



THE NEW PEACEFUL NUCLEAR COOPERATION AGREEMENT BETWEEN SOUTH KOREA AND THE UNITED STATES

From Dependence to Parity

Fred McGoldrick



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September 2015

An assessment by
Fred McGoldrick

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The Korea Economic Institute (KEI) is pleased to issue this volume on U.S.-Korean civil nuclear cooperation as part of our “Special Studies” series. The series is intended to offer a more in-depth exploration of important issues in U.S.-Korea relations than can be accommodated by the formats of our other publications. Some issues simply require more detail than others to be adequately appreciated. Understanding the new agreement between the governments of the United States and the Republic of Korea on peaceful nuclear cooperation clearly falls into that category. The author of this volume, Fred McGoldrick, has written about the new agreement in a way that will inform readers who only have a passing acquaintance with the issues involved but want to understand them better, and also those who are expert in the field and seek a more detailed understanding of the agreement.

Replacing the existing 1974 U.S.-Korean bilateral agreement on nuclear cooperation took years of negotiation to balance the interests and requirements of the two countries in promoting the development of nuclear energy, avoiding the dangers of proliferation, ensuring safety, and taking into account the interests of third countries in regard, among other issues, to their own potential nuclear cooperation agreements. The 1974 bilateral agreement was set to expire in 2016. Time may have helped the negotiators to conclude the agreement, but their success is largely due to the mutual trust and respect that have developed between the United States and the Republic of Korea over the years. As Mr. McGoldrick points out, the new agreement establishes an unprecedented level of cooperation between two governments in the field of civil nuclear energy.

KEI seeks to provide objective, informative analysis to both policy makers and the general public. We would welcome comments on this and our other publications. We would also be pleased to receive suggestions for other “Special Studies” that would further our mission of increasing mutual understanding between the United States and the Republic of Korea. We also welcome your comments on this and our other publications, all of which may be downloaded from our website, www.keia.org.



The Honorable Donald Manzullo
President and CEO

Korea Economic Institute of America
September 2015

INTRODUCTION AND BACKGROUND

On June 16, 2015, President Obama submitted the text of a new peaceful nuclear cooperation agreement between the Republic of Korea and the United States of America to the U.S. Congress for its review. In accordance with the requirements the Atomic Energy Act, the agreement must lie before Congress for 90 days of continuous session before it may enter into effect.

The new agreement will be an important component of the relationship between the two countries. It could play a pivotal role in preserving and boosting U.S.-South Korean civil nuclear collaboration both bilaterally and in third countries, strengthening the strategic ties between the two countries, establishing model nonproliferation, nuclear security and nuclear safety standards, and helping to realize the potential of nuclear power to reduce carbon emissions and combat global warming.

The negotiation of this agreement proved challenging as the two sides had to devise a mutually acceptable outcome that would reflect:

- the national interests of the ROK in managing its used nuclear fuel safely, obtaining a reliable supply of nuclear fuel, and promoting the competitiveness of its nuclear exports in the global nuclear market; and,
- the global concerns of the United States to prevent the spread of sensitive nuclear technology, particularly in light of the North Korean nuclear threat.

This report will address the following:

- the need for a new U.S.-ROK peaceful nuclear cooperation agreement given the limitations and obsolete nature of the existing agreement;
- the main issues that had to be resolved by the negotiators;
- the nonproliferation provisions of the proposed new U.S.-ROK agreement and how they meet the requirements of U.S. and South nuclear export laws and policies and international nuclear export guidelines;
- the prospects for enhanced U.S.-ROK nuclear cooperation under the new agreement; and,
- the overall strategic and political importance of the new agreement.

Chapter II examines the existing ROK-U.S. peaceful nuclear cooperation agreement with the purpose of identifying its limited scope and outmoded nature and the need for its updating and modernization.

Chapter III explores the differences in the views the two countries brought to the negotiating table that stemmed from their different status and interests and distinctive, albeit similar, perspectives on nonproliferation and nuclear power.

Chapter IV examines the provisions of the new agreement that reflect the mature and advanced nuclear status and capabilities of South Korea and the equality of the relationship between the two countries. It describes in detail the range of nuclear nonproliferation assurances and guarantees in the new agreement that govern their civil nuclear cooperation, comply with each other's nonproliferation laws and policies and reflect the modern international nonproliferation regime. It emphasizes the reciprocal nature of nonproliferation assurances and guarantees contained in the new agreement.

Chapter V discusses the two most challenging issues the two countries faced in negotiating the agreement, namely:

- South Korea's need to manage its used nuclear fuel, secure a stable supply of nuclear fuel for its civil nuclear program, and promote the competitiveness of South Korean nuclear exports in the global market; and,
- U.S. interest in preventing the spread of enrichment and reprocessing technology in general and ensuring in particular that the new agreement does not compromise efforts to address the North Korea nuclear threat.

It also examines the unique high-level institution that the new agreement establishes to address these issues.

Chapter VI assesses the prospects for U.S.-ROK nuclear cooperation under the new agreement, including trade between the two countries, collaboration in third countries and joint nuclear research and development.

Chapter VII evaluates the overall strategic and political importance of the new agreement.

Chapter VIII summarizes the state of the new agreement, puts it into context, and discusses its implementation.

THE EXISTING AGREEMENT

The current U.S.-South Korean cooperation agreement came into force in 1974 and was extended in its original form for two years in 2014. It will expire on March 19, 2016.

A peaceful nuclear cooperation has two fundamental purposes: to enable and facilitate cooperation in the civil uses of nuclear energy and to ensure that such cooperation is restricted to exclusively peaceful, non-explosive uses, i.e., that it is subject to effective assurances and guarantees to prevent the proliferation of nuclear weapons. The present agreement comes up short in meeting these two fundamental purposes.

THE EXISTING AGREEMENT AND NUCLEAR COOPERATION

The existing agreement contains provisions for nuclear trade and cooperation that are out-of-date, obsolete and non-operational. For example, the agreement makes reference to the supply by the “Commission” as the supplier of nuclear materials—a reference to the U.S. Atomic Energy Commission—a U.S. government agency long since disbanded. Moreover, the enrichment capabilities of the United States are now in the hands of private industry. The existing agreement notes that the supply of equipment and devices are subject to limitations which may arise from shortages of supplies or other circumstances existing at the time, and the supply of fuel is subject to limitations on quantity—considerations that no longer apply. The agreement also references the leasing of special nuclear material, a practice long since abandoned by the United States.

Although the text of the present agreement makes general reference to cooperation and exchanges of information, materials, devices and equipment between the parties, the agreement is clearly a one-sided arrangement that reflects a supplier-consumer relationship wherein the United States is the provider of nuclear materials, equipment and technology and the ROK is the recipient. The existing agreement reflected the fact that in 1974 South Korea’s nuclear industry depended heavily on imports of nuclear materials, equipment, and technology from the United States. South Korea’s first nuclear power reactor—Kori 1—was built by Westinghouse on a turnkey contract. It started up in 1977 and achieved commercial operation in 1978.

Since the 1974 agreement, South Korea’s nuclear program and the U.S.-ROK nuclear relationship have undergone major changes.

The South Korean domestic nuclear power program has grown from its very modest beginnings to become one of the world’s leading producers of nuclear energy today. Today, 24 reactors totaling 21.6 GWe provide about one-third of South Korea’s electricity. South Korea announced in January 2014 that 29% of its electricity needs will come from nuclear. This would require 43 GWe of installed capacity by 2035, requiring the construction of 7 GWe beyond the 8.6 GWe already planned (World Nuclear Association).

Bilateral nuclear cooperation between the U.S. and the ROK has also undergone significant changes. A relationship that was once primarily one of U.S. supply to South Korea now involves extensive two-way trade between the two countries. Not only does the U.S. export nuclear materials, parts, and technology to South Korea, but South Korea also supplies nuclear equipment to support nuclear projects in the United States. South Korean firms are significant suppliers to the eight Westinghouse AP1000 reactors under construction in the United States. For example, South Korea delivered a steam generator to Georgia Power’s Vogtle reactor site in June 2015 (Georgia Power). The two Westinghouse AP1000 reactors currently under construction in South Carolina will use reactor vessels and steam generators from Changwon, condensers from Sacheon, demineralizers and heat exchangers from Ansan, and valves from Cheonan. Since 2006–2007, South Korean content in U.S. nuclear plants has become greater than U.S. content in South Korean plants. In addition, the ROK and the U.S. participate in bilateral and international R&D projects (Lipman).

South Korea has become an important exporter to the international market. The ROK's December 2009 win of the \$20.4 billion bid to build four APR1400 reactors in the UAE by Korean Electric Power Company (KEPCO) has demonstrated the capabilities of South Korea's nuclear energy industry, and has increased the opportunities for the country's companies to compete in the global market. In 2010, the South Korean Ministry of Knowledge Economy (now the Ministry of Trade, Industry, and Energy) stated that it aimed to achieve exports of 80 nuclear power reactors worth \$400 billion by 2030, in the course of becoming the world's fourth-largest supplier of such technology, with a 20 percent share of the world market, behind the U.S., Russia and France (World Nuclear Association). Seoul remains intent on competing for nuclear projects in a number of countries, including India, Vietnam, Indonesia, Poland, Jordan, Saudi Arabia, Turkey, South Africa, and China (Patel). South Korea has signed nuclear cooperation agreements with 29 states. The ROK has already signed an agreement with Jordan for a research reactor (Patel) and has recently signed a memorandum of understanding with Saudi Arabia to conduct a three-year preliminary study on the feasibility of constructing SMART (System-integrated Modular Advanced Reactor) reactors in Saudi Arabia—South Korea's version of a small modular reactor (World Nuclear Association).

The U.S. and the ROK cooperate in nuclear projects in third countries such as the reactors being constructed in the United Arab Emirates. The APR-1400 reactors that KEPCO is building in the UAE employ a Westinghouse-based design. American companies have a significant role in the UAE project. Westinghouse's contribution to the UAE reactors includes design; technical support services; consulting on licensing issues; and the provision of control equipment, instrumentation, and major components (Lipman). In addition, a number of U.S. nuclear companies have provided engineering, construction management, training, legal, regulatory, environmental, and other services to the UAE project. South Korea's Doosan Heavy Industries & Construction has partnered with Westinghouse to supply two pressure vessels and four steam generators for the two AP1000 nuclear power reactors under construction in China (Westinghouse Enlists Doosan for China).

The existing agreement does not reflect these developments, and an up-to-date agreement is needed to recognize these new realities.

THE EXISTING AGREEMENT AND NONPROLIFERATION

The nonproliferation provisions of the existing agreement are completely one-sided in that they require peaceful-use, safeguards, and other nonproliferation assurances only from South Korea. They impose no equivalent obligations on the United States. This disparity is a logical consequence of the fact that the agreement foresees the U.S. as the supplier and the ROK as the consumer. It does not provide for Korean nuclear exports to the United States and therefore recognizes no need for the U.S. to give the ROK any nonproliferation assurances.

In addition, the nonproliferation assurances contained in the existing agreement, are outdated, use outmoded language, and do not reflect the evolution of the international nonproliferation regime as well as current U.S. and South Korean nonproliferation laws, regulations and policies.

The present agreement was concluded four years before passage of the U.S. Nuclear Nonproliferation Act (NNPA) in 1978. The NNPA amended the 1954 Atomic Energy Act to include more rigorous and more extensive nonproliferation requirements for U.S. nuclear export, including peaceful, non-explosive use assurances; safeguards in perpetuity; comprehensive safeguards; adequate physical protection and consent rights for reprocessing, alteration in form or content of used fuel; enrichment of uranium; storage of weapons-usable materials; and consent to retransfer items subject to the agreement. The existing agreement contains only a small fraction of these requirements.

The nonproliferation provisions of the existing agreement do not reflect changes in the international nuclear export control guidelines of the Zangger Committee or the Nuclear Suppliers Group. South Korea joined these two multilateral nuclear export control regimes in 1995 and has incorporated these guidelines within its own domestic legal framework. South Korea's Nuclear Safety Act governs the export of nuclear materials, equipment and technology based on the Nuclear Suppliers guidelines Part 1.

The only nonproliferation guarantees in the existing agreement are safeguards, a peaceful use assurance and consent rights for reprocessing and retransfer, and these are outmoded.

For example, the safeguards articles (Article XI and XII) of the present agreement are limited, and do not reflect key developments in the international safeguards system over the last 40 years. Article XI provides the U.S. with bilateral safeguards rights, “Except to the extent that the safeguards rights provided for in this Agreement are suspended by virtue of the application of safeguards of the International Atomic Energy Agency.” They apply only to U.S.-supplied items and are not comprehensive in scope. The safeguards articles refer to the then pending trilateral safeguards agreement between the ROK, the U.S. and the International Atomic Energy Agency (IAEA) and foresee the possibility of the application of IAEA safeguards pursuant to Article III of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The latter was consummated and replaced by the ROK’s NPT safeguards agreement in 1975 when South Korea joined the NPT that year.

The present agreement has only two consent rights that apply to 1) the retransfer of transferred items and special nuclear material produced from U.S.-supplied material (Articles VIII H and X) and 2) the reprocessing and alteration in form or content of irradiated fuel elements subject to the agreement (Article VIII F). The criterion for approving reprocessing is defined narrowly as a joint determination that safeguards may be effectively applied and does not encompass broader nonproliferation considerations.

The Peaceful Use Assurance is limited and outdated. In Article X.2 the ROK guarantees that material and items subject to the agreement will not be used for “atomic weapons, or for research on or development of atomic weapons,” or “for any military purpose.” This language does not mention the prohibition of items subject to the agreement for nuclear explosive purposes, even though the NPT, which entered into force in 1970, banned the use of nuclear material and equipment for these purposes. U.S. and South Korean laws also extend this prohibition to nuclear explosive devices.

As noted, the NNPA of 1978 specified a number of criteria that cooperating partners had to meet in order to receive U.S. nuclear exports. The existing agreement does not contain the full range of nonproliferation assurances and guarantees required by that U.S. law, e.g., a non-explosive-use assurance, safeguards in perpetuity, adequate physical protection, and more extensive consent rights. Thus, in order to continue to license exports of nuclear material and equipment to South Korea, the U.S. has had to exchange government-to-government notes with South Korea to obtain these legislatively mandated nonproliferation assurances.

The U.S.-ROK agreement is the only U.S. peaceful nuclear cooperation agreement that has not been renegotiated since the enactment of the NNPA in 1978, and its replacement with a modern, more balanced and up-to-date nonproliferation and nuclear trade provision and conditions is long overdue.

THE MAIN ISSUES

The negotiations on peaceful nuclear cooperation between the United States and the Republic of Korea took place against a background of differences in the status and interests of the two countries as well as their distinctive, albeit similar, views on nonproliferation and civil nuclear power.

The United States remains a superpower and a nuclear-weapon state member of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). Its nonproliferation policy has always been global in scope and has placed special emphasis on preventing the spread of enrichment and reprocessing – two technologies that can produce materials—highly enriched uranium and plutonium—that can be used directly in nuclear weapons.

South Korea, on other hand, is a “middle power,” (Snyder) albeit one that, over the last several decades, has achieved great strides economically, militarily and politically on the world stage. It is a non-nuclear-weapon state party to the NPT. While the ROK is a strong supporter of the international nonproliferation regime, Seoul places special importance on its rights specified in Article IV of the Treaty. That Article states:

Nothing in this Treaty shall be interpreted as affecting the inalienable right of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Articles I and II of this Treaty.

Seoul has been striving for a greater overall balance in its relationship with the United States, but particularly in its civil nuclear relationship, as it considers the existing peaceful nuclear trade agreement to be particularly one-sided in imposing restrictive nonproliferation obligations only on South Korea. South Koreans have felt especially constrained by U.S. non-proliferation controls in pursuing their fuel cycle goals, namely managing used fuel, obtaining a secure supply of nuclear fuel and promoting South Korean nuclear exports. These goals included the possible, eventual acquisition of commercial pyroprocessing¹ and enrichment technologies.

As a nuclear-weapon state party to the NPT, the United States has a special responsibility to ensure that the terms and conditions of the new agreement are as balanced and as nondiscriminatory as possible. On the other hand, as a fully compliant non-nuclear-weapon state party to the NPT facing a unique security threat posed by North Korea’s nuclear weapons programs that includes Pyongyang’s possession of enrichment and reprocessing facilities dedicated to providing nuclear materials to that program, Seoul has a special responsibility to ensure that its civil nuclear program is subject to the highest nonproliferation standards and structured in such a way that it meets South Korea’s civil nuclear power needs, while not giving justification to North Korea’s pursuit of nuclear weapons and avoiding setting a precedent for other states to acquire their own sensitive nuclear facilities.

Nuclear power is more important to South Korea than to the United States. According to the World Nuclear Association, nuclear energy remains a strategic priority for South Korea, and nuclear capacity is planned to increase by 59% to 32.9 GWe by 2022, and then to remain at that level until 2035. Its reactors provide about one-third of South Korea’s electricity from 21.6 GWe of plant. Considerable new capacity is planned by 2035. South Korea imports 97% of its fuel, by ship. Some \$170 billion was spent on imported energy in 2011, one third of all imports. Without nuclear power, this import bill would have been about \$20 billion higher according to KEPCO (World Nuclear Association).

¹ Pyroprocessing differs from classic PUREX (plutonium-uranium extraction) reprocessing where the plutonium is fully separated other elements. In pyroprocessing, the plutonium separated from used fuel remains mixed with other elements. South Korean officials have argued that this difference makes pyroprocessing more proliferation resistant than traditional reprocessing.

Although the U.S. remains the world's largest producer of nuclear power, accounting for more than 30% of worldwide nuclear generation of electricity and producing a little under 20 percent of total electrical output from America's 100 nuclear reactors, the U.S. nuclear industry is struggling to maintain its nuclear power's share of the electricity market. While there are five new nuclear reactors under construction, lower gas prices since 2009, slow growth in electricity demand and the high cost of new nuclear plants have put the economic viability of some existing reactors and proposed projects in doubt (World Nuclear Association).

Thus, while the United States has not seen a new nuclear plant built in several decades, South Korea has greatly expanded its nuclear fleet.

Against this background, the American and South Korean sides had to resolve four difficult, interrelated issues in the course of negotiating the new civil nuclear cooperation agreement. These were:

1. How to give adequate recognition to South Korea's political status as a valued ally and full and equal cooperating partner of the United States in civil nuclear cooperation. This meant crafting an agreement in which both parties assumed essentially equivalent and reciprocal obligations, rights and opportunities. This included how to deal with Article IV of the NPT.
2. How to deal with South Korea's problems in managing its used nuclear fuel and in securing a stable supply of nuclear fuel for the ROK. One way to address these problems was for the ROK to seek a pathway for long-term U.S. consent to pyroprocessing and enrichment—two sensitive nuclear technologies that can be used either to produce fuel for civil nuclear reactors or to manufacture weapons-grade uranium or separated plutonium for use in nuclear weapons.
3. How to support the competitiveness of South Korean nuclear exports.
4. How to reach a mutually satisfactory agreement that would meet both South Korean fuel cycle goals and U.S. objectives in preventing the spread of sensitive nuclear technologies, particularly in such a volatile area as the Korean Peninsula where the Democratic People's Republic of Korea (DPRK) has already acquired sensitive nuclear facilities and has tested nuclear weapons.

Initially, the above four issues began as two main ones during the previous Lee Myung-bak administration—Article IV of the NPT and explicit demands for enrichment and pyroprocessing capabilities. These later evolved into a different framing of the issues under the current Park Geun-hye administration (Kim).

THE POSITION OF SOUTH KOREA

The objectives of the ROK in negotiating a new civil nuclear cooperation agreement with the United States were two-fold: 1) political and 2) programmatic.

Political Objectives

During her May 2013 address to a joint session to Congress, South Korean president Park Geun-hye made the following points:

- Korea has been pursuing the peaceful use of nuclear energy.
- It is also firmly committed to the principle of non-proliferation.
- Korea and the United States are partnering to build reactors in third countries.
- In this regard, we need a modernized, mutually beneficial successor to our existing civil nuclear agreement.
- Such an accord will bring huge benefits to related industries in both our countries (Congress Joint Session Transcript).

The South Korean civil nuclear energy program has undergone tremendous growth over the past several decades, has achieved a high level of self-sufficiency, has a robust and widely diversified nuclear R&D program, and has begun to engage in nuclear cooperation on the international market. Nuclear energy in the ROK has become one of the premier nuclear power programs in the world. Seoul viewed the negotiation of a new peaceful nuclear agreement with the United States as an opportunity to move from the status of a junior partner as reflected in the existing agreement to a full-fledged and equal collaborator with Washington in the field of civil nuclear energy.

The current one-sided relationship in which the ROK is subject to strict nonproliferation restrictions imposed by the United States has led some conservatives and media to call for “nuclear sovereignty.” This meant, among other things, that 1) South Korea’s strategic and economic importance and status as a strong ally should give it the right to engage in enrichment and reprocessing on its own territory, and 2) Washington should accord South Korea the same status as it has in its agreements with the other major nuclear trading partners.

More specifically, some conservatives in the ROK urged the U.S. to grant long-term consent (sometimes called programmatic consent) to pyroprocessing and enrichment on terms comparable to those that the U.S. accorded such countries as Japan, EURATOM and India. In these agreements the U.S. gave consent to reprocessing of used fuel produced from U.S.-origin nuclear material and equipment and to the use of the recovered plutonium in their peaceful nuclear programs for the life of the agreements.

The U.S. also gave Switzerland consent for the life of the agreement to transfer its used fuel to EURATOM for reprocessing and for the return of the recovered plutonium to Switzerland for use as fuel in its power reactors. In addition the U.S. gave similar consent to Sweden, the United Arab Emirates and Taiwan to transfer their U.S.-obligated used nuclear fuel to EURATOM for reprocessing.

South Koreans found it particularly difficult to accept the fact that a country such as Japan has both uranium enrichment and reprocessing programs while the ROK has no equivalent capabilities. In the view of many South Koreans, were Washington to provide less favorable treatment to the ROK than it provided its other major nuclear trading partners, it would mean the U.S. regarded Korea as a subordinate ally. As already noted, some South Koreans have argued that as a sovereign state and as a compliant party to the NPT, Article IV of the NPT affords it the right to the peaceful nuclear energy, including enrichment and reprocessing.

Programmatic Objectives

Seoul also had certain programmatic objectives. During her May 2013 visit to Washington, President Park Geun-hye identified to President Obama South Korea’s three key objectives in concluding the new U.S.-ROK peaceful nuclear cooperation agreement. She has repeatedly stated three goals:

1. alleviate South Korea’s used fuel storage problem;
2. ensure reliable access to enriched uranium to fuel the ROK’s nuclear reactors; and
3. promote the competitiveness of South Korea’s nuclear industry in global markets (Einhorn).

It merits emphasis that President Park’s definition of South Korea’s objectives in the negotiations was highly pragmatic and avoided explicit reference to such neuralgic issues such as sovereignty, long-term consent to enrichment and reprocessing, and Article IV rights, all of which would have made reaching agreement much more difficult.

Used Fuel Management

The South Korean nuclear program faces both short-term and long-term challenges in managing its used nuclear fuel. The most immediate one is the lack of adequate storage facilities for used nuclear fuel. The government has not yet found a solution to this problem.

South Korea has around 70 percent, or nearly 9,000 tonnes, of its used fuel stored in temporary storage pools originally intended to hold it for five or six years, with some sites due to fill by the end of 2016. South Korea’s nuclear reactors add a total of some 750 tonnes of used fuel every year to the 13,300 tonnes that filled 71 percent of its wet and dry storage

capacity as of last year, according to reactor operator Korea Hydro and Nuclear Power Co Ltd (KHNP), owned by state-run Korea Electric Power Corp (KEPCO). That means storage could fill by 2021, with some pools in danger of reaching capacity by the end of 2016 (Cho). The lack of adequate used fuel storage capacity could be one of the biggest stumbling blocks for South Korea's plans to generate more nuclear power.

In the longer term, the ROK must also find a solution for the politically delicate problem of locating a site to dispose of its high-level nuclear waste.

In seeking solutions to its used fuel management problems, the ROK hopes to develop and commercialize pyroprocessing technology. The South Koreans believe pyroprocessing will help reduce the required size of a waste repository, and thereby help to address public opposition to the siting of such a repository. In addition, they believe it can contribute to meeting the ROK's long-term energy needs because the product of pyroprocessing can be used to fuel future fast reactors.

About two-thirds of the used nuclear fuel in South Korea is subject to the U.S.-ROK peaceful nuclear cooperation agreement. The U.S. regards pyroprocessing as reprocessing. Thus, under the terms of both the existing U.S.-ROK agreement and the new one, U.S. consent is needed by South Korea to engage in pyroprocessing. During the negotiations, South Korea pressed the United States to define a pathway for possible U.S. long-term or programmatic consent for Korea to pyroprocess used nuclear material fuel produced from U.S.-supplied nuclear fuel and equipment as part of the new agreement.

Secure Fuel Supply

South Korea must import all of its enriched uranium for its nuclear power program and therefore is seeking a secure and reliable source of nuclear fuel for its power reactors. The ROK does not currently possess an enrichment capacity, and some South Koreans have argued that it needs to be able to enrich uranium to enhance its energy security by reducing its reliance on foreign uranium enrichment suppliers. Some in the ROK want the capability to enrich uranium domestically in order to ensure that South Korea will have a reliable source of enriched fuel for its growing fleet of light water reactors. South Korean negotiators therefore sought to define a mechanism for eventual U.S. consent to enrich U.S.-supplied uranium.

Export Competitiveness

Some in South Korea also believe the country needs enrichment capabilities to be able to compete with other major nuclear suppliers. South Korea's chief competitors in the international nuclear market, such as France, Russia, and the United States all offer enrichment services. South Korea sees its inability to offer fuel services as a major competitive disadvantage in the international nuclear market.

THE POSITION OF THE UNITED STATES

The United States supported the political and programmatic goals set out by President Park, but has long opposed the spread of reprocessing and enrichment capabilities. The U.S. concern is that such facilities can increase the risk of proliferation in several ways:

1. They can produce nuclear materials--highly enriched uranium (HEU) and separated plutonium that are directly usable in nuclear weapons. With such materials, a state could abrogate its nonproliferation commitments and produce a nuclear weapon within a short period of time;
2. Reprocessing plants are challenging and costly to inspect. The IAEA faces technical and financial problems in ensuring timely detection of the diversion from reprocessing plants of significant quantities of weapon-usable materials to nuclear explosive purposes;
3. It is difficult to detect—either through national technical means or IAEA safeguards or both—clandestine enrichment plants using such technologies as centrifuge or laser isotope separation; and
4. Highly enriched uranium produced at enrichment plants and plutonium recovered from reprocessing facilities offer tempting targets for terrorists or other non-state actors.

As for the argument regarding rights to enrichment and reprocessing under Article IV of the NPT, the U.S. position is that, while the NPT clearly affords non-nuclear weapons states access to nuclear technology for peaceful purposes as long as they are in compliance with the Treaty, it does not specifically afford or deny specific rights to enrichment and reprocessing to member states.

The U.S. does not question South Korea's commitment to nonproliferation. Nor has the U.S. singled out the ROK in its policy of opposing the spread of reprocessing or enrichment or in refusing to grant consent to the reprocessing or enrichment of U.S.-obligated nuclear material. It has granted consent to reprocessing to only a few countries that already possessed well-established, industrial-scale programs—Japan, EURATOM, India and more recently China—and to enrichment up to less than 20% to a somewhat larger number of states.² The ROK differs from these countries, since Seoul has neither built nor operated reprocessing or enrichment facilities and is, therefore, not in a position to argue that its existing programs should be “grandfathered” like those in Japan and EURATOM.

The Obama administration's approach to programmatic consent to reprocessing in South Korea was addressed in written answers that Ellen Tauscher provided to Senator Richard Lugar, then ranking minority member of the Senate Foreign Relations Committee, in connection with her nomination hearings for the position of Under Secretary of State for Arms Control and International Security. When asked about allowing reprocessing in Taiwan and the ROK, she replied that, “The Administration does not believe that such programmatic consent to reprocessing is *necessarily appropriate* (italicized for emphasis) in other cases, including Taiwan and the Republic of Korea” (Tauscher).

Some members of the U.S. Congress and the American nonproliferation community have argued that all new U.S. peaceful nuclear cooperation agreements should contain a legal commitment by the cooperating partner to forswear the acquisition of enrichment and reprocessing technologies—the so-called “gold standard.” Although the Administration has not accepted this one-size-fits-all approach, it provided an important background to the negotiations.

The 1992 North-South Korean Declaration has continuing relevance to South Korea's interest in fuel cycle facilities. The U.S. and South Korea share the objective of persuading North Korea to dismantle its nuclear weapons capabilities, including its fuel cycle capabilities. The United States has concerns that this objective will be made even more difficult if the North Koreans can point to enrichment or pyroprocessing programs in South Korea. In this connection, the U.S. has placed considerable emphasis on the ROK-DPRK joint declaration of January 20, 1992, that stated, among other things:

- South and North Korea shall not test, manufacture, produce, receive, possess, store, deploy or use nuclear weapons;
- South and North Korea shall use nuclear energy solely for peaceful purposes; and
- South and North Korea shall not possess nuclear reprocessing and uranium enrichment facilities.

Since signing the declaration, North Korea has constructed reprocessing and uranium enrichment facilities in breach of the bilateral declaration, withdrawn from the NPT, conducted three nuclear weapons tests and declared itself a nuclear weapon state. The South-North Korean joint declaration constitutes a political commitment between the two countries and does not have the force of international law. However, even if it were legally a treaty, South Korea could formally terminate it, since North Korea is in material breach of the declaration (Joyner). To some South Koreans, U.S. calls for Seoul to abide by its 1992 declaration appear unfair, and some in South Korea do not consider Seoul bound by the 1992 declaration given Pyongyang's repeated violations of the agreement. However, Seoul has not renounced the declaration.

The U.S. side, on the other hand, has continued to place strong emphasis on the continuing importance of this declaration as a commitment by North Korea to denuclearize.

In the view of the U.S. pyroprocessing will not solve South Korea's immediate used fuel management problems. The U.S. has taken the position that pyroprocessing, even if it proves technically and economically feasible, will not be available in time to solve the ROK's near-term used fuel storage problems. Pyroprocessing is still an experimental technology that has yet to be demonstrated on a commercial scale. In addition, the economics of pyroprocessing are still unknown, and it has

² Argentina, Australia, Brazil, Canada, EURATOM, India, Japan, Russia and Switzerland.

yet to be determined whether and how commercial-scale pyroprocessing facilities can be effectively safeguarded. Korean nuclear scientists believe pyroprocessing is more proliferation-resistant than the PUREX system employed by France, Japan and Russia because it does not separate pure plutonium from used reactor fuel. However, in 2008, DOE released a draft Nonproliferation Impact Assessment (NPIA) of the Global Nuclear Energy Partnership (GNEP) Programmatic Alternatives that reached the preliminary conclusion that the candidate reprocessing technologies studied, including pyroprocessing, suggest only modest improvements in reducing proliferation risk over existing PUREX technologies, and that these would reduce the risks that non-state actors, but not states, would be able to gain access to the plutonium (National Nuclear Security Administration).

The U.S. took the position that a medium-term solution and a more realistic path forward would be to store South Korea's used fuel in dry casks that could hold such material for up to 100 years.

For several reasons the U.S. also took the position that South Korea does not need enrichment technology to meet its own fuel needs or to improve its competitiveness in the international market. First, the international market for uranium and enrichment services has worked well over a period of many decades, and consumers have suffered no disruptions in supply. Second, the ROK has diversified its sources of supply to minimize commercial, technical, and political risks by purchasing enrichment services from the United States, France, and Russia. Third, the world enjoys an excess of enrichment capacity. Fourth, it is highly unlikely that enrichment technology holders such as URENCO or Areva would be interested in building an enrichment facility in South Korea. Fourth, for South Korea to build its own enrichment plant would be much more expensive than to purchase enrichment services from the international market. Fifth, if South Korea needed further supply assurances, it could consider investing in an advanced, foreign enrichment operation. Finally, South Korea does not need a domestic uranium enrichment capacity to promote the competitiveness of the ROK nuclear industry as an exporter. South Korea or its customers can acquire the necessary enriched uranium from a third country, which is a common industry practice (Einhorn).

Although the U.S. places a high priority on the nonproliferation aspects of its civil nuclear pacts, it would be a mistake to regard U.S. interests in concluding a new civil nuclear cooperation with the ROK as limited to issues of nonproliferation. The U.S. sees the proposed new agreement as an important element of its relationship with a key ally in East Asia and as a means of preserving and expanding its nuclear export opportunities not only in South Korea but globally.

THE NEW AGREEMENT: FROM DEPENDENCE TO PARITY IN TRADE AND NONPROLIFERATION

Reconciling the positions of the U.S. and South Korea was not easy. It took many years to resolve the outstanding differences and required compromises by both parties. The result of these efforts is a new agreement that replaces a one-sided and outmoded pact with one that 1) reflects the mature and advanced nuclear status and capabilities of South Korea and 2) contains a range of reciprocal nuclear controls and guarantees that reflect the modern international non-proliferation regime.

Chapter V examines the unprecedented high-level, institutional mechanism the two parties have established to resolve the challenging fuel cycle issues facing South Korea, of managing used nuclear fuel, including pyroprocessing, assured fuel supply, and export competitiveness. This chapter examines the specific provisions in the new agreement concerning 1) nuclear trade and cooperation and 2) nonproliferation guarantees and assurances.

PARITY AS NUCLEAR TRADING PARTNERS AND EXPANSION OF COOPERATION

Unlike the existing agreement, which assigns the U.S. role as the supplier and the ROK as the recipient of nuclear materials, equipment and technology, the new agreement recognizes South Korea as a supplier of nuclear materials, goods and services. The agreement provides for a wide range of nuclear cooperation between the two countries.

Articles 2 and 4 provide for the transfer of information, nuclear material, moderator material, equipment and components. In Article 6 the parties agree to facilitate trade in nuclear material, moderator material, equipment and components between themselves and their authorized persons. In Article 3 the parties undertake to facilitate the fullest possible cooperation in nuclear research, development and demonstration in a range of areas, including: nuclear safety; next generation nuclear energy systems including advanced nuclear fuel cycle technology; radioactive waste management including disposal, production of radioactive isotopes and application of radiation and radioactive isotopes; safeguards and physical protection; and controlled thermonuclear fusion including in multilateral projects; the design and manufacture of nuclear fuels; and the development, design, construction, operation, maintenance and use of reactors, reactor experiments; and decommissioning. In Article 4 the parties undertake to facilitate commercial and industrial cooperation.

These areas of cooperation far exceed those in the existing agreement and are indicative of the advanced state of the nuclear industries in both countries.

PARITY AND MODERNIZATION OF NONPROLIFERATION ASSURANCES AND CONTROLS

While the present agreement imposes nonproliferation obligations only on the ROK, the new agreement creates reciprocal nonproliferation obligations for both parties. Thus, the agreement imposes safeguards, peaceful, non-explosive assurances, and physical protection assurances on both the United States and the Republic of Korea. Both countries also have prior consent rights over enrichment, reprocessing and alteration in form or content of materials subject to the agreement, as well as storage of weapons-usable materials, and the retransfer of nuclear material and equipment to third countries.

The new peaceful nuclear cooperation agreement is also wholly consistent with the national nuclear export and nonproliferation laws of the two countries and with international nuclear export guidelines. The new agreement contains all nuclear export guarantees, assurances and controls required by Section 123 of the Atomic Energy Act (AEA) as amended by the

NNPA of 1978, as well as the Republic of Korea's nuclear export legal and regulatory requirements.³ South Korea joined the Nuclear Suppliers Group (NSG) in 1995 and Korea implements the strategic trade control measures of Part 1 of the NSG guidelines on nuclear trigger list items⁴ (Korean Institute of Nuclear Nonproliferation and Control). The NSG guidelines call for nonproliferation assurances and guarantees comparable to those in the U.S. AEA.

The following describes the key nonproliferation assurances and guarantees of the new agreement and their consistency with U.S. and South Korean laws and policies and international guidelines.

Peaceful, Non-Explosive Use Assurance

Article 13 of the new agreement provides that nuclear material, moderator material, equipment and components subject to the agreement “shall not be used for any nuclear explosive device, for research on or development of any nuclear explosive device, including but not limited to the production of tritium for use in such a device, or for any military purpose.”

This article replaces the guarantee in the existing agreement that prohibits the use of materials and items subject to the agreement only for “atomic weapons” and expands it to ban their use for “any nuclear explosive device, or for research on or development of any nuclear explosive device, or for any other military purpose.”

It fulfills Section 123 (a) (3) of the AEA that requires a guarantee by the cooperating party that no nuclear materials, equipment or sensitive nuclear technology subject to an agreement⁵ “will be used for any nuclear explosive device, or for research on or development of any nuclear explosive device, or for any other military purpose.” It also conforms to paragraph 2 of Part 1 of the NSG Guidelines that calls for the authorization of the export of trigger list items only upon formal governmental assurances from recipients explicitly excluding uses which would result in any nuclear explosive device.

Comprehensive Safeguards

Paragraphs 1 and 2 of Article 14 of the agreement stipulates that cooperation under the agreement shall be subject to “the Agreement of October 31, 1975 between the Republic of Korea and the IAEA for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), and the Additional Protocol thereto of September 23, 1997.”

This article fulfills section 123 (a) (2) of the AEA, which provides, in the case of non-nuclear-weapon states a requirement as a condition of continued United States nuclear supply under the agreement for cooperation, that IAEA safeguards be maintained with respect to all nuclear materials in all peaceful nuclear activities within the territory of such state, under its jurisdiction, or carried out under its control anywhere. It also conforms to paragraph 4 (a) of the NSG guidelines that states, “Suppliers should transfer trigger list items or related technology to a non-nuclear weapon State only when the receiving State has brought into force an agreement with the IAEA requiring the application of safeguards on all source and special fissionable material in its current and future peaceful activities.”⁶

Paragraph 3 of the article provides that material shall be subject to the agreement in the United States to the agreement between the U.S. and the IAEA for the Application of Safeguards in the United States of America, signed on November 18, 1977.

³ The ROK legal basis of export and import control of nuclear materials and equipment for the prevention of nuclear proliferation is the Foreign Trade Act (Act. No. 9221 of 2008). The Ministry of Knowledge Economy is responsible for the implementation of this act. Article 19 of the act sets forth the regulations related to export control of strategic goods including nuclear materials and equipment. The “Public Notice for the export and import of strategic goods” under the Foreign Trade Act provides the control list, control area, licensing procedures and government agencies which are responsible for the licensing of specific items. The Korean Government revised the Public Notice under the Foreign Trade Act to adhere to the guidelines of the Nuclear Suppliers Group (NSG). The new Public Notice came into force on 1 October 1995, before Korea joined the NSG and the Zangger Committee (see Article 32 of Presidential Decree No. 21104 of 2008). See “Nuclear Legislation in OECD and NEA Countries. Regulatory and Institutional Framework for Nuclear Activities Republic of Korea”, OECD, 2009,

⁴ They are called trigger list items because their export would “trigger” the application of safeguards and other nonproliferation controls.

⁵ The term “subject to the agreement” means material transferred pursuant to the agreement for cooperation and no material used in or produced through the use of any material, production facility, or utilization facility transferred pursuant to the agreement for cooperation.

⁶ The NSG adopted this guideline in 1993 and it applied only to new nuclear supply commitments, thus exempting existing commitments (the so-called grandfather clause) and allows for exceptions in the cases of safety emergencies.

IAEA Safeguards in Perpetuity

Paragraph 6 of Article 21 of the new agreement provides that safeguards will continue notwithstanding the termination or expiration of the agreement or any cessation of cooperation hereunder for any reason.

This article conforms with section 123 (a) (1) of the AEA that requires a guarantee by the cooperating party that safeguards as set forth in the agreement for cooperation will be maintained with respect to all U.S.-obligated nuclear materials and equipment, so long as they remain under the jurisdiction or control of the cooperating party, irrespective of the duration of other provisions in the agreement or whether the agreement is terminated or suspended for any reason. This article is also consistent with the paragraph 4 (a) of Part 1 of the guidelines of the NSG (INFCIRC 254/Rev.12.)

Additional Protocol to IAEA Safeguards Agreements

Paragraphs 3 and 4 of article 14 of the agreement provides that material subject to the agreement shall be subject to the Additional Protocols of the two parties' respective safeguards with the IAEA.

U.S. law does not require the Additional Protocol as a condition of U.S. nuclear supply under peaceful nuclear cooperation agreements. However, since the IAEA adoption of the Model Additional Protocol in 1997, the United States has included the AP as a condition of supply in its agreements with the Russian Federation (2010), India (2008), and the UAE (2009). Other agreements that entered into force after 1997—Argentina (1997), Australia (2010), Bangladesh (2000), Brazil (1999), Kazakhstan (1999), Morocco (2002), Turkey (2008), Ukraine (1999) and Vietnam (2014)—do not contain a provision on the Additional Protocol. South Korea has not made the adoption of the AP a condition for nuclear exports, but has said it will support this requirement if the NSG endorses it (Hibbs).

The NSG has thus far been unable to reach a consensus on requiring the AP as a condition of supply for trigger-list items, since some members insist that it is a voluntary measure and not required by the NPT.⁷ The inclusion of the AP as a condition of supply between two major nuclear states should serve as a model for other states to follow.

Fall-Back Safeguards

Paragraph 4 of Article 14 of the agreement provides for “back-up” safeguards in the event the IAEA safeguards agreement with the ROK is not being applied. Paragraph 5 of the same article imposes the same requirement for the United States. In such eventuality, the party affected is obliged to enter into an agreement with the IAEA for the application of safeguards which provides for effectiveness and coverage equivalent to that provided by the original safeguards agreement. Or if that is not possible, the parties shall immediately establish safeguards arrangements for the application of safeguards that provide for effectiveness and coverage equivalent to that provided by their respective safeguards agreement with the IAEA. Paragraph 2 of the Agreed Minute provides that, in the event that the ROK-IAEA Safeguards Agreement or the U.S.-IAEA Safeguards Agreement is not being applied, either party shall have the right to apply specified safeguards measures on a bilateral basis.

The United States, as a matter of policy, includes provisions in its post-NNPA agreements on peaceful nuclear cooperation that, in the event that the IAEA is not applying safeguards, the cooperating partner is obliged to enter fall-back safeguards arrangements such as those contained in the new U.S.-ROK agreement described above. Paragraph 4 (a) of the NSG guidelines provides that if the IAEA decides that the application of IAEA safeguards is no longer possible, the supplier and recipient should elaborate appropriate verification measures.

Prior Consent to Retransfers

Article 10 of the agreement provides that material and equipment subject to the agreement will not be transferred (a) to any unauthorized persons within its jurisdiction; or (b) beyond its territorial jurisdiction unless mutually determined by the parties.

⁷ The NSG, however, calls on suppliers to authorize transfers of enrichment and reprocessing only when the recipient has brought into force a Comprehensive Safeguards Agreement, and an Additional Protocol based on the Model Additional Protocol or, pending this, is implementing appropriate safeguards agreements in cooperation with the IAEA, including a regional accounting and control arrangement for nuclear materials, as approved by the IAEA Board of Governors.

AEA section 123 (a) (5) requires a U.S. right of prior consent for retransfers of nuclear material and equipment subject to a U.S. agreement on peaceful nuclear cooperation. The NSG guidelines call for a right of prior approval for retransfer as a condition of exporting trigger-list items. For most nuclear items and related technology, paragraph 9 (a) of the NSG guidelines requires the recipient to extend assurances from the original transfer to subsequent transfers.

Physical Protection

Article 12 of the agreement provides for the maintenance of adequate physical protection with respect to materials and equipment at (1) levels of physical protection at least equivalent to the recommendations published in IAEA document entitled “Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INF-CIRC/225/Revision 5)” and in any subsequent revisions of that document agreed to by the parties, and (2) the provisions of the Convention on the Physical Protection of Nuclear Material of March 3, 1980, and any amendments to that Convention that enter into force for both parties.

This fulfills the requirement of section 123 (a) (6) of the AEA that obliges a cooperating partner to provide a guarantee that adequate physical protection be maintained with respect to items subject to the agreement. It also conforms to paragraph 3 (a) of the NSG guidelines that provides, “All nuclear materials and facilities identified by the agreed trigger list should be placed under effective physical protection levels to prevent unauthorized use and handling, consistent with the relevant IAEA recommendations, in particular those set out in INFCIRC/225.”

Consent Rights on Reprocessing, Alteration in Form or Content of Nuclear Material, and Enrichment

Paragraph 1 of Article 11 of the agreement provides that reprocessing or other alteration in form or content of nuclear material subject to the agreement may take place only if the parties agree in writing, including with respect to the facilities in which such an activity may be performed.⁸

Paragraph 2 of Article 11 stipulates that uranium subject to the agreement may be enriched up to less than 20% enriched⁹ in the isotope 235 only if the parties agree in writing on an arrangement to do so, following consultations undertaken bilaterally through the High Level Bilateral Commission. (For a discussion of this Commission, see Chapter V).

This article fulfills the requirement of section 123 (a) (7) of the AEA that requires a guarantee by the cooperating party that no material subject to the agreement will be reprocessed, enriched or (in the case of plutonium, uranium 233, or uranium enriched to greater than twenty percent in the isotope 235, or other nuclear materials which have been irradiated) otherwise altered in form or content without the prior approval of the United States. It is also consistent with paragraph 8 of the NSG guidelines that call for suppliers to include in agreements for supply of nuclear materials or of facilities that produce material usable for nuclear weapons or other nuclear explosive devices provisions for mutual agreement between the supplier and the recipient on arrangements for reprocessing, storage, alteration, use, transfer, or retransfer of any material usable for nuclear weapons or other nuclear explosive devices involved. NSG guidelines do not impose an unqualified and unambiguous requirement for consent rights in all cases but merely calls for consent rights “whenever appropriate and practicable,” leaving to the individual supplier how to interpret such a phrase.

Consent Right on Storage of Weapons-Usable Nuclear Materials

Paragraph 1 of Article 10 provides that plutonium or uranium 233 (except as contained in irradiated fuel elements) or highly enriched uranium that are subject to the agreement shall only be stored in a facility to which the parties agree.

This article meets the requirement of section 123 (a) (8) of the AEA for a guarantee by the cooperating party that no plutonium, no uranium 233, and no uranium enriched to greater than twenty percent in the isotope 235 will be stored in any facility that has not been approved in advance by the United States. It also conforms to paragraph 8 of the NSG guidelines.

⁸ Paragraph 3 of Article 11 provides that alteration in form or content does not include irradiation or re-irradiation of nuclear reactor fuel, or conversion, reconversion, or fabrication involving unirradiated source material or unirradiated low enriched uranium.

⁹ Uranium enriched to 20% is so-called high-enriched uranium that is suitable for nuclear weapons, and major, worldwide efforts are underway to eliminate the use of this material in civil nuclear programs.

Restricted Data and Sensitive Nuclear Technology

Paragraph 3 of Article prohibits the transfer of Restricted Data.¹⁰

Most U.S. agreements on peaceful nuclear cooperation also prohibit the transfer of sensitive nuclear technology under the agreement or require an amendment to the agreement for such transfer.¹¹

The U.S.-ROK agreement addresses the issue of transfer of sensitive nuclear technology somewhat differently. Paragraph 1 of Article 7 provides that “any facility designed or used primarily for uranium enrichment, reprocessing of nuclear fuel, heavy water production, or fabrication of nuclear fuel containing plutonium, and any part or group of parts essential to the operation of such a facility may be transferred under this Agreement if provided for by an amendment to this Agreement, or may be transferred under a separate agreement between the Parties.” Any amendment to the agreement would be subject to the same procedures for presidential approval and congressional review as those set forth in Section 123 of the Atomic Energy Act for a new agreement.

The above paragraph deals with sensitive nuclear facilities and their parts. It does not mention technology specifically, although such facilities and parts would incorporate sensitive technology.

The only reference to sensitive nuclear technology per se may be found in paragraph 4 of Article 4, which stipulates that sensitive nuclear technology and technology or information that is not in the public domain concerning fabrication of nuclear fuel containing plutonium may be transferred under this agreement if provided for by an amendment to this agreement, or may be transferred by a separate agreement between the parties.

The absence of any reference to sensitive nuclear technology other than that related to plutonium fabrication does not mean that such technology may be transferred under the agreement. Section 123 (a) (9) of the AEA requires a guarantee by the cooperating partner that special nuclear material and any facilities produced or constructed by or through the use of sensitive nuclear technology (enrichment, reprocessing, and heavy water technology) transferred pursuant to an agreement be subject to all the nonproliferation requirements set out in section 123 of the AEA. Since the agreement contains no such provision, no sensitive nuclear technology may be transferred under the agreement.

The NSG has adopted guidelines that contain specific criteria for the transfer of sensitive nuclear technology. These limit the transfer of enrichment and reprocessing technologies only to a state that is in compliance with nonproliferation objectives, is an NPT party, and meets agreed standards of safeguards, physical protection, and safety. They also call for suppliers to seek an appropriate agreement with recipients to accept sensitive enrichment equipment and enabling technologies or an operable enrichment facility only under conditions that do not permit or enable replication of the facilities (so-called black-box conditions).

Cessation of Cooperation and Right of Return

Article 17 of the agreement provides that, if either party at any time following entry into force of the agreement does not comply with the provisions of Articles 10 (consent to storage and retransfer), 11 (consent to reprocessing, alteration in form or content), 12 (physical protection), 13 (no-explosive use) 14 (safeguards) or materially breaches, terminates or abrogates a safeguards agreement with the Agency, the other party shall have the right to cease further cooperation under the agreement or terminate the agreement and in either case to require the return of any nuclear material, moderator material, equipment or component subject to the agreement.

¹⁰ The Atomic Energy Act defines Restricted Data as meaning “all data concerning (1) design, manufacture, or utilization of atomic weapons; (2) the production of special nuclear material; or (3) the use of special nuclear material in the production of energy, but shall not include data declassified or removed from the Restricted Data category...”

¹¹ An exception to this policy is the U.S.-Canada agreement on peaceful nuclear cooperation. While that agreement allows for the transfers of sensitive nuclear technology, no such transfer has taken place since the entry into force of the latest amendment to that agreement in 1980. In addition, the United States and Australia have concluded an agreement providing for the transfer of laser enrichment technology to the United States from Australia.

This provision meets the requirements of section 129 of the AEA that specifies a number of actions by a non-nuclear-weapon state that would require the suspension of U.S. nuclear exports but allows the president to waive such suspension if he determines that it would be seriously prejudicial to the achievement of U.S. nonproliferation objectives or would otherwise jeopardize the common defense and security. It also conforms to paragraph 16 (c) of the NSG guidelines that states suppliers should consult in the event that one or more of them believe that there has been a violation of the supplier-recipient understanding resulting from these guidelines, particularly in the case of an explosion of a nuclear device, or if there has been an illegal termination or violation of IAEA safeguards by a recipient and should consider suspending transfers of trigger-list items while consultations are ongoing, pending supplier agreement on an appropriate response.

Article 17 also fulfills the requirement of section 123 (a) (4) that stipulates the United States shall have the right to require the return of any nuclear materials and equipment transferred pursuant thereto and any special nuclear material produced through the use thereof if the cooperating party detonates a nuclear explosive device.

Paragraph 4 (9) (a) of the NSG guidelines also addresses this issue by providing that, “if the IAEA decides that the application of IAEA safeguards is no longer possible, the supplier and recipient should elaborate appropriate verification measures. If the recipient does not accept these measures, it should allow at the request of the supplier the restitution of transferred and derived trigger list items.”

Perpetuity of Nonproliferation Assurances

Article 21 of the agreement provides that notwithstanding the termination or expiration of the agreement or any cessation of cooperation hereunder for any reason, the articles dealing with consent rights for storage and retransfers, enrichment, reprocessing and alteration in form or content and physical protection, no explosive use and military application, safeguards, and cessation of cooperation and the right of return as well as the Agreed Minute “shall continue in the case of nuclear material or moderator no longer usable for any nuclear activity relevant from the point of view of international safeguards or has become practicably irrecoverable, or, in the case of equipment, components, or byproduct material, such items are no longer usable for nuclear purposes.”

Although not required by U.S. law, all the nonproliferation conditions and controls in U.S. agreements on peaceful nuclear cooperation continue in effect even if the agreements terminate, expire, or are suspended. Post-NNPA agreements explicitly provide that these obligations continue in effect as long as the nuclear material and equipment subject to the agreement remain in the territory of the cooperating partner or under its jurisdiction or control anywhere, or until such time as the United States and the country concerned agree that the nuclear material is no longer usable for any nuclear activity relevant from the point of view of safeguards. The NSG guidelines provide for the perpetuity of safeguards but not for the other nonproliferation guarantees and assurances contained in the guidelines.

CONCLUSION

By imposing virtually the same nonproliferation obligations on the United States as on the ROK, the new agreement has eliminated the one-sided nature of the existing agreement.¹² This was a clear win for South Korea. However, this parity

¹² However, since the U.S. is a nuclear-weapon state and South Korea is a non-nuclear weapon state, the mutual obligations are not identical in all respects. The key exception is safeguards where the ROK as a non-nuclear-weapon state is obliged to accept comprehensive IAEA safeguards while the U.S. has a so-called “voluntary” safeguards agreement with the IAEA and has placed all of its civil nuclear facilities on the eligible list of its safeguards agreement with the IAEA. Article III of the NPT requires that IAEA safeguards applied to all source or special fissionable material in all peaceful nuclear activities within the territory of non-nuclear-state party to the Treaty, under its jurisdiction, or carried out under its control anywhere. In addition, section 123 (a) (2) of the AEA, contains the same requirement for comprehensive safeguards as a condition of continued United States nuclear supply under the agreement for cooperation. However, neither the NPT nor this provision of U.S. law requires the application of IAEA safeguards to materials in a nuclear-weapon state. Nevertheless, U.S. has concluded a voluntary safeguards agreement with the IAEA and has placed all of its civil nuclear facilities on the eligible list of its safeguards agreement with the IAEA. Paragraph 3 of Article 14 of the new U.S.-ROK requires that source or special nuclear material transferred to the United States of America pursuant to the Agreement and any source or special nuclear material used in or produced through the use of any material, equipment or components transferred pursuant to the Agreement shall be subject to the agreement between the United States of America and the IAEA for the application of safeguards in the United States.

of treatment has meant, of course, that South Korea agreed to accept a number of new nonproliferation obligations that it did not have under the existing agreement. These include comprehensive safeguards as a condition of supply, adequate physical protection, and a broader prohibition on all nuclear explosive devices as opposed to “atomic weapons,” consent rights for enrichment, reprocessing and alteration in form or content of nuclear material subject to the new agreement as well as storage of weapons-usable materials and retransfer of nuclear material and equipment subject to the agreement to third countries.

The nonproliferation guarantees and assurances in the new agreement are more numerous and comprehensive in nature than those in the existing agreement. Nevertheless, as already noted, these rights are reciprocal in nature. Thus, the ROK must consent to any reprocessing, alteration in form or content, or enrichment of nuclear materials subject to the agreement in the United States. Moreover, although these nonproliferation assurances create new legal obligations to nuclear trade between the U.S. and South Korea, they are unlikely to have a significant practical effect, since both countries already adhere to these norms and practices. Importantly, they upgrade the bilateral U.S.-ROK nuclear relationship to conform to modern standards of international civil nuclear trade.

Finally, it merits noting that the agreement has a duration of twenty years with the option of a one-time extension of an additional five years if both parties agree. This is shorter than other U.S. agreements, and gives the two countries the opportunity of revising the agreement sooner than is customary if political or technical developments warrant.

THE NEW AGREEMENT: FINDING A WAY FORWARD ON THE FUEL CYCLE ISSUES

The U.S. and the ROK had to find mutually acceptable paths forward to meet the political and programmatic interests of South Korea while satisfying the nonproliferation concerns of the United States. The outcome of the negotiations was a series of compromises by the two parties.

POLITICAL ISSUES AND THE FUEL CYCLE

The two sides had to come to agreement on three “political” issues as described earlier – the handling of the so-called “gold standard,” the 1992 South Korean-North Korean Denuclearization Statement and Article IV of the NPT.

The U.S. did not try to oblige the ROK to forswear its right to enrichment and reprocessing, i.e. the so-called “gold standard” as it did in its recent agreements with the United Arab Emirates and TECRO (Taiwan). As previously noted, some members of Congress and the American nonproliferation community have advocated that all new agreements contain such legally binding commitments. The administration, however, has rejected this “one size fits all” approach. As Assistant Secretary of State Thomas Countryman explained:

This type of blanket requirement would reduce our ability to extend our strong nonproliferation norms to new parts of the world – norms that have a real impact in preventing proliferation. Instead this blanket approach would likely drive states with emerging nuclear power programs into the arms of suppliers with lower nonproliferation standards (Countryman).

The administration has taken a flexible approach to this issue, as evidenced by recent agreements. U.S. agreements with UAE and TECRO (Taiwan) contain the gold standard, and the U.S. has sought similar commitments, thus far unsuccessfully, in talks to conclude agreements with countries in the Middle East such as Jordan and Saudi Arabia. On the other hand, the U.S. agreement with Vietnam contained only a political statement in the preamble registering Hanoi’s intent to rely on existing international markets for nuclear fuel services rather than a legal commitment to refrain from acquiring such technologies. The U.S. agreement with the IAEA contained no gold standard language.

The so-called gold standard would be inappropriate for a country such as the ROK that is key ally of the U.S., has a major nuclear power program and has demonstrated strong nonproliferation credentials. Moreover, a U.S. proposal for such a commitment would have been rejected out of hand by the South Koreans and made the conclusion of a new agreement impossible.

The agreement also contains no reference to the 1992 joint declaration between North and South Korea proscribing enrichment and reprocessing in both countries.

While holding North Korea to account for its commitment in the 1992 statement is important, a bilateral U.S.-ROK civil nuclear trade pact containing a reference to this statement would be highly unlikely to affect North Korea’s unwillingness to abandon its nuclear program. Pyongyang’s aggressive enrichment and plutonium production programs, nuclear weapons and missile tests, and its move towards weaponization and miniaturization of warheads increasingly indicate that the regime is unlikely to forgo its nuclear weapons program short of regime collapse. Only intensified political and economic pressure from the U.S., South Korea, Japan, China, and Russia and a reopened dialogue with the North Korean regime offer whatever hope there may be for Pyongyang’s denuclearization.

Even though Seoul has not renounced the 1992 joint statement, some in South Korea do not consider Seoul to be bound by that document given Pyongyang's repeated violations of the agreement and would have found it politically unpalatable to acknowledge the statement in the U.S.-ROK agreement, as long as North Korea continues its flagrant violation of its commitments.

These outcomes were politically important to South Korea and helped make a compromise outcome possible.

On the other hand, the agreement refers to Article IV of the NPT in the preamble only and not in any of the operative paragraphs of the agreement or its agreed minute. It makes no reference to enrichment or reprocessing, thus avoiding the disputed issue of whether Article IV includes rights to these sensitive nuclear technologies. This is relevant because, "The preamble of an international agreement sets out the context in which the agreement was negotiated and concluded. Under general rules of treaty interpretation the preamble is not considered to be part of the legally binding or "operative" text of the agreement" (Mackenzie, Burhenne-Guilmin and La Viña).

PROGRAMMATIC ISSUES AND THE FUEL CYCLE

The U.S. and ROK have been cooperating in studying pyroprocessing since the mid-1990s. Beginning in 1996, the U.S. consented to KAERI to perform post-irradiation experiments (PIEs)¹³ on U.S.-obligated used fuel over five-year periods. This did not involve any reprocessing, i.e., no separation of plutonium from high-level wastes, but rather a so-called "alteration in form and content."¹⁴ Scientists in South Korea have used only natural uranium, which does not contain plutonium. And the United States has not approved any "hot" processing in South Korea, i.e., the separation of plutonium from fission products. The U.S. has been conducting some pyroprocessing R&D in Idaho with the participation of South Korean scientists.

In April 2011, the two countries launched the Joint Fuel Cycle Study (JFCS) to explore the technical and economic feasibility and the nonproliferation acceptability of the electrochemical recycling process of pyroprocessing as well as other used fuel management options. The objectives of the JFCS are to:

- Demonstrate the technical feasibility of the electrochemical process at laboratory scale;
- Complete the development of technology (process, fuels, and safeguards) to scale the complete electrochemical process to the kilogram-scale;
- Perform an integrated demonstration of the electrochemical process fuel cycle, including fuel fabrication from irradiated materials and supporting safeguards technology, at the kilogram-scale;
- Perform an irradiation of recycled materials from electrochemical recycling;
- Perform post-irradiation examinations of fuel rodlets from recycled materials;
- Generate data to support the assessment of the technical and economic feasibility and nonproliferation acceptability of the electrochemical recycling; and

¹³ Post examination (PIE) involves the study of the performance of nuclear fuel in a nuclear reactor. It is common that experimental and production fuel will be examined after irradiation to determine the quality, safety and effectiveness of the fuel. Due to the intensely radioactive nature of the used fuel the PIE is done in a hot cell, using both nondestructive and destructive methods.

¹⁴ U.S. law does not define the term alteration in form or content. Alteration in form or content also involves the handling or manipulation of weapons-usable nuclear material, such as plutonium fuel manufacture and, sometimes, post-irradiation examination. Most agreements expressly exclude the irradiation or further irradiation of plutonium from the definition of alteration in form or content. The term has generally been interpreted to include the manufacture of plutonium-bearing fuels in the case of power reactor fuel or HEU-bearing fuels in the case of research reactor fuel. This means that the United States must agree to the manufacture of plutonium (recovered from U.S.-obligated used fuel) into mixed oxide fuel or to the manufacture of HEU into fuel elements or targets. In implementing U.S. agreements, the United States has treated the post-irradiation examination of used fuel in a pragmatic way. For example, if the cladding on irradiated fuel is altered in form or content, it is alteration in form or content. If it is not broken, it is not alteration in form or content. Destructive testing of used fuel is alteration in form or content, while nondestructive measurements on used fuel are not. Re-fabrication of irradiated material recovered from destructive processing of used fuel is alteration in form or content. In a few cases, alteration in form or content has been defined explicitly in an agreement. For example, in the U.S.-EURATOM Agreement, alteration in form or content means conversion of plutonium, highly enriched uranium, or uranium-233 or fabrication of fuel containing plutonium, highly enriched uranium, or uranium-233; it does not include post-irradiation examination involving chemical dissolution or separation, disassembly or reassembly of fuel assemblies, irradiation, reprocessing, or enrichment.

- Assess the technical and economic feasibility and nonproliferation acceptability of the electrochemical recycling.
- Assess options for the management of used nuclear fuel in the ROK.

The JFCS has three working groups: 1) electro-chemical recycling, 2) safeguards and security, and 3) alternatives. The two sides are now at the second stage of the study, involving engineering experiments that will take five years. The third stage, which will last three years, will involve making fuel, doing irradiation tests in a reactor and verifying its performance.

In June 2013, the U.S. concluded an agreement with the ROK that authorized the transfer of electrochemical recycling technology necessary for the successful completion of the JFCS. The U.S. Government concluded that electrochemical recycling technology is sensitive nuclear technology (SNT) within the meaning of the NNPA. The agreement to transfer this technology noted that continuation of the research and development may at some time in the future involve alteration in form or content of nuclear material.

The U.S. and the ROK agreed to review at an appropriate time the issue of consent to alteration in form or content to support continued research and development, and recognized that granting any such consent will be subject to compliance with any necessary domestic legal requirements of the party granting the consent. They also agreed no nuclear material produced by or through the use of transferred technologies, including, but not limited to, nuclear material used in or produced through the use of equipment produced or constructed by or through the use of transferred technologies, shall be reprocessed, and no irradiated fuel elements containing such material removed from a reactor shall be altered in form or content, except by irradiation or further irradiation, unless the parties agree.

Thus the two countries have an extensive background of R&D cooperation in fuel cycle technology. However, it merits emphasis that none of the above activities involve reprocessing, i.e., the separation of plutonium from high-level nuclear wastes.

THE NEW AGREEMENT: PYROPROCESSING AND ENRICHMENT

The two sides reached an agreement on a pathway for possible U.S. long-term consent to pyroprocessing or enrichment of nuclear material subject to the agreement with South Korea. In other words, Washington did not rule out the possibility of South Korea's acquiring these technologies in the future but deferred a decision on such consent to a later date when the two sides acquire a better understanding of the technical and economic feasibility of the technologies and conduct a thorough assessment of their implications for the nonproliferation regime.

Toward that end, Article 18 of the agreement establishes a High-Level Bilateral Commission to be chaired by the U.S. Deputy Secretary of Energy and the South Korean Vice Foreign Minister that will address these as well as other matters of mutual interest on an on-going basis. The bilateral commission will have four working groups:

1. spent fuel management
2. assured fuel supply
3. export cooperation
4. nuclear security

They may also address any other topics related to peaceful nuclear cooperation mutually agreed to in writing by the parties.

The high-level commission is an unprecedented institution for U.S. peaceful nuclear agreements and demonstrates the willingness of both parties to give serious, senior-level attention to a broad range of interests to both parties. It also constitutes a concrete U.S. recognition of South Korea as a major civil nuclear power and a close ally.

THE NEW AGREEMENT AND CONSENTS PENDING COMPLETION OF THE JFCS

Pending completion of the JFCS, the new agreement allows for joint research and development activities on pyroprocessing and certain ROK operations that stop short of separation of materials, i.e., reprocessing/pyroprocessing. The U.S. and

the ROK will enter into a consultative process under the auspices of the High-Level Bilateral Commission and, based on the results of the JFCS, will decide on whether and under what conditions South Korea should pyroprocess nuclear materials subject to the agreement.

The agreement gives consent to certain operations in specified facilities and establishes a process by which additional facilities may be added to the list of facilities.

In paragraph 5 of the Agreed Minute, each party grants consent to the other party for postirradiation examination of irradiated nuclear material subject to the agreement and the separation of radioisotopes from irradiated low enriched uranium subject to the agreement at the facilities in the U.S. and the ROK that are listed in Section 1 of Annex I to the Agreed Minute.

These facilities are:

- Post Irradiation Examination Facility (PIEF) at Korea Atomic Energy Research Institute (KAERI), Republic of Korea
- Irradiated Materials Examination Facility (IMEF) at KAERI, Republic of Korea
- Advanced Spent Fuel Conditioning Process Facility (ACPF) at KAERI, Republic of Korea
- DUPIC Fuel Development Facility (DFDF) at KAERI, Republic of Korea
- Hot Fuel Examination Facility at Idaho National Laboratory, United States of America

Facilities may be added to this list provided one party notifies the other party in writing of the facilities to be added and the other party provides written acknowledgment of such notification. The parties are also to conduct consultations in order to ensure that an appropriate IAEA safeguards arrangement containing key elements as agreed upon with the IAEA has been brought into force with respect to that facility.

The two countries also consented to material consolidation and treatment involving alteration in form or content of irradiated nuclear material subject to the agreement in which transuranics or other special fissionable material are not capable of being separated. These operations may be conducted at specified facilities in the U.S. and the ROK listed in Section 2 of Annex I to the Agreed Minute. These are:

- Advanced Spent Fuel Conditioning Process Facility (ACPF) at KAERI, Republic of Korea
- DUPIC Fuel Development Facility (DFDF) at KAERI, Republic of Korea
- Hot Fuel Examination Facility at Idaho National Laboratory, United States of America.

Facilities may be added to this list provided one party notifies the other party in writing of the facilities to be added and the other party provides written acknowledgment of such notification. The parties are obliged to consult together with the IAEA to develop a safeguards approach and key elements of a safeguards arrangement mutually acceptable to the parties and to the IAEA to be brought into force with respect to that facility. Such consultations are to result in written agreement that must include, as a condition for the addition of the proposed facility to Section 2 of Annex I to this Agreed Minute, entry into force of a safeguards arrangement with respect to the proposed facility with the IAEA containing the safeguards approach and key elements resulting from the consultations, and must provide for modifications of the key elements by written agreement of the parties.

South Korea believes pyroprocessing can be a future option for long-term used fuel management. The development and demonstration of this technology will take a long time. The consent of the United States to the alteration of form or content of U.S.-obligated nuclear material as described above is therefore essential to the evaluation, development and demonstration of this technology.

It merits emphasis that the U.S. consent applied to the operations described above also do not involve reprocessing, i.e., the separation of plutonium from high-level nuclear wastes.

COMPLETION OF THE JFCS AND THE MANAGEMENT OF USED FUEL

The agreement stipulates that, following the completion of the Joint Fuel Cycle Study, or at such other time as the parties may agree, they will consult with a view to identifying appropriate options for the management and disposition of used nuclear fuel subject to the agreement and for further development or demonstration of relevant technologies. These consultations are to be conducted under the auspices of the High Level Bilateral Commission. The new agreement provides for a joint review of the issue of U.S. consent to pyroprocessing and enrichment in South Korea of nuclear materials subject to the agreement on the basis of the findings of the Joint Fuel Cycle Study.

If the High-Level Bilateral Commission agrees to the technical and economic feasibility and nonproliferation acceptability of pyroprocessing or enrichment based on certain criteria, the U.S. could give advance consent to these operations in South Korea. This would not require an amendment to the agreement. U.S. consent could be given through a so-called subsequent arrangement process.¹⁵

One issue was whether the two sides could agree in advance on a set of specific criteria, such as safeguards standards and approaches, on-line monitoring and extended containment and surveillance, etc., that, if met, would justify a U.S. decision for long-term consent. However, the U.S. could not accept such a restricted approach because, among other things, the U.S. Atomic Act requires that broader national security considerations be taken into account in approving requests for the reprocessing or enrichment of U.S. obligated materials. Section 131 of the AEA provides that the Secretary of Energy may not approve used fuel reprocessing or retransfers involving plutonium in excess of 500 grams unless, in his or her judgment and that of the Secretary of State, such reprocessing or retransfer:

...will not result in a significant increase of the risk of proliferation beyond that which exists at the time that approval is requested. Among all the factors in making this judgment, foremost consideration will be given to whether or not the reprocessing or retransfer will take place under conditions that will ensure timely warning to the United States of any diversion well in advance of the time by which the non-nuclear weapon state could transform the diverted material into a nuclear explosive device.

The U.S. would make the required determination based on factors such the kind of relationship the cooperating partner has with the U.S., its nonproliferation credentials, adherence by the cooperating partner to the various components of the international nonproliferation system and the overall implications a consent would have on efforts to prevent the proliferation of nuclear weapons and the spread of sensitive nuclear facilities. This means that any U.S. decision would have to take into account what effect South Korean acquisition of enrichment and/or pyroprocessing facilities would have on efforts to persuade North Korea to dismantle its nuclear weapons program, including its sensitive nuclear fuel cycle facilities.

Section 6.2 of the Agreed Minute recognizes these considerations by providing that the consultations conducted under the auspices of the High Level Bilateral Commission:

shall take into account all relevant considerations, including the specific characteristics of the technologies involved in such options (“Technologies”), in particular those considerations needed to ensure that

¹⁵ Under section 131 of the AEA, the term “subsequent arrangements” means arrangements entered into by any agency or department of the United States Government with respect to cooperation with any nation or group of nations (but not purely private or domestic arrangements) involving—

- (A) contracts for the furnishing of nuclear materials and equipment;
- (B) approvals for the transfer, for which prior approval is required under an agreement for cooperation, by a recipient of any source or special nuclear material, production or utilization facility, or nuclear technology;
- (C) authorization for the distribution of nuclear materials and equipment pursuant to this Act which is not subject to the procedures set forth in section 111b., section 126, or section 09b.;
- (D) arrangements for physical security;
- (E) arrangements for the storage or disposition of irradiated fuel elements;
- (F) arrangements for the application of safeguards with respect to nuclear materials and equipment; or
- (G) any other arrangement which the President finds to be important from the standpoint of preventing proliferation.

the deployment of such Technologies *will not result in a significant increase of the risk of proliferation* (italics for emphasis). These considerations include:

the technical feasibility of the Technologies evaluated in the Joint Fuel Cycle Study;
the economic viability of the Technologies evaluated in the Joint Fuel Cycle Study; and
the nonproliferation acceptability of the Technologies evaluated in the Joint Fuel Cycle Study,
such as:

the ability to effectively apply safeguards to the Technologies evaluated in the Joint Fuel Cycle Study;
the ability to ensure timely detection and early warning of diversion of nuclear material recovered through the facilities incorporating the Technologies; and
the ability of the Technologies evaluated in the Joint Fuel Cycle Study to deter or impede nuclear proliferation.

Section 6.3 of the Agreed Minute states that, “If these consultations identify an option for the management and disposition of spent fuel that involves reprocessing or other alteration in form or content of nuclear material subject to the Agreement and that the Parties agree in writing:

- a. is technically feasible, which may be demonstrated by a very high level of recovery of group actinides from irradiated nuclear material -- targeting a level to result in product and waste streams that can be licensed by the Parties’ respective regulatory authorities – through engineering-scale demonstrations, and the verification of performance and integrity of group actinide fuels through irradiation tests in the Joint Fuel Cycle Study;
- b. is economically viable, including consideration of the expected total lifecycle cost of the option, as evaluated in the Joint Fuel Cycle Study, 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;
- c. is effectively safeguardable, which may be demonstrated by the availability of mutually agreed safeguards approaches for facilities, to the extent safeguards are required by the applicable safeguards agreement referenced in Article 14 of the Agreement, developed jointly through bilateral collaboration between the Parties, or trilateral collaboration (among the Parties and the IAEA), in the Joint Fuel Cycle Study or elsewhere as appropriate;
- d. does not significantly increase the risk of proliferation and ensures timely detection and early warning of diversion, based on, inter alia, (1) features that deter or impede nuclear proliferation from the perspectives of both design and operation of facilities, and (2) the availability of mutually acceptable safeguards and other measures for timely detection and early warning (such as extended containment and surveillance measures and process monitoring based on sharing of information on the operation of facilities) developed jointly through bilateral or trilateral collaboration in the Joint Fuel Cycle Study; and
- e. avoids the buildup of stocks of group actinides¹⁶ in excess of an amount that is reasonably needed, based on a plan to utilize for transmutation the group actinides recovered from spent fuel subject to the Agreement, in particular as fuel in fast reactors; (Author’s note: This is a unique provision in U.S. agreements and reflects Washington’s emphasis on the importance of minimizing the world’s stocks of plutonium.) then the Parties shall seek, in accordance with their respective national laws and regulations, to establish written arrangements for the implementation of the provisions of paragraph 1 of Article 11 of the Agreement with respect to the identified option on a long-term, predictable and reliable basis in a manner that will further facilitate peaceful uses of nuclear energy in their respective countries.”

¹⁶ Actinides encompass the 15 metallic chemical elements with atomic numbers from 89 to 103 and include neptunium, americium and plutonium.

In addition, prior to decisions the parties are to consult together with the IAEA in order to confirm which of the safeguards approaches would be applied to the proposed facility and to develop the key elements of a safeguards arrangement mutually acceptable to the parties and to the IAEA for the implementation of that safeguards approach to be brought into force with respect to that facility.

USED FUEL STORAGE AND DISPOSAL

Article 9 of the agreement provides that the U.S. “shall consider such actions as are feasible to assist the Republic of Korea in the safe and secure management, including, but not limited to, storage, transportation, and disposal, of irradiated special fissionable material produced through the use of nuclear material or equipment transferred pursuant to this Agreement.”

The U.S. and the ROK have already been engaged in a program of cooperation to share experience and work jointly to develop practical solutions to the used fuel storage problem, including the use of dry casks. With the establishment of the working group on used fuel management, it is expected that the two sides will intensify information exchanges and experiences to help each other in finding solutions to the pressing needs of both interim used fuel storage and long-term waste disposal.

Both countries will need to find ways to relieve their near-term used nuclear fuel storage problems through interim storage of used fuel either at reactors or at some central or regional storage facilities. The major challenge in establishing used fuel storage facilities or final waste disposal sites lies less in scientifically and technically demonstrating their safety than in securing the willingness of state and local communities to host such sites.

On March 24, 2015 at the Bipartisan Policy Center, a think tank in Washington, Secretary of Energy Ernest Moniz made an announcement that DOE was moving to take steps to implement its plans to address America’s used nuclear fuel and waste management problems. He said that DOE plans to begin with the operation of a pilot interim storage facility, followed by the siting and licensing of a larger interim storage facility, and finally the siting and characterization of sites for one or more permanent geologic repositories. Most important, the strategy emphasizes the importance of a consent-based approach to nuclear waste management and disposal for all sites. Moniz pointed out that:

Real progress on the commercial side begins with the development of a pilot interim storage facility with an initial focus on accepting used nuclear fuel specifically from shut down reactor sites. Such a focus would provide an opportunity to build and demonstrate the capability to safely transport and store used nuclear fuel. A pilot interim site would also build trust among stakeholders, including any potential host community that would give its consent for the facility, as well as jurisdictions along transportation routes and communities with used fuel at reactor sites (Department of Energy).

The U.S. will employ a consent-based process to site one or more interim storage facilities for used fuel and one or more nuclear waste repositories. This means obtaining the support of the state and local communities for a storage or disposal site. In addition, two American private ventures are moving to build interim used fuel storage facilities in Texas and New Mexico and are seeking the support of the relevant states and communities.

South Korea is also faced with an urgent challenge in finding acceptable solutions to its used fuel storage problems. In 2013 the Ministry of Trade, Industry and Energy established the Public Engagement Commission on Used Nuclear Fuel Management (PECOS) to lead the public engagement and stakeholder consultation process. On June 11, 2015, PECOS recommended that South Korea should select a domestic site by 2020 for an underground laboratory that could conduct safety checks and provide temporary used fuel storage. The facility could become the site for a long-term storage facility, which would dispose of the country’s nuclear waste 1,640 feet underground and start operations from 2051 (Cho, S. Korea needs new facility for used fuel storage-advisory groups). Used fuel should be moved to reliable storage facilities before temporary storage capacity is exceeded or the operating permit of temporary storage facilities expires (International Panel on Fissile Materials). Progress on this issue will require greater efforts at educating the public on the safety of used fuel storage.¹⁷

¹⁷ For a discussion of South Korea’s challenges in winning public acceptance of used fuel storage and waste disposal sites, see Jungmin Kang, Seoc-Woo Kim, and Byong-Chul Lee titled “Hot potato in South Korea: The spent nuclear fuel storage dilemma,” *Bulletin of Atomic Scientists*, May/June 2015.

Another option for managing South Korea's used nuclear fuel would be to ship some of it to a third country for reprocessing. In Paragraph 3.2 of the Agreed Minute, the U.S. has given advance consent to retransfer used fuel for storage and reprocessing to France, the United Kingdom, and also to any other country or destination as may be agreed upon in writing by the parties, provided the material transferred is subject to the terms and conditions of the agreement for cooperation the recipient country has in effect with the United States.

In Paragraph 4.2 of the Agreed Minute, the U.S. has given consent to South Korea to the return to the ROK of nuclear material, i.e. plutonium and uranium, recovered from the used fuel provided that such material will be subject to the U.S.-ROK agreement for cooperation and will be transferred in the form and subject to physical protection arrangements as agreed in writing by the parties.

The ROK has given the U.S. the same advance consent to retransfer used fuel, although American industry has no plans to export any used fuel abroad for reprocessing.

Such consents are not unprecedented. The United States has given consent to Japan and Switzerland to retransfer U.S.-obligated used fuel to EURATOM for reprocessing and fabrication of MOX fuel elements and for the return of MOX fuel elements from EURATOM to Japan and Switzerland for use in specified facilities as part of their plutonium recycling programs. The United States also granted advance consent to transfer used fuel from the UAE and TECRO to EURATOM for reprocessing. Under these consent arrangements, the UAE and TECRO may not transfer any plutonium recovered from such reprocessing without the further consent of the United States. However, by giving advance approval to the return of the recovered plutonium to South Korea, the U.S. has accorded the same status to the ROK as it has to Japan and Switzerland.

The U.S. approval for the return of plutonium recovered from reprocessing in Europe to South Korea may raise proliferation concerns in the United States. However, these concerns may be mitigated by the fact that South Korea has no plans at the present to pursue off-shore reprocessing or to use plutonium. The ROK has established the Public Engagement Committee on Spent Nuclear Fuel to identify appropriate options for managing its used nuclear fuel. It also has a plan to develop pyroprocessing that foresees the use of transuranic waste mixture (TRUs), but it has no policy for recycling TRUs or direct disposal of spent fuel at the present time.

In addition, the U.S. must approve the physical protection arrangements for the shipment of plutonium from Europe to South Korea, and either party may suspend or withdraw in whole or in part its consent to such retransfers if it determines that one or more of the conditions for such consent is not satisfied, or if it determines that exceptional circumstances of concern from a nonproliferation or security standpoint so require.

ASSURED FUEL SUPPLY

One of South Korea's key programmatic objectives in negotiating the new agreement was to secure a nuclear fuel supply. In Paragraph 1 of Article 8 the United States commits "to endeavor to take such actions as may be necessary and feasible to ensure a reliable supply of low enriched uranium to the Republic of Korea." These include "the prompt issuance, subject to its domestic laws, regulations and licensing policies, of licenses for the export to the Republic of Korea of low enriched uranium and authorizations for the retransfer to the Republic of Korea of low enriched uranium resulting from the processing of nuclear material exported from the United States to third countries for processing into nuclear fuel for use in the Republic of Korea."

In addition, paragraph 1 section 7 of the Agreed Minute provides that the two parties may consult in the High Level Bilateral Commission with a view to identifying appropriate options for enrichment of uranium subject to the agreement. Paragraph 2 stipulates that these consultations shall take into account any relevant considerations raised by either party, in particular the technical feasibility, economic viability, effective safeguardability, and adequate physical protection of the options identified and whether or not the deployment of any equipment, components, or technology necessary to carry out such options will result in a significant increase of the risk of proliferation.

This section of the Agreed Minute also stipulates that, if the parties, having taken the considerations described above into account, jointly identify a mutually acceptable option for enrichment of uranium, "the Parties may establish written

arrangements applicable to that option, taking into account the Nuclear Suppliers Group Guidelines. Prior to granting consent to enrichment, the parties shall consult together with the IAEA in order to develop a safeguards approach and the incorporated key elements of a safeguards arrangement mutually acceptable to the Parties and to the IAEA, to be brought into force with respect to that facility.”

Thus the agreement leaves open the possibility of U.S. consent to enrichment of U.S.-obligated material in South Korea provided these criteria are met. Section 402 of the NNPA requires that the approval of enrichment of U.S.-obligated nuclear material shall be subject to the same procedures and criteria set out in section 131 described above.

SOUTH KOREA’S EXPORT COMPETITIVENESS

One of South Korea’s objectives in negotiating the new agreement with the U.S. was to promote the competitiveness of South Korea’s nuclear industry in global markets.

As already noted immediately above, the U.S. agreed in paragraph 1 of Article 8 to facilitate the retransfer of low-enriched uranium from South Korea to third countries. In addition, in paragraph 3 of section 3 of the Agreed Minute, the United States has given advance consent to the retransfer of unirradiated low enriched uranium, unirradiated source material, equipment and components to third country destinations it has identified, provided the receiving country agrees to hold the transferred items subject to terms and conditions of the agreement for cooperation with the United States. After entry into force of the agreement, the U.S. and the ROK will exchange lists of countries to which this advance consent applies.

Allowance is made for adding countries that do not have such agreements in effect, provided that country provides the U.S. necessary nonproliferation assurances through an exchange of diplomatic notes or other appropriate diplomatic arrangements. This advance consent means that South Korea will not be obligated to seek U.S. approvals on a case-by-case basis for retransfers of such materials and items to third countries. This should facilitate South Korean exports and thereby enhance its competitiveness in the global market.

The ROK has accorded the same advance consent to the United States to retransfer the same materials and items to third countries that South Korea has designated. Either party may suspend or withdraw in whole or in part this consent if it determines that one or more of the specified conditions is not satisfied, or if it determines that exceptional circumstances of concern from a nonproliferation or security standpoint so require.

This advance consent for retransfers should facilitate retransfers to third countries of items that are subject to the U.S.-ROK agreement and thereby enhance the competitiveness of South Korean nuclear industry in the global nuclear market.

NUCLEAR SECURITY

The agreement also provides for the establishment of a working group on nuclear security under the High-level Commission with a mandate to facilitate cooperation on nuclear security, including:

- Identifying ways to minimize the civil use of high enriched uranium and separated plutonium;
- Seeking ways to strengthen the global nuclear security legal framework, including outreach efforts to bring into force the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material;
- Strengthening the efforts on this issue of international organizations having a nuclear security as part of their mission, in particular the United Nations and the International Atomic Energy Agency;
- Cooperating in global nuclear security initiatives, including the Global Partnership against the Spread of Weapons and Materials of Mass Destruction and the Global Initiative to Combat Nuclear Terrorism;
- Enhancing regional and international cooperation to promote a nuclear security culture, including through the further development of Centers of Excellence;

- Addressing the emerging threat of cyber terrorism against nuclear facilities; and,
- Identifying best practices in the area of physical protection of nuclear materials and facilities.

Although not a fuel cycle issue as such, both countries have given a high priority to nuclear security, and taken on leadership roles on this issues, most notably by hosting the nuclear security summit. With the conclusion of the nuclear security summits in 2016, the bilateral cooperation envisaged by this working group takes on added importance.

CONCLUSION

Overall, the compromises reached on enrichment and pyroprocessing appear to be a win-win outcome for the two sides. The U.S. will be able to obtain sufficient information about the technical and economic feasibility of these technologies and acquire a full understanding of their proliferation implications before determining whether and under what conditions it may consent to enrichment and pyroprocessing. On the other hand, the U.S. did not say “no” to such operations for all time, and instead both countries set up a unique mechanism to ensure that the merits of the use of these technologies receive continuing high-level attention. In addition, the fact that the commission is composed of the Vice Foreign Minister of South Korea and the Deputy Secretary of Energy of the United States will ensure that the issues will not be lost in the lower rungs of the bureaucracy and will receive the priority attention of the two governments.

In the meantime the U.S. and the ROK will cooperate closely to grapple with their urgent needs to find solutions to their used fuel management problems. In addition, the working group on nuclear security will provide a forum for advancing an important issue for the two countries.

Importantly, the two governments were able to agree upon a mutually acceptable path forward. They resolved the issues that could be resolved and set up a mechanism for continued examination of those questions that were particularly knotty and premature to answer satisfactorily at the present time. Failure to have come to an understanding or to opt for another extension of the existing agreement would have inflicted serious damage to the relationship between these close allies.

THE NEW AGREEMENT: PROSPECTS FOR U.S.-ROK NUCLEAR COOPERATION

The new agreement for peaceful nuclear cooperation between the United States and the Republic of Korea should provide the basis for 1) increased nuclear trade between the two countries, 2) continued cooperation in nuclear safety, 3) enhanced collaboration in nuclear research and development, and 4) expanded cooperation in the international nuclear market.

The new agreement should also provide opportunities to advance mutual nonproliferation objectives by addressing the risks of nuclear proliferation and nuclear terrorism – issues that will be addressed in Chapter VII.

BILATERAL NUCLEAR TRADE

The agreement establishes the legal framework for trade in nuclear materials, equipment, components and technology. As such, it does not constitute a supply commitment but is an enabling document that permits but does not obligate the parties to export nuclear materials and equipment to each other. It will be up to Korean and American nuclear industries to take advantage of the potential for collaboration provided by the proposed new agreement. The agreement also constitutes a political foundation that should help foster enhanced cooperation between the governments, nuclear industries, laboratories, research institutes and academic institutions of the two countries.

Article 2 of the new agreement provides for the mutual exchange of nuclear materials, equipment and technology between the United States and South Korea and thus transforms the one-sided nature of the existing agreement with the U.S. as the exporter and the ROK as the importer. This evidences South Korea's enhanced stature in the nuclear energy field both domestically and internationally and reflects the fact that the ROK has already become an important supplier to the American nuclear industry.

The United States has been a major nuclear supplier to the South Korean nuclear industry for decades. A total of 19 of South Korea's existing 24 reactors—along with those under construction, on order, or planned—are based on U.S. technology (Lipman). Although the percentage of U.S. content in South Korean nuclear power projects has declined over the years, as South Korean content has increased, Westinghouse and other U.S. nuclear companies remain important suppliers to the ROK of instrumentation and control equipment, and other major components such as reactor coolant pumps and reactor vessel internals, as well as technical and engineering services (Holt).

South Korean firms are providing key components to the eight Westinghouse AP1000 reactors under construction in the United States. The two Westinghouse AP1000 reactors currently under construction in South Carolina will use reactor vessels and steam generators from Changwon, condensers from Sacheon, demineralizers and heat exchangers from Ansan, and valves from Cheonan (Lipman). Since 2006–2007, South Korean content in U.S. nuclear plants has become greater than U.S. content in South Korean plants.

The new agreement will enhance opportunities for nuclear trade between the two countries. While the domestic companies of each country are likely to satisfy the bulk of their own large industrial orders, the new agreement will facilitate access to each other's nuclear industries as an important supplementary source of equipment, components and technology. Improved access to the full array of equipment, components and services should help both countries meet their domestic and international nuclear power objectives.

Forging a broader, more practical, and equal partnership on civil nuclear projects should strengthen the ability of the two countries to work together on these goals.

NUCLEAR SAFETY

The new agreement will enable continued and strengthened collaboration between the U.S. Nuclear Regulatory Commission, the Korean Institute of Nuclear Safety, and the Korean Nuclear Safety and Security Commission. Article 3 of the agreement calls for cooperation on research, development and demonstration on nuclear safety. The agreement contains several provisions dealing with nuclear safety. Article 18 calls for consultation on the development of further cooperation in the field of the peaceful uses of nuclear energy, including nuclear safety.

The working group on spent fuel management has the task of developing advanced technologies for minimizing the impact of spent fuel management on the environment, public health, and safety and cooperating on the effective implementation of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. Paragraph 4 of the Agreed Minute calls for safety issues to be continued to be addressed through cooperation and consultation between the appropriate nuclear regulatory organizations of the two countries.

One recent analysis (Scott Snyder) argued that “U.S.-ROK cooperation on nuclear safety is currently the most valuable dimension of nuclear partnership between the two countries that is enabled by the nuclear cooperation agreement.” The authors of that analysis point to the recent debate about re-licensing the Wolsong nuclear power station in South Korea as evidence that “the safe operation of nuclear reactors is arguably the most important issue for the Korean public as they evaluate dependence on nuclear power.”

Another study (McGoldrick, Einhorn and Kim) concluded that recent scandals involving steam generator tube and main condenser tube failures, and the installation of safety-related control cabling with falsified documentation, could damage South Korea’s export prospects. South Korea’s use of U.S.-based technology and the involvement of U.S. personnel in South Korea’s domestic nuclear industry and exports may help enhance Seoul’s nuclear competitiveness, given that other nations not only look to the United States industry for operational experience, but also see the NRC as setting the international gold standard for safety and physical security regulation. Korea Hydro & Nuclear Power Co. has submitted an application to the U.S. NRC for certification of its APR1400 reactor design for licensing in the United States. The NRC’s certification of the South Korean reactor could not only help to enhance the reputation for safety of Seoul’s nuclear exports but could also possibly lay the groundwork for South Korean reactor exports to the United States.

R&D COLLABORATION

While the new U.S.-ROK agreement could strengthen nuclear ties between the two countries in the next few years, the more significant benefits of an agreement may emerge over the long run as the two countries seek to develop a broader technical agenda in the field of nuclear energy and research and nonproliferation development.

South Korea and the United States have enjoyed a long and fruitful bilateral relationship in nuclear research and development. Both countries also participate in a range of international R&D efforts.

The American Nuclear Society (ANS) and the Korean Nuclear Society (KNS) have had a longstanding professional collaboration to promote the safe and secure use of nuclear technology and materials.

Although the two countries have collaborated on a wide range of subjects, including waste storage and disposal, environmental protection, safety, and regulatory matters, the predominant focus has been on the development of a fast reactor fuel cycle utilizing pyroprocessing to recover energy from spent fuel.

In the early 1980s, the American and South Korean governments established the Joint Standing Committee on Nuclear Energy Cooperation to provide a forum for exchanging views on nuclear R&D and other nuclear energy issues. In the 1990s, KAERI conducted a joint research program with DOE national laboratories and Atomic Energy of Canada Limited on the DUPIC fuel cycle (direct use of PWR spent fuel in CANDU reactors, in which light water reactor spent fuel would be made into CANDU fuel without reprocessing). In 2002, the U.S. and the ROK undertook studies on pyroprocessing, in which U.S. and ROK scientists engaged in joint pyroprocessing experiments involving used nuclear fuel at U.S. laboratories.

In 2011, the U.S. and South Korea agreed to a 10-year Joint Fuel Cycle Study (JFCS) on pyroprocessing, in which KAERI scientists would conduct spent fuel separation work at the Idaho National Laboratory and other U.S. facilities, while work in South Korea would be restricted to simulated material. The purpose of the JFCS is to explore the technical and economic feasibility and proliferation implications of the electrochemical recycling process and of other spent fuel management options.

Argonne National Laboratory and KAERI signed an MOU on August 25, 2014, covering “a broad field of technical cooperation on nuclear science and technology.” KAERI’s Sodium-Cooled Fast Reactor Development Agency has provided \$6.78 million funding to date for Argonne’s contributions to the development of a Prototype Generation-IV Sodium-Cooled Fast Reactor (PGSFR). The PGSFR is a 400 MWth, 150 MWe, advanced sodium-cooled fast reactor that incorporates many innovative design features; in particular, metal fuel, which enables inherent safety characteristics. With Argonne support, KAERI is developing the reactor system while the Korean engineering and construction firm KEPCO E&C is designing the balance of the plant. The PGSFR Project aims to secure the Korean licensing authority’s design approval by the end of 2020, and the schedule calls for PGSFR to be commissioned by the end of 2028 (Hardin, Argonne, KAERI to develop prototype nuclear reactor).

The metal fuel technology base was developed at Argonne in the 1980s and ‘90s: its inherent safety potential was demonstrated in the landmark tests conducted on the Experimental Breeder Reactor-II in April 1986. They demonstrated the safe shutdown and cooling of the reactor without operator action following a simulated loss-of-cooling accident. The Argonne-KAERI collaboration on PGSFR was established following the U.S. Government authorization of the 10 CFR Part 810 request to transfer sodium-cooled fast reactor and low-enriched uranium fuel technology to the Republic of Korea (World Nuclear News). This partnership will benefit from the research experience of both the U.S. and South Korea in sodium fast reactors using metallic fuels as well as pyroprocessing.

Fast reactor technologies offer the potential for providing more efficient utilization of uranium, improving waste management by consuming long-lived transuranic elements in spent fuel, and incorporating passive safety features. However, the development of fast reactors in the U.S. has been controversial, and their commercialization present a number of technical and cost problems as well as proliferation challenges.

The International Nuclear Energy Research Initiative (I-NERI), which began in the early 2000s, led to over 40 collaborative research projects between South Korea and the U.S. Most of the current projects focus on next generation reactors and advanced fuel cycles. Within the Generation IV International Forum (GIF), an endeavor to organize and coordinate international research efforts on future reactor concepts, the U.S. and South Korea have worked primarily on very high temperature reactors (VHTR) and sodium fast reactors, one of the key elements of Korea’s envisioned closed fuel cycle (Global America Business Institute).

DOE conducts a number of programs to promote nuclear energy as a viable energy source and to support R&D activities aimed at resolving the technical, cost, safety, waste management, proliferation resistance, and security challenges of using nuclear energy (Lyons). DOE’s major nuclear R&D programs include reactor concepts research, development and demonstration, next generation nuclear plants, light water reactor sustainability, and waste management (Department of Energy).

The new civil nuclear agreement offers the potential for cooperation in all these areas between DOE and its laboratories and the ROK’s corresponding institutions.

Article 3 of the agreement provides that the parties will cooperate in a broad range of areas, including transportation, used fuel storage and disposition as next generation nuclear energy systems including: advanced nuclear fuel cycle technology, safeguards and physical protection; controlled thermonuclear fusion including in multilateral projects; design and manufacture of nuclear fuels; development, design, construction, operation, maintenance and use of reactors; reactor experiments; and, decommissioning.

Perhaps most importantly, the new nuclear cooperation agreement will strengthen collaboration in areas that are of increasingly urgent importance to both countries, namely identifying and implementing options for interim storage of used nuclear fuel and long-term waste disposal. Secretary of Energy Ernest Moniz recently announced that the U.S. Department

of Energy is beginning a search for an interim facility to consolidate and store spent fuel from commercial nuclear power plants until a permanent waste repository becomes available. The commercialization of pyroprocessing and associated fast reactors will not be available options for dealing with South Korea's spent fuel on a large scale for several decades. South Korea will need more storage capacity whether it pursues pyroprocessing or not. The U.S. and the ROK are already examining prospects for the long-term storage of spent fuel. The new agreement elevates the importance of this issue by identifying it as one of the key areas to be addressed by the High-Level Commission. Moreover, South Korea and the United States will eventually need to identify a final disposal option for their nuclear wastes, a highly contentious issue in both countries. Thus, the siting and characterization of geological repositories may be a particularly fruitful area for joint study and cooperation by the two governments.

COLLABORATION IN THIRD MARKETS

The new agreement could help promote collaboration between Korean and American companies in global nuclear markets and facilitate retransfers of nuclear materials, equipment and technology subject to the agreement to third countries.

In 2009, a consortium led by KEPCO won a contract from the UAE to construct four nuclear power reactors. The consortium includes Westinghouse Electric Company, and Westinghouse along with other U.S. companies are providing design, technical support services, consultation on licensing issues, and the provision of control equipment, instrumentation, and major components as well as engineering, construction management, training, legal, regulatory, environmental, and other services to the UAE project (Lipman). South Korean companies are supplying key equipment to Westinghouse reactors under construction in China.

As a recent study concluded, (McGoldrick, Einhorn and Kim) while the U.S. and South Korea are competitors in the international nuclear market, a number of factors may favor collaboration by the two countries in pursuing nuclear sales in third countries. These include: common technology; minimal language barriers; the long-standing familiarity between the two industries, especially between KEPCO and Westinghouse; the use the same codes and standards from the American Society of Mechanical Engineers; common use of NRC licensing practices; and the Bechtel system of engineering. Project implementation is also similar in both countries. Such commonalities should ease cooperation between the U.S. and ROK industries.

In addition, the relative strengths of one country's nuclear industry may compensate for the weaknesses of the other. The ROK's strong manufacturing capabilities of major components; the integrated nature of its industry; its good track record for construction, operation, and maintenance; the consistency of its government policy; its strong nuclear infrastructure; and the financial and political support it receives from the ROK government may compensate for the sharp decline in some U.S. manufacturing capabilities. On the other hand, the United States' strengths in safety may help compensate for the reputational damage that the ROK industry has recently taken in that area. In addition, American record in areas such as advanced reactor design, safety, the provision of high precision products, and a proven record in constructing reactors in the global market could complement ROK capabilities. Furthermore, the political, economic, and strategic relationship that the two countries enjoy with each other may prove advantageous in winning contracts in some countries (Chen Kane).

Moreover, the U.S. and South Korea have strong strategic reasons for collaborating for projects in third countries as they will face fierce competition from Russia, which has many advantages in exporting its nuclear technology—its vertically integrated industry, strong support from government, political pressure, aggressive financing, and its spent fuel take-back policy. China is also likely to be a major force in the international market in the longer term. The U.S. and the ROK should strengthen their civil nuclear collaboration in the global nuclear market to provide a counterbalance to Russian and Chinese influence in this key strategic area (McGoldrick, Einhorn and Kim).

As described in Chapter V, the agreement contains provisions for facilitating such collaboration in third countries by giving long-term consent to the retransfer of nuclear materials and equipment to third countries.

The U.S. has also recently taken steps to facilitate retransfers of U.S.-origin technology from South Korea to third countries by reforming its regulatory process (10 *CFR* part 810) governing approvals of transfers and retransfers of U.S.-origin

technology. On February 23, 2015, DOE published a long-awaited revision to its Part 810 regulation. Most nuclear technology exports are “generally authorized,” i.e., they may be transferred from the United States without a specific authorization from the Secretary of Energy. However, transfers to certain countries and exports of sensitive nuclear technology, such as enrichment and reprocessing, do require the “specific authorization” of the Secretary of Energy.

Perhaps the most important change to the new Part 810 is that a large number of countries that were generally authorized under the old Part 810 will now require specific authorization under the new Part 810. However, many countries have no change in their status, including 44 major nuclear trading partners, such as the EURATOM, the Republic of Korea, and Japan. Thus most nuclear technology exports to South Korea remain generally authorized with the new revision to Part 810. In addition, nuclear technology exports to Kazakhstan, Croatia, Vietnam, the United Arab Emirates and Ukraine will no longer require specific authorization.

Although the new Part 810 increases the number of countries requiring specific authorization, virtually all of them have no nuclear programs and do not engage in nuclear trade—the major exceptions being China, Russia and India who will continue to require specific authorization from DOE. Even though these three countries have peaceful nuclear cooperation agreements with the United States, the U.S. has concerns that they do not adequately separate their civil nuclear activities from their military nuclear programs.

The change in reclassification is, therefore, unlikely to have a negative impact on the ability of the U.S. to export nuclear technology to South Korea or on the ability of the ROK to re-export U.S. nuclear technology to third countries.

More importantly, DOE is taking steps to address long-standing complaints that the Part 810 approval process has been both onerous and time-consuming. In particular, DOE has initiated a “process improvement program” (PIP) to make the Part 810 authorization process more transparent, orderly, and efficient in order to reduce specific authorization processing time. DOE also plans to create a guide to Part 810 and an electronic application and tracking system.

The changes to Part 810 will hopefully help to streamline the approval process and thereby facilitate exports of U.S. nuclear technology to South Korea. How effectively they will do this, however, will depend crucially on how successful DOE is in implementing the process improvement program.

THE OVERALL STRATEGIC AND STRATEGIC IMPORTANCE OF THE NEW U.S.-ROK AGREEMENT

The new agreement between the United States and the Republic of Korea will have wide ranging benefits beyond the obvious ones of facilitating civil nuclear trade and strengthening the commercial ties between the two countries. The conclusion of the agreement will strengthen the political and strategic alliance between the two allies, promote mutually shared nonproliferation, nuclear security and nuclear safety objectives, enhance American and Korean influence on the global expansion of nuclear power, and help tackle problems of climate change.

THE NEW AGREEMENT AND THE ALLIANCE

The United States and the Republic of Korea have been close strategic allies for several decades. The alliance between the two countries has helped maintain the balance of power in Northeast Asia and has served as a bulwark against threats from nuclear-armed North Korea. Kurt Campbell, former Assistant Secretary of State for Asia has been quoted as saying, “The fulcrum issue in Asia is the role of South Korea” (Ignatius).

The nature and importance of the ties between the two nations were underscored by the presidents of the two countries during their summit meeting in April 2014.

Among other things, President Obama said:

- The Republic of Korea is one of our strongest allies in the world;
- Our alliance remains a linchpin of security in Asia. Beyond this peninsula, our alliance is increasingly a global one;
- Our alliance will continuously strengthen its role as a linchpin for peace and stability in the Asia Pacific region and also contribute to the people of the U.S. and Korea and the world;
- With respect to some of the other issues in East Asia, the United States’ position has been clear and consistent throughout. We consider ourselves a (sic) Asia Pacific power; and,
- We will make sure that freedom of navigation and other principles that have underwritten the prosperity of the Asia Pacific region and the growth in trade and commerce of this region continue and we’ll continue to project ourselves in the Pacific to ensure that that continues (White House, Office of the Press Secretary).

In his address to the Business Roundtable on April in Seoul, president Obama added,

“...what we want to do is to underscore the fact that, as important as the security relationship and the alliance is between the Republic of Korea and the United States, what is also important is the incredible and growing economic ties that are creating jobs and opportunity in both countries” (U.S. Embassy Seoul).

Key members of Congress have voiced their appreciation of the political, economic and strategic importance of the U.S.-ROK nuclear relationship.¹⁸

¹⁸ See the statement of Congressman Ed Royce, Chairman of the House Foreign Affairs Committee at <http://foreignaffairs.house.gov/press-release/chairman-royce-bill-strengthen-us-south-korea-relations-passes-house>, and the statement of Senator Bob Corker, Chairman of the Senate Foreign Relations Committee at <http://foreignaffairs.house.gov/press-release/chairman-royce-bill-strengthen-us-south-korea-relations-passes-house>.

At their joint press conference, South Korean president Park Geun-hye reiterated these views:

I firmly believe that President Obama's Asia trip demonstrates his strong commitment toward his policy of rebalancing toward the region and his pledge to implement the commitment.

As the U.N. Security Council member, South Korea stands side by side with the U.S. to resolve any major issues undermining peace and stability in the global community. Another important pillar of our alliance is practical cooperation in economic, social and cultural sectors. This topic has continued so far and will continue. KORUS FTA will, together with the U.S.-ROK mutual defense treaty, have become two major linchpins of our alliance. We plan to expand mutual beneficial cooperation based on KORUS FTA...

Our alliance will continuously strengthen its role as a linchpin for peace and stability in the Asia Pacific region and also contribute to the people of the U.S. and Korea and the world.

KORUS FTA¹⁹ will, together with the U.S.-ROK mutual defense treaty, have become two major linchpins of our alliance (White House, Office of the Press Secretary).

The new peaceful nuclear cooperation will add another important pillar underpinning the alliance. It will reaffirm the central nature of partnership between the two countries by establishing a strengthened and modernized framework for cooperation in the strategically important area of nuclear power development. It will also add another layer to the strong U.S. commitment to rebalancing its policy toward the Asian region.

One analyst has argued that energy adds an important new intermediary approach between "hard power" (coercive means such as military force) and "soft power" (less aggressive means of persuasion, such as diplomacy, economic aid, and propaganda to promote a country's national interests). "As an alternative to hard power, energy power communicates the United States' seriousness of intent, but without inviting the perils of military action; as an alternative to soft power, it provides a degree of leverage not available from diplomacy alone." He goes on to argue that the U.S. has exhibited an eagerness to increase reliance on energy power as an instrument of foreign policy for several reasons, including the reluctance to resort to hard power, especially against major powers, dissatisfaction with soft power alone, and so seeks more potent tools of influence amidst growing fears about energy security and the safety of international supply networks. One way energy power can be used is to bolster ties with a geostrategic partner, as in the nuclear agreement forged between the United States and India (Klare).

The new peaceful nuclear cooperation agreement with the ROK serves the same purpose.

THE NEW AGREEMENT AND U.S-ROK POLITICAL RELATIONSHIP

The political nature of the civil nuclear relationship between the two countries is also important. South Koreans had come to believe that the one-sided and unbalanced nature of the existing U.S. peaceful nuclear cooperation agreement has meant that the U.S. has been treating the ROK as junior partner in its civil nuclear matters. The new agreement will be reciprocal in nature and will impose the same conditions on ROK exports of nuclear materials and equipment to the United States as it does on U.S. nuclear supplies to South Korea. In this respect the agreement will both strengthen nonproliferation controls on nuclear cooperation and will greatly diminish the one-sided and discriminatory nature of past nuclear cooperation between the two countries.

The new agreement should constitute another important symbol of a close and enduring bilateral relationship and send a clear message that the United States regards South Korea as full and equal collaborator, no longer a junior partner.

¹⁹ The United States and the Republic of Korea signed the United States-Korea Free Trade Agreement (KORUS FTA) in 2007 and entered into force in 2012. The U.S. regards As the first U.S. FTA with a North Asian partner, the KORUS FTA is a model for trade agreements for the rest of the region, and underscores the U.S. commitment to, and engagement in, the Asia-Pacific region.

The United States has modernized peaceful nuclear cooperation agreements with all the major civil nuclear powers countries. The updated and balanced nature of the new U.S.-ROK civil nuclear pact will put the ROK on par with other key U.S. allies and major nuclear powers. The new agreement should also go a long way in demonstrating a U.S. recognition of South Korea's growing status as a major civil nuclear power including its role as an increasingly important commercial exporter to the global nuclear market.

THE NEW AGREEMENT AND NONPROLIFERATION

It is axiomatic that some of the material and equipment that can be used for peaceful nuclear development can also be applied to nuclear weapons and that effective controls have to be placed on peaceful nuclear trade to ensure against its use for nuclear explosive or military purposes. The non-proliferation conditions required by governments on their civil nuclear trade are not only vital to their national security interests but are also absolutely essential to the long-term stability of nuclear trade. A world with many nuclear-weapon states is a threat not only to international security but also to the development of peaceful nuclear commerce.

In the early decades of the nuclear era, the United States enjoyed an effective monopoly on civil nuclear energy. This status enabled the United States to play a crucial role in establishing the major elements of the nonproliferation regime. Today, the role of the U.S has declined significantly, and it can no longer unilaterally prescribe the rules for international nuclear trade, but must work with like-minded states like the ROK to help shape the global nuclear trade regime. To play a significant role in the international marketplace, U.S. nuclear industry will have to enter into alliances with key foreign suppliers such as the ROK. The growth of South Korea's commercial nuclear program and the ROK's emergence as an important nuclear exporter puts South Korea in a key position to work with the United States in establishing high standards and norms for nuclear nonproliferation, security and safety.

The ROK and the United States share a strong interest in ensuring that civil nuclear trade does not lead to the spread of nuclear weapons. The two countries have a long history of working together to strengthen the various components of the global nonproliferation regime, including the NPT, IAEA safeguards, and the multilateral nuclear export control mechanisms: and the guidelines of the Zangger Committee and the Nuclear Suppliers Group. South Korea has become a key nonproliferation partner for the United States in Asia, particularly since hosting the 2012 Nuclear Security Summit.

As President Park Geun-hye said in her address to the U.S. Congress in May 2013:

Following the Washington conference in 2010, Seoul hosted the 2nd Nuclear Security Summit last year. There we reaffirmed our commitment to the vision of "a world without nuclear weapons.

'A world without nuclear weapons'—President Obama's vision—must start on the Korean Peninsula. For the Peninsula is home to the only divided nation-state and directly faces the threat of nuclear weapons. It is an ideal test-bed for a future free of nuclear arms. If we can pull it off on the Korean Peninsula, then we can pull it off anywhere else.

Korea has been pursuing the peaceful use of nuclear energy. It is also firmly committed to the principle of non-proliferation. Korea and the United States are partnering to build reactors in third countries. In this regard, we need a modernized, mutually beneficial successor to our existing civil nuclear agreement (Geun-hye).

The U.S.-ROK agreement has the potential to not only boost civil nuclear trade between the two countries, but also to influence the development of nuclear power worldwide along paths that strengthen global nonproliferation, nuclear safety and nuclear security standards.

The proposed peaceful nuclear cooperation agreement between the U.S and the ROK sets a high nonproliferation standard for peaceful nuclear cooperation. Former Deputy Secretary of Energy Daniel Poneman has maintained that American peaceful nuclear cooperation agreements provide "the world's strongest framework agreements for peaceful nuclear cooperation." He added, "They set the global nonproliferation standard, thereby discouraging a nonproliferation 'race to the bottom,' in which potential partners negotiate peaceful nuclear cooperation agreements with suboptimal nonprolifer-

ation controls. No government requires more stringent nonproliferation conditions than the United States.” He also said, “The more such agreements that exist in the world, the stronger the nonproliferation controls that will apply to all nuclear commerce. Consequently, it is in the U.S. national security interest to maximize the number of countries with which the United States has peaceful nuclear cooperation agreements. Because U.S. standards are the highest in the world, by concluding new agreements, we bring our nonproliferation standards to the partner country, and thereby enhance U.S. national security” (Poneman).

From the U.S. point of view, the new agreement ought to serve as a model for the nonproliferation controls and assurances that should be an essential part of peaceful nuclear cooperation agreements between all countries. From the South Korean point of view, given the strict nature of U.S. nonproliferation requirements for peaceful nuclear cooperation, the conclusion of the agreement should serve as a validation of Seoul’s nuclear nonproliferation credentials.

The new agreement also contains specific provisions that should strengthen the nonproliferation regime. One of these is the commitment of both parties to accept the Additional Protocol (AP) to their IAEA safeguards agreement as a condition of nuclear cooperation under the agreement. The AP, which the IAEA Board adopted in 1997, expands the IAEA’s authority and practices to gain increased information about, and access to, a state’s nuclear activities and greatly enhances its ability to detect illegal, clandestine activities.

The U.S. and others have sought to promote universal acceptance of the AP and its recognition as the international safeguards norm in various international fora such as the NPT Review Conference, the IAEA General Conference and the Nuclear Suppliers Group. However, some states continue to take the position that acceptance of the AP is a voluntary matter, and is not required as a condition of trade. The United States has required cooperating partners to adopt the AP only in some recent agreements, and South Korea has not made the adoption of an IAEA additional protocol a condition for its nuclear exports, but has said it will support this requirement if the NSG endorses it (Chen Kane) (Hibbs).

Requiring the AP as a condition of supply in their own bilateral nuclear relationship would serve as a model for all states to endorse the AP as the verification standard under article III of the NPT and as the IAEA standard for all non-nuclear weapon states. The two countries should use this template in their future agreements with other states, particularly in countries where the U.S. engages in joint collaboration in providing civil nuclear assistance to third countries.

Also of particular importance will be how the new agreement will affect the issue of minimizing the risks of the spread of sensitive nuclear technologies. The agreement recognizes concerns regarding the proliferation of enrichment and reprocessing and has set up a mechanism to address those in the South Korea context. A key question will be how the implementation of the new agreement will affect the controversial issue of enrichment and the recycling of plutonium for civil use not only in South Korea but globally. In evaluating the results of the Joint Fuel Cycle Study, the two countries will face the challenge of deciding on a course of action that ensures the fuel cycle choice in the ROK not only fulfills Korean nuclear power needs, but truly meets a high standard of proliferation-resistance and simultaneously avoids setting a precedent for other states to acquire their own sensitive nuclear facilities.

In the long run the agreement can also foster collaboration in the development of advanced, proliferation-resistant nuclear reactors and fuel management technologies. Argonne National Laboratory and the Korea Atomic Energy Research Institute (KAERI) are collaborating to develop the Prototype Generation-IV Sodium-cooled Fast Reactor (PGSFR) (Hardin). Fast spectrum reactors are uniquely capable of generating energy while consuming long-lived waste. However, one of the main challenges will be to design such reactors in such a way that they do not create unacceptable risks of proliferation.

Finally, the new peaceful nuclear cooperation agreement will strengthen South Korea’s commitment to nonproliferation. Some observers have speculated on the circumstances that could lead Seoul to try to develop nuclear weapons (Ferguson) (Santoro) (Colby). In addition, from time to time, conservative South Korean politicians have called for the ROK to develop nuclear weapons to counter North Korea’s growing nuclear threat, and public opinion polls have favored the acquisition of nuclear weapons particularly when taken in response to North Korea’s provocative actions such as its nuclear weapons tests. However, these views do not represent Korean government thinking or policy. South Korea has demon-

strated its strong legal and political commitments to abstain from acquiring nuclear weapons and has taken a leading role in supporting the global nonproliferation regime.

Further, U.S. security assurances and the U.S.-ROK mutual defense treaty are vital to Seoul's security. These U.S. commitments would be placed in grave jeopardy if South Korea were to seek a nuclear weapons capability, leaving South Korea far more vulnerable than it is without nuclear weapons. In the absence of radical changes in the regional security arrangements in East Asia, the ROK's interest in acquiring nuclear weapons would appear implausible. Nevertheless, the new peaceful nuclear cooperation builds on existing barriers to proliferation by requiring a range of binding South Korean nonproliferation commitments to the U.S., the violation of which would have profoundly negative effects on the U.S.-ROK relationship in general and on the ROK's civil nuclear program in particular.

THE NEW AGREEMENT AND NUCLEAR SAFETY

The U.S. Nuclear Regulatory Commission (NRC), the Korean Institute of Nuclear Safety (KINS), and the Korean Nuclear Safety and Security Commission (NSSC) already cooperate extensively in the nuclear safety field. The new agreement will provide the framework for strengthened collaboration in nuclear safety. This will be of benefit to both countries as they share experiences in upgrading nuclear safety standards and practices in the post-Fukushima environment. But as already noted, it could be of particular benefit to South Korea's domestic nuclear industry in light of the considerable public hostility towards nuclear power in South Korea following the 2011 Fukushima disaster as well as corruption scandals in its domestic nuclear industry.

One analysis has suggested that, "U.S.-ROK cooperation on nuclear safety is currently the most valuable dimension of nuclear partnership between the two countries that is enabled by the nuclear cooperation agreement" (Scott Snyder, Safety and Science Drive U.S.-South Korean Nuclear Cooperation).

The U.S. NRC nuclear safety standards are considered the gold standard for nuclear regulators around the world and U.S. nuclear companies are known for process excellence, human performance and safety culture. South Korea's use of U.S.-based technology and the involvement of U.S. personnel in South Korea's domestic nuclear industry and exports may help enhance Seoul's nuclear competitiveness, since other nations not only look to the United States industry for operational experience, but also see the NRC as setting the international gold standard for safety and physical security regulation (Bipartisan Policy Center).

The Korea Electric Power Corporation (KEPCO) and Korea Hydro and Nuclear Power (KHNP) have begun the process of seeking NRC approval for the APR1400 design in 2013, by submitting a revised version of its application in December 2014. The NRC has completed an acceptance check and ruled that the revised application is sufficiently complete for it to undertake a full design certification review. The design certification process determines whether a reactor design meets U.S. safety requirements, independent of any specific site or plan to build. It is a required step before a reactor design can be built in the United States (World Nuclear Association News).

The NRC's certification of the South Korean reactor could improve the confidence of the Korean public in the safety of this reactor and help to enhance South Korean nuclear exports' reputation for safety. It could also potentially open the door to export of this reactor to the American market.

THE NEW AGREEMENT AND NUCLEAR SECURITY

The U.S. and South Korea have played leadership roles in strengthening the global nuclear security regime. Both are active participants in the Global Initiative to Combat Nuclear Terrorism and the Global Partnership against the Spread of Weapons and Materials of Mass Destruction. In addition, the U.S. hosted the first Nuclear Security Summit in Washington in 2010, and the ROK held the second one in Seoul in 2012. Both participated in the third summit in 2014 in The Hague, and they will take part in the final summit in the United States in 2016.

The new U.S.-ROK peaceful nuclear cooperation agreement has established a working group on nuclear security under the high-level bilateral commission. This new bilateral mechanism should strengthen collaboration in this vital area in a variety of ways. DOE and the ROK's Custom Service already work together to scan containerized cargo at the port of Busan to detect and interdict illicit transfers of special nuclear and other radiological materials; conduct joint safeguards and security training with Korea's new Center of Excellence, the International Nuclear Security Academy (INSA) at the Korea Institute of Nuclear Nonproliferation and Control (KINAC); are developing a national nuclear forensics library with KINAC and the Korea Atomic Energy Institute (KAERI); and provide nuclear forensics training through the ASEAN Regional Forum (Korea Institute of Nuclear Nonproliferation and Control) (Nuclear Threat Initiative).

As discussed above, the new agreement should enhance the opportunities for the nuclear industries to partner in providing nuclear equipment components, services and technology to nuclear projects third countries. This collaboration should provide opportunities the governments and industries of both countries to further nonproliferation, security, and safety objectives.²⁰

THE NEW AGREEMENT AND CLIMATE CHANGE

While many groups continue to oppose nuclear power, an increasing numbers of environmentalists and climate scientists are arguing that nuclear energy must be developed quickly to slow the growth of carbon dioxide emissions. The governments of both the United States and the Republic of Korea are committed to combating global warming and both see nuclear power as an important means of contributing to this goal.

Nuclear power has been an important component of South Korea's National Strategy for Green Growth, a policy aimed at promoting both economic growth and environmental protection. In August 2008, the administration of then South Korean President Lee Myung-bak chose nuclear energy as an essential engine in its National Green Growth Strategy and as a practical tool to achieve economic growth, energy security, climate change goals, and job creation (Kim).

His successor, Park Geun-hye, pledged while a candidate to support her country's nuclear reactor industry in overseas markets as Korea's new growth engine (Kim).

After her inauguration, she announced that South Korea would continue to follow its current nuclear energy plan, while focusing on nuclear plant safety. The Park Geun-hye Administration decided that securing alternative energy sources is difficult, and renewable energy is inefficient (Lee). President Park Geun-hye told a UN climate summit in New York in September 2014, "Climate change is the greatest challenge of the 21st century," and urged delegates to see environmental action as an opportunity not a burden (Mundy).

During their joint press conference in April 2014, President Park Geun-hye and President Obama noted that the two countries are working closely on new clean energy technologies to address climate change and with the international community on an ambitious new climate agreement. Korean and American companies and experts have strengthened cooperation in clean energy.

In his April 5, 2009 speech in Prague, President Obama said, "We must harness the power of nuclear energy on behalf of our efforts to combat climate change." The Obama administration is pursuing an 'all of the above' energy policy and a commitment to reduce carbon emissions from the electric power sector.

In his remarks at the IAEA International Conference on Nuclear Security on July 1, 2013, U.S. Secretary of Energy Ernest Moniz said:

In the past two weeks, President Obama has given major speeches on two of the greatest challenges facing us today: in Berlin on nuclear security and in Washington on climate change.

These topics are linked by more than timing; nuclear energy is a key part of addressing climate change,

²⁰ For various ways in which in which the two countries could promote nonproliferation, nuclear security and safety, see Fred McGoldrick et al. op.cit.

and ensuring nuclear security is integral to the expansion of carbon-free nuclear generation.

President Obama has laid out an ambitious plan to reduce carbon pollution and begin combating the effects of a warming planet.

With energy demand increasing rapidly in India, China, throughout parts of Africa, and elsewhere around the globe, the need for clean energy is rising like never before.

Nuclear energy can and should be part of the solution. But if we are to take advantage of nuclear energy as part of a low-carbon economy, we must also address the challenges of nuclear security (Moniz).

In his remarks at the 2014 IAEA General Conference, U.S. Secretary of Energy Ernest Moniz said:

Responding to the conclusive findings of the global scientific community, President Obama announced his Climate Action Plan to cut carbon pollution, prepare the United States for the impacts of a changing climate, and lead international efforts to combat it.

Strong global action is needed to reduce greenhouse gas emissions and address their impacts on climate and development. Smart climate policies can drive cleaner growth, resulting in a range of economic and social benefits.

President Obama has made clear that nuclear energy is an important part of our all-of-the-above energy strategy. We know there will be challenges: there are five new reactors under construction right now in the United States, but we also expect a number of plants to be decommissioned in the coming decades. If most nuclear power plants are retired at 60 years, we will see many retirements starting in 2030. We will need to know within a decade how new nuclear energy sources can play a major part in the clean energy solution.

Nuclear energy can be an important contributor to reducing greenhouse gas emissions. As a large source of clean, nearly greenhouse gas-free energy, nuclear power can make major contributions toward meeting current and future energy demands. The new peaceful nuclear cooperation agreement could enhance bilateral cooperation to combat climate change.

Through its potential for increasing bilateral nuclear trade between the two countries, facilitating retransfers to third countries, creating enhanced opportunities for joint collaboration in the global nuclear market and strengthening R&D collaboration, the new U.S.-ROK peaceful nuclear cooperation agreement could foster the contribution that nuclear power can make to reducing carbon emissions.

SUMMARY AND CONCLUSIONS

On June 16, 2015, President Obama submitted the text of a new peaceful nuclear cooperation agreement between the Republic of Korea (ROK) and the United States of America (U.S.) to the U.S. Congress for its review. The current U.S.-South Korean cooperation agreement came into force in 1974 and was extended in its original form for two years in 2014. It will expire by its own terms on March 19, 2016.

The existing agreement is one-sided, obsolete and needs replacing. The present agreement is an unbalanced arrangement in which the United States is the supplier of nuclear materials, equipment and technology, and the ROK is the recipient. This relationship reflects the fact that in 1974, South Korea's nuclear industry depended heavily on imports of nuclear materials, equipment and technology. Today South Korea is one of the world's leading producers of nuclear energy, engages in extensive two-way trade with the U.S., and is an important exporter to the international market, including cooperation with the U.S. in nuclear projects in third countries such as reactors being constructed in the United Arab Emirates (UAE) and China.

In addition, the nonproliferation guarantees in the existing agreement are one-sided and apply only to South Korea. They are also outdated, use outmoded language, and do not reflect the evolution of the international nonproliferation regime or U.S. and South Korean nonproliferation laws, regulations and policies.

The U.S.-ROK agreement is the only U.S. peaceful nuclear cooperation agreement that has not been renegotiated since the enactment of the Nuclear Non-Proliferation Act of 1978 (NNPA). Its replacement with modern and more balanced non-proliferation and nuclear trade provisions and conditions is long overdue.

The Main Issues

The negotiation of this agreement proved challenging as the two sides had to resolve difficult issues and devise a win-win outcome that would reflect:

1. South Korea's political status as a valued ally and full and equal cooperating partner of the United States in civil nuclear cooperation;
2. the national interests of the ROK in managing its used nuclear fuel safely, obtaining a reliable supply of nuclear fuel, and promoting the competitiveness of its nuclear exports in the global nuclear market; and,
3. the global nonproliferation concerns of the United States in preventing the global spread of sensitive nuclear technology, particularly in light of the North Korean nuclear threat.

The objectives of the ROK in the negotiations were both political and programmatic.

Politically, Seoul viewed the negotiation of a new peaceful nuclear agreement with the United States as an opportunity to move from the status of a junior partner as reflected in the existing agreement to a full-fledged and equal collaborator with Washington in the field of civil nuclear energy. Many South Koreans have argued that as a sovereign state and as a compliant party to the Treaty on the Non-Proliferation Weapons (NPT), Article IV of that treaty affords it the right to the peaceful uses of nuclear energy, including enrichment and reprocessing.

Seoul also had certain programmatic goals. During her May 2013 visit to Washington, President Park Geun-hye identified South Korea's three key objectives in concluding the new U.S.-ROK peaceful nuclear cooperation agreement, namely:

- alleviate South Korea's used fuel storage problem;
- ensure a reliable fuel supply for the ROK's nuclear reactors; and
- promote the competitiveness of South Korea's nuclear industry in global markets.

In the near term, the lack of adequate capacity to store the used fuel discharged from its nuclear power plants could be one of the biggest stumbling blocks for South Korea's plans to generate more nuclear power. In the longer term, the ROK must also find a solution to the politically delicate problem of locating a site to dispose of its high-level nuclear waste. The ROK's hopes for addressing these challenges has been to develop and commercialize pyroprocessing technology, and South Korea sought some means that would lead to U.S. long-term or programmatic consent for Korea to pyroprocess used nuclear material fuel produced from U.S.-supplied nuclear fuel and equipment as part of the new agreement.

Some in South Korea also argued that Seoul needs to be able to enrich uranium to enhance its energy security by reducing its reliance on foreign uranium enrichment suppliers. Some also felt that the ROK must offer its foreign customers a package of both reactors and fuel, as some of its major competitors are able to do. They viewed South Korea's inability to offer fuel services as a commercial disadvantage in competing in the global nuclear market. Seoul, therefore, sought a pathway for eventual U.S. consent to enrich U.S.-supplied uranium.

The United States supported the political and programmatic goals set out by President Park, but due to the risks of proliferation, has long-opposed the spread of enrichment and reprocessing. These technologies produce materials that may be directly used in nuclear weapons, reprocessing plants are difficult to safeguard, and clandestine enrichment plants are difficult to detect. Washington regards pyroprocessing, Seoul's proposed method, as reprocessing.

The U.S. also continued to place importance on the ROK-DPRK joint declaration of January 20, 1992, in which the two countries agreed, among other things, not to possess nuclear weapons or reprocessing and enrichment facilities.

In addition, the U.S. judged that pyroprocessing, even if it were to prove technically and economically feasible, would not be available in time to solve the ROK's near-term used fuel storage problems and that a more realistic, medium path forward would be to store South Korea's used fuel on an interim basis.

The U.S. also took the position that South Korea does not need enrichment technology to meet its own fuel needs nor does South Korea need this technology to improve its competitiveness in the international market for several reasons: the global enrichment market has worked well without disruption, the ROK has diversified its sources of supply, the world has an excess of enrichment capacity, enrichment technology holders such as URENCO or AREVA would not be interested in building an enrichment facility in South Korea, and South Korea's construction of its own enrichment capacity would be much more expensive than purchasing enrichment services on the international market.

Although the U.S. places a high priority on the nonproliferation aspects of its civil nuclear pacts, it would be a mistake to regard U.S. interests in concluding a new civil nuclear cooperation with the ROK as limited to issues of nonproliferation. The U.S. sees the proposed new agreement as an important element of its relationship with a key ally in East Asia and as a means of preserving and expanding its nuclear export opportunities not only in South Korea but globally.

FROM DEPENDENCE TO PARITY

Reconciling the positions of the U.S. and South Korea was not easy, took many years to accomplish, and required compromises by both parties. The result of these efforts is a new agreement that replaces a one-sided and outmoded pact with one that 1) reflects the mature and advanced nuclear status and capabilities of South Korea and 2) contains a range of reciprocal nonproliferation obligations for both parties that reflect the modern international nuclear export control regime.

The new agreement contains all nonproliferation guarantees, assurances and controls required by Section 123 of the U.S. Atomic Energy Act (AEA) as amended by the NNPA of 1978. It also meets the legal and regulatory requirements of the Republic of Korea. South Korea joined the Nuclear Suppliers Group (NSG) in 1995, and it implements the strategic trade control measures of part 1 of the NSG guidelines on nuclear trigger list items (INFIRC/254/part1/Rev.12). The NSG guidelines call for nonproliferation assurances and guarantees comparable to those in the U.S. AEA.

This parity of treatment has meant, of course, that South Korea agreed to accept a number of new nonproliferation obligations that it did not have under the existing agreement. These include: comprehensive safeguards as a condition of supply; adequate physical protection; a broader prohibition on all nuclear explosive devices as opposed to “atomic weapons”; consent rights for enrichment, reprocessing and alteration in form or content of nuclear material subject to the new agreement as well as storage of weapons-usable materials; and retransfer of nuclear material and equipment subject to the agreement to third countries.

The nonproliferation guarantees and assurances in the new agreement are more numerous and comprehensive in nature than those in the existing agreement. Nevertheless, as already noted, these rights are reciprocal in nature. Thus the ROK has the right to consent to reprocessing, alteration in form or content, or enrichment of nuclear materials subject to the agreement in the United States. Moreover, although these nonproliferation assurances create new legal obligations with respect to nuclear trade between the U.S. and South Korea, they are unlikely to have a significant practical effect, since both countries already adhere to these norms and practices. Importantly, they upgrade the bilateral U.S.-ROK nuclear relationship to conform to modern standards of international civil nuclear trade.

FUEL CYCLE ISSUES

The most difficult issue facing the negotiators was finding a mutually acceptable path forward that would 1) meet South Korean interests in pursuing various options for managing its used nuclear fuel and securing an adequate supply of enrichment services for the domestic and international market, and 2) satisfy U.S. concerns about the spread of sensitive nuclear technologies.

The outcome was a series of compromises by the two parties.

The U.S. did not try to oblige the ROK to foreswear legally its right to enrichment and reprocessing as it did in its recent agreements with the United Arab Emirates (UAE) and TECRO (Taiwan)—the so-called “gold standard.” Many in Congress and the American nonproliferation community have advocated that all new agreements contain such legally binding commitments. The administration, however, has rejected this “one size fits all” approach. The so-called gold standard would be inappropriate for a country such as the ROK that is key ally of the U.S., has a major nuclear power program and has demonstrated strong nonproliferation credentials. Moreover, U.S. insistence on such a commitment would have been rejected out of hand by the South Koreans and made the conclusion of a new agreement impossible.

The agreement also contains no reference to the 1992 joint declaration between North and South Korea proscribing enrichment and reprocessing in both countries. While holding North Korea to account for its commitment in the 1992 statement is important, a bilateral U.S.-ROK civil nuclear trade pact containing a reference to this statement is highly unlikely to affect North Korea’s willingness to abandon its nuclear program. Only intensified political and economic pressure from the U.S., South Korea, Japan, China, and Russia and a reopened dialogue with the North Korean regime offer whatever hope there may be for Pyongyang’s denuclearization. Even though Seoul has not renounced the 1992 joint statement, some South Koreans do not consider the country bound by that document given Pyongyang’s repeated violations of the agreement and would have found it politically unpalatable to acknowledge the statement in the U.S.-ROK agreement, as long as North Korea is flagrantly violating its commitments.

On the other hand, the agreement refers to Article IV of the NPT in the preamble only and not in any of the operative paragraphs of the agreement or its agreed minute. It makes no reference to enrichment or reprocessing, thus avoiding the disputed issue of whether Article IV includes rights to these sensitive nuclear technologies.

These compromises helped make agreement possible.

With respect to the programmatic issues, the agreement sets out a pathway for possible U.S. long-term consent to the South Koreans to pyroprocessing or enrichment of nuclear material subject to the agreement. In other words, Washington did not rule out the possibility of Seoul’s acquiring these technologies but deferred a decision on U.S. consent to these operations to a later date when the two sides acquire a better understanding of the technical and economic feasibility of the technologies and conduct a thorough assessment of their implications for nonproliferation. In April 2011, the two

countries launched the Joint Fuel Cycle Study (JFCS) to explore the technical and economic feasibility and the nonproliferation acceptability of the electrochemical recycling process as well as other used fuel management options. The new agreement establishes a High-Level Bilateral Commission chaired by the U.S. Deputy Secretary of Energy and the South Korean Vice Foreign Minister that will address these as well as other matters of mutual interest on an on-going basis. The commission will have four working groups: used fuel management, stable fuel supply, nuclear export cooperation and nuclear security. The High-Level Commission is an unprecedented institution for U.S. peaceful nuclear agreements and demonstrates the willingness of both parties to give serious, senior-level attention to a broad range of interests to both parties. It also constitutes a concrete U.S. recognition of South Korea as a major civil nuclear power and a close ally.

The new agreement allows for joint research and development (R&D) activities on pyroprocessing and for the alteration in form or content of used nuclear fuel in specified facilities in both countries listed in annexes to the Agreed Minute and allows for the addition of other facilities provided certain procedural requirements are met, including the application of mutually agreed safeguards. None of these activities involve reprocessing in Korea, i.e., the separation plutonium from high-level wastes, and no such consent is contemplated until the two sides are able to review the results of the JFCS.

If the High-Level Bilateral Commission agrees to the technical feasibility and economic viability and the nonproliferation acceptability of pyroprocessing or enrichment, South Korea could conduct these activities with respect to nuclear materials subject to the agreement.

One issue was whether the two sides could agree in advance on a set of specific criteria, such as safeguards standards and approaches, on-line monitoring and extended containment and surveillance, etc., that, if met, would warrant a U.S. decision for long-term consent. However, the U.S. was obliged to meet the requirements of the U.S. Atomic Act, which requires that broader national security considerations be taken into account in approving requests for the reprocessing or enrichment of U.S.-obligated materials. The agreement recognizes these considerations by specifying that the criteria to be satisfied include whether the technologies are technically feasible and economically viable, can be effectively safeguarded, do not significantly increase the risk of proliferation, ensure timely detection and early warning of diversion and avoid the buildup of stocks of group actinides (which include plutonium) in excess of an amount that is reasonably needed. The latter criterion is unique in U.S. agreements and reflects the U.S. emphasis on minimizing stocks of plutonium.

In the meantime, the working group on used fuel management of the High-Level Bilateral Commission will address the pressing issue that both countries face in finding ways to relieve their near-term used nuclear fuel storage problems through interim storage of used fuel either at reactors or at some central or regional storage facilities. The major challenge in establishing used fuel storage facilities or final waste disposal sites lies less in scientifically and technically demonstrating their safety than in securing the willingness of state and local communities to host such sites. It is expected that the two sides will exchange information and experiences to help each other in finding solutions to both near-term used fuel storage and long-term waste disposal problems.

Another option for managing South Korea's used nuclear fuel would be to ship some of it to a third country for reprocessing. Although the ROK has no near-term plans for off-shore reprocessing, the U.S. has given consent to retransfer U.S.-obligated used fuel from South Korea to France and UK (EURATOM) for reprocessing and storage, and South Korea has given the U.S. a similar consent. Such consent is not unprecedented as the U.S. has given similar approvals to Japan, Switzerland, and more recently to the UAE and TECRO (Taiwan) to retransfer used fuel to EURATOM. By giving approval to the return of the recovered plutonium, the U.S. is according the ROK the same status as Japan and Switzerland. (Washington did not grant such approval to the UAE or TECRO.) The U.S. approval for the return of plutonium recovered from reprocessing in Europe may raise proliferation concerns in the United States. However, these concerns may be mitigated by the fact that South Korea has no plans at the present time to pursue off-shore reprocessing or to use plutonium. The ROK has established the Public Engagement Committee on Spent Nuclear Fuel to identify appropriate options for managing its used nuclear fuel. It also has a plan to develop pyroprocessing that foresees the use of transuranic waste mixture (TRUs)²¹, but it has no policy for recycling TRUs or direct disposal of spent fuel at the present time. In addition, the U.S. would have to approve the physical

²¹ Material contaminated with transuranic elements—artificially made, radioactive elements, such as neptunium, plutonium, americium, and others—that have atomic numbers higher than uranium in the periodic table of elements.

protection arrangements for the transfer of the plutonium from Europe to the ROK, and either party may suspend or withdraw in whole or in part its consent to such retransfers if it determines that one or more of the conditions for the consents not satisfied, or if it determines that exceptional circumstances of concern from a nonproliferation or security standpoint so require.

Overall, the compromises reached on enrichment and pyroprocessing appear to be a win-win outcome for both sides. On the one hand, the U.S. deferred a decision on consent to enrichment and pyroprocessing until both sides had sufficient information about the technical and economic feasibility of these technologies and a full understanding of their proliferation implications. On the other hand, the U.S. did not say “no” to such operations for all time, and instead set up a unique mechanism to ensure that the merits of the use of these technologies receive continuing high-level attention. The fact that the commission is composed of the Vice Foreign Minister of South Korea and the Deputy Secretary of Energy of the United States will ensure that the issue will not be lost in the lower rungs of the bureaucracy and will receive the priority attention of the two governments.

In the meantime the U.S. and the ROK will cooperate closely to grapple with their urgent needs to find solutions to their used fuel management problems. In addition, the working group on nuclear security will provide a forum for advancing an important issue for the two countries.

The two governments were able to agree on a mutually acceptable path forward. They resolved the issues that could be resolved and set up a mechanism for continued examination of those questions that were particularly knotty and premature to answer satisfactorily at the present time. Importantly, failure to have come to an understanding or to opt for another extension of the existing agreement would have inflicted serious damage on the relationship between these close allies.

PROSPECTS FOR NUCLEAR COOPERATION

The new agreement should provide the basis for 1) increased nuclear trade between the two countries, 2) continued cooperation in nuclear nonproliferation, nuclear security, and nuclear safety, 3) enhanced collaboration in nuclear research and development, and 4) expanded cooperation in the international nuclear market.

While the domestic companies of each country are likely to satisfy the bulk of their own large industrial orders, the new agreement will facilitate access to each other’s nuclear industries as an important supplementary source of equipment, components and technology. Improved access to the full range of equipment, components and services should help both countries meet their respective national and international nuclear power objectives.

Some observers have argued that U.S.-ROK cooperation on nuclear safety is currently the most valuable dimension of nuclear partnership between the two countries. The new agreement will enable continued and strengthened collaboration between the U.S. Nuclear Regulatory Commission, the Korean Institute of Nuclear Safety, and the Korean Nuclear Safety and Security Commission.

While the new U.S.-ROK agreement could strengthen nuclear ties between the two countries in the next few years, more significant benefits of an agreement may materialize over the long run as the two countries seek to develop a broader technical agenda in the field of nuclear energy and nonproliferation research and development (R&D).

The new agreement also contains provisions for facilitating cooperation in third countries that could help promote collaboration between Korean and American companies in global nuclear markets and facilitate retransfers of nuclear materials, equipment and technology subject to the agreement to third countries. The U.S. and South Korea have strong strategic reasons for collaborating for projects in third countries as they will face fierce competition from Russia, China and others in the global nuclear market. The U.S. and the ROK should strengthen their civil nuclear cooperation in the global nuclear market to provide a counterbalance to Russian and Chinese influence in this key strategic area.

THE OVERALL STRATEGIC AND POLITICAL IMPORTANCE OF THE NEW AGREEMENT

The new agreement will strengthen the political and strategic alliance between the two allies, promote mutually shared nonproliferation, nuclear security and nuclear safety objectives, enhance American and Korean influence on the global expansion of nuclear power, and help tackle problems of climate change.

The alliance between the U.S. and South Korea has helped maintain the balance of power in Northeast Asia and has served as a bulwark against threats from nuclear-armed North Korea. The new peaceful nuclear cooperation will add another important pillar underpinning the alliance. It will reaffirm the central nature of partnership between the two countries by establishing a strengthened and modernized framework for cooperation in the strategically important area of nuclear power development. It will also add another layer to the strong U.S. commitment to rebalancing its policy toward the Asian region.

Politically, the new agreement should constitute another important symbol of a close and enduring bilateral relationship and send a clear message that the United States regards South Korea as full and equal collaborator, no longer a junior partner.

The new agreement sets a high nonproliferation standard for peaceful nuclear cooperation and should help influence the development of nuclear power worldwide in ways that strengthen global nonproliferation, nuclear safety and nuclear security. From the U.S. point of view, the new agreement ought to serve as a model for the nonproliferation controls and assurances that should be an essential part of peaceful nuclear cooperation agreements between all countries. From the South Korean point of view, given the strict nature of U.S. nonproliferation requirements for peaceful nuclear cooperation, the conclusion of the agreement should serve as a validation of Seoul's nuclear nonproliferation credentials.

A key question will be how the implementation of the new agreement will affect the controversial issue of enrichment and the reprocessing of used fuel for civil use not only in South Korea but globally. In evaluating the results of the Joint Fuel Cycle Study, the two countries will face the challenge of deciding on a course of action that ensures the fuel cycle choice in the ROK not only fulfills Korean nuclear power needs, but truly meets a high standard of proliferation-resistance and simultaneously avoids setting a precedent for other states to acquire their own sensitive nuclear facilities.

The U.S. and South Korea have played leadership roles in strengthening the global nuclear security regime, most notably in hosting nuclear security summits. The new U.S.-ROK peaceful nuclear cooperation agreement has established a working group on nuclear security under the High-Level Bilateral Commission. With the conclusion of the nuclear security summits in 2016, the bilateral cooperation envisaged by this working group takes on added importance.

Finally, the U.S.-ROK peaceful nuclear cooperation agreement could foster nuclear power's contribution to reducing carbon emissions by increasing bilateral nuclear trade between the two countries, facilitating retransfers to third countries, creating enhanced opportunities for joint collaboration in the global nuclear market and strengthening R&D collaboration.

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Fred McGoldrick held senior positions in the U.S. Department of Energy and the U.S. Department of State, where he negotiated U.S. peaceful nuclear cooperation agreements and helped shape U.S. policy to prevent the spread of nuclear weapons. He also served in the U.S. Mission to the International Atomic Energy Agency (IAEA) in Vienna. Since his retirement from the State Department in 1998, he has consulted on issues of nonproliferation and nuclear export controls and published numerous articles and monographs on these subjects. He was the recipient of numerous Senior Executive Service Performance awards, two Superior Honor awards, a Meritorious Honor award and the Presidential Meritorious Executive Award. He holds a BA degree magna cum laude from Boston College (1964), a master's degree in international affairs from Columbia University (1966) and Ph.D. in international service from The American University (1973).

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