An Analysis of Moon Jae-in’s Nuclear Phase-out Policy

The Past, Present, and Future of Nuclear Energy in South Korea

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Although South Korea adopted nuclear energy later than countries like the United States, Russia, or France, the country, until recently, has been considered to have one of the most successful civil nuclear power programs in the world, with a fully-developed supply chain, a remarkable record in constructing and operating nuclear power plants (NPPs), and the ability to compete and win contracts to supply NPPs abroad. The fortune of South Korea’s nuclear program has seemingly come to an end, however, with the election of Moon Jae-in. The new South Korean President promised to reduce the country’s dependence on nuclear energy, and has, since taking office, implemented measures to phase out this type of electricity generation.

In this paper, following a brief history of the development of nuclear energy in South Korea, the root causes that instilled public distrust of nuclear energy and Moon Jae-in’s phase-out policy are discussed. Subsequently, by analyzing the validity of Moon’s plan, I argue that this phase-out policy is not beneficial for the long-term sustainability of South Korea’s economy in general, and of the Korean nuclear industry in particular. The paper concludes with policy recommendations for a more balanced nuclear policy that can accommodate public opinion and, at the same time, ensure energy security and provide other economic and diplomatic benefits.

Nuclear Energy’s Successful Past

South Korea, bound by an isolated electricity grid and a lack of natural resources, has imported most of its primary energy sources since the 1960s.1 For this reason, South Korea was among the first participants in the “Atoms for Peace” initiative, which in 1962 provided the East Asian state with its first research reactor built by the United States (U.S.). In the same year, then-President Park Chung-hee initiated the Korean civil nuclear program and involved numerous organizations, from research institutes (the Korea Atomic Energy Research Institute—KAERI, which was established in 1959), to universities (starting with Hanyang and Seoul National Universities), to

1 The World Bank, World Development Indicators, (Washington, D.C.: The World Bank, 2015), Primary energy imports as a percentage of the Republic of Korea’s total energy consumption has increased from around 60 percent in the early 1970s to almost 90 percent since the early 2000s.
utility providers (the Korea Electric Company – KECO, later renamed to Korea Electric Power Corporation—KEPCO). The first major fruit of South Korea’s nuclear program was the Kori-1 power reactor, which was put into operation in 1978 and was followed by eight other units during the 1980s. Although the first two nuclear power units in South Korea were built using U.S. technology supplied by Westinghouse, the South Korean government actively tried to diversify its technology and material supplies by approaching vendors from Canada and France. By localizing U.S. designs and generating sufficient manpower for a self-dependent civil nuclear program, Seoul also intensified the effort to develop its own technologies. South Korea reaffirmed its commitment to nuclear technology in the 1990s, during which the country added seven other reactors in a period that is often considered the low point of nuclear power development worldwide.

Since the 2000s, the share of nuclear energy in South Korea’s electricity mix has dropped from almost 45 percent in 2000 to 26 percent in 2013, with four new reactors being put into operation in the 2000s, five in the 2010s, and three currently under construction. Such decrease in the country’s reliance on nuclear energy comes from several factors, including the more high-tech, high-value, and less energy-intensive orientation of the Korean economy, the rise of natural gas consumption, and the decline in public support for nuclear energy. Nevertheless, the indigenous nuclear industry of South Korea has achieved several important milestones, including the successful development of the advanced reactor technology APR1400 (Advanced Power Reactor with 1400 MW electricity capacity), export contracts to supply the first research reactor in Jordan, and most importantly, four APR1400 units for the United Arab Emirates. While the Jordan reactor was already commissioned in December 2016 after three years of construction, the Barakah project in the United Arab Emirates has been generally implemented on time and within budget. Given the recent struggles of more experienced suppliers including France and

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3 The increasing reliance of South Korea on natural gas for electricity production can be found in the World Development Indicators database of the World Bank. Regarding the instability of Korean public support for nuclear energy, surveys on public acceptance of nuclear energy in the late 1980s and early 1990s showed that 63 percent to 72 percent of respondents expressed support for this type of technology, whereas the percentage of interviewees opposing nuclear energy always remained below 30 percent. However, more recent surveys conducted by the Korea Nuclear Energy Agency (KNEA) from 2013 to 2015 indicate that such support has since dropped to around 30 percent. Ministry of Trade, Industry, and Energy and Korea Nuclear Energy Agency, 2012 Modularization of Korea’s Development Experience: Energy Policies. (Republic of Korea: Ministry of Strategy and Finance, 2013); Young Sung Choi et al, “Development of the Public Attitude Model Toward Nuclear Power in Korea,” Annal of Nuclear Energy 25, no. 12 (1998): 923-936; Korea Nuclear Energy Agency, 원자력 국민인식조사 결과 [Nuclear National Survey Result] (2016).
the U.S., such achievements are indeed commendable and would help South Korea strengthen its position in the nuclear export market.

Moon Jae-in and the Reversal of Fortune for Nuclear Energy in South Korea

As previously mentioned, public support for nuclear energy in South Korea has generally declined in recent years. There are several possible explanations for the downturn, including the rapid improvement in living standards and the democratization of the Korean society. More frequent occurrences of significant seismic activity could also have induced safety concerns regarding NPPs. Additionally, the issue of radioactive waste management is still unresolved: the nation is running out of space to store spent fuels, while the government has been unable to gain public support for a final disposal site. Furthermore, the image of nuclear energy, once considered a major factor that led to the rapid economic growth of South Korea—the so-called “Miracle on the Han River”—has been seriously tarnished by the recent exposés of safety-related scandals of the South Korean nuclear industry and, in particular, the Fukushima nuclear accident in March 2011.

Nuclear energy was actively promoted domestically and overseas by the conservative administrations of Presidents Lee Myung-bak (2008–2013) and Park Geun-hye (2013–2017). Recent scandals involving Lee and Park have further undermined the credibility of the nuclear industry in South Korea: Lee was investigated and arrested on corruption charges, while Park, the daughter of former South Korean president and nuclear industry godfather Park Chung-hee, was impeached in 2016. Therefore, it

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4 This observation was made based on the correlation between public acceptance of nuclear energy and other socio-economic factors, as well as the psychological impact of nuclear accidents. Viet Phuong Nguyen and Man-Sung Yim, “Examination of different socio-economic factors that contribute to the public acceptance of nuclear energy”, Nuclear Engineering and Technology (2018); Shirley S. Ho et al., “Science Literacy or Value Predisposition? A Meta-Analysis of Factors Predicting Public Perceptions of Benefits, Risks, and Acceptance of Nuclear Energy”, Environmental Communication, (2018); Edwin Latré et al., “Public opinion change after the Fukushima nuclear accident: The role of national context revisited”, Energy Policy 104 (2017).


6 There have been allegations that Lee Myung-bak made a controversial military agreement with the United Arab Emirates that required South Korea to deploy South Korea forces to support the country in case of conflicts. If they turn out to be true, the successful story of South Korea’s nuclear export to UAE will be severely tarnished. June Park and Ali Ahmad, "Risky Business: South Korea’s Secret Military Deal with UAE," The Diplomat, March 1, 2018. https://thediplomat.com/2018/03/risky-business-south-koreas-secret-military-deal-with-uae/.
came as no surprise that anti-nuclear energy policy featured prominently in the agendas of several liberal candidates during the 2017 presidential elections.

Among those candidates was Moon Jae-in, who had publicly expressed his affection for *Pandora*—a popular 2016 disaster film about a fictional nuclear accident in South Korea—as well as his intention to reverse the pro-nuclear policy of his two predecessors. He cited concerns over the possibility that a Fukushima-like accident could happen with Korean NPPs and cause unforeseeable damage to populations living near those plants. In the end, South Korean voters elected Moon to succeed Park Geun-hye.

In late June 2017, only one month after taking office, Moon Jae-in announced his nuclear phase-out policy outlining a range of measures such as 1) permanently shutting down the aging Kori-1 reactor; 2) temporarily stopping the construction of the Shin Kori-5 and Shin Kori-6 nuclear units; 3) organizing a “citizen jury” to decide the fate of these two projects; and 4) revising the national nuclear energy plan to cancel all future domestic nuclear projects. The construction of the two power reactors at the Shin Kori NPP was later resumed thanks to the voting result of the aforementioned “citizen jury,” who favored the restart of constructions already in progress but recommended lowering the future share of nuclear energy in the national power consumption mix. Nonetheless, Moon's administration has maintained the decision to cancel all six constructions of new nuclear power units, reject applications to extend the lifespans of old reactors, and ultimately reduce the current fleet of operating power reactors from 24 to 14 or fewer by 2038. Coupled with the nuclear phase-out policy, Moon Jae-in also decided to close down all old coal-fired power plants aged 30 years or more in order to address the air pollution issue that has plagued South Korea in recent years. To replace the bulk of electricity generated by nuclear energy and fossil fuels, Moon proposed an ambitious plan to accelerate the deployment of solar power stations and wind farms, as well as step up natural gas imports from suppliers like Qatar or Russia.

An Uncertain Future for the Korean Nuclear Industry

Given the high approval rating of Moon Jae-in in public polls, it is likely that Moon’s administration will continue to implement measures to curb the development of nuclear energy in South Korea. In addition, although Moon has faced opposition from the nuclear industry and other pro-nuclear groups, including communities that are worried about the economic impact of closing down their local NPPs, his transparent

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and largely democratic approach to the nuclear policy decision-making process will help him maintain support from environmental groups and gain new support from undecided voters.

Despite its being viewed positively by a growing part of the Korean public, Moon’s phase-out policy has several disadvantages that make it unsustainable in the long run. Firstly, as nuclear energy remains the cheapest type of electricity generation in South Korea, any drastic nuclear phase-out will induce a sharp increase in energy prices. This may negatively affect energy-intensive industries like steel production, which still play a major role in the South Korean economy. For example, one energy policy adviser to Moon Jae-in claimed that energy prices would rise by 25 percent by 2030 if the phase-out policy is fully implemented, noting that a mere 10 percent hike in prices would lead to a 30 percent decrease in profits.⁹

Aside from rising energy costs, South Korea should take into account the negative impacts of the nuclear phase-out policy in Taiwan, which shares similarly high levels of dependence on foreign supply of primary energy and difficulties in expanding renewable sources due to high population density and geographic limitations. Since the Taiwanese leader Chen Shui-bian declared his plan to drastically phase out nuclear energy during his presidency from 2000 to 2008, the island has experienced numerous problems like massive blackouts, vulnerability of foreign energy supply, and air pollution due to the increase in coal consumption as an alternative source of energy.¹⁰ In France—another major nuclear energy user—the newly-elected President Emmanuel Macron recently reneged on his campaign promise to close numerous NPPs after he realized the difficulty of maintaining both environmental conservation practices and a nuclear phase-out policy, especially without a viable, environmentally-friendly alternative to nuclear energy. Macron explained, “I don’t idolize nuclear energy at all. But I think you have to pick your battle. My priority in France, Europe, and internationally is carbon dioxide emissions and [global] warming.”¹¹

Secondly, numerous studies have shown that if South Korea wants to sustain its energy security while reducing greenhouse gas emissions, it is not feasible to fully depend on natural gas and renewable sources—absent nuclear energy sources—for electricity

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¹⁰ Here it should be noted that coal-fired power plants are also targets of Moon’s phase-out policy. However, so far his administration has only announced concrete plans to close down eight old coal-fired plants with low impacts on the electricity market, as the new coal capacity under construction in 2017 alone (around 5 GW) has already doubled the generation capacity of these plants. Michael Cooper, “Fate of South Korea’s new coal plants rests with its new president,” S&P Global Platts, May 31, 2017.

generation due to the country’s geographical, demographic, and economic limitations. In addition, expanding the portfolio of natural gas suppliers has proven to be a complicated task for South Korea, as the country faces strong competition from other major importers like China and Japan. Increasing natural gas imports from Russia does not appear to be a desirable strategy at the moment, given the heightened political tension between this major gas exporter and the U.S.—South Korea’s closest ally—and the fact that Russia has a record of using energy export disruption as a tool for political leverage in bilateral disputes.

Finally, Moon’s phase-out policy would likely make the competitive edge of South Korea’s nuclear industry disappear—a lesson that the U.S. nuclear industry has already learned the hard way. Lack of domestic demand disrupted the nuclear supply chain, and undermined the financial capabilities of U.S. companies, which are much needed for their competition with vendors from Russia, China, and South Korea over contracts in newcomer countries like Saudi Arabia.

Furthermore, despite the successful Barakah project in the United Arab Emirates, winning the bidding war to build the first NPP in Saudi Arabia and securing the Moorside nuclear power project in the United Kingdom remain big challenges for Moon Jae-in. This is due to the fact that the credibility of the South Korean nuclear industry, in terms of safety, was questioned by Moon himself when he announced the phase-out policy in 2017. Given the role of South Korea in helping the United Arab Emirates commit to nuclear nonproliferation—which includes the renouncement of the right to develop sensitive nuclear technologies like enrichment and reprocessing—losing the Saudi contract to other suppliers will be a missed opportunity for South Korea to help protect the security of the Middle East and promote nonproliferation.

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15 It was ironic that while questioning the safety of the domestic NPPs, Moon’s administration also suggested that South Korea should consider developing nuclear-powered submarines, linked to many more recorded accidents. Jun-suk Yeo, “Talk of tactical nuclear weapons resurfaces,” The Korea Herald, August 31, 2017; Lami Kim, “South Korea’s Nuclear Hedging?,” The Washington Quarterly 41, no.1 (2018): 115-133. For the United Arab Emirate’s nuclear transparency, see: Viet Phuong Nguyen and Man-Sung Yim, “Building trust in nonproliferation: transparency in nuclear-power development,” The Nonproliferation Review 24, no. 5-6 (2017); For information on the South Korea’s efforts to secure the Moorside project, see: Jillian Ambrose, “Koreans save Cumbria’s Moorside nuclear plant,” The Telegraph, December 2, 2017; Eun-jung Kim, “S.Korea stepping up efforts to build nuclear reactors in Britain,” Yonhap News, November 28, 2017.
Conclusions and Policy Recommendations

It was a stroke of unexpected luck for the Korean nuclear industry that the 5.4-magnitude Pohang earthquake—the second-strongest earthquake in South Korea’s modern history—struck North Gyeongsang Province (the site of the Wolsong NPP), a few weeks after the “citizen jury’s” decision to restart the construction of the Shin Kori-5 and 6 reactors had been made. Had the 2017 earthquake occurred before the vote, its visible destruction of the city of Pohang and nearby areas would have affected the decisions of the jury members and the fate of the Shin Kori constructions. This is just another example of the uncertain future of nuclear energy in South Korea, when taking into account its declining public support and Moon Jae-in’s determination to minimize the use of nuclear power in this country.

At the same time, however, Moon should also be mindful of the potential backlash from the public against him and his Democratic Party that could erupt once the disadvantages of the phase-out policy—including increasing electricity costs and weakening energy security—become clear. Therefore, it would be beneficial for Moon’s administration, and for South Korea’s economy, if the current phase-out policy is revised into a long-term strategy that focuses on a greener and more sustainable electricity mix, while maintaining the competitive edge of the Korean nuclear industry through domestic and foreign contracts. Since South Korea has been searching for a roadmap to grow into a regional and global middle power, Moon Jae-in and his successors should consider retaining advanced, proliferation-resistant nuclear technologies as a way to assist nuclear newcomers in complying with the nonproliferation regime. A country with robust energy security supported by a balanced mix of renewables, fossil fuels, and nuclear energy, competitiveness in the nuclear export market, and ability to effectively support the nonproliferation regime would definitely be a legacy that Moon Jae-in would want to leave behind in 2022, after finishing his single five-year term as the President of South Korea.16

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16 Moon should also consider the risk that his nuclear phase-out policy will be reversed by his successors, especially those from conservative parties that have always maintained their support for nuclear energy, given the long-term unsustainability of this policy.