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JOHN BEAR INTERVIEW

Q: Welcome to John Bear who's the CEO of MISO, the
Midcontinent Independent System Operator. Hi, John.

A: Hello, Marty. How are you today?

Q: Very good. We're very glad to have a conversation with you about MISO, what it's up to and maybe get an update on what happened in mid-February around the Midwest and down into Texas. First, let's take a minute and talk about MISO. It's a not-for-profit. How is it similar to and different from the other ISOs like Cal ISO and New York ISO?

A: Well, all of us have a little bit different scope given the sort of underlying membership that we have, right? So MISO is predominately a vertically-integrated aligned membership. I think we have about 10% of our area, mostly Illinois and a small part of Michigan that has Retail Choice and everybody else is vertically integrated. So, that differentiates us a little bit. And then, the other difference is MISO has an independent board of directors that is elected by the membership and I think that makes us a little bit different as well. We don't have any sort of votes that are required by membership to file things in FERC,

to file things in different Commissions, things like that so, our board approves our budget, votes to approve a transmission plan on an annual basis and then also oversees management and makes sure that management's doing its job.

Q: So, you have according to your website, 471 market participants serving 42 million people. Are all of them utilities or is there something else in the mix?

A: There would be a whole lot of things in that mix so it wouldn't be just utilities, no sir.

Q: So, of the utility component of that, how visible must...how much of a look do you have into what their plans are for EVs and electrification and how does that affect your planning?

A: Well, I would say we have a very good look into what they're doing related to EVs or anything else that they're working on with their plans. We spend quite a bit of time with our members, staying very close to them, making sure that we understand what they're trying to do strategically, as they move their business forward, so that we can make sure that the things we're doing at MISO are prioritized appropriately, and also, are the right scope and scale so we can help them implement what they need to implement in an efficient and reliable manner.

Q: How big is the change that you see coming in terms of electrifying transportation and getting EV charging out in your 15 U.S. States and Manitoba?

A: I think from an electrification or EV standpoint, what we see coming is significant but it's not right in front of us. We have some bigger issues that are right in front of us that are a lot more significant I would say over the next five years.

Q: And what would those be?

A: Well, we're having a significant portfolio change in the electric grid we're operating. We're going to - over the next five to ten years - double the amount of renewables that we have on our system, that being wind and solar, at a sort of scalable wholesale level. And that is a significant change so we'll have continued retirements of coal and gas and we also have projected a little bit of nuclear retirement, and we're forecasting a significant addition again of solar at wholesale scale as well as wind at wholesale scale adding to our system.

Q: So, off of your website the figures I've snatched, has renewables at about 19%. Gas at 42%. Coal at 29%. Is that about accurate for today?

A: That does sound correct, yes.

Q: So, give us an idea of how that's going to change or how large will renewables get as a share of your 184,000 megawatts of capacity?

A: So, if you go out to 2040 for example, we're looking at wind and solar being around 25% of our portfolio.

Q: Such growth may be not as dramatic as other parts of the country is that fair?

A: Well, I think that's because of our scale and the fact that we're already sitting on 9% to 10%.

Q: Um hum.

A: But it's still is double.

Q: So, so as you get to that, what role will battery storage play? Are you going to have to have significant increases in storage?

A: We are going to need significant increases in storage and we like to talk about it generally, Marty, that if we're going to have that level of intermittent resources on our system, we know we're going to need a whole lot of flexibility to make sure we can manage that, and that flexibility needs to be quick. It needs to be flexible. It needs to be reliable. And, whether that's hydrogen; whether that's gas; whether that's a mix of the two; whether that's batteries; we don't know yet. It will depend upon where technology goes.

Q: You and I chatted several weeks ago or right after the mid-February cold snap really did some serious damage down in Texas and to ERCOT and had spillover effects into MISO. Talk for a minute about those spillover effects and how you managed through that period.

A: Yeah, and I wouldn't call them spillover effects, not to pick at your words, just because things in Texas didn't necessarily affect MISO. I think we were able to help our friends at SPP with helping them import some energy which helped them reduce or mitigate some of the exposure they had. We had some transmission issues in East Texas which caused us to have to curtail some load to balance things out. We had enough energy. We just didn't have enough transmission capability to move it where it needed to go, so we had some issues in East Texas. We also had some issues in Southern Illinois for a small period of time.

Q: Do you think the 65,800 miles of transmission you have is fairly well-protected against changes more common and more virulent changes in weather?

A: I do. I think that our state commissioners have done a nice job of One: Making sure that the transmission grid is well-prepared for that kind of weather but also, making sure that most of our generation is well-prepared for that kind of

weather. We didn't have the winterization issues, if you will, in some of the gas and electric issues that folks experienced down in ERCOT that caused a lot of their outages.

Q: Do you have an opinion on what ERCOT needs to do to fix its situation?

A: Well, I am not as close to it to give you that opinion but I know there's a 2011 report that FERC and some others put together for Texas, kind of giving them a roadmap of things to do. I would start there, and then use the lessons learned to come out of this to add any additional things they need to add or need to do going forward.

Q: Um hum. You have...you talked about your transmission plans for expansion enhancements. You have over \$4 billion dollars of spending in the wings. Talk about what technology changes you're going to get for that and what do the projects look like? What do they entail?

A: Well, most of the projects that you are referring to that are on our books today, if you will, in terms of our existing transmission plans that we have asked our members to move forward and put in place are reliability-structured, both upgrading the existing system and then interconnecting new resources to our system. I will tell you that as we look forward into the future and look to change towards that portfolio that I

talked to you about earlier, getting us to 25% of wind and solar on our system, we are going to need some significant transmission changes. Number one, to make sure that we can move the wind and solar around so they don't have to curtail it when we don't have enough load to absorb it in the regions that it's in. And number two, we're going to need to be able to bring flexible resources to firm that up for the wind and the solar areas when it's not windy or sunny to keep things reliable, and that's going to require quite a bit of transmission investment as we go forward.

Q: Will that by itself force you to accommodate more market participants? Do you see that expanding from current levels?

A: I don't think it's dependent upon market participants at all. I think it's more just us planning our transmission system for the resource portfolio that we're trying to operate going forward. Now, it may mean more market participants in terms of folks coming in to provide that flexibility in whatever form it may come in whether it's hydrogen, whether it's batteries, whether it's gas, but we'll have to see what happens.

Q: You've been at MISO since 2004; 16-17 years. How has that organization changed in that timeframe would you say?

A: I would say we've change significantly. We've gone from a startup organization in 2004. We started our energy markets in

2005. We've largely operated probably an 80% coal portfolio with some gas plants that helped us peak during the summertime when we needed to peak. And a portfolio that I believe in 2005, had a hundred megawatts of wind to one today that I believe has around 26 gigawatts of wind on it as well as we've added our southern regions, so we're quite different today. Things have become a lot more complicated as our portfolio has changed and so we've matured quite a bit, but we definitely have a much bigger task on our hands in terms of making sure that we can be affordable and reliable.

Q: What are some of the big issues as FERC that you're tracking these days that with either will enhance or create problems for your business?

A: Well, I think there's a couple of big things going on at FERC right now and one is that we are trying to move forward in changing our resource adequacy construct. We have something we call our Reliability Imperative where we're starting to think about what resource availability looks like and what resource accreditation looks like, across seasons. And then, how do we take into account or consideration the outages that we're having. So, we're looking at everything that we're working on with FERC on that front. Secondly, emergency and scarcity pricing. We think we need to make some pretty significant

changes there to make sure that pricing is reflective of our underlying system condition so that when we get into situations like the polar vortex we were just through, our system sends the right signals to parties outside. As you know, the interconnection of the broader grid in the Eastern Interconnect can be very, very helpful. It can provide the right incentives. And then ultimately, long-range transmission planning. We're looking to see what FERC is thinking about and saying around FERC Order 1000 and how it's thinking about long range transmission going forward and how those things are being thought through.

Q: You mentioned scarcity pricing and with 42% roughly of the generation in your area being gas, was there a sharp uptick in gas costs in mid-February?

A: There was. There was a significant increase. Most of our gas plants were online prior to the weekend which preceded the major storm so a lot of those folks had already bought gas, which was good. But I will tell you and you know this, is that gas prices got pretty high because of the scarcity of that gas. We can have some issues in MISO where the gas competes with home heating, although we didn't see a lot of that this time because the plans were put in place well in advance of the state of the event but we did see some pretty high prices, yes.

Q: How did that impact your customers?

A: Well, it impacts our customers because it raises their prices.

Q: Was it painful or was it because of the mix and what you talked about that they were already operating? Was it mitigated somewhat?

A: Well, I think it's both. I think it was mitigated somewhat but any time this happens, prices are going to go up significantly which I think we definitely saw that happen. It is going to be a little bit painful for those who had generating units that couldn't perform and were short in the market price.

Q: Do you have any opinions on what happened to the gas down in Texas that could have been forestalled?

A: You know, I don't, Marty. The one thing that I will tell you that we took away from some of the events that we've read about and we've talked to folks in Texas is that we're going to work hard with our member utilities to make sure that our outage planning is seasonal and risk-adjusted for those seasons. One of the things that you can fall prey to is, when you have to reduce load, it's usually in the summertime and when that's the case, you have a different group that you would curtail, if you have to, than maybe you would curtail in the wintertime, if you have to. One of the things that we want to do is make sure that our

curtailment plans are seasonal by nature so that we do it as efficiently as possible if we ever have to do it.

Q: The last topic that I really want to explore with you is the question of grid security at a time when Russia, China, Iran, and other bad actors are constantly probing our cyberspace. Do you see an uptick and what is required at MISO to protect its assets?

A: Marty, there is a significant uptick and that's probably one of the things I should have mentioned earlier when you asked me, what things have changed from 2004 to now? In 2004-2005, we made sure that everybody had Internet protection on their personal computer and we kind of moved on, right? And as you know, the amount of bad actors out there and the threats and the complications and the complexity of those threats is significant. And so, we spend every minute of every day making sure that we can protect our systems as best as possible and it is a fulltime job. And it takes all of us together to make that happen.

Q: What...when you come to work each day, what excites you most about what the future's going to bring?

A: You know, I'm most excited about the decarbonization effort that's ongoing. I think that it's super exciting to see the pace and the velocity of which our industry is having to change and

then having to think through how to make all of that work together in a reliable, affordable way. It is a big, big challenge but I will tell you, it's-intellectually, it's very, very stimulating, because there's no perfect answer. We're having to figure this out on the fly so we're sort of changing the airplane engines on the plane while the plane is in flight, and it is an exciting challenge. We're really excited about it and I think we're up for it.

Q: The Federal Government is looking at a major infusion into infrastructure in this coming year or two. What would you like to see that include as far as the electric rate is included is concerned?

A: Transmission. Transmission. Transmission and transmission.

Q: Is there a specific proposal before them to assist?

A: You know, there is not. I think there's some things that are incremental at best that are on the table right now as I read it. I do think the investment tax credit is a step in the right direction but a 30% reduction gives us less costs that we have to share and move around. The truth is, we all benefit from this and if we really believe that climate change is an existential threat to the country, a high-voltage transmission grid laid over the top much like an Eisenhower-style highway plan, is what we really need to move this forward and I don't

hear anything like that being talked about. And without that, I don't know how we're going to interconnect to the level of renewables that's being discussed so that we can really get to zero carbon by 2035 or 2050.

Q: Right. Thanks for talking to us, John.

A: Marty, I appreciate your time. Thank you.

Q: Thanks for listening to Grid Talk and thanks to our guest, John Bear, who's the CEO of MISO for sharing his insights about what's going on in his business and the electric industry in general. Please send us feedback or questions at GridTalk@NREL.gov. And we encourage you to give the podcast a rating or review on your favorite podcast platform. For more information, please visit SmartGrid.gov

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