



POWERING THE SURGE: ENERGY RESILIENCE AND NUCLEAR ENERGY'S ROLE

Announcer 00:01

Please welcome the panel on “Powering the Surge: Energy Resilience and Nuclear Energy's Role,” moderated by Hiromichi Mizuno, founder and CEO, Good Steward Partners.

Hiromichi Mizuno 00:47

Good morning, everyone. Thank you for joining this panel to discuss the potential of nuclear. We are discussing energy resilience, actually, and nuclear's role in delivering reliable, affordable, and sustainable power. And this topic is very close to my heart. I'm a senior advisor to Milken Institute, and I have been asked to moderate this session, and I just felt like this topic is very close to my heart for three reasons. First, I was advisor to the Abe administration of Japan to discuss the green economic growth strategy. At that time, I advocated the idea of introducing SMR connected with smart grid and a battery EV. And at that time, which was about 10 years ago, I got a huge pushback from Japanese industrial leadership saying a small reactor is not economically feasible. And I think Douglas will respond to that later. And then the second, I have approached nuclear from two different investment perspectives. I was the chief investment officer of Government Pension Fund of Japan, and I really struggled how to put nuclear in the ESG portfolio strategy. And after I became UN special envoy for sustainable investment, where we worked hard to reshift the money of the private sector investor into nuclear on the green energy infrastructure. And for, if I say most or maybe all of the investors at that time, nuclear almost no-go as an investment asset. So that's definitely— I really want to hear from Patrick later. And finally, but not the least, I volunteered in Fukushima after the incidents, and I saw the impact of the nuclear accident firsthand. So, safety of nuclear and that's impact on the society and environment is really shaped my perspective on nuclear. So today we have distinguished panelists to discuss this very topical and important topic. So from my side, Patrick Franz, managing director of PFYN Capital—

Patrick Franz 03:12

“PFYN” Capital—

Hiromichi Mizuno 03:13

“PFYN” Capital AG. And Sarah Ladislaw, the founding director of New Energy Industrial Strategy Center. And Xin Wei Low, CEO of Singapore Nuclear Research and Safety Institute, and Douglas Smith, global head of public affairs and managing director, MENA at The Nuclear Company. And please feel free to add more of your background to just make the discussion more interesting or more relevant. So let me ask the opening question to all of the panelists. Casual open and easy question. So let me start from Patrick. Why nuclear now?

Patrick Franz 03:57

Why nuclear now? That's a very big question, I would say. So, I guess that when we go back to pre-COVID times and post-COVID times, we've seen a lot of use of electricity and increased demand on electricity, and especially with the rise of AI. There is a huge demand on data centers, but the question is also how do we actually propel these data centers, and how do we power these ones going forward? We've seen, for example, investments from Google of \$13 billion into Finland just in regards to using power to power their data center requirements. So that is probably one of the biggest. But we've also seen the likes of Amazon investing into X-energy. We've got Microsoft into Three Mile Island. So all these requirements, we're going to see that there's a big, big push towards the use of the nuclear power.

Hiromichi Mizuno 04:48

Sarah?

Sarah Ladislaw 04:49

Yeah, I agree with that. To be honest, I think that nuclear has been on pause for a little while, and the recognition of the rapid growth in energy demand and the optionality of the different nuclear technologies you have to apply to those different sources of demand. I think it's really fit for purpose in a period of time where we are as interested in the energy that we're trying to deploy to fund and to power some of these new industries, and also can see that nuclear in and of itself, as an innovation platform, can lead to lots of other different types of technologies, advanced manufacturing breakthroughs, a whole lot of other things that are actually really important to the economic future of different countries. So I think nuclear presents a really interesting strategic package for particularly, countries that are advanced industrialized economies that are trying to think about what the innovation platforms are that they're going to be looking to cultivate over the next 10 to 15 years. And nuclear really seems to occupy a sweet spot.

Hiromichi Mizuno 05:51

Thank you.

Xin Wei Low 05:52

Thank you, Hiro. So, for Singapore, it's for three reasons. One, we're committed to decarbonize by 2050. And for Singapore, some of you have the chance to tour around Singapore. We don't have that many green technology options. So solar, 10 percent, no wind. You'll feel it on the beach. No wind. So nuclear seems like a pretty sensible option for us. Secondly, security has come to the fore fairly recently. Now 95 percent of our electricity comes from natural gas. As you can imagine, every time there's a swing, we feel the pinch, and we are obviously on the lookout for fuels that are much less volatile, much more secure for small countries like us. The third actually is that there is a wave of interest both on the supply side and the demand side. Many SMR designs are coming to the fore, much more than before. Many countries, including those around us, are actively looking. You really do have to find the

right time and place to be able to explore nuclear. And I think this is a great time with this surge of interest and competing technologies for us actually to be on the lookout for something that works for Singapore.

Hiromichi Mizuno 06:58

Thank you. So Douglas?

Douglas Smith 07:01

Yeah, I would answer that by why not? Nuclear power has been proven, it's been deployed, it's been used worldwide for 50-plus years. I think we're seeing, particularly with what is going on in the Gulf, just the wild swings in energy pricing, that nuclear offers a phenomenal basis for the grid, whether it's in developed countries, but also in Africa and other parts of the world. In the United States, for the first time in a very, very long time—and who knows about polls? They're probably all fake news, but they're showing 70-plus percent approval for nuclear, particularly in the centers of the country, great states like Missouri, other places that have these plans to bring back jobs, to bring back certainty and energy in our great research facilities in the United States. They want to know when they flip the switch on, there's consistent power. You can't have breakthroughs in medical research if the grid is fluctuating. And the wonderful thing of what we're looking at in the US, particularly with The Nuclear Company, we're bringing back large scale. It's not that we're against SMRs. We think when SMRs come online, it'll be amazing, but we can't wait. If we want to bring 100 gigs of power online in the US alone, let alone in the Middle East, in Africa, in these parts of the world, what we're looking to is proven deployable technologies, things like the AP1000. Which for—to put in perspective, one gig from a nuclear power plant in the United States powers a million homes. And so in big areas like in Texas and other locations where there are huge research facilities—let alone data centers. Data centers is the topic of the day, but the needs of consistent base load power that citizens can flip on that switch and know that they're getting has reached epic proportions in the United States. And so we're hopeful that the baseline that the Biden administration laid out—the Trump administration has been unbelievably bullish on nuclear—, that the time is now.

Hiromichi Mizuno 08:58

Thank you very much. I think that I have a lot of questions to follow up some of the points that you, that all the panelists made, but let me start with Singapore. Because we are in Singapore right now. What is the benefit of SMR to the other country like this dense city, like Singapore?

Xin Wei Low 09:17

Well, I'm preaching to Hiro, who spent an earlier part of his life arguing for SMRs. I think for SMRs, the two sort of attractions for us, one is the safety record. Not much the safety record, the safety claims of SMRs. Previously in Singapore in 2012, we actually did a pre-feasibility study on adopting nuclear in Singapore. When we looked at all the conventional nuclear power plants out there with their EPZs of 10 miles, 16 kilometers in Singapore. You take a look at Singapore's map, and when you draw a circle with a 16-kilometer radius, you cover most of Singapore. So that's quite—looking backwards, that was a little bit of a no-go for us. However, I think the new SMR technologies and the supporting regulation from countries like the US and China have allowed them to be able to shrink the EPZ, the exclusion zones, to less than a kilometer. A lot of them within the site boundaries of the plant itself. Suddenly, I think that looks very plausible for us because then we don't have to start moving half of Singapore away to the other half and then make our flats even taller. But so that's, I think, one point. Also, the types of fuel that they use. In nuclear, we do use the word, the safety case, but essentially, it's a probability multiplied by the impact. The safety features in some of these SMRs basically target all the flaws that plague older conventional

plants, for example, in Fukushima, and try to improve on them. So the probability of safety certainly goes down. But in Singapore, we can't just play on probability alone, and the impact itself must be something we can bear. Some of the technologies use safer fuels, have smaller nuclear inventory, so even in the event of a fallout not much radionuclide would escape. And therefore, even in the event of an accident, the risk and the impact itself is something that we think we can bear. But also the range of SMRs that are out there, they have departed away from, I think, pressurized water, boiling water reactors producing exclusively electricity. And if you look at it from a decarbonization standpoint, I was previously from the Energy Market Authority, tasked with building our decarbonization strategy. I think the range of SMR technologies out there now allows us to comprehensively decarbonize a lot of sectors. First of all, nuclear plants, flat load, base load, otherwise economics can't work. Newer ones, like the molten-salt reactors, allow you to be able to load shift. To be able to have nuclear stand alongside renewables such as solar, as well as gas. Some of them produce extremely high heat. 40 percent of Singapore's carbon emission comes from petrochemical industry. They burn fossil fuel as feedstock to be able to run petrochemical processes. In the future, we're talking about hydrogen economy. The high heat from some of these SMRs, high temperature gas-cooled reactors or molten-salt reactors allow us to directly provide the kind of heat from this, and therefore cover 40 percent of our carbon emissions that were previously termed hard to abate. So these sorts of, I think, the wide range of use cases for the SMR designs of today make them extremely effective to comprehensively decarbonize Singapore's energy mix.

Hiromichi Mizuno 12:46

So as a way to decarbonize the economy, like the other—simply depending on the renewable, it doesn't make sense. So I think they have to combine the nuclear and the small to big with the renewable capability probably is a solution, I believe. But just coming back to the— Douglas, your point, you also advocated for the scale, like a fleet scale deployment of the small or medium reactor. Otherwise, it makes no sense. And that's probably, and you even mentioned about building the other big, like the nuclear, will probably make more sense depending on the region. And one of the things that the other people are now, particularly in Japan, are shifting more to the smaller medium reactor is the...we just learned that how difficult [it is] to take control when something happens over that size of facility. So how do you think, can you just articulate a little bit more about the benefit of the other big reactor and a small to medium, and then maybe make a definition of what do you mean by small and medium? Because sometimes everybody has a different scale in mind.

Douglas Smith 14:02

Well, let me just take one step back and emphasize the most important thing in all this is safety. I mean, nuclear power per gigawatt outside of wind has the fewest deaths of any energy generation in the world. Fukushima was a terrible situation, but as you know, you were there. All those deaths came from the earthquake. And so I think this industry, it's so important for all of us in the nuclear space to emphasize, nothing is more important than the safety baseline. If something bad happens in Bulgaria, ripple effects across the world. In the United States, where we're looking at it from, is design once, build many. The SMRs—and I'll come to that in a second, hugely important—but when you're trying to meet these demands, this huge scale, I'd much rather build a large facility at one time than to build 12 and link them together. The second point on that is, particularly in the US, we're looking at proven technologies already. For example, the AP1000 by Westinghouse—unbelievably safe. It's a generation three-plus reactor. It's been deployed, it's been built, it works. And so while we're waiting for SMRs to come online—super important. But I think you bring up a great point. It isn't one size fits all. And depending upon where in the world, there will be different applications. One of the things for Singapore that I'll be watching for, there's a company out there that in the United States, we've had nuclear reactors on ships for 50 years. They work, unbelievably powerful. I don't know what is classified, what's not, but suffice to say, like on US naval ships right now, they

produce hundreds and hundreds and hundreds of gigawatts of energy off these things. So being able to deploy a ship-based SMR in a country like Singapore would be really interesting. One of the US aircraft carriers is now back at Newport, and they're actually doing a test where they've plugged it into the grid in Virginia to take the energy from that ship back into the grid. So we'll see interesting things. I think in the greater ASEAN region, while clearly a multi-gigawatt plant would never fit in Singapore, there are lots of places in the ASEAN region where it would fit. For example, in Vietnam, they've been desperate to get rid of hydro. That's destroying—from an environmental point of view—just destroying the Mekong Delta.

Douglas Smith 16:19

So the implications for cleaner air in Singapore and Malaysia across the region, if they're able to take coal offline building these larger power plants. On the specifics on the SMR, right now, sort of worldwide, I would say there are roughly 35 or so companies all fighting to see which is the best technology. Forget micros, just traditional SMRs. And they're getting close, and it's going to be super, super interesting. And in more remote, smaller, different areas, they're going to be an important part of filling that grid. The last thing is, what it really comes back to, is certainty. And the reason at The Nuclear Company, we're looking at these large design once, build many times is that it's a proven super-safe technology. It's one that the regulators understand really well. And to be clear, we want regulation. This is incredibly complicated, sophisticated form of energy. This amount of uranium [*holds up a small glass with a paper lid*], it would take 55-gallon drums of oil to match it. So you want to protect this really well—more than just a little paper cover on it. You want that certainty on the protection of it. So I think I'll just close with saying the competition is great. We want to see SMRs that the right winners come out, whether it's lead-cooled, any number of these different designs coming on, and down the road fusion when that all happens. But our whole thing is let's go with what's proven right now because the needs are so great.

Hirofumi Mizuno 17:55

Thank you. I really wanted to ask Sarah about the regulation, but can I just ask a bit more questions to Douglas because I'm so interested in how all those small medium reactors can be put in a real operation. Because when I advised the Abe administration about that idea, Hitachi chairman at that time told me that Japan has the technology to build it, but we don't have experience operating it. So he said operating a nuclear power plant is totally different to building it. And then I asked him, "Who has that experience?" He said, "It's US Navy," to your point. But how to get that, the know-how or experience into private sector, because now private sector is competing, as you described.

Douglas Smith 18:44

Yeah, that's a great question, and it's one we spend a lot of time on. We call it human capital transfer. In-house, we stole away the last two plants built in America, Vogtle 3 and 4. We hired that entire team in-house. The project manager on that was a US Navy submarine operator. So we've definitely seen our navy as a great resource for it. But we're also scaling up. We've created partnerships, for example, with University of South Carolina, a number of other schools in the United States, to build a pipeline for nuclear engineers. Now, the reality is on these sites, you don't need 100 nuclear engineers per site. You just need a few. We also need welders. In the United States, the largest growth market in employment are high school graduates. And so training people how to be welders, how to be electricians, how to be builders. For the purposes of your question on operating these SMRs in Japan, that old expression, what came first, the chicken or the egg? I think we just need to get a proven SMR technology deployed. That's the hard part. The part that I'm not worried about is then finding the people to operate it. There are a lot of super smart engineers out there that will be able to operate it. We just need to get a smart, proven

design that the regulators, whether it's Japan, the United States, Saudi Arabia, pick your country, are comfortable with. The actual protecting and operating of it is kind of—very important, don't get me wrong, super important, but the least of my worries. The bigger challenge is getting smart ones out there that can be replicated and deployed the world over.

Hiromichi Mizuno 20:18

Thank you. So Sarah, everybody agrees, for this kind of technology, we need to have the government policy and the government regulation to guarantee the safety. But on the other hand, we really need to speed up the building of the capacity, given the huge demand coming from AIs and etc. So how do you think a government can speed up the approval process while maintaining the safety?

Sarah Ladislav 20:51

Yeah, I think there's probably a few answers. I just want to point out, though, that we haven't said cost. And so I think safety is really important, but let's not kid ourselves, folks. This is nuclear. The issue is cost, right? So I'm fairly agnostic about how many AP1000s versus SMRs versus microreactors that we build. If they don't deliver on cost, you don't get to do more of them. And that is where the regulatory and the safety side and the government policy side all sort of come together, which is, yes, of course, the AI companies that are buying all of these, or at least contracting out for all of these SMR technologies in the United States, very much want speed to market. They want them to be safe, but they need them to be cost effective. AP1000s need to get to a spot where they're being cost effective, right? So I do think that we are making a lot of strides in understanding for all energy infrastructure, that the way that we do regulation and permitting and siting and safety is a little too slow, right? And that's a euphemism. It's much too slow, right? And so I think what you've seen is a couple of mechanisms that both this administration in the US, previous administration in the US, and then lots of other countries around the world are trying, which is let's take proven technologies that we know we regulated in one place, make sure that we don't redo that regulatory process in another place. The US-UK Atlantic Charter agreement was predicated on this. Let's make sure that if we're going to do NRC licensing, that we're not reinventing the wheel all the time, that we streamline those processes, that we have expectations for how long those processes should take. And that we protect those processes from an overly litigious structure that allows things to keep going longer than they need to. I think there are genuine safety issues that everybody recognizes, but a lot of what happens on the nuclear side has to do with redesign. It has to do with the permitting that has nothing to do with the nuclear aspects of it. It has more to do with the construction aspects of it. I think we're learning how to streamline a lot of this. I think it's one of those areas where the more cooperation you can see between countries among sort of these regulatory processes, these safety learning cases, the more innovation that you can see there. There's a lot of things that can be used with advanced technologies that, yes, of course, a human has to see, but probably doesn't have to do themselves.

Sarah Ladislav 23:13

One thing I do worry about is streamlining is not the same as firing everybody, right? So you do need capable human beings to be doing some of these safety and regulatory reviews, and so you do need to be able to keep them in the mix as well. I think there's a lot of promise there. I will say, when we say safety and resilience and reliability issues, I do worry that we need to make sure that the places we're deploying nuclear technologies, particularly if they have water-use issues, like what we saw in Europe this summer with the excessive heat. We do need to think about making sure that everywhere nuclear is deployed, it's going to be resilient and safe for the long term. I think that's another added layer that we, in the climate community, just need to make sure that we're

paying attention to the physical infrastructure in that perspective. But I do think it's really important to note that a lot of times when we mean safety, we mean permitting, we mean regulatory processes, and there's a lot more that goes into that side of speeding up nuclear deployment that I think we're getting much better at. The last thing I'll just flag in the US, which I think is the next thing to—if you look at the US, our goal is to have 400 gigawatts of capacity by 2050, and that's a lot. I think one big question is where are you going to put all of that? And learning that there are some communities that already have nuclear physical infrastructure, that have coal-related physical infrastructure, that have innovation capacity, that are much more likely to work with regulators to make sure that deployment happens quickly because they're a permissive environment that wants that nuclear in their territory. I think that that's something that everybody, every country who's looking to deploy nuclear, should think about. It is a far different thing trying to deploy nuclear technology, particularly for the first time, in a place that doesn't trust it, versus one that says, "Nope, I'm going to put my hand up and I'm going to try to make this go as quickly and safely as possible." And I think we need to start thinking about that. I think it'll happen in the US because, quite frankly, the data centers that want to buy it have to do the same thing, too. So they need a permission structure that allows them into a local community to be able to build quickly.

Hiromichi Mizuno 25:12

Sarah, I think you raised a very important point of the cost of the nuclear power generation. And then I think the cost element of the nuclear is totally different when you include this contingency liability. And then one of the issue with the nuclear is—I think it'll probably give us a good leeway to your point as an investor. But if I look at the nuclear investment from investor's perspective, who's going to assume the contingency liability associated with the potential incidents? And Fukushima cost Japan probably more than \$100 billion. And then if the country with less fiscal capability, they build it, the government guarantee doesn't give peace of mind to the investor. So who's going to take that risk, and how to make that, including a contingency liability as nuclear power, as the financially feasible, investable project?

Patrick Franz 26:19

Yeah. Thank you. And I think there are several aspects. It's a very, very complex environment. For example, with insurance companies, when they are looking at insuring nuclear power plants, it's not like just in one country, one insurance company insures a nuclear power plant. It's essentially a consortium across different countries, which are taking on different risks. That's one part. But I think also to Sarah's question was one part is, when we go back to regulations and licensing, it's also the questions like, number one, we are selecting a reactor. Okay, let's just, for the sake of this exercise, select the AP1000 or AP300. So now, for example, a country like Finland, Singapore, Malaysia, or Indonesia decides to adopt this technology, then it's also the question how fast is the licensing going? Because it's not just a question around selecting your technology. It's also about, okay, this facility is licensed in America. But how can we license this one in Indonesia? And then also, how do we get the insurance companies to insure this facility in my country, which has potentially a completely different geological aspect? Can we actually build this plant here? And that's then coming towards the question around for the investors, can we actually finance a project like that? Can we take a PE stake in a project like this? What sort of risks do we essentially expose our limited partners to from a fund manager's perspective? These are extremely complex questions. But I think let's go back to what we've seen in the last two and a half decades. So we've seen restarts in the United States with Palisades which is a very, very interesting project. They're essentially taking Palisades back online, which is an old mothballed plant. And on top of that one, they're going to look at building two different small modular reactors side by side. Which could be a very interesting demonstration plant. That is one part. Then in Finland, you look at, for example, the Mankala model, which means the industry comes together to provide

financing to the nuclear power plant backed by a power purchase agreement. And that's then over the life of the facility, produces power for heavy industry such as steel, paper mills, and so on. That's another model.

Patrick Franz 28:43

But then you also have the traditional model, as we've seen with Sizewell C in Flamanville, France, where you have essentially the state government kicking in and saying, "Okay, we're providing the finance." I think when we are now looking at developing nations like Malaysia, Indonesia, Philippines, and at the adoption of nuclear technology, they also need to think about, number one, what does actually my grid currently look like in terms of power availability? If we're adopting more and more data centers to our power grid, how much power do they actually need, and how much do we need to supply to them, and how do we actually produce this power? It's not like a nuclear power plant is just going to be built in the next five to 10 years. It's going to take a lot longer, especially with the regulations aspect. That's another aspect. But I think where I'm going to go with this question is really just like, it's not a question that it's like, is nuclear suitable for us? Nuclear will essentially come. In what form or shape? That's the question mark. But I think a good model will be between public-private partnerships to essentially get the government, and to some extent, you're going to get private investors to de-risk the whole model, and then at least going to start the building process. Once the building process is finalized, you're going to implement the technology, then the government will essentially take it over as a strategic asset, and then you're going to take on the financing from there. When we're looking, for example, countries like France, which is really having one of the cleanest power grids across Europe, the lowest prices on electricity compared to someone like in a neighboring Spain or Germany, where you have very high prices in terms of electricity, you've got very high carbon emissions just because the renewable policy has—might not be so successful as it might have thought. Then, of course, you need to look at how are we actually going to do the grid connection. But I think there's also a fourth opportunity which comes in just recently, and it was actually done here at the Asia Philanthropic Summit with the Global Coalition of Nuclear Philanthropy. That is actually something which quite caught my eyes, because initially I thought, "What does actually philanthropy does in the nuclear space?" But I was actually quite critical to it, proven wrong thanks. But I have to say that with Temasek Trust and Rockefeller Foundation coming actually to the table and sign an MOU to say, "This is an interesting space for us to play a role to essentially provide capital to the Global South," which means essentially the African countries, the Southeast Asian nations, and also developing nations in South America, where they can essentially provide capital to build facilities to build the human resources. For example, in terms of engineering capabilities, in terms of regulations, licensing capabilities, and essentially just building the fundamental structure of how do we actually educate our newcomers to this section, because it's such an incredible, complex industry. However, there's a lot of sharing still going on, and there's a space for everyone, which I think is quite interesting. But yeah, the global philanthropic community is now coming together into this, and this is quite fascinating, I would say.

Hiromichi Mizuno 31:58

I join—I'm quite skeptical about it, but I think it's a good gesture, to be honest. Yeah. It is. I originated the innovative financial facility for the Asia decarbonation with the ADB and those philanthropic funds. It's very difficult to align all the different risk-return profile over the different participants. But I think at the end of the day, the issue is the size of the investment—because you are talking about the private sector insurance to cover contingency liability of all the nuclear project we are planning to build. I'm just—I'm not that optimistic. So, who can play that role? And then probably Sarah, do you think we need a bit more international partnership or something to manage the private sector—I mean, government partnership to manage the risk associated with the full-scale deployment of the nuclear power across the world?

Sarah Ladislaw 32:57

Yes, absolutely. That's why I created the institute that I run. So, when I was working at the White House under the Biden administration, what we were trying to do was try to figure out how we were going to build as much as we want to build across global supply chains, because we recognized that supply chain security was increasingly an imperative of governments, right? This was a hard enough challenge to solve when you actually didn't care where you bought things from, and you just deployed it as quickly as you can. But particularly for nuclear, having the capacity to be able to figure out how you actually scale up the supply chains for the deployment we look at is not a small issue. Doug spoke to it and is doing amazing work to try to create the human capacity that we need in the US. I remember the first time, in the first Trump administration, I was then working at another think tank, and they brought everybody together, and they were talking about Vogtle and V.C. Summer, and we were going to build, getting back in the nuclear business, and we said, "Hey, how many people do we have in this country that have actually managed a nuclear construction project?" And the answer was one. You can't go from 20 years of actually shrinking your nuclear capacity to 20 years of—if you just take the G7 plus, say, Australia and Korea, excuse me, Australia and India, you want to almost triple it by 2050. That's an amazing expansion that we are nowhere close to being capable to pull off. So I actually am not worried at all about the fact that we might have this very large number of expectations about AP1000s, and we have all of these microreactors that we're going to try to deploy and all of these SMRs that we're going to try to deploy because, yes, this is complex, but if you look at it from a "what can the supply-chain bear" perspective and how do countries work together, you start to see through lines, right? So, for example, you've got Japan deploying BWRX-300s in Canada that the US is also going to be deploying in TVA.

Sarah Ladislaw 34:53

You've got the Koreans taking a position in Westinghouse, potentially. You've got the US and the UK working together on licensing. You've got Sapporo 5, which was all of us trying to bump up our nuclear fuel supply chain capacity. The reason being, if any one of us tries to do this by ourselves, we absolutely cannot. Totally. It just doesn't work. And so we advocate for looking across all of these countries' plans, particularly advanced industrialized economies—and that's not because I don't believe in deploying nuclear in developing economies. I just think there's a timing and sequencing issue here, whereas if you can't get advanced industrialized economies to be able to drop the cost of these technologies to provide that cost overrun, sort of confidence that we know how to do this, that we can do it together. The Koreans are very much better at doing certain things. The US is particularly good at doing certain things. We've got to build up those supply chains together by deploying one step at a time. And I think, to be candid, I think that the US, I think Korea, I think Japan, I think India, Europe, are all playing a leadership role where they can. But the place we're going to mess up is if we don't think about working together. We will all waste money, we will all move slower. And so really figuring out ways to deploy and be competent at deploying nuclear technologies across those ranges is going to be the thing that we absolutely have to do, or I promise you, I'll be here in three or four years at this very same conference, and we'll be like, "What happened? What went wrong?" And we just can't afford that. So I really think that that spirit of partnership, which we're actually seeing happen, is really, really important.

Hiromichi Mizuno 36:28

The discussion you have been suggesting to happen is, what is the best forum for that conversation to happen?

Sarah Ladislaw 36:39

It happens in lots of different places. To be candid, not to besmirch my old job, Doug used to do this too, and I think you probably do a bit of this. You could talk a lot in a lot of different forums. The question is how do you mobilize capital? And I will say, the thing that the US is getting right, right now is—to your earlier question—there is not one type of intervention that the government is going to make to make this happen. It is about the government being a partner with the private sector to engineer our ways to success that is the thing that has been missing in US industrial strategy. We just think, "Well, I don't want to bear the cost. I don't want to bear the risk. I don't want to..." And we do that dance with each other a lot. I think what you're seeing now is across the range of the different nuclear technologies that we're trying to put into the field, between the private sector, between investors and the government, we are finding ways to share risk. And if we can continue to do that, and then we can actually build stuff that doesn't run us afoul of that risk I think everything's going to be great. But again, Korea has the same challenge. India has the same challenge. Japan has the same challenge. And I've traveled to all of those countries a lot in the last several months, and the thing that I worry about is everybody is saying they're going to deploy at their maximum. That's absolutely not going to happen. And so let's just be very careful about what society's expectations should be for what we're going to do. And if we can competently start to deploy nuclear reactors, and we can show a portfolio of projects that we're going to be trying to execute, and we can start to put those in the field, I think that's going to solve a lot of some of these financing challenges that we tend to get wrapped around the axle, because we just don't have a lot of examples of really competently building these facilities.

Hiromichi Mizuno 38:17

Thank you.

Xin Wei Low 38:18

If I may add to what Sarah said, what you said about this network of international partners working together to make the new nuclear facilities and development work, runs a bit contrary to Doug's point about this philosophy of design one, build many. The reason why Korea and China has been able to get the unit cost of each of their plants down is because they've built multiple units. And what's maybe not so well-known is how they have indigenized the entire supply chain around building it. You work with the same partners, the same suppliers for 20 different plants. You do get a lot of learning from that, and that's allowed them to be able to keep the cost low. So that model of being able to work with the same partners indigenously to be able to get costs low, it's going to be very hard to break. But I see a very heartening development on the SMR fronts. I think particularly with the US SMR developers, I think they realize that the strength in manufacturing, in engineering and building a plant may not necessarily sit very well in I think, countries like the US. So they found very strong strategy partners actually in the Koreans. I visited a site in Busan recently where they were laying out this huge facility building SMR reactors. And we were saying, "But you don't have one. You don't have a design out there." It doesn't really matter because we've got a number of parties who are all going to build their reactors here in any case. So it doesn't matter who wins. Whoever wins will build them here. And many of them are partnering with the Korean EPCs to be able to get the plants built on time and on target. So I really do hope that with the modularization of the smaller modular reactors, it provides the condition for this international partnership to be able to, I think, also diversify supply chains and bring overall costs down.

Douglas Smith 40:19

I realize this won't come as a surprise, as a proud American and longtime person in the national security community. The US invented the space. And I am so bullish on America's capabilities to enhance it. The most

important thing, which I couldn't agree more, and not to minimize the importance of the nuclear side of it, that's not our problem. It is a supply chain. It's large-scale forging. For example, United States, at Groton Boatworks in Connecticut, the welders there who make our nuclear submarines, they make over \$300,000 a year. Average age is over 62 years old of these welders. The challenge in the United States isn't our ability to build these plants. It's to build out the workforce. It's to bring large-scale forging onshore. And by doing that, it'll obviously enhance our national security by creating long-term jobs, which will be great. One of the hiccups for us is we depend on, there's incredible forging that comes out of Japan, but that's a three, four-year lag time. So we get it forged there, then we got to put it on a ship, and then a war starts in the Gulf and the ships get delayed, or heaven forbid, there's a typhoon. So I think in the United States, the thing that we're spending a huge amount of time really focusing on, and luckily, Sarah, we hired all the builders from Vogtle, so in-house at The Nuclear Company—little commercial—we stole the market. We have all those guys. But we're going to have to really double down on building a long-term supply chain. The exciting thing in the US is we look at what I call the Boeing model. When airplanes are made in Renton, Washington, for every job there, it's 18 downstream. And that's what we're really trying to develop in the US, is create these long-term jobs to then build it up. But cooperation is king. I was in Korea a month and a half ago. I leave from here, I go to India. Working with our partners around the world, because that old saying, a rising tide lifts all boats, there's no better place to see that than in the nuclear industry. Because if we don't do it, safety tip, China is opening three a year. The United States has not started new construction on a plant in almost 23. Luckily, we made news a few weeks ago that we are starting construction, so that will be exciting on large scale. But the US, while we're still the leaders in the world on nuclear energy generation, we are about to be surpassed by China. What they are doing is amazing. It really is. Now, you're going to give me the secrets you picked up while you were there. I won't tell anybody that you told me everything. But look, we're going to have to be bigger, smarter, faster to be able to compete.

Douglas Smith 42:52

And I think the AI is playing an important and interesting role in that, and that we're utilizing. We're—in our partnership with Palantir—building a proprietary system that eliminates paper from the space because we want to give the regulators certainty in doing all that. But it is that last mile. Sarah couldn't be more right. We got to get the—where's the cable coming from? Luckily, with the exception of the actual fuel, the stuff needed to make a reactor is pretty simple. It's cement, it's iron. But to build these large-scale plants, it's 5,000 to 7,000 laborers. And they don't just fall out of trees. We have to train them. It's why we're working so closely with the tradesmen in the United States to build a sustainable pipeline. I think the challenge, yes, it's financing, it's other things. It's also global events. For us, the bit of a spat between the United States and Canada, not exactly helpful at the moment given where we're depending upon a lot of our fuel to come from. I think Senator Blunt can let us know when that's going to pass, hopefully. Yeah. But I think the bigger thing I just want to land the plane on is, yes, we talk about cost, but we are talking about investing in a 75 to a 100-year asset. If you look where that number tends to break even, for example, against LNG—it is cheaper and faster to build an LNG plant. But forget what's happening in the war and the speculation of the giant moves around with LNG. At year 14 or so, the cost of operating nuclear power compared to LNG just falls off. And now we're looking at a facility that's around for 75 plus years. And so, we're going to have to get past that first one and prove to the markets that we can do it. I am incredibly bullish that if anyone can do it, the United States can. But to all of your guys' points, we've got to get one out of the gate in the modern era and show that it works, and then I think once that happens, markets will see certainty to that. And I look to the way, for example, the sovereigns out of the Middle East from here invest. They're long-term investors. They're not looking for a quick buck. They're looking for, how do I put money into something that's going to generate a return 14, 16 percent, for the next 30, 40, 50 years? And that's where we're going to see a large-scale deploy in nuclear.

Hiromichi Mizuno 45:21

I think the other—talking about investment, I think that Patrick, we would agree, but we just need to find a way that from the investor perspective—some of the risk, investors cannot take at all. It has to be either de-risked by the government or private sector somehow. At this point of time, it is not readily available. And do you have any hope that the—

Patrick Franz 45:45

Hope is a good way in financing, I guess—No, I think as long as we can show over time the de-risking of a project like that, then we've got a good chance. Look, obviously Barakah was a very successful project. Without a doubt. They built it on time, on schedule. Of course, they've got very deep pockets that needs to be seen as well. But at least it shows that something like that works. They done it on their own, of course, with Korean technology. But I think if you're going to build something like that here in Singapore, Malaysia, or here in the region, you also need the sovereigns to support it. You cannot do this by yourself. And again, Sarah, as you mentioned, that is something which is really important. It needs to be a PPP, and you need to also have the government guarantees because without that, no investor would touch it. No. And as I before said with Flamanville and Sizewell C in the UK—it's probably one of the worst examples you can show to an investor, to put your money in there, we're going to give you 2 or 3 percent of it, which is less than inflation, right? So no, that's not going to fly. But if you want to have an investment into a nuclear project where you can see it's similar to an infrastructure project where you can get pretty low returns, around 9 to 11 percent thereabouts, but it's a stable income, then it does make sense. Because again, as Douglas also mentioned, it's a project which runs 80, even potentially 100 years. So for an infrastructure fund, it's something which is actually quite attractive.

Hiromichi Mizuno 47:14

Okay, thank you. I think we're already running out of time, but just as my last question to you, I think we are trying to send a message that nuclear is now hot and everybody should come into this space and work together and coordinate a policy and etc. But one concern I have is, I heard in Japan that all the industry leaders are concerned about now nuclear is very unpopular among young people, so there's no applicant for the University of Tokyo nuclear engineering. But what about the US? Because, Douglas, you talk about aging problem of your workers. But what do you think?

Douglas Smith 47:59

Well, luckily in the US it's, I don't want to use that word, but it is hot. There are a lot of these schools, particularly University of South Carolina, other places, that are seeing a huge influx of young students wanting to get into this space. So, it's a very exciting field in the United States because they now see a path forward. They see, wow, if I get this degree, really learn this, there's a job that I can have, and it's a job not for five years, it's a job for the next 50 years. It's a tremendous career. The pay scales on operating nuclear power plants in the United States are phenomenal. These are not minimum wage jobs. These are highly sophisticated. Our security personnel on these sites typically make six figures in the United States. So I think what we're seeing at some of our top-tier engineering schools in the United States is a huge interest. And it's also super exciting that a lot of our foreign partners are now wanting to partner with our American universities to create a human capital transfer that can work across in other places in the world. So I think hopefully next year when Sarah and I are sitting up here, we're cutting a ribbon and we have shovels in the ground on our first build in the United States, and people are really seeing it. Because it's happening. Back to China, China is opening three a year. They are just building these things

like crazy. And the United States has got to get back to business on it, and I think we're there. It's going to happen. I think we saw the perils of when Germany turned them off, and Putin marched into Ukraine and turned off the LNG. We saw what happened to their economy. I think the United Kingdom, whoever would've thought they would've tried to bring Hinkley back on? Here they are trying to get that operational. We're seeing huge progress in Scandinavia. The French are 90 percent on nuclear power, 30 percent of that power is from recycled uranium that they have figured out how to take even more of a life out of. So I think the time is now. The last thing is, look, data centers have been helpful for us because it's spotlighted the inconsistencies on the dependency of power. The reality is, the needs are much bigger than data centers. Data centers can be run much more efficiently than they are. It's kind of the dirty little secret. Well, I guess I let the secret out. They can be managed much more efficiently. But what can't be met is the overall demand needs for what we want. And while administrations in the US and other places in the world come and go, the reality is people like to breathe clean air. It is why Singapore has been such a thought leader in the region of decommissioning coal plants. Coal was easy, it was cheap, it was efficient. But they've recognized the health impacts to their citizens, the citizens all across ASEAN. And so if they're able to bring on, whether it's SMRs, large scale, to improve air quality, efficiency, and power delivery, we're going to see this energy renaissance that we're seeing in the United States.

Hiromichi Mizuno 50:57

Thanks, just one word from each panelist before we close.

Xin Wei Low 51:02

Yeah, I thought what Sarah brought up was actually a very valuable point about how the regulations would enable this. And I think for SMRs, the regulators do have to try harder. They need to build very good fit-for-purpose regulations to take a lot of the risk out of newcomers trying to second-guess how to operate it safely. Nothing beats us buying a product than if a credible regulator in the host country is able to, I think, put the right assurance framework around it. So I think that's a very important point for many new countries looking at some of these new SMR technologies.

Hiromichi Mizuno 51:42

Thank you. Sarah?

Sarah Ladislav 51:44

Yeah. So the good news for nuclear is, to be honest, if I was in any other room, which I do often, speaking about any other energy technology, I promise you there are problems there too. So it's not like we're picking one that's easy. None of them are easy right now. What we're dealing with is a world where every country is realizing that they can't just do things the way they were doing it nor can they be an island unto themselves. And so I think this is, I call it mutually assured resilience. We are going to have to rebuild relationships with people we trust to build the societies that we want, and that's it. And so in the US, we thought we didn't need to build all this stuff. Turns out you kind of do need to be able to do that, to be able to innovate, to be able to power your economy, to have people that are satisfied with their lives and livelihoods. You have to have that. And so that's the thing that's happening that is hot. Nuclear will benefit from that if it is successful. If it is not, we are all going to live in a world that is fundamentally less resilient. So there's not like there's a choice here. You're not going to go to a wind conference, and it's going to be easier. It is just about putting your head down and getting the thing done that needs to be done, which is competently deploying technologies that maybe you haven't done in a long time. But every advanced economy that I go to, it's what they're up for right now. They know it is job number one. And so

that's a great environment to be in. It's pushing on an open door at a time when costs are pretty high and the world's a little bit crazy, but it's okay. I think it's something that we can do, and I think that's what's hot right now.

Hiromichi Mizuno 53:14

Thank you. So Patrick, the floor is yours to wrap up.

Patrick Franz 53:19

So we had about 45 minutes now to talk about nuclear, and we can only get a bit of a feeling as to how incredibly complex this whole topic is. From a financing perspective or from an investor's perspective, we run a fund, we look at projects, we're looking at 130 different SMR technologies. How on earth would you potentially make a decision as to which one is going to work? It's an extremely complex topic. And of course, we work with MIT to look at these designs. We work with other universities and other providers, but it still remains to be seen as to who is actually going to make it. We haven't even yet touched on the nuclear fuel supply chain. Which reactor has actually got its fuel supply chain sorted? We haven't even touched on that topic, which is probably one of the most important parts. Because when you imagine how long it's going to take for the actual fuel to be licensed, that's going to be a completely different challenge. So are we relying to a Gen III reactor? Are we going to go with a Gen IV reactor? What will it be? I can't give you these answers yet, but what I really am looking forward in this whole kind of industry, we shifted our whole business model since 2020 when the uranium was trading at \$20, somewhere around there, to where it's trading today at about, well, just about \$90. You can see that there's an incredible demand for this material, which will also propel the industry forward. Our marketing department brought this little dice to me and said, "Take one of these ones. At least you can show people as to—"

Hiromichi Mizuno 54:50

What is that?

Patrick Franz 54:51

This is a fuel pellet. So it goes into the very traditional reactor, and it can essentially propel your own house for over two years with that little of capacity. And out of this fuel pellet, there's still 95 percent of uranium left inside, which the French and also our Russian colleagues are the only ones who can actually reprocess that fuel to use it then for future energy use. So, if I cannot convince you to invest into uranium tonight, the only thing I can let you know is at least share with your colleagues, with your friends and family, that nuclear is something which we have now researched for over 80 years. It's not as had been broadcast in the last kind of 20, 30 years as like the worst industry. It is the lowest carbon emission industry. It's got the highest capacity, and it probably requires one of the smartest and biggest people in the industry to actually manage these processes.

Hiromichi Mizuno 55:50

Thank you, Patrick. You wrapped up beautifully. So, thank you everyone. Please join me to thank all these panelists.

Announcer 56:02

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