

MARTY ROSENBERG
11.12.2020
#202
ARSHAD MANSOOR INTERVIEW

Shaping Tomorrow's Electric Research

Q: We're here with Arshad Mansoor, president and CEO---in January will be CEO---of EPRI, the research arm of the utility industry. Arshad, when we talk about integrating renewables at a better level and conquering some of the technology hurdles, what's generally thought of is the main hurdle is how resources are---they can't be relied on regularly. They're intermittent and is that the key that you'll be looking at in this new consortium that EPRI has joined?

A: So, first, thank you for the opportunity. When you look at the way power system has evolved over the last, I'd say more the last hundred years, that we plan, we design, we operate, we refurbish, we retire, and that whole process was based on a different set of resource mix. So, as we are getting more and more valuable generation in different parts of the world, there are several opportunities to refine that planning, design, operational power banks. One you mentioned, the intermittency of the resources. That's on the planning side, that's on the resource adequacy. We have been doing planning for a long time.

We need to rethink what flexible resource adequacy really needs. But it's not just planning; it's all the operation. So, when we are operating, we are protecting. Protection is a big piece of the power system. For protection, we rely on fall current and the fall current comes from synchronous generators. So, when we have a significant amount of inverter-based generation, how does the whole protection scheme that we have designed so well over the last decade, how does that evolve? That's a big piece as well. And if you look at the foundation of the way power system works it's based on either 16 hertz or 15 hertz of frequency. Frequency is set by a rotating machine. What does this frequency mean when 60-70-80 percent of the generation can come from inverter-base? So, there are a number of opportunities, none of them are insurmountable. Research is going on worldwide; EPRI is one of the research arms but you have to thoughtfully start transitioning to a higher, and higher, and higher penetration because once it's, get the technologies right, get the planning costs right. But the other piece is now you've got to bring it back to operating utilities so that we're doing this in a reliable way. So, that's the opportunity that the consortium will be working on. I don't see that as a hurdle, I see that as an opportunity and we just need to make sure that we're doing the transition thoughtfully.

Q: So, in this organization the National Renewable Energy Lab is playing a part. You have the Australian Energy Market Operator. Here in the U.S., you have CAISO in California and ERCOT in Texas. How do you bring these diverse parties to the table to come up with a common set of problems and programs for addressing those problems?

A: Oh, good question and when we introduced EPRI, one of the things that people may not know about it almost one-third of our research is funded by utilities outside of U.S. We're actually in a unique position. We have offices in Ireland, we have EPRI staff throughout the globe. We have members in Europe, Korea, Japan, Australia. And what our role is really, if you look at the power system piece; yes, it's different in different parts of the world but the planning, operation, the design, the protection; they're pretty standardized and we have opportunities to learn from the experiments that are happening worldwide and our research is not to just do our research, but really to identify that those innovations are happening, apply them as a demonstration project in a limited scale and then really help the utilities to scale up those procedures to move into technologies so that your operating a system with a significantly different resource mix than you did 20 years ago.

Q: In addition to joining this international consortium on tackling resources and challenges of renewables, EPRI is promoting low-carbon resources to achieve a net zero objective by 2050, something that three dozen U.S. utilities already committed to. Is that the ballpark of what we're hoping to achieve globally as well or will the United States get there first?

A: I think we all will get there in there in the right time. The low-carbon resource initiative that you mentioned, it's a five-year initiative, really just launched a couple of months ago. It is a moonshot that the industry's making so that we advance technologies in this decade that we would need in future decades to get to net zero. We know we need to do electrification. We know the grid needs to be more flexible. We know our resource adequacy needs to be pre-cooked. Those are known things that we're working on. But, how do you decarbonize the cement industry? How do you decarbonize the natural gas pipeline, the use of natural gas? How do you decarbonize the airline industry? The shipping industry? And, that's really where the opportunity of clean electricity, producing clean molecules like hydrogen, like liquid ammonia, like synthesis methane and helping to decarbonize this hard-to-decarbonize sector is really what the methods of ORCI is. We had our fourth

international member that joined. We have manufacturers of technology: GE, Mitsubishi; they're part of ORCI. We're just at the early stage of building this collaboration, learning from others, methodically looking at the challenges and doing the research so that we keep on advancing the technologies so they're available at scale and affordable at the time when we need to continue our progression on decarbonization.

Q: So, EPRI has been involved in research for quite some time. As a matter of fact, you were established 47 years ago in 1973 right around the time of the Arab oil embargo and the world's a very different place right now than it was back in the '70s. How has that changing mission been reflected in how EPRI organizing itself and goes about its work?

A: If you look at, go back out, use as an example of one of the most profound projects we did in the early '80s. And that project was bringing the utility industry together, developing the requirements and the requirements mean it's a series of requirements to deploy advance light water reactors in this country. It was not just done by one utility or two utilities, it was done by the industry; EPRI played the role of the collaborator. And what that has resulted in is nuclear being the largest carbon-free energy source in U.S. Those types of grand challenges that happens in different part times and in each one

of them, our mission actually hasn't changed. A) We're focusing on the people who need electric energy most so affordability, reliability, environmental justice, social empathy; they're all part of our mission. We also believe in optionality and diversity of technology. Nuclear gives you an option. When we looked at natural gas generation, natural gas gave you an option. As we're looking into the future, hydrogen will give us another option. Liquid ammonia will give us another option. And so, our research is to continue to advance those optionality's so that we have multiple options at scale and affordable. But we are also making sure that we are focusing on is the transition happening the right way for the society that enjoys energy that's reliable, clean and affordable. So, in a way, it hasn't changed. In a way, it has changed because the challenges now are different than the challenges that we had in the '80s and '90s. We are seeing---we are talking about clean energy. We're not talking about the other side of clean energy which is the industry and the society will be successful. We are confident in achieving a net zero at the right time. But even if we're successful, every year we're accumulating more and more reliable information. The weather pattern in 2040 will be different than the weather pattern in 1940, and our power system design basis both planning, operation; weather plays a very important role.

Now, it's not just wildfires; it's wildfires, it's hurricanes, it's windstorm. So, we need to rethink, what is the design basis of this power system to be more resilient in 2040 when A) the weather is different, and B) because of electrification, society depends more on electricity. That's another grand challenge that most single utility or entity can really tackle and that's where EPRI comes in. So, I would say the challenges that we face which are opportunities for us, is more profound now than it was maybe even after the oil embargo.

Q: So, you know something about the genesis of research, the bedrock. According to my quick survey search around the Internet, you personally have five patents. So, my question to you is, how does a grand organization like EPRI coordinate any work with entities around the United States and around the world to try to achieve these kinds of objectives on renewable technology? How do you motivate the granular-level research of individuals that have to do the work and achieve the breakthroughs to accomplish what you hope?

A: So, you mentioned patent. Patent is part of our research process. We actually, if you look and the role that EPRI plays, we formally believe technology advancement, specially in the early stage, is going to happen in universities, in national labs, in start-up companies. We also understand those

technologies to accelerate on that readiness level and be adopted widely by the utility. That's the gap that we try to fill and all of us are all focused on the mission that let's make sure that A) we're not duplicating what things that are going on. B) we have a broad horizon of scanning of where technologies are coming from. We want to be completely independent of anybody's patent. Sometimes we do patents so that we can make it available to the public. But our goal is to scan where the technologies are. Do the vetting in the right way so we can identify some of the promising ones that needs to be moved forward. Put together the collaboration with the electric utilities to move those technologies forward. Try them out. Understand how they can be deployed and then like the advanced light water reactor, come up with the requirements document. Utilities are ready to deploy, and now it's a matter of capital coming in; technology being deployed. And that's really what we play at EPRI the role of advancing technology.

Q: Let me focus on, or at least close the circle on, nuclear technology, and that is, you talked about the large-based nuclear plants of the '80s that you helped champion. What do you see---what role do you see for small-scale nuclear to provide the back-up to intermittent renewable technology and do you

think that's going to be a big play in this country and around the world?

A: Well, you brought up nuclear and as you all know in the U.S. specifically, nuclear is the largest carbon resource of energy to large plants. We need to make sure we continue to have that resource but we have to reimagine nuclear, and the reimagination is happening right now. First, we have to reimagine nuclear. Is it just producing electricity? Or in the future, it's a production of steam, it's a production of heat, it's a production of hydrogen when the grid doesn't need electricity. Second, do we really need thousand megawatts; can we do a hundred megawatts, 50 megawatts, but not just scale it down as the small modular reactors are doing now? But, can we actually construct them not on-site but really fabricate them with powder metallurgy, with PDP printing in a totally different way? And then if advance like light water reactor, still look at technology as more consult as a high temperature reactor that's coming out. So, I think we're in a---I would say right now from an international perspective, the developing country for them to grow at a 6-7-8 percent, they need large-scale resources. For developed countries like us, we need to continue to have those carbon-free energy resource but we should be rethinking, reimagining nuclear and the role of nuclear in 2030 and in 2035.

And if you look at the technology, if you look at what high temperature does to electrolysis to increase the efficiency of how we produce hydrogen, we think those are essential things that we need to be working on. And part of our low-carbon resource initiative is actually to partner with other companies and utilities in reimagining what is the future of nuclear in specially countries like the U.S.

Q: Arshad, you talk about reimagining nuclear. Can you take a minute and reimagine solar and wind? What will they look like by 2050 do you think?

A: So, we all know the tremendous advancement that has happened in solar. It's been just over the last, I'd say, just over the last 10-15 years. So, when we look into the future, a lot of advancement has actually happened. If you look at how we operate these large either wind or solar and if you look at the optimization that you can continue to do, you will see cost reduction happening in the future using existing technology. But then you have the work that's going on on multi-junction PVs and these are much higher efficiencies, more expensive now so I think that the future of renewables we will continue to see efficiency gain on existing technologies. We have opportunities for some breakthrough technologies but there is a big opportunity and a challenge that this we have to overcome. Just

like when we had fossil in the coal plants, we have gas plants or nuclear plants, there are environmental issues that we have addressed; socks, knocks, scrubbers. When you look at the scale that we are putting renewables on the ground, what do---how do we dispose at the end of the life? How do we reclaim some of the materials that are still needed? How do we make sure what's going in the landfill, we exactly know what hazardous product is out there? Tremendous work is going on but that's something that we need to have a very focused research approach so that we are ready for recycling, reuse, safe disposal of the significant amount. I mean, just in the 10 years even in the U.S., we see renewables from 6, 7, 8 percent of our energy mix to double, triple, quad-triple so I think the opportunity of renewables with just at the surface level. We also need to understand our focus is on clean energy economy-wide. Renewable will play an important role, but renewable is not the only technology that will play a role, and we need to look at other technology as well.

Q Let's look at energy storage and batteries. How might this consortium plug in and achieve greater breakthroughs in the area of energy storage?

A: So, when you look at energy storage, some of the analysis we have done, more on the U.S. side, we think that the grid

would need 30 gigawatts of flexible resource by 2030. Some would say we would need it earlier than that. And if you compare what 30 gigawatts of flexible resource means, that's the amount of hydro and pump-hydro that we have in the U.S. that took us decades to build. So now, flexibility will come from batteries but flexibility could also come from load flexibility and the whole grid modernization, the DRMS research that's going on, the grid could be a source of flexibility by using load. Energy storage batteries could be a source of flexibility. Our thinking is over the next, not 10 years; 3, 4 5, 6 years, utilities will be thinking of energy storage just the way we think about capacitors, the way we think about a transformer. This would be a tool in the toolbox, not a specific purpose design demonstration project. We know the parameters, we know how to design it, we know how to install it, and on the energy storage side, one of the grand challenge is, we need to make sure we have very clear understanding that in the case there's an unforeseen event, do we know what hazardous materials are being released? Do we know how far the plume can go? Do we have very clear direction for the people in the path of the plume and the first responders? And, we hope it never happens but we need to make sure that we are ready because energy storage in this decade---not even decade; in the next five years, will move from

large-scale demonstrations projects and large projects to a tool in the toolbox.

Q: Will you be doing work on microgrids and can you comment on the role they'll play as this ecosystem evolves?

A: We are, we are doing work more on the integration side and well as to work the microgrid. And the microgrid, there's a lot of applications. But really, what the application is becoming more and more clear is community resiliency. And when you look at community resiliency, not just from a wildfire perspective--- I mean, think of the future where 6 out of 10 new cars that are being sold as electric. Think of the future where a household that today has two cars on an average, that they can afford electric vehicles and they have both of their vehicles electric. The resiliency need for the grid will be very different for the future than it is today. And you can't just build that resiliency by undergrounding or hardware or more stronger transmission lines; they are part of the answer. But microgrid could be also part of that answer on enhancing community resilience.

Q: The work that EPRI does or any other entity does in terms of research on a national or global scale doesn't take place in a vacuum and it's a reflection of cultural and political imperatives. As we talk, I understand Arun Majumdar is under

consideration as a frontrunner for Secretary of Energy in the new Biden administration.

A: I had the privilege and pleasure to engage Arun as he has been on our advisory council. He has been in our board. He resigned after he was nominated to lead the transition team. It's a loss for EPRI but a huge gain for the country. We have worked with the Department of Energy and their leadership in the last four years, four years before that, and we will be working with four years from now. Adding, what you see them bringing and we have worked with them as deep knowledge, understanding, pragmatism, the ability to bring private and public sector together. There will be great opportunities to continue to move the ball to a cleaner energy transmission. And if you look at just the last 18 months, largest utilities in the U.S., whether it's Southern Company or Duke Energy, or you name the utility, we all have committed to a transition to net zero. This challenge is very granite. It's easy to say net zero. Just on the electric sector it's a big challenge. But CO2 or greenhouse gas really doesn't care whether it's coming from the electric sector or transportation sector or from cement industry. So, economy-wide net zero which is really where we should be going, is even grander a challenge. And, as a researcher, you are excited; these challenges are opportunities that preexist just

one of the research arms that we'll be addressing. So, we have opportunities to collaborate, coordinate, bring the knowledge from the national labs and really be what you just mentioned in the beginning that our focus is on society but we work with the industry. We are the industry's research arm.

Q: Arshad, finally, I'd like you to take a minute and talk about your personal career and what you aspire to do in the next few years at EPRI. How do you see your work, your colleagues? You've been at EPRI 14 years. You take over for Mike Howard who's been there about a decade. What would you like to build on and what do you personally feel about the challenge that you're confronting?

A: Well, it is an honor, it's a privilege, it is something that I don't take lightly what the board has entrusted me. If you look at---EPRI's not a job for us; EPRI's a mission. Energy is a mission. And we get excited every day to learn more and I get excited to learn not just from our talented staff but from our members. And we now have this grand challenge of cleaner energy transition. As we look into the next decade, that next decade could be the most pivotal decade for the energy industry because we will come up with a pathway to accelerate the clean energy transition but we will also have to rethink what this grid means in 2040 from the resiliency point of view. How do you

clean the petroleum sector? How do you clean the natural gas sector? Is the molecule in the future natural gas, or is it a combination of natural gas and hydrogen or synthetic methane? And the electric sector actually produces those other molecules so I think if you look at the next 10 years, our mission stays the same, our focus stays the same, just the urgency of the challenge has changed. We'll have to move faster as an industry and we'll have to move faster as a research arm. We need to be nimble; we need to be agile; we need to make sure we're looking at where innovation is happening and that's just not at EPRI. And we need to make sure we have a pathway to accelerate those innovations so some of them that are successful gets adopted by the industry.

Q: Thank you, Arshad.

A: Right, it's a pleasure. Thank you so much for the opportunity.

A: And thanks for listening to Grid Talk. We've been talking to Arshad Mansoor, president of EPRI, the research arm of the electric utility sector, to become CEO in January. Please send us feedback or questions about Grid Talk to GridTalk@NREL.gov. We encourage you to give the podcast a rating or review on your favorite podcast platform. For more information about this series or to view past podcasts, please visit SmartGrid.gov.

END OF TAPE