

**MARTY ROSENBERG**  
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**WILL McNAMARA INTERVIEW**

Hi, and welcome to GridTalk. Today's conversation is all about the future of energy storage in our grid in our energy system and we're pleased to have for our conversation join us today, Will McNamara, who's Grid Energy Policy Storage Analyst with Sandia National Laboratories based in Albuquerque. Will talks to us from Wisconsin.

Q: Hi, Will. How are you?

A: I'm doing well, Marty. How are you?

Q: Good. You are the man of the hour because you're heading up an effort of the National Consortium for the Advancement of Long Duration Energy Storage technologies. That's a mouthful.

A: It is.

Q: It's an effort involving multiple six national laboratories and it's all about getting energy storage ready for primetime in this country.

A: That is correct.

Q: Tell us a little about this effort that's a year old and then we'll get into really quickly, the significance of it.

A: All right. Well, thank you so much for having me here today. The LDES National Consortium originated last year so back in 2023, there was a proposal call issued by the Department of Energy offering funds to the national labs to create an industry forum focused on the many challenges that are facing long-duration energy storage technologies and create this forum so that the industry can come together and address these challenges with recommendations on how to solve them.

Q: So, let's start by defining terms. Long-duration is 10 hours or more?

A: Yes, so, we are going by the DOE's definition of 10 hours plus in duration so when energy storage technology can provide that duration in 10 hours plus. Now one thing I want to make clear right out of the gate is that although we may refer to LDES as a single concept, it is not. It includes multiple technologies that are emerging. There are four main categories that we can discuss.

Q: Before we go there, Will, when we have energy storage being deployed now and it's being deployed at a very fast rate. It may be a small base but it's growing according to some industry surveys, at 32% per year. What is out there now? What is the average duration of energy storage?

A: The average duration right now is much shorter. It's approximately four hours let's say, and that's mostly lithium-ion batteries and that has served a very important purpose up to this point; however, as we go into the future and we work toward decarbonization net-zero goals across the country, we are going to need ever longer durations of energy storage as we see a significant increase in renewable energy coming on to the grid.

Q: So, I've done this podcast for the Department of Energy, Office of Electricity for four years now and the most delightful, among the most delightful podcasts are those where people will come forward and offer themselves and their story up for a broader discussion and we're very proud to provide that platform, so I want to thank you for reaching out to GridTalk. As soon as I started scratching into this topic, the enormity of it and its under-appreciation by the energy sector quickly dawned on me. You have a study that says that by mid-century, by 2050, we're going to need 450 gigawatts of long-duration energy storage to achieve our carbon reduction goals. To give our audience a sense of what 450,000 megawatts means, that's more than 4½ times the total output of our nuclear generation fleet in the United States now so we're talking about something huge and I wonder if you could just give us a 30,000-foot sense of the scale of this, the effort that's going to be required, and

you're really at frontend in terms of defining the technology. Give us the broader sense of why we should be excited and paying attention to this.

A: Well, it is a huge national effort, that is absolutely true. Why we should care is that science proves to us that climate change is real. We see many examples of it happening and we are in the midst of a transition nationally away from fossil fuels. We have a long history in fossil fuels; natural gas, coal, and the industry, the energy industry is moving away from that into clean power and renewable energy. Renewable energy is intermittent; the sun doesn't always shine, the wind doesn't always blow so we need to find a way to store the energy to make it dispatchable, hence the need for energy storage, so we are absolutely in this evolutionary period. We are building the constructs for the future. A number of states, about 19 in fact, have established clean energy goals, meaning that by an established date in the future, they will transition to 100% renewables and in some cases, 100% clean energy, which would allow for nuclear power to be a participant. In addition to that, we have about 11 states that have adopted an energy storage goal, meaning that they are committed to procuring a specified amount of energy storage by a specific date so the momentum is well underway primarily at the state level and so

understandably, we're in a transitional period now with the executive administration. We're coming into a new era at that level but the state activity that has embraced decarbonization and embracing clean energy shows no indication of stopping. That is going full speed ahead and so with that backdrop, we need long-duration energy storage. To put it very simply, we cannot achieve decarbonization without long-duration energy storage; they go hand-in-hand.

Q: So, this National Consortium at its heart, are six national laboratories that represent the deepest well of thinking on the emerging energy technology in this country, if not the world. Tell us what is happening at those six laboratories and give us a sense of the depth of work that's already underway.

A: Great, so, here's the point that I really want to stress. The Consortium is very unique because it is DOE-funded, national lab facilitated and industry-driven so that last piece is really key. The labs are facilitating this effort but it's really an industry-driven effort. We have approximately 200 teaming partners that have joined forces with us to comprise this Consortium and the teaming partners are any organization that has a stakeholder interest in LDES in the United States so that includes the technology developers, the suppliers and

manufacturers, the investors, the policy makers, utilities, customer representation, etc.; it's a very significant effort.

Q: So, give me a sense of, as the man overseeing this, as the conductor if you will, talk about this symphony; so many players involved. How do you get coordination and working towards a common goal or is that not an objective? Do you want many voices coming up with many solutions?

A: Well, we do want many voices with many perspectives. The output of the effort is the set of industry recommendations that we are developing. How we do it in practical terms is with such a large group of participants, we break it down into subgroups. We have what we call Tiger Teams. These are breakout groups that really get focused on a particular area of the industry to examine what are the unique challenges in that space facing LDES technologies so to give you an example of the 16 Tiger Teams that we have; we have grid infrastructure; we have investor confidence; we have interconnection; we have utility resource planning; we have economics and valuation; we have policy and regulations, so that gives you a flavor. So, of the 200 teaming partners, they break out into subgroups, the Tiger Teams. We meet on a monthly basis virtually and have these conversations about what are the identified challenges so again, the larger number of participants we have, the greater diversity of

perspectives that we have because what's really key to understand here is that the electric industry in the United States is not homogeneous; it's very different. We can't just think of it in terms of one market. We have vertically integrated states and restructured states. In the restructured states some have RTOs; Regional Transmission Organizations, or Independent System Operators. They all operate differently as well with their own market rules, etc., so it's a very complex industry with a number of challenges that we are working through. One way that we organized our work is that in 2023, the Department of Energy released a series of Liftoff Reports looking at a number of different technologies and how to get them commercially ready for the future. LDES was part of that so there was an LDES Liftoff Report that was published in 2023. That report identified a number of challenges but didn't take that next step of coming up with recommendations to address those challenges.

Q: But it did come up; that's the report that mentioned the 450 gigawatts, correct?

A: Yes so hence, that provided an ideal opportunity for the National Consortium to really hit the ground running in January of 2024. We took that report, we pulled out 11 challenges that were referenced in the report and immediately assigned those

challenges to our Tiger Teams to start working right out of the gate, so we've been doing that since January 2024. We published our first set of industry regulations in September of this year; It's up on our website, it's [www.LDESConsortium.Sandia.gov](http://www.LDESConsortium.Sandia.gov) so the public can go and see the work that we have prepared.

Q: Could you give us, Will, a sense of one or two of the key recommendations there?

A: Sure.

Q: Just to give us a flavor?

A: Sure. Because that we have 16 teams, we're dealing with a multitude of issues and they're all important. Policy and regulation I would say is fundamental to this exercise. I am a policy person; I've spent 30 years in this industry with a concentration on regulatory and legislative policy so I am partial to having those issues explored. We need policy change at the federal level and at the state level to recognize the value that LDES can bring to the industry and create the mechanisms to bring it onto the grid, so a couple of examples toward that end is that I mentioned 11 states have energy storage procurement targets or mandates. Those 11 states with the exception of California and New York, do not specify a duration for energy storage so hence, it's typically the four-hour duration that is going to meet that requirement. One of the

recommendations coming out of the Consortium is that we need to have LDES-specific procurement targets defining a duration because again, we need the 10-hour plus duration in order to achieve our decarbonization goals.

Q: And why is that considered a sweet spot? What would elevating the duration do in terms of renewable deployments?

A: Well, it gets us into the level of both interday and seasonal duration so we're increasingly able to smooth out the intermittency of renewables coming onto the grid for longer stretches and as we're seeing, that's already happening as a result of climate change. We are seeing longer stretches of winter outages. Example of Texas a couple of years ago that suddenly faced multiday outages as a result of a winter storm that came through. If we have the infrastructure for LDES in place, that serves a vitally important purpose in terms of reliability and resilience in smoothing out those gaps on the grid so...

Q: Do you think getting from four hours to 10 hours average duration will allow for proliferation of wind and solar beyond where they are today?

A: Well, the proliferation of wind and solar is happening so we're seeing that increase across the country particularly in some markets: New York, California as clear examples of where

that renewables development is happening. The key here is that as we start to reach penetrations of about 60%, meaning a state or a region is transitioning into renewables and they're reaching about 60% penetration, that's when the need for LDES technologies just explodes and becomes exponentially more critical because again as we're relying on renewables more heavily, we need the storage to create that consistency across the grid.

Q: So, will moving from four to 10 hours require us to move away from lithium-ion or evolve lithium-ion? What's your sense on the technology that will be needed?

A: Lithium-ion is not going away. It's very important and it serves a purpose. It is going to be used for electric vehicles for the future. We don't see that changing but there are deficiencies with lithium-ion that make it unsuitable for we're talking about with long-duration energy storage. Number one, the average duration for lithium-ion is about four hours. Secondly, there's a supply concern. We're not going to have enough lithium on a global scale to meet the demands that we're projecting. Third, there are safety concerns. There have been a number of instances of fires associated with lithium-ion so bundling all that together, lithium-ion is not the ultimate solution that we need.

Q: So, is part of what this Consortium is doing, are you working with researchers to develop new battery technologies? Folks like Don Sadoway at MIT was starting some pilots. Is that being endorsed by this Consortium?

A: Absolutely and it's also supported through the work that we're doing at the labs so the national labs are in a great position to be developing, testing, evaluating technologies and it's really important, Marty, here to make this point that when we talk about LDES, we're certainly including batteries, different kinds of batteries like flow batteries, metal anode batteries, iron, zinc, metal air, but we're also talking about other types of technologies; compressed air, liquid air, sensible heat, latent heat, hydrogen, so LDES as I said at the start, encompasses a lot of different emerging technologies. We put them into four main categories and I'll just read them off for those who want to explore it further but there are electrochemical technologies, mechanical, thermal, and chemical. And within those four main groups, there are subsets of technologies. They're all at different levels of commercial development and deployment and we are very much in a phase right now, I would say for the next five to 10 years of continuing to explore these technologies, figure out where they are best suited to support grid operations, which applications and use-

cases they are most effective for and I believe strongly, that ultimately we will have a diversity of technologies that are at play. There is not going to be one technology that meets all of our needs so really want to iterate that point for the audience when we talk about LDES, there's room for a number of technologies to come to the forefront and participate and support the grid.

Q: Okay. Will, you have a background in utilities that you and I were reminiscing that we probably have crossed paths out in California when you were working with Semper and San Diego Gas and Electric. I want to take you on a time machine to 2050. If you're talking about deployment of 450,000 megawatts of storage in some form and whatever the technology, that's going to be a massive capital investment. Have you daydreamed or thought or even done some research on what the economic muscle power will be that creates this? Will utilities deploy it? Will oil companies deploy it? Who are the players that are going to emerge to meet this massive capital investment need?

A: Will, I think it's ultimately going to be a mix. We are seeing a number of third-party technology developers enter the space. They're looking for financial support from the investment community but utilities have a fundamental role to play here and they always will. They are operating the grid through regional transmission organizations that look at it at a regional basis

but for the distribution lines, the utilities have a very fundamental role in grid operations and so obviously utilities are concerned about reliability, keeping the lights on, resilience and LDES factors into that directly for the future so I believe that utilities, while there is still quite a lot of education that needs to take place right now, utilities are increasingly embracing the operational opportunities that they can find through these technologies, whether that is through an ownership model where the utilities actually own the assets or whether a third party owns it but utilities have access to these technologies to call upon them when needed to support the grid and there are many different models that are emerging.

Q: Utilities have a reputation of being conservative and slow-moving.

A: Yes.

Q: And right now, if you look at where energy storage has been deployed, 80% of the distributed power capacity out there now is in the residential segment.

A: Yes.

Q: Do you think utilities might soon be getting off the dime in terms of bringing this technology to their commercial and industrial customers and really making it a part of their broader mid?

A: I think so because we're seeing an increase of interest in both microgrids, which are systems that can support and end-users that may be islanded from the utility or not connected to a distribution grid. We're also starting to see a marked increase in what we would call virtual power plants and these are aggregations of distributed energy resources that may be on a smaller scale but that they become aggregated together as an operating unit. The utilities have a tremendous opportunity here to utilize those assets and draw upon them to support their operation so in other words, as we're moving away from this centralized generation infrastructure that's been in place for the last century and moving toward more distributed energy resources that include renewables, utilities need access to those assets to support their own operations so there's a lot of data coming off these technologies, being able to call upon them as necessary. The utilities are in the sweet spot to play that role so in my opinion, this should not be viewed as a threat. This should be viewed as an opportunity.

Q: So, can I assume that the utilities are closely watching what you're doing, and are EPRI and EEI; are they part of your Consortium?

A: Absolutely, 100%, both EEI and EPRI are teaming partners with the National Consortium so they are part of this dialogue and helping us address these challenges.

Q: What about the RTOs and the ITOs? Are they involved?

A: Yes, so we do have some of the RTOs. We are growing this Consortium on a daily basis so we're continuing to welcome new participants in. We're happy to say that we have some of the RTOs engaged right now. We also have FERC engaged so FERC is a teaming partner helping us to ensure that the recommendations we're producing are appropriate, if they would be recommended to FERC to fall within their jurisdiction.

Q: Just to finish the field here, do you also have electric utilities and oil companies? Are any of them joining in on this?

A: Yes. We absolutely utilities engaged. Some of the larger utilities that would be recognized by name are engaged with us and we include not only the investor-owned utilities but we have municipals and electric co-operators as well because LDES is an opportunity across the board.

Q: Okay, and I mentioned the oil companies. What about traditional fossil fuel companies? Are any of them involved?

A: Well, they certainly would be welcome to join in this dialogue and explore how they would approach the future which is in my opinion, going to clearly be built around clean energy and

renewable energy, so they are welcome to join us in this conversation and to provide their perspective.

A: The last thing I want you to talk about; you've been around this industry for three decades you've said. The acronym describing your organization, the National Consortium, LDES, is quite a mouthful. The work you're doing is very important. Do you think you're getting the attention you merit and what are you going to do to make sure that average consumers as well as policy makers and industry leaders all give this the attention it deserves?

A: Well, we're absolutely getting the support and the attention that it deserves. We are supported by the DOE so the funding for this effort comes directly from the Department of Energy with funds that originated in the Bipartisan Infrastructure Law so first and foremost, we very much appreciate the DOE recognizing this industry need and supporting it with funds. We are met by the industry's contribution to this effort. The industry provides what we call in-kind cost sharing so in other words, the industry participants are contributing their time, volunteered, to help us in this process of looking at the challenges facing LDES technologies and working on the recommendations, and I think that there could not be a better testament so show the momentum that we have rather the figure of

the 200 teaming partners that we've already gotten onboard, and we did that in a very short order. We launched in January; we're sitting here in December, so that was a rapid growth that really exceeded expectations.

Q: Does your Consortium have a sunset date where you hope to wrap-up your work and recommendations?

A: Yes; this is a three-year project so we are funded now to last through 2026. The ultimate goal and the DOE established this in the proposal call when the opportunity presented itself. Ultimately, the Consortium will be transferred over to a private entity for permanent ownership so this is a long-term effort that we want to remain in place. We want to position it so that it can continue to operate without relying on federal funds. That it will be a private industry-led organization and we are building the steps to make that happen. We will be issuing an RFI and RFP toward the end part of 2025 and ultimately we will be selecting the organization that will maintain the Consortium.

Q: Very exciting. Thank you for joining with us, Will.

A: Oh, thank you, Marty. It's been great to talk with you.

We've been talking with Will McNamara, Grid Energy Policy Storage Analyst with Sandia National Laboratories in

Albuquerque, NM. Will heads up the National Consortium for the Advancement of Long Duration Energy Storage technologies.

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