



## **Overview of Energy in North Korea Opportunities for International Cooperation and Infrastructure Development**

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The Democratic People's Republic of Korea (DPRK, or North Korea) routinely experiences energy shortages and blackouts despite possessing abundant resources of coal and hydropower. These energy shortfalls have largely been the result of aging infrastructure, outdated technologies, and policy issues. Pyongyang has opted for both short-term and long-term solutions to address problems affecting energy production, but these measures have, for the most part, either created new difficulties or exacerbated existing issues. Without definitive solutions, such hurdles and complications can continue to impede the North's economic development. However, the warming of inter-Korean and U.S.-DPRK relations may present opportunities to improve the country's energy prospects via international development projects, information sharing, and technology exports.

### State of North Korea's Energy Sector

The DPRK's generation mix consists largely of coal and hydroelectric power, reflecting North Korea's natural resource endowment. According to estimates by the South Korean government in 2014, North Korea's energy mix consisted of coal (53%), hydroelectric power (29%), oil (7%), and other sources, including biomass (11%).<sup>[i]</sup> Another estimate by the CIA in 2015 stated that North Korea's energy mix was approximately 45% fossil fuels, including coal and oil, and 55% hydroelectric generation.<sup>[ii]</sup> While there are uncertainties about estimates on North Korea's energy mix (primarily as a result of the relative lack of open information), the numbers generally show that the DPRK is largely dependent on coal and hydroelectric power, along with some reliance on oil. A 2011 declassified CIA report estimates that North Korea's coal reserves are somewhere between 8 to 12 billion metric tons. Most of these coal reserves are comprised of anthracite coal, which is of high carbon content and used mainly in electricity generation. Any high-quality coking coal needs for metallurgical industrial processes are met with imports from China and Russia.<sup>[iii]</sup>

Despite its ample coal and hydropower reserves, relatively small population, and slow economic growth, the DPRK is unable to meet the energy demands of its industrial sector. A 2007 report estimated that although the DPRK's total energy generation capacity was 10 GW, only 5.9 GW or less was operable.[iv] Such challenges within North Korea's power system have largely been the result of aging infrastructure, obsolete technologies, and misplaced policies. Thermal generation facilities and systems have experienced significant deterioration over time. Only a select number of boilers and turbines are operating at large power stations, and even these are being operated at low capacity and efficiency: the energy loss in the power system is estimated to be as high as 20%. Furthermore, centralized decisionmaking structures in the DPRK play a disproportionate role in determining energy resource allocations.

#### North Korean Energy Policies

To address these energy issues, DPRK leadership has implemented a number of short-term initiatives that have ultimately either aggravated problems or created new issues. One of these short-term measures has been to call on producers to increase output. However, by doing so, the producers have pushed their generation assets to the point of damage; furthermore, directives to increase output have given producers less time to conduct maintenance on their systems, further contributing to their degradation. North Korea has also attempted to promote greater use of alternate fuels, but the use of lower octane gasoline or methane reduces efficiency and increases the likelihood of damage in vehicle engines. Another short-term solution that North Korea has tried to implement was calling for reductions in energy use. In practice, such austerity measures resulted in significant financial costs as a result of idle workers and equipment damage.

To deal with the broader, systemic issues within its energy sector, the DPRK has instituted three main long-term objectives: increasing coal output, building new hydroelectric generation capacity, and increasing imports of petroleum from neighboring nations. However, it is unlikely that these long-term solutions will result in any fundamental changes to North Korea's energy situation. The increase of coal output will require significant upgrades to coal mining technology. While the DPRK has rich coal reserves, it will be difficult to increase production from these reserves without upgrades to its mining equipment and infrastructure. Given economic sanctions on North Korea, the country has had difficulties in importing outside technology and assistance on this front. Additionally, the use of new hydroelectric generation capacity to meet demand is not only costly because of the capital-intensive nature of hydro construction projects, but the inefficiency of North Korean hydroelectric generation technologies further compounds this issue of economics. It is likely that the DPRK will fall short of fulfilling their energy demand with new hydroelectric capacity. Increasing petroleum imports from neighboring countries is the long-term solution with the lowest likelihood for success. DPRK has fallen behind on payments in the past, and it is unlikely that new lines of credit would be established to meet increased import volumes. In the past, North Korea has paid for Iranian oil with arms, but this is unlikely to be sustainable--China's increasing arms trade with Iran makes it less likely that Tehran would accept North Korean military equipment as payment.[v]

### Opportunities for International Involvement in North Korean Energy

While it is unlikely that the DPRK will be able to address its energy issues alone, given the sudden potential for thawing relations with the outside world, international cooperation may be a possible path forward. Significant improvements would be required across North Korea's entire energy sector, with infrastructure arguably the most important. Wide-ranging infrastructural improvements such as rebuilding of the electrical transmission and distribution system, improvements to power plant system components, strengthening of coal supply and coal transport systems, and rehabilitation of rural and agriculture infrastructure[vi] would only be possible with outside assistance. In the past, energy infrastructure development project ideas have been proposed for North Korea, including the siting of transnational gas pipeline infrastructure, as well as the ill-fated KEDO light water reactor construction project. However, these ideas have not come into fruition because of political factors. North-South rapprochement and the unexpected warming of U.S.-DPRK relations may herald opportunities for foreign companies and vendors to participate in the North Korean energy market and engage in activities that may help modernize the North's energy sector and economy.

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[i] Kwang-jin Kim, Gulag, Inc, trans. Raymond Ha (USA: Committee for Human Rights in North Korea, 2016), 3.

[ii] "Korea, North," CIA World Factbook online, <https://www.cia.gov/library/publications/the-world-factbook/geos/kn.html>.

[iii] U.S. CIA, Office of East Asian Analysis, North Korea: Energy Scene (2011), <https://www.cia.gov/library/readingroom/docs/CIA-RDP88T00539R000500760002-1.pdf>.

[iv] David Von Hippel et al. "Energy Security for North Korea." Science Magazine 316, no. 5829 (2007): 1288-1289. doi: 10.1126/science.1142090.

[v] U.S. CIA, Office of East Asian Analysis, North Korea: Energy Scene.

[vi] Von Hippel et al. "Energy Security for North Korea."

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