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Q: Hi Audrey, and welcome to the Podcast. For starters, tell us about your job in Australia.

A: It's the Australian Energy Market Operator, so AEMO was formed about 10 years ago, actually, and it was when the Australians liberalized its power markets and also commercialized their assets previously to that much like much of Europe. All of the resources were owned by the government. The government decided to actually sell off the generation assets as well as the distribution and transmission. Various governments had kept them as publicly-owned, but at any event, it was at that time the markets were for renamed. AEMO was formed at that time and operates across the country. Australia is a bit different than the US even though the geographic size of Australia is roughly the same as the lower 48, most people live along the coast, like 80-90% of the population is along the coast because the middle of the country is largely desert, so it's a very different system. We operate the system called the national energy market which actually includes 5 states from Queensland down to Tasmania. Then, we also, and this

is a separate inner-connection, we also operate the Southwest Interconnected System which is in Western Australia, and we're not at all connected.

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Q: So, you probably remember the Joanie Mitchell song, "Both Sides Now," so you've looked at electricity from both sides of the Pacific.

A: Both sides of the Pacific.

Q: What common threads emerge in your mind? What things, what lessons are you learning that you think might be relevant in the United States?

A: There are a few. Aside from my [unclear; 00:02:34] early this morning, you know, Australia is the, first of all, we offer both electric and gas markets. I'm finding, having been at PJM, that having visibility in the gas markets is actually quite an advantage to us. That, I would say, that's a really important lesson learned as we start thinking about sector coupling. The more you're able to manage these under a common approach, the easier it is to manage and the easier it is to actually have integrated support of various sectors. That's probably a good lesson learned. I know it was always a struggle. It can be a struggle in the markets in the US because it's just

electric and does not involve gas even though we're increasingly dependent on natural gas.

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The other piece, I think, is just simply from what's going on in Australia, is just the technical challenges. The power grid in the eastern part of the US is 5,000 kilometers long. It's probably the longest single system, but the fact of the matter is Australia's growth in renewables in terms of how rapidly they're coming on and also the impact of coal retirement is really getting us to get the first row seat in the technical challenges associated in synchronizing to a synchronized system and relying on electronics as opposed to motors. That is sort of recognizing how quickly that can change on you. Having a plan and really thinking through how you're going to manage the transition is really critical. It's not as if you don't want it to occur, it's just recognizing their technical challenges. I think, I know, in talking to my colleagues in California ISO, very similar to the types of things that they think about, we think about.

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Q: Among the challenges-- I'm sorry, go ahead.

A: No, I think having respect for the engineering challenges is very critical.

Q: Among the challenges that we've had were a string of blackouts in southern Australia. How is that fairing right now? What were the causes of that, and what have the fixes been?

A: Well, it wasn't a strain. It was a single-system blackout. We had a major storm come through, and it knocked down a number of transmission tower and also affected a major interconnector between South Australia and Victoria. The thing that, you know, nothing's different and terrible even as the US learned in the 2003 system blackout even that occurred in Ohio and affected the Northeast. Nothing very different than going to Minnesota when we had straight-line winds come in and knock out a portion of our region. You know, these are all lessons learned and industry learned.

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The one thing that we did learn from there is that the wind system, the wind farms, had certain controls on them, and they had been adjusted not in a way that caused them to trip off when they probably didn't have to, but that's nothing heroic, and people learn things out of every system black, and it was a major storm, so I think that there's a

misunderstanding, I think, that was created by renewables. It wasn't created by renewables; it was created by [unclear] events.

Q: The prices in Australia historically have been almost double the US and Canada. What's the root cause of that, and is that perceived as a problem?

A: Yes, so there's a couple things that are going on. One is, as you know, in the US, we have a great deal of availability of low-cost natural gas, so that will change the fuel mix relative to Australia. Australia has-- you know we're one of the largest exporters of LNG. The cost of extraction here is much more than it is in the US, so that's affecting the price of gas here.

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The other thing is simply the market design here was an energy market design which is based on scarcity-type pricing to attract new investment. The challenge we have is in the absence of no capacity markets is when we've had coal retirement which we've had. The price spikes were high and are not drawing in the types of dispatchable resources we need. As a result, what we're finding is that energy only, renewables can produce energy obviously as a marginal cost. The market needs to be supplemented with different types of

essential services that were forming the types of services we need to manage the power system. I don't think that's going to be an issue in the US because most of the markets have those types of services built in even though, for example, air [unclear] energy only market like ours has other types of markets which is ramping markets, etc.

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I don't particularly think of that as a phenomena where the US can learn from Australia. That's one probably where Australia can learn from the US around how to add to the markets you already have.

Q: When you came into this job, roughly two and a half years ago, did you have any marching orders of getting prices down or allow for the grid to evolve to accommodate more renewables? What were your central objectives that you were hired to achieve?

A: I think it was a recognition when I came in that there were substantial challenges in terms of managing the transition and that I was hired to help provide a stronger strategic direction. I'm not the regulator. I'm the system operator, but I've obviously, as the only system operator in the country where obviously I have a significant aspect

in terms of roles to play in helping to define how the market's moving forward.

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Being as I've lived here, what I've appreciated, one, is that the pace of change here is just so much faster than the US. I think it's partly because of the size of this country but also because of the climate. The thing that's fascinating about Australia right now, and it's probably going to be where we are leading isn't that understanding some of the technical challenges with integration of renewables, and the other piece is in terms of rooftop solar. We have, in parts of our country, Western Australia and southern Australia, rooftop solar now representing a larger source of power which means that when the sun is not shining and we have clouds coming over, we're seeing the system move in a very significant way because of the changes in demand. The need to integrate DR, the distributive resources, in very much the way we were talking about New York around REV is a really critical need in order for us to manage the system, so it's quickly moving to a more distributed system, and using that as a capability as opposed to a problem is, for me, very much a front-of-mind issue.

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Q: With the speed of change being faster in Australia, are you learning lessons that you think at some point you'd like to bring back to the United States and possibility help speed along the pace of change here?

A: I what's happening in Australia in terms of the pace of change, it's really that we are a lucky country in terms of the climate, so we have these advantages. I think there are aspects-- parts of the US have similar advantages which probably could be a good place for us to work with, and we do actually work even though we're a little bit far away. We're part of various groups where there's shared learning. We do have an opportunity to do that right now. I think the most important thing to me is that, if I were back in the US, is that actually the importance, and this is maybe what Australia doing, has underscored my experience in New York. It's not the technical issues. The technical issues are solved.

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What we need to do is recognize that with the speed of this transformation and how quickly it changes and how the scales have changed, we need to be prepared to adapt our regulatory conventions as well as our market conventions in a way that is as much an incremental change and recognizing

there's a step difference. There's no longer a situation of pricing or commodity because we have so much zero-marginal-cost resources. It actually is the industry itself that's quickly becoming a services-type industry where we have to really pay for services such as inertia and frequency and voltage and firming. That's very different than we've done previously, and the challenge is, of course, the transition. Once we have the new technology base, that's easy to deal with, but it's when you're getting out of one technology base and adding in another that you need that type of regulatory market insight to be able to adapt to both, and I find-- and as I've watched the press in the US and certainly the situation here-- trying to harness that and stay focused on the critical issues and agree that these electrons are amoral and they go with the laws of physics, not particular politics or economics, and actually willingness to make the changes necessary to continue to make the system work in a sufficient way is a critical one. [00:13:22]

That's what we try to do in REV in New York. We really wanted to focus on how to change the system to deal with the changing dynamic of the technology, the regulatory system, and I find, when I look at the debates in the US, while

there's some understanding of it, I think that the fact that there's still so many politics involved is going to create challenges.

Q: What about the customer-facing side of this? According to the last figures I could dig out, roughly 6.5 million of Australia's 10 million households and small businesses have customer choice. Does that make for a more information public than you see in the United States?

A: Well, the people in Australia, the cause of the issue is that they always charge low prices and now are seeing much higher prices. They're much more aware. Unfortunately, in the US, all the regional transmissional operators produce an annual plan about what's going on in the summer. For the most part, those are largely ignored except in the industry press, maybe a little bit more in Texas now. In Australia, it's front page news in all the national papers when we publish a report on summer readiness.

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I think unfortunately actually the public here is hyperaware of energy issues because it's become very big front page news. I think one of my goals before I leave is to get it back to being very boring because I think essential services should be largely boring for the mass public. The thing that is

happening in Australia though is, with so many people, right now in Perth, in western Australia, one in three households have rooftop solar, and basically what our calculation is is that we're adding 6 panels every minute in Australia, so it's a phenomenal growth change, and in many ways, putting solar on your roof now is as common as putting a car in your garage. That type of change means that people in Australia do see energy as something that they are much more aware of. You know, there's a huge amount of pools in Australia, a lot of resources around managing, efficient management of pool pumps and present demand resources. Those types of things are almost naturally happening.

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Q: Take a minute, and you mentioned you monitor for the press. I'm sure you're still well-connected with New York State. How do you think REV has been rolling out? Any disappointments there or is everything pretty much what you expected would be happening?

A: I actually am not that connected to New York State, so I really couldn't comment on it. I see what's in the press and certainly see the governor's plan to run emission reductions and off-shore wins. All those things are very

exciting. I can't tell you in terms of REV itself. I haven't really talked a lot about it.

Q: Let me tick off a few objectives. 70% of New York electricity should be renewable by 2030, an 85% cut in greenhouse gas emissions by 2050, 9 gigawatts of off-shore winds, 6 gigawatts of solar, 3 gigawatts of storage-- is that comparable to what you're seeing in Australia, or do you think that stuff is coming on faster in Australia?

A: Well, I think it is actually comparable. I mean, again, it's hard to probably be-- the thing is a bit more in Australia than it's going to be in New York. The issue in New York, of course, is in order for them to accomplish that, they're going to have to look at hydro, I would expect, from Canada. I don't see how that's going to happen without.

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Even with the off-shore wind coming in, there's going to be issues in terms of the amount of wind and solar potential on-shore in New York without more hydro from Canada, but I don't know. Again, that's not been part of these discussions.

Q: How much longer do you think you'll be in Australia? You said you have an objective. When do you hope to achieve it by?

A: Well, you know, don't have an end to my time here. I certainly have, given where I am and my life, I would like to be in a position where I don't work too much longer because I want to spend time with my children and grandchildren, but that really remains to be seen.

Q: When you reflect on what you've done in New York State and what you're now doing in Australia, what are some of the things that are top-of-mind that you think people in the industry should pay attention to?

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A: I think the first thing we have to assign intention to is the speed of change. I think that this industry-- you know, when I first started looking at REV in New York and asked how long this would take, now I basically said five to ten years not really having a forecast but simply seeming that that seems like a reasonable amount of time and nobody can hold you to it. Again, what I think happens is that you hit a tipping point, and we've hit it here, so there's no stopping the transformation, and despite the industry talking about it, I do feel like we're not moving

as quickly as we need to be ahead of this change so that we can make sure that it happens in a way that is seamless for individuals. The concerns that I have are round-- are we prepared to make the investments that are necessary? The challenge, and it is a substantial challenge that I think the industry and government haven't quite grappled with is that when we exit some of these large central station power plants, they produce a huge amount of energy for the system, and that has to be replaced.

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A lot of these plants are retiring because they're just aged. Some things we saw in New York around aging-- nuclear is very similar. We have to be prepared that for the resources that come in, they are very different than the resources that are leaving, and they require different types of network capability, and that has to be addressed in advance, not after the fact. The other piece that I think is very critical to recognize is that as you look at more distributive energy resources, even with population growth and population growth in Australia is much greater than it is in the US and economic growth, because we're just generally more efficient users of energy, we're seeing here as we're seeing in the US not a lot of demand growth,

and that means that you're replacing old infrastructure with new infrastructure off of a slowing or reducing demand profile. That is going to have a price effect if we continue to price things as we always have. Those types of things I'm not sure that people are absolutely grasping in the industry yet: the pace of change and the implications on prices when you have to put in new infrastructure. The third piece that I think the industry, that we talk about it, is around digitalization. I know NYPA (New York Power Authority) has done a significant amount of work because they are true leaders in the area, but the fact of the matter is that using advanced technologies, AI, things like that are not a data that we have to use now to manage the power system compared to before.

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You know, when you think about it for Australia, that's 26 million people. You know, in the national energy market, we've gone from 30-odd generators to 2 million various devices to potentially 4 million devices that we're actually having to actively use to manage the power system. You need a much different operating system to manage that type of resource than you did when you were just managing large-scale generators, so all of those things, I think,

are certainly tangible challenges that we're grappling with, but I don't see that conversation in the press. This is a phenomenal change in the industry beyond just the fuel type, and the less politics we put into it, the more conversation around what are the real problems that have to be solved, and how do we go about solving, I think, should be really the focus of all the industries both industry players, government, and policy makers.

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Q: Do you think that with the pace of change coming faster to Australia than more in the United States your former colleagues and state regulatory agencies around the United States, utility executives might want to come over and view Australia as a test bit or laboratory, and is there any way in your mind to formalize that of trying to bring folks over and have more collaboration?

A: Yeah, I think that would be a fantastic idea. As a matter of fact, we are actually hosting a conference in November, and we're bringing in-- this is for academics from around the world who are coming here to talk about markets of the future. But we're also actually working closely with Enrail [sp?] today, and I'm hoping to have another conference here in our fall, your spring to talk about what

the technical challenges are, and we do, at a technical level, we do work a lot, but I think, and I know, our regulators are part of the international regulatory groups, but I do feel like there's a lot to learn here, and there's a lot to learn from each other. I would say that no particular jurisdiction has all the answers. We're all looking at various pieces of this elephant we're all trying to deal with.

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Certainly what Australia can add is the technical understanding and, I think, very quickly you will see us doing work around integration of distributive resources in a much more seamless way than elsewhere, and I think that will be important. The other aspect is creating these essential services and better markets for moving away from really sort of the energy focus to an essential service focus would be, I think, will vary in the next several years. We're working on it. I think that will be something that will really change the nature of the markets in the future.

Q: This might sound too simplistic. With some utilities, are they even thinking of offering an essential service with the flat rate? Do you think that might be part of this

transition to get away from a volumetric kind of business model?

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A: I think we have to. When you think about what we're saying, it is much more around-- particularly for us, when people put solar on their roof, unless they totally go off-grid, they are still relying on the grid. Volumetric pricing just doesn't make sense in that context, so we do need to re-look at that and move to essentially the type of pricing you see on the internet, etc. for other really fixed assets. I think that's going to be important, and I know there's a lot of good thinking, which is why I think exchanges are good ideas because collaboration is really critical and being open to hearing others are solving it is the way we could all be much more successful.

Q: Okay, on a personal note, what's been the most exciting, enjoyable part of being in a totally new part of the world?

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A: First of all, it's a lovely country that's been a lot of fun. Secondly, I guess, you know, meeting lots of new friends has been a fantastic opportunity. I think it's rare that you get at my age, I came over here when I was 60, to get a chance to really re-look at the world from a

different perspective, and that's been a terrific time, and then the other piece is that I met a great guy, so that's always fun too.

Q: Great. Well, thanks for talking to us Audrey, and I really appreciate the update.

A: Thanks, see ya. Bye.

Q: Have a good day. Bye.

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