

## Policy Perspectives

## Unique Nuclear Allies: The New U.S.-South Korea Nuclear Cooperation Agreement

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Figure 1: Korean reactor under construction. Photo by Sharon Squassoni

After years of intense negotiations, including a two-year extension, the United States and the Republic of Korea finalized their framework agreement for nuclear cooperation in early summer 2015. The agreement, which was formally submitted to the U.S. Congress on June 16, 2015, will enter into force by December 2015 unless Congress passes a resolution of disapproval or conditions its approval. With so many other issues to distract Congress this fall, the chances are excellent that the agreement will quietly enter into force. But its implementation will bear close watching over the next few years. The significant pains that U.S. negotiators took to confer special status

upon South Korea may have unintended consequences for U.S. nonproliferation policy. The inclusion of “pathways toward a possible U.S. government decision to grant advance consent to the ROK to enrich or pyroprocess U.S.-obligated nuclear material” ensures that the negotiations haven’t ended – in fact, they’ve just begun.

### **Nuclear cooperation then and now**

The ROK, like many other countries, began cooperating with the United States on nuclear research in the mid-1950s under the Atoms for Peace initiative. Two decades later, South Korea developed a major nuclear energy program, moving quickly from complete reliance on foreign reactors, components and fuel supply to developing its own supply chain and reactor designs. KEPCO's securing the UAE contract for four nuclear power reactors in 2009 was a huge step forward in Korea's plans to become an international vendor itself. The power reactors it is currently exporting still have some U.S. components and intellectual property, but South Korea could be exporting completely indigenous reactors in the coming years.

The current U.S.-ROK agreement was signed in 1974, before passage of the 1978 Nuclear Nonproliferation Act (NNPA). It was fairly restrictive and reflected the U.S.-ROK nuclear relationship at that time: South Korea did not yet have operational nuclear power plants, but what it did have was sourced almost entirely from the United States. The United States even promised to supply all of Korea's low-enriched uranium for its reactors. Not only does a new agreement need to reflect South Korea's advanced nuclear status but it also needs to conform to the nonproliferation criteria enacted by the NNPA. The most significant of these criteria address the rights that the United States maintains over the material, equipment, and technology that it will share with South Korea to ensure their security. These are called "consent rights."

strenuously for greater autonomy and greater access to technology. Specifically, South Korea wanted the renewal agreement to provide what Japan got in 1988: advance consent to enrich and/or reprocess U.S.-origin material.

The United States, as a matter of policy, does not transfer enrichment and reprocessing facilities or equipment because these are sensitive parts of the nuclear fuel cycle (i.e., they can be used to produce fissile material for nuclear weapons). The United States sometimes makes exceptions for sharing technology in the public domain, if a country already has the capabilities (for example, Japan), but South Korea does not have those capabilities. Instead, South Korea sought the U.S. "stamp of approval" for a cooperating country to do its own enrichment or reprocessing with US-origin material. This is commonly called "advance consent."

This issue of advance consent was so important to the Koreans that it threatened to derail negotiations, causing the parties to ask for a 2-year extension in 2014. It is a provision that the United States has included in just a handful of nuclear cooperation agreements, reserved for countries that already have enrichment and reprocessing technology (e.g., EURATOM countries, Japan, China, India and enrichment

### **Major Negotiating Hurdles**

The biggest issue for negotiators of this agreement was how to update South Korea's status: with 24 nuclear power plants operating, four under construction, and a burgeoning nuclear export business, South Korea argued

for Russia). In a hearing before the Senate Foreign Relations Committee on October 1, 2015, Assistant Secretary of State Tom Countryman called this “recognition” of countries’ enrichment and reprocessing capabilities. The ROK Nonproliferation Assessment Statement (NPAS) specifically states that advance consents incorporated into Section 123 agreements (so-called after Section 123 of the Atomic Energy Act) “have long been understood to be consistent with the Atomic Energy Act” and then says “no provision of the Act precludes the United States from giving such approvals in advance.”

Advance consent is, in effect, a short-cut for meeting the Atomic Energy Act’s requirement for prior consent for certain activities like storage, transfer, retransfer, enrichment and reprocessing. The consent was designed to ensure that U.S. cooperation was not misused for military purposes.<sup>1</sup> The short-cut was devised in the 1980s to respond to allies’ concerns that nuclear commerce would be unduly hampered. By writing the prior consent into the framework agreement, it never has to be given again. It is therefore reserved for “trusted” partners.

It may seem odd for South Korea to ask U.S. permission to conduct activities for which it currently has no capacity. It may also seem odd for South Korea to ask for a U.S. blessing on activities it specifically agreed not to conduct under the 1992 Joint Declaration on the Denuclearization of the Korean Peninsula it

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<sup>1</sup>The 1978 Nuclear Nonproliferation Act (NNPA), which amended the Atomic Energy Act, required prior consent. A few short years after India misappropriated a Canadian research reactor and U.S. heavy water to produce the plutonium for its first bomb, lawmakers were

### **South Korea’s Unique Nuclear Energy Challenges**

South Korea’s 48 million people are thirsty for energy: in 2011, the ROK was the world’s 9th largest energy consumer. And yet, it depends on foreign sources of energy for 97% of its demand. Even though it has no uranium, nuclear energy is attractive because foreign nuclear fuel is not as vulnerable to supply disruption as foreign coal, oil or natural gas. The ROK relies on nuclear energy for about 22% of its electricity production (for comparison, the US is about 20%) and the government plans to increase this to 29% by 2035 (down from projected 40% in earlier plans).

Like many other states, South Korea has put off the day of reckoning for nuclear waste. Consequently, reactor pools are reaching capacity for spent nuclear fuel. South Korea would like to pyroprocess that fuel (a technique that recycles Pu fuel for fast reactors). The technical feasibility, economics, and proliferation-resistance of this process and other spent fuel management options are the subject of a 10-yr Joint Fuel Cycle Study by the ROK and US begun in 2011. The results of that study may chart the way forward.

signed with North Korea. The ROK may be hesitant to officially abandon the 1992 Joint Declaration, but certainly future U.S. consent for such activities could be a useful camouflage. In the past, South Korea’s adherence to the 1992 Joint Declaration strengthened its nonproliferation credibility and helped enhance regional stability and security, but North Korea’s blatant abrogation of this agreement (through

understandably sensitive to this risk. See Sharon Squassoni, “Looking Back: The 1978 NNPA,” *Arms Control Today*, December 2008, [http://legacy.armscontrol.org/act/2008\\_12/lookingback\\_NPT](http://legacy.armscontrol.org/act/2008_12/lookingback_NPT)

reprocessing, enrichment and nuclear weapons tests) make this a less compelling argument.

South Korean motives for indigenous enrichment and reprocessing are complex. Assured supply of enriched uranium, both for Korean reactors and Korean customers, is one motive. Extending South Korean expertise further along the nuclear fuel cycle is another. South Korean officials at times have claimed that they would be able to enrich uranium at more competitive prices than even URENCO, the world's second largest enricher with 31% of the world's enrichment market (Russia's Tenex is first).<sup>2</sup> Prestige is also clearly a factor for South Korea. Officially, Korean negotiators reportedly have not used the argument that they must have the same capabilities as Japan. Often, however, Korean officials have stressed what a good ally Korea has been, implying that this is grounds for preferential treatment (similar to Japan).

With respect to reprocessing, motivations are also complex. South Korea desires to recycle fuel for its fast reactor program (in the R&D stage) and has undertaken research into pyroprocessing, a form of reprocessing that does not separate fission products from plutonium. South Korean officials also view pyroprocessing as useful to help address limited capacity for storing spent nuclear fuel. In Korea, decisions to site even low level nuclear waste have been costly and politically divisive. In the eyes of technical officials, pyroprocessing would skirt those difficult negotiations by providing an alternative. In reality, pyroprocessing is not an alternative to siting nuclear waste (which is

inevitable) and it would create other kinds of waste streams. What's more, the full realization of pyroprocessing's benefits depends on commercialization of fast reactors, which is several decades from now. In short, pyroprocessing provides no relief from short-term storage limits for spent nuclear fuel.

### **The Compromise**

The United States did not give South Korea the agreement it wanted, but it did provide limited advance consent (on storage, transfer and return) and a promise to talk about more far-reaching advance consent in the future. The agreement walks back an earlier redline – that of keeping “hot processing,” or work on irradiated fuel, solely in the United States. And, to further the joint study, the United States agreed to transfer sensitive nuclear technology to Korea in 2013.

In many respects, the resulting agreement is quite creative, but with creativity comes risks. The biggest risk is that the outlining of pathways for a future decision has already tipped the scales towards a positive decision. At the Senate Foreign Relations Committee hearing on the U.S.-ROK agreement on October 1, 2015, senators used a variety of metaphors to describe the pathways approach: a green light, an open door, a wink and a nod, a bread trail and the camel's nose under the tent. These metaphors probably do not do justice to the cooperative effort that has been underway for many years, dating far back before the Joint Fuel Cycle Study began in 2011.<sup>3</sup> The United States and South

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<sup>2</sup> Upon request, however, South Korean officials have never shared the actual data produced by Korean industry.

<sup>3</sup> In the 1990s, U.S. national laboratories collaborated with South Korean and Canadian scientists on recycling

spent light water reactor fuel to use in CANDU reactors. This DUPIC process eventually led to pyroprocessing. The Bush Administration endorsed pyroprocessing R&D with the ROK in 2002 but stopped short of allowing work on irradiated material. See Mark Holt, “U.S. and South

Korea have acted more like chefs planning a banquet together: after preparing and tasting the food, the decision to disinvite one chef from the meal will be difficult indeed.

Several elements of the agreement, described below, give a flavor of just how unique the ROK is as a nuclear ally.

**1. Joint Fuel Cycle Study<sup>4</sup>** – Originally devised to buy time (10 years) and to allow for a balanced review of spent nuclear fuel (SNF) management options, the Joint Fuel Cycle Study became the impetus for transferring sensitive nuclear technology to the ROK (initially to ROK nationals working at Idaho National Laboratory under a 2013 sensitive nuclear technologies agreement). Rather than keeping radioactive processing in the US (a decision made initially by the Bush administration), facilities are now listed in the Annexes that can process irradiated material. In other words, South Korea received advance consent in this agreement to conduct post-irradiation experiments, separate radioisotopes from spent fuel and do limited pyroprocessing (called material consolidation and treatment). Only if Korea opens new facilities for this work will the U.S. government request approval from Congress again.

The Joint Fuel Cycle Study will report its findings on pyroprocessing and other spent fuel management options to the High-Level Bilateral Commission. The Nonproliferation Assessment

Statement, which accompanied the agreement when it was submitted to Congress, describes the first two working groups (on Electrochemical Recycling and Safeguards/Security) in detail, while the Fuel Cycle Alternatives Working Group is merely “evaluating other fuel cycle alternatives related to used fuel storage, transportation, and disposition in comparison with one another and with electrochemical recycling.”

**2. High Level Bilateral Commission (HLBC):** The Commission will be led by the U.S. Deputy Secretary of Energy and the ROK Vice Minister of Foreign Affairs. This would replace previous commissions, which the State Department has traditionally led.<sup>5</sup> It’s not clear why the State Department decided to cede leadership on this and raises the question of what this implies for negotiating new 123 agreements, especially since according to the NPAS, the current standing committee with the ROK is “the model upon which the US proposes such committees to other countries”<sup>6</sup>. In addition, the authorities of the Commission seem to be quite broad. With respect to enrichment, it appears in the Agreed Minute that if the Commission identifies a mutually acceptable option for uranium enrichment, Parties could establish written arrangements and proceed as long safeguards on facilities are in place.

**3. Pathways:** U.S. officials describe the agreement as containing “pathways toward a

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Korean Cooperation in the World Nuclear Energy Market: Major Policy Considerations,” CRS Report, June 25, 2013, p. 11 for a description of U.S. nuclear cooperation in this area. Available at [www.fas.org/sgp/crs/row/R41032.pdf](http://www.fas.org/sgp/crs/row/R41032.pdf)

<sup>4</sup> The objective of the study was to explore the technical feasibility, economic feasibility and nonproliferation acceptability of spent nuclear fuel management options. Phase I (2011-2013) evaluated the laboratory scale feasibility of ER, presumably done at Idaho National

Laboratory. Phase II (2013-2018) evaluates kilogram-scale integrated process operation and fuel fabrication and Phase III (2018-2021) will validate recycle fuel fabrication, irradiation and post-irradiation experiments.)

<sup>5</sup> These were originally the Joint Standing Committee on Nuclear and Other Energy Technologies and the Joint Standing Committee on Nuclear Energy Cooperation – JSCNOET and JSCNEC.

<sup>6</sup> Nonproliferation Assessment Statement (NPAS), page 3.

possible U.S. government decision to grant advance consent to the ROK to enrich or pyroprocess U.S.-obligated nuclear material. “

For both enrichment and pyroprocessing, the parties would need to take into account the technical feasibility of the technology, the economic viability of the technology and the nonproliferation acceptability of the technology, including its safeguardability and whether it significantly increases the risk of proliferation.

The Joint Fuel Cycle study, which ends in 2021, is likely to conclude that pyroprocessing is technically feasible. After all, U.S. scientists pioneered the technique decades ago under the Integral Fast Reactor program and U.S. pyroprocessing has been used to condition the fuel taken from the Three Mile Island reactor accident. The Korean technology likely contains some modifications. On the nonproliferation acceptability of the technologies in the JFCS, the Agreed Minute attempts to narrow the considerations to the ability to apply safeguards to the technology, the ability to ensure timely warning of diversion and the ability of the technologies to deter or impede nuclear proliferation. There is no mention of the impact more broadly on the nonproliferation regime of the spread of reprocessing technology.

Finally, on the economic feasibility of pyroprocessing, it is difficult to see how the parties could agree on more than the fact that they will disagree. First, the economics of commercial reprocessing is hotly contested even though several countries have reprocessed for decades. Second, the economics of pyroprocessing will be dependent on the economics of the fast reactor fuel cycle in South

Korea, which exists only on paper. Third, although the United States and others have attempted to argue against the spread of enrichment and reprocessing on the basis of economics, economics rarely wins over sovereignty and prestige when it comes to nuclear energy. It will be difficult for the United States to dispute South Korean claims on economic viability without real data from actual operations because there will be no commercial facility built and operating by the time a decision is reached. In addition, South Korea has insisted on “taking into account the social and environmental costs and benefits of the option in the context of the relevant Party’s laws, regulations and policies.”<sup>7</sup> As long as South Korea views pyroprocessing as an alternative to siting nuclear waste, the political and social costs of storage and disposal will counterbalance the costs of pyroprocessing.

With respect to enrichment, it is hard to see how the parties could not agree on the technical feasibility, safeguardability and economic feasibility of enrichment, assuming South Korea opts to purchase enrichment equipment rather than develop it indigenously. South Korea nominally meets the Nuclear Suppliers Group criteria for enrichment transfers and if it succeeds in securing such, there is no reason why it wouldn’t meet the Commission criteria. Uncertainties would enter into the equation if South Korea chooses to develop technology on its own. There is the additional question of why the pathway to advance consent specifies that South Korea can enrich up to just below 20%,

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<sup>7</sup> Text of the Proposed Agreement for Cooperation Between the Government of the U.S. and the

Government of the Republic of Korea Concerning Peaceful Uses of Nuclear Energy, p. 35.

**4. Advance consent for storage and transferring to 3<sup>rd</sup> countries for reprocessing:** This provision is not unique to the U.S.-South Korean agreement, but a relatively recent innovation included in agreements the United States recently concluded with the UAE and Taiwan. It is perhaps most justifiable in the Taiwan and ROK cases, where spent fuel is reaching storage capacity limits. In general, however, it undermines the U.S. position that reprocessing is not needed for a civil nuclear energy program and U.S. policy preferences for long-term interim storage and disposal.

**5. Return of material after reprocessing:** The ROK agreement contains what the Nonproliferation Assessment Statement (NPAS) calls “similar to advance consent to retransfer.” The important feature is that it allows the ROK to receive back nuclear material recovered from reprocessing, provided that the parties agree in writing on the form of the material to be returned and physical protection requirements. This will require a Section 131 subsequent arrangement (for review by Congress).

The agreement’s advance consents for storage, transfer and retransfer of nuclear material back to the ROK can be interpreted as incentives for South Korea to send its fuel out for reprocessing as an alternative to pyroprocessing. But the inclusion of pathways for a possible U.S. government decision for advance consent for enrichment and reprocessing may cancel out those incentives. The High Level Bilateral Commission will ensure there is enough political pressure to continue making this a strategic issue.

### **Implications for U.S. Nonproliferation Policy**

In the last decade, a few high-profile nuclear cooperation agreements have prompted a

debate about whether the United States should take a principled approach on nuclear cooperation or tailor each agreement to the particular country. The 2008 agreement with India, a country that has never joined the Nuclear Nonproliferation Treaty (NPT), sparked the most controversy because the George W. Bush administration argued to make an exception to U.S. law and also NSG guidelines for cooperation with a non-NPT state. The 2008 agreement with the United Arab Emirates, which included a commitment by the UAE not to enrich uranium or reprocess spent fuel, was briefly described by U.S. officials as the “gold standard” for cooperation agreements (at least in the Middle East). After months of debate, the Obama administration reverted to the long-standing case-by-case approach. With respect to the ROK, U.S. officials seem to have mistaken flexibility for strength. In this case, the tailored approach risks undermining U.S. nonproliferation policy for short-term bilateral gains.

## South Korea's Unique Nuclear Weapons Challenges

For South Korea, nuclear weapons are an important part of assuring its national security. From 1958 to 1991, the United States deployed nuclear weapons in South Korea (believed to have been as many as 950 warheads). President George H.W. Bush withdrew these as part of his initiative to remove all overseas tactical nuclear weapons (excepting some NATO countries) and to help facilitate the 1992 Joint Declaration on the Denuclearization of the Korean Peninsula in which the two Koreas agreed not to test, produce, manufacture, possess, receive, store, deploy or use nuclear weapons. Since then, South Korea has relied on long-range U.S. systems (ballistic missile nuclear submarines) to extend U.S. nuclear deterrence. North Korea's development of nuclear weapons, including tests in 2006, 2009 and 2013, has greatly complicated the deterrence calculation.

In spite of the presence of U.S. nuclear weapons and troops in South Korea, Park Chung-hee's authoritarian government is widely believed to have conducted a nuclear weapons program until his death in 1979, which some speculate was spurred by a reduction in aid and troops as a result of the Nixon doctrine. U.S. troop levels, which were at 66,000 in 1969, dropped to 41,000 by 1971 and foreign assistance dropped about \$200M annually in the first half of the 1960s to half that amount by 1971.<sup>8</sup> South Korea had signed the Nuclear Nonproliferation Treaty in 1970, but did not formally accede until 1975. Its plans to purchase a reprocessing plant from France and heavy water production technology succumbed to intense U.S. pressure.<sup>9</sup> President Park declared his

intention to pursue peaceful nuclear energy, but reports suggest the program continued a few years more amid the sustained threat of U.S. troop withdrawals. With Park's death and President Reagan's cancellation of troop reductions, nuclear weapons plans were shelved.

In the bureaucracy, shadows of that past existed as recently as 2000. As South Korea completed its paperwork for bringing the International Atomic Energy Agency's (IAEA) Additional Protocol to its safeguards agreement into force, officials discovered unreported activities in laser enrichment of uranium and separation of plutonium. These are referred to in the Nonproliferation Assessment Statement that accompanied the agreement as it was submitted to Congress as "safeguards reporting failures," and it was not treated by the IAEA in 2004 when it came to light as rising to the level of safeguards noncompliance.

In the public, nuclear weapons are also not a dead issue. Occasionally, prominent South Korean newspapers publish editorials advocating nuclear weapons acquisition.<sup>10</sup> Public opinion polls in the last ten years show a majority supporting a Korean nuclear deterrent: from 2004, the numbers of South Koreans supporting an indigenous nuclear weapons capability have climbed from 49% to a high of 73% in 2013.<sup>11</sup> This is not surprising, since North Korea openly tested nuclear weapons for the first time in 2006, then again in 2009 and 2013.

<sup>8</sup> For U.S. troop levels, see "Global U.S. Troop Deployment, 1950-2003," by Tim Kane, available at <http://www.heritage.org/research/reports/2004/10/global-us-troop-deployment-1950-2003>

<sup>9</sup> See Daniel Pinkston, "South Korea's Nuclear Experiments," November 9, 2004, available at <http://cns.miis.edu/stories/041109.htm>

<sup>10</sup> See, for example, the Asan Institute for Policy Studies November 2010 public opinion poll entitled, "The Asan Institute Opinion Poll in the Wake of the Attack on the Yeonpyeong Island," by Dr. Kim Ji Yoon and Dr. Woo Jung Yeop, available

at [www.asaninst.org/upload\\_eng/board\\_files/file1\\_265.docx](http://www.asaninst.org/upload_eng/board_files/file1_265.docx). See also columns by Kim Dae-joong in The Chosun Ilbo, available at [http://news.chosun.com/site/data/html\\_dir/2011/02/07/2011020701994.html](http://news.chosun.com/site/data/html_dir/2011/02/07/2011020701994.html).

<sup>11</sup> Han-wool Jeong, "KOREAN VIEWS 2014. Changes in South Korea's Status and. Dilemmas of Foreign Perceptions." EAI Opinion Review. Center for Public Opinion Research. East Asia Institute. April 2015.

In an ideal world, the case-by-case policy approach rejects the notion that some agreements can be precedents for others. Countries invariably see precedents where there may be none (and U.S. negotiators never start from a blank slate). Two such examples are the provision of advance consent to enrich and reprocess for India, a state that has not signed the NPT, and the acquiescence to Iranian enrichment under the Joint Comprehensive Plan of Action. On the former, U.S. officials could argue their last line of defense – that advance consent is given only to countries already with a capability. Yet even this may be eroded if the U.S. grants advance consent to enrich to Korea before it has a fully operational plant. In this light, the decision by the United States to share sensitive nuclear technology on pyroprocessing with South Korea is doubly questionable.

On enrichment, there is every incentive for South Korea to begin lobbying NSG members now for enrichment facilities and/or technology. Under the current NSG guidelines, South Korea could partner with another NSG member to develop new technology (e.g., laser enrichment). A demonstration by the U.S. SILEX plant of the commercial viability of laser enrichment could particularly spur such a development. Coupled with the example of Iran enriching uranium to no apparent purpose, it could become increasingly difficult for the United States to insist on any restrictions on enrichment in new agreements with partners.

An additional question down the road is whether a potential U.S. decision to grant advance consent to pyroprocess is seen as demonstrably different from consent to reprocess. According to the NPAS, the United States treats pyroprocessing equipment and

technology as “especially designed or prepared for reprocessing or irradiated fuel elements and, therefore, that such equipment and related technology are subject to NSG Part I Guidelines.” U.S. officials have stated on several occasions that they consider pyroprocessing to be reprocessing.

In 1970s, surges of enthusiasm for reprocessing succumbed to economic realities as nuclear energy declined. More recently, enthusiasm for enrichment has waned a little as the uranium market has slumped. In the long run, however, continued reliance on market fluctuations and the poor economics of fuel cycle facilities is a risky substitute for strong nonproliferation leadership. The United States needs to develop a consistent and principled approach that is as strong as it is flexible.