**A140C769\_22061544\_CANON.mp3**

[00:00:03] **Unidentified** All right. Good to go. Okay.

[00:00:05] **Speaker 1** Well, thank you so much for doing this. We really appreciate you lending your expertize. I want to start with so the grid monitor is warning of these blackouts. Growing demand and shrinking supply. So are temperatures like what we're seeing right now? Storm related outages are this straining the system? We have, you know, almost 100 degree weather yesterday and today.

[00:00:36] **Speaker 2** Certainly, you know, warm summer weather is one of the stressors to the power grid. And it is the warm summer days that the grid reliability monitors tend to look at as kind of worst case scenarios to examine for reliability. But I would say presently we're seeing a mix of both warm summer temperatures. You know, we're perhaps a little early with the temperatures we've experienced this past week, but they're certainly typical for what we might see at some point in the peak of summer. I think that's coupled with significant in an accelerating transition in our generation mix and to some degree in the patterns of our load, which new sources of electrical demand and the like that are creating new stresses on the grid. You know, these are creating concerns that have been anticipated for some time, but I think are perhaps hitting a little bit more rapidly than perhaps might have been anticipated, even, say, two years ago.

[00:01:34] **Speaker 1** So these headlines about potential blackouts, is that creating an alarm for you as someone who knows kind of the ins and outs of how the grid works.

[00:01:47] **Speaker 2** To some degree? But let me back up a little bit if I can put that in context. I, I suspect the alarm that you're referring to, the report that would have brought this to broader public attention comes from the North American Electric Reliability Corporation, which is an independent entity, but charged with the regulatory backstop from Federal Energy Regulatory Commission. And they really serve, if you will, as the enforcer of grid reliability with the energy policy. After 2005, they actually got enforcement authority to find participants in the power grid for, shall we say, blatant lapses in attention to reliability. They issue a summer report each year in May. Kind of looking ahead, what are the challenges for the summer? And their report in this May of 2022 flagged particularly the north central region of the US, the northern Midwest, as being short on sufficient capacity margin. So we always like to build in some margin for unforeseen events, equipment outages, unexpectedly warm weather, some peak in load that wasn't foreseen. And those margins are slimmer now than these reliability organizations would like them to be. I would say the NURK is the acronym. They go by NURK, raise that alarm, I think in part to spur action. And the actual operator of the grid throughout much of the middle part of the country is the midcontinent independent system operator. They actually had signs of some of these shortfalls earlier in the spring, and they've certainly been trying to take steps. I think Newark's warning certainly legitimate, certainly based on real data, but in part being conservative to spur action to try and avoid significant outages. So at this point, I would suspect we might see and of these that, shall we say, may have agreed under market arrangements to reduce load being called upon to do so under severe conditions perhaps even this week. But, you know, more likely later in the summer, if hot weather hits again, I'd like to think the risk of, shall we say, truly unplanned forced outages on folks who weren't expecting them remain low. But with those margins tighter than they used to be, the probability is very small, but it's a little bit bigger than it had been in the past.

[00:04:23] **Speaker 1** Is that why experts disagree on the severity? Because the report is saying that it's a sobering situation, but other people are saying we really don't need to be that concerned.

[00:04:36] **Speaker 2** You know, there's certainly a mix of motivations among the different players in the grid. But I think the challenge in much of this is you really are trying to predict things that are inherently random chance. We know that inevitably some equipment will fail. Inevitably we'll get some conditions we didn't anticipate. And historically, you know, when severe blackouts have happened there, an accumulation of these relative. Every rare event coming together. So it's a judgment call and how you weight those different probabilities. I think it is important that the organizations in charge take a conservative approach. And, you know, reliability remains an important need. And I think a backdrop to all of this that thankfully thus far has not proven to be a significant concern as we might have anticipated earlier in the year. But are there risks of cyber attacks on the grid simultaneous with these, shall we say, natural events that might be straining it?

[00:05:41] **Speaker 1** Are cyber attacks legitimate, large concern?

[00:05:46] **Speaker 2** I think they remain a legitimate concern. The evidence, to the extent that's available publicly seems to be that there have not been the scale of significant attacks that world events might have caused us to fear earlier in the year. But, you know, that same situation evolves day by day.

[00:06:05] **Speaker 1** So supply is caused by potential peak surges in energy uses such as extremely hot weather generator outages, even potentially by torrential storms. What is causing the low supply? Why are we seeing the same amounts of energy production that we should?

[00:06:29] **Speaker 2** So the question there hinges sort of two timescales. One is choices of supply from, shall we say, the equipment we already have. And then some of it is what is the mix of equipment being built and being retired? Throughout the Midwest, we've seen perhaps earlier retirements than anticipated for a number of larger plants going back a number of years. Some of the nuclear power plants retiring earlier than people might have anticipated here in Wisconsin. Some of the larger ones haven't hit yet, but our imminent Columbia coal power plant north of here in Portage is scheduled to be retired by the end of 2024, for example. And it's that kind of event throughout the Midwest, the retirement of older generating units, many of them coal being retired for a mix of economic and environmental reasons, and then the rate at which new resources come in. You know, wind has seen very significant growth throughout the year. The Midwest solar is beginning to pick up, but the rates of those pickups have perhaps not been quite as fast as some folks might hope. Some of the questions here or really the mechanisms for bringing new generation online lie with the utility companies that are perhaps familiar to end use customers. They get to deploy new resources if they wish. But then the Mid-Continent, so that I referred to myself, serves as a kind of backstop for that and is an indicator that some of these problems, ma'am, in coming each April, they run in essence, you can think of it, it's an auction to try and secure extra capacity resources to get other companies to commit either new generation resources or redirect ones into the market that hadn't previously been made available to provide extra capacity for just the kinds of situations we're facing in past years. That auction is run in April. Looking ahead for a coming one year period in my SO. In past years, the prices paid to encourage new generation capacity being made available had stayed very low. Suddenly this year, in the April auction in this northern portion of the Midwest, they shot up to their cap. There's a limit placed on the highest price and not as much new resource came in as was previously predicted. Now, some folks will say that high price will incentivize more in the future, but there have been some criticisms of that mechanism for, shall we say, encouraging that last backstop of capacity. I'm not going to comment on the economics. I'll I'll leave that to the market economists. But I think you may see some changes in the way that system operates. I believe MISO is reexamining the way they set up that backstop, particularly in light of this year's outcome.

[00:09:40] **Speaker 1** And so in order to lower the probability even further of any sorts of rolling blackouts from happening, we need to increase the margin of additional capacity that we have now. Does Wisconsin have additional capacity? Is that something that can be produced and stored or are we importing energy? From outside of the state.

[00:10:04] **Speaker 2** So as a state, we are typically a net importer and indeed on a broader geographic scale. Several of these regions that my show operates, which by the way, don't coincide exactly with state lines, were part of two of the ten regions that MISO divides up as kind of operational areas. For these capacity assessments, they are net importers. The general viewpoint is that's not a bad thing provided that's import capacity that you can absolutely count upon. You've made the arrangements. All the studies have been done to make sure that both the transmission capacity to carry the energy and whatever production resources are behind that creating the energy will both be assured to be available. And in some of these alarm bells that went off in April and May, I should again kind of temper the concern. I don't want to say there aren't significant causes for concern, but they're based on firm reef sources, both imports and production that you can guarantee will be available. There are other resources out there. Just the concern is when the time comes, can we absolutely be assured they'll be available again? Probabilities. Good probability? Yes, but not assured.

[00:11:24] **Speaker 1** Should we be looking at this in April or should we just before the summer hits with these higher chances of a blackout potentially happening from higher energy needs? Or is there a longer term look at this picture?

[00:11:40] **Speaker 2** So I think there you see sort of a question. Are you running in that case, an auction or arrangement to try and procure capacity based on the expectation that there really is physical equipment out there that could do the job? And you just need to make the market arrangements, commercial arrangements to make sure it's available or do you really need to get new equipment built? And I think as we're seeing the accelerated retirement of older units, I think we're shifting more to that scenario where we really need to see new equipment build. And I think that's exactly what does call into question this sort of short time frame that's being used. And I'll repeat, I, I have no inside information, but I think the evidence suggests that mechanism is going to get reexamined.

[00:12:31] **Speaker 1** How successfully is Wisconsin bringing alternative energy to the market?

[00:12:37] **Speaker 2** I think quite successfully, although, you know, we're not as naturally endowed as some of our adjoining states. Wind resources are somewhat better as you move north to the west in Minnesota and southwestern Iowa. So, you know, being well positioned to take advantage of those resources is advantageous for Wisconsin. You could say for, you know, a given amount of wind capacity build. It's going to produce more clean energy in high wind locations in Iowa and Minnesota than it might in some locations in Wisconsin. But, you know, counterbalancing that, if you don't have to move the energy is far less chance of congestion and other transmission problems interfering with your ability to get it to the load. So, you know, I would give Wisconsin reasonably good marks for its development, but there there has been some slowdown, you know, a few years back when there was some uncertainty about siting requirements and other regulatory requirements on wind. I think you're beginning to see that turn around and you're seeing solar grow in importance and attractiveness.

[00:13:49] **Speaker 1** So are experts like yourself forecasting climate change as a factor within this whole conversation and how it's going to impact energy usage and needs in the grid going forward.

[00:14:05] **Speaker 2** When one certainly has to look at those aspects? So much of grid operations are conditioned on weather and environmental conditions. And frankly, as we draw more of our generation fleet from wind and solar, that tie in to weather conditions becoming greater and greater. So I think those issues are certainly important and high temperatures in general, stress, electrical equipment. And if we see longer periods of high temperatures and then somewhat more subtly, if we see phenomena like less cooling at night, you know, there really is equipment that gets its life shortened if it doesn't get a little rest at night, so to speak. And if we see longer periods of continued high temperatures without relief over the evening hours, that will impact the lifetime of equipment.

[00:14:57] **Speaker 1** Are there things that can be done that aren't?

[00:15:02] **Speaker 2** I don't want to be flippant, but I think you could always answer yes to that question. There's always more that could be done. You know, much as I think reliability is so important in the grid that, you know, we have to give it very high importance. And if you take a market viewpoint, put a very high value on reliability, it's always a trade off. You know, at some point. Guaranteeing absolutely reliable power is extraordinarily expensive and undoubtedly increases the environmental impact. So finding that right balance to make sure an important need for society is met. You know, we depend on electricity for a lot and chances are we will depend on it for even more in the future with vehicle electrification and the like. But we have to find a good balance, you know, invest enough to be reliable, but keep costs and environmental impact reasonable.

[00:16:00] **Speaker 1** How much do the somewhat contested high capacity transmission lines, how do those play into the entire energy landscape in Wisconsin?

[00:16:14] **Speaker 2** Well, coming back to my earlier point, thinking about wind resources, but many classes of resources, you benefit from geographic diversity and ties into your question regarding to weather events as well. You know, of course, severe weather events can often have an impact over a big geographic footprint. But if you can reach further for your sources of energy, you know, you may move outside of a particular pocket of very hot weather or storm conditions. So it is attractive to be able to move energy effectively over long distances. But it comes at that environmental cost of building transmission lines. You know, I my personal orientation as an electrical engineer, I probably like transmission lines more than the average person. But I recognize, you know, many folks find them an eyesore and would prefer not to have them close to their property. That represents a societal tradeoff we really have to grapple with in policy. You know, what are the benefits? And the difficult part is they are often benefits that are spread over a big geographic region. But the person who feels the transmission line is, you know, an imposition on their property, their view, their local environment fuels those things very locally.

[00:17:33] **Speaker 1** Does the increase in battery technology make it easier to store and potentially have energy at hand for when emergencies happen?

[00:17:45] **Speaker 2** Certainly, you know, any mechanism that gives you, in essence, kind of flexibility in time as to exactly when the power comes in versus the point in time when it gets consumed is really helpful. You know, part of the challenge in the power grid that, you know, I think even the layperson sort of roughly understands, but the impact may be bigger than many folks recognize. It really is a system in which supply has to match demand moment by moment. And that puts real stresses on the grid that even a little bit of relief in time, you know, half an hour, certainly several hours can be very valuable. So I think what you'll see increasingly, particularly with solar resources, you know, not hard to understand that they produce their maximum output mid-day. But since we humans tend to feel the accumulated effect of heat, we often tend to pump up air conditioners most at the end of the afternoon. So you don't get an exact coincidence in time of when you're getting the best production from the sun versus when the sun is, roughly speaking, driving the biggest component of consumption, air conditioning. And if you can move that a little bit a few hours in time, you can do a great deal to relieve stress on the grid and, you know, in some cases may lessen the need for longer distance transmission.

[00:19:10] **Speaker 1** All right. Well, Professor Chris DeMarco, thank you so much for this conversation.

[00:19:14] **Speaker 2** A real pleasure to be with you today. Thank you.

[00:19:18] **Speaker 1** Thanks. Great job is.

[00:19:20] **Speaker 2** Useful.

[00:19:21] **Speaker 1** Yeah, definitely longer than we will air on the broadcast. Figured as much, so we'll cut it down.