Introduction: Energy and Mineral Resources in North Korean Security and Sustainability

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Addressing the DPRK nuclear weapons issue requires that the DPRK rebuild its economy in peaceful ways that avoid illicit or sanctioned activities. Two major components of this economic transformation are the state’s mineral sector and energy sector, which must have the infrastructure to support economic growth. Accurately assessing the DPRK energy and mineral sectors is challenging, given the significant amount of inaccurate data on the subject. However, unless such policy-relevant data and analysis can be generated, it is impossible for decision-makers to determine how to engage the DPRK in a meaningful way. From a DPRK perspective, such analysis is equally critical because it is evident that substantial rehabilitation of the energy sector and development of the mineral sector is impossible without external assistance. The following papers contained in this special edition of the KJDA outline the status of the energy and mineral sectors and paint a bleak picture of North Korea: a decaying energy infrastructure, mines lacking adequate supplies and fuel, and a crippled energy sector unable to support commercial development that now functions at a fraction of its output 20 years ago. However, three options for engaging the DPRK are available: 1) Cooperative energy efficiency projects in the DPRK. 2) Working with the DPRK to ensure that the pilot light water reactor at Yongbyon complies with proper design and construction standards. 3) Assisting the DPRK with minerals-sector development, including providing markets for the minerals produced.

Resolving the DPRK nuclear weapons issue requires that a number of necessary conditions be met. One of the most critical is that the DPRK rebuilds its economy in ways that are peaceful and avoid illicit or sanctioned activities. Two major components of this economic transformation are the state’s energy sector, which must have the required infrastructure to support economic growth, and the mineral sector, North Korea’s most valuable resource and its best opportunity to rapidly develop its economy. Building on nearly two decades of work in the DPRK, the Nautilus Institute has expanded the attention given to its energy sector analysis to the minerals sector. The three main goals of this analytic effort are to:

A. Assess the interdependence of the minerals sector on energy supply in North Korea.

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B. Construct policy-relevant options for engagement of and negotiation with the DPRK with those sectors in mind.

C. Design these options to meet the following criteria: sustainability—an improvement in human welfare for the North Korean people and security—a reduction in the threat of nuclear next-use and proliferation.

Accurately assessing the DPRK energy and mineral sectors is challenging given the significant amount of inaccurate data on the subject, including North Korean data. Often, analysts use data that is based on anecdotes or a few limited accurate sources and extrapolate it without regard to physical or economic plausibility. Given that these data are used to determine the effectiveness of aid programs and assess potential investments in North Korea, improving the reliability of analysis in the face of the data uncertainties is essential. The energy-economic analysis conducted by the Nautilus Institute requires that data be ground-truthed or be physically consistent within a range of plausible estimates and aggregates of data generated independently from a variety of sources. In this manner, errors arising from sources are offset and are bounded by a physical input-output analysis. Where these techniques prove inadequate, the methodology identifies areas where more research is needed to reduce uncertainty on sector activity and/or related energy supply and demand to acceptable levels for purposes of policy analysis. The point is to achieve sufficient confidence in the underlying data to support a nuanced and realistic assessment of these sectors in the DPRK as well as guide where the most productive investment and engagement may be undertaken.

Unless such policy-relevant data and analyses can be generated, it is impossible for decision-makers to determine how to engage the DPRK in a meaningful way, whatever its preferences. From a DPRK perspective, such analysis is equally critical because it is evident that a substantial rehabilitation of the DPRK energy sector and the development of the mineral sector are impossible without external assistance. The DPRK energy sector is too decrepit for an endogenous recovery to be viable. Rather, wholesale reconstruction of the country’s energy infrastructure is necessary. Although Chinese investors are active in the DPRK, and the Chinese government has acquiesced to the succession of a third generation of dynastic North Korean leadership, the Chinese are unlikely to rebuild the DPRK’s energy sector.

In reality, achieving a flow of energy-related external assistance on the necessary scale would require U.S. and allied nation support. Such a flow is contingent upon reducing, the high levels of tension on the Korean peninsula, resumption of dialogue and negotiation with the DPRK over its nuclear weapons, and a substantial progress in verifiable denuclearization over time. For its part, the DPRK will require first a reduction of the perceived threat of a preemptive nuclear attack on North Korea, substantial energy aid, normalization of relations with the United States, and guarantees of an overall settlement package by China and Russia. The United States would require the verifiable denuclearization of North Korea over time, starting with substantial progress on halting uranium enrichment and the deployment of nuclear weapons, as well as concrete assurances with regard to nuclear proliferation activities. Thus, although energy-related assistance—especially as it pertains to the minerals sector as an option that the DPRK can substitute for illicit and destabilizing nuclear and arms exports—is a necessary condition, it is far from sufficient.

Finally, due to humanitarian and long-term stability considerations in the DPRK
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The provision of light-water reactors under the 1994 U.S.-DPRK Agreed Framework failed to take into account the urgency of North Korean needs for electricity in the short and medium terms, and ignored the physical reality of a decrepit and a fragmented small electrical grid in relation to the operating requirements of light water reactors. The KEDO light-water reactor project was patently unsustainable, did nothing to reduce the vulnerability of the North Korean people to the collapse of the economy, and contributed to the insecurity of the state itself; the end result was that it was not useful in terms of achieving the denuclearization of the DPRK. Future external engagement of the DPRK must consider these lessons.

Energy Security and Sustainable Mineral Development in North Korea

A review of the DPRK energy and minerals sector in a sustainability framework reveals the deeply insecure and unsustainable political and military basis of the North Korean state. Conversely, a shift toward sustainability, even small shifts at the beginning of external engagement, could have large benefits to North Koreans involved in the energy and minerals sectors. Currently, it appears that minerals exports are simply driven by the imperative of earning sufficient foreign currency to allow the North Korean state to survive, regardless of sustainability considerations. A reversal of this unsustainable minerals export drive can be achieved only as part of a resolution of the nuclear issues. In this manner, security and sustainability considerations are inextricably linked.

Minerals and Sustainable Development

As noted by Arabella Imhoff in Mining and Sustainable Development, While the capture of minerals wealth and economic opportunities may prop up a government’s revenue stream and lead to increased economic activity, these measures alone are not sufficient to ensure that the minerals and mining sector is making a sustainable contribution to economic development.... Sustainable development is premised on the idea that losses in certain kinds of capital will be offset by gains in other forms of capital. The loss of natural capital in the form of minerals may be offset by the development of human capital, in the form of skills and a healthy and educated workforce. When they are exhausted or become uneconomical to mine, the mineral wealth will dry up unless carefully targeted policies are implemented that aim to maximize the economic opportunities and wealth generated by minerals development to produce gains in other forms of capital, be it physical, social or human, which provide the basis for long-term economic development.1

In North Korea, rather than utilizing these minerals to promote the economic development of the country, the DPRK is, as Nate Aden notes in his paper, “trading the regime’s political present for the country’s energy and economic future.”2 Currently the mineral sector in North Korea does not meet any of the established standards associated with sustainable mineral development. For example, the DPRK needs to greatly improve the investment environment for foreign companies operating in the DPRK. In an effort to encourage investment, the DPRK has only recently
granted Chinese investors management rights over their projects.\textsuperscript{3} It remains unclear to investors whether these measures will be adhered to over the long term and not reversed due to security concerns or a change in policy. Thus, increased investment and expanded mineral development will not be possible in the DPRK until these concerns are addressed.

Additionally the infrastructure in the DPRK is currently inadequate to support effective mining operations. The locomotives that serve the mines are prone to shutdown due to shortages of energy supplies from local thermal plants.\textsuperscript{4} Poor electricity has also made it impossible for some equipment, especially electric motors, to function at all.\textsuperscript{5}

To date, mineral development in the DPRK has resulted in an environmental nightmare. As Choi Kyung-soo notes, wastewater from mines is dumped directly into the rivers in the DPRK, leading to severe environmental damage.\textsuperscript{6} Yoon reports that more than 200,000 people living near the Sangnong Mine have developed health problems from waste disposed from the gold mine in that area and, although they receive preferential benefits for working there, diseases are common among workers at the uranium mines.\textsuperscript{7} Mine closure in the DPRK is generally driven by declining production from the mines than the environmental consequences of abandoned facilities.\textsuperscript{8}

Because mining operations in North Korea are not sustainable in a way acceptable even to Chinese investors, let alone the standard investors in the mining sector, North Korean officials are aware that they are boxed into a corner. They also believe that it is important to avoid over-dependence on China. For these reasons, they are interested in expanding cooperation with other countries. Dialogue with North Korean officials and technical experts on sustainable mineral development is a way to build a technical, non-politicized cooperative engagement, while larger security issues are negotiated and before large-scale investment can occur in the DPRK. In addition, in the DPRK, mineral development is a multi-generational livelihood passed down in families; in addition, the corporations and towns that are built around minerals extraction and processing also provide social services to workers or families living in the mining area. Engagement on sustainability is one way to begin talking to North Koreans about human welfare issues that may not be possible otherwise, especially given North Korean practices of using gulags and other punitive forms of labor in the mining sector.

**Energy Security and North Korea**

A nation-state is energy secure to the degree that fuel and energy services are available to ensure: a) survival of the nation, b) protection of national welfare, and c) minimization of risks associated with supply and use of fuel and energy services. Each of these energy security objectives must be realized in energy supply-related, economic, technological, environmental, social and cultural, and military/security-related dimensions. In addition, energy policies must address the domestic and international implications of each of these dimensions. Thus, national energy policies should be evaluated against each of the three basic objectives as manifested in the domestic and international implications of each dimension.\textsuperscript{9}

Currently, by this definition, North Korea is highly energy-insecure. Lack of energy in the DPRK has crippled economic development. As noted above, North
Korea’s mines lack electricity, thereby reducing its ability to use mineral development to support the economy.\textsuperscript{10}

Technologically the country has an obsolete, worn-out energy infrastructure that is operating far below capacity and loses much of the generated energy in delivery.\textsuperscript{11} The poor quality of delivered electricity has led to decreased production at the point of end-use in all types of industrial and commercial activity.\textsuperscript{12}

Technologically, the DPRK is far from being energy secure. Some of the DPRK’s energy infrastructure was built during the Japanese colonial period. Other plants were imported from the Soviet bloc in the 1960s and 1970s. Replacement parts are now unavailable and maintaining the improvised operation of these facilities becomes more difficult every year.

As we see in the paper by Hayes, von Hippel, and Bruce, the lack of fuel in the country has contributed to the environmental degradation of the state and heightened the vulnerability of the North Korean people, failing to protect their welfare and minimize risks. Lacking adequate energy for basic heating has increasingly turned households toward using biomass for fuel that has left many areas of North Korea more vulnerable to mudslides and floods.

Even the military, which is generally recognized to have preferential access to energy and other supplies in the DPRK, only has the fuel to support its military equipment for about one month in a wartime setting. After about a month of wartime operational tempo, it would require two months to resupply (including importing fuel—a questionable option during wartime)—assuming that the supply capacity was not already attrited.\textsuperscript{13}

Finally, the DPRK’s energy sector has yet to address the domestic or international risks associated with its energy development. The pilot light water reactor project under development in Yongbyon was built without knowledge of or attention to international safety standards and has negative implications for the entire region. A meltdown in that facility would be disastrous for North Korea as well as for Seoul and Tokyo that are downwind from the site for much of the year.

Previous efforts to address the state’s energy security, both on the part of the government and in the context of international negotiations, have not been successful in resolving the problem. Attempts to rehabilitate power plants in North Korea have not produced noticeable results and attempts to develop new plants have not resulted in significant additional energy supply. Heavy fuel oil given under the Agreed Framework actually debilitated some of the DPRK’s power plants due to its sulfur content. The DPRK remains isolated from the international community, allowing most outside assistance projects limited access to North Korea and blunting any potential transformative impact on the country.\textsuperscript{14}

Unless these energy-related insecurities are overcome, there will be no resolution of the North Korean nuclear issue. Energy aid has been a critical part of all negotiations over the DPRK’s nuclear program and is a necessary requirement for restarting the North Korean economy and ending the vicious cycle of ecological destruction in which the country is locked. North Korea’s fundamental goal in the nuclear negotiations is to secure the survival of the state. Denuclearization without addressing those needs is highly improbable. Additionally, it is the North Korean population, not the state’s leaders, who carry the weight of the country’s energy insecurity. The rural population has limited access to electricity. North Korea’s urbanites are also vulnerable to energy insecurity due to the poor construction and inefficiency of residential
buildings, as well as lack of power to meet the needs of water lifting, sewage disposal and cooking. These are not abstract issues; they are a core part of the daily human insecurity that makes people vulnerable to the control exercised by the North Korean state and the predation of its agencies.

Ultimately, energy assistance to North Korea that does not help the country meet the standard of energy security outlined above will not meet the security imperatives of the North Korean state or fulfill the human security needs of the North Korean population and will ultimately fail to contribute to the resolution of the DPRK’s nuclear program.

**The DPRK Energy and Minerals Working Group Meeting**

For all the reasons adduced above, the Nautilus Institute launched the DPRK Energy and Minerals Working Group Project. The Nautilus Institute maintains a unique database and set of quantitative and qualitative analytic tools to evaluate and track the DPRK’s energy economy, it has also has maintained working relations with North Korean scientists and technical personnel from the energy sector for nearly two decades.

To maintain this database Nautilus tracks a host of open source information outlets, including DPRK announcements, North Korean analyses, and input from experts who work in or visit the DPRK. We aggregate this information with the quantitative data gathered first-hand in the DPRK. This information is used to build a consistent physical framework accounting for supply and demand over time as well as forecasting future supply and demand levels based on different underlying drivers of the DPRK energy economy. This balance is described in detail in the Nautilus report “Fueling DPRK Energy Futures and Energy Security: 2005 Energy Balance, Engagement Options, and Future Paths” completed in 2007. This database underlies all Nautilus research and policy analysis on the DPRK’s energy economy. In addition, the database is updated regularly due to the transparent and accessible nature of the underlying algorithms and coefficients that enable us to partly dissolve the granite curtain of opacity in the DPRK.

We also convene meetings for sectoral analysis working groups of experts on the DPRK energy sector, individuals with first-hand experience working in the DPRK, and others to update our database. This allows us to ensure that the underlying data and technical analysis available at Nautilus is as accurate as possible; in addition, that salient analysis and policy advice is available when requested by U.S., ROK, and other officials.

These working group meetings have been held in 2006, 2008, and 2010 with the help of the Center for International Security and Cooperation (CISAC) at Stanford University, the Korean Energy Economics Institute (KEEI), the University of San Francisco Center for the Pacific Rim, the Beijing Energy Technology Center (BETC) at Tsinghua University, and the Environmental Education Media Project (EEMP). The meetings have been funded by the U.S. Department of Energy, the MacArthur Foundation, and the Ploughshares Fund.

The 2010 meeting, held in September in Beijing, China, was expanded to include the DPRK minerals sector. In addition, all of the papers in this journal were developed from presentations at the Beijing workshop of September 2010.
Peter Hayes, David von Hippel, and Scott Bruce, the main organizers of the energy and minerals working group, begin this special issue by noting the significance of the DPRK energy sector and its importance in a range of possible futures for North Korea, including engagement, stagnation, and collapse. Paralleling the overview of the DPRK energy sector, Edward Yoon examines mineral development in the DPRK including the location of mines, available mineral resources, the outdated equipment used in North Korea, and possible linkages to overseas markets for future development options. Nathaniel Aden builds on these studies by looking at the trade in energy and minerals between China and the DPRK in terms of volume and cost. Aden concludes that the DPRK is selling the resources it has for foreign exchange and bartering the future value of the country for hard currency in the present.

Finally, we then look at possible links to South Korea in the energy and minerals sectors. Jae-young Yoon looks at the decrepit DPRK energy grid and weighs the benefits of several strategies for inter-connecting the ROK and DPRK energy grids, potentially as part of energy for capital trade with Far-East Russia. Choi Kyung-soo then notes the history of inter-Korean mineral development projects and proposes the next steps for the ROK to become more involved in that sector.

**Sustainable Development, Security, and North Korea**

The included papers paint a bleak picture of North Korea: a decaying energy infrastructure held together by North Korean determination, mines lacking adequate supplies and fuel, and a crippled energy sector that is unable to support commercial development and functioning at a fraction of its output twenty years ago. Meanwhile North Korea exports mineral resources that could be used to develop the state and society at discounted prices to China to keep itself afloat.

Three possible options for engaging the DPRK and ending this cycle are available:

1. Energy efficiency projects in the DPRK have a direct and significant impact on the lives of the North Koreans. These projects build scientific and technical cooperation with the DPRK as well as open the door for further engagement opportunities. Additionally, demonstrating the benefits of these projects, in a way that is viable for the North Koreans to understand and adopt, will help focus policy-makers on energy aid options that offer the best long-term prospects to sustainably improve the North Korean energy sector and economy.

2. The DPRK pilot light water reactor in Yongbyon announced in November 2010 represents a significant safety risk to both North and South Koreas. One possible response would be to work with the DPRK to ensure that the pilot light water reactor complies with the proper safety standards for design and construction. The North Koreans would have an interest in discussing options to upgrade the reactor to meet safety and manufacturing standards, something that will take the DPRK decades to do on its own. In addition, the parties should discuss options for energy sector planning and development so that with energy assistance from the United States, or other states, the DPRK can integrate small reactors into a national grid capable of meeting the DPRK’s energy needs. A possible forum for these discussions could be the nuclear security summit to be held in South Korea in May 2012.

3. In the ROK and elsewhere, there is significant interest in assisting the DPRK with minerals-sector development including providing markets for the minerals produced.
The DPRK is looking for resource development opportunities with other states to dilute the influence of China. Successfully working with the DPRK to develop its minerals sector requires knowledge about: the DPRK’s mineral resources and the infrastructure required to extract them and bring them to market, an understanding of which engagement approaches are likely to be most effective in helping the DPRK develop the sector, coordination between parties seeking to be involved in developing the DPRK minerals sector, and coordination with general strategies of DPRK energy sector and economic development.

The prospects for the states in the region to take advantage of these opportunities are currently negligible, but may change in 2012. A significant thaw in inter-Korean relations before 2012 is unlikely. North Korea is focused on developing the economy and securing the succession issue. The Cheonan sinking and shelling of Yeonpyeong Island have made engagement with the North a politically unviable strategy for the Lee Myung-bak administration. Similarly, the Obama administration likely will not change its policy of “strategic patience” and containment until after the 2012 U.S. Presidential Election. Japan is preoccupied with the aftermath of the March 11, 2011 Tōhoku earthquake and tsunami.

Although prospects for change in the dismal outlook for engaging North Korea are currently bleak, elections in the U.S. and ROK and the 100th anniversary of the birth of Kim Il Sung in 2012 may open doors that are currently closed. It is prudent therefore to prepare now for what may be a future moment of rapid realignment and an opportunity to promote currently blocked solutions to the North Korean nuclear problem.

Notes

8. Ibid., 31


**Notes on Contributors**

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