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MIKE FEHR INTERVIEW

Q: Hi and welcome to Grid Talk. Today we have with us Mike Fehr with MidAmerican Energy. Mike is senior vice president of renewable generation and compliance. Hi, Mike. How are you?

A: I'm well. How are you?

Q: Good, good. So, I'm really pleased to have you onboard today to talk about some bold initiatives that you've taken at MidAmerican to secure renewable portfolio generation. I wonder if you could go into the highlights of what you've been able to achieve?

A: Yeah, so we have...we had set out a vision some years ago to be 100% renewable and we established that vision after we had already started our wind fleet so we already have about 7,000 megawatts of wind in our fleet right now, little over that actually and at the time we set this 100% renewable goal, we had I think, about 50% roughly of our retail load that we could cover with renewable energy certificates from our own wind generation, so we wanted to take that up to 100%. At the time I think most of our customers were using a REC-based approach to visit their own sustainability and try to advance their own

sustainability goals so in that effort, we've...we created a program called GreenAdvantage where we have our regulator, Iowa Utilities Board, verifies the RECs we've retired on behalf of the customers and they verify the load and last year we had 83.6% coverage which I think is really a pretty good story for us.

Q: So, the wind blows pretty fiercely in Iowa as across the central prairie. You have abundant resources but it's really come on fast according to your website. It was zero percent of your generation as recently as two decades ago and now stands at 60%, is that correct?

A: Yeah, that's 60% of our capacity - name plate capacity I believe that's correct. We started with...we put our first wind and it went into service in and I think 2004 was the first year it has been in service for the entire year so those 7,000 megawatts of wind have all come into service since so..

Q: So, at the same time, you've brought down coal as a percentage of generation from 70% to under 25%. For those of our utility listeners' that are concerned with about going from a reliable source to an intermittent source, what kind of challenge...challenges were created by flipping to wind and how have you been able to address them?

A: Yeah, we still do have dispatchable generation resources. We still have coal generating units and we also have ownership in, part ownership in a nuclear facility and then we have natural gas facilities too, but part of the reason that we're able to add this much wind is that we're part of the larger MISO Market and so we export energy or we import energy just depending on the market conditions in that hour, we don't balance against our own load but we do have an obligation to maintain sufficient capacity, accredited capacity to serve our load and we do that and that's something that we do to make it so we're in full compliance with the MISO requirements.

Q: How big a role does storage and battery storage now play on your grid and do you see that changing as battery storage technology evolves?

A: Yeah, it doesn't really play a very big role now. Part of the issue; I think it will in the future so I'll just answer that up front. I think it's got a role to play definitely as a grid resource but for right now, most of the technologies that are commercial technologies are really optimized around solar and so if you're in an area that has high solar penetration generally you're looking to move energy from late afternoon maybe into early evening so you're just trying to shift a few hours of that production back to later in the day and that's a

different...if you optimize your storage technology around that, you're going to get a different solution than if you did it for wind. For wind, we may go several days or week where we would want to charge an energy storage device and then maybe go a week without doing anything and then maybe you discharge it for a week so it's a different technology. We look at...we have a lot of different battery chemistries and other potential energy-based storage technologies that we look at that we think will; some of those technologies are eventually going to be commercialized and they'll be a good solution for wind.

Q: What's your total megawatt capacity of wind that you have to call on?

A: Right now, we have 7,000 megawatts of wind, actually 7,100 megawatts of wind.

Q: And how much of that potential energy would you say goes untapped in the evening when demand is low when winds are generally picking up?

A: Um, it's, it's kind of...so the amount of winds that we have so most...because we're in a MISO market, we don't match against our own loads so our wind will go on the grid if there's not a transmission congestion issue or other constraint and so we sell that energy on the wholesale market here in MISO and that will

displace other, most expensive generation that would otherwise be sold into that MISO Market.

Q: So, you haven't had a situation like they had a number of years back in the Pacific Northwest where they had so much hydro and wind power come on at the same time that they had to give some of it away?

A: Yeah, we do occasionally have periods where we have more wind power than we can get out to load so if load is light in Iowa and that energy has to get shifted to either eastern Iowa or outside of Iowa or maybe to Minneapolis if there's a transmission issue, we have had times where we've had to curtail wind and so, that's actually a fairly common occurrence. It's usually not a very large percentage of wind, but in the spring and fall, that happens where we have to curtail wind.

Q: Let me ask you Mike, there's a lot of focus now on the coming wave of EV deployments in the electrification of transportation with major automakers like Ford announcing that they're going to make their car sales and truck sales almost exclusively EVs in coming decades. As that happens and as regulators encourage the use of time and day rates so that a lot of recharging can take place in the evening, given your proximity to cities like Chicago and other parts of the MISO

region, do you think this wind resource will be utilized more efficiently?

A: Yeah, I think that there's things we can do to help shape the demand, that will help. That's a benefit of any intermittent resource so whether it's solar or wind. Things like EVs where you can have...you can send signals, price signals to the end-user on when to charge, definitely that's something that works very well in enhancing the benefits of renewable energy. We are excited about electrification, too. We have...currently we are expanding our network of DC fast-charging stations. We expect to have 36 in place at the end of this year and they're located to help ensure that those transportation corridors have good coverage for anyone traveling across Iowa.

Q: Let's talk a little bit about solar because just like the Midwest has abundant wind, it also has a lot of sunshine. It has been slower though relative to wind and it's taking off. I see you're putting a three-megawatt solar installation in Waterloo and adding about 60 megawatts of solar this year and 80 next year. Can you talk about your path towards the embrace of solar and where you see that having the next five years let's say?

A: Sure, yeah. Solar...I doubt that we'll ever have as much solar in Iowa as we do wind just because we really do have a good wind resource here. But we also have a solar resource. It's not like

what you would see in the Southwestern United States but I think we're going to see solar grow for a few reasons so, one of the reasons is that our customers are moving; their sustainability goals are shifting to more hourly coverage and to more of a net-zero carbon type approach and so we're also trying to adjust to that, so solar does a really good job of generating; it matches up well with wind. Solar produces most in the middle of the day and the summer months and that's not when wind is at its strongest so we have, as you mentioned, started our solar fleet. We really didn't have any solar in service prior to the Waterloo project which will...it's only a three-megawatt project but by the end of the year, and we expect to have over 60 megawatts in service then continuing to build out of another 80 megawatts next year. And I think as you look at what's in the interconnection queue in Iowa, I think you're going to see solar start to be the dominant form of energy until it catches up until to where its place really should be relative to wind. Again, I don't think that will ever be half wind, half solar but.

Q: Mike, what's your pathway at MidAmerican towards zero carbon emissions given that 24% of your generation now comes from coal? Where do you see that going in the next few years?

A: Yeah, that comes back to kind of your initial question. It is a challenge to try to be completely dependent on dispatchable resources so there's non-dispatchable resources like wind and solar; they definitely will play a very large part in net-zero but closing that last little bit of the gap I think, is going to take kind of a much broader of view and we are investigating other things like some of the new nuclear technologies that would provide some baseload generation but that has ramping capability well beyond what existing nuclear today has. We look at things like carbon sequestration and a lot of different energy storage technologies. Hydrogen is one of the things that we think could have a role to play in the future and a lot of these technologies are being developed and there's a lot of R&D money going into them but maybe they're not quite commercially available yet I would say. And so, some of these technologies we're going to see over time, what kind of floats to the top as the most competitive means of helping fill out the demand profile that wind and solar is not able to fill out. Energy storage will also I think play a large role in that, too. The types and what type of energy storage technology that is maybe is a little bit yet to be seen in a wind-heavy area like Iowa but I think it will definitely have a role to play.

Q: You mentioned nuclear technologies, companies like NuScale are developing small modular reactors. Do you think that's something that will be ready for primetime for you in the next five years?

A: I don't think in five years but we have one of our affiliate companies a fellow Berkshire Hathaway Energy company is advancing one of those small measure modular reactor technologies and we think it has a lot of promise. These newer technologies with modular technologies are developed with much better capabilities to adapt to grid conditions as renewables ramp up or ramp down based on the resource, so I don't think they're going to be ready in five years but 7 years to 10 years maybe is probably the timeline for those new technologies.

Q: Now, carbon sequestration was something that the U.S. Department of Energy backed and backed away from and then backed again. Can you tell me what it looks like now and where you see that practically being available?

A: Yeah, I think carbon sequestration; part of the reason they backed away from it, I think there's really kind of two schools of thought on carbon sequestration as an environmentally-friendly technology. It's not green enough for everybody but it's the kind of technology that if it's not developed and commercialized in the U.S., it probably never will be something

that can be deployed to developing countries and so, if you really want to make a global change, I think there's a good argument to be made that carbon sequestration would have a role to play in that. It's not something that's going to be competitive without some kind of subsidization initially to help get that technology fully developed.

Q: When you mention hydrogen, what kinds of applications do you see? Is there a way of using some of your excess wind capacity possibly to generate hydrogen?

A: Yeah, that's probably the most promising path that I see for hydrogen. It's really as much of an energy storage and it can also be like a demand response type product on the market. When you produce hydrogen using electrolysis of water, it's a pretty energy intensive process and so definitely one of the things we're looking at is using hydrogen as an energy storage, a form of energy storage where when you have excess renewable generation, you split water into hydrogen and oxygen and store the hydrogen. And then when you have periods of poor renewable resource, you would then burn that hydrogen in a combustion turbine either simple cycle or combined cycle combustion turbine project and produce power.

Q: The Federal Government and Congress seems to be about to adopt some sweeping infrastructure legislation that's going to

have in excess of \$200 billion dollars dedicated to clean energy. Given that MidAmerican's so far along already down that path, do you see any value in that money coming into your region and how would you like to see it deployed?

A: Yeah, we see value in that. I think again it really comes down to in part our customers requesting; they're more particular about the type of energy they get. It's not just reliable and affordable, they're also interested in sustainable energy and so we're trying to strike those balances and I think over time, they're only going to become more demanding on the sustainable portion without ever really giving any ground on reliability or affordability but we're still going to need even in our area that has a pretty good head start on renewables, we're going to need some incentives if we're going to attain the level of sustainability that our customers are really insisting on. I think as far as what that might look like, I think transmission investments, there's some incentives there are being contemplated. For transmission investments that would be helpful as well as the other technologies that we discussed so whether it's further incentives for wind and solar as traditional renewable resources or some of the incentives around energy storage, new nuclear technologies, hydrogen, those I think could all be beneficial in our area.

Q: You mentioned how interrelated the grid is and your involvement in the ISO energy markets. When there was a massive winter storm last February down predominately down in Texas and there were sweeping outages all the way up into your neck of the woods and across the Upper Midwest, how did that affect your service territory and do you see new ways of insulating yourselves against those kinds of problems?

A: Yeah, so our service territory actually was not affected. There were some short rolling blackouts in Iowa but those were not in our service territory. Those were in the part of Iowa that's in the Southwest Power Pool which is a different market than the MISO Energy Market. We actually...our fleet performed really well through that through that experience. Our wind fleet never got below 91% availability which is quite a bit better than what happened further south where they don't have the same kind of winterization of their wind fleet or really any of their fleet.

Q: Mark, do you think there's a lesson in that in terms of the resiliency provided by wind?

A: Yeah, well I think part of it the issue, if you look at what happened especially in Texas, the wind fleet did not perform very well. It had a really low availability but if you look at the coal fleet, it had a low availability. I think they

even had a nuclear unit come offline and then natural gas of course, was a real challenge through the whole thing so I think there is a lesson there in that we need to expect maybe some more frequent extreme weather conditions and make sure whether it's winterizing better or trying to make sure here in Iowa that we're prepared for something like the derecho windstorm that we had, just making sure that everything is really built for more extreme events.

Q: Of course, Iowa has its share of cold winter weather. How do you go about winterizing your fleet and what could other regions of the country learn from that?

A: Yeah, there's something called the Cold Weather Package that we purchase with our wind turbines and so that includes things like you have some heaters in different areas of the nacelle. The actual steel design of the towers is a little bit different and the overall wind turbine itself is just different physically. It's not just a matter of going out and putting in a different oil viscosity. It's actually hardware in the turbine that's different and it's an extra cost and I can see where if you were far enough south you would probably not take a chance on...you maybe not feel that that cost would be justified but certainly in Iowa it is and we pay for that. We have that in all

of our wind turbines and like I said, they performed very well through that cold weather event.

Q: Mike, as you look at the next decade what are some of the exciting developments that you hope to see in renewable technology and how do you see the grid in your territory evolving?

A: Yeah, that's a really good question. I am excited. I think it's going to change a lot and if you're looking at globally what's going to change, I think it's going to be really exciting to see all of these different technologies that are really pretty early, kind of in their infancy competing to fill in that gap that's created when you get too reliant on just renewables so I think it's going to be really exciting to see what emerges from that. Which of those technologies are stepping up and really being able to be the economic solution to ensure reliability in a grid that has more and more intermittent generation. I think the transmission grid itself is going to have to become more robust so I think we'll really see large investments in transmission. That helps time diversify renewables as well so if it's windy in one part of the market, the energy market, and not very windy in another part of the market, you can get a more stable level of production within the market even from just the intermittent generation. I think we

will see some development of things like new nuclear which would be interesting. Nuclear kind of comes in in fits and starts and right now I think a lot of the nuclear you see retiring may make it seem like nuclear's on the way out but I really don't think that's the case. I think it's certainly one of those technologies that can compete for a role in the future.

Q: Mike, my last question is the utility sector has often been criticized but for the fact of not spending a lot of money on R&D as a percentage of its revenues. Given that MidAmerican is a foremost technology company in its deployment of cutting-edge renewable technologies, do you think that's fair and are you partnering with organizations like EPRI and ENREL? And, talk about some of the projects that you might be working collaboratively on.

A: Yeah, that's a good question. I think so in some ways, the regulated utilities really probably not a good vehicle for driving some of the large-scale R&D that goes on. That's something that doesn't really have a high hit rate and so our customer base, how much of that cost they bear. I think that we need to be very careful with...we're very proud of our low rates here at MidAmerican. They're about 32% below the national average and we want to keep it that way. But on the other hand, we are going to rely on these technologies so we do have I think

an obligation to help develop them and some of what we can do is we work with others is do some pilot projects. For example, we did a pilot project on a fairly small battery in our service territory and we can help with some of that kind of thing but as far as just direct funds, end-use from the regulated utilities to support R&D I think that's probably something that regulated utilities probably aren't going to be the major player in.

Q: Great, thanks.

A: You're welcome.

Q: And thanks for listening to Grid Talk. We've been talking with Mike Fehr who's senior vice president of MidAmerican Energy. Please send us your 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 about the series or to subscribe, visit SmartGrid.gov.

END OF TAPE