strategic ambiguity that the militant, yet vulnerable, economically depressed, and isolated, nation found valuable in balancing the growing relative power of the outside world (Noland 2000, 152). The moment of truth under the agreement was to come around 2003, when KEDO was obligated to deliver the reactors and the North Koreans would be obligated to submit to unrestricted International Atomic Energy Agency inspections to which they had previously been highly resistant.

Once formally established, KEDO experienced a long series of political frustrations,[3] rooted partially in the ambiguous character of the Agreed Framework and partially in the broader relationships between the United States and the DPRK. Snyder (2000, 21–2) has pointed out that early tactical mis-

3 For details, see Pollack (2003) and Noland (2000, 151–70).

takes by the Clinton administration—chiefly in consultations, or lack thereof, with Congress—may well have compounded KEDO's problems. Congress was never enthusiastic about either the Agreed Framework or KEDO, voting to provide only half the money needed to purchase the heavy fuel oil in 1996 and coming close to appropriating no funds at all in 1998.

On its side, the North clearly poisoned the atmosphere for cooperation with its Taepo-dong missile launch of August 1998 and by minor, yet politically damaging, steps such as demanding exorbitant salaries for the North Korean workers detailed to the Kumho reactor-building project. And the final blow to the Agreed Framework was North Korea's admission in October 2002 of its continuing covert HEU nuclear program, a step that led to the freezing of heavy-oil deliveries in December 2002 and the one-year freeze on the Kumho reactor project in November 2003.

The KEDO project, to be sure, has achieved a few modest successes. It has slowly and quietly built unprecedented interpersonal networks, mainly of technical specialists, between North and South Korea. It has likewise established previously unknown forms of direct communication, including an air link initiated on 15 October 2002 between Yangyang airport in South Korea and the reactor project site at Kumho in the North as well as a training program for North Korean workers. KEDO has stationed eight KEDO employees on-site in North Korea for the past several years and has installed flow meters, provided by the United States under the agreement, at seven North Korean power plants to monitor the flow of heavy fuel oil (KEDO 2002).

The KEDO framework also has the important geopolitical merit, from a U.S. perspective, of providing a framework for trilateral interaction among the United States, Japan, and South Korea on Northeast Asian issues. In contrast with the four-party framework inherited from Korean War armistice negotiations (the United States, the People's Republic of China, the ROK, and the DPRK) that it succeeded, KEDO's trilateralism has provided an unprecedented opportunity to consolidate the comprehensive security relationship among U.S. allies in Northeast Asia. It gave birth to the Trilateral Coordination and Oversight Group (TCOG) consultation talks among ranking U.S., Korean, and Japanese officials that since the North Korean missile test of 1998 have become a significant part of diplomacy in the North Pacific. This process, however, is now well institutionalized and is in no sense dependent on KEDO for future momentum.

Despite the modest technical successes and the opportunity for U.S.-ROK-Japan trilateral dialogue that it provided, KEDO has failed; its failure was perhaps unavoidable given its small staff, precarious mandate, and lack of enforcement and monitoring capacity. It failed, in particular, to prevent North Korean subversion of the Agreed Framework in 1998 as it conducted its missile test and, more seriously, as it proceeded with its covert HEU program. Since December 2002, heavy-fuel-oil deliveries to the North have been suspended and, since November 2003, construction on the Kumho reactor

project itself has been in abeyance. Given KEDO's original imperfections, as a result in significant part of the crisis circumstances in which it originated, the irrelevance of its original time framework, and its loss of legitimacy because of persistent violations of its provisions, the KEDO framework should be seriously rethought and revised to make it relevant to the new circumstances of Northeast Asian energy now emerging.

New Options for the Future

As suggested above, there are serious problems with KEDO, and the Agreed Framework on which it is based, as a comprehensive blueprint for North Korea's energy future. With fuel-oil deliveries and reactor construction at Kumho now suspended and with six-party talks on the nuclear question in progress, the time is right to think analytically and dispassionately about what sort of mechanism should supplant KEDO—a mechanism that can capitalize on KEDO's achievements in network building and on sunk investments already made, while it addresses North Korea's acute energy problems more directly, fundamentally, and efficiently than KEDO has.

A basic problem in the original Agreed Framework was that the accord made no provisions regarding connection of the two 1,000 MW reactors to be built under the agreement with North Korea's electric-power grid. Indeed, differences in technical standards and recent degradation of the network would make it both technically difficult and quite dangerous to attach the Kumho reactor currently under construction, or its prospective counterpart, to the North Korean grid. The power to be produced through the KEDO venture could presumably be exported to South Korea or elsewhere in the world, but it would be very difficult to use within the DPRK itself.

The two large reactors contemplated under KEDO would not only be virtually impossible to connect to the North Korean power grid; at a projected cost of $5 billion, they would also be extraordinarily expensive compared with alternative energy projects.[4] Roughly $1.5 billion has been expended since 1996 on the construction of the first reactor. These sunk costs, and the possibility of exporting the power produced to South Korea or elsewhere in the region once a modernized regional grid is established, would plausibly justify to South Korea and Japan the completion of at least one reactor. Yet cancellation of the second reactor and substituting a more rational, cost-effective energy infrastructure should definitely be a central element of any post-KEDO arrangement.

The indispensable condition for any alternatives to KEDO—indeed, for any form of continued energy cooperation with North Korea at all—must be a verifiable nonproliferation agreement. Provided that such an agreement is

4 These reactors, at around $5 billion, would reportedly cost more than the prospective cost ($3 billion to $3.5 billion) of the proposed Seoul-to-Sakhalin natural gas pipeline (Harrison 2002–03, 33).

forthcoming, the nuclear dimension of the energy-support program should be scaled down or eliminated. In place of this, the overriding imperatives are threefold:

- To modernize the North Korean electric-power grid, with an emphasis on increased efficiency;
- To proceed, in a related fashion, with pipeline proposals that would allow both North and South Korean access to Russian gas, thus generating much needed electric power; and
- To pursue greater energy efficiency within the North Korean industrial and transport sectors through expanded technical assistance.

The feasibility of connecting a refurbished North Korean grid directly to the South Korean power system, which could inhibit destabilizing political-economic actions on the part of the North, might also be considered.

Northeast Asia at present is the one major region of the industrialized world that still lacks a regional natural gas grid, and the region has remarkably little reliance on natural gas despite that fuel's many attractive properties. Natural gas is one of the most energy efficient and environmentally attractive energy sources in the world, in the view of ever-growing numbers of energy experts worldwide. With one-quarter of the world's population, the region has little more than 5 percent of its natural gas usage (Calder 2000, 12; BP Amoco 2000, 26–27). Korea, like its Northeast Asian neighbors, uses relatively little gas despite that fuel's intrinsically attractive properties. Only 12 percent of South Korea's primary energy is derived from gas, compared with about 21 percent in Germany and 26 percent in the United States (BP Amoco 2003, 38). Indeed, South Korea's total gas use, as a share of overall energy consumption, remains significantly less than levels in Japan despite a vigorous recent support policy in Seoul for natural gas.[5] In North Korea, gas use is negligible.

Considerable potential exists for expansion in gas consumption on the Korean peninsula as a whole, particularly in the North. And Russia is the logical source of supply. Russia has nearly one-third of the proven natural gas reserves in the world, many of them located within commercial distance of the Korean peninsula. South Korea, to be sure, can easily access liquefied natural gas (LNG) from the Persian Gulf and is, in fact, the world's second-largest LNG importer following Japan. Yet Middle Eastern LNG is a much less attractive proposition for North Korea, for both geographical and infrastructural reasons.

The costs of large-scale pipeline development could be massive, however. There are three basic pipeline options between Russia and Korea. The simplest would run roughly 3,200 km from Sakhalin through the Russian Far

5 In 2002, natural gas provided 11.5 percent of South Korea's primary energy consumption compared with 13.7 percent in Japan (BP Amoco 2003).

East and North Korea, down the Korean east coast, toward Seoul. The Japanese—and, more recently, U.S. and Anglo-Dutch interests—have been discussing these reserves with the Russians since the mid-1960s (Burrows and Windrem 1994, 435). The Sakhalin route, a central piece of the Soviet Union's Vostok Plan of the early 1990s (Valencia and Dorian 1998, 5–7), has substantial attraction for the Russians because it could provide important gas infrastructure to urban centers of the Russian Far East such as Khabarovsk and Vladivostok en route. It also has a substantial informal constituency in South Korea as well, and it could prospectively involve Exxon-Mobil, the largest of the multinational U.S. energy firms, which is a major participant in the Sakhalin gas and oil fields that this pipeline option would access.

The second pipeline option—a longer and more complex route—would run from the massive Kovykta gas field, northwest of Lake Baikal, through Manchuria and either under the Yellow Sea or along the western coast of North Korea, toward Seoul. Two variants have been proposed: one via Mongolia and a second solely within Russian and Chinese territory. The Chinese have strongly preferred the latter route and have promoted it above other Russian pipeline alternatives, as it would provide fuel directly to Northeast Chinese urban centers before it would pass on to Korea. In November 2003, KOGAS, CNPC, and RUSIA Petroleum completed a detailed feasibility study regarding this route.

The third pipeline option between Russia and Korea, and the most attractive alternative to Sakhalin from a Korean perspective, is the Sakha Republic (Yakutia) option. Yakutia is a sprawling area more than 3,000 km north of Korea, covering one-fifth of the vast Russian Federation (3.1 million km^2) but hosting a population of only 1.3 million people. Much of Yakutia's desolate Arctic and sub-Arctic terrain remains unprospected.

Initial recoverable gas reserves in Sakha/Yakutia are estimated at more than 8 trillion m^3, at depths from 1 to 4 km. Together with the massive South Pars field of Iran/Qatar, the Sakha fields are thus the largest gas fields ever discovered on Earth. They could supply Korea, and potentially much of the rest of continental Asia as well, with natural gas for at least another half century, at an estimated present-value development cost of around $20 billion.

The Sakha/Yakutia route has the considerable merit, from a Korean perspective, of being prospectively a Korea-centric, rather than a Japan-centric, concept, in contrast with Sakhalin. The Japanese, to be sure, held 10 years of discussions during the Soviet era over Yakutsk gas, involving Bechtel and El Paso Natural Gas of the United States at one point. Yet disagreement over pipeline routes, liquefaction sites, and security (the Soviet invasion of Afghanistan) stalled the project. Since a dramatic January 1989 initiative by Chung Ju-yung, founder of the Hyundai Group, South Korea has been a central player with respect to Yakutsk.[6]

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6 On the complex, frustrating history of Siberian and Sakhalin projects, see Paik (1995, 207–21).

Chung's bold notion, on which discussions have since proceeded, was to construct a 3,200 km gas pipeline across Russian territory near the Chinese border along the Amur and Ussuri Rivers, across North Korea, toward Seoul. Korean President Kim Young-sam and Russian President Boris Yeltsin jointly agreed to support a detailed feasibility study at their 1994 summit. Nevertheless, the project remains in abeyance. Uncertainties in energy demand and financing since the Asian financial crisis exploded in late 1997, including the collapse of the major *chaebol* Daewoo in November 1999, compounded the short-run difficulties of proceeding further. Despite its long-term attractiveness from a Korean point of view, the Yakutia option thus appears to have less short-term feasibility than the other two pipeline alternatives.

All of the three basic Russia-to-Korea gas pipeline options, it is important to note, at least consider the prospect of transiting North Korea. The ultimate locus of consumption, after all, is South Korea, and the source of supply is one of the three Siberian locations mentioned above—all located to the north of the Korean peninsula. In the absence of a verifiable nuclear nonproliferation agreement with the DPRK, it is obviously premature to move toward agreement on a trans–North Korea pipeline from any of the three major prospective sources of Russian gas, even though it would be cheaper than alternatives and more attractive to most Korean parties concerned.

The recent international feasibility study on the Kovykta field, recommending a 4,887 km, $12 billion pipeline under the Yellow Sea to South Korea—bypassing the North—was thus the correct decision.[7] Yet if North Korea is forthcoming on the nuclear issue—within the six-party talks framework or elsewhere—the issue of transit pipelines across North Korea from either Kovykta or Sakhalin or, ultimately, from Yakutia should be revisited. Indeed, all these options have prospectively strong political-economic merits that could make them the heart of a realistic "grand bargain" between North Korea and the nations of the North Pacific, provided that the nuclear issue is satisfactorily resolved. Such a grand bargain, with natural gas pipeline projects at its heart and also involving a related modernization of the North Korean electric-power grid and power generation systems, could be a highly constructive element of a broad, long-range Northeast Asian economic development plan. Indeed, a grand bargain could be a crucial political-economic catalyst for moving regional gas and electric-power-grid projects forward, given the immense scale, financial cost, and geopolitical coordination issues that are involved.

From the perspective of North Korean economic development as well as political preference, the Sakhalin route is definitely more attractive than Kovykta. The DPRK apparently fears that China, with its rapidly growing domestic demand for gas and geopolitical leverage, would not be willing for

7 For details, see *Gas Matters Today,* 3 February 2004.

very long to let Kovykta gas go to Korea. Kim Jong-il has repeatedly conveyed his preferences to Russian president Vladimir Putin for a Sakhalin pipeline (Harrison 2002–03, 30).

One possible alternative to a gas pipeline—or a long-run supplement, should Korea's explosive growth in energy demand continue—would be a long-distance electric-power transmission line approximately 235 miles long from Vladivostok into North Korea. Russian hydroelectric potential is massive and could help ameliorate Korea's prospective energy shortages. The electric-power transmission line option would also be substantially cheaper than the long-distance gas pipeline.

Connecting selected economic centers in North Korea to the South Korean electric-power grid has also been suggested. This seems most technically and politically feasible in the case of special economic zones (SEZs) isolated from the dilapidated North Korean power system as a whole, such as the Kaesong SEZ along the Demilitarized Zone. There a connection to the South Korean grid would provide a symmetrical combination of economic advantage and geopolitical benefits to the major parties involved, sufficient to make it a realistic short-term proposition.

The Northeast Asian pipeline options could be highly synergistic with North Korean energy development, addressing many of the problems discussed above. Such options could harness long-term regional energy imperatives to the solution of serious local North Korean infrastructural problems. Concretely, gas-fired power stations could be built along the pipeline route, with two 500 MW combined cycle stations that combine optimal energy efficiency and positive environmental traits and compensate for the electric power prospectively forgone in the cancellation of one of the 1,000 MW reactors contemplated under the KEDO agreement. Three such gas-fired stations were contemplated in the 2001 understanding between a consortium of three Dutch trading companies (one since acquired by Bechtel although it has indicated a desire to scuttle the deal) and North Korea, and the underlying conception would seem to have economic logic (Harrison 2002–03, 32).

Another possibility would be building a network of smaller 250 MW gas-fired power stations along the pipeline route, connected to a series of small local transmission grids. This could be an alternative to constructing a large-scale national transmission grid, which would likely be much more expensive. Korean energy specialist Paik Keun-wook has calculated that it would cost roughly $1.4 billion to construct such a network of eight regional gas-fired power stations linked to a trans–North Korea pipeline and connect them with a decentralized transmission grid such as that discussed above (Paik 1995, 33). At that cost, this proposal would be one-third as expensive as the estimated total cost of the two oversized reactors promised under the Agreed Framework, and much better adapted to North Korea's basic energy needs.

Although Japan does not appear likely to establish a national gas grid anytime soon because such a grid could cost as much as $25–$40 billion to build, calculations appear to be somewhat different in South Korea. Since 1999 South Korea has built a network of domestic pipelines that already surpasses Japan's and is pursuing much more varied and ambitious uses for national gas than is Japan. Seoul, for example, has been promoting demand for natural gas through tax incentives, aid for introduction of natural gas vehicles such as gas-powered buses, and expansion of the domestic natural gas grid. This growing gas network would appear to be establishing a solid economic basis for key Korean involvement in regionwide pipeline ventures in the foreseeable future—potentially including trans–North Korea pipelines.

The attractiveness for Korea of piped gas, as opposed to LNG or other fuel choices such as nuclear power, depends to an important degree on the interrelationship between global energy prices and the progress of major North-South political-economic détente on the Korean peninsula itself. If global energy prices are predictably high and the prospect of North-South détente with Korea is also strong, there would be a strong political-economic rationale in Korea for rising dependence on Russian piped gas and for the construction of the extensive Northeast Asian pipeline system that is often discussed. Conversely, if the political prospects are for North-South confrontation, the case for nuclear power may be strengthened.[8]

Apart from the economics of a natural gas–based alternative to KEDO's nuclear bias, there is also a geopolitical rationale—one especially relevant under the assumption of a nuclear nonproliferation agreement and intrusive inspections as a precondition for the energy initiatives toward North Korea that are outlined here. The trans–North Korean pipelines contemplated here—like the railroads and regional electric-power grids also frequently discussed—would transform North Korea (or a united Korea that could well succeed it) from an outsider in the regional political economy into a central player. North Korea's crucial transit role for a panoply of infrastructural projects, including pipelines and railways as well as transnational electric-power grids, would yield it ongoing revenue to offset the otherwise depressed state of its domestic economy. Yet this transit role would also provide—through the advantages it would bestow on neighboring nations—positive international economic leverage for a transformed North Korea as well. This leverage would compensate, at least in part, for the increased vulnerability that the DPRK or a successor state would experience through abandonment of its nuclear program. It would clearly provide a much healthier basis for political equilibrium in the region than would otherwise exist if the North continued to rely, as it has done for so long, purely on military might and brinkmanship to gain recognition from the broader world.

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8 For the political-economic assumptions involved, see Calder (2000, 17).

In the absence of both a conclusive elimination of North Korean nuclear-weapons-related capabilities and a clear transformation of North Korea's regional role in more peaceful directions, more limited incremental options can also be considered. Clear political-military progress should obviously accompany such incremental steps, but they need not involve the comprehensive grand bargain that large-scale pipeline or electric-grid overtures would necessarily entail. Apart from the selective connection of North Korean SEZs to South Korean, Russian, or Chinese power grids, technical assistance in improving the efficiency and reliability of electric-power transmission in the North, including the training of North Korean engineers and other specialists, could be a constructive incremental step. Regardless of the details, it is clear that the legitimate policy interdependence of the economic and security aspects of North Korea's energy problems must not be forgotten.

Conclusion

North Korea has faced a severe energy crisis over the past decade along several dimensions: primary energy supply (apart from coal); electric-power generation and distribution; and fuel for transportation. Indeed, energy has been the Achilles' heel of the economy as a whole, with energy shortages also crippling industry and agriculture. These shortages have inhibited North Korean military adventurism, to be sure, but they have also crippled economic growth, in both the DPRK and surrounding areas.

KEDO helped defuse the dangerous military confrontation of 1994–95 and helped reinforce the important triangular relationship among the United States, Japan, and South Korea. It also helped forge delicate but often useful interpersonal ties, mainly technical, between North Korea and the outside world. Yet the organization could not forestall the covert North Korean HEU nuclear program, and it has been continually weakened by political cross fire. Given the inappropriate energy choices with which it started, the body needs to be fundamentally transformed, with due consideration for the sunk costs and the residual benefits involved.

A post-KEDO energy development body for North Korea should of course include all the nations involved at present as central members of that organization, with a central role for the United States. To elicit needed political support in the United States, any successor will also need to provide significant commercial opportunities for U.S. firms, and at least some jobs for U.S. workers. Yet a successor body to KEDO should also broaden to include Russia and China in more systematic ways. With a more substantial mandate centering on developmental issues such as transnational natural gas and electric-power grids that naturally involve neighboring nations as well as North Korea, such a post-KEDO body could reasonably expect to avoid the nuclear-power-specific resentments and sourcing difficulties that have rendered relationships between KEDO and its massive neighbors so complex. By includ-

ing all the nations now involved in the six-party talks on the North Korean nuclear crisis, a "KEDO II" could also appropriately institutionalize that six-party forum to promote the long-term energy development of the Northeast Asian region as a whole.

A new Northeast Asian energy-development body, based on the emerging six-party-talks framework, should keep its energy-specific character, but broaden its mandate and focus particularly on the development of natural gas resources in the region. Because of sunk costs, one of the 1,000 MW nuclear reactors proposed under the Agreed Framework should be continued, but the other should be cancelled and succeeded by a systematic network of medium-scale gas-fired power plants connected to a trans-Korean pipeline grid. All such planning, of course, needs to be contingent on a resolution of the nuclear crisis consistent with the imperatives of global security.

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