

MARTY ROSENBERG
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ELLIOT MAINZER INTERVIEW

Q: Hi and welcome to Grid Talk. Today, we have with us, Elliot Mainzer who's the president and CEO of California's Independent System Operator. Good morning, Elliot. How are you?

A: I'm fine. Good to speak with you, thanks.

Q: So, let's plunge right in and talk about the hot weather. Last Sunday, I read a press release that you called the first Flex Alert because of the unseasonably hot weather I believe in Southern California was 15 degrees above normal for this time of year. What is that Flex Alert mean and how are you sitting going into this hot summer?

A: Flex Alerts are a tool that we use when we are seeing really tight conditions in the day-ahead market, so if we run the market in the early afternoon and it looks as though we may be facing limits on imports, or just loads inside California that are really stressing the grid, or a combination of those two things, we trigger the Flex Alert which goes out to consumers across California and encourages them to take a set of really specific actions, particularly during the hours of about four p.m. to nine p.m.. That's when solar fleets begin to back

off and loads continue to stay relatively high, what we refer to as our "Net Peak." So the Flex Alerts are our mechanism of communicating that we need conservation from consumers and we've put a lot of effort into it this year to try to increase the breadth and reach of that program.

Q: So, before we plunge into some great nitty-gritty detail, let's take a big step back and tell our listeners who are interview professionals, how running California's ISO is different from the eighteen years you spent at Bonneville Power Authority. What's similar, what's different? And then I'm going to ask you, how does your ISO differ from let's say, Texas's ERCOT in terms of similarities and differences?

A: Yeah, that's a great question. You know, there were definitely some interesting similarities in terms of my experience at the BPA. One of the things that people often forget is that Bonneville doesn't actually own the hydroelectric dams on the Columbia River. The dams are actually owned and operated largely by the U.S. Army Corps of Engineers and Bureau of Reclamation. Bonneville owns the transmission grid up there and has to work very closely with both of those other Federal entities to have a coordinated and reliable operation on the Columbia River and so, it's actually quite interesting coming down to California. The ISO operates the transmission grid in

California and operates the energy market within California, the Energy Imbalance Market that spans the parts of the West. But we have to work very closely with the California Public Utilities Commission and the California Energy Commission, the two state entities that have sort of primary jurisdiction over some of the most important resource adequacies decisions that California faces. So, resource planning, load forecasting, procurements -- those are all state-level functions, and so, there's a similar, important set of relationships and coordination and collaboration that has to happen in order for California to stay reliable. So, a big focus for me coming in over the last nine months is building those partnerships and making sure that's there's a real clear understanding of the relative division of labor between us. I think when we look at Texas and we look at California, you know there are some very foundational differences in the energy market design in California. Texas relies very much on scarcity pricing to send incentives for generation. I think we saw last February, just the kind of runaway electricity prices and some of the economic damage that caused and some of the limitations of their resources adequacy framework. California, obviously, challenged in certain areas just keeping up with the pace of the climate signals, keeping up with just the incredible amount of resource transformation

that's happening on both the generation and transmission side. But California possesses a much more durable and more forward-looking resource adequacy and capacity procurement framework than they have in Texas. And so, the fact that we've got a plain reserve margin that never crosses these explicit targets around the procurement of capacity I think is very important in California. It's a differentiating factor.

A: So, California is moving fairly rapidly towards being fully renewable carbon-free I believe the electric system by 2045. What role does CAISO play in that effort?

Q: Well, we play an absolutely essential role. I mean, obviously there's a couple of areas just in terms of infrastructure, operations, and planning. The next five/seven years, California is going to be bringing on a monumental amount of new supply into the system. Just last week, the California Public Utilities Commission approved an order for 11,500 megawatts of new capacity in energy resources coming online. A lot of it is to replace retiring generation. The Diablo Canyon nuclear plant is retiring the next several years and a set of once-neutral gas plants, so just getting the replacement capacity on the system is a big challenge and we are going to have to be very efficient in how we practice our interconnection queue and we're going to have to work very closely with the

asset owners to make sure that we have the necessary deliverability, the necessary network upgrades and substations' infrastructure to get those resources on the grid. So, that's very important and we have to be very forward-looking on our transmission planning. Also, extremely pragmatic about the grid infrastructure to make sure we can onboard new resources. That's foundational, of course Our energy market is extremely important with regard to sending the pricing signals, the right points of interconnection and remuneration and operations of these new resources; everything from forecasting and awareness tools to the types of actual market designs, market structures that we put in and that we set the right incentives. One of the big areas that we're really having to push the envelope on now is in the area of energy storage. I think you heard, we're going to have as much as 2,000 megawatts of batteries on the California grid this summer that are going to play a really important role in shifting generation from the middle of the day into the post-sunset times and we've put some initial mechanisms in place. You know, I would say a little bit sort of command control mechanisms. We will actually make sure that the batteries have a minimum state of charge during those times when we see some inefficiencies in the day market but that over time, we want to better evolve our energy market so that it better aligns price

signals and reliability with both the intrinsic and extrinsic value and opportunities of those batteries and also opens up opportunities for new chemistries and new iterations so that energy storage can really flourish on our system. So, both of those I think are really important; things that we can do on infrastructure, readiness, and efficient operations.

A: So, the California grid is one of the largest and most complex in the world. To what extent is integrating this 2,000 megawatts a game changer for the industry that's going to have implications outside of California (that's A)? And part B for the question is: How large is the storage going to get as we work towards 2045?

Q: Well, we certainly recognize that the amount of storage on the California grid this summer is going to be one of the largest in the world and we're very excited to be sharing our experiences with others in the utility community, literally around the world to various efforts, and they're going to be comparing notes with others who are experimenting as well, so that's something that I think will be precedential. I think we also recognize that just over the next several years, we'll be putting stuff about the megawatts, more energy storage on the system. Certainly, lithium-ion batteries but also experimenting with some of the longer-duration storage technologies as well.

And I think that energy storage across multiple differences in systems is going to be a key part of California's resource strategy. I mean the thing we really need more than anything now on our grid is to make sure that we have dispatchable capacity during the Net Peak period. That's the transition that's really been happening so we're moving natural gas projects from the system and shifting to much greater reliance on wind and solar. The energy contents of those resources is extremely valuable; it's clean, carbon-free generation. But we need to better match it up with the pattern of demand on the system, so that's going to be a big focus area. And then looking for other types of firm, clean, generation sources that can play a mix on geothermal. That's obviously something that's being looked at in California. And looking longer term at everything from hydrogen, carbon capture and storage, etc.. And then I've just mentioned, of course, transmission and the area geographical diversifications, so California has now began looking quite aggressively at offshore wind. And we're particularly during this period time looking very carefully now at some of the other transmission lines. There is a trough being developed across the Western United States that has the potential to provide significant resource diversification for California and other states and also to provide greater interconnectivity between the

different regions of the West to support the economical, environmental value of our growing and evolving regional energy markets, so all of those dimensions are going to be critical for California to make sure that we can meet our long-term decarbonization target.

A: So, talk about the wholesale energy market and how it works across the West and how is it working today and what kind of tweaks do you see needed going forward and what kinds of capabilities is it giving you?

A: Right. Well, as you recall back in 2014, we - the CAISO and PacifiCorp - opened up and started the Energy Imbalance Market, built in off of the California's high real-time market architecture and that market has grown to the point now where I think by the end of next year, we'll have close to 80% of the load in the West represented within that market. It's been really just a tremendous success. It's produced over \$1.3 billion dollars of gross value and it has developed a whole new set of working relationships and opportunities for optimization across utilities in the West. And I think that now we have states...

Q: Let me just quickly interrupt, \$1.3 billion in value creation. Can you define that a little more and then continue?

Q: Yes, exactly. These, so the correct value that's been created through the economic trade between the Energy Imbalance Market participants has been estimated at that much money, about a billion three since the market was created so this is opportunities for folks to buy cheaper resources from others that have them and for others to sell and monetize the value of their surplus electricity that might otherwise go to waste, might otherwise be curtailed. So, it's been a tremendous opportunity to open up real values and I think, have a significant impact on greenhouse gas emissions in the West as well. So, it's just been a fabulous success and I think there's a lot of interest now in the West in continuing to grow and develop the regional energy market. And so, we are now in the process of making some very important governance reforms to the Energy Imbalance Market. Those will be voted on later this summer and now also, really gearing up for our big push into the Day Ahead Market. We have a number of entities I think that see that would be a very logical next step to grow that, and then of course, there are many folks in the West now who are looking at monitoring their state's routes and organization of the energy market in the West. We're paying very careful attention to that and trying to kick some really good solid next steps to keep growing the value of the energy market, Energy Imbalance Market

and beyond, and keeping the utilities that we collaborate with working closely together to kind of make more progress.

A: California has upwards of 600,000 electric vehicles now; it's one of the densest concentrations of EVs in the world. How does that rollup and effect both CAISO and the Imbalance Market and how do you see the ISO and the market facilitating rapid expansion of EVs?

A: Well, I think from our perspective, the retail utilities are really on the frontlines of the electric vehicle move. You know, Southern California Edison and PG&E; the other utilities in California really driving that and also making sure that the necessary distribution level upgrades are being made to accommodate the electric vehicles on the system. From our perspective, what we think is really very important in California is that rate design and expectations are established early that incentivizes those batteries to come on to be grid assets, not necessarily grid liabilities, which means we're going to want them to have the capacity to change their charging behavior in response to price signals, and to make sure that their load comes onto the system in ways that doesn't exacerbate the challenges that we're having with our Net Peaks. So, you know, charging in the middle of the day on a hot summer day is going to be a fabulous opportunity and value to the system

rather than in coming in at seven o'clock in the evening and plugging in. As a matter of fact, that these batteries have the two-dimensional capability. They can both have the capacity to come in charged during the day and actually even release some of their power into the grid later in the evening and be part of the reliability solutions. So, we need to think of them as grid assets as they come on the system and I think that's probably our biggest interest of the idea itself.

Q: Back about a decade ago, there were folks at the Department of Energy that said enough generation existed in the United States to handle new crossover from fossil fuels to EV transport without building additional generation. If, as you just said, the utilization's at the right time of day. Well, now that you have auto makers and government policy makers saying it's only a matter of time until fossil fuel cars aren't made anymore, is California and CAISO ready for the day for when all vehicles are electric; I don't know if it's in twenty years or forty years, but in...how are you preparing for that and what impact will that have?

Q: Well, as you know, Governor Newsom late last year stipulated in his Executive Order that California will be effectively phasing out sales of combustion engines, internal combustion engines by 2035, so that set a major goal and we're

certainly preparing for that and some of these things can be accelerated depending on how the market opens up. So, the California Public Utilities Commission and the California Energy Commission and the utilities are definitely beginning to really try to integrate into their forecasts what both the capacity and energy demand will be from that fleet of vehicles that really migrates on the grid and of course, the other major sectors of our economy are going to be migrating onto the grid so that load lift is going to be important.

A: Just on the face of that, does that mean if you take the electric marketplace in California and bolt-on the gasoline sales on the marketplace, that's what the new electric economy will be comprised of; is it will grow exponentially?

A: Yeah. It's going to grow and it's going to grow in a very big way. I don't have at my easy disposal today what the specific load-ware factor is but I think the real expectation is that in the next twenty years, California will see tremendous growth in total demand on its system from the migration of the transportation and other sectors on the grid. We're starting to get a better handle on that through the Energy Commission and CPUC, and as I mentioned, we need to make sure there's wholesale market interfaces in the transmission infrastructure and the right pricing to make sure as that new demand comes on the

system, it happens efficiently and it's as cost effective as possible.

Q: If you look at the West, California's densely populated with one of agricultural land but the rest of the West has wide open spaces. Do you think that the marketplace that you're forging across multi-states will allow for ever increasing amounts in of deployable amounts of renewables, I'm thinking wind and solar, to make this new reality possible?

A: I do. I think that utilities across the Western United States now are all really leaning in with their regulators and their constituents around them and recognizing that a tremendous amount of additional renewable resources are going to need to be developed, whether it's in Wyoming or Utah or Idaho or the Pacific Northwest or Arizona, Nevada, and New Mexico so there's a lot of work going in to really take a look at the siting. Then ,particularly with the very strong interest of the Biden administration, that we have a number of people...quite a few people in the current administration who really understand the importance of transmission development and resource diversification in the West. I think we're seeing, potentially for the infrastructure bill, a lot of targeted and intelligent support being directed towards the West to potentially help get some of these transmission lines built, and to access those

diverse resources so, I do think it's going to be critical. There's just no way we're going to be able to meet our clean energy objectives reliably without additional transmission resource diversification.

Q: Elliot, we've talked about the heat that's come on early and waiting in the wings, everybody's nervously watching for forest fire development. That is a major threat to the electric grid, is it not, and as somebody's who's privy to all of the planning that's been going on, is there an answer to these spreading wildfires or is this just something's that's going to be a wildcard for as far as the eye can see?

A: You know, I think unfortunately we've entered a new normal here with temperature, the kind of drought that's spreading in the West at the moment and I just mentioned this last week, it was 117 degrees in Salem, Oregon. It's hotter than it's ever been in Vegas; I mean just that the pattern of heat and drought; it's alarming, and so, this is something that we're going to be dealing with I think that for some time and have a lot of implications for resource planning. The wildfire risk itself is something that obviously California has really struggled with in recent years and is putting in tremendous time and effort and capital to harden up its grid. So far, we've been reasonably lucky. Within California, we have not had tremendous impacts to

the bulk electric system but really, it's just a matter of time likely when one of the major AC or DC paths gets impacted by one of these fires and so it's something that we're having to watch very carefully. It is a significant risk variable for this summer, and we've started to try along with the investor-owned utilities and the public utilities to try to really communicate better through our reliability coordinator function that spans quite a bit of the Western United States to improve communication coordination around wildfires and to make sure that we get the best updated information about any of our lines that may be impacted. So, it's a definite risk variable and something that doesn't appear to be going away any time soon.

Q: Well, help educate our audience. These DC paths, these major DC paths - pathways - I assume there's quite a bit of brush clearing and around it. If there's fire on either side of these lines, might it impact them or how would that scenario evolve and what would the impact be? Could you see large parts of the state going without electricity until it's restored?

A: Well, put it this way, I mean, of course the ISO is not the actual owners of the transmission lines, right? We operate them but they're owned by the utilities and the major path operators here in California, whether it's Los Angeles Department of Water and Power or Southern California Edison,

PG&E and then, of course in the Northwest, you've got Bonneville and and others. Those entities work very hard to manage vegetation loading around those transmission lines and try to keep those corridors as healthy as possible. And I think many of them are in good shape. I think that some of other transmission lines that feed into them particularly ones that are in heavy natural forests, which have been very stressed by the drought and the increasing fire concerns -- those are some of the ones that we're particularly interested in so we're really looking to the asset owners to do the hard work of keeping those transmission corridors in good shape through the vegetation management and the constant surveying to make sure there aren't any disturbances. And we then provide the state awareness of how the grid is actually being operated - watching for overloadings and work with them to make sure that there are contingences in place if any of these lines are taken out by the wildfires.

Q: So...

A: But we are really dependent on others for the day-to-day care and feeding.

Q: You think we'll get through this summer without a major outage or is it too hard to tell?

A: It's too hard to tell honestly. You know we've already had... we had our first major heatwave four days before the official

start of summer. We called our first Flex Alert on June 17th and June 18th and then just this last weekend, you know it was extraordinarily hot in the Pacific Northwest. It didn't get that hot in California. In the next week or so it's looking regionally calm but honestly, we're just recognizing now the risk of simultaneous major heating in the Northwest, in the desert Southwest, and in the West simultaneously just appears to be increasing so we're obviously doing absolutely everything in our power to minimize the probability of rotating outages. But honestly, it's going to take a lot of communication coordination if and when we get those tight conditions. We need to make sure that our demand response programs, both the voluntary and compensated programs, are as effective as possible.

Q: With all of these pressures, and with the task of coordinating with your members and the board and the CPUC and the California Energy Commission, do you still have time to play the saxophone and how do you deal with it all?

A: *Elliot chuckling*...You know, I'm going to admit that my sax playing has attenuated a little bit this past year, ever since I left Bonneville in August of 2020 and made this transition. It's been a busy year but I'm blessed with a very supportive family. I do try to get out for some exercise. I've really enjoy meeting my new colleagues at the ISO and in the state and staying

connected to my old friends in the Northwest and others. The relationships are really important. That's what gets me through and it's meaningful work. These are important challenges and I'm inspired by the goals of getting through this transition in a reliable fashion so, it's exciting work, very satisfying, and I appreciate your interest and all your listeners and many of whom I'm sure we'll partner with in one way or another through partnerships and collaboration that are going to make us successful. So I am looking forward to more of that.

Q: Thank you, Elliot.

A: My pleasure. It's great talking to you.

A: Thanks for listening to Grid Talk. We've been chatting with Elliot Mainzer who's the president and CEO of California Independent System Operator. 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 platform. For more information or to subscribe, please visit SmartGrid.gov.

END OF TAPE