V. Atoms for Peace or Strategic Power? Re-aligning U.S.-South Korea's Nuclear Nonproliferation Agendas

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1. Introduction

Since the aftermath of World War II, the United States and the Republic of Korea (ROK, also known commonly as South Korea) have shared strategic diplomatic, security, and economic relations. The U.S.-ROK security alliance—forged during the 1950s Korean War and codified in the 1953 U.S.-ROK Mutual Defense Treaty—stands as a powerful, strategic "linchpin"[1] for U.S. foreign policy and extended deterrence in the Indo-Pacific region. Over the past 70 years, the relationship between Washington and Seoul has extended beyond bilateral security dynamics, encompassing critical cooperation and, at times, competition in the global supply chain for core traditional and emerging technologies. Within today's evolving security dynamics in the Indo-Pacific region, the U.S.-ROK "global comprehensive strategic alliance"[2] spans geostrategic and economic interests, including shared advancements in civil nuclear technology development, deployment, and export deals.[3]

Despite the United States and South Korea's close cooperation, however, growing

1) Often in U.S. foreign policy and military documents, U.S.-ROK relations are herald as the "linchpi n" (or also "lynchpin"), indicating South Korea's pivotal role in promoting peace, security, and prosperity in the Indo-Pacific region. See, "United States-Republic of Korea Leaders' Joint State ment," U.S. White House, last modified May 21, 2022, https://bidenwhitehouse.archives.gov/brief ing-room/statements-releases/2022/05/21/united-states-republic-of-korea-leaders-joint-stat ement/.

2) "Leaders' Joint Statement in Commemoration of the 70th Anniversary of the Alliance between the United States of America and the Republic of Korea," U.S. White House, last modified April 26, 2023, https://bidenwhitehouse.archives.gov/briefing-room/statements-releases/2023/04/26 /leaders-joint-statement-in-commemoration-of-the-70th-anniversary-of-the-alliance-betwee n-the-united-states-of-america-and-the-republic-of-korea/.

3) Orta, Kayla, "US-ROK Global Strategic Partnership in the Indo-Pacific," Woodrow Wilson Interna tional Center for Scholars, March 19, 2024, https://www.wilsoncenter.org/publication/us-rok-gl obal-strategic-partnership-indo-pacific.

concerns over North Korea's ever-growing nuclear weapons buildup, the Russia-North Korean defense pact, and a more assertive China have led to a rising tide of voices in South Korea supportive of nuclear armament. Advocates for South Korea's own nuclear sovereignty argue for either the redeployment of U.S. tactical weapons to the Korean Peninsula or, in response to North Korea's disinterest in denuclearization, the development of a South Korean indigenous nuclear weapons program. Amid these shifting dynamics, recent announcements by U.S. President Donald Trump and South Korean President Lee Jae Myung have also set steps in motion to readdress longstanding limitations on South Korea's enrichment and reprocessing technologies. On November 13, 2025, the two nations agreed to support the exploration of South Korea expanded fuel cycle capabilities to include "the ROK's civil uranium enrichment and spent fuel reprocessing for peaceful uses" under the current bilateral legal framework and regulatory systems in each country respectively.[4)]

While South Korea's internal debate over 'going nuclear' is based in rising regional security concerns, the ongoing U.S.-ROK discussions over revising previously agreed upon limits for uranium enrichment and spent fuel reprocessing are rooted in broader considerations for long-term energy security and, most importantly, nuclear nonproliferation. Conflating the two agendas may present costly diplomatic and economic implications for South Korea's emerging and globally expansive civil nuclear export industry. As Washington and Seoul seek to secure global leadership in civil nuclear energy,[5)] such pro-nuclearization debates within South Korea risk destabilizing early advancements in the two nations' collaborations on advanced nuclear research and development (R&D) and third-party civil nuclear export initiatives.

4) U.S. White House, "Joint Fact Sheet on President Donald J. Trump's Meeting with President Lee Jae Myung," November 13, 2025, https://www.whitehouse.gov/fact-sheets/2025/11/joint-fact-sheet-on-president-donald-j-trumps-meeting-with-president-lee-Jae Myung/.

5) Orta, Kayla, "US-South Korean Civil Nuclear Exports Are a Winning Strategy," *The National Interest*, September 29, 2025, https://nationalinterest.org/blog/energy-world/us-south-korean-civil-nuclear-exports-are-a-winning-strategy; Also, see, Jeon, Kyung-joo and Kayla Orta, "Strength in Partnership: Elevating U.S.-ROK Cooperation in Nuclear Energy," *The National Interest*, April 15, 2025, https://nationalinterest.org/blog/energy-world/strength-in-partnership-elevating-u-s-rok-cooperation-in-nuclear-energy.

2. South Korea's Civil Nuclear Leadership

Within the global nuclear energy market, South Korea is increasingly recognized as a nuclear energy powerhouse—having successfully transitioned from a domestically-focused civil nuclear industry to a globally-oriented export nation. In 2024, South Korea was ranked the fifth largest nuclear energy producer, surpassed only by the United States, China, France, and Russia.[6] Leading South Korea's civil nuclear developments are the nation's state-owned and corporate-led industry and research institutions, including the Korea Atomic Energy Research Institute (KAERI), Korea Hydro & Nuclear Power (KHNP), Korea Electric Power Corporation (KEPCO), Doosan Enerbility, and Hyundai E&C among others. Furthermore, these frontrunner institutions and companies have placed South Korea's civil nuclear industry at a strategic advantage internationally, successfully securing competitive nuclear export deals first in the United Arab Emirates (UAE) and, more recently, the Czech Republic. With expectations for global nuclear energy demand predicted to rise,[7] South Korea's civil nuclear industry is likely to push forward future international nuclear reactor exports both in traditional and new market regions, including Europe, the Middle East, and Southeast Asia.[8]

1) Development of South Korea's Civil Nuclear Program

Historically, South Korea ventured first into atomic energy R&D in the aftermath of the Korean War (1950-1953). Seeking to rebuild the nation, South Korea actively explored various energy pathways as a means to fuel post-war reconstruction. Under the auspice of U.S. President Eisenhower's "Atoms for Peace" initiative, the United States and South Korea signed their first bilateral nuclear cooperation agreement,

6) World Nuclear Association (WNA), "Nuclear Generation by Country," updated September 30, 2025, https://world-nuclear.org/information-library/facts-and-figures/nuclear-generation-by-country.

7) See International Atomic Energy Agency (IAEA), *Energy, Electricity and Nuclear Power Estimates for the Period up to 2050* (IAEA, 2025). https://doi.org/10.61092/iaea.gwov-o544.

8) See, Lee, Heesu and Will Wade, "As Nuclear Power Makes a Comeback, South Korea Emerges a Winner," *Bloomberg*, May 14, 2025, https://www.bloomberg.com/news/features/2025-05-14/south-korea-nuclear-energy-is-leading-the-industry-comeback.

titled the "Agreement on Cooperation Concerning Civil Uses of Atomic Energy," in 1956. The following year, South Korea joined the International Atomic Energy Agency (IAEA) on 8 August 1957, signaling its commitment to the development of peaceful nuclear energy. At a domestic level, the ROK government established the national oversite framework for atomic energy first through the passing of the nation's 1958 Atomic Energy Law, which founded the Office of Atomic Energy in 1959.[9] In 1958, the ROK government selected a U.S. company, General Atomics, to build the nation's first Korean Research Reactor (KRR), a 100-kilowatt (kW) TRIGA Mark-II reactor. In 1962, with U.S. and IAEA technical assistance, the research reactor, KRR-1, reached criticality—marking South Korea's official entry into the nuclear age.[10]

During the late 1960s, growing energy demands and regional security tensions spurred South Korea to pursue a focused civil nuclear energy program. As such, in 1967, the United States, South Korea, and the IAEA concluded a trilateral safeguards agreement[11] which resulted in a second research reactor, KRR-2 (TRIGA Mark III), in South Korea. This agreement marked the first "practical activity" related international safeguards conducted by the ROK government since joining the IAEA.[12] In 1972, South Korea began construction on the Kori-1 reactor—a U.S.-supplied pressurized water reactor (PWR) built under a Westinghouse turnkey contract—reached operation in 1978. Throughout the 1980s and 1990s, South Korea rapidly expanded its civil nuclear infrastructure, building and connecting fifteen new nuclear reactors to the national grid. Subsequent decades saw the growth of ROK

9) *Atomic Energy Act*, Republic of Korea (ROK) National Assembly, Korea Law Translation Center, accessed August 14, 2025, https://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=23918&type=sogan&key=2.

10) Lee, Kwang Seok, et al., *Investigation on the 50 Years of Nuclear Development in Korea*, Korea Atomic Energy Research Institute, Daejeon (Korea, Republic of), October 2007, https://inis.iaea.org/records/2raqj-qpa07.

11) *Agreement Between the International Atomic Energy Agency, the Government of the Republic of Korea and the Government of the United States of America for the Application of Safeguards* (INFCIRC/11), International Atomic Energy Agency (IAEA), April 9, 1968, archived at https://www.iaea.org/sites/default/files/infcirc111.pdf.

12) Choi, Young-Myung and Hosik Yoo, "Safeguards Development and Challenges in the ROK During the Last Fifty Years," in *Special Issue: 50 Years of IAEA*, *Journal of Nuclear Materials Management* 35, no. 4, https://resources.inmm.org/system/files/jnmm/vol_35/V-35_4.pdf.

industry leaders, which emerging as a regional atomic energy powerhouse and drove South Korea's nuclear innovation and forged the Indo-Pacific nation's eventual pathway into the global reactor exports market.

Behind public-facing civil nuclear development, however, the nation's early nuclear energy program raised doubts over South Korea's nonproliferation commitments. In the 1970s, the persistent security tensions with North Korea and the withdrawal of 20,000 U.S. troops stationed on the Korean Peninsula led the Park Chung-hee administration to explore alterative strategies for ensuring South Korean national security, including seeking out pathways to establish an early-stage nuclear weapons and missile programs. The Park administration's efforts to purchase dual-use nuclear technology and materials from Canada, France, and, later, Belgium seeded concerns in Washington over Seoul's pursuit of a nuclear weapons program.[13] To halt the South Korea's acquisition of military-use nuclear technology, the U.S. government conditioned its continued technical and industrial nuclear cooperation with Seoul on the renewed assurances of its commitments for peaceful nuclear development.

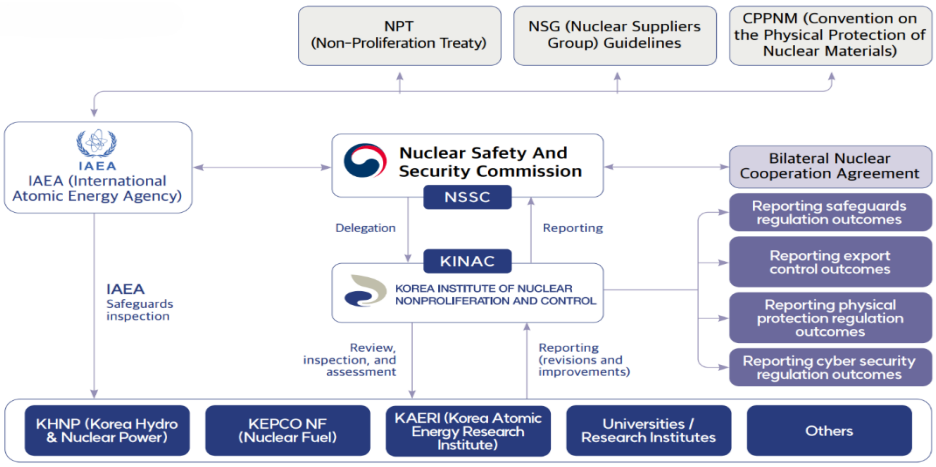
As such, the United States required that South Korea reaffirm its nonproliferation obligations through a new "123 Agreement" as defined in the 1954 U.S. Atomic Energy Act and signatory accession to the Nuclear Non-Proliferation Treaty (NPT). South Korea fulfilled these commitments by concluding the revised U.S.-ROK bilateral cooperation agreement in 1974—later renewed in 2015—and formally joined the NPT in 1975. Since signing the NPT, South Korea also ratified the Convention on the Physical Protection of Nuclear Materials in April 1982 and Comprehensive Nuclear-Test-Ban Treaty in September 1999.[14] These foundational agreements

13) For a discussion on South Korea's historical nuclear weapons program, see Kim, Seung-Young, "Security, Nationalism and the Pursuit of Nuclear Weapons and Missiles: The South Korean Case, 1970-82," *Diplomacy & Statecraft*, 12, no. 4, 53-80, http://dx.doi.org/10.1080/09592290108406226; Hong, Sung Gul, "The Search for Deterrence: Park's Nuclear Option," Chapter in *The Park Chung Hee Era: The Transformation of South Korea*, edited by Byung-Kook Kim and Ezra F. Vogel (Harvard University Press, 2013), 483-510, https://doi.org/10.4159/harvard.9780674061064.c17; Lim, Eunjung, "South Korea's Nuclear Dilemmas," Journal for Peace and Nuclear Disarmament, 2, no. 1, 297-318, https://www.tandfonline.com/action/showCitFormats?doi=10.1080/25751654.2019.1585585.

14) For an overview of South Korea's nonproliferation and disarmament agreements, see United

continue to underpin South Korea's present-day adherence to the peaceful, secure, and transparent development of nuclear energy.

As a signatory of the NPT, South Korea holds nonproliferation agreements bilaterally with the United States and the IAEA respectively. Beyond its initial IAEA safeguards agreement, South Korea became the 39th country to sign the IAEA's Addition Protocols in June 1999. After ratification in February 2004, the formal agreement, titled "Protocol Additional to the Agreement between the Government of the Republic of Korea and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons," grants the IAEA additional access to information and facility locations for the entirety of South Korea's domestic nuclear program, ongoing R&D, and nuclear material balances and trade relations.[15]



South Korea's regulatory and research institutions in support of nuclear safety, security, and safeguards[16]

Nations (UN), "Republic of Korea," Office for Disarmament Affairs' Regional Centre for Peace and Disarmament in Asia and the Pacific, accessed on November 13, 2025, https://www.unrcpd.org/region/republic-korea/.

15) "IAEA Additional Protocol Entered into Force in the Republic of Korea," ROK Ministry of Foreign Affairs, February 18, 2004, https://www.mofa.go.kr/eng/brd/m_5676/view.do?seq=296347&srchFr=&amp%3BsrchTo=&amp%3BsrchWord=&amp%3BsrchTp=&amp%3Bmulti_itm_seq=0&amp%3Bitm_seq_1=0&amp%3Bitm_seq_2=0&amp%3Bcompany_cd=&amp%3Bcompany_nm=&page=846&titleNm=.

16) For an overview of South Korea's nuclear-related regulatory organizations and R&D facility, see Korea Institute of Nuclear Nonproliferation and Control (KINAC), "Institutional Brochure

In order to ensure continue compliance to international and bilateral nonproliferation agreements, South Korea has a well-established nuclear regulatory and safeguards framework. In accordance with the NPT, the ROK government devised a state system for accounting and control (SSAC) of nuclear materials as required for its national reporting to the IAEA beginning in the 1970s. Through the ROK's Atomic Energy Law, the Ministry of Science and Technology established, under KAERI, the Technology Center for Nuclear Control (TCNC), a "formal technical body for national safeguards implementation," in 1994.[17] Later, the TCNC was changed to the Korea Institute of Nuclear Nonproliferation and Control (KINAC) in June 2006 as means to strengthen the independence of the SSAC system.

Today, KINAC plays a pivotal role in ensuring domestic-level partnerships in monitoring, enhancing, and reporting for South Korea's IAEA safeguards commitments. Internationally, KAERI and KINAC lead a variety of research initiatives and workforce development programs, which underpin South Korea's long-term support the IAEA's global nonproliferation efforts and the safe, secure, and responsible expansion of nuclear energy worldwide.

2) Future of South Korea's Civil Nuclear Advancements

According to the IAEA's annual forecasting, the global nuclear energy capacity—which was 337 gigawatts (GWe) in 2024—is expect to increase at 50% to reach 561 GWe by 2050 based on low estimates.[18] Based on high case scenarios, nuclear operational capacity is projected to increase upwards of 2.6 times by the mid-century.[19] As a leading nuclear energy producer globally, South Korea is well positioned to play a key international role in the development and deployment of

[in English]," (Daejon, 2024), pg. 7, accessible online at https://www.kinac.re.kr/board/view?pageNum=1&rowCnt=8&linkId=LK0000018946&menuId=MN0000000430&schType=0&boardStyle=&categoryId=&continent=&siteId=00003&contents1=&contents2=&country=&schText=&schKeyword=.

17) Choi and Yoo, "Safeguards Development."

18) IAEA, *Energy, Electricity and Nuclear Power Estimates*.

19) Ibid.

next-generation advanced nuclear technologies. With 26 operating reactors supplying roughly one-third of national electricity, South Korea ranks among the world's top five nuclear energy producers.[20] Domestically, South Korea's civil nuclear infrastructure is set to continue to grow with two new APR-1400 reactors slotted for finished construction by the early 2030s, while international Korean companies have won competitive nuclear reactor exports bids in the Middle East and Eastern Europe.

With newcomer nations worldwide looking to sign cooperative memorandums of understanding (MOUs) and, potentially, purchase nuclear reactors, South Korea stands to benefit from rising demand for advanced nuclear technologies. Next-generation nuclear reactors offer new design features to address traditional issues of legacy reactors; and, increasingly national governments are more interested in exploring potential routes to install advanced, small, and micro modular reactors (AMRs, SMRs, and MMRs respectively). Recently, SMRs, producing a maximum of 300 megawatts (MWe) per unit, are increasingly viewed as a more desirable choice compared to their traditional gigawatt counterparts. In this regard, South Korea's advancements in next-generation civil nuclear technologies—exemplified by KHNP and KAERI's development of the i-SMR and SMART-100 reactor designs—demonstrate the country's capacity to provide scalable solutions that expand energy production domestically and, simultaneously, stimulate opportunities for broader entry into international nuclear energy markets.[21]

South Korea's established technical expertise, robust regulatory framework, and proven track record in reactor design and construction uniquely position the nation to lead the global transition toward advanced and SMR technologies. By capitalizing on its strengths in innovation, manufacturing, and export competitiveness, South Korea can play a pivotal role in shaping the emerging international nuclear

20) World Nuclear Association, "Nuclear Power in South Korea," last updated October 24, 2025, https://world-nuclear.org/information-library/country-profiles/countries-o-s/south-korea.

21) Orta, Kayla, "High-Tech Alliances: South Korea, the G7 and the Future of AI and Nuclear Innovation," in *IAI Papers Series*, No. 25 (26), Instituto Affari Internationali, October 30, 2025, https://www.iai.it/en/pubblicazioni/c03/high-tech-alliances-south-korea-g7-and-future-ai-and-nuclear-innovation.

landscape while advancing global energy security and champing the U.S.-led nonproliferation regime and implementation of IAEA safeguards.[22] However, renewed domestic debates surrounding potential nuclear weapons development risk undermining this progress. Such discourse could erode international confidence in South Korea's long-standing nonproliferation commitments, jeopardize partnerships built on trust and transparency, and constrain the country's expanding civil nuclear export potential. To sustain global credibility as a responsible nuclear energy leader, therefore, will depend on Seoul's continued emphasis on peaceful nuclear development, technological excellence, and steadfast adherence to nonproliferation norms.

3. Implications of the Indo-Pacific's Evolving Nuclear Landscape

With the rise of geopolitical competition and increasing erosion of legacy arms control agreements, the post-Cold War system of nuclear restraint is being challenged at a global scale. According to the U.S. 2022 National Security Strategy, over the next five to ten years, the United States will for "first time" face the dual-front challenge of deterring two competing nuclear powers: Russia and China.[23] Since the end of the Cold War, the U.S.-led nuclear proliferation regime—mainly rooted in the NPT's international framework, enforced by international consensus, and monitored by the civil nuclear energy watch-dog, the IAEA—has stood as a bulwark against the technological diffusion and horizontal spread of nuclear weapons. However, amid today's rising challenges, the threat landscape is both increasingly "dynamic and uncertain"[24] and, ever more, intertwined across key national industries for critical and emerging technologies.

22) Jeon and Orta, "Strength in Partnership."

23) *National Security Strategy*, U.S. White House, October 2022, https://bidenwhitehouse.archives.gov/wp-content/uploads/2022/10/Biden-Harris-Administrations-National-Security-Strategy-10.2022.pdf.

24) "Under Secretary Jenkins' Remarks at the NATO WMD Conference," U.S. Department of State, last updated on 3 October 2024, https://2021-2025.state.gov/under-secretary-jenkins-remarks-at-the-nato-wmd-conference/.

Today, the United States, alongside regional allies and partners, is questioning the dawn of a 'third' nuclear age, faced for the first time with the potential of a recognized multipolar nuclear security landscape.[25] Within Northeast Asia, Russia, China, and North Korea all present strategic challenges to U.S. national security interests. Russia's near-peer and China's pacing nuclear threat present challenges to the post-Cold War balance of international power and previously established systems of arms control. Despite a robust history of U.S.-USSR (later Russian) arms control and cooperative threat reduction (CTR) initiatives, Russia has increasingly played an obstructionist role in ongoing U.S.-Russian risk reduction talks. Furthermore, Russia's denouncement of its treaty obligations under the Measures for the Further Reductions and Limitation of Strategic Offensive Arms (New START)—set to expire in early 2026—many traditional supporters of global arms control frameworks are increasingly worried about potentially systemic corrosion of effective nonproliferation and arms control engagement. Additionally, China is quickly rising in its nuclear ambitions. According to the Stockholm International Peace Research Institute (SIPRI), China's nuclear industrial complex is undergoing "significant modernization and expansion of its nuclear arsenal," with the potential of amassing a stockpile of 1,500 nuclear warheads by 2035.[26]

Moreover, North Korea's advancement of its nuclear weapons buildup continues to included enhancements in warhead technologies and missile testing. Previously estimates showed that Pyongyang's nuclear weapons program could entail upwards of 200 nuclear warheads by 2027.[27] The continuation of North Korea's expanding

25) To review the U.S. policy options amid shifting global dynamics and the rise of a multipolar nuclear order, the 2022 National Defense Authorization Act (NDAA) established the U.S. Congre ssional Commission on the Strategic Posture of the United States; see final report: "America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States," U.S. Congressional Commission on Strategic Posture of the United States, October 2023, https://www.ida.org/research-and-publications/publications/all/a/am/americ as-strategic-posture. For a broader discussion on the 'third nuclear age,' see Futter, Andrew, et. al., *The Global Third Nuclear Age: Clashing Visions for a New Era in International Politics* (Routledge, 2025).

26) Stockholm International Peace Research Institute (SIPRI), *SIPRI Yearbook 2025: Armaments, Disarmament and International Security* (Oxford University Press, 2025).

27) See, Bennet, Bruce, et al., *Countering the Risks of North Korean Nuclear Weapons*, (RAND

weapons of mass destruction (WMD) program, including nuclear warhead stockpiling and missile testing, calls into question the feasibility of denuclearization on the Korean Peninsula. Since the 2022 Nuclear Law, North Korea has announced what is essentially a 'no limit' buildup policy for its nuclear weapons program.[28] Whether for diplomatic leverage or tactical deployment, North Korea's nuclear weapon program continues to demonstrate an urgent and serious threat to the United States and U.S. allies' interest in the Indo-Pacific region. For South Korea, most importantly, Pyongyang's growing WMD program represents an existential threat.[29] As such, while Washington is carefully monitoring Moscow and Beijing, Seoul, however, is most concerned with Pyongyang.

4. South Korea's Security Imperatives & 'Nuclearization' Debate

With prospects for diplomatically achieving North Korean denuclearization seeming unlikely, South Korea's national security is facing perceptible disadvantage against a nuclear-armed North Korea. After the return of U.S. President Donald Trump to the White House, U.S. extended nuclear deterrence commitments towards South Korea are also being called into question. In January 2025, additionally, U.S. Secretary of Defense, Pete Hegseth's reference to North Korea as a "nuclear power" during his confirmation hearing stoked fear in Seoul that the U.S. administration may no longer pursue denuclearization agreements in exchange for the reduction of economic sanctions but, rather, a measure of arms control on the Korean Peninsula.[30] Faced with North Korea's rising WMD threat, South Korea political leaders and citizens alike are calling for a re-evaluation of what a 'nuclearized' South

Corporation, April 2021), https://www.rand.org/content/dam/rand/pubs/perspectives/PEA1000/PEA1015-1/RAND_PEA1015-1.pdf.

28) Smith, Josh, "New North Korea Law Outlines Nuclear Arms Use, Including Preemptive Strikes," Reuters, September 9, 2022, https://www.reuters.com/world/asia-pacific/nkorea-passes-law-declaring-itself-nuclear-weapons-state-kcna-2022-09-08/.

29) See, Bennet, et al., *Countering the Risks of North Korean Nuclear Weapons*.

30) Panda, Ankit, "South Korea Doesn't Want North Korea Labeled as a Nuclear Power. It's Causing Friction With the United States," in Emissary, Carnegie Endowment for International Peace, January 23, 2025, https://carnegieendowment.org/emissary/2025/01/north-korea-nuclear-weapons-npt-us-denuclearization-policy?lang=en.

Korea might look like.

Rising debates in South Korea over indigenous nuclear weapons program are indicative of these shifting dynamics.[31] Public opinion polls, in recent years, have consistently showed that a majority of South Koreans—ranging from more than 60% to upwards of 80%—are in support of strengthening South Korea's nuclear deterrence towards North Korea, indicating support for either the return of U.S. tactical weapons or the initiation of an indigenous nuclear weapons program. A survey by the Chey Institute for Advanced Studies conducted in late 2023 to 2024 reported that 72.8% of polled adults supported South Korea developing its own nuclear weapons.[32] Another public opinion poll, conducted by the Korean Institute for National Unification (KINU) from April to May 2024, similarly found that 66% of South Koreans surveyed believed that if "the North does not give up its nuclear arsenal," then South Korea should also pursue its own nuclear weapons program. [33] In January 2025, following Hegseth's remarks, a Korean Broadcasting System (KBS) public opinion poll results showed that 74% of South Koreans stated that South Korea should go nuclear if the DPRK is recognized as a formal nuclear weapon stage by the United States.[34] In contrast, however, opinion polls of subject matter experts have been more hesitant to promote South Korea's indigenous nuclearization often citing the potential security and economic risks such actions would entail. A surveyed of over 1,000 selected "strategic elites" in South Korea conducted by the U.S.-based Center for Strategic and International Studies (CSIS) showed results that only 34% of policy elites were in favor of South Korean nuclearization.[35]

31) See Lim, "South Korea's Nuclear Dilemmas."

32) "72.8% of Koreans Support S. Korea's Nuclear Weapon Development," *Dong-A Ilbo*, February 6, 2024, https://www.donga.com/en/article/all/20240206/4731163/1.

33) Kim, Seung-yeon, "66 pct of S. Koreans Support Developing Own Nuclear Weapons: Poll," *Yonhap News Agency*, June 27, 2024, https://en.yna.co.kr/view/AEN20240627011200315.

34) "KBS Lunar New Year Opinion Poll [KBS 설특집 여론조사]," *KBS News*, January 28, 2025, https://news.kbs.co.kr/news/pc/view/view.do?ncd=8162418.

35) Cha, Victor, "Breaking Bad: South Korea's Nuclear Option," Center for Strategic and International Studies (CSIS), April 29, 2024, https://www.csis.org/analysis/breaking-bad-south-koreas-nuclear-option.

Looking forward, the debate over South Korea's nuclear security context—often a pivotal partisan discussion topic—is unlikely to cease among South Korean expert policy-makers or general public circles alike. The diverging agendas between South Korea's nuclear deterrence concerns—driven mainly by North Korea's expanding WMD program—and the nation's export-focused civil nuclear strategy runs the risk of undermining the U.S.-ROK alliance cohesion and Seoul's international reputation as a trusted exporter of peaceful nuclear energy.

5. Cost of Ambiguity: Risks to Nonproliferation & Market Credibility

Historically, South Korea has already experience international doubts surrounding its civil nuclear program. In 2004, the IAEA found a discrepancy in the declared civilian nuclear activities reported under the ROK government's Member State declarations. According to the IAEA Director General's to the Board of Governors, South Korea conducted from the 1980s to the early 2000s a series of experiments involving uranium conversion and enrichment as well as plutonium separation, which the ROK government "failed to report to the Agency in accordance with its [safeguards] obligations."[36] The discovery of the discrepancy, although representing a small amounts of fissile material, and the nature of South Korea's reporting failures sparked international debates on the credibility of South Korea's safeguards commitments.

At the time, then-president of KAERI, Chang In-Soon argued that the accusations were "absurd" and the incident was relatively minuscule.[37] However, during his formal address at the United Nations General Assembly (UNGA) in September 2004, ROK Foreign Minister Ban Ki Moon addressed the crisis full-on, stating that:

36) *Implementation of the NPT Safeguards Agreement in the Republic of Korea* (GOV/2004/84), International Atomic Energy Agency (IAEA), November 11, 2004, https://www.iaea.org/sites/default/files/documents/gov2004-84.pdf.

37) Brook, James, "South Korea Calls Experiment Far Below Bomb-Grade Level," *The New York Times*, September 5, 2004, https://www.nytimes.com/2004/09/05/world/south-korea-calls-experiment-far-below-bombgrade-level.html.

> "The experiments were isolated, laboratory-scale research activities that a few scientists conducted on their own for purely experimental purposes… In good faith and with full transparency, my government has been providing full cooperation to the IAEA in its activities to review and verify our declarations on nuclear research activities."[38]

The address echoed the ROK Standing Committee of the National Security Council's public announcement on the "Four Principles for the Peaceful Use of Nuclear Energy," on 18 September 2004.[39] By renewing and reaffirming its commitment to nuclear nonproliferation and the peaceful use of nuclear energy, the ROK government stressed the nation's lack of intent to "develop or possess nuclear weapons" and emphasized Seoul's pledge to ensure nuclear transparency and adherence to international agreements on nuclear nonproliferation.

While the IAEA ultimately deemed the matter "resolved" in 2007,[40] South Korea still faced international criticism and intensified scrutiny from its regional and global partners at the time. As a response, the ROK government launched a concentrated diplomatic campaign to re-establish South Korea as a responsible nuclear energy producing nation. In the early 2000s, South Korea's nuclear industry was in the early phase of establishing the groundwork for future civil nuclear exports. Though the successful nuclear export deal with the United Arab Emirates (UAE) to build four APR-1400 reactors at the Barakah Nuclear Power Plant would not come until 2008, such additional international scrutiny could have weakened international interest in collaboration with South Korean civil nuclear industry.

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38) "Keynote Speech by H.E. Ban Ki-moon at 59th United Nations GA," ROK Permanent Mission to the United Nations, September24, 2004, https://overseas.mofa.go.kr/un-en/brd/m_5032/view.do?seq=747500&srchFr=&srchTo=&srchWord=&srchTp=&multi_itm_seq=0&itm_seq_1=0&itm_seq_2=0&company_cd=&company_nm=.

39) "Statement by the Standing Committee of the National Security Council - Four Principles on the Peaceful Use of Nuclear Energy," ROK Ministry of Unification, September 18, 2004, https://www.unikorea.go.kr/eng_unikorea/news/releases/?boardId=bbs_0000000000000034&mode=view&cntId=31459&category=&pageIdx=.

40) For concluding review of South Korea undeclared nuclear activities, see *Safeguards Statement for 2007*, International Agency for Atomic Energy (IAEA), May 2007, https://www.iaea.org/sites/default/files/es2007.pdf.

More recently, South Korea's pro-nuclear armament debates have triggered debates in Washington regarding South Korea's broader interests in civil nuclear energy production and the inherent dual-use nature such technologies. In March 2025, the U.S. Department of Energy (DOE) designated South Korea as a "sensitive" country, counting the nation on the list of Sensitive and Other Designated Countries.[41] While the list was intended for internal use only—informing DOE offices on regulations for U.S.-South Korean laboratory-to-laboratory activities—the announcement drove concerns in both U.S. and South Korean foreign policy circles on the wider implication of South Korea's designation alongside China, Taiwan, Israel, Russia, Iran, and, even, North Korea.[42]

To sustain credibility and market competitiveness, South Korea should reinforce its long-standing commitment to the NPT and the IAEA safeguards system, leveraging international diplomatic forums to signal Seoul's responsible nuclear leadership. Overall, strengthening alignment between U.S.-ROK security policy and nonproliferation principles will not only bolster Washington and Seoul's cooperative deterrence capabilities but will also secure Seoul's position as a global leader in IAEA safeguard implementation and advanced civil nuclear innovative.

6. Strengthening South Korea's Civil Nuclear Leadership

Amid the global expansion of civil nuclear technologies, the United States and South Korea have an opportunity to work collectively to reassert shared commitments to nonproliferation and safeguards. In particularly, South Korea can demonstration its civil nuclear leadership through three key avenues: 1) advancing Seoul's nonproliferation leadership in international forums, 2) supporting the IAEA's initiatives for peaceful applications of nuclear technology, and 3) expanding the U.S.-ROK partnerships to nonproliferation-centered advanced nuclear reactor R&D and third-party exports.

41) See, Gardner, Timothy, David Brunnstrom, and Ju-min Park, "US Designated South Korea a 'Sensitive' Country Amid Nuclear Concerns," *Reuters*, March 15, 2025, https://www.reuters.com/world/us-designated-south-korea-sensitive-country-amid-talk-nuclear-weapons-2025-03-15/.

42) Ibid.

1) Expanding High-Level Diplomatic Engagement

Over the years, South Korea has played an increasingly visible role in the international community championing the importance of nonproliferation and IAEA safeguards. By hosting the Nuclear Security Summit in 2012, Seoul positioned itself as a global leader on nonproliferation goals, highlighting the ongoing importance of safeguarding nuclear materials and technologies.[43] Additionally, the ROK government has co-hosted the annual United Nation Joint Conference on Disarmament and Nonproliferation with the UN Office for Disarmament Affairs (UNODA) since 2001. Through high-level initiatives such as these, Seoul continues to re-enforce the global normative discourse on nuclear governance, and, in turn, this has served to build South Korea's international credibility as a responsible steward of peaceful nuclear technology.

Beyond multilateral summits, South Korea can play a stronger role as a middle-power for mini-lateral cooperation initiatives for nuclear R&D, including through the Generation IV International Forum (GIF). Established based on a seven-nation consortium in 2005, the GIF is a multilateral platform aiming to expand pathways towards first-of-a-kind deployment of advanced nuclear energy systems.[44] Supported through the Organisation for Economic Cooperation and Development's (OECD) Nuclear Energy Agency (NEA), the GIF has served as a "bedrock" of international R&D toward advance reactor concepts focusing on safety, improved performance, and built-in proliferation-resistant features.[45] In September 2025, South Korea signed the renewed Generation IV International Forum (GIF) Framework Agreement,[46] joining the leading nations—including the Canada, France, Japan,

43) Goodby, James E. and Markku Heiskanen, "The Seoul Nuclear Security Summit: New Thinking in Northeast Asia?" March 28, 2012, https://www.brookings.edu/articles/the-seoul-nuclear-security-summit-new-thinking-in-northeast-asia/.

44) "Multilateral Cooperation," U.S. Department of Energy, n.d. https://www.energy.gov/ne/multilateral-cooperation.

45) "New GIF Framework Agreement to Ensure International Co-operation on Generation IV Systems," Nuclear Energy Agency (NEA), January 29, 2025, https://www.oecd-nea.org/jcms/pl_99831/new-gif-framework-agreement-to-ensure-international-co-operation-on-generation-iv-systems.

Switzerland, the United Kingdom, and the United States—at the forefront of advanced reactor development and deployment. [47]

Overall, South Korea's sustained engagement—at both the multinational and mini-lateral levels—serves to advance global nonproliferation norms, strengthen IAEA safeguards, and underscores Seoul's role as a normative leader in the international nuclear nonproliferation order.

2) Supporting the IAEA's Mission for Peaceful Applications

By supporting both the IAEA's technical cooperation and safeguard verification agendas, South Korea bolsters the IAEA's global mission to ensure the safe, secure, and peaceful use of nuclear technologies. To this end, South Korea should continue pivotal legacy projects and supported new initiatives under the IAEA's variety of mission programs. In particular, South Korean should continue to play a key role in the IAEA's designated International Centre based on Research Reactors (ICERRs) program and the Network of Analytic Laboratories (NWALs).

First, through the ICERRs, the IAEA supports nuclear newcomer nations to develop laboratory safety and safeguard compliance expertise by offering the usage of laboratory facilities, such as in South Korea, for training and R&D purposes.[48] In September 2019, IAEA formally recognized South Korea's world class research facilities by designating KAERI as a participating laboratory for the IAEA-launched ICERRs program.[49] KAERI's success in joining the IAEA's NWALs was due to its

46) Under the renewed the 2025 GIF Framework Agreement, participating nations aim to advance one or more of the following six (6) advanced nuclear reactor technologies: gas-cooled fast reactors, lead-cooled fast reactors, molten salt reactors, sodium-cooled fast reactors, supercriti cal-water-cooled reactors, and very high-temperature reactors.

47) "Korea Signs the New GIF Framework Agreement," Generation IV International Forum, Septemb er 11, 2025, https://www.gen-4.org/resources/news-announcements/korea-signs-new-gif-fra mework-agreement

48) For more information on ICERRs and a list of participating national laboratories worldwide, see "International Centres based on Research Reactors (ICERRs)," International Atomic Energy Agency (IAEA), https://www.iaea.org/about/partnerships/international-centres-based-on-rese arch-reactors-icerrs.

49) Fisher, Matt, "Korea Atomic Energy Research Institute Becomes International Centre under

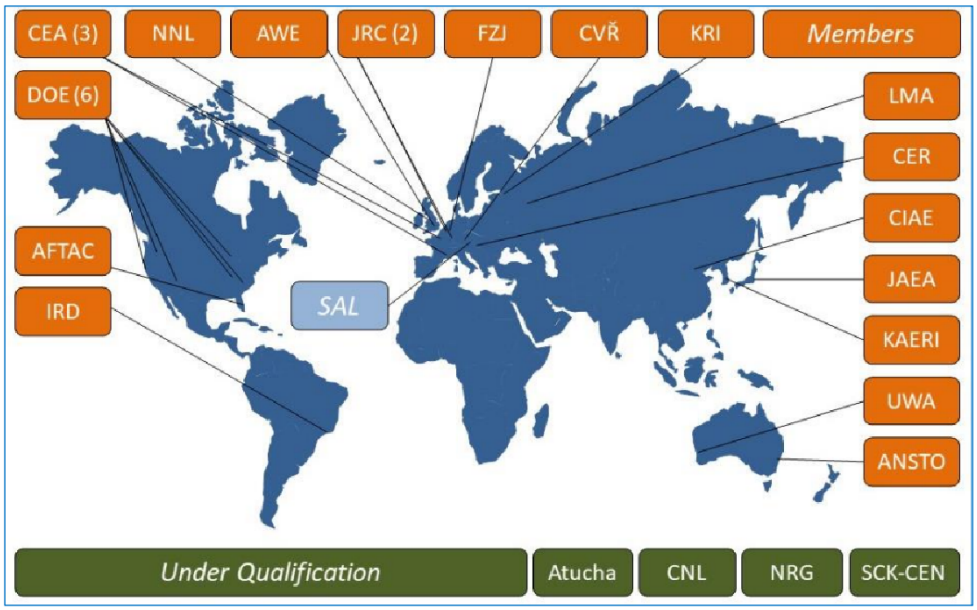
advanced R&D facilities such as the onsite 30 MW(t) research reactor, the High-Flux Advanced Neutron Application Reactor (HANARO), and hot cells facility at the Irradiated Material Examination Facility (IMEF). Through these advanced laboratory facilities, KAERI supports the IAEA's technology cooperation arrangements, providing researchers from participating IAEA Member States access to KAERI's localized training, education, and R&D programs.

Second, KINAC has also assisted in expanding multinational capacity-building programs in nuclear safety and nonproliferation exercise. In 2014, KINAC established the International Nuclear Nonproliferation and Security Academy (INSA) as its flagship nuclear nonproliferation training program. Under INSA, KINAC offers multi-day specialized training in the implementation of IAEA safeguards, including knowledge required for design information questionnaire, nuclear material accounting reports, and additional protocol declarations.[50] Through INSA program, KINAC has supported the training of nearly 600 nuclear nonproliferation trainees from 28 countries across Africa, Eastern Europe, the Middle East, Africa, and Southeast Asia.[51]

IAEA Label," , International Atomic Energy Agency (IAEA), September 17, 2019, https://www.iaea.org/newscenter/news/korea-atomic-energy-research-institute-becomes-international-centre-under-iaea-label.

50) See the Korea Institute of Nuclear Non-Proliferation and Control's (KINAC) official website for more information: https://www.kinac.re.kr/eng.

51) Jeon and Orta, "Strength in Partnership." Also see, "KINAC Produces 567 International Nuclear Nonproliferation and Nuclear Security Experts" [in Korean], *The Korea Herald*, July 12, 2024, https://biz.heraldcorp.com/article/3433401.



IAEA's Network of Analytical Laboratories (NWALs), including 25 qualified laboratories from IAEA Member States worldwide[52]

Third, South Korea also supports the IAEA through its participation in the NWAL system—a constellation of high-tech laboratories across the global.[53] The IAEA depends upon NWAL-listed facilities to support verification of Member States' declarations through technical analysis of environmental sampling. Under the Additional Protocols agreement, IAEA inspectors maintain the ability to collect environmental samples. Environmental sampling—the process of gathering in-fields samples for laboratory analysis—is an essential element in the IAEA's verification toolbox.[54] With the expansion of nuclear technologies worldwide, the rate of

52) See, International Atomic Energy Agency (IAEA), *Development and Implementation Support Programme for Nuclear Verification 2024-2025* (IAEA, 2024), pg. 38-46, https://www.iaea.org/sites/default/files/24/01/development-and-implementation-support-programme-for-nucear-verification-2024-2025.pdf.

53) Ibid.

54) Following the lessons of the 1990s, including the discovery of Iraq's clandestine nuclear weapons program, the IAEA expanded its purview to confirm the "correctness and completeness" of Member States nuclear facilities declarations through the Additional Protocols. For an overview, see Cabanas, Carmen, "How Environmental Sampling Helps Verify the Peaceful Use of Nuclear," International Atomic Energy Agency (IAEA), September 22, 2021, https://www.iaea.org/newscenter/news/how-environmental-sampling-helps-verify-the-peaceful-use-of-nuclear.

samples gathered by IAEA inspectors has been steadily rising. Estimates of annual samples collected are between 400-600 based on IAEA statements and academic reviews[55]—placing mounting pressure on the finite capabilities of the IAEA's Safeguards Analytical Laboratory (SAL) in Seibersdorf, Austria. To address, South Korean laboratories support the augmentation of the IAEA's overall capacity to produce accurate and timely sample analysis.[56]

Moving forward, South Korea should continue to bolster the IAEA-led international community as a means of demonstrate the nation's ongoing commitments to nuclear safety, security, and nonproliferation. Through programs such as ICERRs and the NWAL system, South Korea's certified laboratories at KAERI play a critical role in supporting training and R&D for newcomer nuclear nations as well as anonymously process environmental samples in support of the IAEA's global safeguards framework. Lastly, South Korea has invested institutional expertise in developing multinational training and R&D programs at KAERI and KINAC respectively to provide further nuclear training on safety, security, and safeguards.

3) Advancing U.S.-ROK Civil Nuclear Partnership

The evolving global nuclear energy landscape for new and advanced nuclear technologies presents critical opportunity for the United States and South Korea to demonstrate shared commitment to nuclear nonproliferation norms. Both nations should continue to explore safeguards-centered approaches to national and bilateral public-private partnership—leveraging both top-down and bottom-up initiatives with civil nuclear industry.

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55) M. Schoeppner, et al, "Evaluating Environmental Sampling Data for Safeguards – Principles and Advances," Proceedings of the INMM/ESARDA Joint Annual Meeting, May 22-26, 2023, accessed online at https://resources.inmm.org/sites/default/files/2023-07/finalpaper_618_0512102210.pdf.

56) In September 2013, the ROK government announced an interest for the nuclear facilities at KAERI, including the Clean Laboratory for Analysis of Safeguards Samples (CLASS), to be design ated as a participating facility in the NWALs system. Later, in 2018, following internal review, South Korea officially became the world's third institution to join the NWALs system in support of the IAEA's safeguards sampling analysis.

As a top-down mechanism, Washington and Seoul should further implement the IAEA-led "safeguards-by-design" in the advancements of nuclear technologies, including AMRs and SMRs. On January 8, 2025, Washington and Seoul concluded a joint agreement on the "Principles Concerning Nuclear Exports and Cooperation."[57] Building upon the two nations' long-standing civil nuclear partnerships, the MOU aims to establish a framework for cooperation on third-country civil nuclear exports, "maximizing the peaceful use of nuclear energy under the highest international standards of nuclear safety, security, safeguards, and nonproliferation."[58] To further these bilateral agreements, it is increasingly important that Washington and Seoul seek to re-start the High-Level Bilateral Commission (HLBC) in alignment with the 2015 U.S.-ROK 123 Agreement. Despite successfully convening the HLBC in 2016 and 2018, the joint commission halted shortly after due to a confluence of international and domestic challenges, including the intellectual property dispute between Westinghouse and Korean companies. Following Westinghouse's announced settlement,[59] however, the two nations have an even greater incentive to reactivate the steering power of the HLBC to align U.S.-ROK shared civil nuclear policies.

As a commercial-led bottom-up strategy, the domestic demonstration and commercialization of first-of-a-kind advanced nuclear technologies will be essential for maintaining long-term competitiveness and adherence to international nonproliferation norms. The United States and South Korea are uniquely positioned to influence the trajectory of advanced reactor development, particularly if supported by sustained investment and adaptive regulatory frameworks. Both nations' civil nuclear industries hold crucial positions globally as nuclear energy producers as exporters.[60] According the NEA's SMR Reactor Dashboard, U.S.

57) *Joint Statement of the United States of America and the Republic of Korea on the Expansion of Peaceful Nuclear Energy*, U.S. Department of Energy, January 8, 2025, https://www.energy.gov/articles/joint-statement-united-states-america-and-republic-korea-expansion-peaceful-nuclear-energy.

58) Ibid.

59) "Westinghouse Announces Global Settlement Agreement with KEPCO and KHNP," Westinghouse, January 16, 2015, https://info.westinghousenuclear.com/news/westinghouse-announces-global-settlement-agreement-with-kepco-and-khnp.

enterprises represent approximately one-third of the more than ninety SMR designs presently under review globally.[61] Such industry leadership may serve to not only reinforce the necessity of "safeguards-by-design" for advanced and modular reactors, but could also demonstrate the long-term commercial viability of nonproliferation-centered designs.

Additionally, recent national regulatory authorizations in both the United States and South Korea underscores the technological leadership of both nations' civil nuclear industries—most notably through NuScale's VOYGR, Kairos Power's Hermes, and KAERI's SMART-100 and i-SMR designs.[62] In October 2025, South Korea's SMART 100 (also known as the System-Integrated Modular Advanced Reactor), designed by KAERI, became the first SMR to officially submit to a safeguards technical report to the IAEA. According to KAERI, the recent successes in the SMART 100 reactor development signals "both a demonstration of Korea's advanced reactor technology and a commitment to transparency and international trust…By integrating safeguards considerations into the design from the beginning, we are setting a precedent that will benefit future SMR developers."[63] Aiming to achieve initial SMR deployment by the 2030s, both Washington and Seoul share a unique opportunity to meet the rising global nuclear energy demand and ensure strong continuation of each nation's respective industrial leadership in shaping the future nonproliferation architecture

60) See, Orta, "US-South Korean Civil Nuclear Exports."

61) Nuclear Energy Agency, *The NEA Small Modular Reactor Dashboard: Second Edition* (OECD Publishing, 2024).

62) For an in-depth review of current SMR development initiatives, see International Atomic Energy Agency (IAEA), *Small Modular Reactors: Advances in SMR Developments 2024*, (IAEA, 2024), https://doi.org/10.61092/iaea.3o4h-svum; and also, International Atomic Energy Agency (IAEA), *Advances in Small Modular Reactor Technology Developments – A Supplement to: IAEA Advanced Reactors Information System (ARIS)* (IAEA, 2020), https://aris.iaea.org/publications/smr_book_2020.pdf. Additionally, for specific discussion on leading nuclear developers, particularly the Group of Seven (G7), see Orta, Kayla, "High-Tech Alliances: South Korea, the G7 and the Future of AI and Nuclear Innovation," in *IAI Papers Series*, No. 25 (26), Instituto Affari Internationali, October 30, 2025, https://www.iai.it/en/pubblicazioni/c03/high-tech-alliances-south-korea-g7-and-future-ai-and-nuclear-innovation.

63) "South Korea to Submit Safeguards Report for SMR Design," *World Nuclear News (WNN)*, October 21, 2025, https://world-nuclear-news.org/articles/korea-to-submit-safeguards-report-for-smr-design.

within the international export market for advanced nuclear technologies.

In summary, South Korea's sustained engagement in advancing global nonproliferation norms and strengthening IAEA safeguards continue to re-enforce Seoul position as a normative leader in the international nuclear order. Looking forward, there is a strategic opportunity for the U.S.-ROK bilateral to "serve as a model" for the safeguarding of nonproliferation commitments within the expanding international nuclear export market.[64]

7. Conclusion

Building on its longstanding alignment with U.S. nonproliferation principles, South Korea can reinforce its reputation as a responsible nuclear actor while enhancing U.S.-ROK deterrence cooperation and consolidating its role as a global leader in IAEA safeguards and advanced nuclear innovation. Driven by North Korea's unchecked weapons programs and perceived shifting of U.S. extended deterrence imperatives, South Korea's nuclearization narratives are a significant ongoing domestic debate. Misalignment of Seoul's nuclear agenda, however, would come at the expense of South Korea's hard-earned reputation as a responsible civil nuclear actor within the global nonproliferation regime. To sustain long-term credibility and market competitiveness, Seoul must reaffirm its commitment to the NPT, IAEA safeguards, and international transparency as the core pillars of its civil nuclear agenda.

Historically, by institutionalizing stringent regulatory mechanisms and embracing transparency measures under the IAEA's Additional Protocols framework, Seoul has transformed historic skepticism into international confidence in its peaceful nuclear intentions. As such, South Korea's civil nuclear industry presents a model of innovation and trust that can reinforce global nonproliferation norms. By embedding "safeguards-by-design" principles into next-generation reactor development, supporting the IAEA's verification and training initiatives, and expanding

64) See, Jeon and Orta, "Strength in Partnership."

international cooperation through multilateral and mini-lateral forums, Seoul can continue to demonstrate how technological advancement and nonproliferation can be mutually reinforcing. Additionally, through nonproliferation regulatory and R&D institutions such as KAERI and KINAC, South Korea is already translating its technical expertise into tangible capacity-building programs that strengthen global safeguards implementation and elevate its standing as a responsible exporter of advanced nuclear technologies.

Ultimately, the future of the U.S.-ROK civil nuclear alliance will depend on the ability of both partners to align security policy with nonproliferation principles. As global nuclear competition intensifies, Washington and Seoul have an opportunity to transform their nuclear cooperation from a partnership mainly defined by ambiguity to one anchored in long-term mutual commitment towards strengthening the future of global nuclear nonproliferation and safeguards.

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