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International energy assistance needs and options for the Democratic People's Republic of Korea (DPRK)

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Abstract

Recent agreements between the Democratic People's Republic of Korea (DPRK) and the other countries involved in the six-party talks on the future of the DPRK's nuclear weapons program have focused attention on the North Korean energy sector, and, specifically, what the international community can or should do to assist the DPRK in energy sector redevelopment. During two visits to North Korea in 1998 and 2000, a team of American and North Korean researchers conducted a unique rural energy use survey in a flood-affected rural village in the DPRK—the farming village of Unhari. The information gathered during the survey has important implications on how to properly approach the ongoing rural energy crisis in the DPRK, and, more broadly, to provide overall energy sector assistance. The results of the Unhari survey are described briefly, followed by suggestions of internal policy and legal reforms, approaches to international cooperation, key and attractive energy sector technologies and processes for energy sector redevelopment in the DPRK.

Keywords: North Korea; Rural energy use; Energy sector assistance

1. Introduction

On February 13, 2007, delegates of the two Koreas, the United States, China, Russia, and Japan meeting in Beijing reached an agreement under which North Korea (Democratic People's Republic of Korea, or DPRK) would shut down its plutonium-producing 5-MWe (megawatt-electric-equivalent, though this reactor does not actually produce electricity) graphite reactor in exchange for energy aid. The agreement broke the logjam that had existed in the six-party process on denuclearizing the Korean Peninsula, and marked the first step toward implementation of the September 2005 agreement for complete, verifiable denuclearization.

Much work remains to be done in subsequent rounds, however. In particular, North Korea is certain to renew demands for the two 1-GWe (gigawatt-electric) light-water reactors (LWRs) that were promised it under the 1994 Agreed Framework. The United States, however, has shown no inclination to allow the DPRK to acquire nuclear technology under any circumstances. In fact, even if LWRs are part of a deal again, it will be necessary for the parties to the agreement to develop alternative forms of energy aid to North Korea.

Developing proper plans for energy assistance is hampered by the lack of information about the country's energy situation. What little official data are available are unreliable. To help fill this need for information, the Nautilus Institute for Security and Sustainability has been working to revise its database of energy demand and supply in the DPRK (see, for example, Von Hippel and

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Hayes, 1997, 2007), and maintaining its related cooperative engagement program with North Korea.

During a 3-week mission during September and October of 1998, a team of specialists from the Nautilus Institute, working with a team of specialists from the (DPRK), undertook a collaborative humanitarian project to apply renewable energy technologies—wind power generators—in a flood-affected rural village in the DPRK. This second of the three missions included an initial rural energy survey. Survey follow-up activities took place during a Nautilus mission to the DPRK in September/October of 2000. The specific goals of the survey component of the project were

(1) to provide quantitative information on electric energy and power demand in the host village of Unhari needed to plan and implement connections of the wind energy system to electrical loads in the village;
(2) to obtain an overview of energy use in general in Unhari in order to identify additional opportunities for application of energy-efficiency and renewable energy measures; and
(3) to train and provide practical experience to DPRK specialists in the conduct of rural energy surveys to improve DPRK capacity for and understanding of such surveys.

The initial rural energy survey was motivated by uncertainty regarding rural energy supply and demand in the DPRK in light of the widely reported declining status of the DPRK energy system. By 1996, estimated electricity generation in the DPRK overall had fallen nearly 50 percent from its 1990 level (from about 46 TWh to just over 23 TWh), and estimated coal production had fallen by about 40 percent (Von Hippel and Hayes, 1997). While there have been some improvements in the overall energy situation since 2000 (Von Hippel and Hayes, 2007), the DPRK's energy production remains far lower than that of 1990. (A summary of Nautilus' updated estimate of the DPRK supply–demand balance will be included in an upcoming special issue of *Energy Policy*.)

The survey was conducted during two visits to Unhari, a cooperative farm located on the West (Yellow) Sea in Onchon County. It was the first, and to this date remains the only, direct survey of household energy use conducted in a rural village in the DPRK using internationally recognized methods (for example, Tuntivate, 1995; UNDP/World Bank, 1991; Grosch and Muñoz, 1996; Kumar, 1993). As such, the information obtained, while still containing high degrees of uncertainty, provides the best available information regarding energy supply and demand for ordinary North Koreans. The complete survey can be accessed online at http://www.nautilus.org/DPRKBriefingBook/energy/Unhari_survey.pdf

In the nearly 7 years since the survey was completed, the ongoing nuclear standoff has prevented the DPRK from receiving any significant outside aid for energy development, nor has the country been successful in addressing its energy problems through its own means. Therefore, the information obtained in this survey remains relevant to policymakers seeking to address the DPRK's energy needs as part of the implementation of the February 13 agreement. The remainder of this paper provides a brief summary of survey results, reflects on key energy assistance activities for the DPRK rural sector in particular, then broadens the scope to provide suggestions, growing out of the Unhari project experience and other Nautilus engagement and research efforts in recent years, of energy sector assistance areas and activities that should be considered as negotiations on energy assistance activities continue.

2. Analysis of survey results

2.1. Introduction

In this section, several different results of analyses of the Unhari data are presented. It is important to stress that there is considerable uncertainty in virtually all of the estimates. In some of the tables below the reader will find figures presented to apparently high degrees of precision, but virtually all of the results presented should be interpreted as having accurate to, at best, the second digit of the figures presented, and more often the first.

2.2. Overall estimated energy balance for village

The results of the Unhari surveys were put together with general estimates assembled by others to produce an estimated energy balance for the village. This balance was updated based on responses to questions asked during the September/October 2000 Nautilus mission.

Table 1 presents the estimated energy balance for Unhari village, including its satellite coal mine and (as of 1998) upland corn production areas. Also included in Table 1 is a set of estimates of human labor and draft animal use for agriculture, as well as human labor for coal mining.

In terms of total energy consumption, coal provides about 70 percent of all forms of energy used in the village. Over 92 percent of coal use is estimated to be for household heating, cooking, and preparation of pig feed. On the basis of energy content, petroleum products account for the next largest portion of energy use in Unhari (about 14 percent), about two-thirds of which is estimated to be for tractor fuel. Electricity supplies just under 13 percent of total energy use, with rice straw, human labor, and animal labor accounting for smaller portions.

Fig. 1 shows the breakdown of estimated electricity use in Unhari, including the coal mining and upland corn operations. Electricity use is dominated by major pieces of equipment, namely the air compressor used in the coal mine, the rice threshing and milling equipment, and rice irrigation pumps. It should be remembered, however, that the coal mine provides fuel to one or possibly two other villages. Other uses of electricity, including household use,