A Keynote Conversation with William D. Magwood, IV

[00:00:00] Speaker 1: Welcome back to Day 2 of the Carnegie International Nuclear Policy Conference. I hope you had a good day yesterday just to take it all in and hear the good panels and probably just as, if not more importantly, have opportunity to visit with each other and rebuild the connections that really are so important to us as a community. You will have noticed that we have a lot more nuclear energy content on the agenda this year, which is very much by design. I think this is an issue that we feel like needs to be part of our active conversation, that the silos that tend to exist between nonproliferation and the deterrence parts of the field need to more actively engage with the silos that exist around the nuclear energy parts of the field. And so I'm very excited to start the day today with a keynote that I think will help us to better understand why those silos exist and to help break them down. William Magwood serves as the Director General of the Nuclear Energy Agency in Paris, a position he has held since 2014. He brings to that job deep experience as a former commissioner of the U.S. Nuclear Regulatory Commission, as an independent nuclear energy consultant and as a director of the Department of Energy's Civil Nuclear Energy Program. He began his career as a scientist at Westinghouse and later the Edison Electric Institute. He also has deep ties to Pittsburgh, including degrees from Carnegie Mellon University, which I think essentially makes him part of the Carnegie family. Now, Bill, we haven't talked about that, but I think I'd like to assert that. To lead the conversation with Director General Magwood is Joyce Connery, who I'm proud to know as an admired colleague from days past at the National Nuclear Security Administration. Joyce recently left government after nearly a decade with the Defense Nuclear Facilities Safety Board, six years of which she served as chair. Before becoming an expert in nuclear safety issues, Joyce had also worked in numerous senior positions at NNSA and the National Security Council staff covering nuclear energy policy, nuclear security, and a range of other issues. It's great to have both Bill and Joyce with us today. Please welcome them to the stage. Thank you.

[00:02:33] Speaker 2: It's bright up here. First of all, I want to thank Carnegie for inviting us to do this today and thank you for that introduction, Toby. We did notice that there was more nuclear energy content and you have some regulators smattered around in the itineraries, which I think is good because I think if you're right, we need to get rid of some of the silos between nonproliferation, nuclear safety, nuclear energy, and kind of get everybody working together. I'm excited to talk to you, Bill, and have a conversation with you about your storied career and the future of nuclear energy internationally. I know you had to leave a little early yesterday, so you missed the last panel, which for those of you who are here, was a discussion of nuclear proliferation, the risks in an era of uncertainty. Toward the end of that discussion, I think some of the panelists were noting the fact that the nuclear energy could be used as a carrot or an enticement to the international community to engage with them in a way that would perhaps dissuade them from going down the nuclear weapons path. I thought that was a good starting point and a good segue. What I wanted to start with you to discuss this morning is the ambitious, perhaps unachievable commitment that dozens of countries made to pledge to triple nuclear energy capacity by 2050. That is, again, ambitious, potentially unachievable, but I want to ask you what you think that, say, three things would need to go right in order to achieve that.

[00:04:14] Speaker 3: Thanks, Joyce. First, let me echo your thanks to Carnegie for hosting this discussion. It was very interesting to hear the conversations yesterday morning. I don't usually think much about the nuclear weapons side of things, but to be honest, they're starting to cross over more than they used to. I'll share with you that in our venue, there's been discussions by regulators about whether—they haven't decided in all cases to do this—but whether to start to think about nuclear attacks as part of their commercial emergency preparedness frameworks. There are some countries that are doing that now, depending on their geographic location, but it's becoming a more general conversation. It's sad to see that that's the tenor of the conversation these days. Three things to talk about. The truth is, with nuclear, everything has to go right. It isn't going to be any three things, but over the last few years, the NEA has been holding special ministerial discussions. I say special because there's lots of ministerials that go on in different venues, but to be perfectly honest with you, most of them don't really do very much. They lead to really nice photographs, and people issue really nice statements, but nothing ever happens. What we're trying to do is pull together countries that are serious about moving forward with building new nuclear power plants, and where it makes sense to do things together to get through some of the barriers. That's what we've been doing. We have this process called Roadmaps to New Nuclear. In those contexts, the ministers have identified three high priorities for us to think about. We had a ministerial a couple of years ago that was co-chaired by France. Last year, it was co-chaired by Sweden. This year, co-chaired by Korea. I think Mr. Wang, maybe he's gone now, but he's very involved in this, so I want to thank him for his participation in that. The three areas that the countries have focused on will not surprise you. One is financing. Everybody worries about financing, but it's a very nuanced issue, because different countries have different focuses when it comes to financing. For a lot of countries, obviously, nuclear projects are very large scale. It requires a lot of resources. Particularly if you're in the Global South, those resources don't exist. How do you get nuclear projects going? That's a major issue. One of the reasons we're engaging so deeply with the World Bank, I'm going to be at the World Bank again on Monday to talk to the staff about their participation, acute hopeful participation in nuclear projects. There's also other aspects of financing. This is something if you're in a country like the U.S., you have to think about. That is, how do you deal with all the uncertainties? How do you deal with the first of the kind, particularly uncertainties, to make sure that a nuclear project isn't a bet-the-company proposition? That used to be theoretical. Now all the people on the U.S. side know it's no longer theoretical. We actually saw it happen. One company won, one company lost. Not a very pretty picture. Not very many CEOs want to sign up to do that again. There's that aspect. There's also a geopolitical aspect, which I think echoes with this crowd. That is that if you go to Southeast Asia and Africa, you will see that there are a lot of countries that would like to build nuclear. I've engaged with a lot of those countries. Many of them are very attracted by the kind of financing possibilities presented by state- owned enterprises that a company like Wessinghouse or General Electric or others can't quite replicate. There's different aspects of financing. I think they're all very important. The second issue that comes up is supply chain. This is one that not enough people think about. It's the one, honestly, that scares me the most, because you may have companies that will tell you very ardently, we can provide this part, and we can do this at this cost and this schedule. Then the project gets started, and you find out they can't provide that part. Now you've got a problem. No longer theoretical. It happened during the projects in the US. Many, many suppliers thought they could provide these components, couldn't do it, and therefore time was lost as people had to go back, train people,

explain to them how the certifications work, so they could move forward. The last one, which is probably the hardest to fix, is workforce. The US is actually in probably—while it's not perfect, it's probably in better shape than a lot of other countries. In a lot of countries, there just simply aren't young people coming into nuclear sector. In fact, in most countries, there aren't enough young people coming into science and technology at all. The ones that do go into science and technology go into things like biological medicine, things like that. We really need a major effort to get more young people into the sector. That's a big challenge for a lot of countries. Those are the three issues that we focus on, but obviously there's other things that have to be taken into consideration as well. Those are the ones that we're spending a lot of time on right now.

[00:09:48] Speaker 2: I want to start with the last thing first, which is workforce. If you looked at the report that came out from DOE in 2023 about what it would take for commercial liftoff in the United States, it said to reach our 200 gigawatt goal by 2050, we would have to have 375,000 of people in the workforce. That's technical and not technical. We have about 100,000 now. My math is not great, but that's like 15,000 people a year. Given the situation here in the U.S. with the rising cost of education, the challenges that we're facing now, the universities are facing a lot of challenges, what is the government's role and the private sector's role in supporting nuclear education?

[00:10:34] Speaker 3: To do more. I know it's easy to say that, but I think that's the only reality you can bring to this. For those who have been around a long time, you might remember there was a period during the 90s when the U.S. infrastructure on nuclear education was really near collapse. The only thing that kept it from falling apart entirely was the fact that we at the Department of Energy at the time decided we had to jump in. We jumped in and started spreading money around. It wasn't a lot of money, but it was important money. It was scholarships and fellowships, research grants, infrastructure grants, lots of things like that. It really stabilized the situation. More importantly, it showed the universities, which was really a key audience for this, that we in the federal government thought there was a future to this nuclear sector and that they shouldn't abandon it. I think it really helped save a lot of programs. What really made the difference today, I think, was the fact that when utilities realized that they had a major demographic problem, that they had too many people retiring and not enough people coming in, the salary level started to go up. Then you started to see more and more young people go into the business. That's why the U.S. situation is not as dire as it is in a lot of other places. You say there's a big challenge ahead, but I think you can fix it. I think it's something there's still time to adjust, but you really do have to start planting those seeds now and to make sure that nuclear careers are attractive to a larger number of young people. What we find is that a lot of young people don't really know what it means to have a nuclear career. I think many of them think about radiation, they think about Fukushima Daiichi, they think about nuclear weapons, but they don't think about saving the planet. That's the kind of message I think that the industry and government together really have to get out there, that nuclear technology saves lives, not just through energy, but through medicine and other applications. That's something that we have to really make a bigger effort to get the word out.

[00:12:42] Speaker 2: I think young people might be intrigued by the message of going out saving the world, saving the planet, working for companies because it's more lucrative. You and I both started our careers with the federal government, and

you were in the Nuclear Regulatory Commission. We spoke a little bit with Commissioner Hanson yesterday. Getting people to go into the regulatory sector when it's more financially attractive to go into the private sector and keeping them there is a challenge for the United States. I can imagine in developing countries it's even more of a challenge. What do you do about the regulatory infrastructure that's supposed to underpin the nuclear energy growth?

[00:13:16] Speaker 3: Yeah, it's a big challenge. Commissioner Hanson highlighted this yesterday. In some countries, you think it's bad in the U.S. Basically, if you get your training at the Nuclear Regulatory Commission and say you're in your early 30s, you can probably double your salary very easily by moving into the private sector. In some cases, triple your salary. You have to be driven by more than the money. You have to be driven by the mission, the desire to be a public servant, to protect public health and safety. That's nothing. That's attractive to some people. In other countries, I won't name countries, but there's some countries where the differential between being a nuclear regulator and working in industry is a factor of seven. If you're talking about those kinds of numbers, the mission isn't enough. You need to have more than that. We've really been talking to a lot of governments about looking very seriously at increasing the salary levels to try to close that gap a little bit. You'll never close it entirely, but you have to make it reasonable so that people can make those decisions. This is going to be an ongoing challenge. It's going to get worse. It's not going to get better any time soon. It's going to get worse because regulators also need to try to attract people with expertise in areas like artificial intelligence. As you know, those are very, very high-paying jobs in industry. How does a nuclear regulator have that kind of expertise in-house? That's a big challenge. We're going to have to face it because if we don't, regulators won't be ready. If regulators aren't ready, then all this wonderful progress we've been talking about could come to a grinding halt.

[00:15:02] Speaker 2: Do you worry about corruption at all?

[00:15:05] Speaker 3: Corruption where?

[00:15:07] Speaker 2: In any place that wants to build nuclear power plants.

[00:15:10] Speaker 3: Well, it depends on where. I think any part of the world, there's always that consideration. There's lots of countries that we work with both in the OECD and out of the OECD that have significant corruption problems. I think the difference between where we are today and maybe where we were 20 or 30 years ago is that these countries understand that they have these issues and they talk about it openly. It's not a secret. They have programs and laws to try to address it. It doesn't make it easy, though, but they are very much aware of it. I guess my view is one of the things about the nuclear business that's unique is that it tends to have an overall impact on society. The kinds of disciplines that you have to have in the nuclear sector to be successful in the nuclear program have a way of spreading in other parts of society. I was in Kenya last year and I met this lady who lived in a community that were talking about putting up a nuclear power plant. She made the observation to me, it was a really interesting observation, that where she lives, she pays someone to take her trash away. She discovered that despite the fact she was paying to have the trash taken away and disposed of safely, that the vendor was taking the trash a few miles down the road and dumping it on the side of the road. She said, how do we know that people won't do that in the nuclear sector? I said,

well, one thing is that the entire world is watching everything you do. Your peers are watching. Regulators watch what other regulators do. Nuclear operators watch what each other do through one or another mechanism. The IAEA is watching everything that's done. There's a lot of watching and a lot of peer pressure within the nuclear sector that will make that kind of behavior apparent very quickly and it will be a very bright light on it. I think the fact that the nuclear sector creates those kinds of disciplines, it is something that has a good chance of spreading to the rest of society. I think it actually can help in situations like that and reduce corruption because of the level of oversight that you see in the nuclear sector. I think we'll have a chance to find out because I think a lot of countries that do have these issues are planning to build nuclear power plants. I want to pivot

[00:17:39] Speaker 2: back to, first of all, you mentioned Kenya. I want to talk a little bit about Africa because that's a hot topic in places that are talking about nuclear energy and electrifying Africa and helping Africa get more electricity. We've been seeing in the news some rumors about reorganization in the State Department and whether or not we're going to have a real presence in Africa with our State Department. Again, you mentioned state-owned enterprises also in the commercial field being attractive to Southeast Asia and to Africa. They have a big presence. Our companies are fairly small. They don't have a presence in all of these countries so we rely on our embassies. I feel like that's a little bit of a challenge but I do want to just give folks some numbers about Africa. Right now there are six million people and ten million small businesses with no reliable access to electricity in Africa. This is a huge issue not just for the continent but also there are knock-on effects in terms of global security issues. I just wanted you to touch upon since you've been spending

[00:18:44] Speaker 3: time there. It's been a real education. The NEA historically has not been involved in the Global South. It's not really our venue. We leave that to Rafael's people for the most part so ask him about that later. What we find is that for countries that are really getting serious about building nuclear, they've reached out to us a lot because they're getting past just talking about getting the basics. They want to say, okay, we're really serious about this. How do we solve this problem? How do we solve that problem? That's where we really have been interacting with a lot of countries in the Global South like Philippines. I was just in the Philippines and had really had very comprehensive conversation both public and private sector. The number, maybe you meant this number, but the number that sticks in my head is 600 million. There's 600 million people in Africa without access to electricity, which is kind of mind-boggling when you think about it. To make it worse, people probably don't think about this, but to make it worse, about one-quarter of all humanity by 2050 will be African. You project those trend lines out and you see a global sociological catastrophe on the horizon. We obviously have to do something. I have not had this conversation with the administration yet, although I was at the State Department last week. They're talking a lot about Africa over there. I'm looking forward to having this conversation with senior leadership because I've seen speeches from Secretary Wright where he highlights energy access as being a major priority around the world. It's not just a matter of charity. I think some people try to put in that context. It is really very hard, clear, mutually beneficial reasons for the U.S. and other advanced countries to be involved. Number one, if they don't, then their global competitors will. I think, as someone mentioned yesterday, that it's a hundred-year relationship when you have a nuclear program with—

[00:20:59] Speaker 2: Hug. I think she said it was a hundred-year hug.

[00:21:01] Speaker 3: I don't use that analogy. That's a very important geopolitical aspect of it. Also, if you have small modular reactor vendors in the U.S. and other countries, you need to have the biggest market you can get. You really do. If you don't have a large market, the costs aren't going to come down very quickly. If the costs don't come down, these technologies simply may not be that competitive. We really have to have a big market. We have to sell them to a lot of people. A big part of the future market, very likely, is going to be in the global South. We're not going to be able to do that if we don't understand those markets and understand those needs. That's going to be really important. That's kind of what we're saying and what we're doing. I fully expect that U.S. government will be very sensitive to that as well.

[00:22:00] Speaker 2: I have some questions from the audience, from Mark Shanfin. He wants to know, do you see any advanced nuclear reactors as potentially increasing proliferation risks due to the difficulty for the International Atomic Energy Agency to have effective safeguards? A couple of answers to that.

[00:22:18] Speaker 3: I think that if you're determined to proliferate, it doesn't really matter what technologies you're talking about. You'll find a way to do it. I think a lot depends on which countries you're talking about. I also think that some of the new technologies, I won't say they increase the proliferation risk. I think they change it in some ways. Molten salt reactors are probably the one that comes to mind most immediately because that's an entirely different type of fuel cycle. The kinds of approaches that are taken to inspection today for light water technologies really may not apply entirely to molten salt. I'm sure that the IAEA and others are looking at that, trying to figure out what does that future look like? How do we monitor these things? When I was at NRC, the question was brought to the fore about new technologies and is there a way to require the producers of new technologies to tell us what are the signs of proliferation? How do we know if someone's misbehaving with this particular technology? What are the effluents? What do the buildings look like? I think there's always a way to deal with this. We just have to catch up with the technologies. Part of the challenge that everybody has is that there's so many technologies running around that it's hard to know how to focus your attention. That's one of the reasons we produce the SMR dashboard, which a lot of people have had access to. By the way, the new version is coming out in a month or so, so keep your eyes open for that. What I see is that there's 90-something technologies floating around out there. Our analysis shows it may be like two-thirds of those are real technologies to one degree or another, but the truth is that a much, much smaller percentage of those will be viable commercial technologies by the end of the decade. If it's more than 10, we'd be kind of amazed, but there won't be a whole lot more than that. It'll probably be less than that. Ultimately, we'll start to see where the focus needs to be and we'll be able to then begin to think about what are the new approaches to assuring safeguards in the future. I think it'll be easier than people think it is right now because it won't be as many technologies to deal with.

[00:24:52] Speaker 2: The more technologies, the trickier it is to regulate as well, not just from the...

[00:24:56] Speaker 3: Right, but I don't think there's gonna be that many in the end. I think the

[00:24:59] Speaker 2: list is going to narrow very quickly. Okay, so I'll give Corey Henderstein a personal privilege. She wants to know about the World Bank. You

mentioned them. What's the movement on the World Bank and financing? For those of you who don't know, the World Bank has not been forward-leaning in terms of financing

[00:25:18] Speaker 3: nuclear projects around the world. So I met with Banga and we had a good talk about this. I think he's been very clear publicly that he personally believes that the World Bank needs to do this, but he has a deal with a long legacy of not dealing with nuclear issues and rebuild and build expertise in the bank itself. So that's part of what we're supporting with them, but there's also going to be a political aspect of this because there's going to be members of the board of the bank that are going to be against this no matter what arguments you put forward. So there's going to have to be some political push from countries like the U.S. and Japan and others to try to change that. I think the discussions that are taking place this week might very well make some progress in that area. I certainly hope so. My belief is that it's inevitable. The bank will ultimately do this. It will have no choice because the world is changing and they have to catch up. Otherwise it'll be irrelevant. So I think they'll get there. It's just a question of how long will it take to get to this point, but it will happen. It really has to. And the truth is that when you talk to a lot of countries in the global South, they're being more and more vocal about the need. And I just don't see how the bank can

[00:26:44] Speaker 2: ignore that. So I've heard you speak about not just the issues of climate change but of energy security with countries looking toward nuclear. Can you talk a little bit about the fuel cycle and the dependence on Russian enrichment and what the future looks like in terms of fuel supply to some of these reactors

[00:27:03] Speaker 3: across the world? Well that's a big issue obviously. I mean I think that what the reality of right now, and you know I don't make projections about the future because the future keeps changing, but right now we are living in a bifurcated nuclear fuel market. And none of the analysis that people talk about around the world really deal with that. So that's one of the things we're doing now. We're now looking at, okay the reality is this market's bifurcated. There's some players that people will not buy from. There's other players that people will buy from. And there's some people in the middle who try to buy from everybody. But that makes the market very complicated to understand and to see what the needs are. But two things. First, the bifurcation market is something that governments are already dealing with. You're starting to see big investments in particularly enrichment capacity. People need to deal with conversion as well. They don't talk about conversion as much but they have to deal with conversion. I worry less about uranium supply at this point. We just came out with the new Red Book. There's plenty of uranium available but if we actually triple, then you start to run into some more difficulties. You have to do a lot more exploration and development and investment in the uranium cycle to keep up with that. But so for now I think we're going to stabilize the situation over the next few years. The question is what happens if we do have this big increase in nuclear capacity globally? How do we keep up with that? And is the bifurcated market going to stay a bifurcated market? Because you know if I'm company X and I need to put a big investment to make up for the bifurcated market, how do I know that if I put a billion dollars into new equipment that won't be some deal sign and all of a sudden the market is not bifurcated anymore? That's a big issue. That's really holding back a lot of investment, a lot of work. And until people get comfort that we really are going to continue in a bifurcated market, it's going to be very very slow going. But the good news is if the market signals are

there, we can increase capacity very rapidly I think. But the market signals have to be there. Right now they're not clear and that's an issue.

[00:29:31] Speaker 2: Allie Alcas is asking about the build-on-operate model that is currently being offered by Russia in some countries. Turkey is the one that comes to mind. What can we do to be competitive with that? And is that a good model? How do you think about that in terms of liability and other issues? I mean if

[00:29:49] Speaker 3: you're trying to get a nuclear power plant bill, it's pretty good actually. It's a good offer to be able to make that. I think that if you say we, let's say the United States, how does the United States deal with that? Well the United States certainly can deal with this. There is a lot of capacity to assist with financing nuclear projects abroad. The problem is that we don't have a consistent, organized strategic approach to that. It is, maybe I should defer to Corrie on this. She probably knows more about this than I do because I know in previous administrations there's been work in this area. And so everyone knows you can do it. The question is how do we put together an organized approach so that when some country says hey we want to build nuclear power plant, can you help us? That the answer is yes. Go talk to this person and we'll get this together. Right now I think it's more case-by-case. You know country X says something, if there's enough interest in the government, people get together, they talk about it, and after some period of time something can happen. But it's not like an organized approach. And that, if we're going to really deal with competing against these state-owned enterprises, it's going to have to be a much more comprehensive approach to this. And it really does have to be kind of an all-government consideration. And I think it's important that happen because I think there's aspects of this that people miss. For example, what I've talked to people a lot about is right now today there are hundreds of young people that they get free scholarships to go to Russia to get their nuclear degrees. Then they go back to the home country and because they've got PhD in nuclear, they very quickly rise to the top of the infrastructure, become ministers and other. And when the time comes for them to build a nuclear power plant, who do you think they're going to call? They're going to take out the Russian textbook and call Wessie House? Don't think so. So these seeds get planted over a long period of time. And we also used to provide research reactors to a lot of countries to help spur their nuclear programs. We don't do that anymore. So these seeds are very important as these countries start to develop their infrastructure. And it's really hard to sort of show up at the end of this march, you know, in the ninth inning and say, hi, we're here to help build your nuclear. It's hard. It's hard to make the argument. So we really have to think comprehensively if we're going to compete with state-owned enterprises. And right now it's very, it's very sketchy.

[00:32:34] Speaker 2: So a question about digitization. This comes from Jeanette Chelyaeva. As nuclear systems become more digitized, how seriously is NEA considering cybersecurity risks, not just at reactor levels, but across the global supply chain and

[00:32:48] Speaker 3: regulatory systems? Yeah, I mean, everybody worries about cybersecurity. I mean, cybersecurity is, I hate cybersecurity. Because, you know, the more you know about it, the worse it is. It's really true. Because, I mean, when I was at the NRC, I would get these classified briefings on on cyber threats and I would just walk away so depressed. Because this is like, this just, this just doesn't end. It just gets worse and worse and worse all the time. And I remember I had one, when I was

in NRC, we had one vendor that came in and he sat in my office and said that they had decided that they were going to build all analog systems for their their new technology because they were so worried about cyber. So that's, it's just a reality, you know. We are, we are in that world. So in a nuclear sector, we're very cautious about digital systems. But we're also under a lot of pressure because the rest of the world is going to artificial intelligence and big data and all these other fantastic tools. And if we aren't part of that, we start to look like we're in the 19th century, right? And it makes it even harder to attract young people into the sector. And then we lose efficiencies and potential increases in safety if we just bypass these. So we want, so the answer is we have to find a way to do both. We have to find a way to adopt these technologies in a safe and practical way. And so we are doing things at the NEA to help with this. We have a new project that we're calling RegLab. And basically, we're starting to sandbox different technologies. So you look at artificial intelligence. And so countries will look at, say, okay, if you want to use artificial intelligence in an application, how would it work? What can go wrong? How do we, how do we, let's test the idea. And so they sandbox this and this and then they sort of analyze what they learn from the experience. So it's like a first step to try to deal with this. But I'm worried because, you know, I talk to different parts of the industry, and the industry is so far ahead of regulators on these technologies, it's actually kind of frightening. And I find that most regulators don't understand how far behind they actually are. But they're going to find out because they're, because I was talking to, I'll try not to name vendors, talking to one vendor who said, when we sell nuclear power plants, they're going to come with a digital twin. Ta-da. Right off the bat. And so what do regulators do about that? What does the digital twin mean? How do you use it? How does it apply in a safety context? What do you want people to do and not do? They don't know. They don't have rules on this yet. But they're going to have to figure it out very quickly because it's happening and we're not going to, we're not going to be able to stop it. Do we have to change the

[00:35:40] Speaker 2: approach to educating the workforce so that they're able to deal with this, both in the regulatory and governmental side as well as the industry side? Well, sure. Of

[00:35:47] Speaker 3: course. And that's hard. And I think the good news is with so many young people coming into both the industry and the regulatory side, there are, not enough, but they're coming in, they're much more adept at dealing with, at least thinking about these technologies than some of us who've been around a little while. You know, I still can't figure out the damn cloud. And, you know, so that's something that I think we can harness. But we have to get serious. We really do. We have to put an investment in getting people trained, building a workforce that is tech savvy, not in the old sense but in a new sense with artificial intelligence and other technologies. And if we don't, we're going to see the regulators really become what they don't want to become, which is an obstacle to progress. So

[00:36:40] Speaker 2: everything that you have said comes down to money. Where does the money come from?

[00:36:45] Speaker 3: The money, you know, there's lots of money out there. You know, it was, it's really funny because I was talking to a large company that's involved in encouraging a nuclear technology. And we were talking about the first plant that might be built. And they sort of looked at me and they say, you know, this isn't really a big project for us. I was like, oh, okay, you know, good for you. And it's

true, you know, for a lot of these big companies, you know, built two or three billion dollars. It's just, you know, it's just another investment. It's not a big deal from their standpoint. So the money, so there are people out there that have the resources to do this. The question is, does the money go to the right places at the right time on a schedule that will help us solve all the problems? So it's a matter of really organizing ourselves, making sure that the money is applied correctly, and to, and it really is up to the industry in large respect, to make themselves attractive to these kinds of investments. We can get there. And I feel like we're moving in the right direction in some places, but there's still a ways to go. But there is a lot of money out there. And I think that's true on the government side. I mean, compared to when I was running the program at DOE, we had only dreamed, in our wildest dreams, about the kind of resources that DOE has now for nuclear. It's, it's, it's, it's like, it's got, it's at least four or five times the budget that we used to have. And so the money is out there. You just have to

[00:38:20] Speaker 2: use it the right way. So how did you risk the projects? There's project risk in both siting, there's project risk in building, there's supply chain project

[00:38:30] Speaker 3: risk, there's... I mean, this is one we've talked about a lot. It really is going to require governments to step in in some way. There's just no other way to do it. Governments, for first-of-the-kind projects, governments are going to have to step in and provide some kind of support for first-of-the-kind. But I would also say, and industry people don't always agree with, I would say that the government should do that for, like, the first project or two, and then get out of the way, and not support after that. Because it's the uncertainties of the first projects that you want to deal with. And I think if you get past that, it should be a commercial decision. But if you don't do that, then the commercial decision doesn't get made. And everyone just falls back and just builds more gas, which is, I think, what's likely to happen in a lot of places. So if you want to get away from that, governments are going to have to step up. If they don't, I don't see how you get past it. I really don't. We've looked at this lots of different ways, and the risks and uncertainties are just too big for the private sector to just to deal with all by itself. Although, you know, as you've seen these tech companies coming to the market, I think they help a lot. But they're very, I'll be honest, I mean, when you talk to them, they're very clear that unless the technology can solve their problem in this time frame, they'll just walk away and find something that does solve their problem. Because their interest isn't the advanced nuclear technology. Their interest is get the heat or electricity they need. And that's their focus. And so if these projects don't deliver, they'll move on. And then you'll be stuck. So I see

[00:40:13] Speaker 2: government as really being the key here. So the government has to listen to the needs of the end user in order to be able to pick the winners and losers, which we were always reluctant to do. They don't like picking winners and

[00:40:24] Speaker 3: losers. I mean, I think we've been through that. I think it's really a matter of finding some process to support some of the initial projects to get technologies tested. I mean, I think if you see, if you look at what DOE has already done with X Energy and TerraPower, I mean, that's the kind of thing you're going to have to do. But that's, that gets the projects, that gets the technology development. You have to go to the next step, which is actually commercial application. And I would use similar mechanisms to identify initial projects. Because if we don't, I think you're just going to watch and see a lot of nothing happening very quickly.

[00:41:05] Speaker 2: So what about siding projects, both domestically and internationally? Is there still a lot of public pressure against nuclear power? And the new nuclear in particular, does that have its own constituency?

[00:41:18] Speaker 3: No, it's not as much as you might think. I think there's a lot more acceptance of it now in most countries. But I think when you actually get to making decisions, you're going to run into issues. For developed countries, the easiest thing to do is stick with existing sites. And I think that's what they'll do initially for almost every case we talk to. But for those that have to go to a green site, it'll be that much harder. So it's, you know, the nut in my backyard never goes away. But that's not just nuclear plants, that's anything. And so I think you're always going to have those challenges. But it's up to the governments and the project leadership to take the time to explain what they're doing and to try to show people what the benefits are and what the safety aspects are. And hopefully, if they're credible, they'll be able to convince stakeholders that this is the right thing. We spend a lot of time on stakeholder issues. And so you can get there, but you have to be very patient.

[00:42:20] Speaker 2: So a lot of companies are partnering with industry to co-locate smaller reactors. The idea of smaller advanced reactors with their particular industry, data centers come to mind. In my community, the only thing that's more hated than nuclear is a data center because nobody wants that in their backyard. So do you see that as, what's happening in Europe in this area? Do they have the same kind of aspirations to co-locate power plants

[00:42:46] Speaker 3: with industry? I think the North America is well ahead on that, to be honest. So I think a lot, I think if those issues are solved, they'll probably be solved here first. I do think that there are always special opportunities in particular locations. And where they make sense, where you have public acceptance, you should jump on those as fast as you can. But these are issues that aren't new. They're old issues, and they'll always be here. So I wouldn't expect any magic there. But I do think that people have learned that you have to spend time with your stakeholders. You have to do the homework and do the back and forth dialogue and answer all the questions. And if you don't do that, you're not gonna be successful. You have to be prepared to do hard, long-term work to build the ground and get the stakeholder support. But also, to be honest, making big investments in communities is something that's actually very helpful. People like that. And they learn that there's lots of jobs to be had, lots of investment. I think that gives you a chance to hear, to be heard. And then it's up to you to take it from there.

[00:44:07] Speaker 2: So this is gonna be my last question. This is one of your stakeholder communities, right? This is a stakeholder community for nuclear energy. What would you want to say to the audience about how to engage with the nuclear industry in a way that's both positive for the nonproliferation goals as well as for the

[00:44:25] Speaker 3: energy goals? I mean, I think recognize that we are not two different communities. We don't talk to each other enough. I think we're in the same community. We're talking about the same materials, the same applications. We're looking at it from different perspectives. You know, my job is mostly to focus on the safety and economics of nuclear energy. You know, a lot of people in this room think more about safeguarding the fuel cycle. And if we aren't both doing our job well, nothing works at all. And so we have to be very conscious of that. And certainly, I think on the industry side, you know, people are very aware of the need to focus on

safeguards and security. But, you know, I think the complication is that the environment just keeps changing. You know, we used to have a very, very stable environment, but now it's much more complex. And fortunately, I think the world is going to continue to get more complex. But maybe the big message for all of you is to recognize that we've come out of an era where most nuclear energy capacity were in OECD countries and in other large economies. And when people are in this room 20 years from now, they're going to be in Philippines and Ghana and Kenya and Indonesia and places like that. And your jobs just get a lot more complicated because of that. So it's just a reality of the future. And we have to decide how we're going to work that. And hopefully we work it well. Thank you very much.

[00:46:10] Speaker 2: So help me thank Bill for his comments. And if you want to come visit him, he's in Paris most of the time, correct?

[00:46:20] Speaker 3: Well, when I'm not on an airplane.