

MARTY ROSENBERG
May 18, 2022
Grid Talk #308

MARIA KORSNICK INTERVIEW

Nuclear Renaissance Ahead

Hi and welcome to Grid Talk. Today we have with us, Maria Korsnick, president and chief executive officer of the Nuclear Energy Institute.

Q: Hi, Maria. Thanks for joining with us.

A: Hi, Marty. Nice to be here.

Q: So, there's a lot I want to talk to you about. Give us an overall picture now of the role you see nuclear power playing potentially as we build out the grid the next five to 10 years as we address carbon and all of the issues that we have to face.

A: Sure, thanks for the question. Really if you look at nuclear today the plants that we have are 20% of the electricity sector and more than 50% of the carbon-free generation for the U.S. grid and this is a very exciting time for nuclear because as we look ahead, actually see that doubling between now and 2050 if not more. And so, we are about 90 gigawatts of generation today so it will be an additional 90 gigawatts of generation and because we're talking more small modular reactors, that 90 gigawatts could turn into about 300 SMRs that would be added to the grid

and so imagine nuclear really forming the backbone of that clean-energy, highly-reliable grid upon which the intermittent resources can also be added.

Q: So, when you say doubling, will it represent 40% of the electric power generated in this country?

A: Well, the thing is I think the whole grid is going to get larger so even if we double nuclear, depends on how much larger the grid gets. Some people imagine the grid to be twice as large, so it could be that we would double nuclear and it might still be 20% of the electric sector. That again depends on how fast the grid will grow but it's also possible that nuclear will be a larger percentage than 20.

Q: So, is the era of large-baseload nuclear plants like we saw in the '70s and '80s coming through, is that pretty much over? I know we just extend the life of those as long as we can, or do you see new ones being built?

A: You know, I do see new ones being built and I think really as you look here in the United States, I think we're going to start with the small modular reactors but I do think as we look ahead at the volume of electricity that's going to be needed and the volume of that clean electricity that's going to be needed, I do think that we're going to find occasions where people say, "You know what; a large reactor would be more suitable." Is that

going to be a large light-water reactor or could be a large other style of reactor? I'll get out of the United States for just a minute...let's go over to Europe because there's several different countries over there today considering nuclear: France, Romania, Poland, just to name a few, and they're very interested in large reactors. And so, I don't think that large reactors are "a thing of the past" but I do think that here in the United States, I think the near-term, you're going to see more of the small modular reactors and I think sort of as that wave passes through, I think we'll be open to a variety of sizes...some even smaller than small modular reactors...we call those micros.

Q: Before we focus on the smaller technology, these large units being contemplated in Europe, are they like our grandparent's nuclear plant, or will they look and act very differently?

A: I think they will look and act a bit differently. They're going to be very similar to what we're building in Georgia today so we have two advanced light-water reactors under construction. Should be coming online within a year and that style, the AP1000, which is a Westinghouse Style Reactor, those are being very strongly considered by several countries over in Europe today. France as well, has a light-water reactor that they're interested in building within their country and so, yes, they're a little bit like your father's nuclear plant but they have more passive

systems. Those systems don't require operation action in order to act and so, yes, that's an upgrade of your grandfather's reactor.

Q: Okay. Let's focus on these 300 SMRs, the small modular reactors that could be built-out what, in the next two decades?

A: Yes; two decades...a little bit more.

Q: For those in the industry and for those outside the industry listening in, describe what they would look like and would they be in urban centers? Would they be in outlying areas? Will they be moving around by freight train and rail? How would this build-out look and how would the industry embrace it in terms of financing? Will they be independently owned? Will the utility industry own it? What is some of the thinking going on?

A: Yeah, so I would start by saying, yes to all of what you just said. I think it's really going to be a mixture of several things. So, you said well, will they be closer to urban settings? They could be. We're imagining the emergency planning zones around these smaller reactors needing to be much smaller like a site boundary and as a result of that, they can be placed closer to things. That could be closer to a manufacturing facility as an example, one of the things we see as these smaller modular reactors pairing very nicely with the manufacturing sector, providing...

Q: So, let me just stop you to the extent that they are more locally integrated. Would that mitigate the need for the transmission and distribution construction?

A: It could. In fact, in some places they could be sited...they might be sited where you have that transmission and distribution today, so, think about coal plants or think about fossil fuel plants today that you imagine in the future that you'd like to shut down. Well, rather than shut it down and have that significant impact to the community, why not just replace it? Why not just put carbon-free power right there? And so, you can imagine it being on a coal site or could be on a gas-fired plant site and use that transmission and distribution. I'm sure as you're well aware, siting and permitting is also very challenging for the transmission and distribution system so the more we could reuse what already exists, it's actually better for everybody and then, of course, you have the carbon-free power at your disposal. But, let's talk a little about that because right now today, you imagine nuclear power and electricity, and I want you to think of it differently as you look forward so in the future, yeah, it could be electricity. Could be high-temperature steam is what you want. It takes us back to those manufacturing facilities we talked about. Recently, Dow Chemical came out and talked about

their interest in a small modular reactor but what they want is the high-temperature steam; they want to use that in their chemical processes. In addition, you might be producing hydrogen. Maybe that's the quantity or quality that you want instead of the electricity and you don't have to choose. You might want electricity during the day and hydrogen at night so the versatility that this highly-reliable nuclear plant produces, the sort of variety of energy that it's able to put out I think makes it extremely attractive.

Q: And, what about ownership? Will utilities...what business model do you see for introducing this on the scale of 300 units across the country?

A: Yeah, I think it's going to be a combination of things. I think it will be some of the standard utilities that you know about today that already have nuclear plants, they're very comfortable with nuclear plants; they'll continue to use these to help them decarbonize their portfolio. I think as nuclear gets smaller you're going to have others that become interested in nuclear. Maybe the nuclear of today is a bit large of an investment whereas nuclear of tomorrow could be a much smaller investment, so I think it's going to bring folks into the fold that don't currently have nuclear. Good example of that would be the U.S. project with NuScale and that's the Utah Associated Municipal

Power System that is interested to build that first NuScale plant, so I think you're going to have others like that that are going to become interested. I think that some of these models, maybe not an SMR, maybe the smaller ones, maybe the micros... there's some businesses that want to make those and they want to operate them themselves and so I think you're really going to have a variety of models.

Q: So, Doug Hunter at UMAMPS has been talking about wanting an SMR for a decade now. What's taking so long?

A: Yeah, so big thanks to Doug Hunter for the leadership quite frankly that he has around clean energy and bringing nuclear to the forefront. It's a combination of things but I can see that we're really getting down to the actual deployment of that vision that Doug Hunter has had. It's gone through the NRC licensing process, that has been a very significant milestone for NuScale to have that design approved by the Nuclear Regulatory Commission and I know that they're now looking into the details of actually building one of these plants. In other words, they have to have pieces and parts fabricated and they have that in-play right now so I think over the next few years we're going to see his vision come true.

Q: Can you give us a prediction on what year the juice will start flowing?

A: I'd say it'll be before 2030.

Q: Okay. What about other players like Bill Gates and TerraPower? Are they marching into the market fairly rapidly?

A: So, they are. That's another very exciting opportunity. In fact, the TerraPower plants are partnering with Rocky Mountain Power out in Wyoming is a wonderful example of many of the things that we just talked about. First of all, they're going to site it at an existing coal facility so it's that exact example of using that transmission opportunity instead of using it for coal, let's reuse and use it for nuclear. Instead of that community having to step away from being the thriving community that it is today, it's going to continue to thrive. It's going to thrive even more with this new plant in the same place that that coal facility was. In fact, it was really interesting to see as they selected that site in Wyoming. They actually had several different communities that wanted to have that wanted to have that nuclear plant sited at their facility and one of the beautiful things to watch is to have communities fight over which one gets the nuclear plant, right? That's not something that we're used to hearing about quite as much so very exciting. They're part of what's called the Advanced Reactor Demonstration Program and so it's a public/private partnership to bring this plant into creation and we envision that this will happen again before 2030.

Q: Correct me if I'm wrong but doesn't their technology use existing nuclear waste to extract more energy?

A: I think in the current view that they have they will use what's called high assay LEU which is higher enriched uranium. Whether or not in the future they want to do something with used fuel but I know initially they're not starting out with that as their premise.

Q: So, Bill Gates has some degree of experience on building a business to large-scale. Have you ever had a beer with him and sat down and talked to him of how he see this growing the way Microsoft grew?

A: I'd love to have that beer with Bill Gates but I can say that...

Q: Would you invite me, please and we'll make it a three-way chat?

A: Absolutely but just think about it...you're absolutely right, so from a Bill Gates perspective, why would he get into this to build one or two reactors, right? The answer is, he wouldn't; it wouldn't make any sense. You wouldn't make this kind of investment unless you had a scale and think about the other things he's involved in. He's involved in big things in terms of how to really impact the world so this is his way of saying, "I see it. We've got to get carbon-free and I see by doing this, this is

something we can do at scale.” And I’m sure it’s not just in the United States that he’s interested in. He wants to start in the United States and prove it but for his vision to come true, it would be for this to be deployed worldwide.

Q: So, talk a little bit about what happens when we get up to the 300 SMRs. Do you think coal and even natural gas will go away as a source of generation, or be ratcheted way back? And do you see a grid that largely relies on wind, solar, and nuclear being in our future?

A: I do. I absolutely see nuclear as the backbone for the grid. I will say there won’t be any carbon sequestration and storage but I don’t think it will be a high volume so I think your vision of coal and natural gas being ramped back is true. I think that whatever coal and natural gas that we do have if some still does exist, it does have this carbon-capture if you will, associated with it. But I think the nuclear opportunities are going to be very broad in terms of different styles of reactors, not only for the grid but also for the manufacturing sector and I think it sets up a perfect platform to collaborate with wind and solar and even battery technology. I think every piece has a little bit of a part but I think they need a main player, right; they really need that backbone in order to make this the most affordable transition and I think that’s really key. You know, people talk

about 'could be this; could be that.' At the end of the day, this needs to be done in a cost-effective way and it's very, very clear when you add nuclear to the mix, the overall system cost is reduced.

Q: So, the government is making a sizeable investment in infrastructure right now with about \$80 billion dollars slated for the energy sector. Does this nuclear piece of the puzzle get any of that funds or would you like to see it get any infrastructure spending to help speed development?

A: Yes, in fact, nuclear has received some of those funds in the recently passed infrastructure package. There was a \$6 billion dollar investment called the Civil Nuclear Credit Program and that was to be applied to the current fleet for any plants that were endangered of being closed to try to save those plants from closure so it was deliberately focused on the current fleet, again to the tune of \$6 billion dollars over the next five years and that was funded in the infrastructure package. In addition, there was \$2½ billion funded in the infrastructure package and that was for these advanced reactor demonstration projects that we mentioned. So, one is the Bill Gates project that's out in Wyoming. X-Energy is another one that was funded through that and they're going to have their project out in the state of Washington and they're teaming with Energy Northwest and so, two very

strong examples. And the goal was again, to bring this new development online before this decade is out.

Q: Focus for a second on that Civil Nuclear Credit Program and California's ambitions to get carbon-free very fast. How might it affect the Diablo Canyon closure?

A: Great question. In fact, actually it's in very recent news that Governor Newsome came out and talked about their interest in this Civil Nuclear Credit Program and whether or not they should re-look at Diablo Canyon, so Diablo Canyon is in California and right now, it's slated to close in the 2024-2025 timeframe. But with this Civil Nuclear Credit Program they have at least made some indications that they're interested in potentially applying for it and by using some of those funds perhaps to not close but rather to extend the life of the Diablo Canyon project so this is very much, very fluid right now. It's something that the State of California is looking at and we will see it play out over the next few months.

Q: Specifically, how would those funds be used? Would it be used for physical infrastructure upgrade? Would it be used as a tax benefit for the utility? How would those funds be applied?

A: Well and that's one of the things that each plant needs to file their application and talk about what it is that they need. Right now, the guidance that came out for the Civil Nuclear Cred-

it Program basically said it applies only to plants that have already announced that they intend to close and right now, that applies to two plants: that's the Palisades Plant in Michigan and that's the Diablo Canyon Plant in California. And so, it's an extensive application that you fill out and you talk about what your needs are. Why is your plant being challenged? Why does it need to close down? So, it's an individual sort of site-by-site analysis and then of course, this funding I mentioned is available and then it goes through the Department of Energy assessment to say, okay, does it make sense to use this credit program and apply it to this plant but it's a grant...money is available.

Q: So, I assume and I know NEI's monitoring other plants so are there around the country that might be on this list or owners are thinking of shutting it down? Are there other nuclear-threatened baseload plants?

A: So, it's a very dynamic situation as you can imagine. So, when the price of gas is very low, it puts a lot of pressure because the price of gas is actually also connected to the price of electricity and when the price is very low in the merchant market, it's a challenge for some of the plants and no other plants have announced their intention to close but it doesn't say that other plants are challenged. More recently, the price of gas has

actually gone up and so as the price of gas goes up, it takes some of the pressure off of the plants that we have so I don't know of any other plants right now that would be applying for it but again, it's a very dynamic situation.

Q: So, you introduced the whole concept of global economics and how that affects the complex energy mix that we have. If we move to 300 modular reactors and increase nuclear share or at least total output in our energy mix, what kind of vulnerabilities does that create in terms to access to nuclear supply for fuel for these units that will be built?

A: Well, that's interesting because right now quite frankly, we're having a fuel supply conversation and it's really one that you mentioned before, infrastructure. One of the things that we need to look at is the infrastructure around fuel and fuel supply and from a nuclear perspective you not only have to have that raw material, that uranium, but you also have to enrich it and you also have to fabricate it in order to use it in your reactor and so right now, we're really taking a good look at that front end to ensure that our fuel supply is thriving and there's some investment that's needed there, and we're having these conversations right now with the Department of Energy, with the folks on The Hill, with the Administration, for the investment that's needed to make sure that the United States is well-positioned;

not only for the United States but for us to also be able to export and ensure that the fuel supply broadly around the world is in good shape relative to that. The challenge that we find ourselves in today is that today, Russia is very engaged in the front end of the fuel supply and we've all seen Russia...very bad behavior with what they're doing over in Ukraine and you have a lot of countries that say, "you know what, I want to do business with somebody else relative to my fuel supply." And so, we're working very much to ensure that the United States and our allies are well-positioned without having to rely on Russia.

Q: How robust is the uranium supply in the United States right now?

A: Depends on what part you're asking about, so there's mining; we don't do very much mining here in the United States. It's not because we can't; it's just that there are other places in the world that can mine a bit more efficiently and Canada's a great example. They have some uranium mines in Canada and so, in some cases, in that case, we're not as much in the mining business. Again, that's an area that we're focused on to ensure that we are doing some mining. In terms of conversion and enrichment which are the other two pieces of the front end of the fuel supply. We do have conversion facilities here in the United States. We do have facilities for enrichment here in the United States but in

both of those cases, we really want to do more of it and again, that's why we're working with our allies to have a broader picture of what investments are needed to position us better but it's wonderful to have this now because we're going to put this infrastructure in place and what's that going to mean? Not only are we going to be positioned for those 300 SMRs that you and I are talking about but we're going to be positioned for a lot more than 300 SMRs because it's not just the 300 SMRs that we bought, we want more than that and Canada wants more and Europe wants more and Africa wants more so now is the time to invest in the front end of the fuel supply for the thriving nuclear market that we see ahead.

Q: What about the long unresolved question of nuclear waste? And we've debated about Yucca Mountain forever, it seems. And now, if you have 300 SMRs that would be shipping units of depleted fuel, where will they go? Because currently as you know, with large modular reactors, the waste is stored onsite.

A: It is.

Q: Do you do that in suburban Detroit and suburban Atlanta or what happens to the waste?

A: Yeah and so that is something honestly that we're taking on. There's countries like Finland I guess is a good example, why they just put in a long-term repository in operation in Finland.

I know Canada is also narrowing down from a site selection prospective where they want to build. Sweden I think also recently built so there's a couple of pieces to this. First of all, we need a long-term repository absolutely as part of our waste solution, but I think that when you can make more broadly and kind of just get out of all we need is a long-term repository and you mentioned it earlier, I think in some cases these new reactors that are being built have an opportunity to use some of the waste and there need to be necessary steps to make that happen but I think that's interesting like what piece of that plays overall into this because the reality is, this thing we call waste, there's 95% good energy in this thing we call waste. We've simply transformed it...started out as Uranium 235...you've turned it into Uranium 238. It's not good to be used in our current light-water reactors but it is good to be used in other style reactors. So, this is a real opportunity I think for us to kind of re-evaluate this thing we call waste. It's a little bit of future fuel, right? cause future reactors can burn it and use it and then to also kind of re-characterize what's left because what's left is a lot smaller in volume and so, we can kind of better understand, what actually do we need for waste storage? So, I think the fact that we see nuclear thriving, it also gives us other opportuni-

ties for how we want to use and think about nuclear waste and those conversations are playing out now.

Q: So, Maria, you're giving an upbeat assessment of how you view the future. A recent economist's article pointed out that a nuclear share of electricity produced worldwide declined from about 17½% in 1996 to 10.1% in 2020. Why that retreat?

A: I guess it's a combination of things over that period of time. In the United States, we didn't need, as many virologist's say, as the large reactors...

Q: Because of gas, the abundance of gas, right?

A: The abundance of gas; yes, that's right. It's just sort of easier and quicker to put these gas plants online and the price of gas was so very low and I think as we look ahead for nuclear, we also have to own that our projects have been sort of taking longer than anticipated and cost more than anticipated and I think that's one of the things that the deployment of nuclear as we talk about it now and as we look ahead, that we need to demonstrate quite frankly, and that we are anxious to demonstrate in these small modular reactors. But I'll also mention that there are countries that continue to build over that same time period that you're talking about. Korea is a great example and what that shows you is that if you don't stop building like we did, stop building for 30 years and try again, nothing that you do; you

stop for 30 years, and start again is the most efficient way to do it. Why? Because you have learnings again. Korea kept building and they demonstrated that they could build on time, on budget, and with an improvement over those timeframes and one of the plants that they built recently was in the UAE, and I think those are wonderful examples of nuclear projects that have come in as expected. And so, I do think that we have some bright spots if you will in that and I believe that these smaller nuclear projects that are coming to fore offer a great opportunity to demonstrate that these nuclear projects do have the capability to be on time, on budget, and I think that's really going to cause nuclear to flourish.

Q: My last question is related to the fact that for years there's been a divide in this country over the question of nuclear power and the environmental movement has been very strongly against it. But now there are signs that the carbon threat and global warming is getting people to rethink that position, so you have the EU adding nuclear to the possibility of getting green finance in the future. Do you see old nemesis falling down and new lines of being forged across the environmental movement with young people? Is there a re-thinking of the role of nuclear?

A: Absolutely and I think it's really based on what you said that if we would get out of the tribalism of sort of, what tech-

nology do you love and instead, we look at it and say, "You know what, we have a carbon problem. Let's put our heads together on how to solve this carbon problem." When we put our heads together in a common way, I think that's what brings nuclear to the fore because it's a workforce for carbon-free energy and I think people look at and say, "Listen, that's the existential threat." The existential threat is the carbon that needs to be removed from the atmosphere and stop being added based on our generation of electricity and other things, and so nuclear's value is what's giving it the positive attention that it's getting today. It's a wonderful thing to see and we're embracing and encouraging conversation with environmentalists, answering any questions that they may have because honestly, as we look ahead and there's many, many studies that have been done; the United Nations as an example...their latest study from the climate side of their house demonstrated we have the tools in the toolbox to get carbon-free and that includes nuclear.

Q: Very well. Thank you, Maria.

A: Thank you. It's great talking with you.

We've been talking with Maria Korsnick, the president and CEO of Nuclear Energy Institute in Washington, DC. Thank you for listening to Grid Talk. You may send your feedback or questions to us

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END OF TAPE