A Keynote Conversation with Dr. Jooho Whang

[00:00:00] Speaker 1: All right. I know that everyone is enjoying that good lunch, and hopefully you've got a coffee now and you're ready with some enthusiasm for the afternoon sessions here. So to kick things off, we'll have a little bit more focus on nuclear energy issues as we started to do this morning. It's my great pleasure to welcome to the stage two people who are, I think, poised to really help us dig into some of the challenges of the nuclear energy future that we see. Dr. Wong Ju-ho is president and CEO of Korea Hydro and Nuclear Power. He is a nuclear engineer by training and practice and has long served as a professor at Kyunghee University. In addition to his years as an educator, he has also served in numerous leadership and advisory capacities in various Korean nuclear research organizations and governmental bodies. I think I first met Dr. Wong maybe about 10 years ago and have always been impressed by his thoughtfulness and dedication, not just to the learning in the field, but also the education in the field and helping ensure that we have a pipeline of talent coming into it. And I'm grateful that he has traveled all the way from Seoul to spend some time with us talking about his vision for the nuclear energy future. To moderate this conversation is someone who I expect is known to most of you, Ambassador Laura Holgate. Laura has been a fixture in the nuclear policy community in Washington, D.C., and more recently in Vienna, where she served twice as ambassador to the IAEA and other international organizations. She's had a distinguished career both in government, on the National Security Council staff, leading, for example, the nuclear security summits, before that in the Pentagon and Department of Energy, working on threat reduction issues, as well as in the nongovernmental field as vice president at the Nuclear Threat Initiative. So Dr. Wong, Ambassador Holgate, the session is yours.

[00:02:08] Speaker 2: Thank you. Thank you so much, Toby, and to the whole Carnegie team. It's always great to be on this stage, and even more fun to be in a moderator instead of the hot seat. So I hope that you all will go easy on me and then pay attention to the questions for Dr. Wong. It is really good to have a chance to talk more about nuclear energy, as we see in the agenda for this conference. And this fireside chat gives us a chance to dig in a little bit more. We're seeing a level of demand for nuclear energy as one way to address the global energy poverty than we've ever seen before. And meeting that demand through deploying nuclear power in a timely and responsible manner is going to be more important than ever, if nuclear is going to play the role it needs to play in the clean energy future. Korea Hydro Nuclear Power has continued building nuclear power plants both domestically and internationally, and it's also investing heavily in SMR development. Given this experience, Dr. Wong, I imagine that you've thought deeply about how nuclear energy should be introduced responsibly, especially in terms of nuclear security and nonproliferation. From your perspective, as both an operator and a longtime leader in the nuclear field, how can we deploy nuclear power in a responsible way?

[00:03:43] Speaker 3: Yes. While I was currently, I am currently the CEO of Korea Hydro and Nuclear Power Company, but I was for many years a professor of nuclear engineering, and I've actually attended this Carnegie conference several times in the past, not as a speaker but as audience. I learned a lot from many inspiring experts. So it's quite meaningful for me to be sitting here now, and I feel a strong sense of duty to contribute more than I received. As you pointed out, the world is facing three major challenges. First, the rise of AI industries and data centers has significantly increased global electricity demand. There are currently over 11,000 data centers

globally consuming more than 460 terawatt hours annually. This amount of electricity is the same as Germany spends electricity a year. That demand is expected to more than double soon. Second, the war in Ukraine has reminded us how critical energy security is. And third, climate change has made carbon-free energy source essential. In response, global interest in nuclear energy is rising quickly. According to the IAEA, total global nuclear capacity could reach around 900 gigawatt electric by 2050. Industries are now exploring many ways to maximize the value of nuclear power, not only through building new large plants but also by extending the life of existing reactors and even restarting previously shut down plants. At the same time, advanced reactors such as SMRs are being developed for commercialization. So people are exploring many uses of nuclear energy other than power generation, such as desalination, district heating, industrial heat, and power for ships. So the interest in nuclear power is not limited to developed countries. More and more emerging economies are laying out serious plans for nuclear energy. With so many countries and companies interested, it feels like there's a race to bring these technologies to market. But in our haste, we must not overlook the core values of nuclear energy, safety, nuclear security, and nonproliferation. If we lose sight of these principles, we risk repeating the accidents and incidents of the past. And in the nuclear industry, even a single event can significantly set back momentum. So I want to share a famous Korean saying. We have a saying that the more you hurry, the more you should go the long way around. When we are under pressure and the goal seems close, we are tempted to rush. But in uncertain times, the fastest path is often the one that takes more time and cost. We better choose proven, well-tested ways, even if they cost a bit more and take a bit longer. When adopting nuclear power, safety rules and regulations can feel like barriers. But in fact, they are what allows us to use nuclear energy in a peaceful and safe way. It is essential that operators fully understand and embed them across all levels of the organization. That takes time, but that's the right way. Since completing Korea Unit 1 in 1971, KHMP has been actively building and operating nuclear power plants, both in Korea and abroad, including in the UAE. We are also close to signing a contract with the Czech Republic. Throughout the journey, we have focused not only on delivering on time and within budget, but also on promoting the three essential principles of nuclear energy. Again, safety, security, and safeguards. We don't just apply these principles. We are also committed to sharing and promoting them.

[00:09:17] Speaker 2: Well, Dr. Wang, you mentioned the proverb that sometimes the long way around is actually fastest. When it comes to introducing nuclear power, it's clear that safety, peaceful uses, and responsibility matter more than speed or cost. I'd like to hear from you some examples of how Korea has achieved this goal and what role the IAEA has played in this process.

[00:09:44] Speaker 3: Yes, this is a long story, but long story short. South Korea was able to rise from the ashes of war and adopt nuclear power thanks to strong support from the United States. We were once a beneficiary, and today we have become a contributor to the global community, and Korea is now seen as one of the nuclear energy leaders. We owe much of that to the institutions and experts in the U.S. nuclear field. So I want to take a moment to sincerely thank the U.S. nuclear community who have supported the growth of Korea's nuclear industry. Thank you. Korea signed its first nuclear cooperation agreement with the U.S. in 1956 when I was born, established the Korea Atomic Energy Research Institute, and completed its first research reactor, Trigger Mark 2, in 1962. Nine years later, in 1971, we began construction of our first commercial reactor, Gori Unit 1. The agreement was

revised in 1976, and the power reactor was completed in 1978, making Korea a nuclear power-producing country. The agreement was revised again in 2015, and we have strictly adhered to it ever since. You said you were involved in revising this. Thank you. Throughout this journey, KHMP has continuously built nuclear power plants for nearly 50 years, even during periods when many advanced Western countries slowed or halted their nuclear programs. Our consistent focus has been not just on delivering projects, but on setting a global example in how to use nuclear energy safely and peacefully. The good news is the licensing issue with Westinghouse was recently resolved in a collaborative manner, and I am confident that Korea and the U.S. will continue the strong partnership that has been built over the past 50 years for the future, too. At KHMP, every nuclear power plant we operate reflects our dedication to the three S, safety, security, and safeguards. We have built advanced digital control systems to ensure safe plant operations. In KHMP headquarter, we run a huge monitoring room that allows real-time monitoring of all the plant conditions across the country, contributing to safe operations. On the security side, we have implemented a strong physical protection system. Our plant designs reflect the principle of security by design. We clearly defined vital areas and built multiple layers of defense. We also take cyber threats seriously. Alongside digital control systems, we have strengthened our cyber security measures and linked them with physical protection systems. We conduct regular joint exercises on both physical protection and cyber security in cooperation with organizations like the Korea Institute of Nuclear Nonproliferation and Control and the National Intelligence Service to prevent human error and ensure that our systems are always in top condition. Our nonproliferation compliance IAEA monitoring equipment is built into our plant designs from the start. This enables us to implement IAEA safeguards thoroughly. We also work closely with KINAC, which oversees Korea's export control and nonproliferation procedures to ensure full compliance not only with IAEA standards but also with the U.S.-Korea nuclear cooperation agreement.

[00:15:08] Speaker 2: These are some of the most important components of operating these facilities. What's interesting for the U.S. is because we don't have IAEA safeguards applied routinely to our facilities, even though we do have a voluntary offer agreement that opens that door, that's a skill set from Korea that maybe we could take some advantage of that learning. We all know, and many companies have bemoaned to me, that we don't have a global nuclear regulatory standard. We have national standards. But we do have the IAEA's safety, physical protection, cybersecurity, safeguards, standards and guidance. This is the closest thing we have to a set of global best practices. We also know that as technology advances, as do risks. It's really crucial that safety, security, and safeguard measures keep pace. You mentioned the UAE project earlier. I'd like to return to that because I've always believed that exporting a nuclear plant is like a 100-year hug, the relationship between the exporting country and the importing country. It's more than just technology. It's culture, it's relationships, it's fuel cycle security. It also means exporting a culture of safety and peaceful use. I'd really be interested in hearing how KH&P passed that along, passed that culture along in the course of the UAE project at Baraka.

[00:16:50] Speaker 3: Yes, of course. When we worked to export APR 1400 to the United Arab Emirates, we built a strong cooperation framework with partners like the U.S., IAEA, and the Nuclear Suppliers Group. We fully complied with all export control regulations. For the UAE project, we provided training and support so they could fully understand the responsibilities that come with operating a nuclear power

plant. KH&P's experience can be especially useful for emerging countries that are just beginning to consider nuclear energy. Korea can work alongside those countries to help them develop a strong, solid foundation for nuclear power.

[00:17:48] Speaker 2: That's especially important as we consider that many of the emerging nuclear countries will not have the resources available, the financial resources that UAE had. That puts the supplier of the technology in an especially meaningful position. If I can just summarize what you've just said there, is that the U.S. helped Korea develop its nuclear culture, sharing the safe and peaceful nuclear use approach, and then Korea has done the same with the UAE, passing that culture along. Do you see Korea continuing that role as you look at additional countries where you're looking to build nuclear power plants?

[00:18:28] Speaker 3: Sure, absolutely. In regions like the Middle East, Southeast Asia, and Africa, we are seeing aggressive nuclear exports from China and Russia. Indeed, I have concerns about whether these countries are making sufficient efforts to uphold the nonproliferation regime. To address this, the global community must come together to strengthen nonproliferation and nuclear security. In this effort, I believe Korea can play a key role as a model non-nuclear weapon state. And no single country can tackle this alone, especially in the face of other major players' aggressive expansions. As we navigate rising nuclear energy demand and a changing energy landscape, strong U.S. Korea cooperation is maybe a key to reinforcing the nonproliferation and security regime. If the U.S., a pioneer in the peaceful use of nuclear energy, and South Korea, a non-nuclear weapon state with technical expertise and a strong nonproliferation record, can join forces as Team Nuclear, KORUS, K-O-R-U-S, we can turn our shared vision of Atoms for Peace into reality. And importantly, this partnership can be a practical tool for expanding the nonproliferation regime, particularly for newcomer countries, and countering aggressive moves from other major players in the global nuclear market. KHMP is already helping. We've been educating young engineers around the world, especially from countries planning to introduce nuclear power. We provide education in both nuclear engineering and nuclear policy. In 2012, we launched KINGS, the KEPCO International Nuclear Graduate School. And now I serve as chair of the board here. Last year, KINGS even launched a nonproliferation research center to further promote nonproliferation and security. In this room, the head of this center is with us. Raise his hand. Okay. Okay. We teach students not just technology, but also the importance of nonproliferation and nuclear security. By the way, at the KHMP booth right outside, you can find brochures and souvenirs from KINGS. Anyone can apply. Tuition is free. Yes. You may stay there two years. Yeah. Okay. Taking a master's degree.

[00:22:04] Speaker 2: Yeah. Uh-huh. Take note.

[00:22:07] Speaker 3: Yeah. Yeah. Young folks in the room. Drop by. Yeah.

[00:22:12] Speaker 2: Well, that's great. And I see from the clock before me that I'm a little bit delayed in getting to the Q&A. I apologize to everybody, but there's a couple of good questions in here. And one from Kayla Orta asking the following. She says, moving forward, increasing the talent pipeline for nuclear research and engineering will be crucial. And you've just been talking about that with KINGS. How is KHMP supporting emerging talent, both men, but also especially women, within

Korea domestically and also with other partner countries or third-party nuclear export nations that you may be working with?

[00:22:50] Speaker 3: Okay. Okay. Okay. To address the rapidly increasing nuclear demand, we have to take good talents regardless of gender. So we promote several activities, international activities, like Riese Meitner, of course, and WIN Global, W-I-N Global, yeah. And WIN Korea, too. Women in nuclear global.

[00:23:27] Speaker 2: Yeah, yeah, yeah.

[00:23:28] Speaker 3: Those who may not be familiar. And also, in KHMP, we picked up female power plant head. And also, the large control room overseeing all the nuclear power plants in Korea, the head of that room is also a lady, yeah. And I'm pretty much interested in increasing the number of female high-position workers. Yeah. Yes.

[00:24:11] Speaker 2: Well, we've seen again and again how important it is to have those visible women and other communities that may be less well-represented in our nuclear industry, to have those leaders be visible and to be role models and aspirational for the nuclear community moving forward. Another question here, looking from your point of view as a regulated industry, what do you see as the most important thing to speed up the development of new nuclear reactors? Is it licensing reform inside Korea? Is it coalescing around some kind of a scalable technology? Is it affordable financing, supply chain build-out, other factors? And this is from Ross Matzkin-Bridger from NTI.

[00:25:08] Speaker 3: Yes, you pointed out all the important aspects which are needed for speeding up nuclear deployment. But the most important thing is a consistent national nuclear policy, yeah. Without consistency in nuclear policy, you may not develop any, what is it, supply chains or licensing, and also collecting human resources too. We have experienced in Korea, we experienced inconsistency of nuclear energy policy, how this type of turbulence may affect nuclear industry. For the last government, we experienced a surge of nuclear industries and peoples. So consistency of national energy policy is very important.

[00:26:35] Speaker 2: Yes, well I think as democracies, we see that that can sometimes go different ways under different administrations. It's been interesting to see in the U.S. that we've had a bipartisan consensus in support of nuclear energy that's lasted over a decade now. Hopefully we can stay consistent and you can stay consistent as we look forward to the future of nuclear energy. Going back to your work in Vienna, I remember at the Small Modular Reactor Conference, the IEA's first SMR conference that they held last fall, there was the elevator that goes up to the main plenary. There were three major displays, a Russian display, a Chinese display, and a Korean hydro display that had really cool three-dimensional reactors that lit up and lots of good materials and so on. I'd like to hear more about your SMR approach and how you are balancing both the gigawatt scale and the smaller scale reactor development within Korea Hydro.

[00:27:47] Speaker 3: As the CEO of Korea Hydro and Nuclear Power Company and also as one of the members in the global nuclear industry, I see large plants will be needed for a long time. But SMRs can play different roles, not only for providing electricity but also for providing industrial heat and desalination, and it may find many

uses. We developed the concept of SMR-based smart net zero city. When we develop a city around the population of 200,000, one SMR with around 68 megawatt electricity combined with renewables like wind and solar of about 20 percent, we may easily build a net zero city. At the same time, giving the industries and households the electricity cost 30 percent less. Yes. That's what we developed and we are continuously validating. This is a good model. We introduced this model in COP28 in Dubai. Some of you might have seen it. If you are interested, we may send you the model and some videos introducing those simulations.

[00:30:04] Speaker 2: That's great. I see our time is up, but I really want to thank you for your being here and being part of this conversation. I hope everyone has enjoyed hearing from you, and most importantly for the work that Korea Hydro is doing to enhance nonproliferation nuclear security at home and in your exports. Thank you very much, Dr. Wong.

[00:30:26] Speaker 3: Thank you.

[00:30:27] Speaker 2: Thank you. Thank you.